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***The Role of House Prices
in Regional Inflation Disparities***

by
Dinah Maclean

The views expressed in this report are solely those of the author.
No responsibility for them should be attributed to the Bank of Canada.



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ABSTRACT

Theoretically, house prices will reveal greater disparities between regions than prices for more easily tradable goods and services. This contributes to regional disparities in inflation. In this report the author reviews a range of factors that are likely to cause greater disparities in house price inflation than in the price inflation of other goods and services. Two models are developed and estimated using Canadian data.

Since disparities in house price inflation can arise from regional shocks, the first model that is developed characterizes regional house prices as having an equilibrium relationship with the national consumer price index (CPI) in the long run, being influenced in the short run by such shocks as region-specific movements in real commodity prices, real capital spending and real current government expenditures.

Initial tests for cointegration support the hypothesis of a long-run relationship between house price levels and the level of the national CPI. While overall the estimation results suggest that regional house price movements are influenced by regional shocks, no generalizations across the regions can be made that indicate which shock variables are important.

Finally, the second model pooling cross-section and time-series observations is estimated to test the relative significance of the national and region-specific elements of variations in house prices. Both elements prove to be significant.

RÉSUMÉ

En théorie, les prix des maisons accusent des écarts plus importants d'une région à l'autre que ceux des biens et services dont l'échange se fait plus facilement. Cela explique en partie que le taux d'inflation diffère selon les régions. Dans le présent rapport, l'auteur examine un ensemble de facteurs susceptibles de causer de plus grands écarts entre les hausses des prix des maisons qu'entre les hausses des prix des autres biens et services. Pour éclairer ce phénomène, deux modèles ont été construits, puis estimés à l'aide de données canadiennes.

Étant donné que les écarts qui existent entre les hausses des prix des maisons peuvent résulter de variations dues à des facteurs régionaux, le premier modèle établit une relation d'équilibre de long terme entre les prix régionaux des maisons et l'indice des prix à la consommation (IPC); à court terme, cette relation est influencée par les variations des prix réels des matières premières propres aux régions, la dépense réelle en capital et les dépenses publiques réelles.

Les premiers tests de cointégration confortent l'hypothèse d'une relation à long terme entre les niveaux des prix des maisons et le niveau de l'IPC. Même si les résultats des estimations semblent indiquer dans l'ensemble que les variations des prix des maisons d'une région à l'autre subissent l'influence des chocs régionaux, il n'est pas possible de faire des généralisations au sujet de l'importance à accorder à ces derniers.

Enfin, l'auteur a estimé le second modèle à l'aide de données en coupes instantanées et de séries chronologiques afin de mesurer le poids relatif des variations des prix des maisons dues à des facteurs nationaux et celles qui sont imputables à des facteurs régionaux. De fait, les deux éléments se sont avérés importants.

1 INTRODUCTION

Interest in inflation disparities between regions in Canada increased during the late 1980s. Concerns were raised by some commentators that a national monetary policy was being used to fight a local inflationary problem. Relatively little work, however, has actually been undertaken to study the extent and causes of regional inflation disparities. Theoretically, regional rates of inflation should tend to converge over the long term and the rate of convergence should be greater for homogeneous, unregulated, tradable goods and services than for non-tradables.

This paper explores in some detail regional disparities in the price of one of the least tradable goods: housing. Disparities in house price inflation drew considerable interest in the late 1980s, since general inflation disparities in the 1986–87 period paralleled those in housing markets. Section 2 explores the theoretical reasons why rates of house price inflation are more likely to vary across regions than those of more tradable goods and services. Section 3 provides an overview of regional house price inflation disparities in relation to disparities in the general inflation rate. Section 4 considers the role of regional demand shocks. Finally, Section 5 attempts to ascertain the extent to which regional house prices are influenced by both local and national factors.

Overall, the aim is to increase understanding about the regional price trends of a commodity that is among those most likely to show differences across regions, in order to gain a better understanding of the causes and the extent of more general inflation disparities.

2 THE NATURE OF THE HOUSING MARKET - A THEORETICAL REVIEW

2.1 Introduction

The most frequently cited reason for regional variations in the movements of house prices is that houses are not easily tradable between regions, because they are fixed in one location. Price disparities are, therefore, likely to persist for longer than in the case of goods that can easily be moved from one region to another. This is not, however, the only feature of the housing market that makes it more prone to regional price disparities. There are a number of other factors that slow the adjustment of demand and supply for houses to regionally specific shocks and that may even lead to periods of non-market-clearing prices. In addition, housing markets in different regions may have significantly different characteristics and thus react differently to the same aggregate shocks.

These issues are explored below in a review of a number of characteristics of the housing market: spatial fixity and inelastic supply; the existence of transaction costs in the purchase and sale of housing; regional disparities in demand; government intervention; and the possibility of price “bubbles.”

2.2 Spatial fixity and inelastic supply

Since housing is generally regarded as fixed in one place, one important characteristic of a dwelling unit is its location. When comparing housing units, purchasers will compare such features as distance from work, the quality of the neighbourhood, access to and quality of local services such as schools and health facilities, land use in the surrounding area and the level of property taxes. Differences in these features mean that absolute housing price levels will vary across locations. In other words, there is imperfect substitutability of housing across locations.

The fixed nature of housing means that arbitrage cannot easily occur between different provinces or even different regions within a province. In the case of most goods, consumers can buy products from a range of different locations. In the case of housing, consumers can only take

advantage of relatively lower prices by moving to lower-cost areas. The convergence of housing price movements, therefore, depends to a large extent on the movement of people. Since housing is only one factor in a household's decision of where to live, adjustment is likely to be slow and incomplete. (More detail on the adjustment of housing prices through migration is provided in Section 4.3.)

The consequences of spatial fixity are reinforced by the fact that the supply of housing is largely fixed in the short run. The supply of housing depends on sales from the existing stock of houses and from new construction. Price increases do not generally cause large increases in the number of sales from the existing stock, and construction can only respond after a considerable lag, including administrative holdups related to municipal development planning. Thus, any change in local demand will tend to cause larger price increases in the housing market than in other markets, where supply can at least partially respond in the short run.

2.3 Transaction costs

One of the most important components of the transaction costs involved in buying a house (or finding a rental unit) are the high search costs that result from the great diversity of the housing market. The characteristics of individual housing units differ widely. People wishing to purchase housing, therefore, cannot compare dwellings by using a single feature such as price, but must acquire information about the bundles of characteristics pertaining to each unit. This generally requires personal visits to all likely properties.

Sellers of housing also face the costs of gathering information about prices and the likely market value of their own property. Again, these costs are potentially very high. It is not possible, for example, to assume one's own property is the same value as the house next door, since the size, amenities and condition of the two houses may be very different. For this reason, sellers often rely on the advice of real estate agents, rather than conduct their own price surveys. Real estate commissions in Canada can be as high as 6 per cent of the selling price.

Studies of adjustment in the housing market suggest that in conditions of excess supply, sellers in particular are less aware of the true market value of their property, even though in many cases they may also be trying to buy new properties. This suggests that while they may not lack information about general housing prices, they have a poor assessment of how their property compares to others on the market.

High search costs are only one component of the transaction costs involved in changing housing. Other costs, both tangible and intangible, that buyers face include legal fees, land transfer taxes, time spent arranging the financing, adjusting of furnishings and the psychological effects of moving. Sellers may also face the costs of disseminating information to buyers, the inconvenience of having groups of people touring their property and legal costs.

The presence of such significant transaction costs hinders the adjustment of supply and demand to changing market conditions. For example, households are unlikely to respond instantly to changes in the determinants of demand. Rather, they will wait until the present value of the expected benefits from changing location exceeds the costs of such a change. As a consequence, observed prices and rents may differ from those associated with a fully clearing market. Similarly, as a result of high search costs, buyers and sellers may have incomplete information, which again may lead to non-market-clearing prices. Such lags will slow adjustment to regional shocks and may mean that regional markets adjust in different ways, or at a different pace, even given the same aggregate shock.

2.4 Regional disparities in demand

A wide range of factors affect the demand for housing, including income, relative price, age and size of household and the level of interest rates. While it would not be appropriate to analyse these determinants in detail in the context of this paper, it is nonetheless useful to consider one particular determinant of demand that is frequently credited with causing regional variations: differing demographic factors.

Demand for housing is highly dependent on the age structure of the population. Younger people tend to seek rental accommodation, since they are generally more mobile, while older people are more likely to want to purchase housing. Local house prices may, for example, increase relative to other areas, if a high proportion of the population is reaching an age when they wish to purchase homes.

Table 1 shows some demographic indicators for the 10 provinces. Significant differences are evident between them, with Quebec and British Columbia having the highest median age and Newfoundland the lowest. (It should be noted, however, that since the proportion of owner-occupied housing by province is affected by many other factors as well, it is not necessarily closely correlated with the age structure of the population.)

	Child dependency rate	Old age dependency rate	Median age
Newfoundland	45.4	15.6	30.8
Prince Edward Island	45.6	22.1	32.8
Nova Scotia	36.8	19.7	33.4
New Brunswick	41.2	19.6	33.2
Quebec	37.0	17.2	34.2
Ontario	38.1	18.4	33.6
Manitoba	43.8	22.3	33.0
Saskatchewan	49.9	24.7	32.6
Alberta	44.0	14.4	31.3
British Columbia	38.1	20.4	34.7
Note: Child dependency ratio involves population 0–17 relative to 18–64 (per 100). Old age dependency ratio involves population 65+ relative to 18–64 (per 100).			

2.5 Government intervention

A wide range of government measures influence directly and indirectly the demand, supply and price of housing. These measures can further reduce the efficiency of the market, hindering the adjustment of supply and

demand. Differences in the type and level of intervention also cause variations in the way regional housing markets react to similar shocks.

At the federal level, housing policies include mortgage loan insurance, rent subsidies and financing for low-income housing. In general, the provision of subsidized housing, where the subsidy is tied not only to the household but also to the building concerned, will reduce mobility. Individuals are more reluctant to move if they risk losing a subsidized apartment and having to pay market rents. A substantial literature has developed in Great Britain, documenting the negative impact that the provision of Council housing has had on mobility.

Provincial governments provide a range of measures similar to those at the federal level, including direct lending for housing construction and grants to subsidize housing expenditures by both owners and renters. They also have jurisdiction over rent controls, which can greatly influence the demand for housing. In general, the provinces have emphasized the promotion of home ownership for low and medium income households.

Local and municipal governments also have a major impact on the housing market. The property taxes levied as well as the provision of services such as roads, sewers, water purification, garbage collection, police and fire protection, all have a major effect on house prices in an area.

Municipal governments also have considerable power over land use. Most local governments establish official plans that set out the allowable uses of land and the allowable intensity of land use. These plans are generally given force through a system of zoning by-laws. Often any new residential developments have to be approved and may be subject to extensive regulation regarding lot size, street size and layout, and provision of land for schools, parks and so forth. This affects not only the cost of new construction, but also the speed with which developers are able to respond to increases in demand.

For example, the Vancouver Charter grants very broad powers to the City Council to designate zones in which there are to be no uniform regulations and in which any person who wishes to carry out development

must submit plans and specifications and obtain Council's approval for the form of development. Such a process can greatly increase the costs of development and, depending on the views of those approving proposals, may reduce the supply of new housing.

2.6 Price bubbles

A number of studies have found evidence to suggest that the housing market may be relatively inefficient. For example, Case and Shiller (1989) found that in the United States a change in real city-wide housing prices in a given year tends to predict a change in the same direction, one-quarter to one-half as large in magnitude, the following year, and that predictable movements in real interest rates do not appear to be incorporated in prices.

In order to gain a better idea about house price expectations, Case and Shiller later distributed a questionnaire in three areas of the United States, one a booming housing market, one a post-boom market and the third an area where house prices had been stable for a considerable period of time (Case and Shiller 1988). They concluded that price expectations are based almost entirely on past price movements rather than knowledge of the economic fundamentals and that, in general, home buyers regard real estate as a safe investment.

In a later article, Case (1986) argues that price bubbles can occur in the housing market when prices are bid above their fundamental value on the basis of price expectations. He states that, for a number of reasons, the housing market is particularly susceptible to such bubbles: information on the fundamental yield of a housing unit is difficult to obtain, since the value of housing services to the owner is not directly observable; both buyers and sellers tend to rely to a large extent on the views of real estate agents as to market value.

Real estate agents are unlikely to convey impartial information. They know that properties will move fastest when buyers expect prices to be higher in the future. Moreover, sellers have an incentive to "test" the upper limit of the market. If the price is too high it can always be lowered, but if the price is too low and the house sells immediately, nothing can be

done to correct the error. Case argues that while it is unlikely that agents can start an expectation spiral, there is a potential for perfectly rational buyers, sellers and agents, once market fundamentals begin to generate increases, to turn those increases into an expectational bubble.

Case cites movements in house prices in Boston from 1983 to 1985 as an example of a price bubble. He found that over this period, when house prices grew at well above average rates, such increases could not be adequately explained by movements in the economic fundamentals such as mortgage rates, demographic changes, income and construction costs. If this is true, it suggests that regional movements can diverge for considerable periods, for reasons not directly related to aggregate demand and supply. Just how long such growth can continue is harder to assess.

2.7 Conclusion

A brief review of the literature reveals many factors that are likely to lead to regional disparities in house price movements. These factors support the contention that regional differences in house price movements may be important contributors to regional inflation disparities. The fixed nature of housing and of supply in the short to medium term means that regional shocks are more evident in house prices than in the prices of other goods and services. High transaction costs facing buyers and sellers slow adjustment to any shock. Government intervention in the form of subsidized housing, rent controls and land constraints may further hinder adjustment. Differing regional regulations will also change the character of local housing markets, as will factors such as the demographic structure of the area. Finally, there is evidence to suggest that housing markets are relatively inefficient, and that regional price bubbles can occur.

3 OVERVIEW OF MOVEMENTS IN HOUSING PRICES AND INFLATION

3.1 Introduction

Section 2 provides a theoretical basis for suggesting that house prices may contribute significantly to regional inflation disparities. Do the data, however, show clear links between regional disparities in house prices and regional disparities in inflation? This section provides an overview of the data and illustrates the complexity of the links between house prices and inflation. Few if any generalizations can be made about the contribution of regional house price variability to overall consumer price index (CPI) variability from a simple comparison of the two. Nevertheless, the overview is useful in highlighting similarities in trends in regional disparities and in providing a basis for the models developed in later sections. The section begins with an explanation of the data used both in the overview and in the econometric analysis of Sections 4 and 5. This is followed by brief analyses of the regional trends in inflation and housing prices.

3.2 Explanation of the data

3.2.1 CPI data

The data used in this study on CPI by province was derived by constructing measures of the CPI for five regions (the Atlantic region, Quebec, Ontario, the Prairies and British Columbia) from information on city CPIs. Although this gives narrower coverage than when the standard CPI by province published by Statistics Canada is used, it has the major benefit of providing a longer-run series. Deriving the data from city series gives information for the period 1971–89, whereas Statistics Canada’s provincial series begins only in 1978. A detailed description of how the data were constructed is given in Appendix 1.

Shelter cost series were also derived from city CPI information. For the purpose of this study, shelter costs are defined as the sum of the costs of rental accommodation and owned accommodation (including property taxes, insurance premiums and replacement cost). They do not include water, fuel, electricity and travellers’ accommodation.

3.2.2 House price information

This study also makes use of regional series on the average resale price of housing (all transactions) which are collected by the Canadian Real Estate Association. These series have historical data available at the provincial rather than the city level. Unfortunately, however, the series were discontinued at the end of 1989. More recent data were generated using the average resale price of housing by city for residential transactions. Details on the estimation of these data are given in Appendix 2. It should be noted that these series do not include the cost of new houses. While the all-transactions series include sales of commercial buildings, the Real Estate Association estimates that over 80 per cent of the transactions recorded are in the residential sector. (It was not possible to base the whole analysis on the average resale price of housing for residential transactions, since this series begins only in 1982 and is on a city rather than a provincial basis.)

One of the greatest problems with the house price series just described stems from the diversity of housing markets. Owing to the fact that housing characteristics vary so much from one unit to another, it is hard to differentiate between “true” price movements and movements that are merely due to changing characteristics. A general increase in house prices over time may be due to the fact that people are willing to pay more for the same properties or that the average quality of housing has increased.

In practice it is likely to be some combination of the two. Certainly, measures such as the number of rooms per person, the quality of plumbing and the average age of the housing stock suggest that the quality has increased considerably over the past 20 years. Thus, general price movements over the period will likely overestimate the increase in quality-adjusted house prices. Similarly, data based on resale house prices do not represent the price of the whole stock of housing, but only that small fraction which turns over in a given period.

In order to identify movements in quality-adjusted house prices, many analysts have derived price indexes using data bases that give the prices of repeat sales of the same properties. These price indexes were not

available to me and they are likely biased, since properties undergoing repeat sales may well differ in significant ways from the general stock of housing.

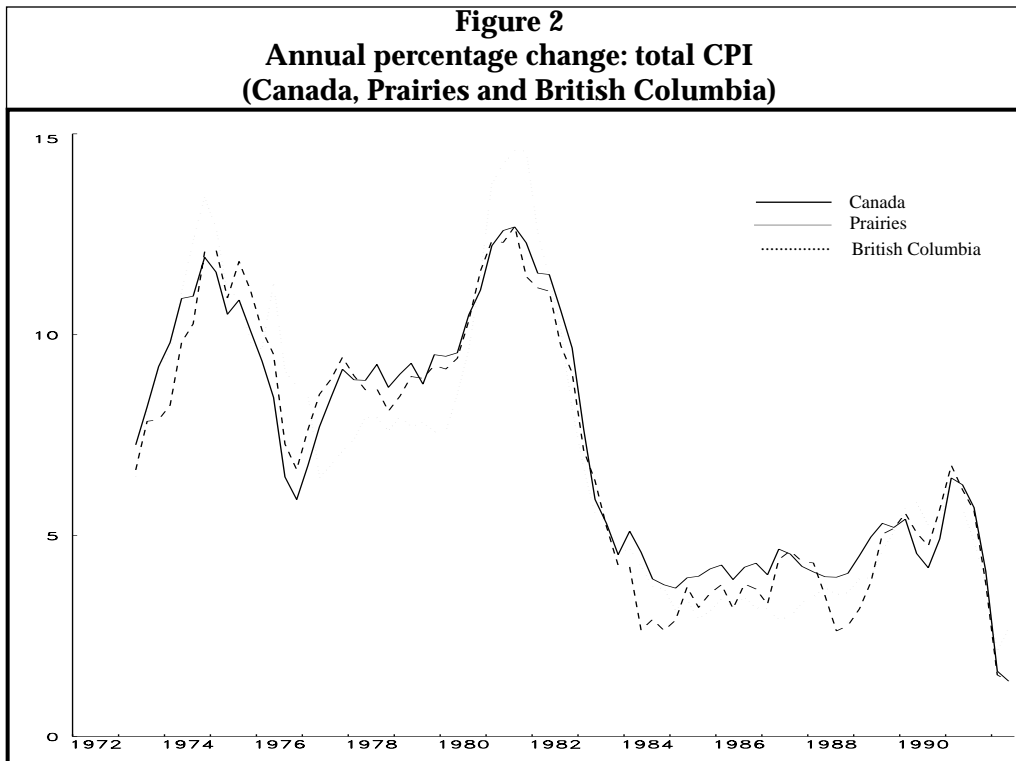
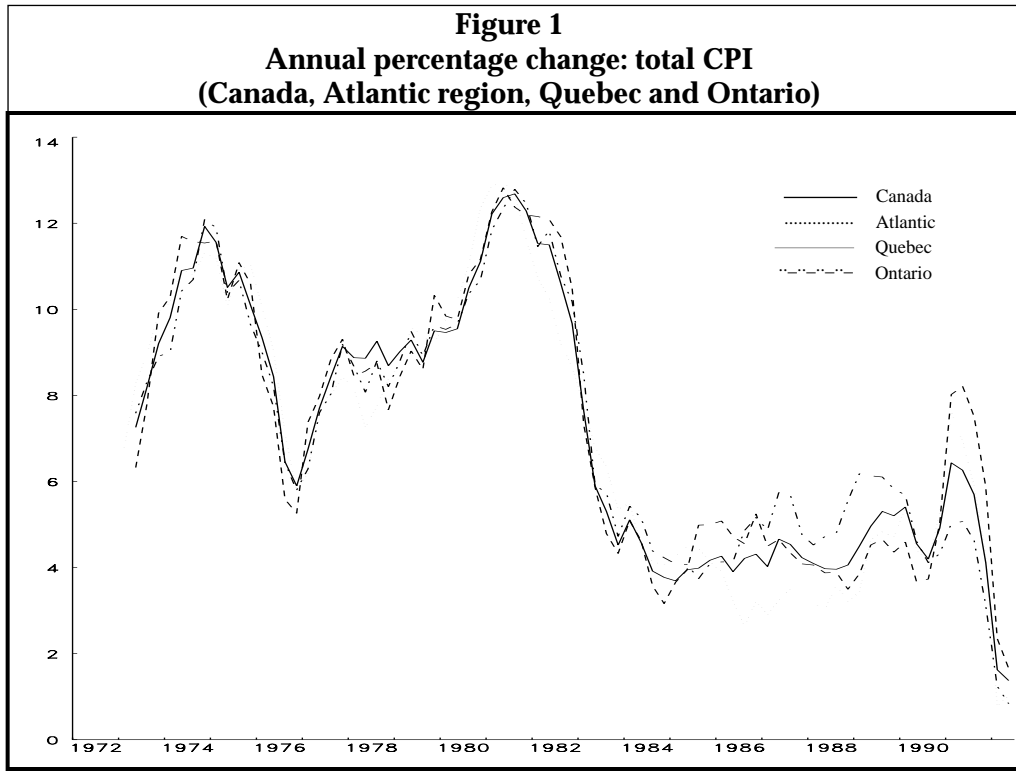
3.2.3 Weights

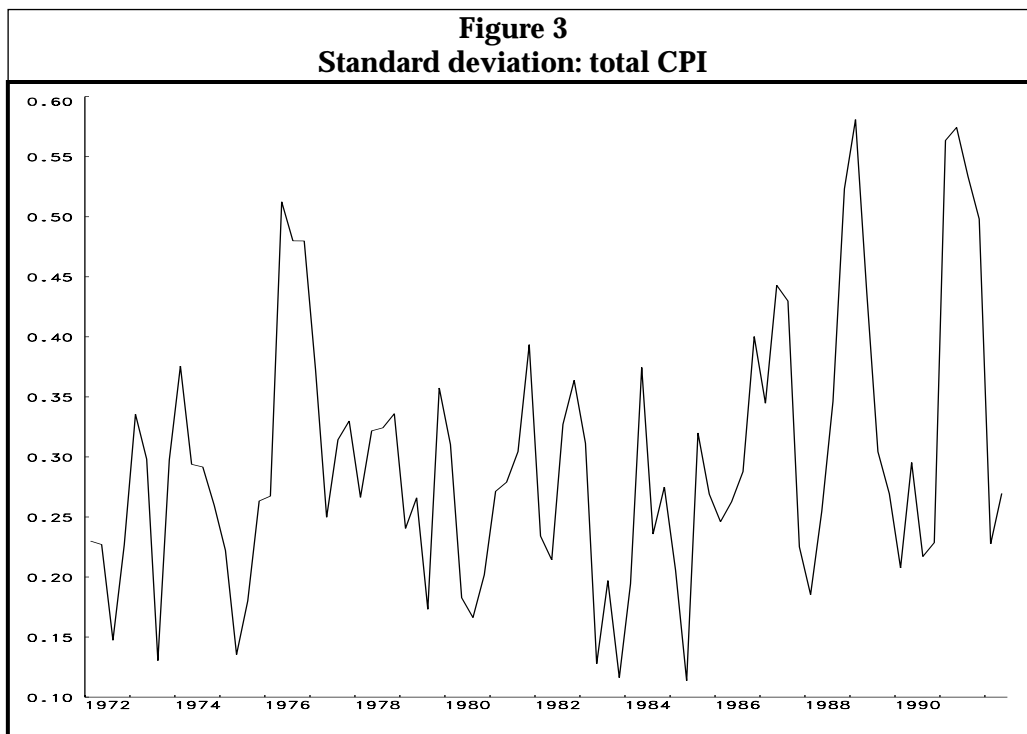
In order to measure provincial disparities, measures of weighted variance were calculated. In the case of the CPI, weights for each province were based on the province's shares of total consumer expenditure. Similarly, for shelter services, weights were derived from a province's share of expenditures on shelter services. Information on the housing stock within each province was used to generate weights for the house price data. (While I used weighted measures in this study, if unweighted measures are used, the results will be unchanged.)

3.3 Trends in inflation disparities

3.3.1 Total CPI

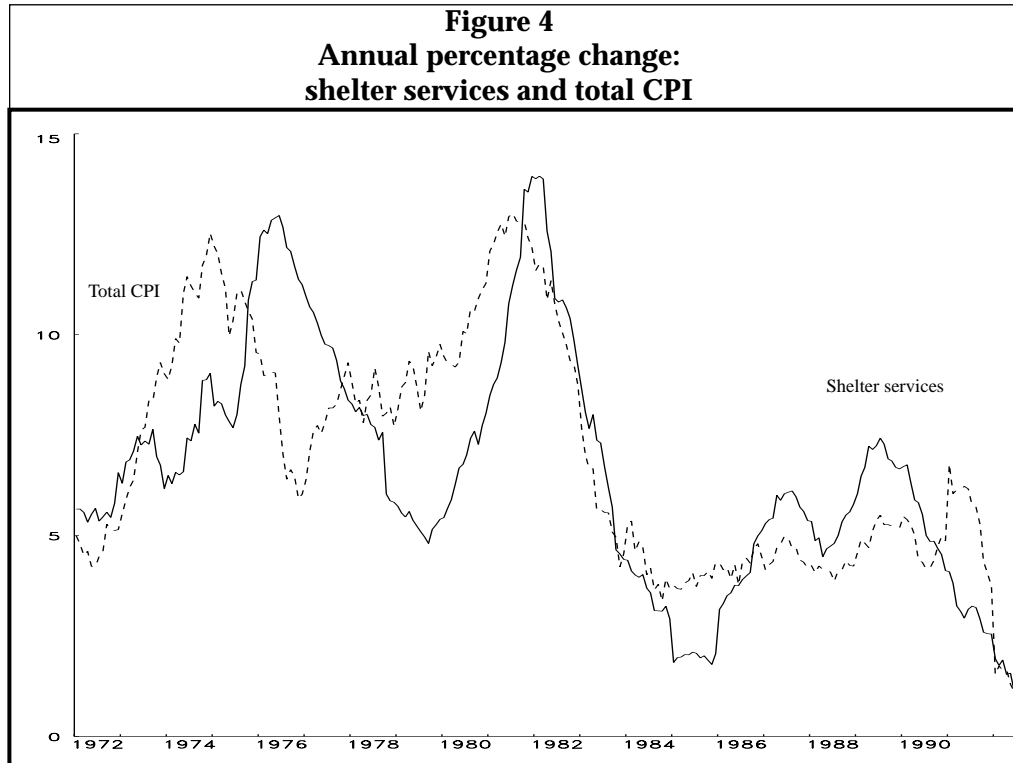
Figures 1 and 2 show the annual percentage change in the CPI for Canada and each of five regions over the period 1972 quarter one to 1992 quarter two. The degree of disparity in the rates of inflation across the regions varied considerably over the study period. This can also be seen in Figure 3, which shows the standard deviation of provincial inflation rates. The standard deviation is a measure of absolute dispersion, measured in the units of the variable for which it is calculated. The standard deviation is a more appropriate measure of disparity than the coefficient of variation, since inflation does not typically change proportionately across regions, and when inflation falls to zero, the coefficient of variation becomes infinitely large. The charts illustrate that there is no simple association between the level of inflation disparity and the level of overall inflation.





A number of general comments, however, can be made about trends in disparities:

- High levels of disparity are often very short-term and are caused largely by a diverging rate of inflation in one region; in many cases this divergence may be due to indirect tax changes.
- British Columbia appears to diverge from the general level of inflation more frequently and by larger amounts than the other provinces; before 1984 all the periods of peak disparity coincide with significantly above or below average inflation in British Columbia.
- The highest levels of disparity occur in 1989 and 1990–91, major contributors being above average inflation in Ontario and an increase in the Quebec provincial sales tax in 1991.

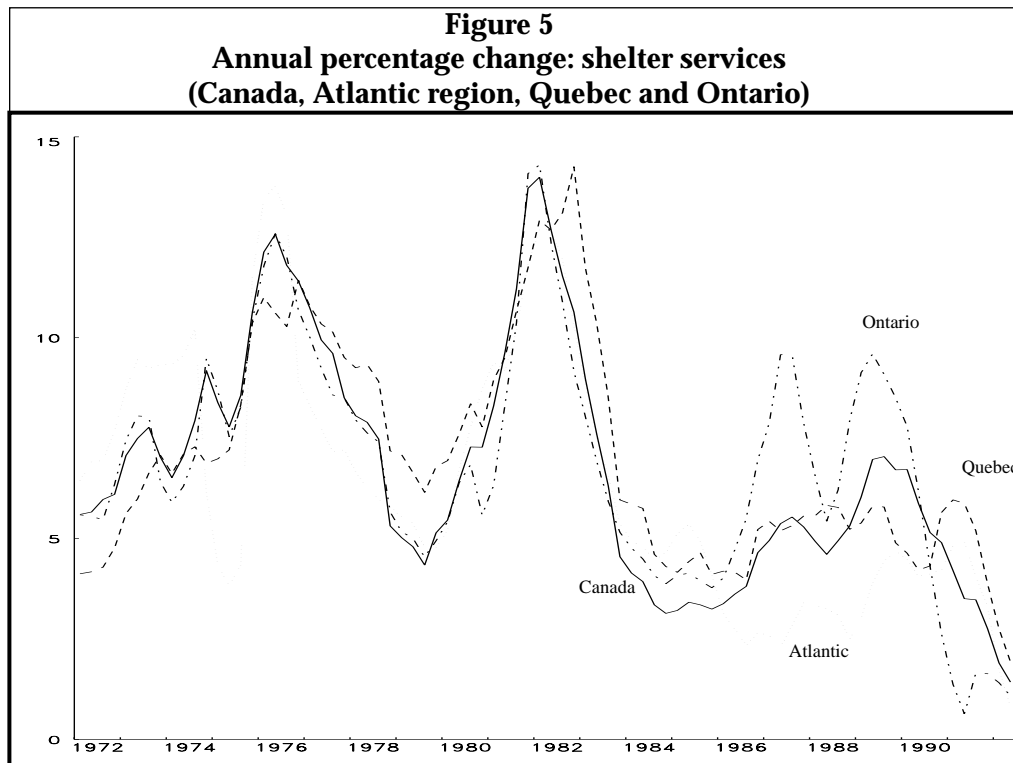


3.3.2 Shelter services

Figures 4 to 7 show measures for shelter service prices similar to those shown for the total CPI. (Shelter costs are defined as the sum of the costs of rental accommodation and owned accommodation, including property taxes, insurance premiums and replacement cost.) From Figure 4 it is evident that general trends in the prices of shelter services have been broadly similar to those of the total CPI, though by no means identical:

- The first peak in shelter-services inflation (1976 quarter two) comes over a year after the first peak in general inflation; the subsequent decrease in inflation rates is more gradual for shelter services, ending in 1979 quarter four, two years after the decrease in the total CPI ends.
- The second acceleration in inflation is, in contrast, more rapid in the shelter services, ending in 1982 quarter one, three quarters after the peak in general inflation.

- From 1984 to 1989, price increases in the shelter services show a stronger upward trend.
- Inflation of shelter services begins to drop sharply in 1989, whereas general inflation does not fall until 1991 (owing, at least in part, to the introduction of the Goods and Services Tax).



It is interesting to note that trends in the standard deviation of shelter price inflation show a stronger association with trends in shelter price inflation than is the case for the total CPI. The standard deviation peaks at about the same time as the 1976 peak in shelter service price increases. The standard deviation also generally increases from 1979 to 1981, although it falls sharply in 1982 when the rate of inflation peaks. Both series follow a generally downward trend from 1982 to the end of 1985. From 1986 onwards, however, the movements of the two series are more dissimilar. The standard deviation peaks three times in that period, reaching its highest level for the study period in 1987.

Figure 6
Annual percentage change: shelter services
(Canada, Prairies and British Columbia)

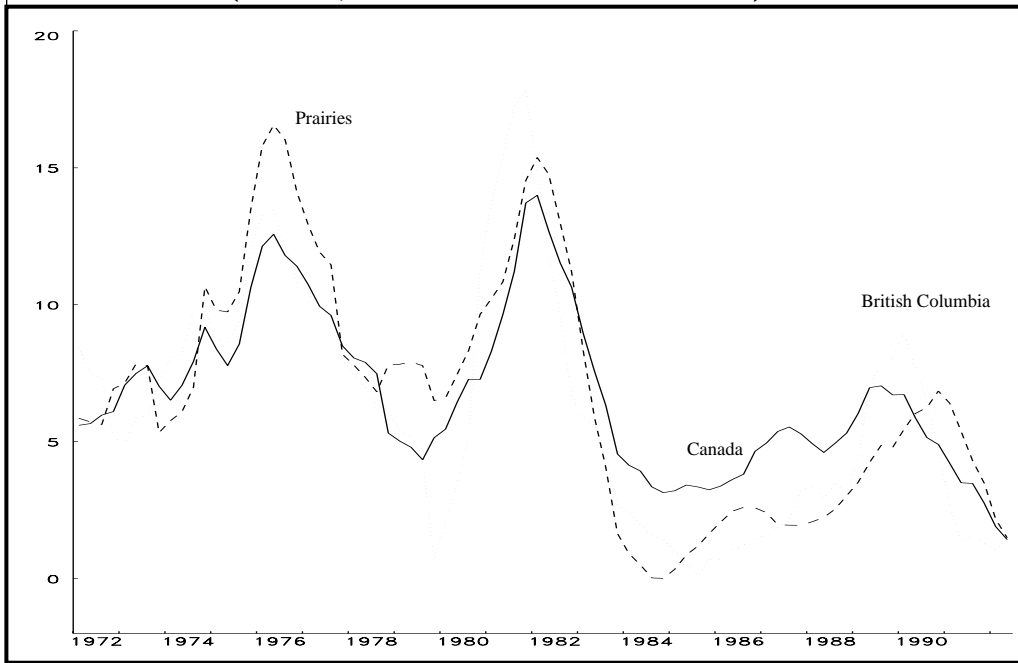
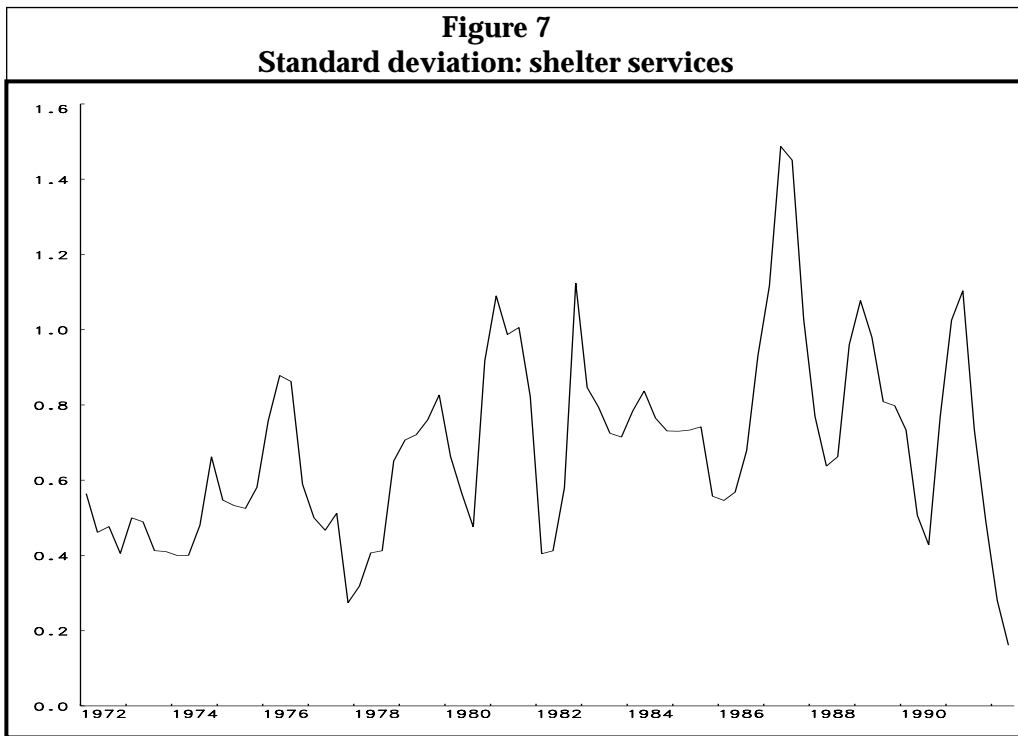


Figure 7
Standard deviation: shelter services



As in the case of total inflation, a number of general trends can be identified:

- The level of regional dispersion in shelter services is generally considerably above that of total inflation.
- British Columbia again shows periods of considerable divergence from the general level of price increase; the Prairies and the Atlantic regions also experience periods of significantly above or below average shelter price increases.
- As in the case of the total CPI, the peaks that occur in the regional dispersion in shelter services in the late 1980s (1987 and 1989) are in part due to very high rates of shelter price inflation in Ontario.

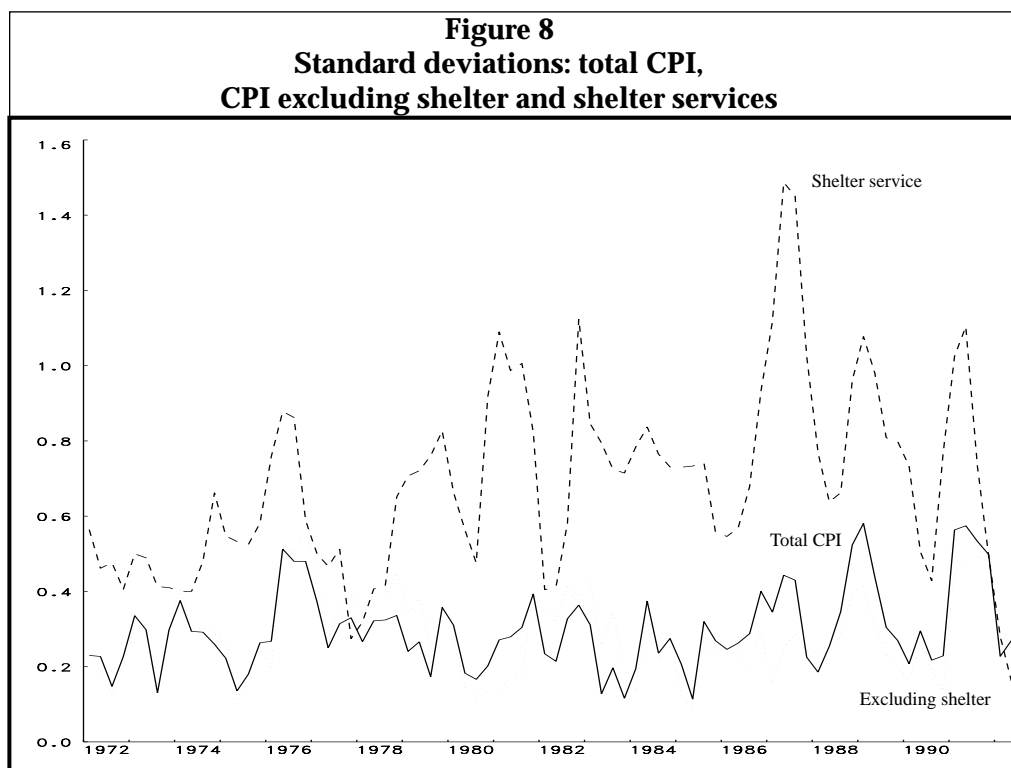


Figure 8 compares the standard deviations of the total CPI, the total CPI excluding shelter services and the shelter services component. The graph shows the following:

- The dispersion of shelter service prices is generally higher than for the total CPI and the CPI excluding shelter services.
- For the period as a whole, there is no close matching between movements in the regional dispersion of shelter service prices and movements in the total CPI. There are periods when both series move together, for example, from 1987 to the end of the study period. Similarly, there are periods when the two diverge, as in the period between 1977 and 1980.

Even though there is no close association between the dispersion trends in shelter services and the CPI, it is tempting to draw the conclusion that since shelter services generally have a higher level of absolute dispersion than either the total CPI or the CPI excluding shelter, shelter services must be a major factor contributing to general inflation disparities. Such a conclusion ignores, however, two important problems:

- The shelter services component of the CPI includes fewer individual elements than either the CPI or the CPI excluding shelter; even if all three series were purely random, one would expect the series with the fewest components to have the greatest variability. Similarly, it is quite likely that if one component of the CPI excluding shelter was identified separately, it too would appear more variable than the total CPI and the CPI excluding shelter services.
- Some of the effects that shelter service prices have on regional disparities are indirect: higher shelter service prices push up the costs of production in a particular area through the demand for high wages. This in turn pushes up the prices of other goods and services produced there; such indirect effects cannot be identified in a simple comparison of the variability of each series.

These problems mean that it is not possible to reach an overall estimate of the degree to which regional disparities in shelter price increases have contributed to regional disparities in inflation.

3.3.3 House prices

Figures 9 to 12 show the annual percentage change and standard deviation in house prices over the study period. Not surprisingly, the general movements in house prices show some similarity with movements in the CPI, though as in the case of shelter services, they are by no means identical. House price inflation soars in the early 1970s, but peaks several quarters before total inflation. House price inflation then follows a generally downward trend, reaching a trough in 1978 quarter one. Both house price inflation and increases in the CPI follow an upward trend in the late 1970s, peaking in 1981 quarter one. In the case of house prices, however, the peak is relatively lower, considerably below that occurring in 1974. Both series then decline, but the trough occurs two years earlier in the case of house prices and is followed by a more marked upward trend. Both series decline in 1991.

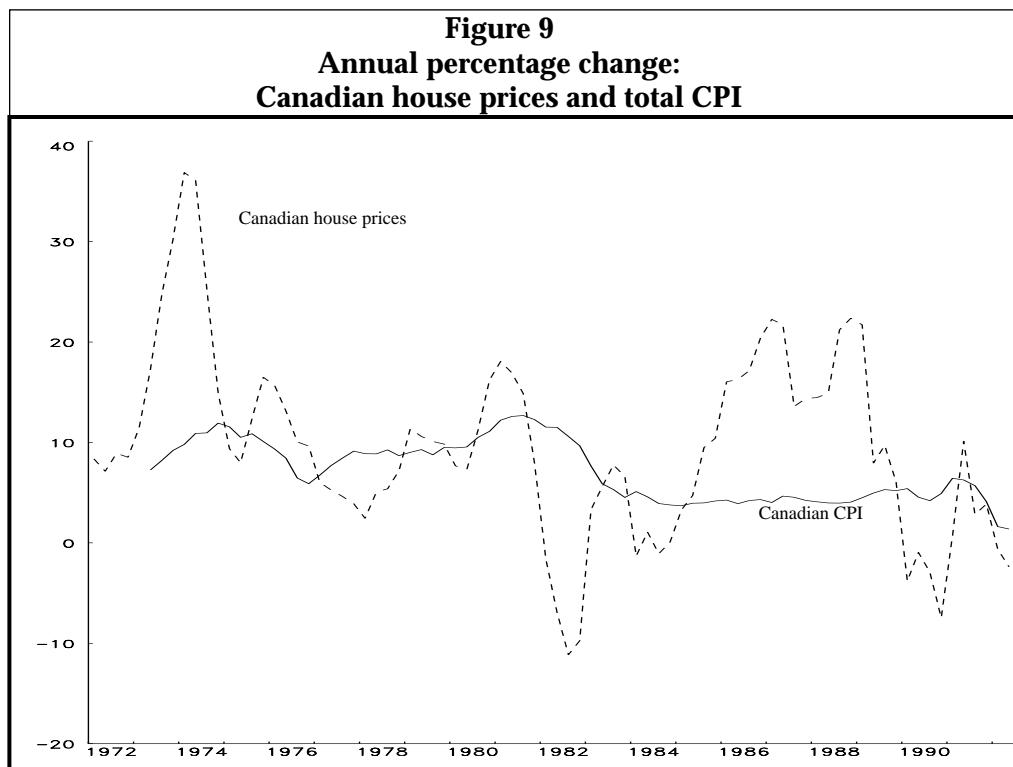


Figure 10
Annual percentage change: house prices
(Canada, Atlantic region, Quebec and Ontario)

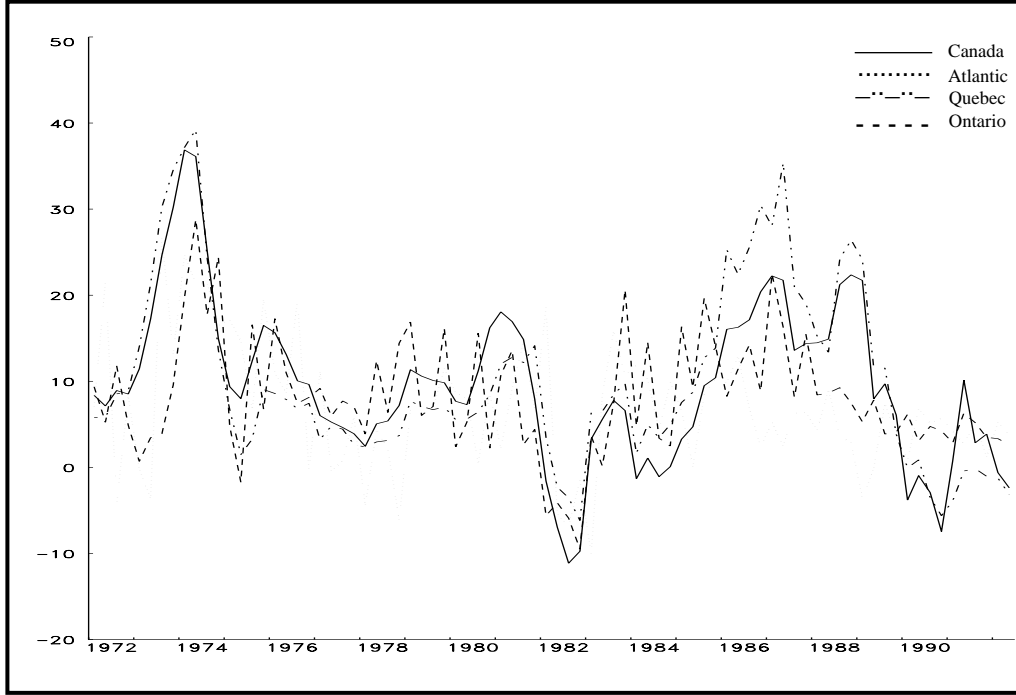
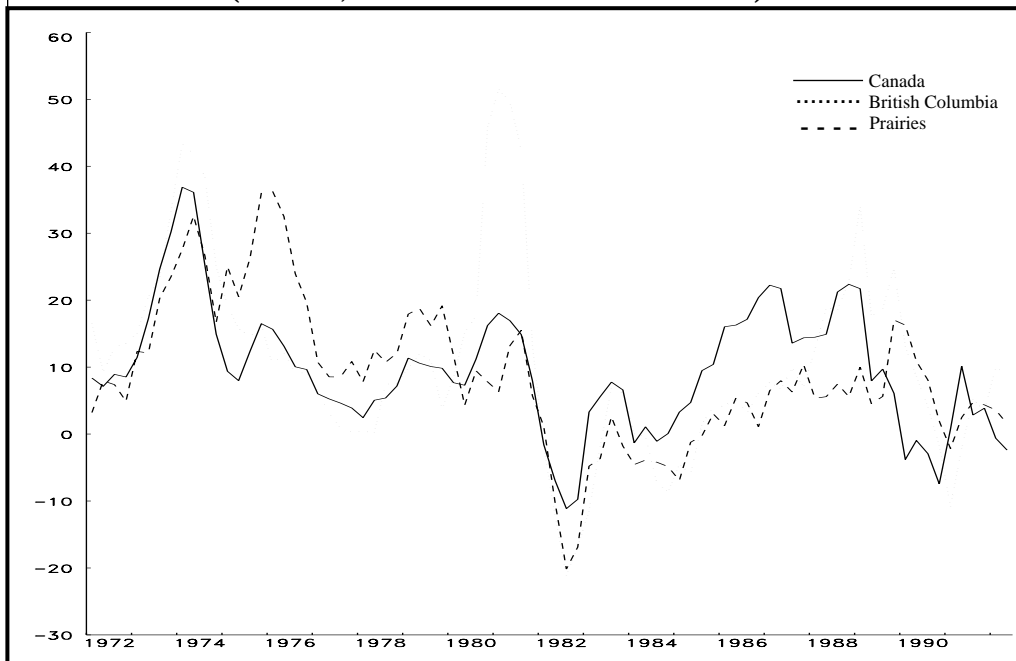
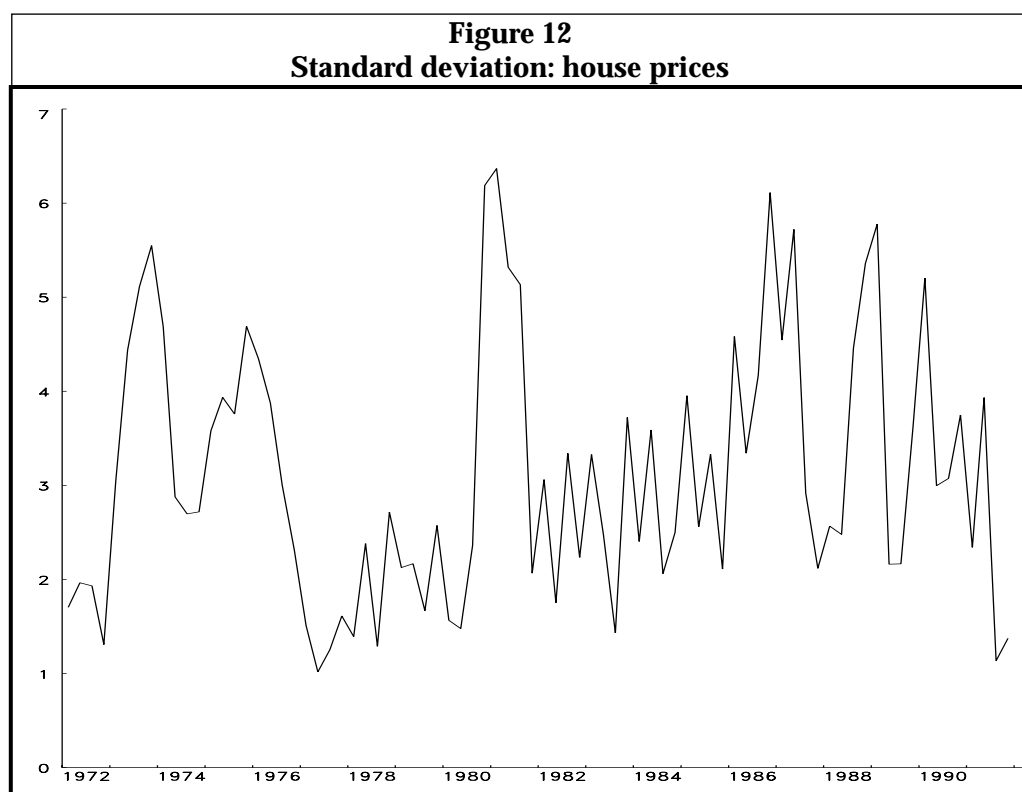


Figure 11
Annual percentage change: house prices
(Canada, Prairies and British Columbia)





As in the case of shelter services, British Columbia, the Prairies and the Atlantic region are the main regions to experience periods of significantly above or below average house price increases before 1983. The general pattern of increases after 1983 (for example, above average increases in Ontario, below average increases in the Prairies and the Atlantic region) is similar to that for shelter services and the CPI.

3.4 Conclusion

Theoretically, house prices are likely to reveal greater regional disparities than many other more easily tradable goods and services. This contributes to regional disparities in inflation. Comparisons between the dispersion of inflation, shelter services and house prices show some similarities: for example, the same provinces experience the greatest divergences from average rates of price increase, and both the CPI and shelter services exhibit sustained levels of relatively high disparities after 1983. In general, however, movements in the three series are too different to allow conclusions to be drawn regarding the degree to which disparities in house prices

or shelter services contribute to overall inflation disparities. A simple comparison of levels of dispersion gives an indeterminate result.

4 THE ROLE OF HOUSE PRICES IN ADJUSTMENT TO REGIONAL DEMAND SHOCKS

4.1 Introduction

Section 2 considered the reasons why house price movements may be likely to show greater regional disparities than movements in the prices of more tradable goods. Such disparities could then contribute to more general inflation disparities across regions. This section takes an alternative view of disparities in house prices by considering the role they play in adjustment to regional demand shocks. When a regional demand shock occurs, house price changes are not only a reaction to the shock, but a key part of the adjustment mechanism whereby growth is disseminated across regions.

4.2 Adjustment to regional demand shocks

Assume a demand shock occurs that increases growth, employment and incomes in a particular area, whether it be an individual community, a city or an entire province. An example would be the realization of a large investment project to transform natural resources in the area. How does that shock impact on prices, and is there any mechanism whereby the growth is disseminated over a wider region?

The general mechanism of adjustment begins with an increase in local demand, due both to the higher incomes being received by the original population and in-migration of people attracted to the improved job opportunities. The increased demand puts upward pressure on prices, and local inflation rises relative to the average. The prices of goods and services produced locally rise in relation to the prices of goods and services produced elsewhere, until gradually exports of local goods fall, while imports from other areas rise. This reduces local demand pressures and increases demand and production in other areas.

The role of house prices in this process may be particularly important, since house prices tend to be more sensitive to greater regional demand disparities than other prices and because they have a more direct impact on the migration decision. As argued in Section 2, the initial

demand shock is likely to be more evident in the case of rents and house prices than in the prices of other goods and services, since houses are in relatively fixed supply in the short to medium term. There is a considerable lag between the beginning of a demand shock and the completion of new houses to meet that shock.

The resulting house price increases put upward pressure on wages, with local workers and incoming migrants wanting to be compensated for the higher costs they will face. In the short term, the combination of higher wages and higher house prices serves to fuel demand pressures further. In the case of house price increases, this occurs through both a wealth and a liquidity effect, as the borrowing capacity of existing home owners expands on the basis of higher house values.

In the medium term, however, increased inflationary pressures will start to weaken growth prospects. Higher house prices directly increase the upward pressure on other prices, as producers face higher costs of production, both directly from the increased cost of land and indirectly through higher labour costs. Rising costs eventually reduce competitiveness and make it less profitable for firms to operate in the area, potentially causing them to shift elsewhere. This last effect is well illustrated by an article in the *Financial Times* (Sinclair 1990):

It's probably cold comfort for the thousands who have fled Toronto in recent years because of high housing costs, but new data from Statistics Canada show that industry is also packing up and leaving the city. In a separate report, Toronto's metropolitan government has confirmed that manufacturing jobs inside its borders declined slightly last year as well.

This suggests that in the long run disparities in house price increases are part of a larger process whereby investment and demand are disseminated across different regions. There are a number of factors, however, which can impede the adjustment process. These include the following:

- Factors that slow migration flows, such as fiscal arrangements favouring low-growth regions.

- Distortions in the wage-bargaining process. Where a large employer unconstrained by profit imperatives has greater freedom to grant wage increases, regional adjustment could be slowed and house prices would have to rise further than in the absence of such an employer. This may be particularly relevant for regions that have a high number of government employees, for example. Similarly, where wage increases are based on national rather than local price movements, adjustment will be slowed. In this case migration to the growing area will be less attractive, thus reducing pressures on housing but tending to perpetuate both excess demand for labour in the growing area and unemployment in low growth regions.
- Price bubbles, where house prices increase more than is necessary to promote adjustment, leading, over the medium term, to a greater reduction in activity in the high-growth area.
- Factors such as local zoning laws, which reduce the rate of new construction and thus limit the supply of housing. These will also tend to lead to higher-than-otherwise price increases; higher house prices will stall migration, impeding labour mobility and thus forcing adjustment through relative prices instead.

Overall, if this is an accurate portrayal of the adjustment process, it suggests house price disparities are a symptom of a regional demand shock and over time will help to disseminate growth and investment across other regions. Such adjustment may be slowed, however, by constraints on, or distortions in, the process of adjustment, or by tendencies for housing markets to exhibit price bubbles.

4.3 Evidence of adjustment to shocks

A brief review of the experience of three regions provides examples of house prices adjusting to local demand shocks:

Figure 13 shows movements in house prices as well as net total migration (international and interprovincial migration) and net interprovincial migration, as a percentage of the total population for Ontario. It can

be seen that house price inflation increased from 1982 to 1987 and that large migration inflows also occurred over this period. More generally, the Ontario economy experienced a period of high expansion from 1983 to 1988, with real gross domestic product (GDP) growth outpacing the Canadian average, employment growth exceeding 2 per cent a year and strong investment growth. After 1988, total net migration remained high, while house price inflation fell sharply and net interprovincial migration declined and turned negative. This reflected the general weakness in the Ontario economy.

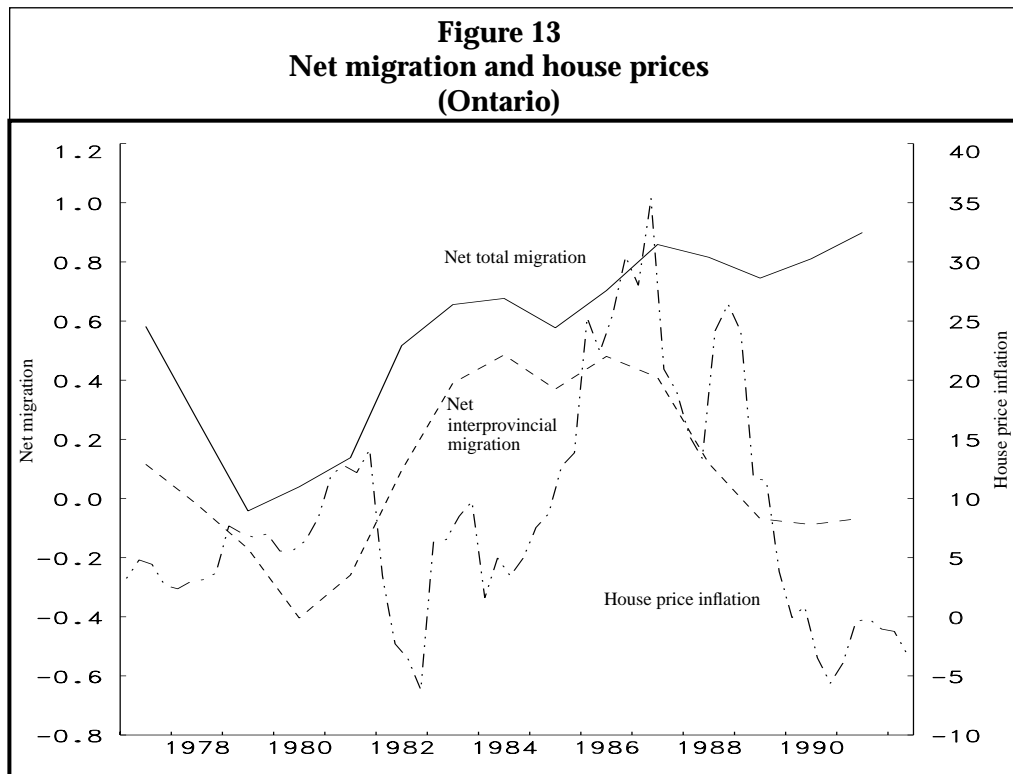
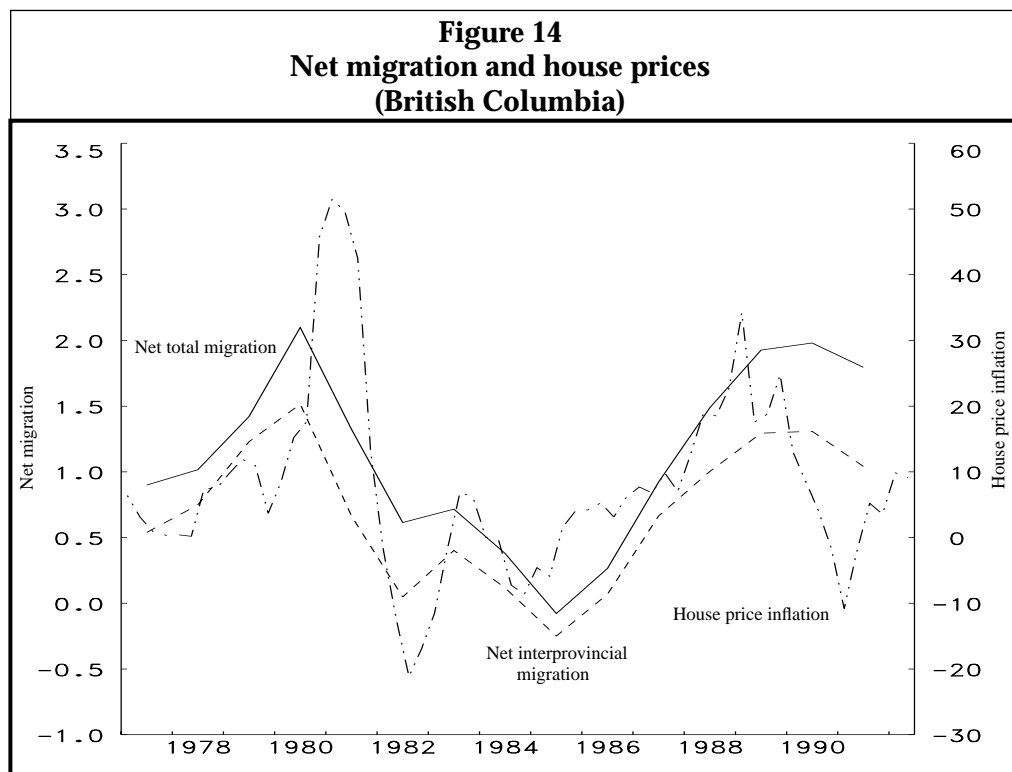


Figure 14 shows that movements in net migration and house prices in British Columbia have also shown a close correlation in recent years. Increasing levels of net migration from 1976 to 1979, for example, were followed by increasing house prices from 1978 to 1981. Over that period the British Columbia economy experienced above average real growth, buoyed initially by the forestry sector, then a strongly increasing service

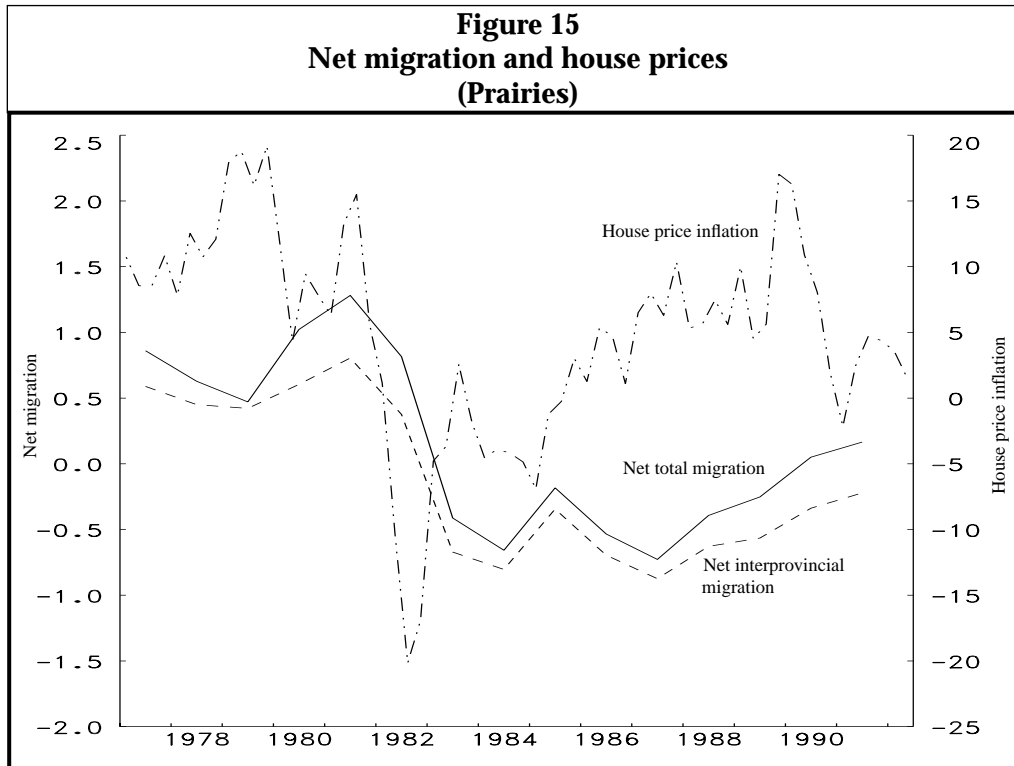
sector. A second bout of net migration and house price increases took place in the period from 1987 to 1990.



A correlation between house price inflation and migration can also be seen for the Prairies in Figure 15; house prices show a high rate of growth from 1976 to 1981, likely because of increases in Alberta, where strong above average growth was experienced, particularly from 1979 to 1981, owing to favourable oil prices. For example, real growth in Alberta reached 10.8 per cent in 1979; in contrast, over much of this period Saskatchewan and Manitoba experienced slow or negative growth in real GDP.

More generally, however, the role of house price increases in demand adjustment cannot be evaluated in isolation from the general adjustment process. The relationship between house price increases and migration is itself complex, with the variables likely to be positively

correlated early in the process, but negatively correlated later on as higher house prices discourage further immigration.



The literature concerning the role of house prices in regional adjustment is very scant. Poloz (1990) has examined relative provincial price changes as measured by both the general CPI and GDP deflators, in order to assess the variability of interregional exchange rate movements within Canada. While his results confirm that exchange rate movements occurring through price changes are an important means of interregional adjustment, the study does not deal with house prices specifically. The one area where the role of house price changes has been tested is in relation to migration. In their study of interprovincial migration in Canada, for example, Winer and Gauthier (1982) found that higher housing price indexes in Alberta and British Columbia had a negative effect on migration to these provinces. A similar conclusion was reached by Mills, Percy and Wilson (1983) with respect to higher housing prices in Alberta and Saskatchewan. Since the prime focus of these studies is to explain migrational flows, however, they provide little insight into house price adjustments.

4.4 Estimation of regional demand shocks

One way to explore the role of regional demand shocks is to develop a simple model of regional house price movements. Since I have argued above that regional shocks cause regional house price movements to deviate temporarily from national trends, one obvious approach is to model deviations of regional house prices from a national price variable as a function of regional demand shocks. Such a model is shown below for region i .

$$\begin{aligned} \Delta[\log(HP_i)]_t &= a + b \left[\log\left(\frac{HP_i}{CP_N}\right) \right]_{t-i} \\ &\quad + c \Delta[\log(CP_N)]_t \\ &\quad + \sum_{j=0} d_j \Delta[\log(RC_i)]_{t-j} \\ &\quad + \sum_{j=0}^T e_j \Delta[\log(GOV_i)]_{t-j} \\ &\quad + \sum_{j=0}^T f_j \Delta[\log(COM_i)]_{t-j} \end{aligned}$$

where Δ is the first difference,

HP_i is the level of housing prices in region i ,

CP_N is the level of the national CPI,

RC_i is real capital expenditure in region i ,

$$+ \sum_{j=0}^T g_j \Delta[\log(POP_i)]_{t-j}$$

$$+ \sum_{j=0}^T h_j \Delta[\log(FDEM_i)]_{t-j}$$

$$+ i \Delta[\log(RREAL)] + E_t$$

GOV_i is real current government expenditure in region i ,

COM_i is a local commodity price index in real terms,

POP_i is population,

$FDEM_i$ is foreign demand for region i 's goods and services,

$RREAL_i$ is the real rate of interest.

This model posits the annual change in house prices in region i to be a function of the following: the ratio of house prices in region i in the previous year to the national CPI, the change in the national CPI, and a series of shock variables. In other words, it suggests that there is a long-run relationship between house prices in any region and the national CPI, but that in the short term regional shocks may cause house prices to deviate from the national trend. The real rate of interest is also included to take account of the impact of monetary policy changes.

It is important to understand that in the above model the deviations of regional house prices from their long-run relationship with the national CPI can be caused by two factors: first, the purely "regional effect," that is,

adjustment to regional shocks; second, the differing response of house prices to regional and national shocks compared with that of a more general price index. In the above formulation, no distinction can be made between these two effects, with the shock coefficients incorporating both.

An alternative formulation that helps identify the purely regional effect includes the change in the log of the ratio of the regional variable to the national variable (for example in the case of real capital expenditure $\Delta[\log(RC_i/RC_N)]$). This removes the impact of Canada-wide changes in the variables, which may already be captured by the national CPI.

The differing response of house prices relative to the CPI could also be identified if the regional CPI was substituted for the national CPI in the first explanatory variable. Such a model would then investigate how regional shocks cause regional house prices to deviate from their long-term relationship with the regional CPI.

The shock variables chosen are intended to capture exogenous changes, but inevitably contain some endogenous elements. Changes in population, for example, may be due to exogenous demographic factors or may be induced by incoming migrants responding to favourable local economic conditions. This in turn may perhaps arise from an improvement in commodity prices or increased real capital expenditure. To the extent that the variables are capturing endogenous elements, problems with high correlations between them may exist.

Table 2 shows the correlation coefficients between the shock variables for each of the provinces. It can be seen that in most provinces high correlations between the variables are not a problem. In the Prairie provinces, however, there is a relatively high correlation between commodity prices and real capital expenditure, and in British Columbia movements in real capital expenditure, government expenditure and commodity prices all show some correlation with changes in population. Particularly notable in the case of British Columbia is the fact that the correlation coefficient between population and real commodity prices is -0.6. The negative coefficient arises because of the impact of lags in the adjustment process. If com-

Table 2
Correlation coefficients between shock variables

Atlantic region				
	$\Delta[\log(\text{POP})]$	$\Delta[\log(\text{RC})]$	$\Delta[\log(\text{GOV})]$	$\Delta[\log(\text{COM})]$
$\Delta[\log(\text{POP})]$	1.000			
$\Delta[\log(\text{RC})]$	-0.179	1.000		
$\Delta[\log(\text{GOV})]$	0.465	-0.339	1.000	
$\Delta[\log(\text{COM})]$	0.205	0.339	0.268	1.000
Quebec				
	$\Delta[\log(\text{POP})]$	$\Delta[\log(\text{RC})]$	$\Delta[\log(\text{GOV})]$	$\Delta[\log(\text{COM})]$
$\Delta[\log(\text{POP})]$	1.000			
$\Delta[\log(\text{RC})]$	0.063	1.000		
$\Delta[\log(\text{GOV})]$	0.119-0.081	0.002	1.000	
$\Delta[\log(\text{COM})]$		0.352	0.219	1.000
Ontario				
	$\Delta[\log(\text{POP})]$	$\Delta[\log(\text{RC})]$	$\Delta[\log(\text{GOV})]$	$\Delta[\log(\text{COM})]$
$\Delta[\log(\text{POP})]$	1.000			
$\Delta[\log(\text{RC})]$	0.156	1.000		
$\Delta[\log(\text{GOV})]$	0.382	0.091	1.000	
$\Delta[\log(\text{COM})]$	0.411	0.322	-0.151	1.000
Prairies				
	$\Delta[\log(\text{POP})]$	$\Delta[\log(\text{RC})]$	$\Delta[\log(\text{GOV})]$	$\Delta[\log(\text{COM})]$
$\Delta[\log(\text{POP})]$	1.000			
$\Delta[\log(\text{RC})]$	0.239	1.000		
$\Delta[\log(\text{GOV})]$	0.222	0.416	1.000	
$\Delta[\log(\text{COM})]$	0.182	0.525	0.375	1.000
British Columbia				
	$\Delta[\log(\text{POP})]$	$\Delta[\log(\text{RC})]$	$\Delta[\log(\text{GOV})]$	$\Delta[\log(\text{COM})]$
$\Delta[\log(\text{POP})]$	1.000			
$\Delta[\log(\text{RC})]$	0.472	1.000		
$\Delta[\log(\text{GOV})]$	0.565	-0.013	1.000	
$\Delta[\log(\text{COM})]$	-0.603	-0.438	0.114	1.000

modity prices are lagged two years the correlation coefficient with population is + 0.5.

Before the model is estimated, the validity of a long-run relationship between the level of house prices in each region and the national CPI must be checked. I did this by testing for cointegration between the two variables. According to a Dickey-Fuller test, cointegration between the regional level of house prices and the CPI was found in four out of five of the regions: the Atlantic region, Quebec, Ontario and the Prairies. For British Columbia, there was no evidence of cointegration in levels, but there was evidence of cointegration between the first differences of these variables.

One reason British Columbia showed no evidence of cointegration in the initial test may be that the local economy is more heavily influenced by such factors as movements in commodity prices, particularly those of forest products, than are many other provinces. A terms-of-trade shock resulting from a commodity price change would be expected to result in a long-lasting or possible permanent change in prices in British Columbia in relation to the rest of Canada. It is also consistent with the finding in Section 3 that British Columbia diverges from the general rate of inflation and the national rate of house price inflation more frequently and by larger amounts than the other provinces.

Initial estimates of the equations were made from the period 1972 to 1991 for the four regions where cointegration between the level of house prices and the national CPI was found. In all cases two principal equations were tried: one in which the shock variables were defined as the change in the total provincial variable, as in the original equation given above, and the other in which the shock variable was the change in the ratio of the regional variable to the national variable. Different lag structures were experimented with and insignificant variables were removed. The results are shown in Tables 3 to 6.

In general the model is not supported by the data:

- In all cases the coefficient for the ratio of house prices to the national CPI is insignificant and/or of the wrong sign.

- The coefficient for the change in the national CPI is also generally insignificant and/or of the wrong sign.
- The equations where the shock variable is defined as the change in the ratio of the regional variables to the national variables are no more successful than those using the change in the total provincial variable, in that the coefficients for the ratio of house prices to the national CPI are no more significant.
- While overall the equations suggest that regional house price movements are influenced by regional shocks, no generalizations across the regions can be made about which shock variables are important and which lag structure would be the most appropriate one to use.

Some of the differences in results between the regions likely stem from differences in both regional housing markets and, more generally, the regional economies. The main conclusion from these estimations, however, is that this particular form of the model is not a good representation of house price inflation.

Table 3
Regional shock model – Atlantic region

	Coefficient	T-statistic	R²: 0.68
Constant	2.780	2.24	
$\log(\text{HP}/\text{CP})_{t-1}$	-0.430	-2.23	
$\Delta[\log(\text{CP}_n)]$	0.630	1.90	
$\Delta[\log(\text{POP})]$	11.300	3.06	
$\Delta[\log(\text{COM})]$	0.610	3.69	
$\Delta[\log(\text{RREAL})]$	-0.008	-3.23	
	Coefficient	T-statistic	R²: 0.73
Constant	0.770	0.97	
$\log(\text{HP}/\text{CP})_{t-1}$	-0.110	-0.87	
$\Delta[\log(\text{CP}_n)]$	0.480	1.64	
$\Delta[\log(\text{POP}_i/\text{POP}_n)]_{t-1}$	9.510	3.43	
$\Delta[\log(\text{GOV}_i/\text{GOV}_n)]_{t-1}$	-0.750	-3.05	
$\Delta[\log(\text{RREAL})]$	-0.006	-2.99	

Table 4
Regional shock model – Quebec

	Coefficient	T-statistic	R²: 0.74
Constant	-0.230	-0.540	
$\log(\text{HP}/\text{CP})_{t-1}$	0.040	0.640	
$\Delta[\log(\text{CP}_n)]$	-0.002	-0.006	
$\Delta[\log(\text{RC})]$	0.440	4.180	
$\Delta[\log(\text{GOV})]_{t-1}$	0.700	2.360	
$\Delta[\log(\text{COM})]$	0.110	1.630	

	Coefficient	T-statistic	R²: 0.86
Constant	-0.603	-2.51	
$\log(\text{HP}/\text{CP})_{t-1}$	0.090	2.71	
$\Delta[\log(\text{CP}_n)]$	0.700	3.23	
$\Delta[\log(\text{RC}_i/\text{RC}_n)]_{t-1}$	0.610	6.85	
$\Delta[\log(\text{GOV}_i/\text{GOV}_n)]_{t-1}$	1.490	4.92	
$\Delta[\log(\text{COM}_i/\text{COM}_n)]$	0.280	5.56	

Table 5
Regional shock model – Ontario

	Coefficient	T-statistic	R²: 0.88
Constant	0.330	1.08	
$\log(\text{HP}/\text{CP})_{t-1}$	-0.040	-0.87	
$\Delta[\log(\text{CP}_n)]$	-0.430	-1.33	
$\Delta[\log(\text{RC})]$	0.300	2.11	
$\Delta[\log(\text{RC})]_{t-1}$	0.490	3.59	
$\Delta[\log(\text{COM})]$	0.340	4.84	
$\Delta[\log(\text{RREAL})]$	-0.008	-3.89	

	Coefficient	T-statistic	R²: 0.61
Constant	-0.07	-0.13	
$\log(\text{HP}/\text{CP})_{t-1}$	-0.01	-0.16	
$\Delta[\log(\text{CP}_n)]$	1.06	1.19	
$\Delta[\log(\text{COM}_i/\text{COM}_n)]$	0.51	2.57	
$\Delta[\log(\text{COM}_i/\text{COM}_n)]_{t-1}$	0.50	2.39	

Table 6
Regional shock model – Prairies

	Coefficient	T-statistic	R²: 0.93
Constant	-5.13	-5.98	
$\log(\text{HP}/\text{CP})_{t-1}$	0.78	6.05	
$\Delta[\log(\text{CP}_n)]$	-0.66	-0.82	
$\Delta[\log(\text{POP})]$	-7.91	-2.42	
$\Delta[\log(\text{POP})]_{t-1}$	-6.67	-2.59	
$\Delta[\log(\text{GOV})]$	2.68	4.65	
$\Delta[\log(\text{GOV})]_{t-1}$	1.59	2.83	
$\Delta[\log(\text{COM})]_{t-1}$	-0.13	-1.93	

	Coefficient	T-statistic	R²: 0.88
Constant	-1.820	-1.93	
$\log(\text{HP}/\text{CP})_{t-1}$	0.300	0.15	
$\Delta[\log(\text{CP}_n)]$	-2.100	-2.15	
$\Delta[\log(\text{RC}_i/\text{RC}_n)]$	0.940	3.87	
$\Delta[\log(\text{GOV}_i/\text{GOV}_n)]$	1.370	1.68	
$\Delta[\log(\text{COM}_i/\text{COM}_n)]_{t-1}$	-0.570	-2.92	
$\Delta[\log(\text{RREAL})]$	-0.001	-3.79	

4.5 Conclusion

House prices seem to play an important role in adjustment to regional demand shocks. While, initially, wealth and liquidity effects of price increases may further increase demand, over the longer term such increases will drive up production costs and encourage investment in other regions. This adjustment may be distorted, however, by such factors as the emergence of price bubbles or distortions that transmit regional inflation into more general inflationary pressures.

A model was developed that characterized regional house prices as having a long-run equilibrium relationship with the national CPI but being influenced in the short run by regional demand shocks. Initial tests for cointegration supported the hypothesis of a long-run relationship between house price levels and the level of the national CPI, but the full estimations of the equation were not successful. The initial model, nevertheless, provides a framework within which further research on regional house prices and demand shocks can be conducted.

5 THE COMPONENTS OF HOUSE PRICE APPRECIATION

5.1 Introduction

In earlier sections it was argued that house prices are more likely to exhibit regional disparities than prices of many other goods and services, both because of the different characteristics of regional housing markets and because house prices react more strongly to regional demand shocks. Section 4 continued with this theme by developing a model in which the level of house prices had a long-run relationship with the national CPI, but deviated from this in the short term as a result of regional demand shocks. This section uses a more general model to consider the broader question of the extent to which house price movements are influenced by national components and by region-specific factors. Unlike in the earlier model, in the general model the national and regional influences are not tied to specific economic variables.

5.2 The model

The model used was based on that developed by Gyourko and Voith (1992). They analyse real home price appreciation in the United States from 1971 to 1989, over a cross section of 56 metropolitan areas, using a pooled cross section–time series model. Drawing on their work, I assumed that the variation in a region’s real house prices is a combination of a region-specific fixed effect, a national time-varying component and a component related to the real price of housing in the previous period.

$$100*\ln(P_{it}/P_{it-1}) = A_i + B_t T_t + C_i 100*\ln(P_{it-1}) + E_{it} \quad (5.1)$$

where:

P_{it} is the real price of housing in region i at time t . The dependent variable was created using the average resale house price data described in Section 4 for five regions: the Atlantic region, Quebec, Ontario, the Prairies and British Columbia. Each nominal regional series was deflated by the

national CPI. Annual house price appreciation series were constructed using quarter four over quarter four observations.¹

A_i is the region-specific fixed effect in appreciation. The fixed effect was created by introducing a series of dichotomous regional dummy variables, where each dummy variable has a value of one for one region across all time periods and a value of zero for all other regions.

T_t is the national time-varying component that captures annual national movements in real housing appreciation; this was incorporated by using a vector of time dummy variables for each year, where the t subscript denotes the time period; and P_{it-1} is the real price level in the previous period.

The purpose of the third component was to test whether house price levels across regions diverge or converge over time. At any point in time it is expected that prices will differ across regions, reflecting the different amenities available in these regions. Unless the amenities in some regions are continually improving relative to those in other regions, the extent of regional price divergence is likely to be limited, based on the difference in amenity levels. If this is the case, the lagged real price coefficient should have a negative value. If all regions have identical C_i , those with the highest level of real prices, P_{it-1} , will then have the lowest rate of price appreciation P_{it}/P_{it-1} . The elasticity of P_{it} to P_{it-1} would be less than one and P_{it} would show no explosive response to shocks.

Again drawing on the work of Gyourko and Voith, I estimated a second equation that included the lagged dependent variable for each region.

$$100*\ln(P_{it}/P_{it-1}) = A_i + B_t T_t + C_i 100*\ln(P_{it-1}) + D_i 100*\ln(P_{it-1}/P_{it-2}) + E_{it} \quad (5.2)$$

1. Gyourko and Voith experimented with various measures of annual appreciation rates and found that while their results were similar across all definitions, smoother annual series based on the average of house prices over four quarters tended to introduce serial correlation into the error structure.

The aim of including the lagged dependent variable was to test whether there is unequal persistence of appreciation rates across regions.

Estimation of the two equations allowed the consideration of a number of hypotheses, in particular:

$D_i = D_j$ for all i not equal to j : joint equality indicates that persistence in appreciation rates does not differ across regions. Moreover, if the coefficients are not significantly different from zero, there is likely no persistence in the price series or, in other words, shocks to local markets are absorbed within a single period.

$B_t = 0$ for all t : if all the B coefficients are insignificant, housing markets are influenced by purely local factors.²

$A_i = A_j$ and $C_i = C_j$ and $D_i = D_j$ for all i not equal to j : if all the region-specific effects are equal across regions, regional housing markets are influenced by purely national factors.

Both equations were estimated using the pooled cross section–time series option in SHAZAM, for the years 1962 to 1991 (30 time periods across 5 cross-sectional units). A cross-sectionally correlated and time-wise autoregressive model was used (Kmenta 1971, 512-14) that allows not only for heteroscedasticity and autoregression in the data, but also mutual correlation between the regions. National shocks could generate correlation of errors across regions. The risk is reduced but perhaps not eliminated by the inclusion of B_t .

5.3 The results

The results of estimation of this equation are summarized in Table 7. It indicates the following:

- There were significant positive fixed effects in three out of five regions.

2. A more rigorous test would be provided by adding a constraint to ensure that the B_t coefficients do not vary with C_j . It was not possible to add a constraint, however, using the pooled cross section–time series option in SHAZAM, a statistical software package.

If the house price series had been standardized for a particular mix of housing characteristics, the varying fixed effects would suggest that individuals could have made higher returns by investing in certain markets rather than others, since the rate of change of house prices appeared to be greater in some regions. Unfortunately, we were unable to obtain such a series; thus, the differing fixed effects may be due to changing levels of amenities or other housing characteristics in the regions. Such an interpretation makes it less surprising that the largest effect was found in the Atlantic provinces. Indeed, it suggests that the effect is likely a result of generally improving conditions in the region, relative to other regions, which have in turn led to a relative rise in the average quality of housing and thus a higher rate of increase in house prices.

- The majority of the national time-varying components were significant.

This result was robust across differing base periods. This suggests that national influences have important impacts on regional house price movements. It is interesting to note that when 1962 was the base period, the national component was positive for every year except 1982, reflecting the relatively low rate of housing price inflation in the base year.

- The coefficients of the lagged price level were all negative, and were significant in all cases except for the Prairies and British Columbia.

In other words, in four regions high real prices in one period appear to be associated with a lower rate of appreciation the following period. The null hypothesis that the coefficients were equal across regions was rejected.³

3. It should be noted that, based on the reduced form of the equation, different C_i imply different effects of B_i across the regions.

Before considering the implications of the results in more detail, it is useful to review the estimate of equation (5.2), where the lagged dependent

Table 7

Results of equation (5.1)

$$\ln(P_{it}/P_{it-1}) = A_i + B_t T_t + C_i \ln(P_{it-1}) + E_{it}$$

Buse $R^2 = 0.98$

Variable name	Estimated coefficient	T-ratio 103 DF	Variable name	Estimated coefficient	T-ratio 103 DF
A _{ATL}	352.70	3.89	B78	5.95	2.90
A _{QUE}	191.88	2.30	B79	8.89	4.93
A _{ONT}	100.46	2.25	B80	9.38	5.35
A _{PR}	29.71	0.89	B81	3.12	2.23
A _{BC}	48.86	1.80	B82	-14.51	-7.98
B63	5.64	8.07	B83	6.29	3.37
B64	6.70	9.67	B84	1.29	0.75
B65	3.95	4.65	B85	8.62	5.20
B66	7.20	8.85	B86	10.51	6.51
B67	9.10	9.39	B87	12.49	7.36
B68	6.42	5.47	B88	15.19	8.87
B69	7.39	7.28	B89	13.17	6.87
B70	4.89	3.53	B90	5.05	2.54
B71	5.89	3.93	B91	7.04	3.78
B72	8.11	5.29	C _{ATL}	-0.55	-3.95
B73	17.63	10.87	C _{QUE}	-0.30	-2.42
B74	12.76	6.55	C _{ONT}	-0.15	-2.31
B75	15.45	8.01	C _{PR}	-0.05	-1.06
B76	12.01	5.47	C _{BC}	-0.08	-1.90
B77	5.37	2.47			

variable was added to the equation. As stated above, the purpose of adding the lagged dependent variable was to test for unequal persistence

of appreciation rates across the regions. The results of this equation are given in Table 8.

- The addition of the lagged dependent variables did not significantly alter the regional fixed effects – they remained positive and significant in the Atlantic region, Quebec and Ontario.
- The majority of national time-varying coefficients remained significant.
- The lagged dependent variable was significant only in the Prairies region, where it had a positive impact.

These results indicate that high rates of house price appreciation in the Prairie provinces tended to be associated with high but decaying rates in the following year, or in other words, that shocks to the regional housing market persisted. The fact that the Prairie provinces, rather than the other regions, exhibited such an effect may be related to the more cyclical nature of the Prairie economies, in particular the longer cycles of the oil and gas industries influencing Alberta. This in turn may cause longer cycles in the housing market.

- With the addition of the lagged dependent variable the lagged real-price coefficient remained significant (and negative) only in Atlantic Canada and Ontario.

The results contrast with those obtained by Gyourko and Voith. They used house price data across 56 metropolitan areas and found significant effects for the national time-varying component and the lagged dependent variable, but could not reject the hypothesis of equal fixed effects across the cities.

Presumably an important factor in explaining the different results is the level of aggregation – city versus regional data. If particular groups of cities are affected by common factors, an analysis at the city level would not capture these common effects. All the cities in Quebec, for example, are likely to be influenced by province-specific regulations, cultural factors

and economic changes. An analysis at the regional level would capture these.

Table 8
Results of equation (5.2)

$$\ln(P_{it}/P_{it-1}) = A_i + B_t T_t + C_i \ln(P_{it-1}) + D_i \ln(P_{it-1}/P_{it-2}) + E_{it}$$

Buse $R^2 = 0.98$

Variable name	Estimated coefficient	T-ratio 103 DF	Variable name	Estimated coefficient	T-ratio 103 DF
A _{ATL}	336.57	3.45	B80	10.04	6.14
A _{QUE}	114.07	1.43	B81	1.52	0.95
A _{ONT}	99.35	2.59	B82	-13.98	-7.60
A _{PR}	29.99	1.31	B83	9.32	3.77
A _{BC}	51.10	1.78	B84	2.60	1.62
B63	5.14	4.77	B85	9.73	6.52
B64	6.21	10.51	B86	10.71	7.47
B65	2.50	2.80	B87	12.39	7.55
B66	6.74	7.02	B88	15.12	9.38
B67	8.67	8.85	B89	12.09	5.93
B68	5.20	4.34	B90	4.28	1.96
B69	7.70	6.48	B91	7.12	3.91
B70	3.44	2.41	C _{ATL}	-0.53	-3.50
B71	6.28	4.70	C _{QUE}	-0.18	-1.54
B72	8.30	5.92	C _{ONT}	-0.15	-2.66
B73	17.18	11.48	C _{PR}	-0.05	-1.55
B74	11.82	5.54	C _{BC}	-0.08	-1.89
B75	14.91	7.55	D _{ATI}	0.11	0.53
B76	10.85	4.86	D _{QUE}	-0.32	-1.90
B77	5.15	2.26	D _{ONT}	0.15	0.96
B78	6.38	3.17	D _{PR}	0.37	2.91
B79	9.70	4.94	D _{BC}	0.13	0.81

Such a proposition is supported by the earlier finding that disparities in house price movements are greater between than within the

regions. On the other hand, factors such as price bubbles may be more likely to occur in a single city, rather than in a whole province. This is likely why our study found little evidence of persistence in price shocks in the regions, whereas the Gyourko and Voith study found stronger evidence of such persistence.

5.4 Robustness across time periods

It is possible that over the period from 1962 to 1991, structural changes occurred in the national and/or provincial housing markets. Such changes could be due, for example, to changes in provincial housing regulations or changes in federal tax policies regarding housing. To test for this, equations (5.1) and (5.2) were reestimated for the periods from 1962 to 1975 and from 1976 to 1991. As in the equations estimated for the period as a whole, in both time periods significant regional fixed effects were found in the Atlantic region, Quebec and Ontario, and the majority of the national time-varying coefficients were significant. Nevertheless, there were indications of some changes between the two time periods:

- In the period from 1962 to 1975, for equation (5.1), house price increases in the Atlantic region and Ontario were negatively related to the lagged real housing price, as in the longer time period, but house prices in Quebec showed no negative relationship as they had done for the full study period.
- In the period from 1962 to 1975, for equation (5.2), house prices in the Atlantic region and Ontario showed a negative relationship with the lagged price level, as they had done for the full study period. A negative relationship was also found in British Columbia, however, and a positive relationship in Quebec.
- In contrast, in the same period from 1962 to 1975, house prices in Quebec showed a negative relationship with the lagged dependent variable, suggesting that high increases in one period are followed by decreases in the following period.

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- In the period from 1976 to 1991, house price increases in both Ontario and the Prairies were positively related to the lagged dependent variable, that is, there was evidence of persistence in appreciation rates in both provinces.

It is interesting to note that during the second period Ontario experienced a long period of steadily increasing house price inflation, while the Prairies saw a long period of declining house price inflation. In the case of Ontario, these trends disappeared when a longer time period was used. This suggests that local persistence of appreciation rates may sometimes be an important reason behind regional house price movements over the short term, but that such persistence of shock is a less important determinant over the long term.

5.5 Conclusion

The results of the equations indicate that while national factors have an important impact on regional housing markets, region-specific factors are also important. In particular, there is evidence of different fixed effects in the regions, which may be related to the changing relative quality of housing. There is also evidence to suggest that different provincial housing markets work in rather different ways. For example, for the period as a whole, there was evidence of persistence in house price shocks in the Prairies region, and that high real prices led to lower rates of appreciation in the Atlantic region, Quebec and Ontario.

There was also evidence of some structural changes between the first and second halves of the estimation period. In addition, persistence of appreciation rates was more evident in shorter time periods. This suggests that factors such as price bubbles and adjustment to local shocks may be important determinants of short-term regional house price movements, but are less important over the longer term.

Overall, the analysis supports the hypothesis that house price inflation varies significantly across the regions, in part owing to differing fixed effects and in part because of the different character of regional housing markets. The analysis is unable to show, however, whether house prices

show greater regional disparities than other prices. In this respect, it would be interesting to see the results from similar analyses of the prices of other goods and services. Would more easily tradable goods, for example, show greater influence from national factors and less impact from region-specific factors? The analysis also suggests that as the considered time period lengthens, national factors appear to play a greater role.

6 CONCLUSION

This report has reviewed a wide range of factors that are likely to cause greater disparities in house price increases than in the rates of inflation of more easily tradable goods and services. An overview of disparities in house price increases and those of the general CPI has revealed, however, that the relationship between the two is complex; systematically greater disparities in house price inflation in Canada were not detected.

A model was developed that characterizes regional house prices as having a long-run equilibrium relationship with the national CPI but being influenced in the short run by such shocks as region-specific movements in real commodity prices, real capital spending and real current government expenditures. Initial tests for cointegration supported the hypothesis of a long-run relationship between house price levels and the level of the national CPI. No generalizations were possible across regions, however, as to which shock variables were important.

Further empirical research based on a more general model confirmed that both national and region-specific factors are important in explaining regional house price movements. Further, region-specific factors such as local demand shocks and price bubbles, while likely important in the short term, are less important in explaining long-term movements. To the extent that such deviations are due to regional demand shocks, they should not be viewed with concern. They are simply a means of reallocating investment and growth between locations.

Possible themes for future research include (1) the extent to which short-term movements are governed by regional shocks rather than price bubbles or other factors, (2) how different markets react to such shocks, and (3) the degree of convergence to national rates of increase in the long term. It would also be useful to repeat this analysis focussing on the prices of other goods and services, to see whether the tendency towards regional disparities is greater in the housing market than in markets for more tradable items.

APPENDIX 1: Derivation of regional CPI series

Since provincial CPI data are available only from September 1978 onwards, series beginning in 1971 quarter one were constructed using city CPI data. The city indexes (both for particular goods and the overall index) were combined by weighting them by the share of expenditures of each city in total Canadian expenditures for the particular good concerned or the overall basket of goods.

During the period concerned five different baskets of goods were used by Statistics Canada to generate the published CPI data. The weights for the basket used during the period 1972–74 are not available, however. Thus, weights from only the four most recent baskets were used. The table below shows the weights used for each period. For example, for the period beginning in January 1989, the relevant weights were from the 1986 basket at December 1988 prices.

Period	Basket	Weight
89M01–92M06	1986	88M12 prices
85M01–88M12	1982	84M12 prices
82M04–84M12	1978	82M03 prices
71M01–82M03	1974	78M09 prices

In order to correctly link the indexes, the series were reindexed to one for the period immediately preceding the linkage point.

APPENDIX 2: Derivation of regional house price series

The average resale price of housing (all transactions) series, which is available from the first quarter of 1971 and is collected by the Canadian Real Estate Association, is one of the few long-run series on house prices that provides information at the provincial level. The series was discontinued, however, in 1989. The average resale price of housing (residential transactions) was therefore used to estimate more up-to-date observations. The residential transactions series is only available from 1982 onwards and at a city rather than a provincial level. I estimated regional series by aggregating weighted city data. Regressions of the all-transactions series on the residential transactions series were then estimated for the period during which the two series overlap (first quarter 1982 to fourth quarter 1989) and the resulting coefficients were used to generate estimates of the all-transactions series for the period from the first quarter of 1990 and the second quarter of 1992. The figures below show the resulting all-transactions series compared with that for residential transactions for each of the five regions estimated.

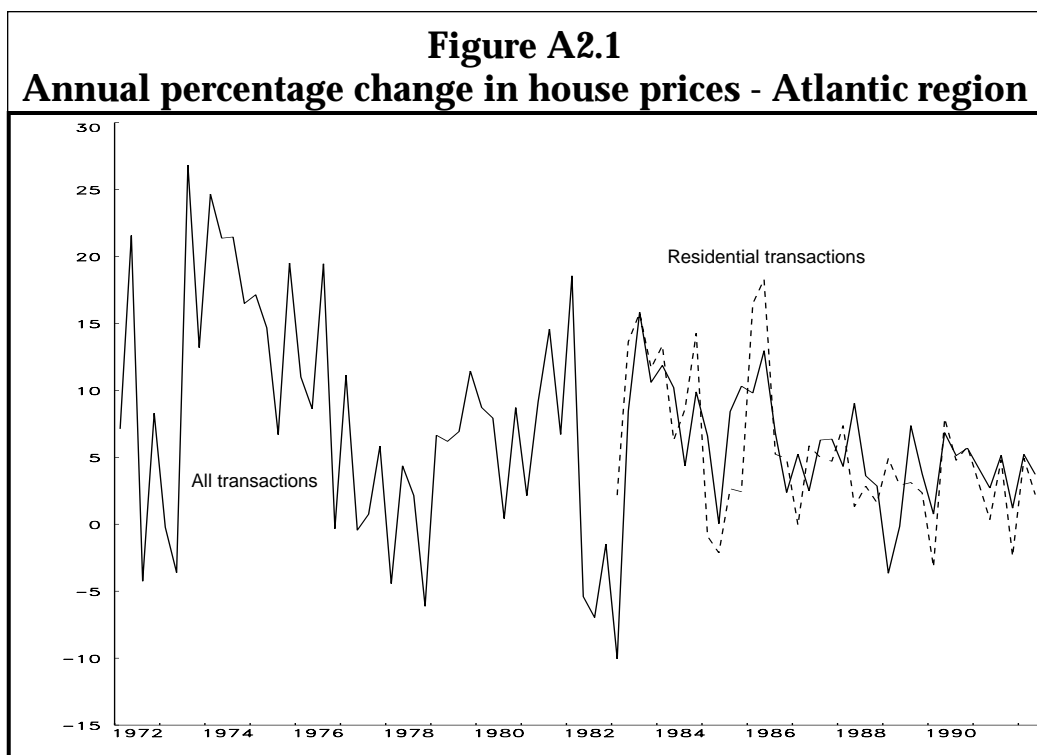


Figure A2.2
Annual percentage change in house prices - Quebec

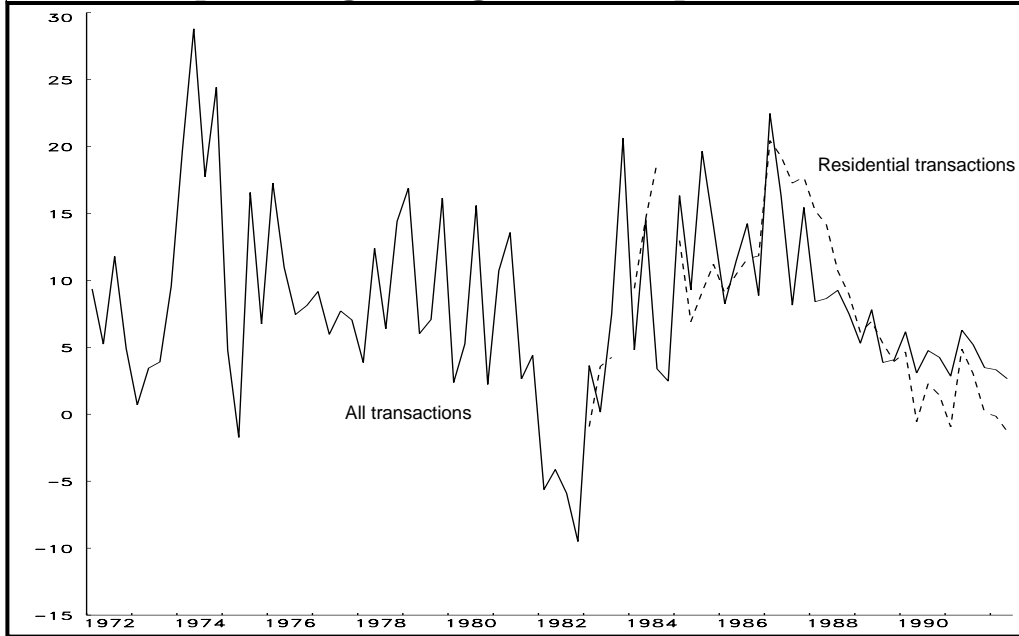


Figure A2.3
Annual percentage change in house prices - Ontario

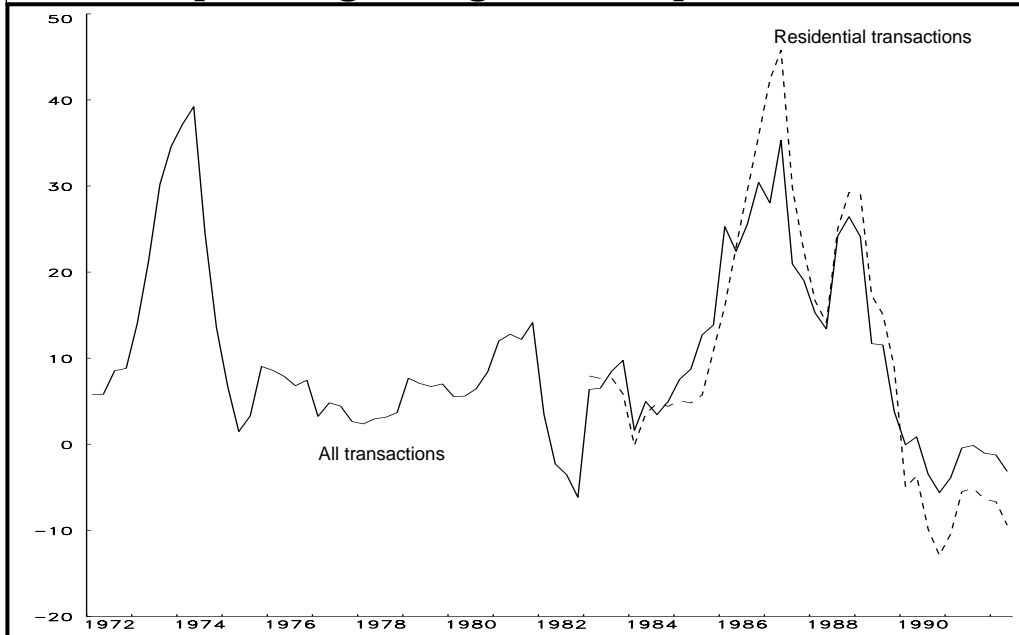


Figure A2.4
Annual percentage change in house prices - Prairies

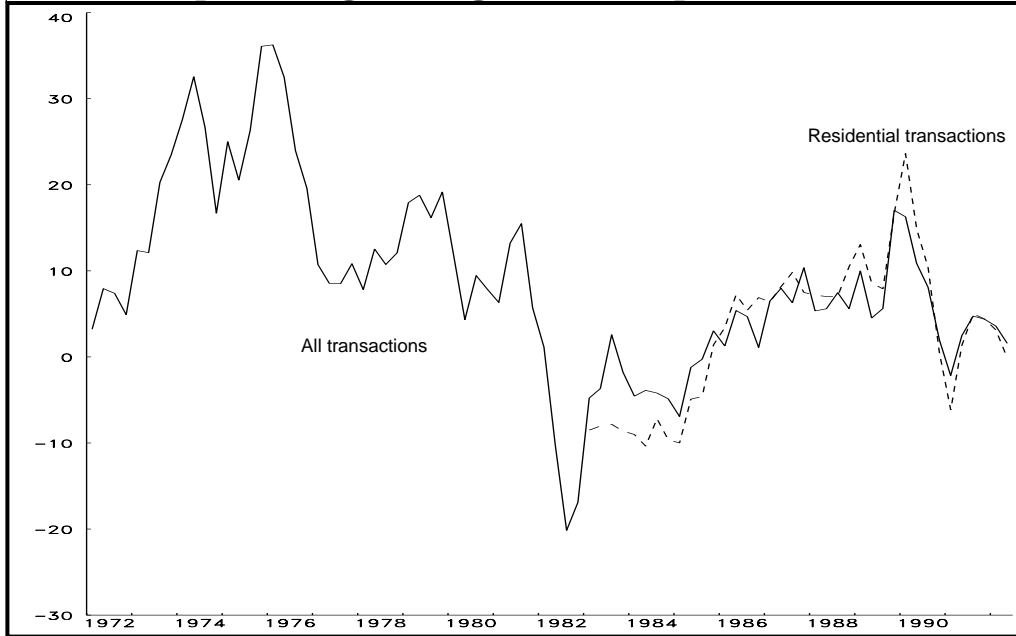
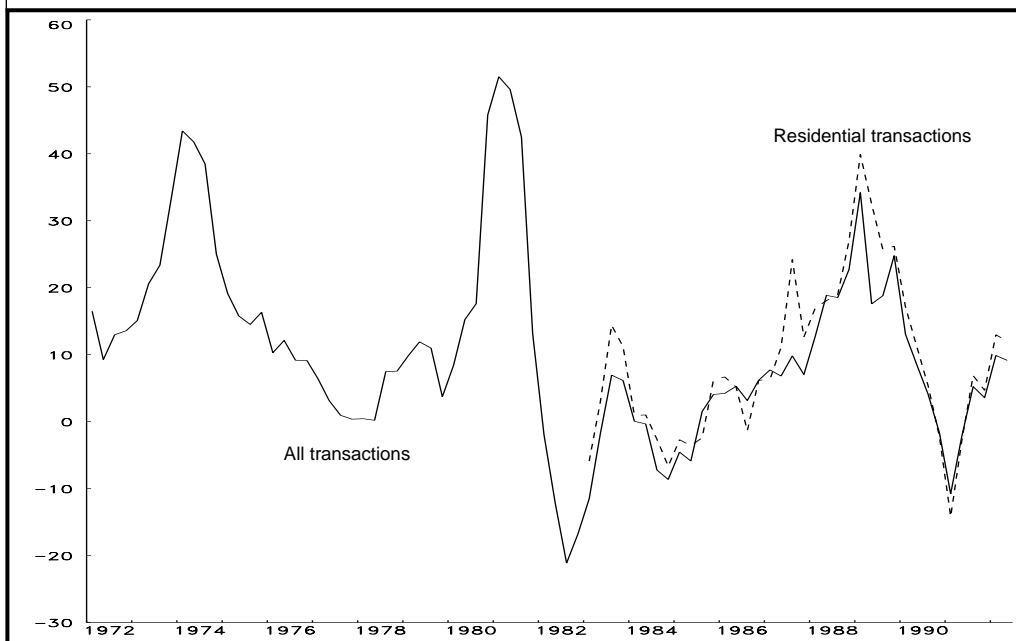


Figure A2.5
Annual percentage change in house prices - British Columbia



BIBLIOGRAPHY

- Bover, Olympia, John Muellbauer and Anthony Murphy. 1989. "Housing, Wages and UK Labour Markets." *Oxford Bulletin of Economics and Statistics* 51 (March): 97-136.
- Carruthers, David T. 1989. "Housing Market Models and the Regional Housing System." *Urban Studies* 26 (April): 214-22.
- Case, Karl E. 1986. "The Market for Single-Family Homes in the Boston Area." *New England Economic Review* (May/June): 38-48.
- Case, Karl E. and Robert J. Shiller. 1987. "Prices of Single-Family Homes since 1970: New Indexes for Four Cities." *New England Economic Review* (Sept./Oct.): 45-56.
- Case, Karl E. and Robert J. Shiller. 1988. "The Behavior of Home Buyers in Boom and Post-boom Markets." *New England Economic Review* (Nov./Dec.): 29-46.
- Case, Karl E. and Robert J. Shiller. 1989. "The Efficiency of the Market for Single-Family Homes." *American Economic Review* 79 (March): 125-37.
- Dougherty, Ann and Robert Van Order. 1982. "Inflation, Housing Costs and the Consumer Price Index." *American Economic Review* 72 (March): 154-64.
- Fallis, George. 1985. *Housing Economics*. Toronto: Butterworths.
- Glennon, Dennis. 1989. "Estimating the Income, Price, and Interest Elasticities of Housing Demand." *Journal of Urban Economics* 25 (March): 219-29.
- Goodman, Allen C. 1990. "Demographics of Individual Housing Demand." *Regional Science and Urban Economics* 20 (June): 83-102.

- Gottfried, Robert R. 1988. "The Effect of Recreation Communities on Local Land Prices: The Case of Beech Mountain." *The American Economist* 32 (Spring): 59-65.
- Gyourko, Joseph and Richard Voith. 1990. "Local Market and National Components in House Price Appreciation." *Journal of Urban Economics* 32:52-69.
- Haurin, Donald R. and R. Jean Haurin. 1988. "Net Migration, Unemployment, and the Business Cycle." *Journal of Regional Science* 28 (May): 239-54.
- Kirwan, Richard M. 1987. "Fiscal Policy and the Price of Land and Housing in Japan." *Urban Studies* 24 (October): 345-60.
- Kmenta, Jan. 1971. *Elements of Econometrics*. New York: Macmillan Company.
- Makuch, S. M. 1986. "Urban Law and Policy Development in Canada: The Myth and the Reality." In *Labour Law and Urban Law in Canada*, edited by Ivan Bernier and Andrée Lajoie, vol. 51, 167-91. Royal Commission on the Economic Union and Development Prospects for Canada. Toronto: University of Toronto Press.
- Melvin, James R. 1987. "Regional Inequalities in Canada: Underlying Causes and Policy Implications." *Canadian Public Policy* 13 (September): 304-17.
- Mills, K. E., M. B. Percy and L. S. Wilson. 1983. "The Influence of Fiscal Incentives on Interregional Migration: Canada 1961-78." *Canadian Journal of Regional Science* 6: 207-29.
- Norrie, Kenneth, ed. 1986. *Disparities and Interregional Adjustment*. Royal Commission on the Economic Union and Development Prospects for Canada, vol. 64. Toronto: University of Toronto Press.

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- Northouse, Cameron and Kenneth G. Foltz. 1986. "The Impact of Changing Economic Trends on the Single-Family Housing Market." *Real Estate Finance Journal* 2 (Summer): 41-45.
- Poloz, Stephen S. 1990. "Real Exchange Rate Adjustment Between Regions in a Common Currency Area." Photocopy. Bank of Canada, Ottawa.
- Reece, B. F. 1988. "The Price-Adjustment Process for Rental Housing: Some Further Evidence." *American Real Estate and Urban Economics Association Journal* 16 (Winter): 411-18.
- Shaw, R. Paul. 1985. *Intermetropolitan Migration in Canada: Changing Determinants Over Three Decades*. Catalogue No. 89-504E. Toronto: NC Press Ltd. and Statistics Canada.
- Sinclair, Clayton. 1990. "Blue Collars Become White." *Financial Times of Canada*. 10 September, p. 5.
- Smith, Lawrence B., Kenneth T. Rosen and George Fallis. 1988. "Recent Developments in Economic Models of Housing Markets." *Journal of Economic Literature* 26 (March): 29-64.
- Titman, Sheridan. 1982. "The Effects of Anticipated Inflation on Housing Market Equilibrium." *Journal of Finance* 37 (June): 827-42.
- Voith, Richard and Theodore Crone. 1988. "National Vacancy Rates and the Persistence of Shocks in U.S. Office Markets." *American Real Estate and Urban Economics Journal* (Winter) 16: 437-58.
- Winer, Stanley L. and Denis Gauthier. 1982. *Internal Migration and Fiscal Structure*. Ottawa: Economic Council of Canada.

