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The Commodity-Price Cycle and Regional Economic Performance in Canada

by
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Abstract

This paper attempts to provide one interpretation of the broad regional economic history of Canada since the early 1970s. As the title of the paper suggests, we believe that, to a significant degree, regional diversity in economic performance reflects movements in Canada's terms of trade, which very frequently are tied to developments in world commodity markets. To state our hypothesis briefly, an improvement in Canada's terms of trade due to a rise in world commodity prices tends to boost output in the regions that produce primary products and dampen output in those that use primary products as an input. Because these activities are not uniformly distributed across regions in Canada, such shocks have implications for regional economic performance. A qualitative analysis of three episodes, 1974, 1978 and 1987, seems to be broadly supportive of this theory. A statistical analysis using VARs also provides some support. Our results may have implications for other branches of the economic literature. One example is studies of long-term convergence between Canada's regions. Such studies might in fact be underestimating fundamental convergence because occasional terms-of-trade shocks are tending to derail the process; alternatively, these studies might actually be detecting evidence of re-equilibration to terms-of-trade shocks rather than fundamental convergence.

Résumé

Cette étude tente de fournir une interprétation de l'évolution économique régionale depuis le début des années 1970. Comme il est mentionné dans le titre, nous croyons que les variations des termes de l'échange, lesquelles sont souvent reliées aux changements dans les prix des matières premières, expliquent une partie importante de l'évolution économique des différentes régions du Canada. En fait, nous croyons qu'une amélioration des termes de l'échange, causée entre autres par une hausse du prix des matières premières, a tendance à augmenter le niveau de production dans les régions qui oeuvrent dans les secteurs primaires, alors qu'elle diminue la production de celles qui utilisent les matières premières comme intrant à la production. Puisque la production dans les différents champs d'activité n'est pas répartie uniformément entre les régions du pays, les variations soudaines des termes de l'échange auront des conséquences importantes sur l'activité économique régionale. Une analyse qualitative portant sur trois épisodes en particulier, soit 1974, 1978 et 1987, semble donner raison à cette théorie. Une évaluation empirique à l'aide de modèle VAR ajoute également un certain soutien. Nos résultats ne sont pas sans conséquence pour d'autres champs d'études en économie. Pensons entre autres aux études portant sur la convergence entre les provinces canadiennes. Il est probable que la convergence aurait été encore plus rapide si les fortes variations des termes de l'échange n'avaient pas empêché celle-ci de se produire. À l'inverse, il est aussi probable que la convergence captée par ces études ne soit en fait qu'un retour à l'équilibre suite à une forte variation des termes de l'échange.

Contents

1.0 Introduction

Among the major world economies Canada has traditionally enjoyed relatively favourable economic performance at the aggregate level. However, this average experience masks rather a wide diversity across the various regions. Regional rates of growth of activity, rates of unemployment, and rates of inflation have always differed to some degree, occasionally substantially so (Day 1989).

Some of the reasons for this variety in experience are obvious. Such reasons usually are structural in nature, having to do with natural endowments in particular. In short, some regions simply have economic advantages over others. However, to a large extent our regional economies behave differently because they react differently to a common shock at the macroeconomic level. For example, unexpectedly strong real growth in the U.S. economy might lead to increased exports of Canadian manufactured goods from central Canada, while boosting tourism on the two coasts. In contrast, a change in world and Canadian real interest rates might be expected to have similar first-round effects across regions.

In this paper we attempt to provide one interpretation of the broad regional economic history for Canada since the early 1970s. As the title of the paper suggests, we believe that to a significant degree regional diversity in economic performance has to do with movements in Canada's terms-of-trade, which very frequently are tied to developments in world commodity markets. To state our hypothesis briefly, an improvement in Canada's terms-of-trade, caused by a rise in world commodity prices, tends to boost those sectors that produce primary products and dampen those sectors that use primary products as an input. Because such activities are not uniformly distributed regionally throughout Canada, such shocks have implications for regional economic performance.[1] A closely related issue is the role of the exchange rate in influencing the pattern of activity across regions, because commodity prices are an important determinant of the external value of the Canadian dollar (Amano and van Norden 1995). This channel of influence is reinforced by the fact that commodity price movements tend to have different implications for our trading partners than they do for Canada. Given the importance of the world commodity price cycle to the average performance of the Canadian economy over time, we believe that this same

1. The results in Poloz (1990) indicate that the process of adjustment to terms-of-trade shocks is relevant to the understanding of inter-regional differences in Canada.

factor can account for a large proportion of the regional variability that has been observed over time.

Although the issue may be amenable to formal econometric modelling, we do not pursue such work here. Rather, we restrict ourselves to a relatively broad reconciliation of the stylized facts, and use vector autoregression (VAR) methodology to analyse the available data. In Section 2 we briefly discuss the theory underlying our hypothesis. In Section 3 we present an assortment of regional stylized facts, and attempt to explain on a qualitative level the broad differences in economic performance that have been observed across regions over the past 20 years. Section 4 attempts to bring some additional formality to the question by fitting simple VAR models to the regional data. Section 5 offers some concluding remarks.

2.0 Theoretical considerations

Most macroeconomic models are built conceptually on a single good. In such models, regional or sectoral dimensions have no meaning, and relative prices usually appear only in basic accounting relationships. A model with the structure necessary to analyse terms-of-trade shocks has been developed by Macklem (1993). Macklem sets out a small optimizing model with three types of producers: nontradeable goods, commodities and manufactured goods. Commodities are an input into the production of manufactured goods. Wage and price inflexibilities are introduced in the form of nominal contracts, and expectations are rational. At the centre of his analysis is a terms-of-trade shock that affects the relative price of tradeables and commodities. A deterioration of the terms-of-trade of 3 per cent — which in the Canadian data may be associated with a drop in commodity prices of around 10 per cent — leads to an increase in production of manufactured goods, a drop in production of commodities, and, eventually, a drop in production of nontradeables. The long-run rise in manufactured goods output is on the order of 18 per cent, while the drop in commodities output is 13 per cent.

When one considers the degree of regional concentration of production in Canada — with most manufactures produced in central Canada and commodities produced mainly in the outlying regions — it is clear that the kind of shock considered by Macklem (1993) can have important inter-regional implications. Thus, a positive terms-of-trade shock might be expected to raise

output in the outlying regions relative to output in Central Canada; this would initially show up in relative employment growth and unemployment rates and then, assuming that the shock persists, in net migration flows away from Central Canada. These flows would bring about re-equilibration of the unemployment disparities that had emerged (although structural disparities would remain) and would be expected to push up the relative cost of housing in the resource-producing regions. This adjustment would manifest itself in a temporary rise in the relative rate of measured inflation in those same areas, although it is unclear whether this would take the form of higher measured inflation in the resource-producing region, lower inflation in the manufacturing region, or some combination of the two. Of course, Central Canada produces commodities as well, so the regional distinctions are likely to be less clear in practice than in theory. A degree of empirical support for this story can be found in Maclean (1994), who analyses the role of movements in house prices across Canada in determining regional inflation disparities. She finds that an aggregate commodity price index helps explain the behaviour of house prices relative to the overall price level in some regions.

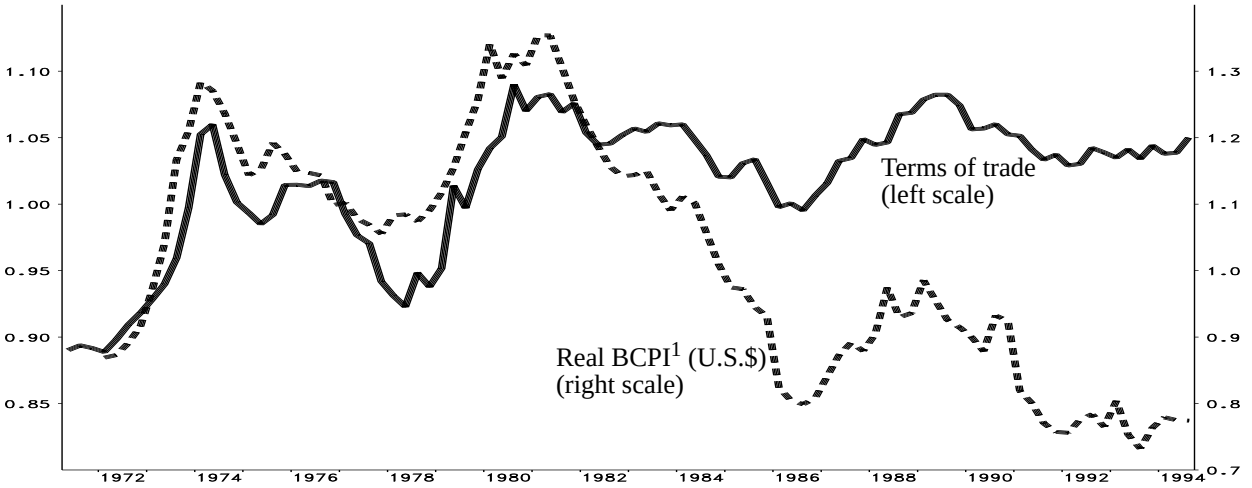
One paper that tackles this issue for a particular region is Jankowski and Moazzami (1994), who demonstrate that there are strong linkages between commodity prices, the exchange rate and employment in Northern Ontario. Their methodology is a good reminder that it is probably appropriate to include the exchange rate in any reduced form that seeks to identify the linkage between employment and commodity prices or the terms of trade.

3.0 Developments in Canada's regions, 1970-1994

In this section we provide an overview of Canada's regional economic history over the past 20 years, and attempt to illustrate the importance of terms-of-trade shocks in those developments. To begin, Figure 3.1 identifies three important episodes when Canada's terms-of-trade experienced a sustained shift. The first one occurred between the second quarter of 1972 and the second quarter of 1974 (19.3 per cent increase in the terms-of-trade); the second between the third quarter of 1978 and the third quarter of 1980 (18.1 per cent increase); and the third took place between the fourth quarter of 1986 and the second quarter of 1989 (8.8 per cent increase). Of course, each of these episodes was completed by a subsequent period of unwinding, so that the picture is really one of three terms-of-trade cycles. Figure 3.1 also shows the Canadian real

commodity price index (based on production weights) in U.S. dollars; we see that these terms-of-trade shocks are typically driven by commodity price fluctuations. A divergence has emerged in the levels of the two series since the early 1980s; this is the result of declining computer prices, which tend to improve Canada's terms of trade relative to resource prices.

Figure 3.1: Canadian real commodity price index and terms of trade (1971Q2-1994Q3)



[1]BCPI is the Bank of Canada commodity price index.

It is also worth pointing out that the commodity price cycle is positively correlated with the cycle in world output. This is shown in Figure 3.2, which plots an estimate of the aggregate output gap for the seven major world economies, along with the output gap for Canada and the real commodity price index. Such a correlation presumably reflects the fact that higher rates of production in the world economy result in stronger demand for raw materials and, with relatively inelastic supply, prices tend to rise. Figure 3.3 shows that the correspondence between commodity prices and the world output gap is even stronger when energy prices are removed.[2]

2. This is because most energy price shocks are driven by supply factors that generally have nothing to do with the world business cycle.

Figure 3.2: Real BCPI and output gaps (1971Q2-1994Q3)

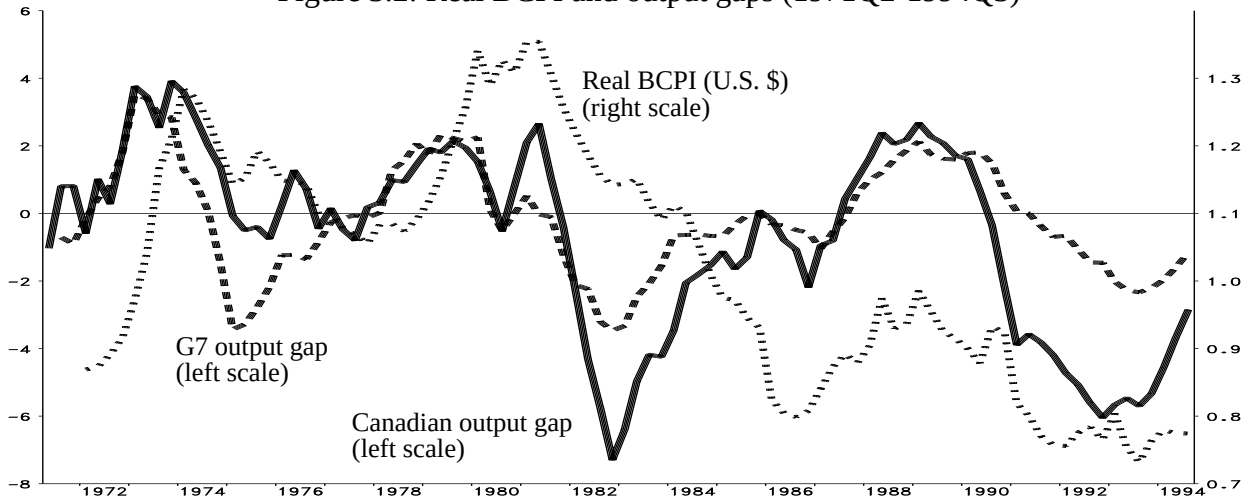
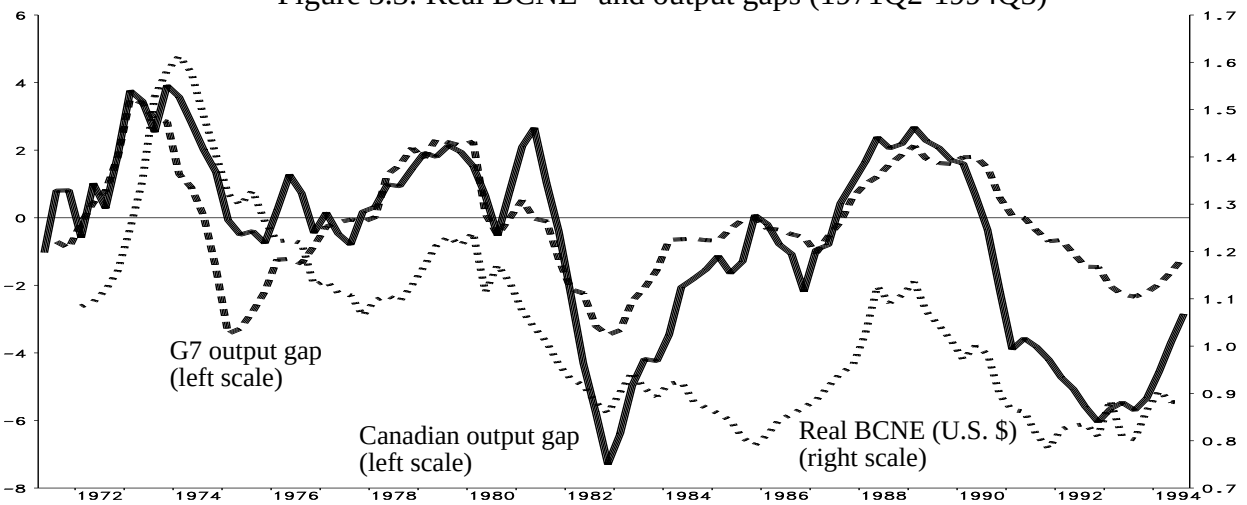


Figure 3.3: Real BCNE[1] and output gaps (1971Q2-1994Q3)



[1]BCNE is the Bank of Canada non-energy commodity price index.

We will now examine each of the three terms-of-trade shocks identified in Figure 3.1 to see if the stylized facts outlined in the previous section may be identified in the data. Indeed, because of their similarity, we consider the 1972-74 shock and the 1978-80 shock together; both of these shocks were led by very strong increases in oil prices, and the Canadian commodity price index reached much higher levels during the shocks of the 1970s than it did during the 1987-89 shock.[3] The latter shock, in contrast, was preceded by important declines in both the commodity price index and the exchange rate.

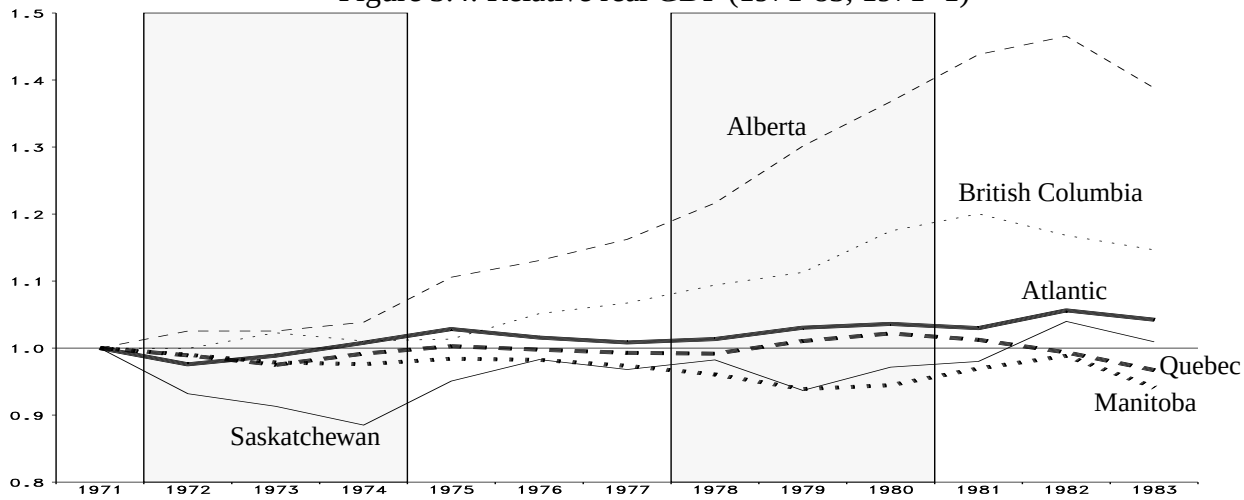
3. We refer to the third shock as the “1987-89 shock” even though it began in the fourth quarter of 1986.

In terms of methodology, the analysis is conducted using relative measures of different economic variables with Ontario as the “numéraire” or base. Since Ontario was still, in 1993, the province with the lowest share of primary product output and the highest share of manufacturing output as a percentage of total output, our hypothesis suggests that, relative to Ontario, the other provinces should benefit to varying degrees from a rise in Canada’s terms of trade.

3.1 Terms-of-trade shocks in the 1970s

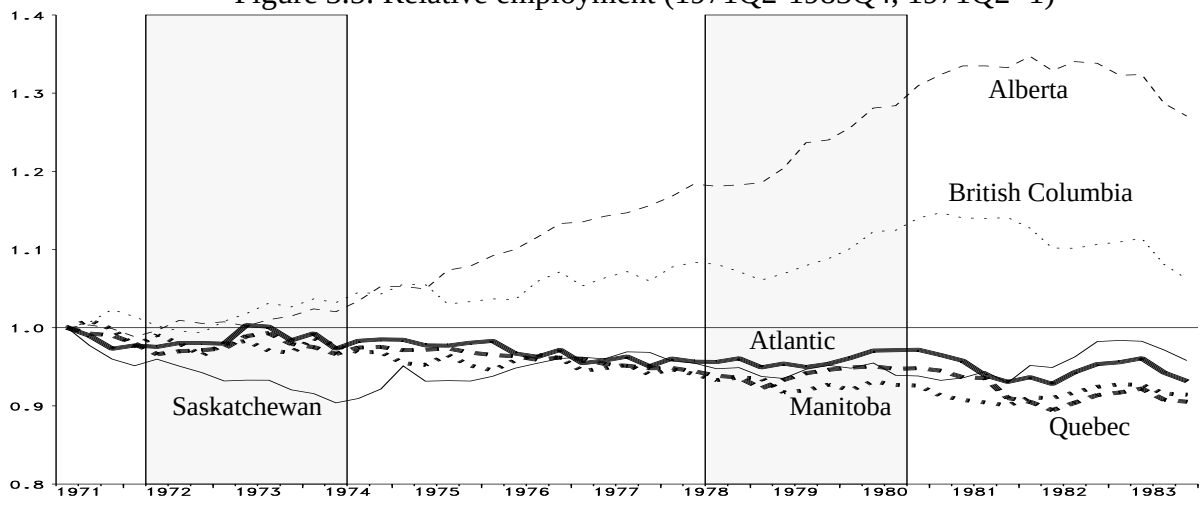
We will begin our analysis by examining the impact of a Canadian terms-of-trade shock on the relative real GDP of each individual province. Figure 3.4 shows the evolution of each provincial real GDP relative to Ontario’s real GDP over the 1972-83 period. Shaded areas on the graph represent periods of rising terms of trade. The figure shows that the relative GDP of all the regions, with the exception of Manitoba, rose during those periods. The relative GDP of Saskatchewan seems to have reacted with a somewhat longer lag than the other provinces, perhaps reflecting the particular mix of commodity price rises that took place. The relative GDP of Alberta posted the largest gains, particularly after the 1978-80 shock, which is not surprising given the importance of oil prices in those two episodes. The Atlantic region also posted higher relative GDP growth following both shocks, but particularly after the 1972-74 shock, as fish prices (especially cod) increased significantly over that period. In the case of British Columbia’s relative GDP, the increase was greater during the 1978-80 shock, in part because of strong increases in the prices for natural gas, gold and silver. Quebec’s relative GDP gain following these shocks was small, which is not surprising given that, of all the provinces, the Quebec economy most resembles Ontario’s.

Figure 3.4: Relative real GDP (1971-83, 1971=1)



Turning to the other stages of the adjustment process, Figure 3.5 shows the evolution of relative employment in each region. Reflecting their relatively strong performance in terms of GDP during both shocks, the provinces of Alberta and British Columbia also posted relatively strong relative employment growth. This is particularly true for Alberta during the 1978-80 shock. The province of Saskatchewan also posted some relative gains in employment after the 1978-80 shock when we allow for lags. For the other regions, however, it is much more difficult to detect a reaction in relative employment.

Figure 3.5: Relative employment (1971Q2-1983Q4, 1971Q2=1)



The relative unemployment rates are plotted for each region in Figure 3.6. As expected, considering their relative output and employment performance, Alberta and British Columbia posted declines in their relative unemployment rates during both of the shocks. Quebec,

Manitoba, and Saskatchewan also recorded declines in their relative unemployment rate during the 1972-74 shock, which is somewhat surprising since their relative employment responses to the terms-of-trade shock were not obvious. A possible explanation is the degree of out-migration experienced by these provinces in most of the first half of the 1970s, as we shall see below. The Atlantic region also posted reductions in its relative unemployment rate after each shock, but particularly after the 1978-80 shock. The same region posted a significant increase in relative unemployment during the 1972-74 shock; this may have more to do with the 1971 revisions to the Unemployment Insurance Act (which increased the generosity of UI benefits and reduced to eight the number of working weeks needed to draw the UI benefits) than with the terms-of-trade shock per se. Following these revisions, substantial increases in labour-force participation rates were observed in Newfoundland, Prince Edward Island and New Brunswick.

Figure 3.6: Relative unemployment rate (1971Q2-1983Q4, 1971Q2=1)

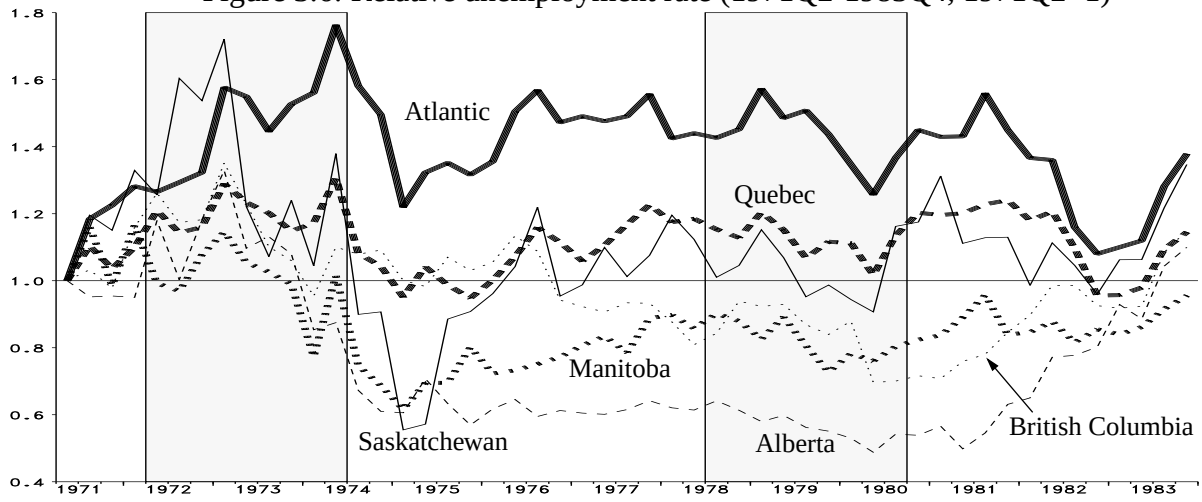
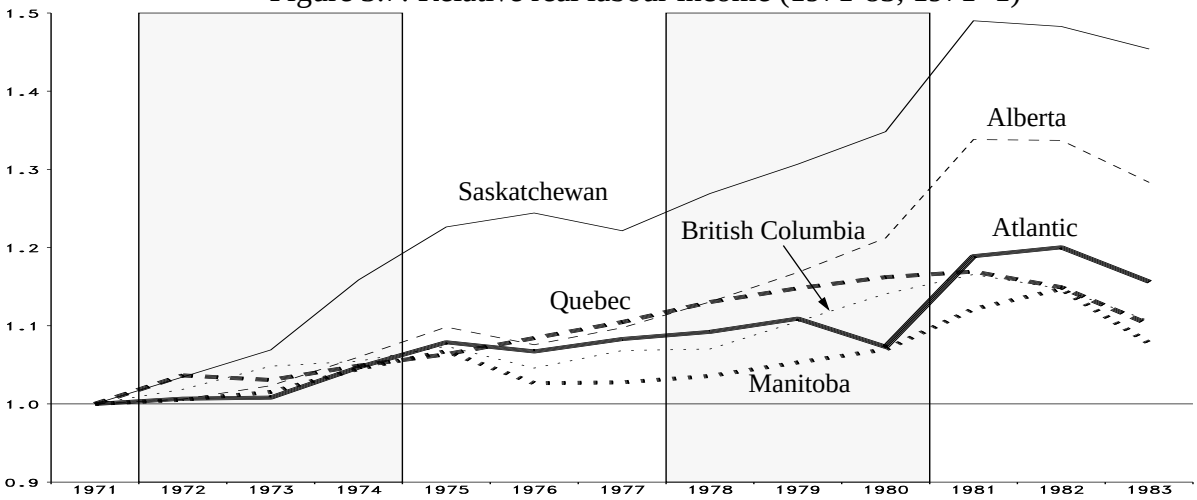


Figure 3.7 presents the evolution of relative real labour income for each region. All regions posted strong increases in labour income relative to Ontario during these two episodes; moreover, these increases occurred after very short lags.

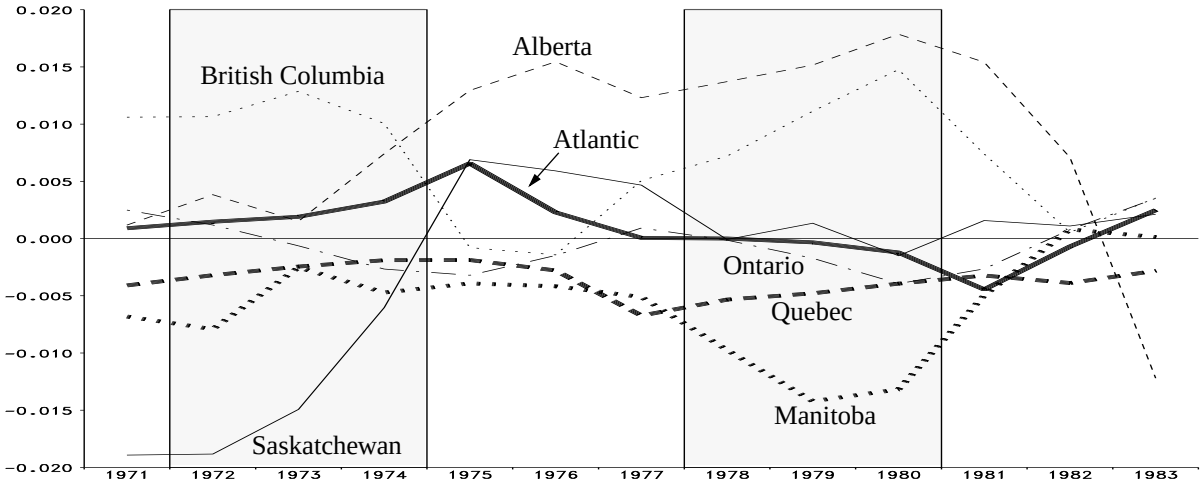
Figure 3.7: Relative real labour income (1971-83, 1971=1)



Turning to what we could call the final stages of the adjustment process, Figure 3.8 presents the net-migration-to-population ratio for each of the regions studied. Alberta and British Columbia generally maintained high net-migration-to-population ratios during these episodes. Indeed, it is quite surprising to see how quickly migration to those provinces reacted to these terms-of-trade shocks. The behaviour of Saskatchewan is more in tune with expectations, where the peak in the migration ratio is observed a couple of years after the end of each shock. Manitoba's migration ratio also increased significantly after the 1978-80 shock. Quebec showed an improvement in its migration ratio after both shocks, though its net-migration ratio remained negative during both of them.[4] In the Atlantic region, the net-migration ratio posted its highest level over the last 20 years in 1975, just after the end of the 1972-74 shock, but it declined significantly after that, reaching its lowest value in 1981, just after the end of the 1978-80 shock. It is worth noting that this trough in net migration coincided with the peak in the ratio for Alberta and with a very high level of migration to British Columbia. Figure 3.8 also shows that the migration ratio for Ontario declined during both of these shocks, also reaching a trough in 1981.

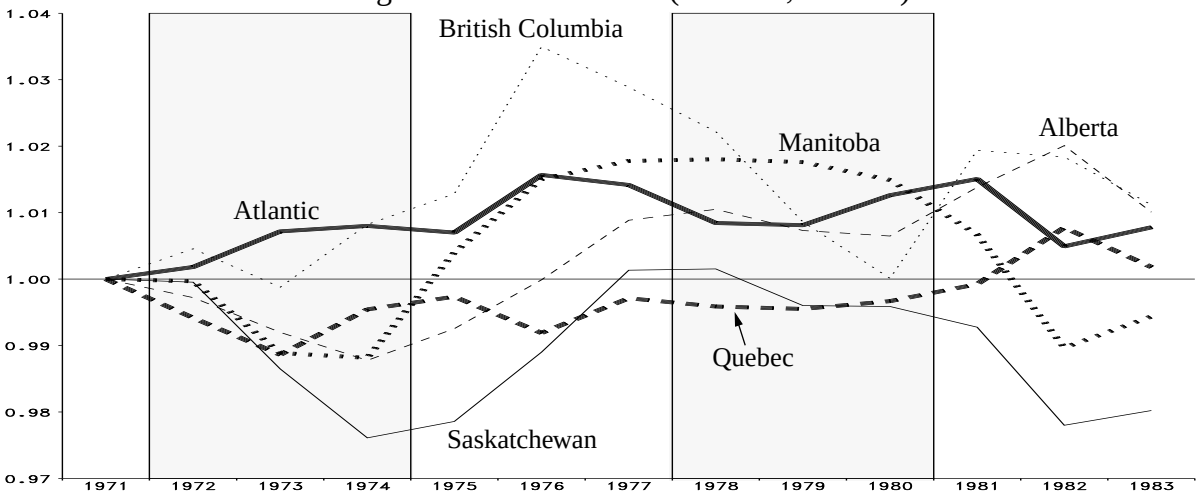
4. One could speculate that labour mobility out of Quebec is more limited than in the other provinces owing in part to a language constraint.

Figure 3.8: Net-migration-to-population ratio (1971-83)



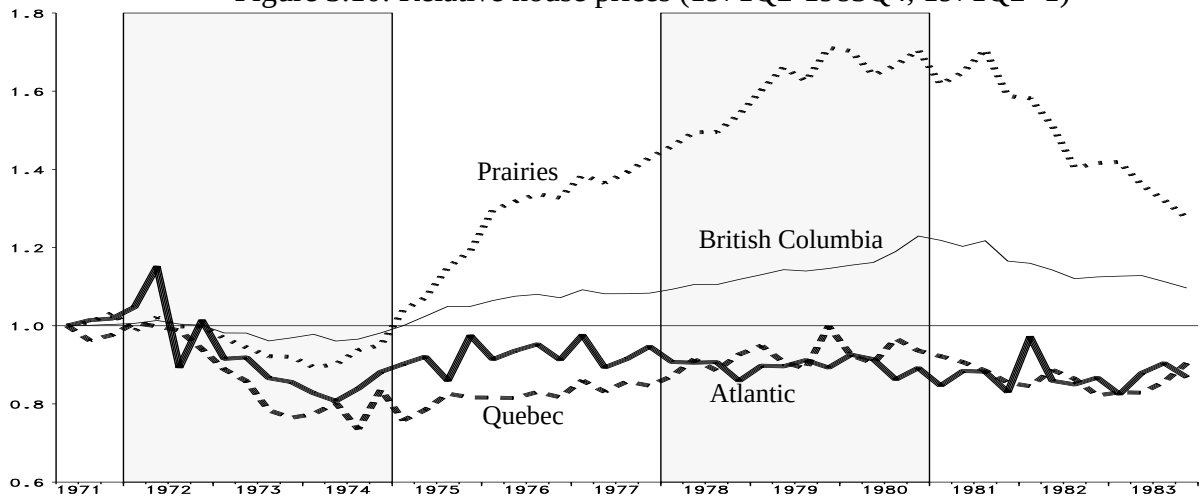
Finally, Figures 3.9 and 3.10 present the evolution of relative prices for consumer goods (CPI) and relative prices for existing houses. We can see from these charts that there are adjustments in the CPI price level in all regions except Saskatchewan. This adjustment begins at least a couple of years after the beginning of the shock and finishes a few years later. The adjustment in terms of relative resale house prices in the western provinces is quite substantial, particularly for the 1978-80 shock.[5] It is, however, much more difficult to detect such a reaction in the Atlantic provinces and in Quebec.

Figure 3.9: Relative CPI (1971-83, 1971=1)



5. Data limitations force us to aggregate house prices for the Prairies as a whole.

Figure 3.10: Relative house prices (1971Q2-1983Q4, 1971Q2=1)



3.2 The 1987-89 shock

Before we turn to an analysis of the effects of the 1987-89 shock, it is interesting to consider what happened before this upward movement in the terms of trade. After posting relatively high levels in the early part of the 1980s, commodity prices as a group fell by almost 40 per cent from the first quarter of 1981 to the first quarter of 1986. This drop was accompanied by a large depreciation in the exchange rate, which declined by almost 15 per cent over the same time period. In reaction, the international competitiveness of Canadian manufactured goods increased substantially, generating an export-led boom in economic activity in Central Canada, especially Ontario. Real GDP in that province posted an average annual growth rate of 5.7 per cent from 1983 to 1986 compared with 3.3 per cent for the rest of Canada.

These developments came just prior to the 1987-89 terms-of-trade shock. This means that our 1987-89 episode begins from a disequilibrium point, making it much more difficult to analyse on this qualitative level. Indeed, Figure 3.11 shows that during the 1987-89 episode the relative GDP of all the other regions posted declines, which is in contradiction with our hypothesis. Similarly, there were declines in relative employment in most regions (Figure 3.12), increases in the relative unemployment rate in all the provinces (Figure 3.13), declines in relative labour income in most regions (Figure 3.14), decreases in net migration to the resource-producing regions (Figure 3.15) and declines in relative consumer price indexes and house prices in all the provinces (Figures 3.16 and 3.17). All this suggests that in 1987-89 the regional economies were

still adjusting to the earlier decline in the terms of trade, and that the relatively small rise that occurred at that time was insufficient to reverse those effects.

Figure 3.11: Relative real GDP (1981-94, 1981=1)

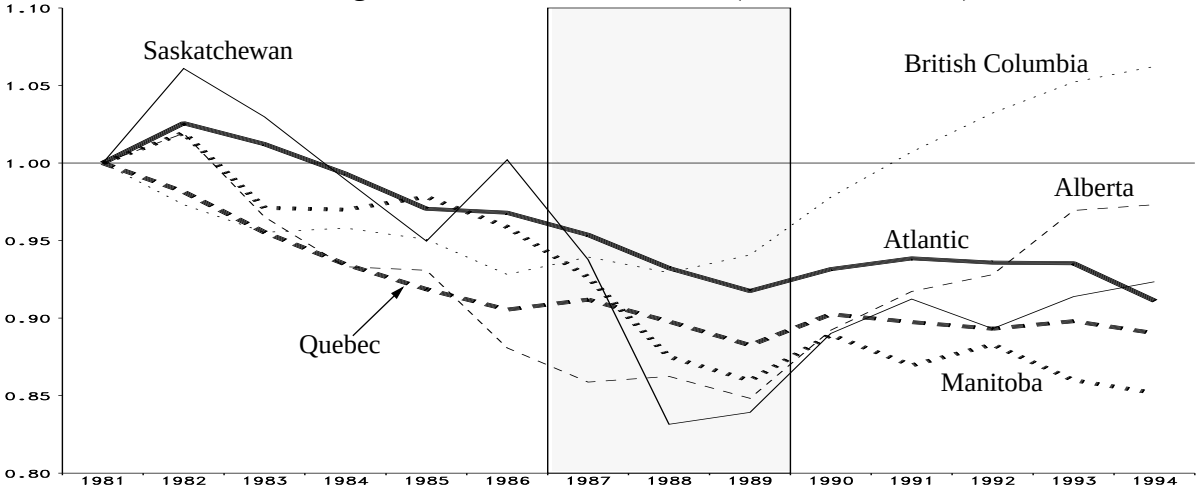


Figure 3.12: Relative employment (1981Q1-1994Q3, 1981Q1=1)

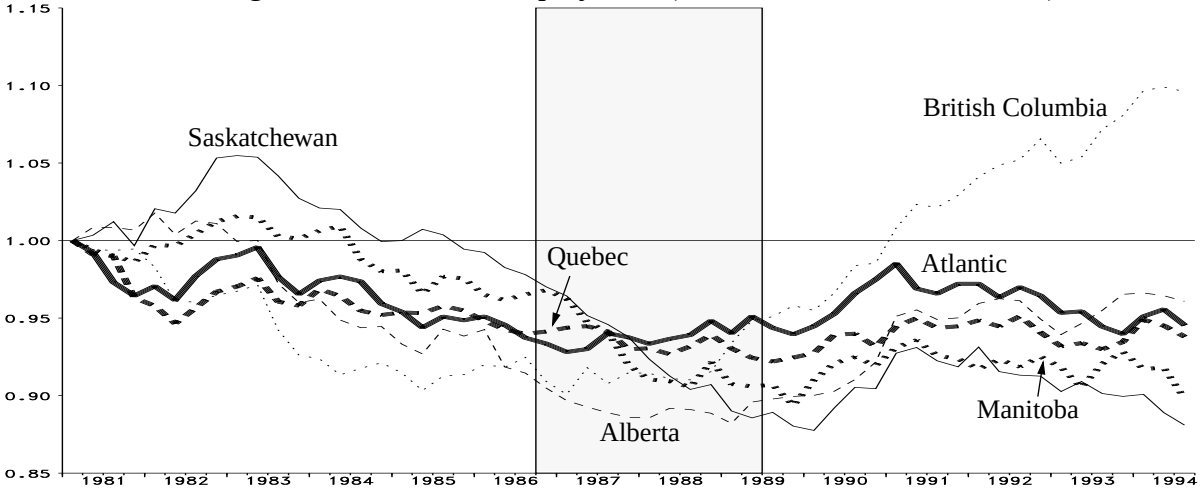


Figure 3.13: Relative unemployment rate (1981Q1-1994Q3, 1981Q1=1)

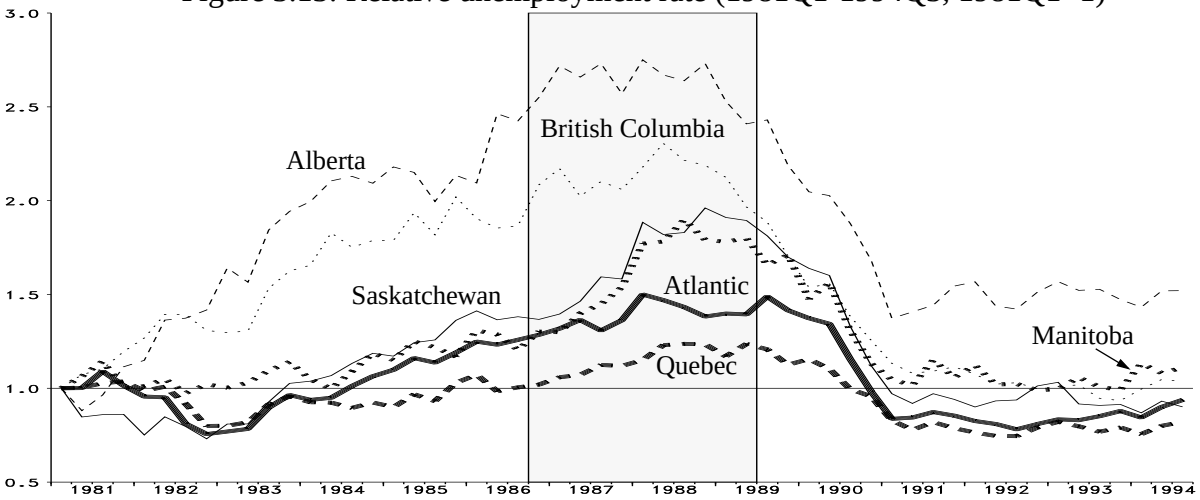


Figure 3.14: Relative real labour income (1981-94, 1981=1)

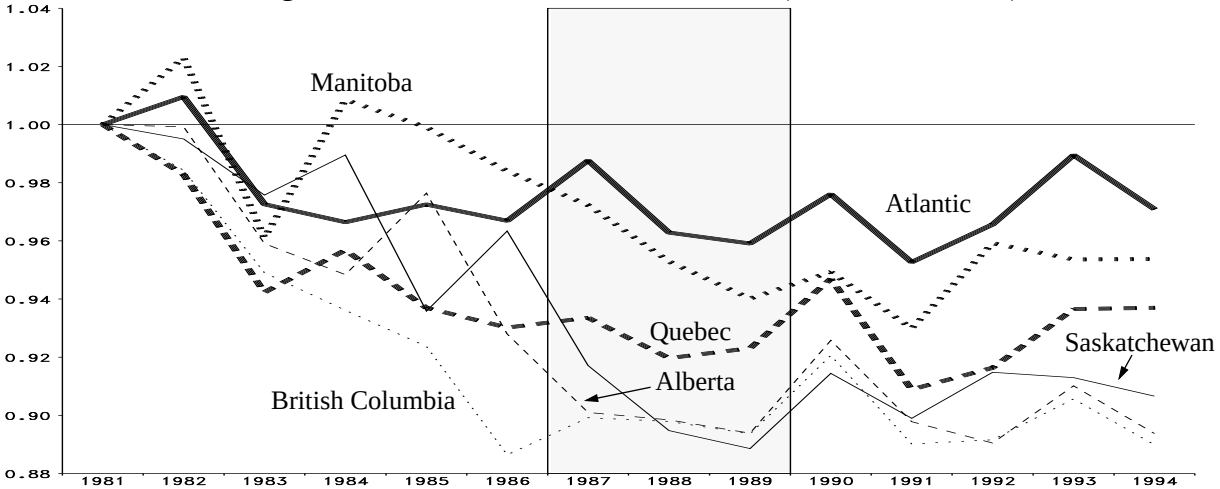


Figure 3.15: Net-migration-to-population ratio (1981-94)

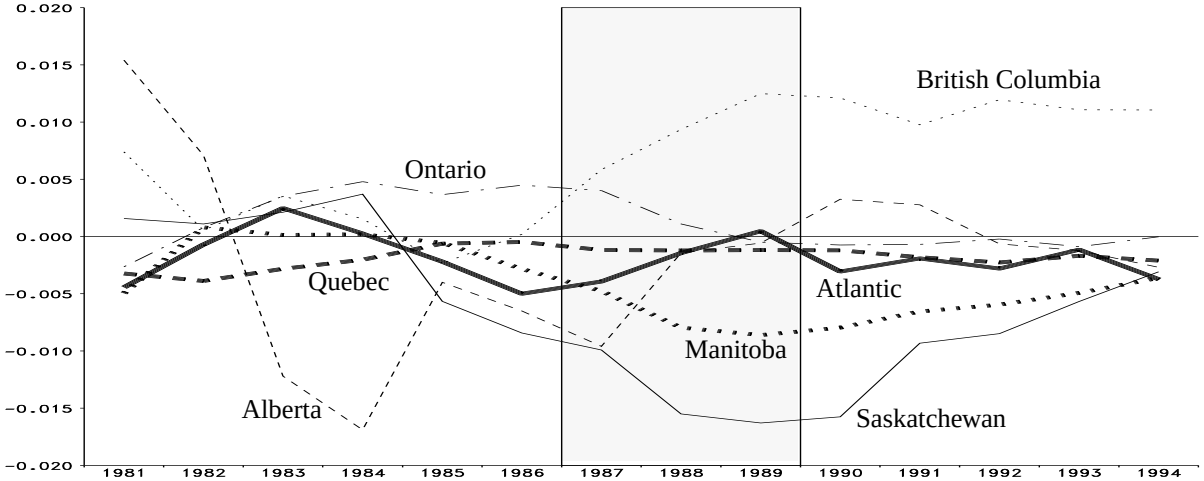


Figure 3.16: Relative CPI (1981-94, 1981=1)

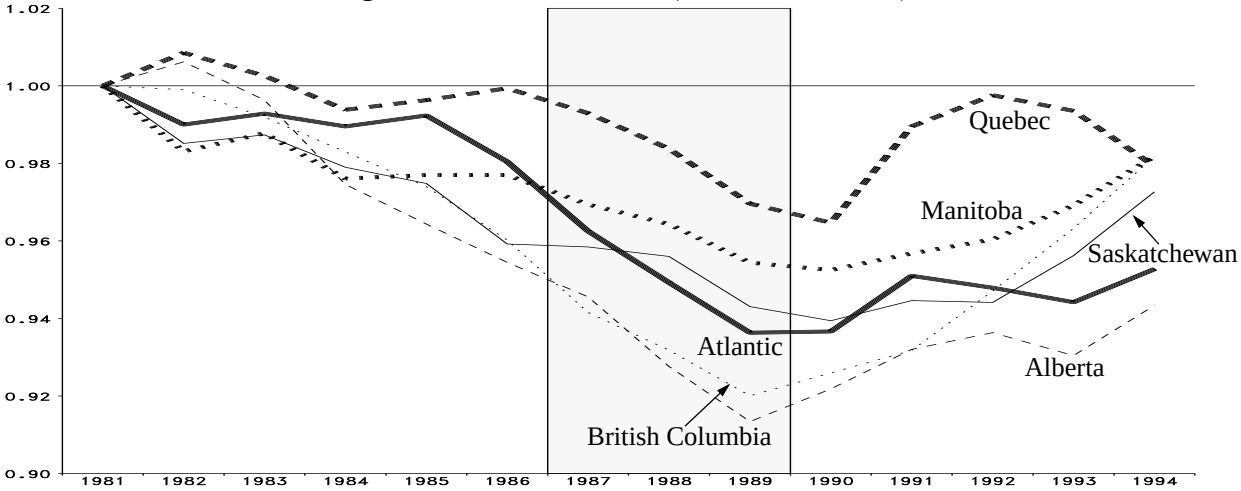
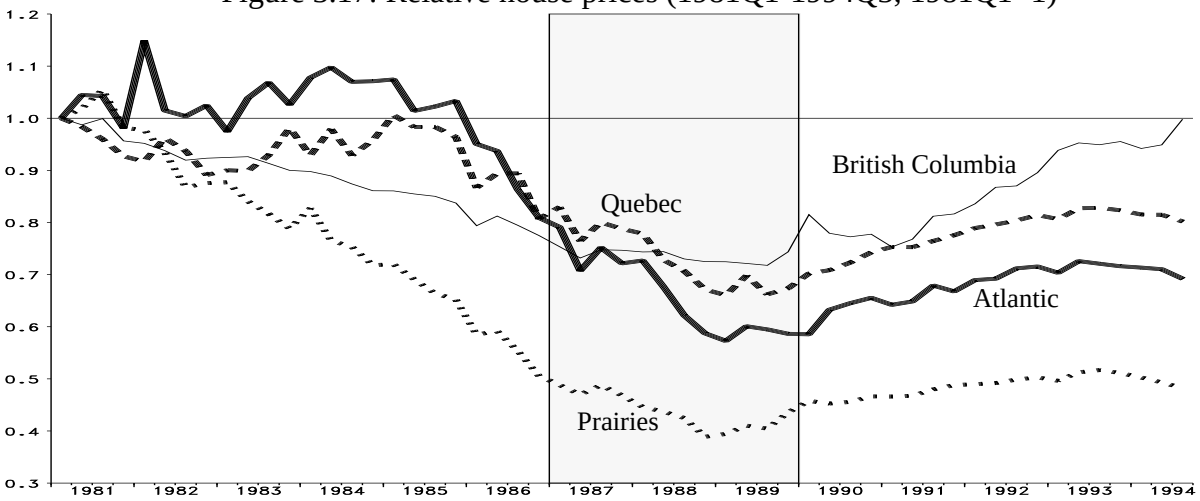


Figure 3.17: Relative house prices (1981Q1-1994Q3, 1981Q1=1)



It is worth pointing out that British Columbia was the only province to post an increase in GDP relative to Ontario during the 1987-89 terms-of-trade shock (Figure 3.11). This can be explained in part by a strong increase in foreign immigration (i.e., from outside Canada) that started in 1987, and by the fact that, unlike the earlier terms-of-trade shocks, commodities like aluminum, copper, pulp and zinc played a disproportionate role in that commodity price cycle. These commodities are particularly important to the British Columbia economy. Looking further ahead, towards 1989 and beyond, however, one can begin to see the predicted forces emerging in most of the other provinces as a consequence of the terms-of-trade rise.

To summarize, the stylized facts would seem to provide considerable support for the hypothesis that terms-of-trade shocks have been instrumental in explaining the differing economic

performance across Canadian regions. In the next section we attempt to provide more formal evidence to support this hypothesis.

4.0 Empirical evidence

In this section we make use of simple vector autoregression (VAR) in an attempt to provide more formal statistical evidence in favour of the regional adjustment hypothesis described above. This should be seen as simply a preliminary step towards the development of a more fully articulated structural model. Given data limitations, we are unable to include all of the elements sketched in the previous section. A VAR is specified for each of four regions — Atlantic, Quebec, Prairies and British Columbia — which includes six variables: (1) employment relative to Ontario, (2) net migration for that region, (3) house resale prices for that region relative to Ontario, (4) a real energy price index in U.S.$, (5) a real non-energy commodity price index in U.S.$, and (6) the Canada/U.S. nominal exchange rate. Variables (4) and (5) are simply a decomposition of the total commodity price index used in the previous section. For reference and to enable interpretation of the "relative" results, a VAR for Ontario was also estimated, where the variables (1) and (3) were not expressed in relative terms. All variables are expressed as percentage first differences to ensure stationarity, except net migration, which is simply differenced. Preliminary work suggested that a four-lag system accounted adequately for the dynamics in the data; the data are quarterly, covering 1972Q2-1994Q3.

Clearly, our principal interest lies in certain parts of the VAR, as we conceptualize variables (1)-(3) as endogenous and as variables (4)-(6) as exogenous at the regional level. Accordingly, the following discussion focusses on these results.

We begin by investigating Granger-causality. Table 1 provides the marginal significance levels of the commodity price and exchange rate variables in the equations for employment, migration and house prices. These data represent the level of confidence with which we can reject the null that the four lags of the exogenous variable in question contain no significant explanatory power for the endogenous variable; a rejection of this hypothesis, then, is equivalent to Granger-causality. Finding that the variable "x" Granger-causes "y", while "y" does not Granger-cause "x", would be suggestive of one-way causality, whereas full interdependence between the two

would usually result in two-way causality. One can also describe Granger-causality as implying that one variable has “information content” for predicting another variable. In terms of the actual numbers reported, a lower number represents greater statistical significance; for example, any number below 0.10 would imply significance at the 10 per cent level or better. In the present context, where the data are differenced and there appear to be only three true “episodes” pertaining to our hypothesis, one probably cannot expect to find sufficiently strong correlations to warrant statements at conventional confidence levels of 5 or 10 per cent. Moreover, a finding that variable x does not directly Granger-cause variable y does not imply that a shock to x will have no implications for y, as the implications might instead flow through the system’s dynamics.

Table 1 provides the marginal significance levels of the five VAR systems for the three variables of interest: employment, net migration and house prices. Beginning with the Atlantic region, we find rather strong correlations between our two commodity price variables and both employment and house prices. Non-energy commodities are significant for net migration only at the 0.23 level; however, notice also that there is a linkage of a similar magnitude between net migration and lagged employment. Thus, there would appear to be statistical support for our adjustment hypothesis in the Atlantic region.

A similar conclusion holds for Quebec. Energy prices are found to be highly significant determinants of all three of our endogenous variables. Non-energy commodities enter the net migration equation significantly, but employment and house prices do not. There are, however, strong dynamic links between the three endogenous variables, as may be seen from the significance of house prices for employment and net migration, and the importance of employment for house prices.

In the case of the Prairies, we find strong Granger-causality of energy prices to employment, and there is a non-trivial effect on net migration as well. There is no evident direct effect of energy prices on house prices. Non-energy commodity prices, in contrast, are highly significant for both net migration and house prices. In the dynamics we see a strong linkage between employment and net migration and house prices.

The results are a little more spotty for British Columbia. There is significant leading information for net migration in both energy and non-energy prices, but the other direct effects are

weak. There are, nevertheless, some important linkages in the dynamics, so a simulation of the model will have to be done before a clear conclusion can be reached.

Finally, the Ontario system reveals a strong link between both commodity price variables and employment, and causality from non-energy prices and net migration. The other direct linkages are weak. Several dynamic linkages appear to be strong, most notably those from house prices and employment to net migration. However, the house price equation has only one significant variable, namely its own lags.

Another noteworthy result is that the exchange rate is found to have a strong impact on employment in all regions.

A second useful means of summarizing the broad correlations in the data is to examine the variance decompositions of the VAR systems. The estimated VARs are used to calculate the percentage of the total variation in each endogenous variable that can be explained by innovations in each of the explanatory variables during a recursive sequence of overlapping eight-quarter simulation horizons. This measure, accordingly, can provide a clearer picture of the economic importance of a given variable for the behaviour of the endogenous variable in question. Such an exercise requires that a causal ordering of the system variables be chosen; for this purpose we have chosen an ordering that matches the adjustment sequence outlined above in Section 2: energy, non-energy, exchange rate, employment, net migration and house prices. However, some experimentation revealed that the ordering assumption was not critical to the results that emerged. The variance decompositions are provided in Table 2. Although in principle the variance decompositions should add to unity, this may not always be the case because of rounding for purposes of presentation.

A common finding in such models is that most of the variation in a given variable is explained by lags of the variable itself, and this is a feature of the regional VARs. This may be seen in the large shares reported along the diagonal of the dynamic portion of the system matrix. Focussing on the commodity price variables, we note a number of instances where the proportion of variance explained is not trivial. Indeed, we find that a fairly large proportion of house price movements in all regions — between 8 and 13 per cent, depending on the region — is explained by energy price movements. Non-energy price movements are found to have relatively large

effects on net migration in all regions except Quebec. The effects on employment appear to be smaller, although energy prices are seen to affect employment in the Atlantic region and on the Prairies, and non-energy prices in Ontario. Overall, the strongest results are found for the Prairies, where energy prices explain 10-15 per cent of the variance of employment, net migration and house prices, and non-energy prices explain 20 per cent of the variation in net migration. All things considered, then, these results appear to be economically significant.

Before moving on, it is also worth noting that commodity prices play an important role in explaining the exchange rate. This is consistent with the findings of Amano and van Norden (1995). Our variance decompositions (not reported here) suggest that 12-16 per cent of the variance in the exchange rate may be explained by our two commodity price variables; this result varies from system to system because each VAR, and therefore its dynamics, is different.

To this point we have not discussed the signs of the various linkages. As noted earlier, for some regions the theoretical direction of the effects seems clear. For example, we would expect that rises in commodity prices would be associated with higher employment, net migration and house prices on the Prairies. However, the effects on Ontario could go in either direction, since Ontario is both a major producer and a major user of commodities. Thus the results for other regions, which are relative to Ontario, must be interpreted with some caution.

One means of examining this issue is to simulate our VARs with a shock to commodity prices, leaving all variables endogenous, and plotting out the predicted dynamic response of each province's employment, net migration and house prices. Figure 4.1 illustrates the predicted effects of a permanent 10 per cent rise in energy prices; the size of the shock seems appropriate given the historical standard error of the series. The Ontario VAR predicts a decline in employment in that province, peaking at 0.4 per cent. House prices fall steadily to a new level about 3 per cent below control. Net migration is negative at first, but becomes positive later; this rebound may imply that there are even more adverse consequences of the shock in other regions.

Figure 4.2 compares the employment responses of the other regions relative to Ontario. We see that, indeed, both Quebec and British Columbia are predicted to fare even more poorly than Ontario on the employment front. Relative employment rises considerably in the Prairies and changes little in Atlantic Canada. Figure 4.3 considers net migration. Evidently people tend to

move out of Atlantic Canada, Quebec (slightly) and British Columbia, and into the Prairies and, eventually, Ontario, in response to such a shock. Figure 4.4 suggests that house prices rise everywhere relative to those in Ontario, most notably in Atlantic Canada and on the Prairies.

Figures 4.5-4.8 repeat the above exercise, simulating a permanent rise in non-energy commodity prices of 5 per cent. Again, the magnitude was chosen based on the historical standard error of the series. Interestingly, we find that the shock has positive implications for employment in Ontario, and house prices rise there also, presumably reflecting the fact that Ontario has an important resource sector. However, net migration is negative, which suggests that the shock has even greater positive implications for other regions. Figure 4.6 reveals that employment is predicted to rise even further than in Ontario in Atlantic Canada and, especially, on the Prairies; relative employment declines in Quebec and, somewhat surprisingly, in British Columbia. Net migration is away from Ontario and (interestingly) from British Columbia, but towards Atlantic Canada, Quebec and especially the Prairies. Finally, Figure 4.8 suggests that relative house prices will decline in Atlantic Canada, Quebec, and (slightly) in British Columbia, but will rise on the Prairies even more than in Ontario.

Admittedly, these simulations are based on a very rudimentary model of regional adjustment, with no structure whatsoever. The underlying coefficients only rarely achieve conventional levels of statistical significance, so the simulated standard errors are liable to be quite large. In short, the simulations might easily have no statistical basis whatsoever. However, the stylized facts appear to be well captured by these simple models, and the predictions in general appear to be consistent with the regional adjustment hypothesis sketched out above. Accordingly, it would appear that further work with a more structured model might prove fruitful.

5.0 Concluding Remarks

The purpose of this paper was to establish a role for terms-of-trade shocks in Canada's regional economic history. Theory suggests that regions will respond differently to terms of trade shocks in accordance with their natural endowments or, putting it another way, their comparative advantages. This response would presumably be reflected by relative employment and net migration movements. For example, one would expect that a rise in world commodity prices will

tend to boost output in those regions that produce primary products, while dampening output in those that use primary products as an input. The qualitative analysis of three episodes in 1974, 1978 and 1987 seemed to be broadly supportive of this theory. The terms-of-trade shocks of the 1970s were particularly beneficial to the Prairies, mainly because of the relative importance of oil prices in those episodes. The British Columbia economy benefited from the shock of the mid-1980s, since commodities like aluminum, copper, pulp and zinc played a disproportionate role in that commodity price cycle.

The VAR analysis that we conducted provides a measure of statistical support. Although the degree of confidence that can be attributed to the inferences is not high by conventional standards, this is to be expected given the paucity of true terms-of-trade episodes contained in our sample. To summarize briefly, the analysis reveals that a rise in energy prices will have a positive economic impact on the economies of the Prairies (led principally by Alberta) and, to a lesser extent, on the economies of the Atlantic provinces. Such a shock will have a negative impact, however, on the economies of Central Canada and British Columbia. The latter is affected with somewhat of a lag, as people leave the province to benefit from the booming economy next door (Alberta). Results are not as clear-cut in the case of an increase in non-energy commodities. This may reflect the fact that the impact of such a shock will vary substantially depending on which commodities are responsible for the shock. It does seem, however, that the economies of Ontario and of the Atlantic provinces generally benefit from an upward shock to non-energy commodities.

Our results may have implications for other branches of the economics literature. One example is studies of long-term convergence between Canada's regions.[6] Such studies might be finding less fundamental convergence than there actually is because occasional terms-of-trade shocks tend to derail the process; alternatively, these studies might actually be picking up evidence of re-equilibration to terms-of-trade shocks, rather than fundamental convergence. Such shocks, then, might be usefully incorporated into the structure of convergence models in order to distinguish these two hypotheses.

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6. See Coulombe and Lee (1993), Lee and Coulombe (1993), Helliwell (1994) and Lefebvre (1994).

Table 1: Tests for Granger-causality

Variables	Employment	Net Migration	House Prices
Atlantic			
energy	0.07	0.67	0.02
non-energy	0.10	0.23	0.15
exchange rate	0.10	0.21	0.73
employment	0.05	0.26	0.74
net migration	0.44	0.11	0.39
house prices	0.63	0.92	0.01
R^2	0.38	0.32	0.48
Quebec			
energy	0.12	0.08	0.09
non-energy	0.44	0.12	0.61
exchange rate	0.10	0.10	0.21
employment	0.13	0.54	0.12
net migration	0.68	0.01	0.64
house prices	0.11	0.16	0.01
R^2	0.33	0.37	0.38
Prairies			
energy	0.06	0.23	0.37
non-energy	0.60	0.03	0.06
exchange rate	0.12	0.60	0.23
employment	0.84	0.41	0.95
net migration	0.01	0.76	0.35
house prices	0.03	0.68	0.01
R^2	0.51	0.42	0.47
British Columbia			
energy	0.41	0.22	0.32
non-energy	0.29	0.05	0.52
exchange rate	0.01	0.18	0.56
employment	0.05	0.40	0.02
net migration	0.14	0.69	0.23
house prices	0.02	0.80	0.32
R^2	0.42	0.38	0.41
Ontario			
energy	0.05	0.54	0.50
non-energy	0.19	0.01	0.40
exchange rate	0.03	0.82	0.72
employment	0.20	0.02	0.69
net migration	0.33	0.06	0.71
house prices	0.16	0.11	0.10
R^2	0.48	0.48	0.40

Table 2: Variance Decompositions after Eight Quarters

Variables	Employment	Net Migration	House Prices
Atlantic			
energy	0.08	0.03	0.11
non-energy	0.05	0.09	0.04
exchange rate	0.09	0.04	0.05
employment	0.71	0.07	0.03
net migration	0.05	0.76	0.03
house prices	0.03	0.02	0.74
Quebec			
energy	0.05	0.04	0.11
non-energy	0.04	0.03	0.05
exchange rate	0.08	0.06	0.06
employment	0.76	0.03	0.04
net migration	0.01	0.74	0.03
house prices	0.07	0.09	0.71
Prairies			
energy	0.15	0.10	0.13
non-energy	0.01	0.20	0.09
exchange rate	0.10	0.10	0.03
employment	0.56	0.02	0.02
net migration	0.04	0.56	0.06
house prices	0.14	0.03	0.68
British Columbia			
energy	0.02	0.11	0.08
non-energy	0.05	0.13	0.04
exchange rate	0.09	0.13	0.02
employment	0.64	0.04	0.16
net migration	0.08	0.58	0.07
house prices	0.13	0.02	0.64
Ontario			
energy	0.06	0.03	0.12
non-energy	0.11	0.09	0.13
exchange rate	0.10	0.06	0.04
employment	0.61	0.12	0.11
net migration	0.02	0.61	0.04
house prices	0.10	0.09	0.57

Figure 4.1: Impact of a permanent 10 per cent energy price increase on key variables of the Ontario economy

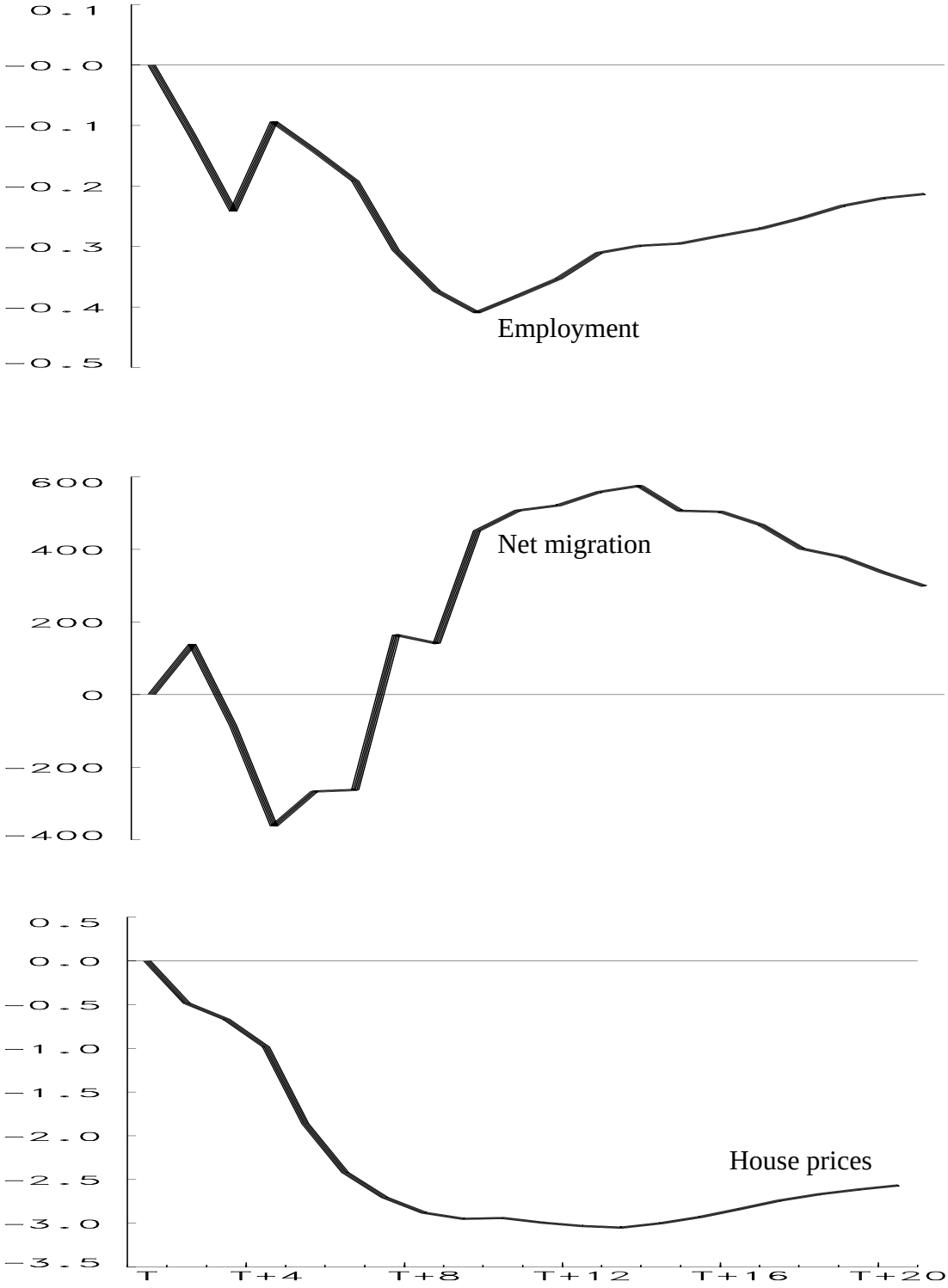


Figure 4.2: Impact of a permanent 10 per cent energy price increase on relative employment

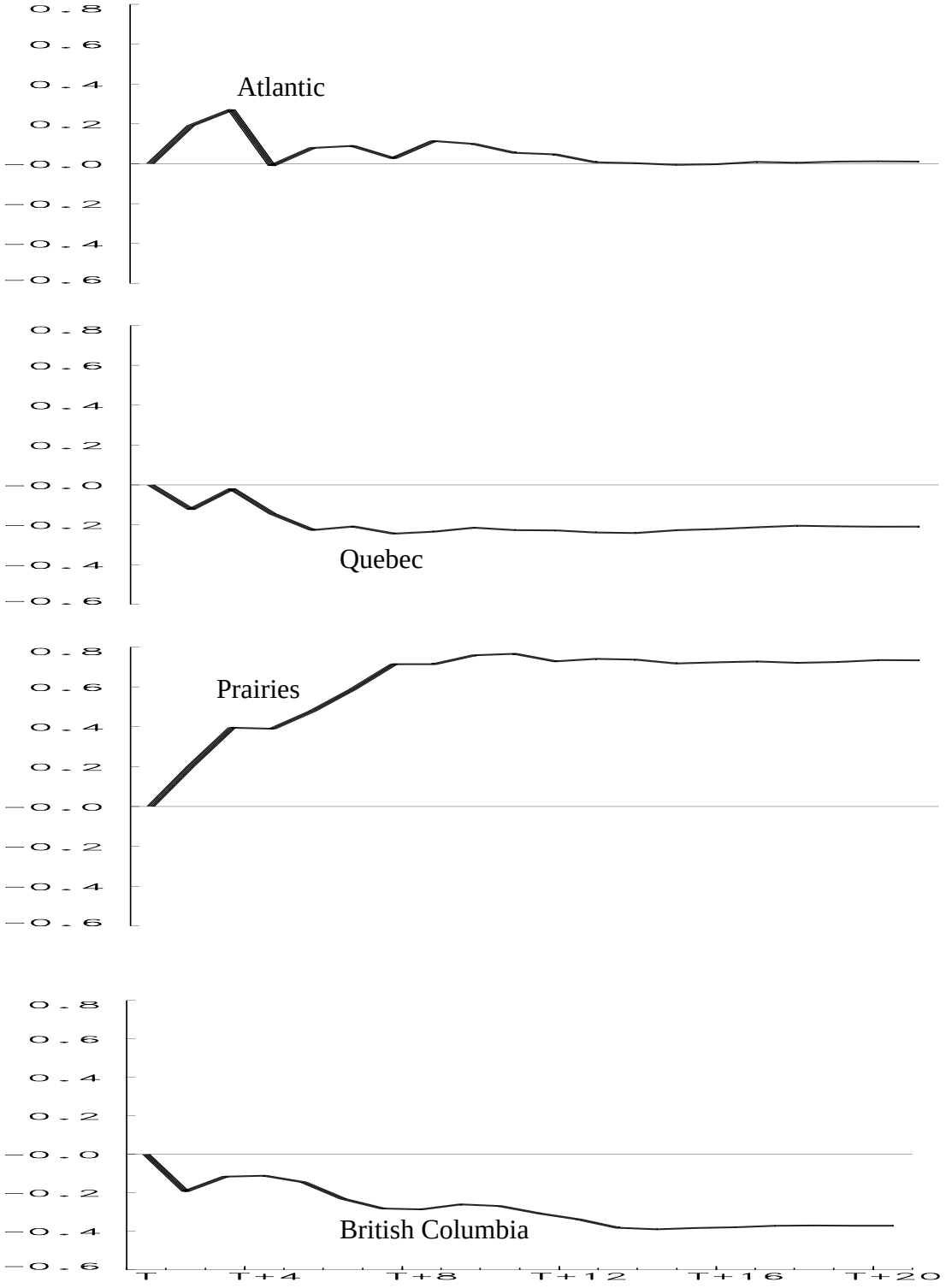


Figure 4.3: Impact of a permanent 10 per cent energy price increase on net migration

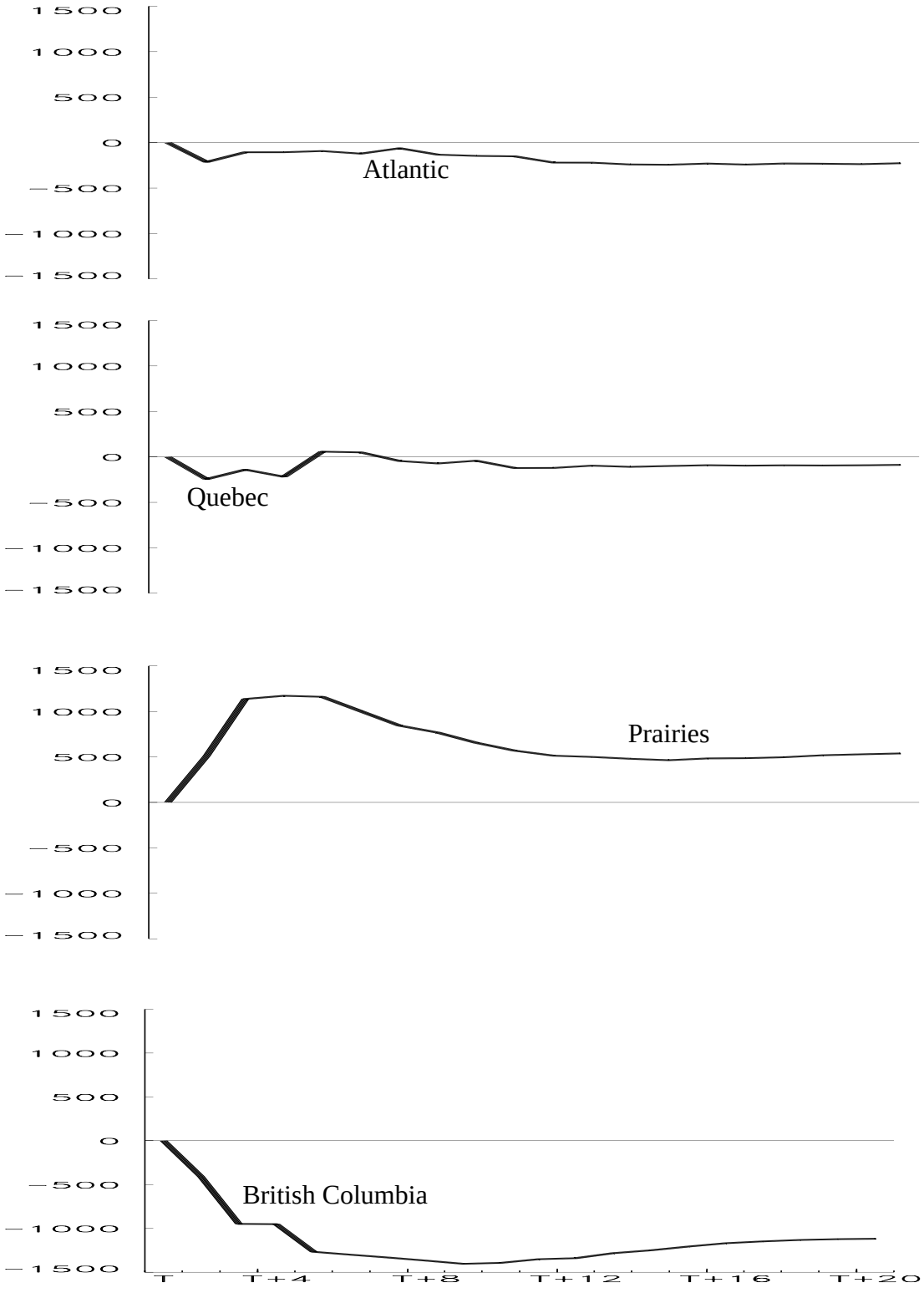


Figure 4.4: Impact of a permanent 10 per cent energy price increase on relative house prices

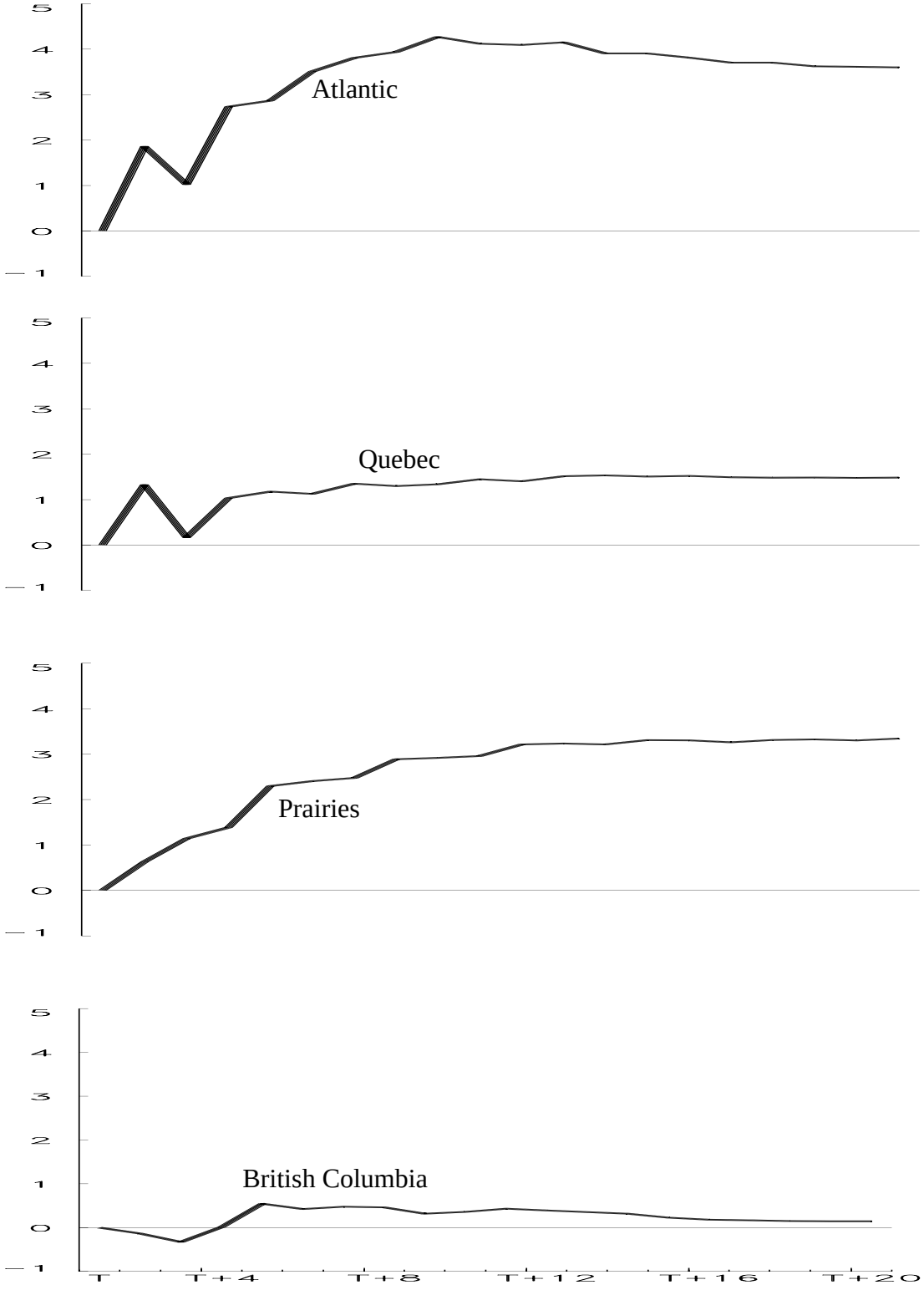


Figure 4.5: Impact of a permanent 5 per cent non-energy price increase on key variables of the Ontario economy

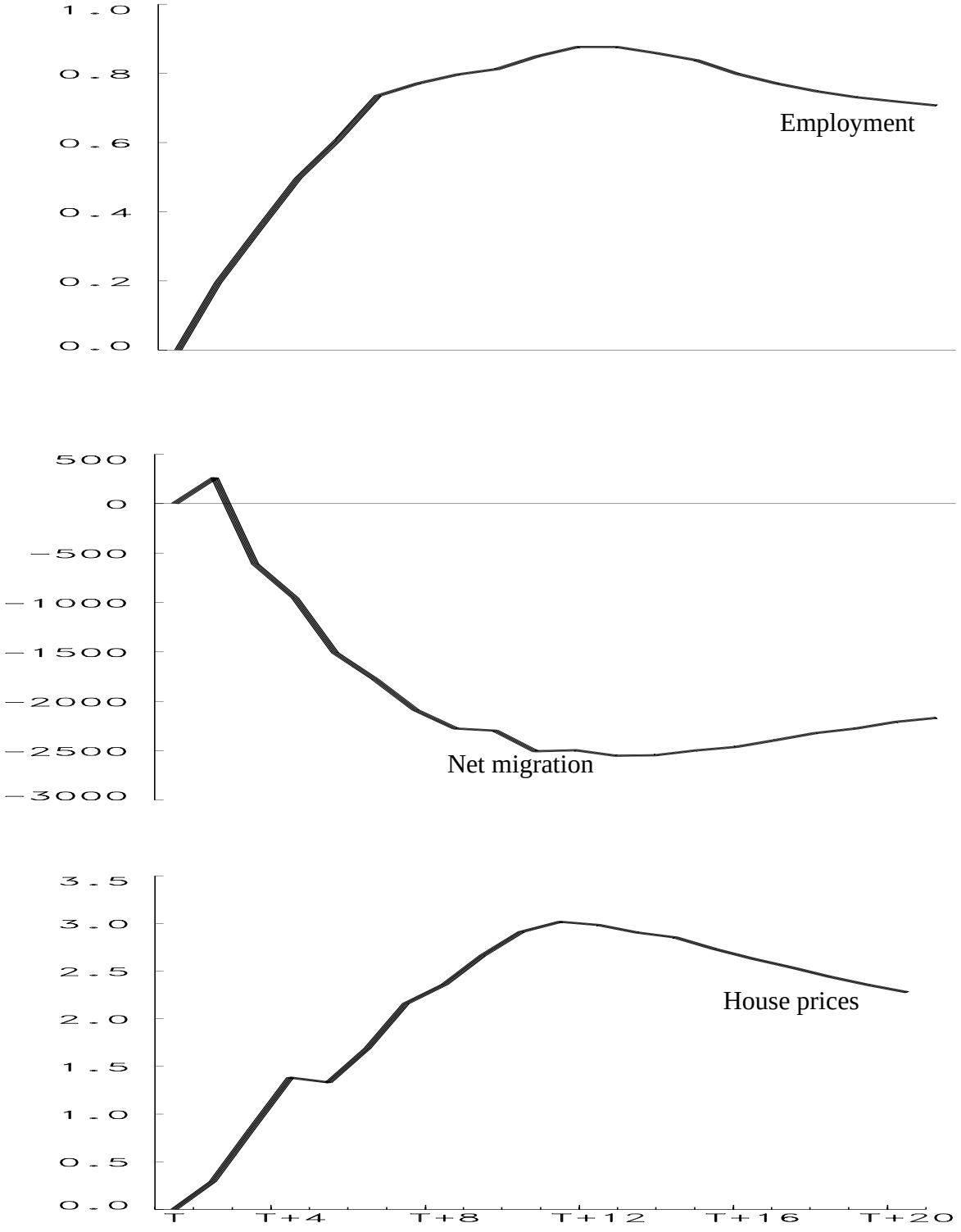


Figure 4.6: Impact of a permanent 5 per cent non-energy price increase on relative employment

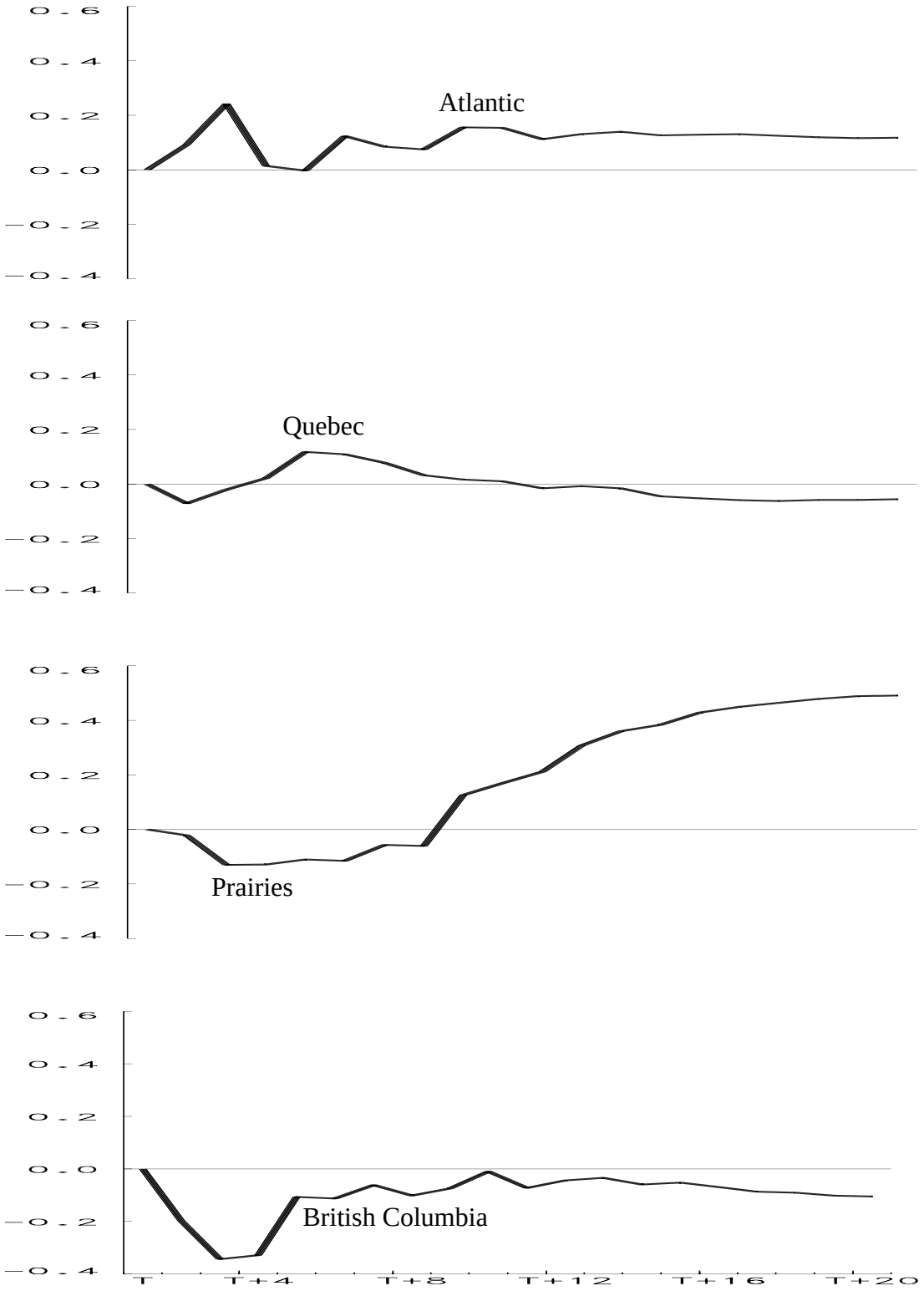


Figure 4.7: Impact of a permanent 5 per cent non-energy price increase on net migration

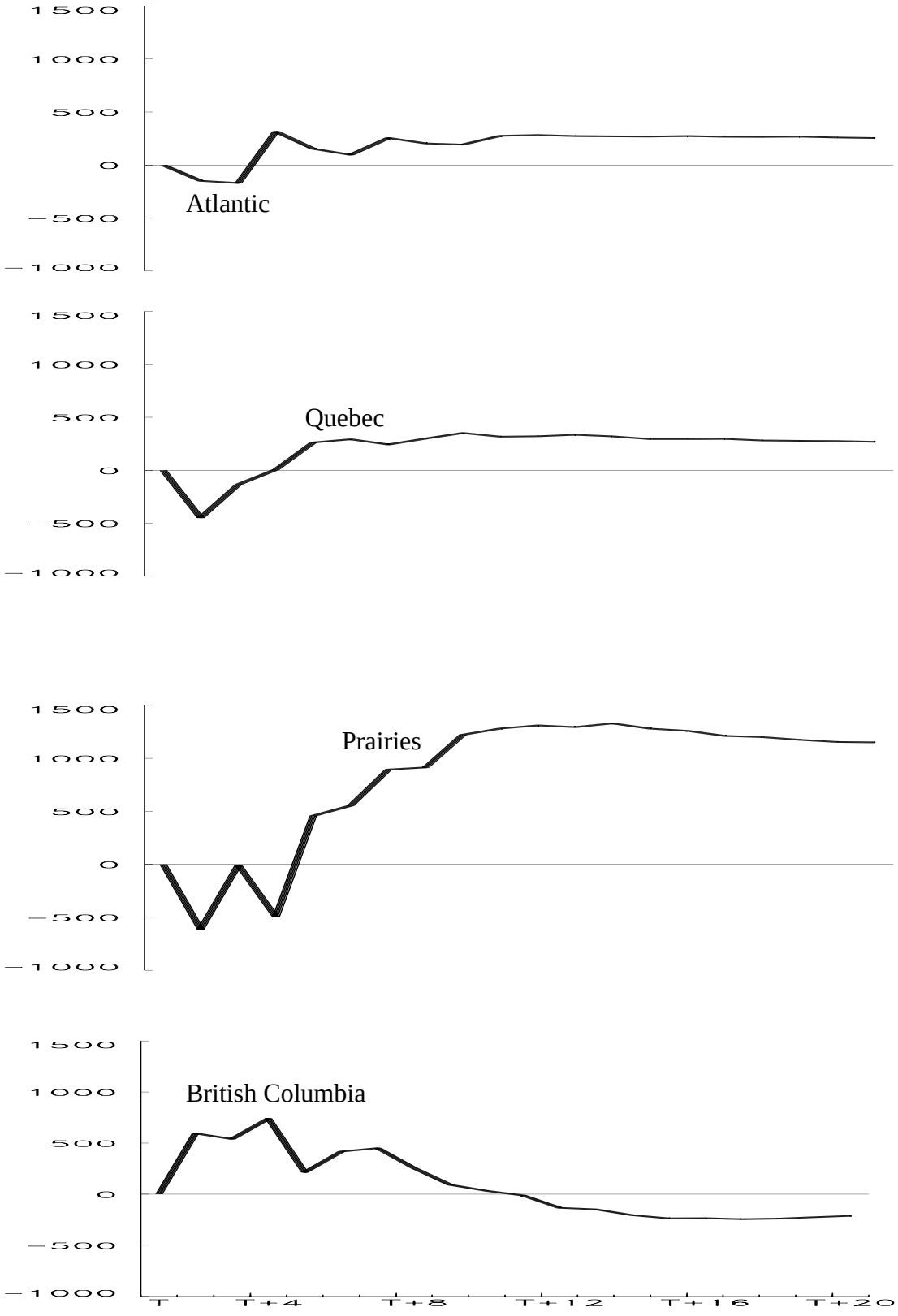
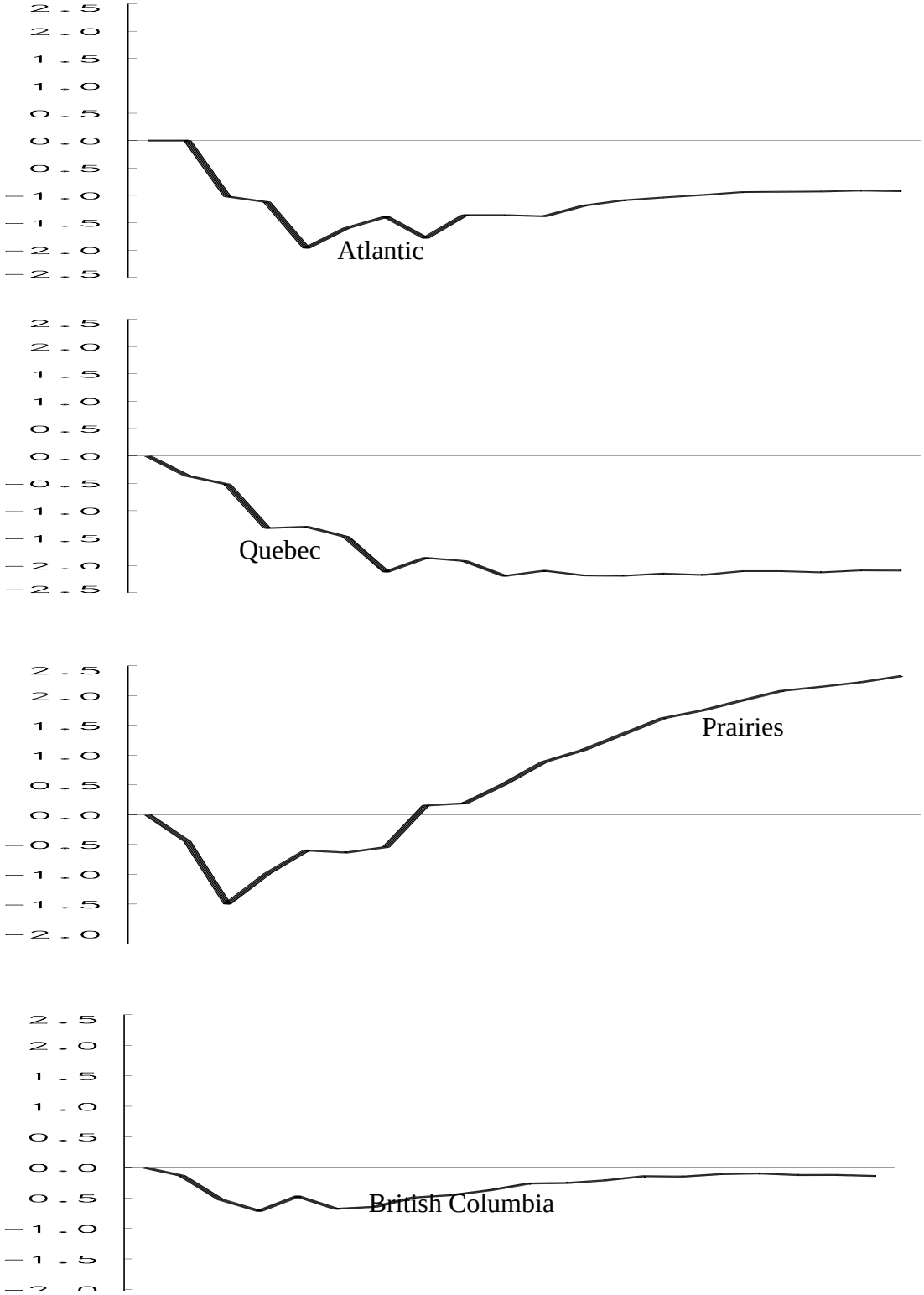


Figure 4.8: Impact of a permanent 5 per cent non-energy price increase on relative house prices



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