A Disaggregated Analysis of Employment Growth Fluctuations in Canada

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This paper studies the sources of fluctuations in Canadian employment growth disaggregated by province and, within each province, by one-digit industry. Using an error components decomposition, industry-specific shocks are found to be relatively more important in explaining fluctuations in employment growth. Aggregate and province-specific shocks also play an important role, with the latter contributing about 30 percent of the explained variance in employment growth. Using a set of additional identifying assumptions, the decomposition technique is then extended to construct time series on the underlying shocks and to examine their properties. (JEL J20, E24)

Introduction

The sources of macroeconomic fluctuations are important in determining the effectiveness of macroeconomic policies which are designed to counteract these fluctuations. For instance, the appropriate policy response to industry-specific shocks ought to be quite different from the response to regional or aggregate shocks. Fluctuations in the labor market, in particular, can be better understood and dealt with by identifying the shocks that cause these fluctuations. The objectives of this paper are to study the sources of fluctuations in Canadian employment growth and to analyze the implications of the relative importance of different shocks. First, the paper provides a decomposition of employment growth fluctuations in Canada into aggregate and disaggregate factors. Using employment data disaggregated by province and, further, by one-digit industry, statistical models are used to evaluate the relative importance of province- and industry-specific shocks and domestic and external aggregate shocks on fluctuations in employment growth.

The decomposition of fluctuations in employment growth has implications in a number of dimensions. For instance, the relative contribution of aggregate and disaggregate shocks to fluctuations in employment growth could be a useful element in determining effective cyclical stabilization policies. In particular, if province-specific shocks are relatively large and have persistent effects, then aggregate demand management policies may have limited success in countering variations in aggregate unemployment. Institutional features that inhibit adjustment to province-specific shocks by restricting

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relative wage adjustment or inter-provincial labor mobility could, therefore, be important determinants of unemployment [Prasad and Thomas, 1998].

Identifying the sources of variations in employment growth could also be useful for evaluating the empirical relevance of competing classes of business cycle models. For example, technology shock models of the business cycle imply that industry-specific shocks are relatively more important than region-specific shocks. On the other hand, many demand-determined models of the business cycle suggest that aggregate (demand) shocks are predominant in explaining economic fluctuations at business cycle frequencies, with sectoral shocks having a relatively small role. Thus, even at the aggregate level, this analysis could have important implications for the design and effectiveness of countercyclical policy since it would isolate the sources of shocks.

The types of statistical models used in this paper to identify different sources of shocks to employment growth have been used by other authors. Altonji and Ham [1990] perform a decomposition of Canadian employment growth using annual data for the period 1961-82 and a methodology related to that used in this paper. They find that a substantial fraction of the variation in Canadian employment growth can be explained by national shocks to the U.S. and Canadian economies, with province-specific, industry-specific, and idiosyncratic (both province- and industry-specific) shocks playing a smaller role. Stockman [1988] examines the effect of a similar decomposition on industrial production growth in two-digit manufacturing industries across a set of industrialized economies. He finds that both industry- and nation-specific shocks have considerable explanatory power. Bayoumi and Prasad [1997] find that the contributions of aggregate, industry-specific, and country- or region-specific shocks are not very different across U.S. regions and European Union countries, although the mechanisms by which adjustment to shocks occurs is very different across these two economic areas. Using different techniques, Norrbin and Schlagenhauf [1988] examine the contributions of aggregate and disaggregate factors to employment growth variation in the U.S.

Using annual data from 1975 to 1993, the results in this paper indicate that industry-specific shocks account for the largest fraction of the explained variance in employment growth in Canada. However, province-specific and aggregate shocks also play an important role. Province-specific shocks contribute about one-third of the explained variance in employment growth. This finding suggests that certain features of the Canadian Unemployment Insurance System, such as regional extended benefits, could have contributed to the significant and persistent disparities in regional unemployment rates in recent years. The aggregate shock, which accounts for over a quarter of the explained variance in employment growth, is largely attributable to U.S. GDP growth.

An additional contribution of this paper is an extension of the standard error components decomposition technique by using a set of identifying assumptions that permit the construction of time series corresponding to the aggregate, province-specific, and industry-specific shocks. This enables an analysis of the properties of these shocks and the relationships among them.

The next section of the paper contains a detailed description of the dataset. The third section describes the econometric methodology and the identification restrictions used in the paper. The results from the decomposition of Canadian employment growth fluctuations into various sources of shocks are presented in the fourth section. The fifth section contains a brief discussion of the implications of the results and the main findings of the paper are summarized in the last section.

Data Description

The dataset consists of employment data disaggregated by province and, within each province, by one-digit industry.[1] In addition, the dataset includes unemployment rates for each province. The labor market data used in this paper cover 1975-93 and were obtained from the Labor Force Survey database maintained by Statistics Canada.[2] In January 1995, employment data from the Labor Force Survey were revised back to 1975 and are not directly comparable with earlier data. Real GDP growth in the U.S. is used to proxy for external shocks. Real GDP data for the U.S. and Canada were obtained from the Data Resources Incorporated databank.

Table 1 provides an indication of the distribution of industries across Canadian provinces. If it were true that industries were localized in one or two provinces, or if a province had a substantial share of its employment in one industry, then it would be difficult to disentangle province- and industry-specific shocks. Table 1 shows that the manufacturing industry has the highest regional concentration. Almost 50 percent of this industry is concentrated in Ontario with Quebec having an additional 30 percent. Quebec and Ontario account for a large share of a number of other industries also. Within each province, however, no single industry dominates. It appears that the large fraction of certain industries in Ontario and Quebec is indicative of the large size of these two provinces, relative to other provinces, rather than purely a high regional concentration of any of these industries. Thus, Table 1 provides some encouraging evidence that it may be possible to statistically distinguish industry-specific shocks from province-specific shocks to employment growth.[3] Bivariate, conditional cross-correlations of provincial employment growth rates were found to be positive but often quite small. Although these positive correlations indicate cyclical co-movement in provincial employment growth rates, there is still a large degree of variation in employment growth over the business cycle across provinces. Cross-correlations of employment growth rates in different industries indicated substantial disparities in annual employment growth rates across industries. The highest correlations of around .7 were among manufacturing, construction, and trade. Many of the other correlations were positive but small and some, in fact, were negative.[4]

These correlation results provide suggestive evidence that modeling cyclical fluctuations in employment growth as being driven primarily by domestic or external aggregate shocks may not be appropriate. There appear to be substantial differences across industries and provinces that would be masked by aggregate measures of the business cycle. This motivates the use of statistical models in an attempt to assess the relative importance of various disaggregate shocks.

TABLE 1
Matrix of Industry Employment Shares Across Canadian Provinces

Province	Primary	Manufacturing	Construction	Transportation and Utilities	Trade	Financial Services	Other Services	Government	Total
Newfoundland	2.2	1.1	1.7	2.0	1.7	0.9	1.6	2.2	1.6
Nova Scotia	3.2	2.2	3.1	3.2	3.3	2.5	3.1	4.0	3.0
New Brunswick	2.4	1.8	2.5	2.8	2.5	1.7	2.3	2.8	2.3
Quebec	15.9	28.9	21.2	24.9	24.4	23.7	25.3	25.2	24.8
Ontario	23.7	48.7	37.8	34.4	37.4	43.0	37.9	36.5	38.7
Manitoba	6.7	3.0	3.5	5.4	4.3	3.8	4.2	4.5	4.2
Saskatchewan	13.5	1.2	3.6	3.6	3.8	3.1	3.5	4.0	3.8
Alberta	20.9	4.5	13.2	10.0	10.0	9.0	9.7	9.8	9.8
British Columbia	10.4	8.4	12.9	13.2	12.1	12.2	11.9	10.5	11.3

Notes: This table shows the distribution of employment shares for each industry across all provinces. The shares are based on average levels of employment from 1975 to 1993. The last column shows the share of each province in aggregate employment.

Econometric Methodology

This paper employs an error components methodology similar to that used by Stockman [1988] in order to identify the relative contributions of province-specific, industry-specific, and aggregate shocks to fluctuations in disaggregated Canadian employment growth. The model uses a set of mutually orthogonal dummy variables to identify the relative contribution of province-specific, industry-specific, and aggregate shocks. The basic model is written as follows:

$$\Delta e(i,j,t) = \alpha(i,t) + \beta(j,t) + \gamma(t) + \epsilon(i,j,t) \quad , \tag{1}$$

where $\Delta e(i,j,t)$ represents the growth rate of employment in industry i located in province j at time t. The regression captures industry-specific effects by including a set of dummy variables $\alpha(i,t)$ specific to each industry i at time t. Similarly, $\beta(j,t)$ denotes province-specific effects. Aggregate effects are captured by time dummies denoted by $\gamma(t)$ that are common to all industries and provinces for a given time period.[5] Since the three sets of dummies are mutually orthogonal by construction, an incremental R^2 criterion can be used to evaluate the relative importance of different shocks for employment variation. In order to control for the fixed effects of industry and province, the mean growth rate of employment over the sample for each set of industry-province observations, indexed by (i,j), was subtracted from $\Delta e(i,j,t)$.

In (1), a linear combination of the set of industry dummies $\alpha(i,t)$ summed over all i would be equal to the time dummy for any given time t. Similar colinearity problems would arise for the province dummies. To avoid multicolinearity, dummies for one industry and one province are excluded from the regression. Thus, the estimated coefficients $\alpha(i,t)$ and $\beta(j,t)$ are to be interpreted as industry- or province-specific shocks, respectively, relative to the excluded industry or province. Standard F-tests for the significance of a particular source of shocks will still be valid in this framework.

However, it is of interest to examine not just the relative importance of the different types of shocks for employment variation, but also their time series properties and their interrelationship. In order to create time series of province- and industry-specific shocks, which are simply the estimated coefficients associated with the corresponding dummy variables, an additional over-identifying restriction is required. The restriction imposed here is that the sum of the province- and industry-specific shocks in any given time period must each equal zero. In other words:

$$\sum_{i=1}^{I} \alpha(i,t) = 0 \quad \text{and} \quad \sum_{i=1}^{J} \beta(j,t) = 0 \quad \forall\ t = 1,\ldots,T \quad . \tag{2}$$

This restriction may be interpreted as implying that province- and industry-specific effects in any time period are deviations from a common aggregate shock. This restriction identifies the shocks to the excluded province and industry. These two shocks are then subtracted from the estimated aggregate shock $\gamma(t)$ in order to arrive at the true aggregate shock in each time period.

Sources of Fluctuations

This section presents results from estimates of the error components model described in (1). After reporting estimates of the baseline specification, a number of alternative specifications are also estimated in order to check the robustness of the results. As noted above, in order to control for fixed effects, sample means were subtracted from each set of province-industry observations indexed by (i, j). Further, to control for differences in cyclical sensitivities across different industries, each such set of observations was divided by the respective sample standard deviations.

Table 2 presents results from the error components decomposition performed by estimating (1) with the dependent variable normalized as described above. The top panel of the table shows that, of the total explanatory power of the regression, aggregate and province-specific shocks contribute about 32 percent each, while industry-specific shocks account for about 37 percent. Two other transformations of the employment growth data were also experimented with. First, sample means were subtracted from each set of province-industry observations, but the observations were not divided by province-industry standard deviations. As shown in the second panel of Table 2, this caused the relative contribution of the aggregate shock to fall to 26 percent, but industry shocks remained the most important factor. Second, employment growth rates were normalized by subtracting sample means as before and then dividing the observations by the standard deviation for each industry at the aggregate level. This normalization produced similar results.[6]

TABLE 2
Sources of Fluctuations in Canadian Employment Growth: An Error Components Decomposition

Model		SSR*	Base-SSR*	Factor	Contribution to ESS**
Specification 1: Employment growth normalized by subtracting province- and industry-specific (i, j) mean and dividing by province- and industry-specific standard deviation.					
Constant	Base =	1236.2			
AGG		1090.8	145.3	AGG	31.9
AGG, PROV		947.5	288.7	PROV	31.5
AGG, IND		924.1	312.1	IND	36.6
AGG, PROV, IND		780.8	455.4		

TABLE 2 (CONT.)

Model		SSR*	Base-SSR*	Factor	Contribution to ESS**
Specification 2: Employment growth normalized by subtracting province- and industry-specific (i, j) mean.					
Constant	Base =	5919.7			
AGG		5466.6	453.1	AGG	25.5
AGG, PROV		4851.7	1068.0	PROV	34.6
AGG, IND		4759.6	1160.1	IND	39.8
AGG, PROV, IND		4144.7	1775.0		
Specification 3: Employment growth normalized by subtracting province- and industry-specific mean (i, j) and dividing by industry-specific standard deviation.					
Constant	Base =	5.0			
AGG		4.6	0.4	AGG	25.8
AGG, PROV		4.1	1.0	PROV	32.5
AGG, IND		3.9	1.1	IND	41.7
AGG, PROV, IND		3.4	1.6		
Specification 4: Employment growth normalized as in Specification 1 and weighted by employment shares.					
Constant	Base =	1236.2			
AGG		1095.6	140.6	AGG	22.8
AGG, PROV		833.3	352.9	PROV	34.4
AGG, IND		819.9	416.3	IND	44.7
AGG, PROV, IND		618.8	617.4		

Notes: Annual data from 1976-93 were used in the estimation. * denotes sum of squared residuals; ** denotes explained sum of squares. SSR = sum of squared residuals. ESS = explained sum of squares. AGG, PROV, and IND refer, respectively, to aggregate (time), provincial, and industry dummies.

As noted earlier, an additional consideration is that the results may be distorted by the fact that the estimation procedure assigns equal weight to all observations. An attempt was made to correct for this by weighting each province-industry observation (in all time periods) by its average share of total employment over the full sample. The results from this weighted regression are reported in the bottom panel of Table 2. Again, the results are broadly similar with industry shocks remaining the most important factor. Although this regression has a higher R^2 than the unweighted regression, a concern is that the dummy variables for the different factors are no longer orthogonal since they are not weighted equally in the estimation.[7] Hence, to maintain a straightforward interpretation of the results for the relative contributions of different factors, the unweighted estimates are used in the analysis that follows.

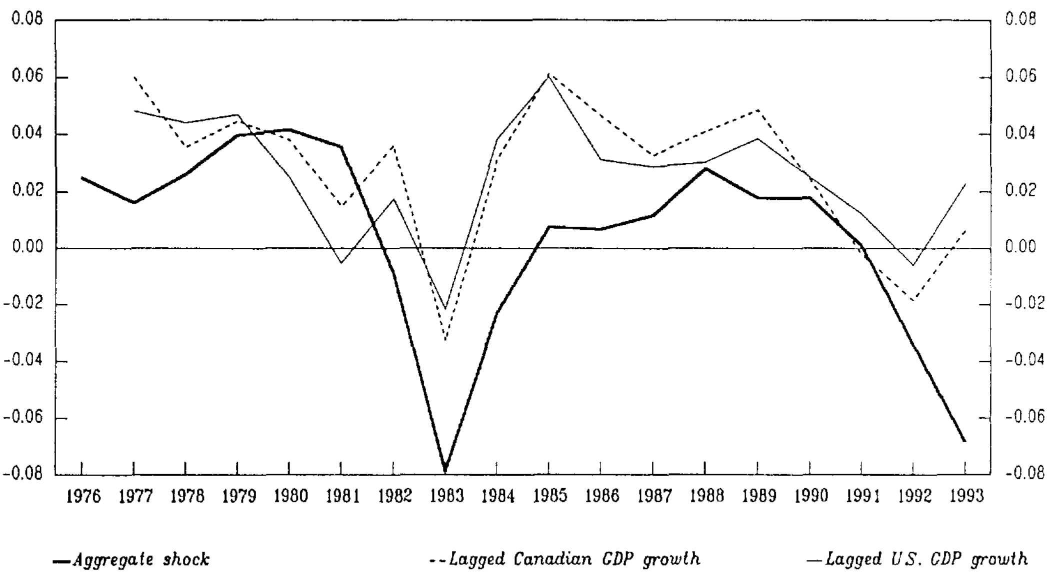
Another concern regarding the methodology is that the estimates may be contaminated by feedback effects among the different shocks. Since annual data are used here, it is a reasonable assumption that much of these feedback effects are likely to be captured by the methodology. As a simple test, bivariate Granger-causality tests, allowing for two lags, were implemented across all possible combinations of the shocks. The null hypothesis of no Granger-causality could be rejected at the 5 percent level in less than 10 percent (21/306) of these cases. These results can be interpreted as providing evidence that the additional feedback effects not captured by these estimates are unlikely to be large.

The main results in Table 2 can now be summarized. Although the relative importance of different factors is affected by the chosen normalization, the results are broadly similar. In order to check the statistical significance of the factors included in the decomposition, standard F-tests were also performed. These tests confirmed that the aggregate and industry-specific shocks were jointly significant at the 5 percent level in the full regression. The province-specific shocks were jointly significant at the 10 percent level. Thus, the conclusion is that industry-specific shocks play the most important role in employment growth fluctuations in Canada, but provincial and aggregate factors are also of substantial importance.

The finding that industry shocks account for most of the variation in employment growth differs from the results of Altonji and Ham [1990] who find that aggregate shocks play a more important role. One possible explanation for this difference is that the sample period in this paper is 1975-93, whereas Altonji and Ham analyze the period 1961-82. The Canadian economy has become substantially more open to international trade since the early 1980s, thereby increasing the potential importance of global technology and productivity shocks for fluctuations in Canadian output and employment. As Stockman [1988] has argued, such shocks are likely to be manifested as industry-specific shocks. Another possible reason for the differences in the results is that Altonji and Ham control for feedback effects between different shocks by projecting employment growth onto lagged employment before performing the industry and province decomposition of shocks. However, according to the results in this paper, such feedback effects are generally eliminated within one year, which corresponds to the frequency of the data used here.

Having identified the various sources of shocks, it is useful to examine the aggregate shock and its relationship with other macroeconomic aggregates. In order to do this, the estimated aggregate shocks were regressed on aggregate domestic activity, represented by Canadian GDP growth, and external activity, proxied by U.S. GDP growth.[8] Current GDP growth both in the U.S. and Canada was found to have little explanatory power when the aggregate shock was regressed on these variables. However, lagged GDP growth in the U.S. and Canada together could account for almost two-thirds of the variation in the aggregate shock. This is consistent with other evidence that employment growth reacts with a lag to fluctuations in output. Figure 1, which plots the aggregate shock and lagged GDP growth in the U.S. and Canada, shows the high degree of positive correlation among these three variables.[9] This provides comforting evidence that a reasonable measure of the aggregate shock has been identified by the methodology.

FIGURE 1
Aggregate Shock and Lagged Canadian and U.S. GDP Growth, 1976-93



It is also possible to compute the relative contributions of different shocks for employment growth variation in each province and in each industry. This can be done using the estimated residuals from the full regression that includes all the dummies but limiting the observations to those related to a particular province or industry. Table 3 shows the fraction of employment growth variation in each province or industry that is explained by aggregate, province-specific, and industry-specific factors and the relative contribution of each factor to this explanatory power.[10] The total R^2 ranges from 27 percent in Alberta to 50 percent in Saskatchewan. Aggregate factors are most important in Newfoundland, Nova Scotia, and Saskatchewan, while province-specific shocks are most important in British Columbia. Province- and industry-specific shocks are of roughly similar importance in Quebec and industry-specific shocks are dominant in the remaining provinces.

TABLE 3
Disaggregated Results from the Error Components Decomposition

		Relative Contributions of Different Factors to Explanatory Power of Regression		
Province and One-Digit Industry	R^2	Aggregate Shocks	Province Shocks	Industry Shocks
Newfoundland	0.41	46.5	25.8	27.7
Nova Scotia	0.39	47.3	24.9	27.8
New Brunswick	0.31	35.3	19.3	45.4
Quebec	0.29	26.3	37.9	35.8
Ontario	0.29	31.5	14.0	54.5
Manitoba	0.44	32.2	21.5	46.3
Saskatchewan	0.50	39.6	27.1	33.3
Alberta	0.27	32.8	32.8	34.3
British Columbia	0.31	00.0	60.9	39.1
Primary	0.17	17.9	00.0	82.0
Manufacturing	0.53	50.9	19.8	29.2
Construction	0.50	28.6	44.9	26.4
Transportation	0.32	35.2	42.6	22.2
Trade	0.42	38.3	35.7	26.0
Finance	0.33	14.5	38.3	47.3
Services	0.41	31.0	42.2	27.1
Government	0.26	14.8	23.0	62.3

Among industries, half of the variation in employment growth in manufacturing and construction is explained by the regression but less than a fifth of the variation in the primary sector is explained. The aggregate shock dominates the manufacturing sector. Sectoral shocks are most important in the primary, finance, and government sectors. As might be expected, province-specific shocks are most important for industries that have products that may be considered nontradable across provinces. This effect is apparent for construction and services.[11]

Next, the correlations between the province- and industry-specific shocks and the aggregate shock were examined.[12] Most of the correlations were statistically insignificant. Among the province-specific shocks, the exceptions were Saskatchewan, which had a positive correlation with the aggregate shock, and British Columbia, which had a negative correlation. The shocks for Quebec and Ontario (which are highly positively correlated with each other) were weakly negatively correlated with the aggregate shock. Among the industry-specific shocks, only manufacturing was found to have a strong positive correlation with the aggregate shock, while the primary sectors, finance and government, had weak negative correlations. This indicates that shocks specific to the manufacturing sector tend to amplify aggregate shocks.

Finally, the cross-correlations of shocks across provinces and across industries were examined. Most of the inter-provincial correlations were insignificant. The shocks specific to Ontario were positively correlated with those of New Brunswick and Quebec. The shocks for Saskatchewan were negatively correlated with those of Quebec and Ontario and positively correlated with those of Manitoba. The shocks to Alberta and Newfoundland were negatively correlated. Apart from a negative correlation between British Columbia and Manitoba, this pattern of cross-correlations is roughly consistent with the findings of other researchers that the western regions of Canada face similar shocks and that these shocks are negatively correlated with shocks to Quebec and Ontario and the eastern provinces. Among the inter-industry correlations, only two were significant. The shocks to construction and the primary sector were negatively correlated as were manufacturing and finance.

Discussion

In summary, the decomposition has identified shocks related to three distinct factors—aggregate, province-specific, and industry-specific factors. All three sources of shocks appear to be quite important in explaining employment growth variation in Canada. While aggregate shocks can possibly be offset in the short run by aggregate demand management policies, the results in this paper indicate that a large fraction of employment growth variation would be difficult to influence with such policies. Industry-specific shocks are likely to be similar across countries and are less likely to be influenced by domestic policies, particularly in the case of a relatively open economy like Canada.

The origins and policy implications of province-specific shocks are more difficult to discern. It is likely that these shocks are affected by and interact with labor market adjustment mechanisms that could vary across provinces. Further, it is possible that institutional features such as the regionally extended benefits feature of the unemployment insurance system in Canada could affect the interaction between shocks and adjustment mechanisms.

Preliminary experiments revealed that employment shocks in all provinces generally do not last beyond a year since they are strongly mean-reverting with very small and insignificant autocorrelation coefficients. However, even temporary employment growth shocks appeared to have a longer-lasting effect on changes in unemployment. This, in turn, implies that such employment growth shocks are estimated to have persistent effects on the levels of provincial unemployment.

A number of interesting issues arise at this juncture. For instance, the persistence of the effects of employment growth shocks on unemployment could be affected by institutional features such as the regionally extended benefits of the unemployment insurance system. Further, over the longer run, it would be interesting to examine if the relative provincial unemployment rate returns to its original level after an employment growth shock through changes in wage rates or participation rates or through inter-provincial labor mobility. These questions are beyond the scope of this paper and are left to future research.

Conclusion

This paper has estimated the relative contributions of different sources of shocks to employment growth in Canada. The estimation was performed using annual data from 1975 to 1993 that were disaggregated by province and, within each province, by one-digit industry. Industry-specific shocks were found to account for the largest fraction of fluctuations in Canadian employment growth, but aggregate and province-specific shocks also appear to play a significant role. A large fraction of the variation in the aggregate shock can be attributed to external factors as proxied by U.S. GDP growth.

The relative importance of province- and industry-specific shocks suggests that, in response to observed aggregate shocks, aggregate demand management policies may be of limited effectiveness in countering variations in unemployment. Province-specific shocks account for about one-third of the explained variance in employment growth fluctuations in Canada. Although these shocks are relatively short-lived, they appear to have persistent effects on provincial unemployment.

The analysis raises many interesting questions about the interaction between shocks and labor market adjustment mechanisms at the provincial level. For instance, along the lines of work done by Blanchard and Katz [1992] for the U.S., the question arises as to what the main adjustment mechanisms are in the short run and the long run in response to provincial employment growth shocks. Adjustment to such shocks could occur through temporary or permanent changes in employment levels, unemployment, participation, and real wages. An analysis of these adjustment mechanisms is left to future research.[13]

Footnotes

1. Prince Edward Island, which accounts for less than .5 percent of the aggregate labor force in Canada, was excluded from this study.
2. These data are, in fact, available monthly. Using monthly or even quarterly data would have allowed additional degrees of freedom but at the cost of introducing a large number of additional parameters. Further, disaggregated employment data in Canada tend to have strong

seasonal patterns. Using seasonally adjusted data, as well as raw data that was adjusted by the authors using variants of the X-11 procedure, it was found that the results (on a quarterly frequency) were sensitive to the deseasonalizing procedure. Using such high frequency data would also have required allowing for dynamic feedback effects among the different shocks, thereby complicating the model considerably.

3. Table 1 also suggests that weighting each province-industry observation equally may distort these empirical results. For instance, a province with a small but highly volatile share of a particular industry could influence the results. This issue is addressed in the empirical work by experimenting with a weighting scheme that assigns to each province-industry observation a weight determined by its share of total employment averaged over the full sample period.
4. To conserve space, these results are not shown here but are available from the authors.
5. More precisely, the notation refers to the product of the relevant dummy variables and the corresponding coefficients.
6. As noted earlier, one province and one industry had to be excluded from the estimation to avoid colinearity. It was found that the choice of the excluded industry and region made virtually no difference to the results obtained from any of these specifications.
7. This can be seen from the fact that contributions of the different factors to the explanatory power of the regression, calculated by examining the incremental reductions in the SSR, now exceeds 100 percent.
8. The aggregate shock in any period is simply the coefficient on the time dummy in that period.
9. After 1991, the aggregate shock sharply declines. This is consistent with the negative employment growth in Canada in 1991 and 1992 (reflecting the effects of the 1990-91 recession) and the very modest pickup in employment growth in 1993.
10. The results reported in this table are drawn from the full regression. When examining a subset of observations, it is possible for the variance of the dependent variable to be actually reduced relative to a particular factor. In isolated instances, this is reflected in a small, negative contribution of a factor to the R^2. For the full regression, of course, this is not possible. In the two cases where there was a small negative R^2 contribution for a factor, the contribution of that factor was set to zero and the contributions of the remaining factors were adjusted accordingly.
11. Bayoumi and Prasad [1997] report similar findings using European data.
12. Tables containing the results discussed here and in the next paragraph are available from the authors.
13. Recent work by Amano and Macklem [1998] and Prasad and Thomas [1998] has proceeded in this direction.

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