Structural Adaptation of Atlantic Provinces:
Growth of Employment and Output
1987-1997

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As the Canadian economy, like most industrialized economies, is becoming increasingly "knowledge-based" and "technology-driven," the economic challenge facing Canada in general and Atlantic Region in particular is essentially that of improving and strengthening the relative position of employment and output. Each region has its own key sectors that perform well above the national average and sectors that lag behind the national average.

Aggregate data mask profound trends in the employment pattern and sectoral output both at the national and the sub-national level. Canada's productivity performance is the result of overall economic performance of the sub-national economies. A thorough understanding of the changing pattern of industrial activity at the provincial level, and hence employment shifts and output growth across the provinces is vitally important.

Consequently in this study we endeavor to analyze and delineate the changes in the growth of employment and output in Atlantic Canada in the past decade. A modified version of the Shift-Share model, as developed by Stilwell [1969], is used for an in-depth analysis of recently available 16 sectoral classifications of employment and 15 sectoral classifications of output.[1] These classifications include the recently emerging sectors of the new economy along with traditional sectors.

The first section describes the methodology, aims and shortcomings of the Shift-Share technique. The second section specifies the modified version of the model. The results are presented in the third section and finally the conclusions of the study are presented.

Methodology[2]

Employment and output are not distributed evenly across the country. The patterns of their distribution are often ambiguous and require strenuous interpretation. To understand the changes in employment and GDP dimensions at the provincial level requires some descriptive and analytical approaches. The measurement of changes in these patterns and evaluation of such changes requires that some standards be defined. For example, what is a favourable or unfavourable industrial mix

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[1]Statistics Canada, *Labour Force Historical Review, 1999*, CD Catalogue number 71F0004XCB.

[2]This section draws heavily from one of the co-authors' earlier studies [9, 10].

and how is it measured? These and many other questions pose methodological challenges. Thus, what measure is to be used as a standard becomes an important question. In this study the national economy is always the reference standard against which the performance of each province is measured in term of employment and output growth.

One method of comparing changes against some standard is "Shift-Share" analysis. The Shift-Share analysis, first used by Creamer (1942) which became the basis of classical works by Dunn [1960] and Perloff, Dunn *et al.* [1960], is a descriptive technique which segregates regional variables such as employment, output, population into three components; regional shift, the proportionately shift, and differential shift [Dunn, 1960]. The first component reflects a national rate of change in employment, output or population. In other words, the regional share is the expected growth of employment, output, population in the region if these variables in the region were to grow at the same rate as the national average over the reference period. The second and the third components reveal industrial structure (mix), and locational advantages or disadvantages of a region's economy respectively. Therefore, the latter two components have been also termed as the composition and competitive effects, respectively.

The difference between actual employment or output growth in the region and the expected national employment or output growth (regional share) is captured by what is called 'total shift'. Total shift indicates the net gain or loss to the region over the reference period. The total shift is divided into a proportionality shift and a differential shift. The positive (negative) proportionality shift indicates that the region has favourable (unfavourable) distribution of fast-growing industries. The differential shift is positive (negative) if the region's industries grow faster (slower) than similar industries in other areas of the nation. The proportionality shift (industrial mix) component reflects the effect of a region's initial industrial structure on its employment or output growth while the differential shift component reflects the competitiveness of its industries vis-a-vis the rest of the nation during the period.

The Shift-Share analysis has been widely used in regional development studies [1, 2, 3, 6, 7,9]. This technique has also been heavily criticized because the results are sensitive to the level of aggregation of the variables.

The Modified Shift-Share Model

In general, there is not a great deal of controversy surrounding the interpretation of the proportionality shift. If it is positive (negative) then the region's growth (loss) of employment or output can be attributed to the region's favourable (unfavourable) industrial mix. The proportionality shift does not explain, as a bona fide growth theory would, what gave the region its initial industrial mix. Furthermore, it does not give any indication of the future prospects to the region in its standard form. Herein lies the importance of the differential shift. The differential shift can be considered as an indicator of the future prospects of a region because it essentially indicates the response of a region's industrial mix to demand and supply conditions over time at both the regional as well as national level. It illustrates that some regions gain an advantage in relation to other region's in their

access to markets and to inputs for one or more specific activities. In other words, embedded in the differential shift are all the important demand and supply, input-output, and location theory considerations that affect the competitive position of the region's industries over the reference period.

However, the proportionality shift, which purports to measure the contribution of the region's industrial mix to the region's growth, and the differential shift, which reflects factors affecting regional growth other than the industrial mix, such as comparative advantage, population migration, or government policy, are interdependent because of inter-industry linkages and multiplier effects that occur within and between regions. This phenomenon will cause the proportionality shift to be understated [MacKay, 1968]. The problem is resolved, however, by regarding the proportionality shift as a minimum estimate of the effect of the industrial mix on the employment growth [Stilwell, 1970].

The Modified Shift-Share model attempts to resolve the fundamental problem, which is the loss of applicability in identifying the industrial mix's full impact in determining the overall regional growth rate relative to the national average. In arriving at the modified version of the Shift-Share model, the technique is to subtract the employment or output growth expected in the region, given it industrial mix at the beginning of the period, from the employment or output growth expected, given the industrial mix at the end of the period. It represents a reversing of the standardization procedure, in that the final period employment or output weight rather than the base period employment weight is used in the calculation of the expected growth. By performing this operation on equation 5, the reverse proportionality shift (equation 9) is generated. Furthermore, if the reverse proportionality shift (RPS) is subtracted from the proportionality shift (PS), the result adds another shift component, the proportionality modification shift (PMS), to the analysis. The PMS may be visualized as representing the shift in employment or output which comes about form the modification of the region's industrial mix over the reference period. If the PMS is positive (negative), it would indicate that the region has a more favourable (less favourable) industrial mix at the end of the period than it had at the start of the period. The Shift-Share model along with its modified version is presented below. The schematic relationship of these shifts is presented in Graph 1.

Shift-Share Basic Model:

The following notations are used in the equations. E_n represents employment in all the industries in the reference area (nation). The rates of growth in the ith industry in region j and in all regions are represented by g_{ij} and g_{in} respectively. The rate of growth of all industry in the nation (reference area) is g_n. The other notations used are as follows:[3]

E_{ijt} = Employment in the ith industry in province j at time t.

E_{ij0} = Employment in the ith industry in province j at time 0.

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[3]These notations are used to represent both employment and output. We are using the word "employment" in the model to represent either one of the variables.

$$\sum_{i=1}^{T} E_{ijt} \qquad = \text{ Total employment in province } j \text{ at time } t.$$

$$\sum_{j=1}^{M} E_{ijt} \qquad = \text{ Total employment in industry } i \text{ in Canada at time } t.$$

$$\sum_{i=1}^{T}\sum_{j=1}^{M} E_{ijt} \qquad = \text{Total employment in all provinces and in all industries at time } t. \text{ (Total}$$

employment in Canada

G_j = Actual total growth in employment in province j.

N_j = Potential growth of employment in province j.

TS_j = Total Shift in employment in province j.

PS_j = Proportionality Shift in employment in province j.

DS_j = Differential Shift in employment in province j.

RPS_j = Reverse Proportionality Shift in employment in province j.

PMS_j = Proportionality Modification Shift in employment in province j.

RDS_j = Residual Differential Shift in employment in province j.

Actual growth of employment G_j is:

$$G_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0} \qquad\qquad 1$$

Potential growth rate (an overall rate of employment change in Canada) is given by:

$$g_n = \frac{\sum_{i=1}^{T}\sum_{j=1}^{M} E_{ijt}}{\sum_{i=1}^{T}\sum_{j=1}^{M} E_{ij0}} - 1 \qquad\qquad 2$$

Hence, potential employment growth of industry i in a region j is given by:

$$N_j = \sum_{i=1}^{T} E_{ij0} g_n \qquad\qquad 3$$

The potential growth in employment is the rate of growth in that would have occurred had the industry in the region grown at the national rate of change in employment.

Total shift is the difference between actual growth and the potential growth of employment, i.e.,

$$TS_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0}(1 + g_n) \qquad\qquad 4$$

Total shift consists of two components, i.e., proportionality shift (PS) and differential shift (DS). Proportionality shift is defined as:

$$PS_j = \sum_{i=1}^{T} E_{ij0}(g_{in} - g_n) \qquad\qquad 5$$

Differential shift is defined as:

$$DS_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0}(1 + g_{in}) \qquad\qquad 6$$

Equation 1 is equal to the sum of equations (3), (4), and (5). That is:

$$G_j = N_j + PS_j + DS_j \qquad\qquad 7$$

Modified Shift-Share Model

The RPS for province j is given by:

$$RPS_j = \sum_{i=1}^{T} E_{ijt}\left(\frac{g_{in} - g_n}{(1 + g_n)(1 + g_{in})}\right) \qquad\qquad 8$$

The PMS for province j is given by difference between equations (8) and (5), i.e., :

$$PMS_j = RPS_j - PS_j = \sum_{i=1}^{T} E_{ijt}\left(\frac{g_{in} - g_n}{(1 + g_n)(1 + g_{in})}\right) - \sum_{i=1}^{T} E_{ij0}(g_{in} - g_n) \qquad\qquad 9$$

The RDS for province j is given by:

$$RDS_j = \sum_{i=1}^{T} E_{ijt}\left(\frac{1 + g_n(2 + g_{in})}{(1 + g_n)(1 + g_{in})}\right) - \sum_{i=1}^{T} E_{ij0}(1 + g_n) \qquad\qquad 10$$

The full range of possibilities (or outcomes) to be generated by the modified model and the classification of provinces based on two-shift (i.e., PS and DS) and three-shift (i.e., PS, PMS, and RDS) analyses are presented in Tables 1 and 2. These grouping schemes were developed by Boudevill [1966] and Stilwell [1969] respectively.

The two-shift method allows a sixfold classification of provinces, as indicated in Table 1. This classification is useful for the identification of the type of regional policy needed in different areas. Provinces under grouping 1, 2, and 3, are those growing faster that the national average, while provinces falling under groupings 4, 5, and 6, are growing slower that the national average. However, while the slow growth in grouping 4 would be due to its relatively unfavourable industrial mix, the slow growth of provinces in grouping 5 would result from "disadvantageous factors' other that the initial industrial composition. Hence, one might suggest that regional policies relevant to areas of latter type involve general improvements in infrastructure, while the areas of the former type simply need injections of growth industries to compensate for their above average share of static and declining industries.

The three-shift analysis allows for a fourteen-fold classification of provinces as shown in Table 2. Referring to the classification of provinces based on three-shift analysis, we can determine the likelihood of future changes in employment or output shares given the alteration of a province's industrial mix as explained above. This classification is more useful that the two-shift model because it helps to identify areas that have suffered declining employment or output shares in the past but are likely to improve in the future (groupings 4, 8, and 12). Provinces not yet suffering from declining

shares, but perhaps likely to do so in the future, would fall under groupings 5, 9, and 13. Attention in the form of development area policy, including financial inducements designed to improve the industrial mix of provinces, should be focused on provinces falling under groupings 2, 6, 10, and 14. Finally, provinces falling under groupings 1, 3, 7, and 11 performed well in terms of employment or output growth in the past and are expected to continue to do so in the future.

Empirical Results

The results of the Modified Shift-Share model and its classification schemes to analyze and delineate changes in employment and output dimensions of the provinces are presented below. The data base consists of sixteen sectoral classifications of employment and fifteen classifications of GDP.[4] However, first we provide an overview of spatial distribution of employment and output growth in four Atlantic provinces followed by the results of the Modified Shift-Share model.

Spatial Distribution of Employment and Output Growth

Table 3 presents the changes in employment and output of the Canadian provinces during the past decade. The preliminary results indicate that geographical distribution of employment and output has occurred in favour of two western provinces and against the Atlantic provinces. The share of employment and output for Alberta and British Columbia increased from 20.8 percent in 1987 to 24.15 percent in 1997, and from 22.07 percent in 1987 to 24.72 percent in 1997 respectively. While the share of Atlantic provinces declined from 7.16 percent in 1987 to 6.85 percent in 1997 for employment and from 6.42 percent in 1987 to 5.84 percent in 1997 for output.

However, further examination of the possible causes of the regional variations in employment and output growth during 1987-1997 by isolating the national share of the shift components can give us a better perspective on whether the favourable (unfavourable) growth was due to the provinces more (less) favourable industrial mix or whether it was due to other reasons such as reflected in a favourable (unfavourable) competitive position compared with similar sectors in other provinces.

Total Shift in Employment and Output

Table 4 reveals that all the provinces in Atlantic Canada experienced a negative total shift. The negative total shift means the employment growth rate in these provinces was less that the national

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[4]The following sectoral data is used in the analysis: Agriculture; Forestry, Fishing, Mining, Oil and Gas; Utilities; Construction; Manufacturing; Trade; Transportation and Warehousing; Finance, Insurance, Real Estate and Leasing ; Professional, Scientific and Technical Services ; Management of Companies and Administrative and Other Support Services ; Educational Services ; Health Care and Social Assistance ; Information, Culture and Recreation ; Accommodation and Food Services ; Other Services ; Public Administration . GDP data follow the same sectoral classifications except for ICR for which no data was available.

average. The components of the total shift, namely, proportional shift and differential shift provide more interesting information about the structural make of these provinces. The proportionality shift was found to be negative for all provinces which means that the initial industrial mix was not favourable to growth. However, Prince Edward Island and New Brunswick experienced a positive differential shift indicating government policies favourable to growth, but they were not large enough to outweigh the negative proportional shift.

Table 5 shows all Atlantic provinces except Prince Edward Island experiencing negative total Shift in output. Proportionality shift was negative for all the provinces while differential shift was also negative for three Atlantic provinces. Prince Edward Island had a positive differential shift which outweighed the negative proportionality shift. This means the favourable competitive advantage (government policies effect) outweighed the initial unfavourable industrial mix to give Prince Edward Island faster growth in output.

To understand the causes behind these shifts, one has to look at the sectoral composition of the economy of each province. The sectoral breakdown of total shift, proportionality shift, and differential shift along with proportionality modification shift and residual differential shift are shown in Tables 6 and 7 for employment and output respectively.

While examining these tables, it should be kept in mind that employment and income variables tend to track together. However, if output is growing faster than the growth in employment or output is growing while employment falls, it would suggest rising productivity or changing wage structure in a particular sector. The sectoral aggregate of proportionality shift figures suggest whether, in the aggregate, the mix of employment in the province under consideration is a favourable or unfavourable one based on the national standard of a "fast" or "slow" growth sector. Therefore, the plus (minus) signs in front of a sector's proportionality shift would indicate that the sector is a fast (slow) growing sector. As can be seen from tables 6 and 7, goods producing sector[5] is decisively a slow growth sector in all Atlantic provinces with the exception of manufacturing sector which has positive total shift for employment and a positive total and proportionality shifts for output for Prince Edward Island.

The service sector[6], on the other hand, reflects favourable tendency of growth both in employment and output in every Atlantic province. The only exception in the service sector is the Transportation and Warehousing, Other Services, and Public Administration which have negative proportionality

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[5]The Goods Producing Sector consists of Agriculture; Forestry, Fishing Mining, oil and Gas; Utilities; Construction; and Manufacturing.

[6]The Service Sector includes: Trade; Transportation and Warehousing; Finance, Insurance, Real Estate and Leasing; Professional, Scientific and Technical Services; Management of companies and Administrative and Other Support Services; Educational services; Health Care and Social Assistance; Information, Culture and Recreation; Accommodation and Food Service; Other service; and Public Administration.

shift indicating unfavourable situation in these three sectors. The output data reveal an unfavourable situation in more sectors for all provinces except for newly emerging sectors, namely, 'Management of Companies and Administrative and Other Support Services', and 'Professional, Scientific and Technical Services'.

Sectoral performance of employment can be evaluated by using differential shift and proportionality modification shift.[7] As mentioned above, differential shift reflects competitive (noncompetitive) position of a particular sector which could be due to locational factors or due to particular government policy for that sector or a host of other factors. These factors can be isolated to some degree by decomposing differential shift into proportionality modification shift and residual differential shift. The proportionality modification shift reflects industrial mix at the end of the study period which might have improved (deteriorated) as indicated by a positive (negative) sign of the shift. This change will reflect the influence of government policy or lack there of or the realization of location advantages. The other influences that might impact the employment situation in a particular sector in a particular province not captured by proportionality modification shift would be reflected in residual differential shift. Tables 6 and 7 list differential shift, proportionality modification shift, and residual differential shift by sectors for all Atlantic provinces.

For goods producing sector, the proportionality modification shift indicates an improvement in the employment situation in every province, except for construction and manufacturing sectors for Prince Edward Island and agriculture and Forestry, Fishing, Mining Oil and Gas sectors for New Brunswick. The output reveals that most of the sector in the goods producing sector are growth sector in terms of generating income for all provinces. Given the fact the goods producing sector is a declining sector nationally, the positive sign for proportionality modification shift does not mean that this is a growth sector in terms of generating employment or output but only that the position of this sector had stabilized or the decline had slowed down.[8]

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[7]The PMS at the sectoral level indicates a change in sectoral employment performance between base year and the terminal year of the time period under consideration. If the PMS of a given sector is positive (negative), it implies that the employment performance is relatively more favourable (unfavourable) in the terminal year that in the base year. After adding up all sectoral PMS for a given province, we can say that the industrial mix is relatively favourable (unfavourable) at the terminal year than in the base year if the aggregate PMS is positive (negative). The sectoral differential shift (DS) in a given province indicates the growth (loss) of employment if the sectoral employment growth is higher (lower) than the sectoral employment growth at the national level. Therefore, sectoral DS implies "competitive advantage" (disadvantage) of a given sector in a given province. A summation of all sectoral DS for a particular province would suggest whether the province under consideration has an overall "competitive advantage".

[8]It is possible to have competitive advantage (disadvantage) in a sector (i.e., employment in a province in that sector expands at a higher (lower) rate than for the nation as a whole) and at the same time, a negative (positive) PMS for that sector. Such a situation indicates that the sectoral employment performance, based on the national standards, is relatively more (less)

Sectoral Classification

Tables 8 and 9 show the classifications of the four Atlantic provinces. The classifications are based on two-shift (PS and DS), and three-shift (PS, PMS, and RDS) analysis. Based on the two-shift analysis we can interpret the result according to the groups. Groupings 1, 2, and 3 indicate employment growth at a faster rate than national average. However, the reasons for faster growth are different for each grouping. In case of grouping 1, the faster growth was due to favourable industrial mix as well as having competitive advantage. In case of grouping 2, a province would suffer from relative competitive disadvantage, but it would be outweighed by favourable industrial mix consisting of leading sectors, thus giving the province a positive total shift. Grouping 3 reflects the opposite of grouping 2, that is, despite the dominance of lagging industries, the competitive advantage would outweigh the unfavourable industrial mix, thus giving the region faster growth than the nation average.

Groupings 4, 5, and 6 under the two-shift analysis, on the other hand, reflect employment (output) growth slower than the national average. Again the reasons for this can be found by looking at the components of the two-shift analysis, i.e., industrial mix and the competitive advantage. For grouping 4 the dominance of lagging sector outweighs any competitive advantage the province might have while in case of grouping 5 it is the competitive disadvantage that would outweigh the dominance of leading sector, thus giving the province a negative total shift. In case of grouping 6 unfavourable industrial mix is combined with competitive disadvantage.

The analysis based on a three-shift scenario is more revealing in terms of likely impact of economic activities over time. There are 14 groupings under three-shift analysis. Under this analysis DS is further broken down into PMS and RDS. Various combinations in these groupings as described in Table 2 can be read from Tables 6 and 7 for each sector and the aggregated results are given in Tables 8 and 9. The results based on Tables 2, 6 and 7, and 8 and 9 are summarized in Tables 10 and 11, which mentions the possible scenarios for each province regarding each of the sectors included in the study.[9]

Sectors falling under the classifications 4, 8, and 12 are likely to improve in the future despite experiencing a declining employment share in the past. Sectors falling under the classifications 5, 9, and 13, on the other hand, are likely to suffer a decline in employment in the future despite their favourable employment share in the past. Classifications 1, 3, 7, and 11 indicate that sectors that have performed well in terms of employment in the past are likely to continue to do so in the future. Classifications 2, 6, 10, and 14 point to the sectors that have suffered declining employment shares in the past and the trend is likely to continue in the future.

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unfavourable at the end of the period than at the beginning of the period.

[9]The inclusion of a sector in a particular classification depends primarily on the positive or negative sign of PMS and whether it is outweighed by other shifts, or it outweighs the other shifts.

Summary and Conclusion

National employment (output) growth has direct bearings on national productivity. However, national employment (output) growth is based on regional employment (output) growth which in turn depends upon the industrial makeup of these regions and the relative competitive advantage and disadvantage of these provinces in terms of location, market forces or government policies. Government policies influence the industrial mix, and changes in the growth rate of employment and the structure of employment affect the overall regional growth.

The purpose of this study was to analyze and delineate the changes in employment and output patterns and the structural adaptation of the provincial economies in Atlantic Canada using modified shift-share model. The basic purpose of the shift-share technique is to decompose the employment (output) growth in a region and to identify the components of that growth. The difference between the actual growth in provincial employment (output) and the national potential growth in employment (output) is termed a total shift (TS). The components of the TS are identified as proportionality shift (PS) and differential shift (DS). In the modified shift-share model, DS is further divided into a proportionality modification shift (PMS) and a residual differential shift (RDS).

The PMS is the key indicator to evaluate the overall improvement (deterioration) in a region's industrial structure. We can think of the PMS as representing the shift in employment which comes about from the modification of the region's industrial structure over the study period. A positive PMS suggests that a region's industrial structure has improved over the study period, while the negative PMS suggests the opposite. However, the exact cause of the change is not explicit and the sectoral rates of growth may be influenced by national and international supply and demand conditions.

Our empirical findings indicate that all the provinces in Atlantic Canada experienced a negative TS in employment at the aggregate level during the period 1987-1997. All the provinces in Atlantic Canada except Prince Edward Island also experienced a negative TS in output. Prince Edward Island had a positive total shift in output at the aggregate level.

At the sectoral level, Nova Scotia and Newfoundland experienced a negative TS in both employment and output in all the goods producing sectors, whereas Prince Edward Island experienced a positive TS in both employment and output for the manufacturing sector and a positive TS in output for the utilities sector. Rest of the s producing sectors in Prince Edward Island experienced a negative TS. New Brunswick experienced a positive TS in employment in 'forestry, fishing, mining, oil and gas' sector. The rest of the goods producing sectors in New Brunswick have a negative TS.

Most of the service sector with the exception of education, public administration, and accommodation and food services registered a positive TS for both employment and output. In order to judge the extent to which the provinces with most unfavourable initial industrial mix improved that mix, we use the proportionality shift (PS) and the proportionality modification shift (PMS). The

empirical results of the study suggest that goods producing sector had an unfavourable employment and output situation at the beginning of the study period as indicated by negative PS for all the provinces, while the service sector generally had the favourable situation as indicated by positive PS for most of the sectors in the service sector. However, over time the employment and output in goods producing sectors stabilized while the growth of employment and output slowed down in the service sector due to government cut back in most of the government supported sectors, such as health care, education, and public administration during the late eighties and early nineties.

Through classification analysis we were able to identify various sectors that had performed well in the past but are likely to experience a slower growth in the future and those sectors that experience slower growth in the past but are likely to perform better in the future. For example these classifications suggest that sector like Professional Scientific, and Technical Services, and Management of Companies and Administration and other Support Services performed well in the past but are likely to experience a slower growth in the future. The sectors that did not perform well in the past but are likely to perform better in the future are Agriculture, Forestry, Fishing, Mining, Oil and Gas, and Manufacturing, to name few.

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Table 1
Classification of the Two-Shift Analysis
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Grouping (or Outcomes)

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1.   Both PS and DS positive
2.   Positive PS outweighs negative DS
3.   Positive DS outweighs negative PS
4.   Positive DS outweighed by negative PS
5.   Positive PS outweighed by negative DS
6.   Both PS and DS negative

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*PS = Proportionality Shift; DS = Differential Shift

Table 2
Classification of the Three-Shift Analysis
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Grouping (or outcomes)

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 1.   All three effects positive
 2.   All three effects negative
 3.   PS and PMS positive and outweigh negative RDS
 4.   PS and PMS positive but outweighed by negative RDS
 5.   PS and RDS positive and outweigh negative PMS
 6.   PS and RDS positive but outweighed by negative PS
 7.   PMS and RDS positive and outweigh negative PS
 8.   PMS and RDS positive but outweighed by negative PS
 9.   PS positive and outweighs negative RDS and PMS
10.   PS positive but outweighed by negative RDS and PMS
11.   PMS positive and outweighs negative RDS and PS
12.   PMS positive but outweighed by negative RDS and PS
13.   RDS positive and outweighs negative PS and PMS
14.   RDS positive but outweighed by negative PS and PMS

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*PS = Proportionality shift; PMS = Proportionality Modification Shift;
 RDS = Residual Differential Shift.

Table 3
Growth of Employment and Gross Domestic Product by Province and Canada
1987-1997

1 Province	2 Percentage Increase in		3 Percentage of National				4 Percentage of National Increase in	
	Employment	GDP	Employment		GDP		Employment	GDP
	87-97	87 -97	1987	1997	1987	1997	87-97	87-97
NFLD.	0.00	5.54	1.54	1.37	1.41	1.23	0.00	0.37
P.E.I.	11.28	23.30	0.43	0.43	0.34	0.35	0.41	0.37
N.S.	7.32	10.21	2.92	2.79	2.63	2.39	1.80	1.25
N.B.	11.16	11.18	2.27	2.26	2.04	1.87	2.15	1.07
QUE.	5.96	14.16	24.47	23.20	22.67	21.32	12.35	15.00
ONT.	8.60	20.23	34.71	38.57	41.12	40.73	28.95	38.89
MAN.	3.81	15.28	4.11	3.82	3.72	3.54	1.33	2.66
SASK.	1.56	21.72	3.75	3.41	3.35	3.36	0.50	3.40
ALTA.	22.65	40.59	9.64	10.58	10.60	12.28	18.52	20.12
B.C.	35.97	31.64	11.16	13.57	11.47	12.44	34.01	16.97
CANADA	11.80	21.39	100.00	100.00	100.00	100.00	100.00	100.00

Table 4
Analysis of Provincial Pattern of Employment Growth
1987-1997

Provinces	National Share** ('000)	Total Shift ('000)	Total Shift as Percentage of Employment*	Proportion-ality Shift ('000)	Proportion-ality Shift as Percentage of Employment*	Differential Shift ('000)	Differential Shift as Percentage of Employment*	Proportion-ality Modi-fication Shift ('000)	Proportion-ality Modification Shift as Percentage of Employment*	Residual differen-tial Shift ('000)	Residual differential Shift as Per-centage of Employment
NFLD.	211.64	- 22.56	-11.92	- 1.39	- 0.73	- 21.17	-11.18	0.15	0.08	- 21.32	-11.26
P.E.I	59.48	- 0.18	- 0.34	- 1.32	- 2.48	1.14	2.14	0.12	0.23	1.01	1.86
N.S.	400.36	- 16.04	- 4.48	- 1.88	- 0.52	-14.17	- 3.96	2.57	0.72	- 16.73	- 4.67
N.B	312.48	- 1.68	-0.60	- 2.00	- 0.72	0.32	0.11	0.15	0.05	0.17	0.06
QUE.	3371.33	- 176.24	- 5.84	-5.41	- 0.18	- 170.84	- 5.67	- 4.78	- 0.16	- 166.06	- 5.51
ONT.	5469.82	-156.53	- 3.20	8.59	0.18	-165.12	- 3.37	15.29	0.31	- 180.41	- 3.69
MAN.	566.04	- 40.67	- 8.03	- 6.60	- 1.30	- 34.06	- 6.73	0.12	0.02	- 34.18	- 6.75
SASK.	517.41	- 47.42	- 10.25	- 17.04	- 3.68	- 30.38	- 6.56	2.07	0.45	- 32.45	- 7.01
ALTA.	1328.97	128.62	10.82	2.02	0.17	126.60	10.65	- 7.26	- 0.61	133.86	11.26
B.C.	1536.80	332.40	24.18	24.96	1.82	307.44	22.37	- 7.70	- 0.56	315.14	22.93
CANADA	13774.4	0	0	0	0	0	0	0	0	0	0

*1987 as a base.
**It reflects the change in employment which would have taken place had the provinces grown at the nation rate of growth in employment. The national employment grew by 11.80 percent during the period 1987-1997.

Total in the last row of the table many not add up to zero because of the rounding error.

Table 5
Analysis of Provincial Pattern of GDP Growth
1987-1997

Provinces	National Share** (Millions)	Total Shift (Millions)	Total Shift as Percentage of GDP*	Proportion-ality Shift (Millions)	Proportion-ality Shift as Percentage of GDP*	Differential Shift (Millions)	Differential Shift as Percentage of GDP*	Proportion-ality Modi-fication Shift (Millions)	Proportion-ality Modification Shift as Percentage of GDP*	Residual differen-tial Shift (Millions)	Residual differential Shift as Per-centage of GDP*
NFLD.	9756.72	-1325.23	-16.49	-262.14	-3.26	-1063.09	-13.23	79.74	0.99	-1142.83	-14.22
P.E.I	2372.57	16.64	0.85	-66.33	-3.39	82.96	4.24	19.54	1.00	63.42	3.24
N.S.	18165.41	-1748.28	-11.68	-401.54	-2.68	-1346.74	-9.00	157.63	1.05	-1504.36	-10.05
N.B	14132.22	-1188.24	-10.21	-232.81	-2.00	-955.53	-8.21	49.04	0.42	-1004.57	-8.63
QUE.	156720.92	-9969.15	-7.72	-831.91	-0.64	-9137.24	-7.08	167.48	0.13	-9304.72	-7.21
ONT.	284286.15	-3599.76	-1.54	493.44	0.21	-4093.19	-1.75	340.74	0.15	-4433.93	-1.89
MAN.	25752.89	-1983.99	-9.35	-159.78	-0.75	-1824.21	-8.60	51.29	0.24	-1875.50	-8.84
SASK.	23135.48	-131.25	-0.69	-165.97	-0.87	34.72	0.18	8.84	0.05	25.88	0.14
ALTA.	73310.82	10648.72	17.63	-348.87	-0.58	10997.59	18.21	-412.21	-0.68	11409.81	18.89
B.C.	79327.15	6095.42	9.33	-55.82	0.09	6961.24	10.65	-176.52	-0.27	7137.76	10.92
CANADA	691363.00	0	0	0	0	0	0	0	0	0	0

*1987 as a base.
**It reflects the change in GDP which would have taken place had the provinces grown at the national rate of growth. The national GDP grew by 21.39 percent during the period 1987-1997.

Total in the last row of the table many not add up to zero because of the rounding error.

Table 6
Sectoral Contribution to the Total Shift and its Components in Employment
1987-1997

Sector	NFLD					PEI					NS					NB				
	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS
AG	-0.35	-0.31	-0.04	0.04	-0.08	-2.41	-1.45	-0.96	0.39	-1.35	-1.76	-1.96	0.20	0.16	0.05	-0.66	-1.55	0.89	-0.06	0.95
FFMOG	-4.82	-1.77	-3.06	0.45	-3.51	-0.19	-0.25	0.05	0.02	0.03	-4.70	-1.75	-2.95	0.44	-3.39	0.78	-1.10	1.88	-0.05	1.92
UT	-0.61	-0.35	-0.25	0.07	-0.32	-0.45	-0.05	-0.39	0.05	-0.45	-1.50	-0.46	-1.04	0.18	-1.22	-0.69	-0.45	0.24	0.08	-0.32
CONS	-4.85	-1.48	-3.37	0.52	-3.89	-0.25	-0.46	0.71	-0.03	0.74	-5.08	-2.83	-2.25	0.54	-2.79	-0.98	-2.11	1.14	0.10	1.04
MANU	-7.00	-2.57	-4.43	0.78	-5.20	1.04	-0.49	1.53	-0.12	1.66	-11.27	-5.54	-5.73	1.24	-6.97	-5.59	-4.71	-0.88	0.60	-1.48
TR	-1.61	-1.48	-0.13	0.16	-0.29	-0.73	-0.41	-0.32	0.06	-0.37	-7.11	-3.12	-3.99	0.49	-4.48	-2.77	-2.30	-0.47	0.26	-0.73
TW	-0.64	-0.25	-0.40	0.03	-0.43	-0.36	-0.06	-0.30	0.01	-0.32	-1.64	-0.41	-1.22	0.07	-1.29	0.10	-0.41	0.51	0.03	0.47
FIREL	0.04	0.25	-0.20	-0.03	-0.17	-0.46	0.08	-0.54	-0.02	-0.52	-0.30	0.75	-1.05	-0.11	-0.94	-0.97	0.51	-1.48	-0.10	-1.38
PSTS	0.30	2.13	-1.83	-0.73	-1.09	0.78	0.51	0.27	0.02	0.25	5.14	4.57	0.57	-0.32	0.89	4.14	2.84	1.30	0.06	1.23
MCAS	-0.28	1.75	-2.03	-0.78	-1.25	0.42	0.38	0.03	-0.03	0.06	4.79	3.77	-0.10	-0.46	1.11	3.80	2.79	1.01	0.00	1.01
ES	-1.94	0.68	-2.61	-0.15	-2.46	0.50	0.14	0.36	0.00	0.36	-1.10	1.09	-2.19	-0.18	-2.01	-0.94	0.86	-1.80	-0.15	-1.65
HCSA	4.33	1.94	2.39	-0.04	2.43	-0.01	0.56	-0.56	-0.10	-0.47 5.42	3.44	1.98	-0.23	2.20	1.61	2.90	-1.30	-0.39	-0.90	
ICR	-0.18	0.63	-0.81	-0.13	-0.68	0.19	0.19	-0.01	-0.02	0.01	1.92	1.45	0.47	-0.11	0.58	0.99	0.93	0.05	-0.09	0.15
AFS	-1.03	1.25	-2.28	-0.34	-1.94	0.09	0.45	-0.37	-0.08	-0.29	5.61	2.30	3.31	0.07	3.25	0.44	2.15	-1.71	-0.39	1.33
OS	-1.17	-0.33	-0.84	0.06	0.90	0.91	-0.08	0.99	-0.02	1.00	-0.48	-0.61	0.13	0.06	0.66	1.35	-0.52	1.86	0.01	1.86
PA	-2.76	-1.48	-1.29	0.25	-1.54	0.26	-0.39	0.64	-0.01	0.65	-3.98	-2.55	-1.42	0.37	-1.80	-2.28	-1.85	-0.44	0.23	-0.67

TS=PS+PMS+RDS. TS=Total Shift; PS= Proportionality Shift; PMS= Proportionality Modification Shift; RDS= Residual Differential Shift.

The sum of the shift values is given in Table 4.   Sectoral abbreviations:
AG = Agriculture;   TR = Trade ;   PSTS = Professional, Scientific and Technical Services ;   PA = Public Administration ;
FFMOS = Forestry, Fishing, Mining, Oil and Gas;   TW = Transportation and Warehousing ;   MCAS = Management of Companies and Administrative and Other Support Services ;
UT = Utilities ;   FIREL= Finance, Insurance, Real Estate and Leasing ;   ES = Educational Services ;
CONS = Construction ;   HCSA = Health Care and Social Assistance ;   AFS = Accommodation and Food Services ;
MANU = Manufacturing ;   ICR = Information, Culture and Recreation ;   OS = Other Services ;

Table 7
Sectoral Contribution to the Total Shift and its Components in Gross Domestic Product
1987-1997

	NFLD					PEI					NS					NB				
Sector	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS	TS	PS	DS	PMS	RDS
AG	5.51	1.36	4.15	-0.09	4.24	-3.08	6.23	-9.32	-1.42	-7.89	-13.54	8.87	-22.42	-2.35	-20.07	-23.22	7.78	-31.00	-2.46	-28.55
FFMOG	-31.89	6.25	-38.14	-1.40	-36.74	-0.06	0.67	-0.73	-0.12	-0.61	-284.54	9.44	-293.98	-4.13	-289.86	-131.41	7.86	-139.27	-2.54	-136.73
UT	-88.43	-49.24	-37.20	11.89	-56.08	7.30	-4.90	12.19	-0.13	12.32	-15.04	-40.98	25.94	5.13	20.80	-96.34	-60.26	-36.08	13.58	-49.66
CONS	-319.76	-478.24	-141.52	60.25	-201.77	-27.84	-31.92	4.08	4.79	-0.71	-458.98	-267.57	-191.41	86.15	-277.56	-159.57	-190.41	30.84	27.23	3.61
MANU	-236.78	10.39	-247.17	-4.44	-242.73	106.72	2.14	104.58	0.72	103.86	-256.03	25.63	-281.67	-7.51	-274.16	-244.05	24.43	-268.48	-7.16	-261.32
TR	-217.76	40.09	-257.85	-14.68	-243.17	-3.28	9.42	-12.71	-2.04	-10.67	-169.88	81.64	-251.52	-21.83	-229.69	-323.74	65.16	-388.90	-22.97	-365.93
TW	-205.16	-16.95	-188.21	7.71	-195.92	-65.32	-6.13	-59.19	2.57	-61.76	-94.79	-22.27	-72.51	5.76	-78.28	-59.74	-21.85	-37.89	4.82	-42.72
FIREL	62.67	109.10	-46.42	-22.21	-24.21	35.28	29.38	5.90	-4.76	10.66	72.31	239.88	-167.56	-53.19	-114.38	-22.54	169.28	-191.82	-42.42	-149.40
PSTS	146.39	116.68	29.71	-13.63	43.34	44.80	22.61	22.20	1.19	21.00	304.23	224.99	79.24	-21.16	100.41	223.60	150.93	72.67	-9.65	82.32
MCAS	17.99	74.11	-56.12	-23.17	-32.94	11.50	12.72	-1.22	-2.46	1.24	133.61	127.98	5.63	-21.53	27.16	150.60	97.00	53.60	-7.42	61.02
ES	-289.51	-133.37	-156.14	42.94	-199.08	-7.97	-22.74	14.77	2.18	12.59	-231.26	-188.45	-42.81	38.59	-81.40	-103.71	-127.12	23.41	19.54	3.88
HCSA	-21.30	-33.64	12.34	5.51	6.83	12.01	-7.52	19.53	0.70	18.82	87.81	-56.42	144.24	5.34	138.90	-41.13	-45.94	4.80	7.90	-3.10
AFS	-6.90	-21.21	14.30	2.48	11.83	-8.66	-8.23	-0.43	1.49	-1.92	-10.42	-47.23	36.81	5.08	31.73	-23.59	-36.78	13.18	5.32	7.87
OS	12.44	-5.65	18.08	0.69	17.39	2.43	-1.72	4.15	0.23	3.92	-96.39	-12.40	-83.99	3.51	-87.50	-19.30	-9.35	-9.95	1.78	-11.74
PA	-154.55	-180.34	25.78	27.24	-1.45	-80.65	-61.48	-19.17	14.22	-33.39	-710.15	-443.56	-266.59	125.18	-391.77	-305.09	-252.01	-53.08	53.77	-106.86

TS=PS+PMS+RDS. TS=Total Shift; PS= Proportionality Shift; PMS= Proportionality Modification Shift; RDS= Residual Differential Shift.

The sum of the shift values is given in Table 2.

Table 8
A Summary of Shift-Analysis of Employment Based on Two-Shift and Three-Shift Classifications
1987-1997

Province	PS*	DS*	TS*	PMS*	RDS*	Net Effect	Classifications of Province Based on	
							Three-Shift Analysis	Two-Shift Analysis
NFLD	-	-	-	+	-	PS + RDS > PMS	12	6
P.E.I.	-	+	-	+	+	PMS+ RDS < PS	8	4
N.S.	-	-	-	+	-	PS + RDS > PMS	12	6
N.B.	-	+	-	+	+	PMS + RDS< PS	8	4

*Positive or Negative

Table 9
A Summary of Shift-Analysis of GDP Based on Two-Shift and Three-Shift Classifications
1987-1997

Province	PS*	DS*	TS*	PMS*	RDS*	Net Effect	Classifications of Province Based on	
							Three-Shift Analysis	Two-Shift Analysis
NFLD	-	-	-	+	-	PS + RDS > PMS	12	6
P.E.I.	-	+	+	+	+	PMS+ RDS > PS	7	3
N.S.	-	-	-	+	-	PS + RDS > PMS	12	6
N.B.	-	-	-	+	-	PS + RDS< PMS	12	6

*Positive or Negative

Table 10
Classification of Sectors : Employment

Province	Sectors that have experienced declining employment shares in the past but are likely to improve in the future. (Classification # 4, 8, and 12)	Sectors not yet suffering from declining employment shares, but perhaps are likely to do so in the future. (Classification # 5, 9, and 13)	Sectors that have performed well in terms of employment growth in the past and are expected to continue to do so in the future. (Classification # 1, 3, 7, and 11).	Sectors that have suffered declining employment shares in the past and the trend is likely to continue in the future. (Classification # 2, 6, 10, and 14)
NFLD.	AG; FFMOG; UT; CONS; MANU; TR; TW; OS; PA .	FIREL; PSTS; HCSA .		MCAS; ES; ICR; AFS .
P.E.I.	AG; FFMOG; UT; TR; TW;	MANU; MCAS; ICR; AFS ; OS; PA .	PSTS; ES .	CON; FIREL; HCSA;
N.S.	AG; FFMOG; UT; CONS; MANU; TR; TW; OS; PA .	PSTS; MCAS; HCSA ; ICR .	AFS .	FIREL; ES .
N.B.	UT; CONS; MANU; TR; TW; PA .	FFMOG; HCSA; ICR; AFS.	PSTS; MCAS; OS.	AG; FIREL; ES .

For explanation of the sectoral abbreviations, see Table 6

Table 11
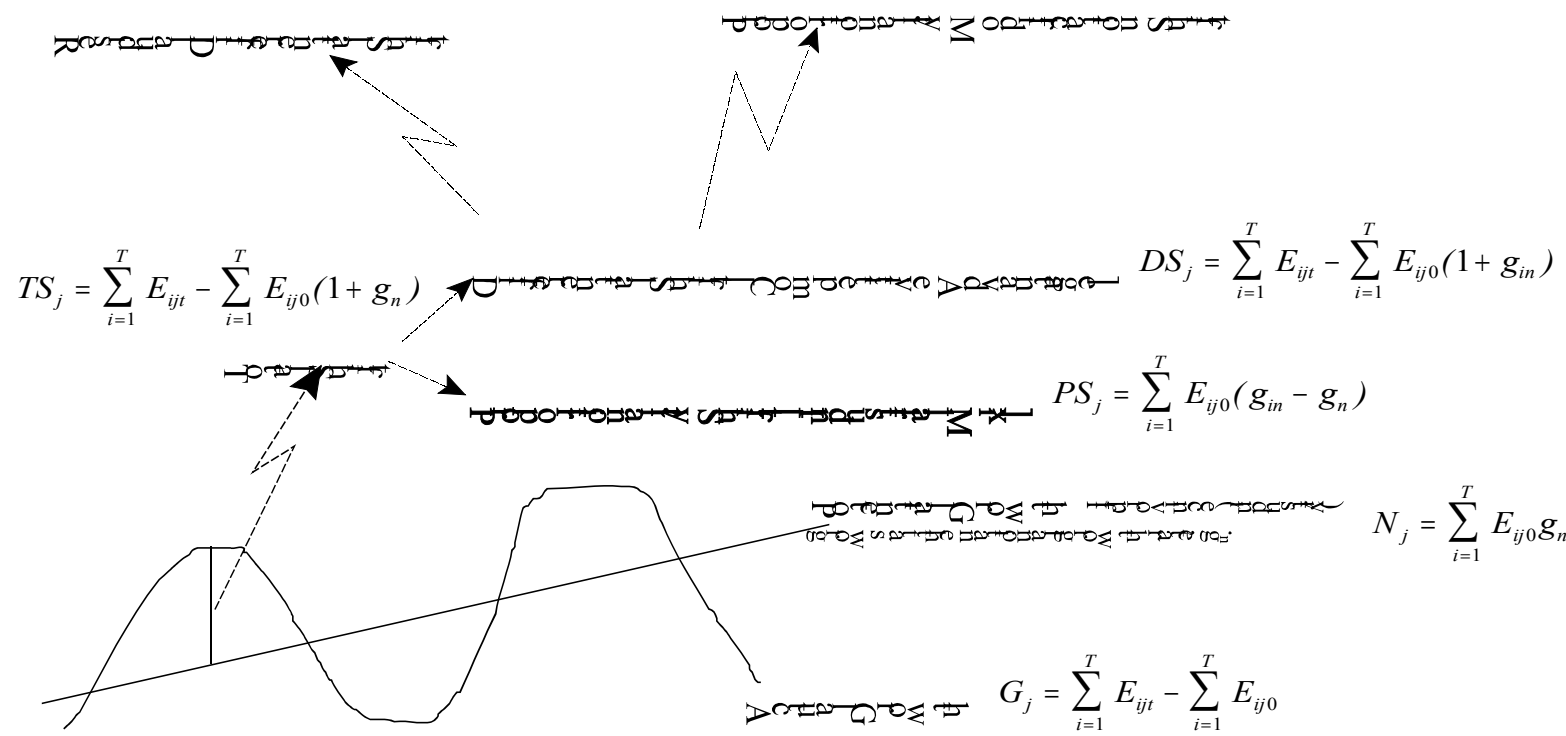Classification of Sectors : Gross Domestic Product

Province	Sectors that have experienced declining employment shares in the past but are likely to improve in the future. (Classification # 4, 8, and 12)	Sectors not yet suffering from declining employment shares, but perhaps are likely to do so in the future. (Classification # 5, 9, and 13)	Sectors that have performed well in terms of employment growth in the past and are expected to continue to do so in the future. (Classification # 1, 3, 7, and 11).	Sectors that have suffered declining employment shares in the past and the trend is likely to continue in the future. (Classification # 2, 6, 10, and 14)
NFLD.	UT; CONS; TW; ES; HCSA; AFS; PA .	AG; FIREL; PSTS; MCAS .	OS .	FFMOG; MANU; TR .
P.E.I.	CONS; TW; ES; AFS; PA .	UT; FIREL; MCAS .	MANU; PSTS; HCSA; OS .	AG; FFMOG; TR .
N.S.	UT; CONS; TW; ES; AFS; OS; PA .	FIREL; PSTS; MCAS .	HCSA .	AG; FFMOG; MANU; TR .
N.B.	UT; CONS; TW; ES; HCSA; AFS; OS; PA .	PSTS; MCAS .		AG; FFMOG; MANU; TR; FIREL.

For explanation of the sectoral abbreviations, see Table 3.
.

$$RDS_j = \sum_{i=1}^{T} E_{ijt}\left(\frac{1+g_n(2+g_{in})}{(1+g_n)(1+g_{in})}\right) - \sum_{i=1}^{T} E_{ij0}(1+g_n) \qquad PMS_j = RPS_j - PS_j = \sum_{i=1}^{T} E_{ijt}\left(\frac{g_{in}-g_n}{(1+g_n)(1+g_{in})}\right) - \sum_{i=1}^{T} E_{ij0}(g_{in}-g_n)$$

$$TS_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0}(1+g_n) \qquad\qquad DS_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0}(1+g_{in})$$

$$PS_j = \sum_{i=1}^{T} E_{ij0}(g_{in}-g_n)$$

$$N_j = \sum_{i=1}^{T} E_{ij0}g_n$$

$$G_j = \sum_{i=1}^{T} E_{ijt} - \sum_{i=1}^{T} E_{ij0}$$

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