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## ESTIMATION OF PANEL CORRELATIONS FOR THE CANADIAN LABOUR FORCE SURVEY

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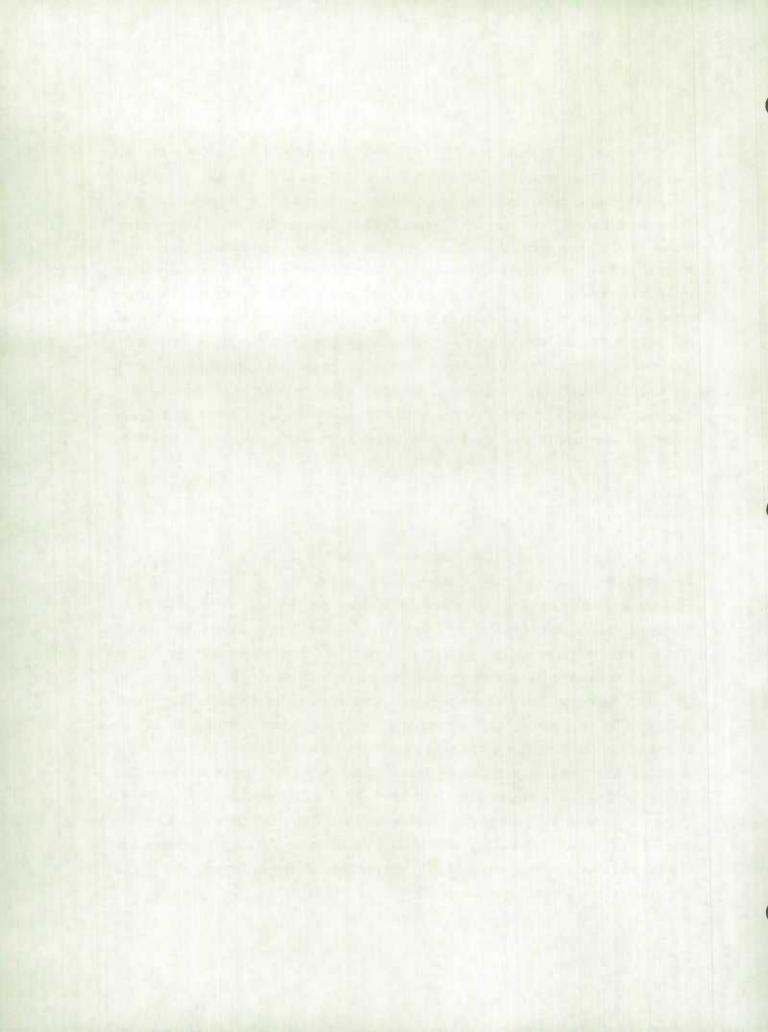
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#### ABSTRACT

The Canadian Labour Force Survey uses the rotation panel design. Every month, one sixth of the sample rotates and five sixths remain. Hence, under this rotation scheme, once a rotation panel enters in the sample, it stays 6 months in the sample before it rotates out. Because of this design feature, the estimates based on the same panel in different months are highly correlated. Moreover, when a rotation panel rotates out, a neighbouring rotation panel usually rotates in. Since they are geographically close, estimates based on the neighbouring rotation panels are also correlated. These correlations are called panel correlations: their magnitudes are variable-specific and time-dependent. This paper describes a methodology for estimating the panel correlations and presents estimated correlations for selected variables using 1980-81 and 1985-87 data. The work was originated for the study of composite estimation technique. However, the results are useful in any situation in which the panel correlation plays a role.

#### RÉSUMÉ

L'enquête sur la population active du Canada utilise une stratégie de renouvellement par panel. Chaque mois, un sixième de l'échantillon est renouvelé tandis que les cinq sixièmes demeurent les mêmes. Donc, sous cette stratégie de renouvellement, un panel demeure dans l'échantillon 6 mois avant d'en sortir. À cause de cette stratégie, les estimations basées sur les mêmes panels dans deux mois différents sont hautement corrélées. De plus, lorsqu'un panel sort de l'échantillon, le panel le remplaçant lui est en général géographique ment voisin. Il en découle que les estimations basées sur des panels voisins sont aussi corrélées. Ces corrélations sont appelées corrélations de panel: leur ampleur dépend de la variable à l'étude et de la période de référence. Cet article décrit la méthodologie pour estimer les corrélations de panel et présente les résultats pour quelques variables en utilisant des données des années 1980 à 1981 et 1985 à 1987. Ce travail a débuté pour l'étude d'une technique d'estimation composite; cependant, les résultats s'avèrent utiles pour toute situation où il y a corrélation de panel.



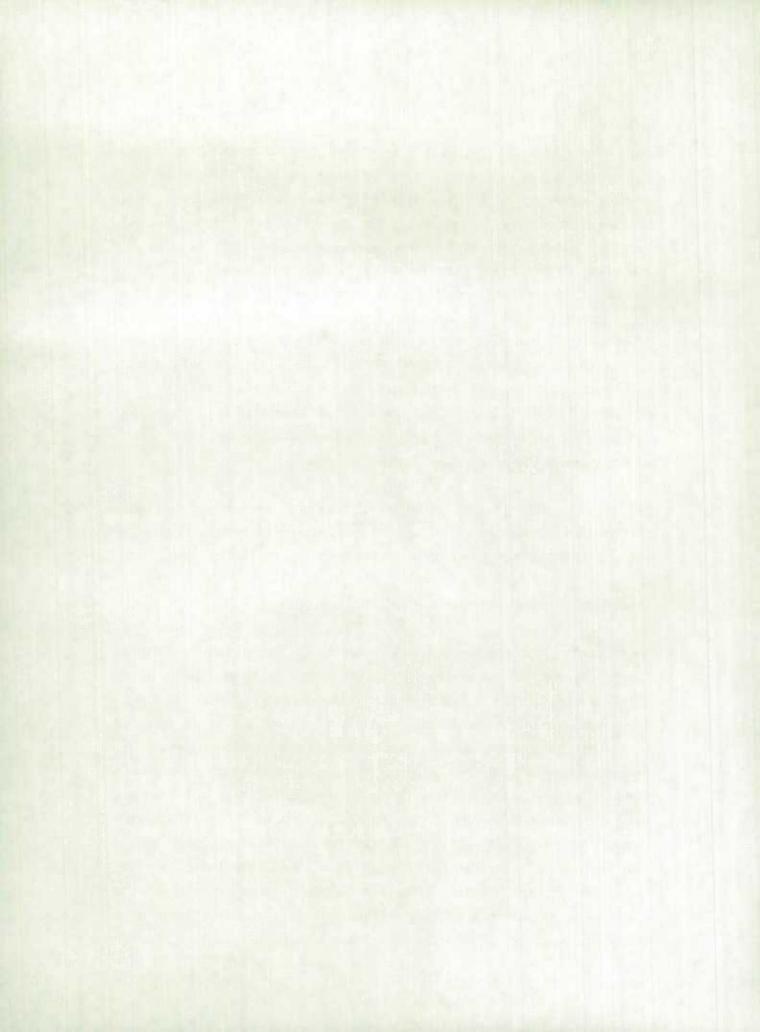
#### 1. Introduction

The Labour Force Survey (LFS) is a continuing monthly household survey which employs rotating panel design. The sample consists of six equal size rotation panels one of which is replaced by a new panel each month. The rotated-in panel stays in the sample for six months before it rotates out from the sample. Therefore, the estimates based on the same panel consisting of the same sampling units in different months are highly correlated. Moreover, an outgoing rotation panel is usually replaced by a neighbouring panel. Because they are geographically close, estimates based on these neighbouring rotation panels are also correlated. These correlations are called panel correlations. In this paper, we will describe and discuss how the panel correlations can be estimated and present their estimates for selected variables. The work was originated for the study of compsite estimation technique. However, the results are applicable in any situation where the panel correlation plays a role.

The paper is structured as follows: In Section 2, necessary definitions, notations and assumptions are given. Methodology is described in Section 3 and results and discussion are given in Section 4.

#### 2. Definitions of Panel Correlation Coefficients

To define various panel correlations we need to define common panels and the predecessor panel. A panel is identified by the panel number which indicates the duration of the panel in the sample. Thus, Panel 1 in month m, becomes Panel 2 in month m+1, Panel 3 in month m+2, and so on. Another term, "rotation group", is often used to identify a panel regardless of its duration in the sample. For instance, Rotation Group 1 which rotates in in January is identified as Rotation Group 1 throughout its stay in the sample until it rotates out in July. Then, Panel 1 in January indicates Rotation Group 1 and Panel 2 in February indicates the same rotation group which is now two months old and so on. Two panels in two different months which represent the same rotation group are called "common panels". On the other hand, when a rotation group rotates out, it is usually replaced by a panel consisting of neighboring households and given the same rotation



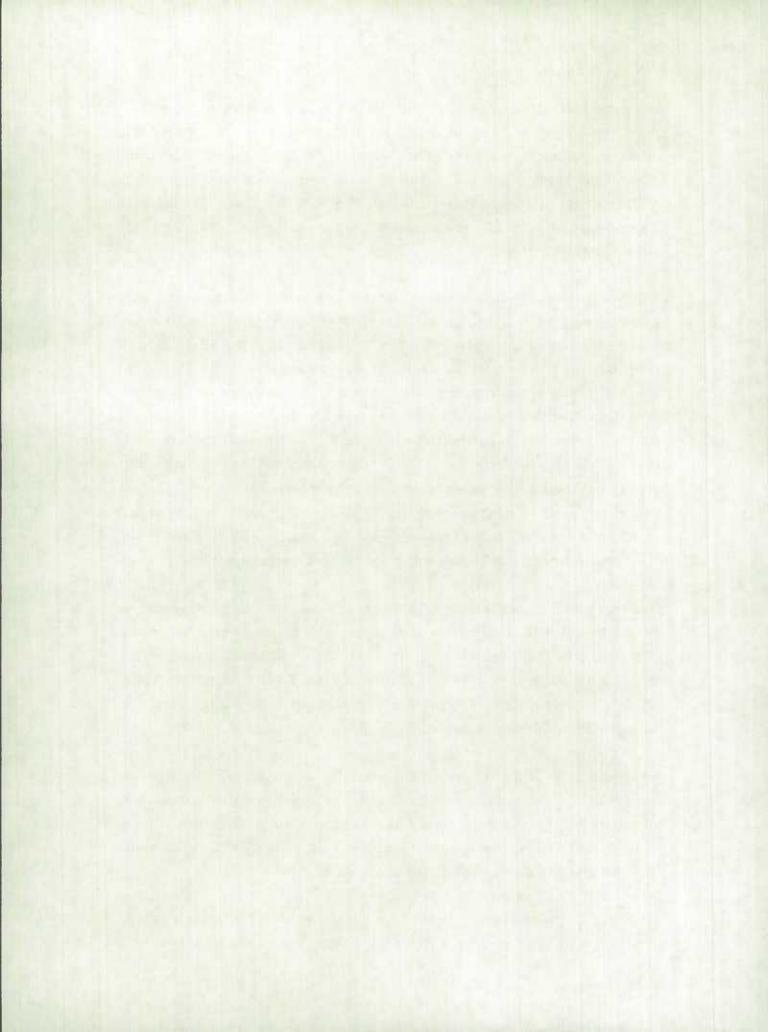
group number. A panel representing the out-going rotation group is called the "Predecessor panel" of the panel associated with the in-coming rotation group to replace the outgoing one. Therefore, in the example, Panel 6 in June which represents Rotation Group 1 is the predecessor panel of Panel 1 in July which rotates in to replace outgoing Rotation Group 1. Table 1 shows schematically the common and predecessor panels pertaining to given months m and m-j

Since each panel can be identified uniquely by two components, month and panel number, let P(month, panel number) denote the panel identified by the month and panel number. Then P(m,4) and P(m-1,3), for instance, are common panels 1 month apart. Similarly, P(m,4) and P(m-2,2) are common panels 2 months apart. The correlation coefficients of estimates of a characteristic based on these common panels are denoted by  $\rho_j$  of which j indicates the number of months apart. Obviously, there are no common panels which are more than 5 months apart and thus, the subscript j can be at most 5. We assume that  $\rho_j$  is independent of m and the particular panel numbers which define this correlation. For instance, P(m,5) and P(m-1,4) defines the same correlation  $\rho_1$  as P(m-2,4) and P(m-3,3) do. However, it is function of j and characteristic-dependent.

The correlation coefficient defined by a panel and its predecessor is denoted by  $\gamma_j$  with j having the same meaning as before. But in this case, j can go up to 11, i.e.  $\gamma_{11}$  is the last correlation coefficient in this series and it is the correlation between P(m,6) and P(m-11,1). We assume again that  $\gamma$ 's are independent of m and the particular panel number. They are also characteristic-dependent.

The third type of panel correlation is defined as the correlation between estimates for two different characteristics from common panels and denoted by  $\tau_j$  for common panels j months part. Now j can take values from 0 to 5. The same assumption for  $\rho$ 's and  $\gamma$ 's is applied here as well. Now we give the formal definitions of  $\rho$ 's,  $\gamma$ 's and  $\tau$ 's.

Let  $y_{m,\ell}$  be the LFS estimate of a characteristic of interest obtained from  $P(m,\ell)$ . We assume that  $V(Y_{m,\ell}) = \sigma_y^2$  regardless of m and  $\ell$ .



Then, p's are defined by

$$Cov(y_{m, \ell}, y_{m-j, \ell-j}) = \rho_j \sigma_y^2, 1 \le j \le 5, j \le \ell \le 6,$$

and y's by

$$Cov(y_{m,\ell}, y_{m-j,6+\ell-j}) = \gamma_j \sigma_y^2,$$

where  $1 \le \ell \le j$  if  $1 \le j \le 6$ ,  $j-5 \le \ell \le 6$  if  $7 \le j \le 11$ .

It is easy to conjecture that  $\rho$ 's and  $\gamma$ 's decrease as the subscript j increases and that  $\rho$ 's are larger than  $\gamma$ 's because  $\rho$ 's are correlation of common households while  $\gamma$ 's are correlation of neighboring households. We can also define the correlation between a panel and the predecessor of the panel's predecessor (denoted by double parentheses and called "double predecessor" in Table 1) in the similar way. However, these correlations will be very small and thus assumed to be zero for simplicity.

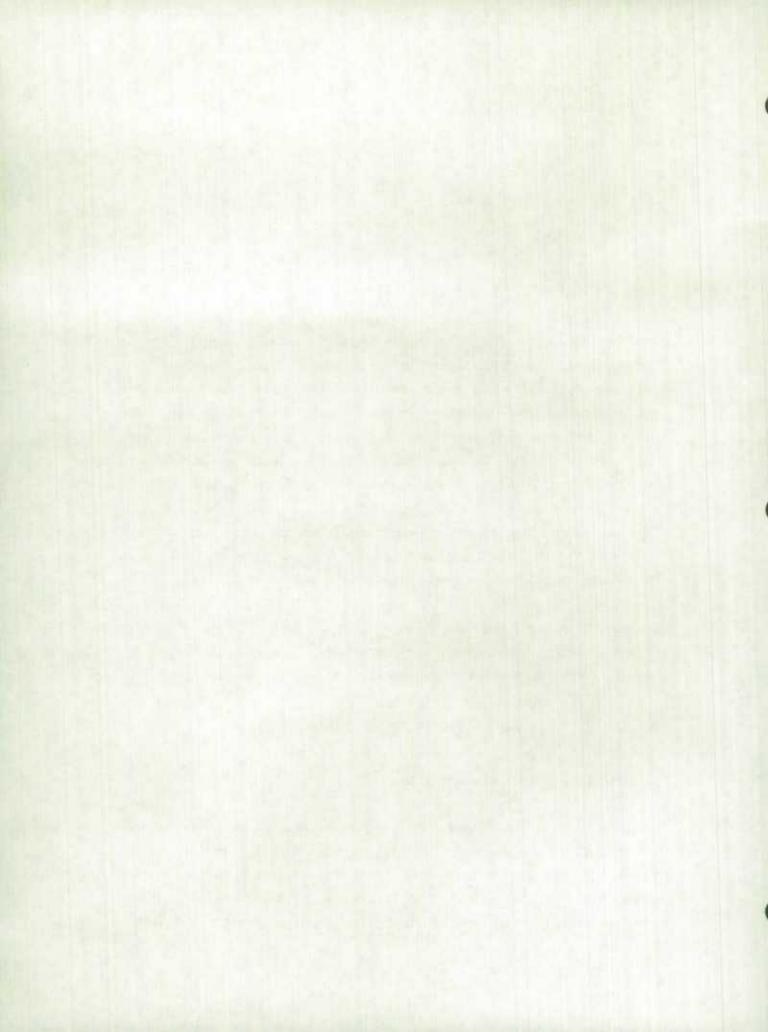
We also assume that all other panel correlations are zero. For instance,  $Cov(y_{m,\ell}, y_{m,\ell}) = 0$  if  $\ell \neq \ell'$  and  $Cov(y_{m,\ell}, y_{m-j,\ell'}) = 0$  if  $\ell \neq \ell'$  and  $\ell = 0$  if  $\ell \neq \ell'$  and  $\ell = 0$  if  $\ell = 0$  i

In order to define  $\tau$  correlations, let  $x_{m,\ell}$  be the LFS estimate of another characteristic obtained from  $P(m,\ell)$  and let  $V(x_{m,\ell}) = \sigma_X^2$  independent of m and  $\ell$ . Then  $\tau$  correlations are defined by

$$Cov(x_{m,2}, y_{m-j,2-j}) = \tau_j \sigma_x \sigma_y, 0 \le j \le 5, j \le 6,$$

#### 3. Estimation of the Panel Correlations

Since a variance estimation computer program was available, the method described here was geared to use this program with minimum modification. The methodology used in the program is the generalized Keyfitz method (Woodruff 1971) better known as the Taylor method. The program can compute variance estimates of linear combinations of monthly estimates.



We employ the following basic equality to estimate the desired correlations using the existing varince program:

$$Cov(A,B) = \frac{V(A) + V(B) - V(A-B)}{2}$$
 (1)

From the program, V(A-B), V(A) and V(B) can be obtained and so can Cov(A,B) using (1).

### 3.1 Estimation of p Correlations

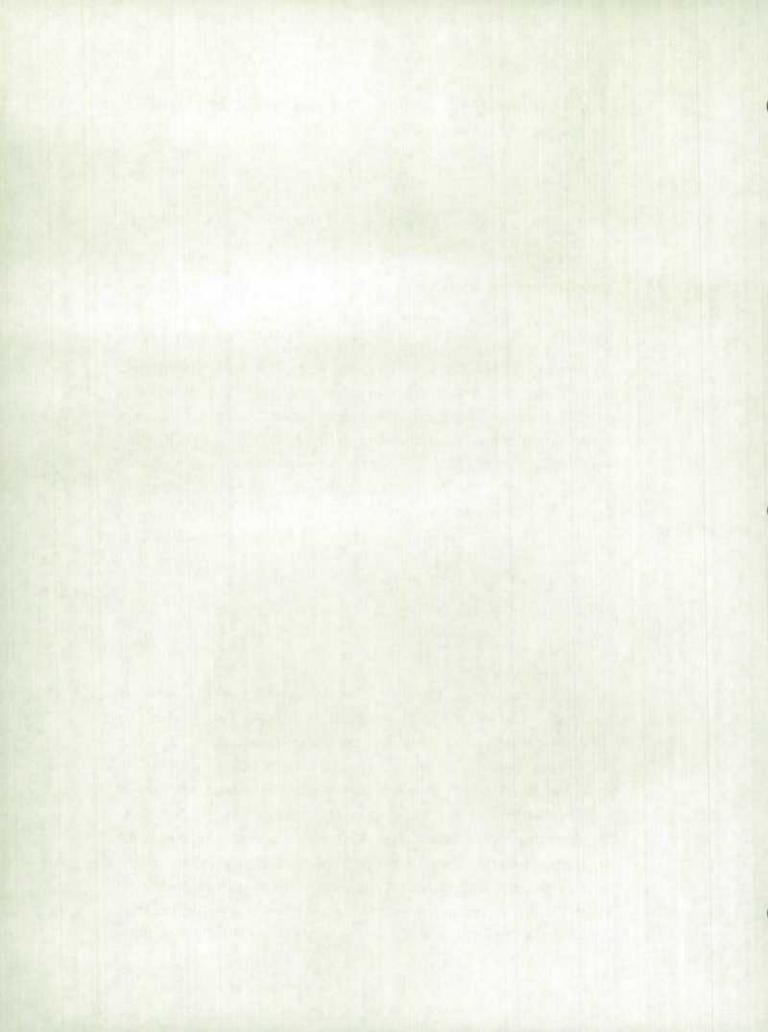
Let  $A = \sum_{k=2}^{5} y_{m,k}$  and  $B = \sum_{k=1}^{5} y_{m-1,k}$ . A and B are obtained by eliminating Panel 1 from month m and Panel 6 from month m-1, respectively. Note that the eliminated panels are uncommon ones and the remaining ones are all common panels. Using the variance program, we compute estimates of V(A-B), V(A) and V(B) and obtain estimates of Cov(A,B) by (1). (An estimate will be indicated by a "^" over the parameter.) From the assumptions given in Section 2, it is easy to see that

Cov(A,B) = 
$$5\rho_1 \sigma_y^2$$
,  
V(A) = V(B) =  $5\sigma_y^2$ ,

and thus,

$$\rho_1 = \frac{\text{Cov}(A, B)}{\{V(A), V(B)\}^{\frac{1}{2}}}.$$
 (2)

An estimate of  $\rho_1$  is then obtained by substituting estimates of Cov(A,B), V(A) and V(B). Estimates of  $\rho_2$ ,  $\rho_3$  and  $\rho_4$  can be obtained similarly. But there is some problem in estimating  $\rho_5$  this way. When we drop all uncommon panels from months m and m-5, only one panel is left in each month and this causes problem in variance estimation for Self-Representing (SR) areas. In Non-Self-Representing (NSR) areas, each PSU which becomes replicate for variance estimation has all rotation panels and after elimination of 5 uncommon panels, there is still one panel remaining in each PSU and thus, variance can be computed. In SR areas, however, rotation panels form replicates and if there is only one panel left, then there



is only one replicate in each stratum and thus variance cannot be computed in the usual way. Therefore,  $\hat{\rho}_5$  was obtained by extrapolating  $\hat{\rho}_3$  and  $\hat{\rho}_4$ . It is based on the assumption that there is a linear relation between  $\rho$ 's and the subscript j. There is another way to get  $\hat{\rho}_5$  which will be discussed later. (For detailed description of the Labour Force Survey methodology, readers are referred to Platek and Singh (1976)).

### 3.2 Estimation of y correlations

It is easy to see that  $Cov(A,B) = (5\rho_1 + \gamma_1)\sigma_y^2$  if  $A = \sum_{k=1}^6 y_{m,k}$  and  $B = \sum_{k=1}^6 y_{m-1,k}$ . In general,  $Cov(A,B) = \{(6-j) \rho_j + j\gamma_j\}\sigma_y^2$  where  $A = \sum_{k=1}^6 y_{m,k}$ ,  $B = \sum_{k=1}^6 y_{m-j,k}$   $j=1, 2, \ldots, 4$ .

Then, an estimate of  $\gamma_j$  can be obtained from the following equation:

$$\gamma_{j} = \left| 6 \frac{\text{Cov}(A,B)}{\{V(A) \ V(B)\}^{\frac{1}{2}}} - (6-j) \ \rho_{j} \right| / j$$
 (3)

by substituting estimated values on the right. There is a direct way to estimate these  $\gamma$  correlations including  $\gamma_5$  by

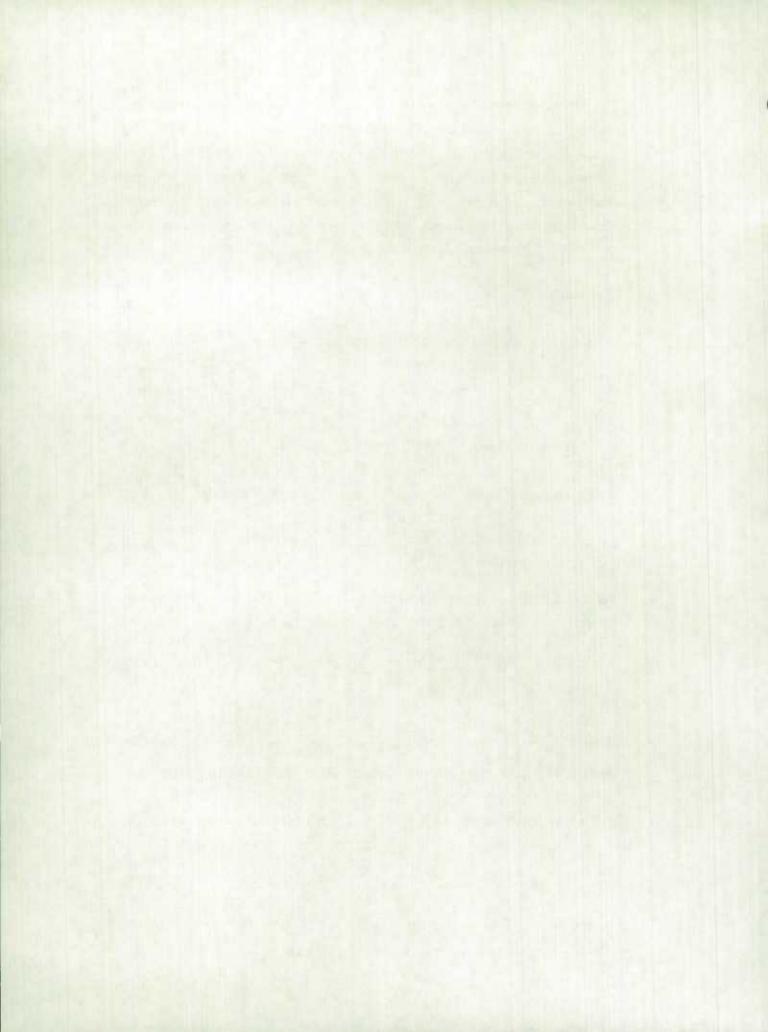
$$y_{j} = \frac{Cov(A_{j}, B_{j})}{\{V(A_{j}) \ V(B_{j})\}^{\frac{1}{2}}}$$
 (4)

where  $A_j = \sum_{\ell=1}^{J} y_{m,\ell}$  and  $B_j = \sum_{\ell=7-j}^{5} y_{m-j,\ell}$ ,  $j=2, \ldots, 5$ . The reason why we do not use this method will be discussed in Section 4.

Other  $\gamma$  correlations ( $\gamma_j$ , j=6, ..., 10) are obtained by (4) with

$$A_{j} = \sum_{k=j-5}^{\Sigma} y_{m,k} \text{ and } B_{j} = \sum_{k=1}^{\Sigma} y_{m-j,k}.$$

There is no simple way of estimating  $\gamma_{11}$  directly or indirectly. Thus, we again extrapolate  $\hat{\gamma}_9$  and  $\hat{\gamma}_{10}$  to get  $\hat{\gamma}_{11}$ .



We obtained  $\hat{\gamma}_5$  by interpolating  $\hat{\gamma}_4$  and  $\hat{\gamma}_6$  even though it can be estimated by (4) directly.

#### 3.3 Estimation of T Correlations

These correlations can be estimated in the same way as for  $\rho$  correlations just by changing the role of  $y_{m,\ell}$  by that of  $x_{m,\ell}$ .

Let 
$$A = \sum_{\ell=j+1}^{6} x_{m,\ell}$$
 and  $B = \sum_{\ell=1}^{6-j} y_{m-j,\ell}$ ,  $j = 0, 1, \ldots, 4$ .

Then Cov(A,B) = (6-j)  $\tau_j \sigma_x \sigma_y$ , V(A) = (6-j)  $\sigma_x^2$ , and V(B) = (6-j)  $\sigma_y^2$ , whence we have

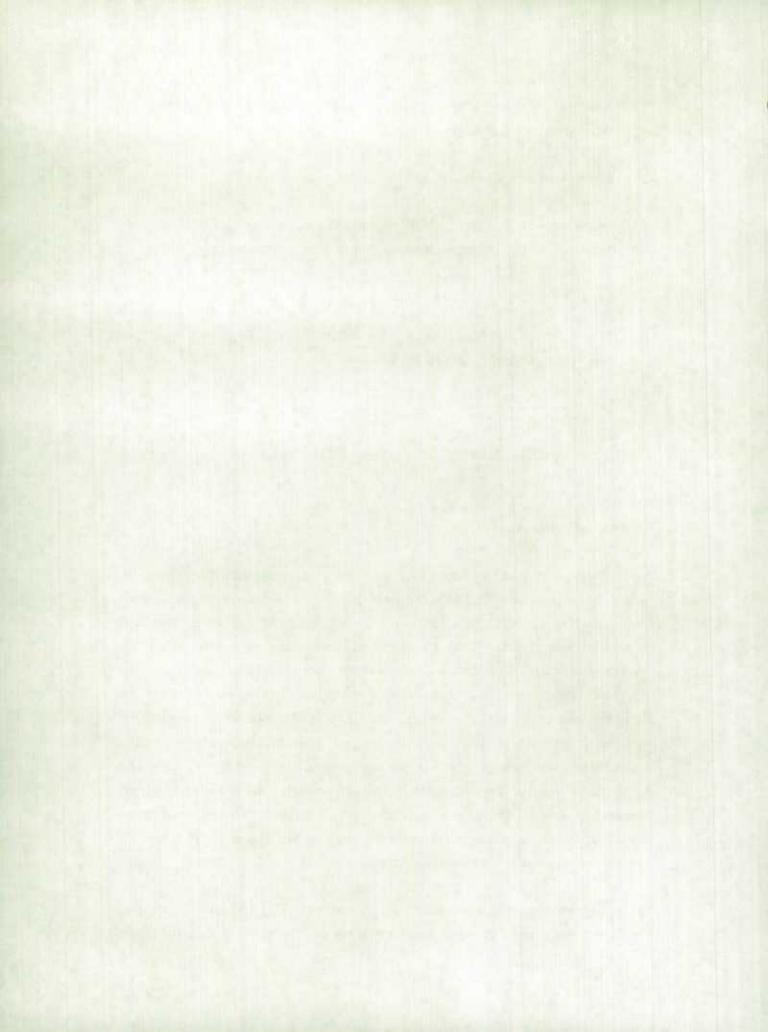
$$\tau_{j} = \frac{\text{Cov}(A,B)}{\{V(A)\ V(B)\}^{\frac{1}{2}}}, \qquad j = 0, 1, ..., 4.$$
 (5)

All  $\tau$ 's can be estimated using (5) except  $\tau_5$  which is estimated by extrapolating  $\hat{\tau}_3$  and  $\hat{\tau}_4$ ,

#### 4. Results and Discussion

Tables 2 and 3 give the estimates of  $\rho$  and  $\gamma$  correlations for 5 labour force characteristics (In Labour Force, Employed, Employed Agriculture, Employed Non-agriculture, Unemployed) obtained by the method described in Section 3 and from 1980-81 data for three provinces, Nova Scotia, Ontario and British Columbia. The  $\rho$  correlations for all characteristics are much larger than  $\gamma$ 's and behave nicely, i.e. decrease over time as expected. As expected,  $\hat{\rho}$ 's and  $\hat{\gamma}$ 's for Employed Agriculture are larger than other characteristics. For unemployed, the correlations are smaller than others. The behaviour of  $\hat{\gamma}$ 's for all characteristics except Employed Agriculture is somewhat fuzzy in that even though they show an over-all decreasing trend, there are up-and-downs locally. This up-and-down behaviour in  $\hat{\gamma}$ 's is more prominent with large subscripts, say  $j \ge 6$ , for all characteristics except Employed Agriculture.

Table 4 gives comparison between  $\hat{\gamma}$ 's obtained by (3) and (4) for Ontario. Employed was picked to serve as an example but the same is true for other



characteristics. As can be seen from these figures,  $\hat{\gamma}$ 's obtained by (4) behave quite differently from  $\hat{\gamma}$ 's obtained by (3). The  $\hat{\gamma}$  series obtained by (4) behave against our intuition by showing increasing trend rather than decreasing trend. That's why we use (3) instead of (4). If the assumption given in Section 3 concerning panel correlations that panel correlations other than  $\rho$ 's and  $\gamma$ 's for the same characteristic are zero is true, then the two formulae should give similar results. This is not the case which indicates that there is some discrepancy between the assumption and real data.

Estimates of  $\rho$  and  $\gamma$  correlations from recent data (March 1985 - February 1987) are presented in Tables 5A-13A and 5B-13B. This time, estimation was extended to 10 provinces and 9 characteristics including Employed 15-24, Employed 25+, Unemployed 15-20, and Unemployed 25+.

The last table numbered 14 presents  $\tau$  correlations for all possible combinations of Employed 15-24, Employed 25+, Unemployed 15-24 and Unemployed 25+ for three provinces Nova Scotia, Ontario and Alberta.

### Acknowledgement

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#### References

- Woodruff, R.S. (1971). A simple method for approximating the variance of a complicated estimate. Journal of the American Statistical Association, 66, 411-414.
- Platek, R., and Singh, M.P. (1976). Methodology for the Canadian Labour Force Survey. Catalogue No. 71-526, Statistics Canada.

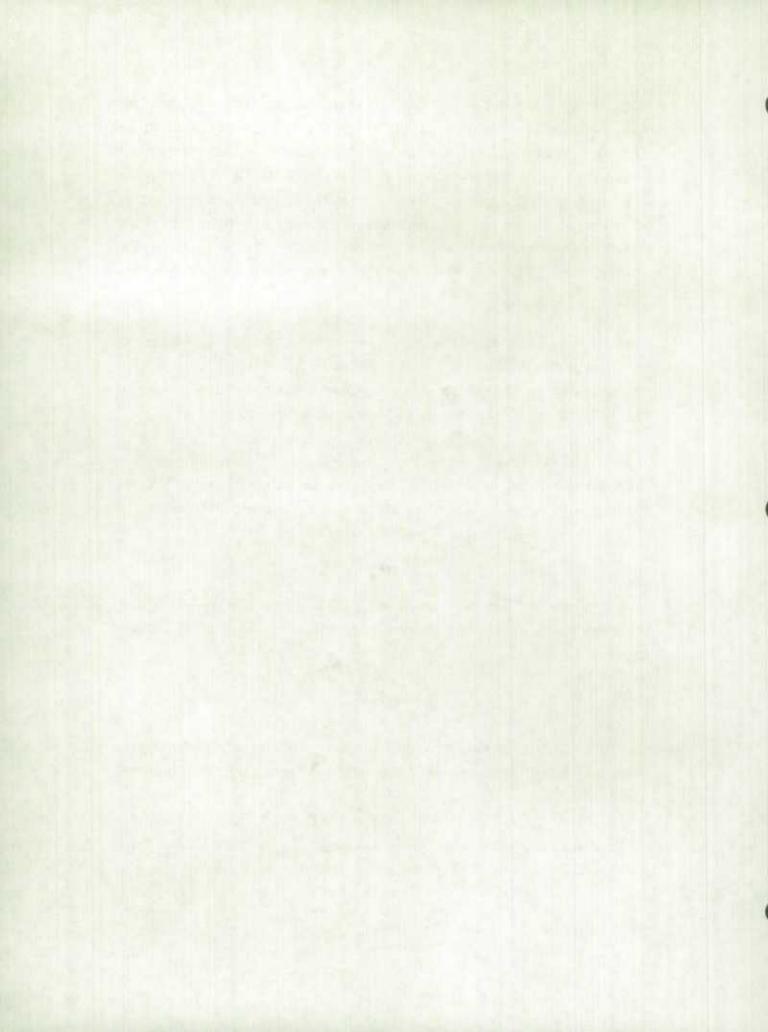


TABLE 1
Common and Predecessor Panels Pertaining to Months m and m-j

Panels in Month m	m-1	m-2	m-3	m-4	m-5	m-6	m-7	m-8	m-9	m-10	m-11
1	(6)	(5)	(4)	(3)	(2)	(1)	((6))	((5))	((4))	((3))	((2))
2	1	(6)	(5)	(4)	(3)	(2)	(1)	((6))	((5))	((4))	((3)
3	2	1	(6)	(5)	(4)	(3)	(2)	(1)	((6))	((5))	((4))
4	3	2	1	(6)	(5)	(4)	(3)	(2)	(1)	((6))	((5)
5	4	3	2	1	(6)	(5)	(4)	(3)	(2)	(1)	((6)
6	5	4	3	2	1	(6)	(5)	(4)	(3)	(2)	(1)

Note: Single parentheses indicate "single" predecessor and double parentheses "double" predecessor.

TABLE 2
Estimates of p Correlations
(1980-81 Data)

Characteristic	ê <sub>1</sub>	ê <sub>2</sub>	ê <sub>3</sub>	ê <sub>4</sub>	ê <sub>5</sub>
		Ne	ova Sco	tia	
In LF	.862	.797	.744	.679	.614
Emp.	.866	.783	.714	.651	.588
Emp. Ag.	.913	.837	.756	.678	.600
Emp. Non-Ag.	.865	.774	.710	.649	.588
Unemp.	.590	. 455	.333	.243	. 153
			Ontari	0	
In LF	.843	.782	.717	.674	.631
Emp.	.852	.779	.709	.664	.619
Emp. Ag.	.955	.926	.901	.861	.821
Emp. Non-Ag.	.861	.791	.724	.678	.632
Unemp.	.580	. 445	.334	. 286	.238
		Briti	ish Colu	umbia	
In LF	. 849	.767	.705	.665	. 625
Emp.	.835	.755	.695	.651	.607
Emp. Ag.	.896	.809	.733	.656	.579
Emp. Non-Ag.	.855	.769	.715	.661	.607
Unemp.	.516	.407	.334	.320	.306

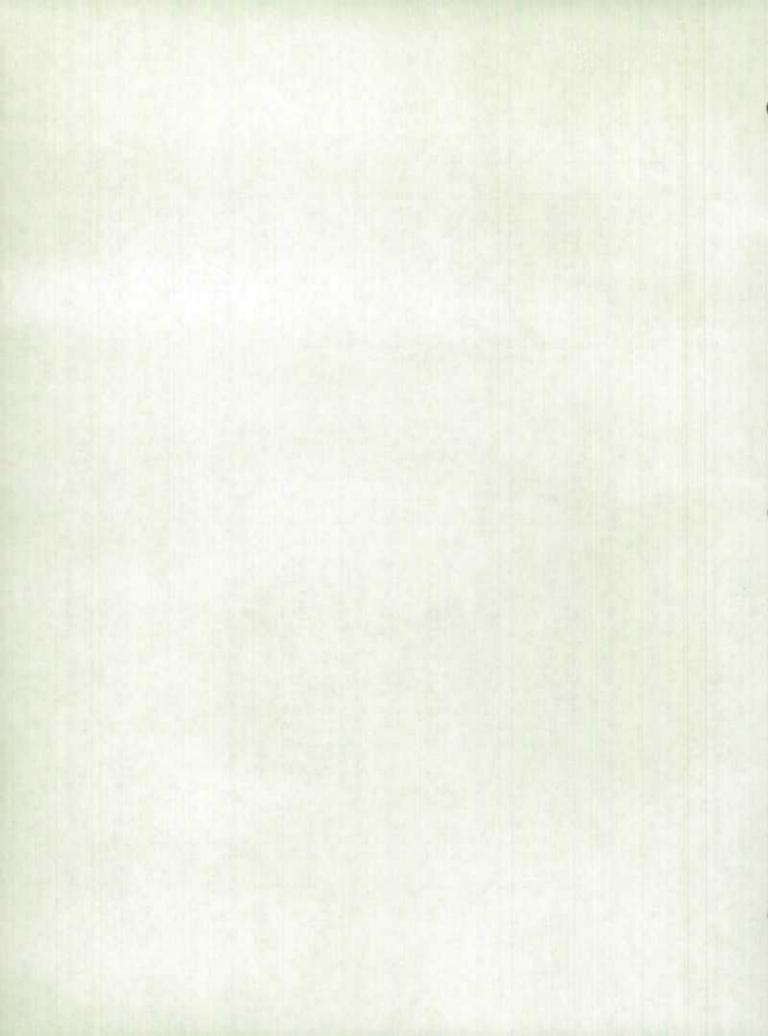


TABLE 3: Estimates of Y Correlations (1980-81 Data)

Characteristic	$\hat{\gamma}_1$	Ŷ2	Ŷ3	Ŷ4	Ŷ5	Ŷ6	Ŷ7	Ŷ8	Ŷ9	Ŷ10	Ŷ11
					N	ova Sc	otia				
In LF	.288	. 263	. 265	. 250	.242	. 233	.211	. 199	. 193	. 167	.141
Emp.	.262	.219	. 228	.226	. 233	.239	.210	.200	.188	.161	.134
Emp. Ag.	.351	.308	.283	.237	.214	.190	.141	.113	.063	.021	021
Emp. Non-Ag.	.238	.187	. 189	. 180	.166	.151	. 123	.121	.136	.091	.046
Unemp.	.106	.176	.091	.097	.087	.076	.066	.063	.066	.032	002
						Ontar	io				
In LF	.161	.141	.128	.133	. 135	.136	.125	.127	.124	.122	.120
Emp.	. 164	.136	.142	.142	.146	.149	.148	.150	.153	.141	.129
Emp. Ag.	.477	. 483	.474	.486	.480	.474	.459	.429	.394	.323	.252
Emp. Non-Ag.	.184	.150	.147	.157	.162	. 167	. 166	. 169	.174	.156	. 138
Unemp.	.141	.074	.076	.063	.057	.051	.045	.060	.077	.136	. 195
					Brit	ish Co	lumbia				
In LF	.177	. 137	.117	.119	.116	.112	.101	.112	.094	.066	.038
Emp.	.211	.146	.133	.107	.095	.083	.050	.068	.058	033	061
Emp. Ag.	.380	.311	.301	.272	. 244	.216	.198	.170	.122	.078	.034
Emp. Non-Ag.	.207	.166	.161	.129	.111	.093	.069	.038	.023	004	027
Unemp.	.126	.125	.114	.103	.090	.076	.062	.092	.032	.040	.048

TABLE 4: Comparison of Estimates of Y2, Y3, Y4 and Y5

Obtained by Different Methods
(1980-81, Ontario)

Characteristic	Method	Ŷ2	Ŷ3	Ŷ4	Ŷ5
In Labour Force	Method 1 Method 2	.141	.128	.133	.135
Employed	Method 1 Method 2	.136	.142	.142	.146
Employed in Agriculture	Method 1 Method 2	.483	.474	.486	.480
Employed in Non-Agriculture	Method 1 Method 2	.150	.147	.157	.162
Unemployed	Method 1 Method 2	.074	.076	.063	.057

Note: Method 1: The method by the formula (3) in Section 3 and used to obtain Table 3.

Method 2: The method by the formula (4).

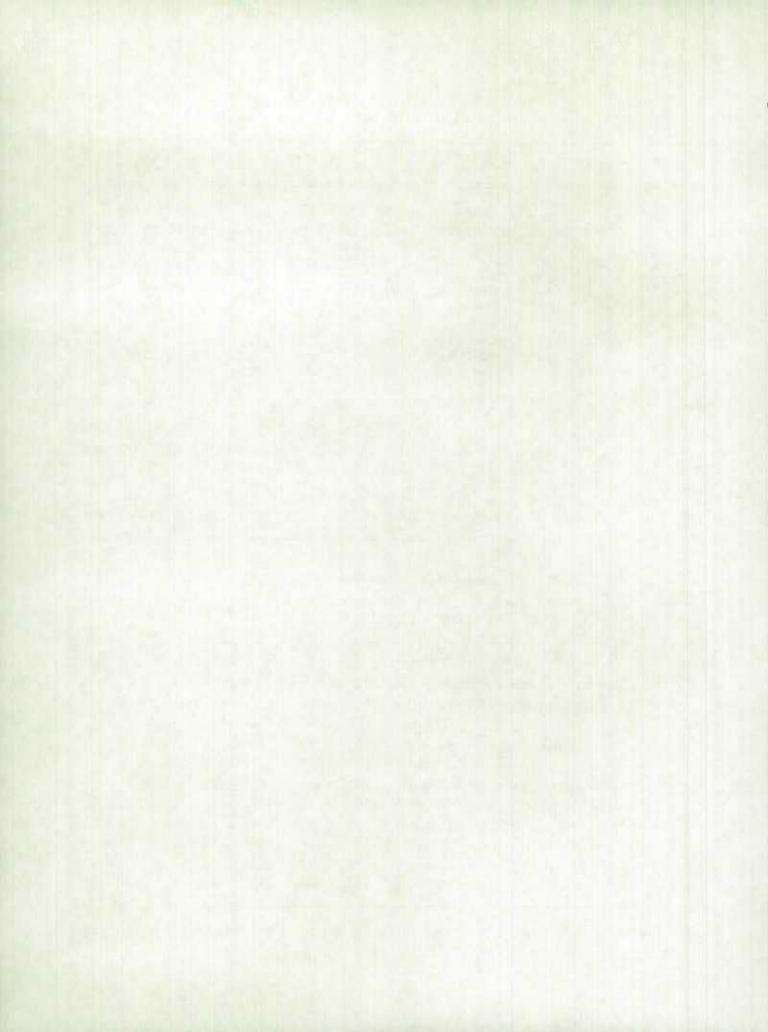


TABLE 5A

### ESTIMATES OF PANEL CORRELATION RHO'S FOR EMPLOYED (MAR 85-FEB 87)

PROVINCE	RHOIT	RHOZ	RHO3	RHO4	RHO5
NFLD	0.855	0.748	0.651	0.586	0.522
PEI	0.831	0.734	0.676	0.608	0.541
NS	0.863	0.768	0.713	0.686	0.659
NB	0.881	0.794	0.743	0.709	0.675
PQ	0.882	0.816	0.754	0.700	0.647
ONT	0.853	0.771	0.706	0.648	0.589
HAN	0.861	0.793	0.737	0.698	0.659
SAS	0.918	0.867	0.811	0.746	0.681
ALT	0.832	0.748	0.680	0.641	0.602
BC	0.851	0.770	0.711	0.651	0.590

TABLE 5B

### ESTIMATES OF PANEL CORRELATION GAMMA'S FOR EMPLOYED (MAR 85-FEB 87)

PROVINCE	GAM1	GAM2	GAM3	GAM4	GAM5	GAM6	GAH7	GAM8	GAM9	GAM10	GAM11	
NELD	0.424	0.266	0.209	0.201	0.241	0.281	0.249	0.268	0.298	0.288	0.277	
PEI	0.235	0.221	0.214	0.202	0.198	0.193	0.195	0.163	0.147	0.063	-0.022	
NS	0.170	0.183	0.205	0.196	0.176	0.157	0.158	0.194	0.198	0.219	0.240	
NB	0.360	0.338	0.366	0.392	0.365	0.338	0.339	0.345	0.308	0.287	0.265	
PQ	0.362	0.356	0.343	0.332	0.318	0.304	0.281	0.267	0.257	0.223	0.188	
ONT	0.114	0.122	0.121	0.122	0.123	0.124	0.119	0.108	0.110	0.112	0.113	
MAN	0.213	0.174	0.158	0.160	0.172	0.185	0.179	0.174	0.190	0.231	0.273	
SAS	0.532	0.551	0.528	0.521	0.499	0.476	0.436	0.383	0.363	0.302	0.241	
ALT	0.063	0.113	0.109	0.127	0.137	0.148	0.171	0.167	0.157	0.131	0.105	
BC	0.125	0.100	0.112	0.111	0.123	0.135	0.123	0.121	0.118	0.095	0.072	

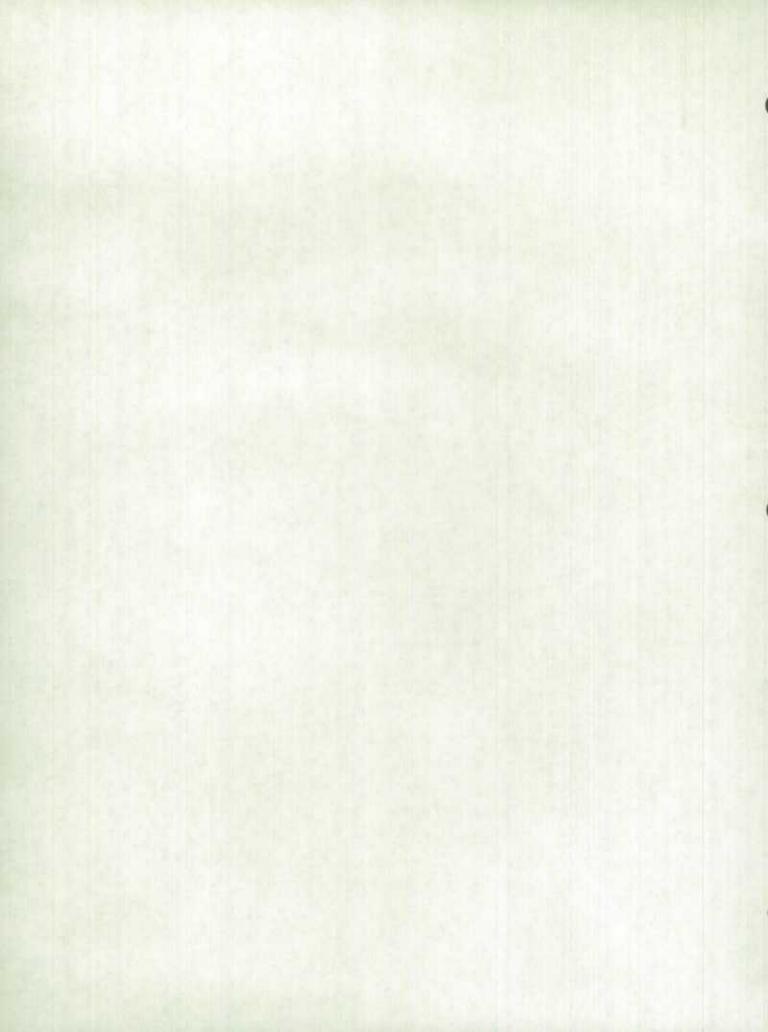


TABLE 6A

## ESTIMATES OF PANEL CORRELATION RHO'S FOR UNEMPLOYED IMAR 85-FEB 871

P	ROVINCE	RHOI	RHOZ	RHO3	RHO4	RHOS
	NFLD	0.741	0.628	0.518	0.485	0.452
	PEI	0.650	0.532	0.458	0.432	0.407
	NS	0.703	0.546	0.426	0.415	0.405
	NB	0.720	0.602	0.523	0.471	0.419
	PQ	0.636	0.512	0.432	0.382	0.331
	ONT	0.579	0.436	0.328	0.291	0.253
	HAN	0.572	0.440	0.355	0.301	0.247
	SAS	0.663	0.534	0.462	0.393	0.324
	ALT	0.658	0.543	0.474	0.405	0.336
	80	0.634	0.524	0.459	0.363	0.267

TABLE 6B

## ESTIMATES OF PANEL CORRELATION GAMMA'S FOR UNEMPLOYED (MAR 85-FEB 87)

PROVINCE	GAMT	GAH2	GAM3	GAM4	GAM5	GAM6	GAH7	GAMS	GAM9	GAM10	GAH11
NFLD	0.482	0.458	0.442	0.449	0.419	0.388	0.383	0.341	0.330	0.308	0.285
PEI	0.190	0.174	0.148	0.150	0.139	0.129	0.123	0.126	0.136	0.112	0.088
NS	0.233	0.267	0.241	0.211	0.189	0.168	0.171	0.176	0.157	0.187	0.216
NB	0.479	0.575	0.540	0.522	0.485	0.448	0.433	0.359	0.288	0.192	0.096
PQ	0.141	0.098	0.071	0.061	0.075	0.089	0.080	0.087	0.090	0.081	0.072
ONT	0.030	0.047	0.055	0.047	0.047	0.048	0.039	0.030	0.039	0.048	0.057
HAN	0.067	0.025	0.009	0.050	0.067	0.084	0.068	0.053	0.045	0.035	0.025
SAS	0.124	0.169	0.175	0.142	0.123	0.104	0.094	0.056	0.038	0.042	0.046
ALT	0.074	0.132	0.127	0.140	0.148	0.155	0.164	0.190	0.170	0.185	0.199
ВС	0.096	0.086	0.084	0.080	0.088	0.097	0.068	0.074	0.068	0.083	0.098

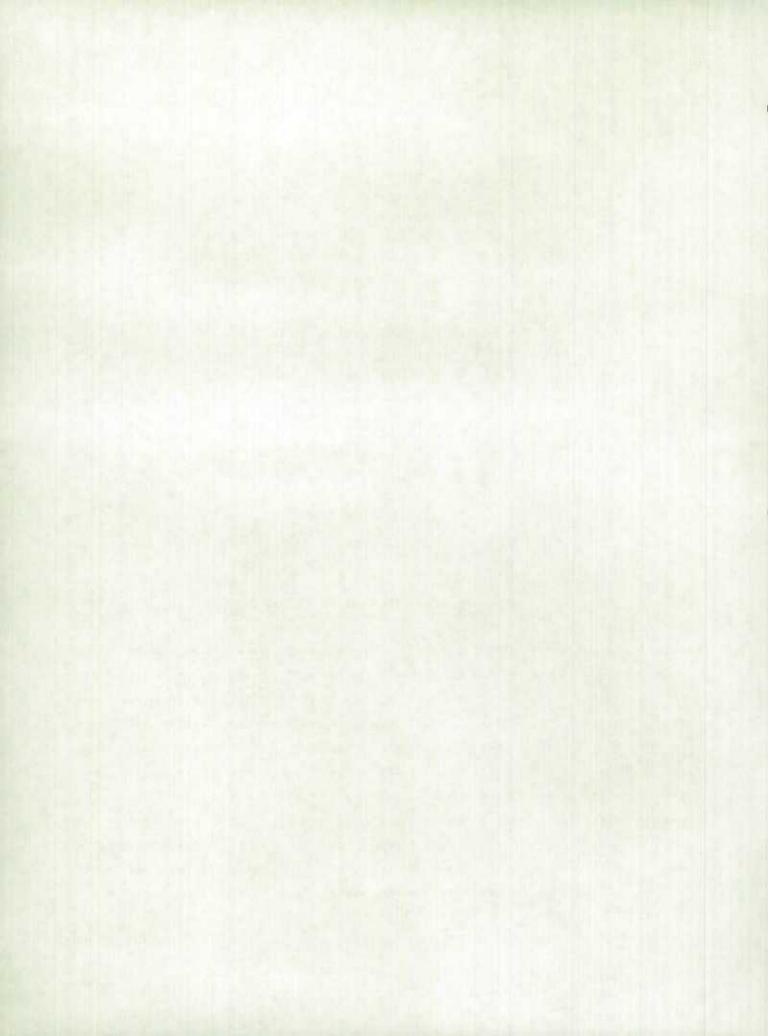


TABLE 7A

### ESTIMATES OF PANEL CORRELATION RHO'S . FOR IN LABOUR FORCE (MAR 85-FEB 87)

PROVINCE	RHOI	RHOZ	RHO3	RH04	RHOS
NELD	0.853	0.750	0.666	0.596	0.525
PEI	0.796	0.705	0.635	0.600	0.564
NS	0.845	0.769	0.730	0.696	0.662
NB	0.878	0.809	0.771	0.714	0.658
PQ	0.844	0.778	0.724	0.670	0.617
ONT	0.846	0.781	0.732	0.681	0.629
MAN	0.839	0.787	0.724	0.697	0.669
SAS	0.901	0.849	0.793	0.742	0.691
ALT	0.803	0.738	0.689	0.639	0.589
ВС	0.817	0.753	0.701	0.647	0.594

### TABLE 7B

## ESTIMATES OF PANEL CORRELATION GAMMA'S FOR IN LABOUR FORCE (MAR 85-FEB 87)

PROVINCE	GAMI	GAM2	GAM3	GAH4	GAM5	GAM6	GAH7	GAM8	GAM9	GAM10	GAM11
NFLD	0.518	0.452	0.427	0.401	0.395	0.390	0.379	0.375	0.351	0.288	0.225
PEI	0.114	0.098	0.131	0.113	0.119	0.125	0.133	0.116	0.135	0.109	0.083
NS	0.250	0.238	0.247	0.230	0.217	0.204	0.181	0.196	0.189	0.162	0.135
NB	0.515	0.466	0.480	0.494	0.479	0.465	0.457	0.458	0.395	0.343	0.292
PQ	0.319	0.306	0.288	0.276	0.259	0.243	0.210	0.203	0.196	0.170	0.143
ONT	0.162	0.138	0.141	0.134	0.134	0.135	0.127	0.116	0.111	0.103	0.095
HAN	0.161	0.144	0.139	0.139	0.147	0.154	0.138	0.139	0.148	0.188	0.227
SAS	0.468	0.475	0.471	0.467	0.451	0.435	0.392	0.345	0.301	0.262	0.223
ALT	0.187	0.132	0.100	0.109	0.099	0.090	0.072	0.064	0.074	0.068	0.062
ВС	0.103	0.095	0.113	0.103	0.096	0.090	0.091	0.083	0.078	0.030	-0.018

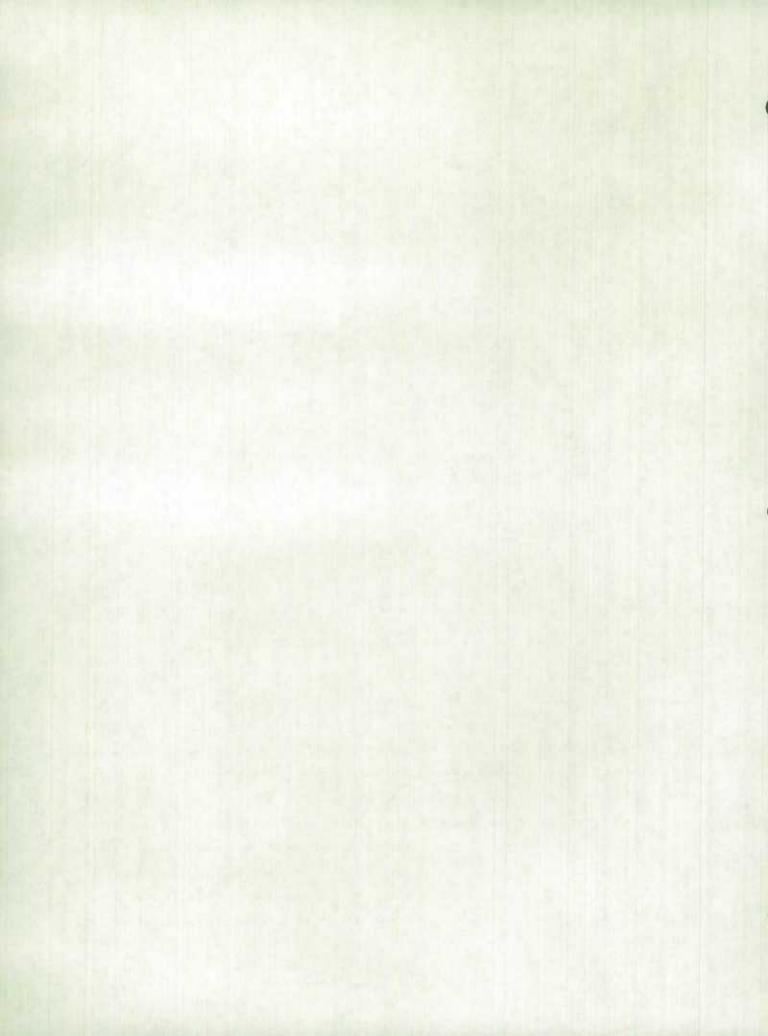


TABLE 8A

ESTIMATES OF PANEL CORRELATION RHO'S FOR EMPLOYED AGRICULTURE (MAR 85-FEB 87)

PROVINCE	RHOI	RHOZ	RH03	RH04	RHO5
NFLD	0.910	0.848	0.794	0.745	0.697
PEI	0.955	0.937	0.923	0.881	0.840
NS	0.912	0.867	0.825	0.802	0.779
NB	0.930	0.899	0.852	0.811	0.770
PQ	0.978	0.964	0.949	0.939	0.930
ONT	0.962	0.948	0.944	0.937	0.930
MAN	0.964	0.938	0.923	0.911	0.899
SAS	0,987	0.981	0.971	0.959	0.948
ALT	0.979	0.974	0.967	0.961	0.955
BC	0.938	0.886	0.847	0.828	0.808
50					

TABLE 8B

### ESTIMATES OF PANEL CORRELATION GAMMA'S FOR EMPLOYED AGRICULTURE (MAR 85-FEB 87)

PROVINCE	GAH1	GAMZ	GAM3	GAM4	GAM5	GAM6	GAH7	SAMS	GAM9	GAM10	GAH11
NFLD	0.159	0.254	0.304	0.390	0.397	0.403	0.343	0.264	0.208	0.147	0.085
PEI	0.531	0.526	0.527	0.533	0.530	0.526	0.529	0.531	0.512	0.529	0.545
NS	0.326	0.296	0.246	0.245	0.256	0.267	0.234	0.217	0.259	0.269	0.278
NB	0.482	0.574	0.584	0.586	0.572	0.558	0.547	0.525	0.492	0.369	0.245
PQ	0.646	0.632	0.608	0.584	0.598	0.611	0.596	0.554	0.525	0.562	0.600
ONT	0.508	0.518	0.553	0.561	0.565	0.569	0.582	0.617	0.668	0.650	0.632
HAN	0.407	0.372	0.363	0.379	0.396	0.412	0.446	0.408	0.418	0.446	0.474
SAS	0.770	0.756	0.756	0.742	0.722	0.702	0.672	0.658	0.666	0.637	0.607
ALT	0.725	0.734	0.724	0.730	0.724	0.717	0.722	0.738	0.753	0.705	0.658
8C	0.394	0.443	0.426	0.401	0.400	0.400	0.401	0.381	0.347	0.334	0.321

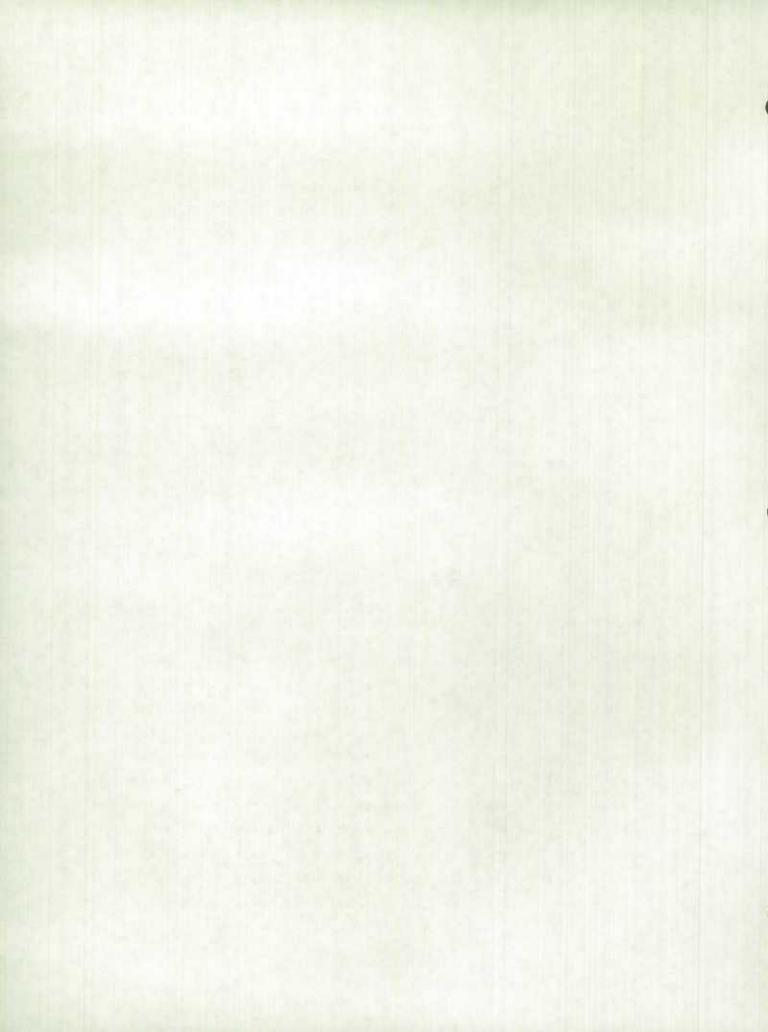


TABLE 9A

## ESTIMATES OF PANEL CORRELATION RHO'S FOR EMPLOYED NONAGRICULTURE (MAR 85-FEB 87)

	-				
PROVINCE	RHOI	RHO2	RHO3	RHO4	RHOS
NFLO	0.859	0.754	0.661	0.598	0.534
PEI	0.885	0.814	0.766	0.719	0.671
NS	0.873	0.779	0.724	0.697	0.669
NB	0.887	0.802	0.751	0.716	0.681
PQ	0.883	0.823	0.767	0.732	0.697
ONT	0.866	0.795	0.746	0.701	0.656
HAN	0.888	0.828	0.785	0.748	0.710
SAS	0.942	0.911	0.881	0.852	0.823
ALT	0.892	0.839	0.800	0.778	0.755
вс	0.857	0.784	0.730	0.679	0.628

### TABLE 9B

## ESTIMATES OF PANEL CORRELATION GAMMA'S FOR EMPLOYED NONAGRICULTURE (MAR 85-FEB 87)

PROVINCE	GAH1	GAHZ	GAH3	GAH4	GAM5	GAM6	GAH7	GAH8	GAH9	GAM10	GAHII
NFLD	0.423	0.267	0.206	0.197	0.239	0.280	0.252	0.274	0.304	0.290	0.277
PEI	0.349	0.330	0.313	0.299	0.295	0.291	0.288	0.250	0.246	0.179	0.113
NS	0.146	0.168	0.199	0.201	0.177	0.153	0.152	0.189	0.199	0.216	0.233
NB	0.376	0.363	0.373	0.387	0.361	0.335	0.336	0.347	0.319	0.285	0.252
PQ	0.262	0.260	0.264	0.263	0.255	0.246	0.254	0.261	0.253	0.255	0.257
ONT	0.133	0.140	0.132	0.140	0.148	0.156	0.168	0.182	0.204	0.205	0.206
HAN	0.262	0.255	0.252	0.277	0.287	0.298	0.310	0.296	0.316	0.327	0.338
SAS	0.463	0.479	0.465	0.458	0.444	0.430	0.412	0.408	0.438	0.407	0.375
ALT	0.290	0.350	0.332	0.327	0.322	0.317	0.332	0.346	0.344	0.326	0.308
8C	0.080	0.067	0.076	0.072	0.091	0.109	0.111	0.118	0.112	0.106	0.099

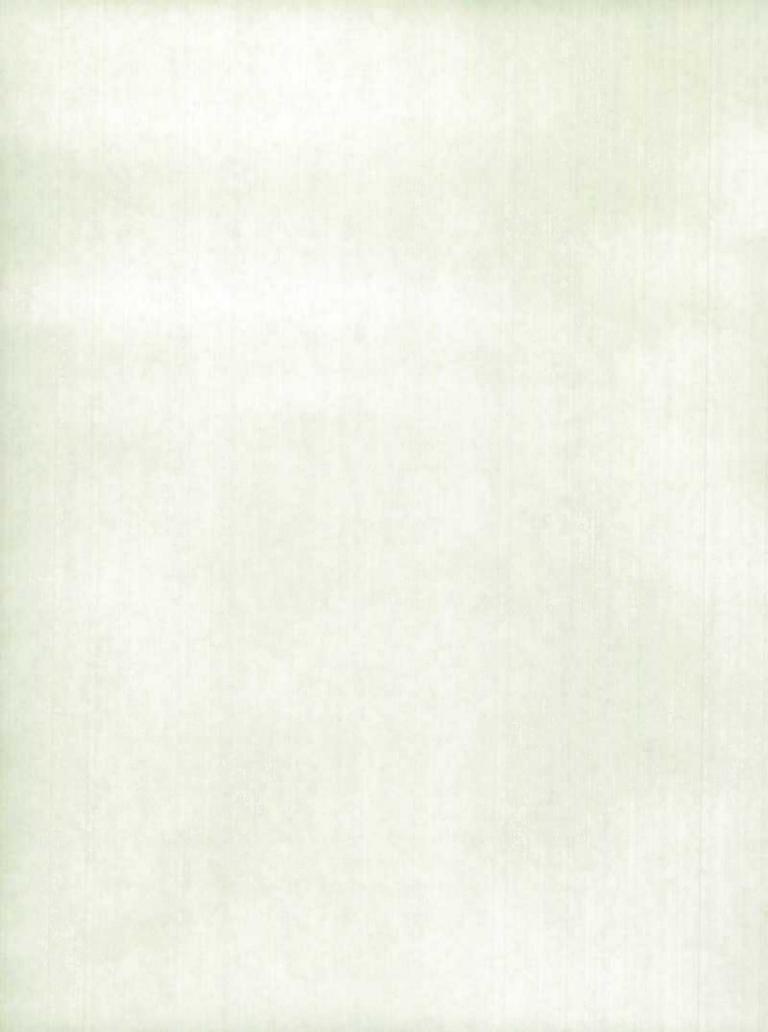


TABLE 10A

## ESTIMATES OF PANEL CORRELATION RHO'S FOR EMPLOYED 15-24 (MAR 85-FEB 87)

PROVINCE	RHOI	RHOZ	RHO3	RHO4	RHOS
NFLD	0.767	0.613	0.503	0.411	0.319
PEI	0.708	0.548	0.474	0.384	0.294
NS	0.773	0.632	0.556	0.495	0.434
NB	0.758	0.615	0.518	0.469	0.420
PQ	0.756	0.633	0.552	0.472	0.392
ONT	0.747	0.605	0.500	0.429	0.357
MAN	0.760	0.632	0.547	0.479	0.410
SAS	0.798	0.670	0.590	0.496	0.403
ALT	0.718	0.589	0.492	0.447	0.401
80	0.740	0.614	0.520	0.454	0.388

### TABLE 10B

### ESTIMATES OF PANEL CORRELATION GAMMA'S FOR EMPLOYED 15-24 (MAR 85-FEB 87)

PROVINCE	GAHI	GAM2	GAH3	GAH4	GAM5	GAM6	GAM7	GAH8	GAM9	GAM10	GAM11
NELD	0.140	0.109	0.090	0.054	0.065	0.077	0.091	0.114	0.109	0.086	0.062
PEI	0.052	0.079	0.103	0.102	0.094	0.086	0.096	0.080	0.095	0.064	0.032
NS	0.107	0.127	0.140	0.133	0.119	0.105	0.099	0.107	0.090	0.074	0.059
NB	0.137	0.036	0.045	0.096	0.124	0.153	0.157	0.175	0.163	0.115	0.067
PQ	0.119	0.099	0.087	0.055	0.056	0.057	0.044	0.052	0.059	0.054	0.049
ONT	0.012	-0.006	0.018	0.031	0.027	0.023	0.011	0.011	0.016	0.044	0.071
HAN	0.126	0.118	0.103	0.092	0.094	0.096	0.107	0.099	0.093	0.067	0.041
SAS	0.247	0.268	0.223	0.220	0.211	0.203	0.178	0.158	0.169	0.123	0.077
ALT	0.084	0.016	0.016	0.035	0.044	0.054	0.055	0.033	0.038	0.037	0.036
вс	0.042	0.053	0.057	0.028	0.024	0.020	0.013	0.013	0.014	-0.006	-0.025

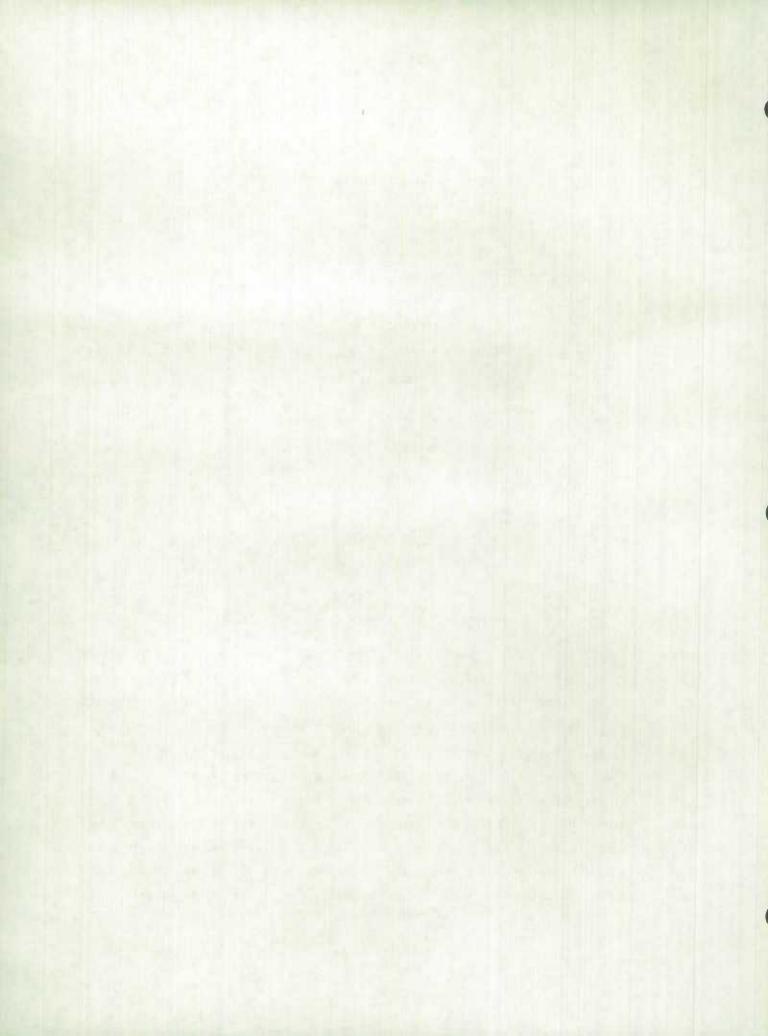


TABLE 11A

ESTIMATES OF PANEL CORRELATION RHO'S FOR EMPLOYED 25+ (MAR 85-FEB 87)

P	ROVINCE	RHO1	RHOZ	RHO3	RH04	RHOS
	NFLD	0.867	0.769	0.686	0.633	0.580
	PEI	0.869	0.794	0.740	0.691	0.642
	NS	0.878	0.800	0.754	0.729	0.703
	NB	0.900	0.836	0.783	0.736	0.690
	PQ	0.906	0.847	0.789	0.734	0.680
	ONT	0.888	0.824	0.777	0.732	0.688
	HAN	0.880	0.823	0.771	0.738	0.704
	SAS	0.926	0.880	0.837	0.781	0.725
	ALT	0.864	0.792	0.733	0.687	0.641
	вс	0.877	0.804	0.752	0.695	0.637

TABLE 11B

### ESTIMATES OF PANEL CORRELATION GAMMA'S FOR EMPLOYED 25+ (MAR 85-FEB 87)

PROVINCE	GAH1	GAM2	GAM3	GAM4	GAMS	GAM6	GAH7	GAHS	GAM9	GAM10	GAM11
NFLD	0.414	0.283	0.220	0.211	0.249	0.286	0.275	0.296	0.329	0.313	0.298
PEI	0.235	0.195	0.207	0.198	0.199	0.199	0.194	0.182	0.139	0.105	0.072
NS	0.088	0.075	0.117	0.108	0.104	0.099	0.090	0.103	0.099	0.137	0.176
NB	0.322	0.289	0.295	0.319	0.302	0.284	0.298	0.317	0.301	0.295	0.288
PQ	0.354	0.358	0.349	0.343	0.328	0.312	0.298	0.285	0.276	0.240	0.204
ONT	0.124	0.124	0.115	0.107	0.114	0.122	0.117	0.103	0.109	0.114	0.119
MAN	0.138	0.106	0.091	0.091	0.101	0.112	0.105	0.107	0.125	0.184	0.242
SAS	0.462	0.494	0.461	0.458	0.440	0.421	0.390	0.348	0.335	0.278	0.221
ALT	0.099	0.138	0.126	0.128	0.132	0.135	0.150	0.160	0.151	0.143	0.136
BC	0.122	0.097	0.097	0.106	0.121	0.135	0.126	0.119	0.125	0.116	0.108

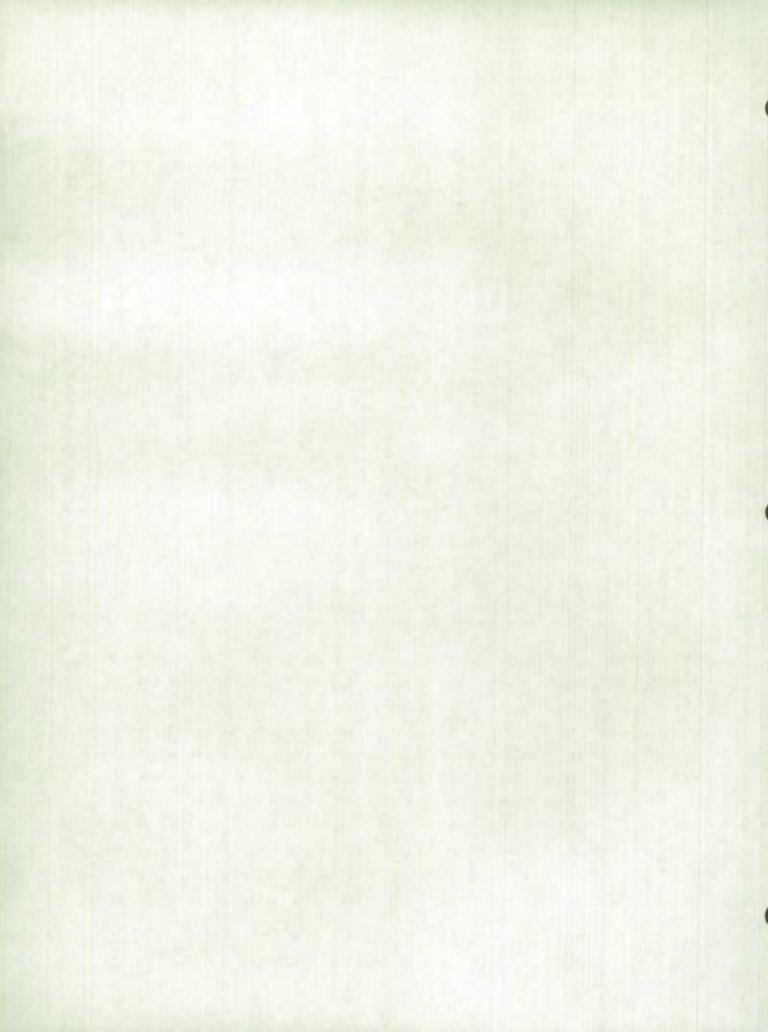


TABLE 12A

### ESTIMATES OF PANEL CORRELATION RHO'S FOR UNEMPLOYED 15-24 (MAR 85-FEB 87)

PROVINCE	RHOI	RHO2	RHO3	RH04	RHOS
PROTEITE	Kiloi	KIIOE	KIIOJ	X1104	KIIOJ
NFLD	0.622	0.480	0.382	0.325	0.267
PEI	0.532	0.400	0.329	0.219	0.110
NS	0.618	0.454	0.364	0.300	0.236
NB	0.582	0.470	0.370	0.311	0.251
PQ	0.563	0.419	0.334	0.310	0.285
ONT	0.468	0.339	0.257	0.219	0.182
HAN	0.455	0.311	0.205	0.171	0.137
SAS	0.536	0.397	0.289	0.256	0.223
ALT	0.486	0.346	0.276	. 0.259	0.242
вс	0.505	0.381	0.315	0.208	0.102

### TABLE 12B

## ESTIMATES OF PANEL CORRELATION GAMMA'S FOR UNEMPLOYED 15-24 (MAR 85-FEB 87)

PROVINCE	GAH1	GAMZ	GAM3	GAM4	GAHS	GAM6	GAH7	GAMA	GAH9	GAM10	GAM11	
NFLD	0.206	0.166	0.181	0.186	0.138	0.090	0.102	0.119	0.127	0.127	0.127	
PEI	0.096	0.007	0.018	0.023	0.019	0.016	0.041	0.051	0.059	0.023	-0.013	
NS	0.051	0.080	0.042	0.024	0.042	0.061	0.079	0.081	0.058	0.011	-0.036	
NB	0.203	0.261	0.267	0.242	0.221	0.199	0.181	0.130	0.090	0.072	0.053	
PQ	0.099	0.027	0.015	0.003	0.018	0.032	0.014	0.031	0.050	0.013	-0.024	
ONT	0.068	0.039	0.038	0.058	0.042	0.026	0.008	0.018	0.011	-0.002	-0.016	
MAN	-0.012	0.009	-0.002	0.028	0.031	0.034	0.043	0.032	0.034	0.031	0.028	
SAS	0.010	0.057	0.043	0.019	0.022	0.025	0.015	0.004	-0.018	-0.009	0.000	
ALT	0.077	0.028	0.048	0.022	0.025	0.027	0.037	0.047	0.061	0.112	0.164	
вс	0.076	0.077	0.045	0.033	0.031	0.028	0.027	0.026	0.027	0.037	0.047	

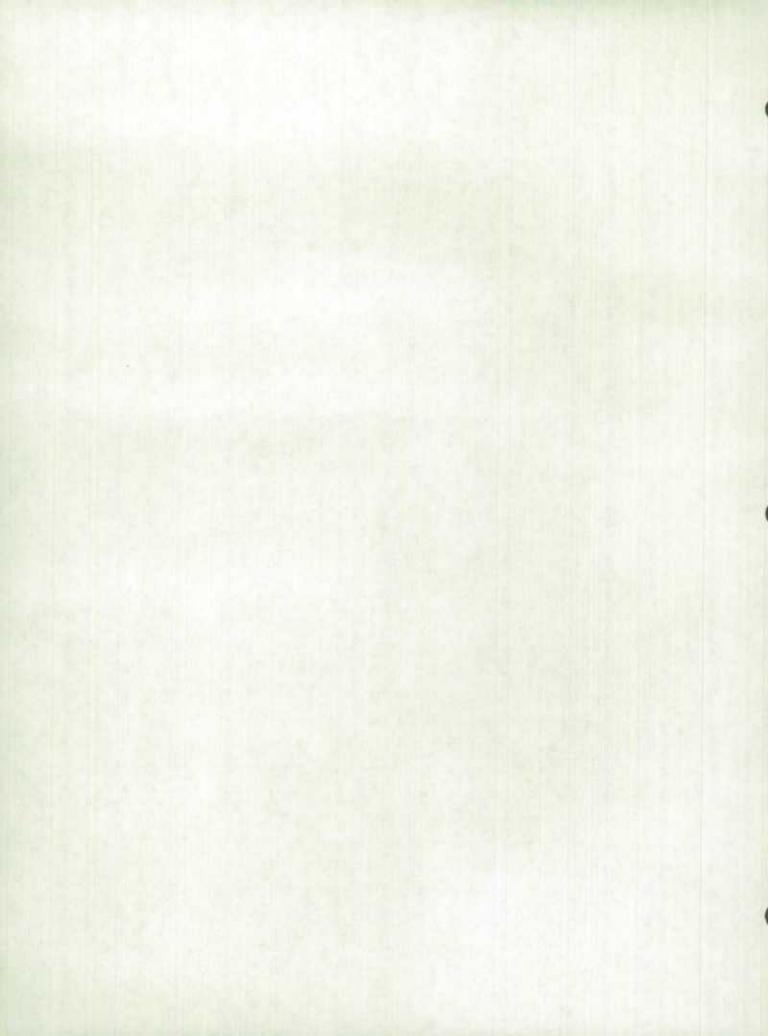


TABLE 13A

### ESTIMATES OF PANEL CORRELATION RHO'S FOR UNEMPLOYED 25+ (MAR 85-FEB 87)

PROVINCE	RHOI	RHO2	RHO3	RHO4	RHO5
NFLD	0.752	0.622	0.530	0.484	0.438
PEI	0.663	0.553	0.466	0.441	0.416
NS	0.695	0.554	0.443	0.440	0.438
NB	0.703	0.582	0.492	0.449	0.406
PQ	0.658	0.535	0.445	0.385	0.325
ONT	0.622	0.468	0.365	0.313	0.261
HAN	0.609	0.484	0.399	0.331	0.264
SAS	0.675	0.553	0.497	0.425	0.354
ALT	0.700	0.577	0.500	0.433	0.365
ВС	0.681	0.570	0.501	0.410	0.319

### TABLE 13B

### ESTIMATES OF PANEL CORRELATION GAMMA'S FOR UNEMPLOYED 25+ (MAR 85-FEB 87)

PROVIN	CE GAM1	GAP12	GAM3	GAH4	GAM5	GAM6	GAH7	GAMS	GAM9	GAH10	GAH11	
NFLD	0.440	0.463	0.428	0.426	0.403	0.380	0.338	0.290	0.250	0.209	0.167	
PEI	0.141	0.155	0.135	0.156	0.142	0.129	0.099	0.109	0.095	0.087	0.079	
NS	0.155	0.129	0.177	0.171	0.165	0.159	0.158	0.127	0.102	0.134	0.165	
NB	0.391	. 0 . 461	0.440	0.408	0.405	0.403	0.372	0.319	0.290	0.194	0.098	
PQ	0.135	0.118	0.108	0.107	0.105	0.103	0.107	0.100	0.110	0.110	0.110	
ONT	0.052	0.054	0.033	0.017	0.025	0.033	0.026	0.018	0.021	0.044	0.066	
HAN	0.074	0.016	0.021	0.016	0.029	0.042	0.029	0.043	0.024	0.029	0.034	
SAS	0.184	0.170	0.189	0.185	0.150	0.116	0.103	0.077	0.051	0.021	-0.010	
ALT	0.058	0.118	0.125	0.143	0.155	0.167	0.170	0.194	0.182	0.189	0.196	
вс	0.026	0 044	0.070	0.081	0.088	0.096	0.076	0.072	0.076	0.081	0.087	

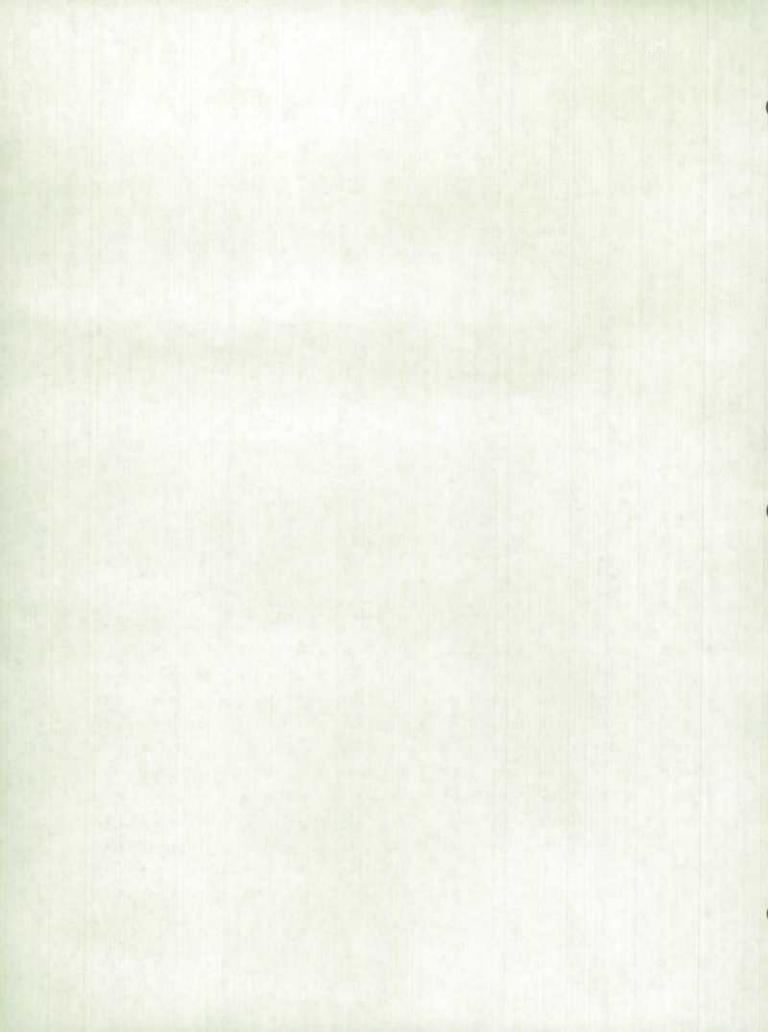


TABLE 14 ESTIMATES OF PANEL CORRELATION TAU'S (MAR 85 - FEB 86)

PROV	CHAR	TO	_11	T2	T3	T4	75
1	1	0.14955	0.14009	0.1484	0.18078	0.18687	0.19297
1	2	-0.44036	-0.27545	-0.1874	-0.13544	-0.03375	0.05794
1	3	-0.03582	-0.04000	-0.0429	-0.01522	0.02388	0.06297
1	4	-0.02945	-0.03691	-0.0779	-0.04944	-0.01637	0.01669
1	5	-0.43700	-0.37445	-0.2763	-0.18200	-0.23087	-0.27975
1	6	0.13591	0.12727	0.0943	0.05533	0.04897	0.04242
2	1	0.09182	0.06973	0.0551	0.04000	0.02812	0.01625
2	2	-0.41982	-0.26682	-0.2045	-0.16056	-0.14450	-0.12844
2	3	-0.06509	-0.05555	-0.0533	-0.03578	-0.02813	-0.02047
2	4	-0.06136	-0.05436	-0.0537	-0.04167	-0.08937	-0.13708
2	5	-0.39191	-0.30255	-0.2295	-0.18722	-0.18075	-0.17428
2	6	0.05836	0.04318	0.0217	0.01322	0.02150	0.02978
3	1	0.22227	0.15809	0.1290	0.11144	0.13800	0.16456
3	2	-0.47264	-0.29991	-0.2287	-0.19967	-0.17925	-0.15883
3	3	-0.16936	-0.13018	-0.1187	-0.03322	-0.09000	-0.09678
3	4	-0.08709	-0.06800	-0.0637	-0.10078	-0.10100	-0.09522
3	5	-0.55455	-0.42882	-0.3570	-0.30211	-0.23437	-0.16064
3	6	0.07373	0.08864	0.0910	0.08033	0.11937	0.15342

Legend: Province 1: Nova Scotia; 2: Ontario; 3: Alberta Definition of CHAR:

1: Cor(X1, X2) 2: Cor(X1, X3)
3: Cor(X1, X4) 4: Cor(X2, X3)
5: Cor(X2, X4) 6: Cor(X3, X4)
where X1: Emp 15-24 X2: Emp 25+

X3: Unemp 15-24 X4: Unemp 25+.

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