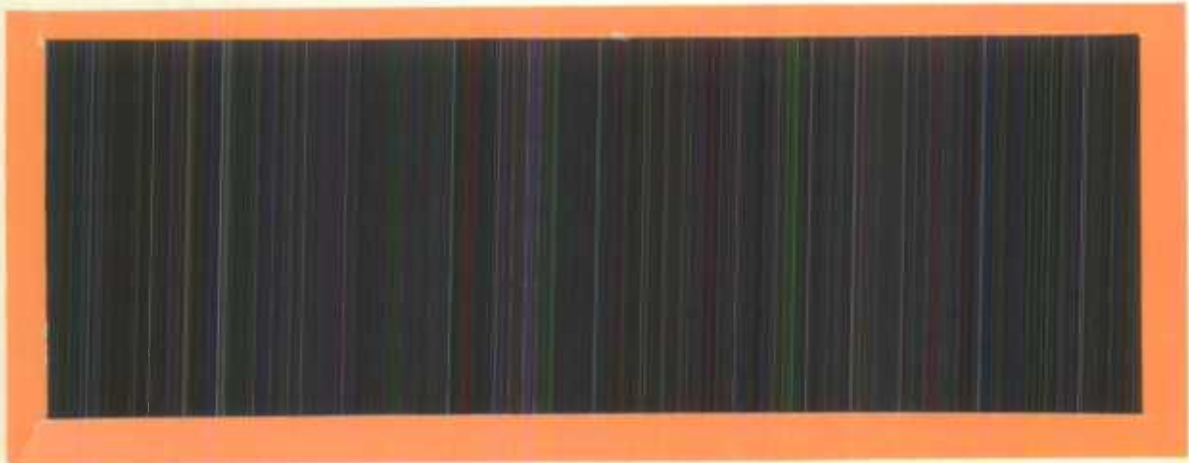




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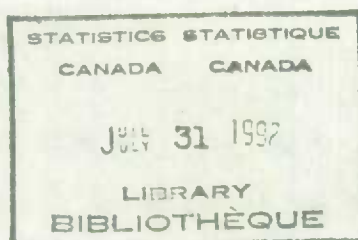


SEASONAL ADJUSTMENT OF  
LABOUR FORCE SERIES DURING RECESSION AND  
NON-RECESSION PERIODS

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## I - INTRODUCTION

Seasonality in some of the labour force series may be subject to abrupt changes due to drastic variations in their composition during the various stages of the business-cycle. An important example is total unemployment which, in relatively prosperous years, consists mainly of workers from construction and the primary sector (agriculture, forestry, fishing, trapping, etc.) in the winter, students seeking summer jobs, persons shifting jobs and new entrants to the labour market. On the other hand, during recession years the number of unemployed increases quickly and the new unemployed are mainly regular workers from heavy industries and related activities characterized by seasonal variations of smaller amplitudes and seasonal patterns different from those in 'normal' years. This kind of shift has been recently observed in Canada where the total unadjusted unemployed rose from 790,000 in August 1981 to 1,494,000 in December, 1982; the newly unemployed coming mainly from the manufacturing and service industries.

The rapid changes in the size and composition of the total unemployment during the depressed phase of the business-cycle raise the question whether the procedure followed to estimate seasonal factors based on data for years of low, mainly frictional and "outdoor" unemployment, are applicable to data for years of high unemployment with large number of jobless added from the secondary and tertiary sectors.

Empirical research at Statistics Canada in 1974, led to current seasonal adjustment of labour force series by the X-11-ARIMA method using concurrent seasonal factors. Similarly, the U.S. Bureau of Labor Statistics officially adopted this method in 1980 using six-month ahead projected seasonal factors. This agency also releases monthly the unemployment rate calculated with X-11-ARIMA and concurrent seasonal factors. Concurrent seasonal factors are obtained by seasonally adjusting, each month, all the data available up to and including that month whereas projected seasonal factors are generated from data that ended, usually, one year before (in the case of the Bureau of Labor Statistics, six-months before).

The main purpose of this study is to assess whether the use of X-11-ARIMA with concurrent seasonal factors still produces the smallest revisions during recession years when compared to other three feasible alternative procedures.

Section 2 gives the mean absolute error (MAE) of concurrent and year-ahead projected seasonal factors of eight Canadian labour force series obtained from X-11-ARIMA and X-11 using the multiplicative seasonal adjustment option.

Year-ahead instead of six-months-ahead projected factors are analysed because they are applied by the majority of government statistical agencies. Furthermore, the MAE's of six-months-ahead factors fall between those of concurrent and year-ahead projected factors.

Section 3 calculates the mean absolute revisions of the additive current seasonal adjustment for the four alternative procedures and compares the MAE's of the additive versus the multiplicative options.

Finally, section 5 presents the conclusions of this study.



## 2 - REVISIONS OF CURRENT SEASONALLY ADJUSTED LABOUR FORCE SERIES DURING RECESSION AND NON-RECESSION PERIODS.

The majority of the seasonal adjustment methods applied by government statistical agencies are based on linear smoothing filters, usually known as moving averages. It is inherent to these methods that the estimates of the observations of the most recent years are less accurate than those corresponding to central data because of the asymmetry of the end point filters. Among these methods, the Method II-X-11 variant developed by Shiskin, Young, and Musgrave (1967) and the X-11-ARIMA developed by Dagum (1980) are the most widely applied. The X-11-ARIMA is a modified version of the X-11 variant that basically consists of extending the original series with extrapolated values from ARIMA models (autoregressive integrated moving averages) of the type developed by Box and Jenkins (1970). The extended series are then seasonally adjusted with a set of moving averages that result from the combination of the X-11 seasonal filters with the extrapolation ARIMA filters. Therefore, the seasonal adjustment filters of X-11-ARIMA and X-11 differ for the data of the most recent year. Only the symmetric filter applied to central observations is the same for both procedures. If the ARIMA option is not used then, the X-11-ARIMA reduces to the X-11 method.

The revisions of current seasonally adjusted values by the X-11-ARIMA and the X-11 method are due to: (1) Differences in the smoothing linear filters applied to the same observations as later data become available; and, (2) the innovations that enter into the series with new observations. One would like to see the revisions of the first kind reduced to a minimum or to be completely eliminated.

Theoretical studies by one of the present authors (Dagum, 1982.a and 1982.b) have shown that the revisions of current seasonally adjusted values due to filter changes can be reduced significantly if: (1) the original series is extended with ARIMA extrapolated values i.e., the X-11-ARIMA is applied; and (2) concurrent seasonal factors are used instead of year-ahead seasonal factors. The conclusion drawn from these two theoretical studies conform to the results given in several empirical works (see e.g. Dagum, 1978, Dagum and Morry, 1982; Kuiper, 1978 and 1981; Pierce, 1980, Kenny and Durbin, 1982, McKenzie, 1982).

We examine next, the optimality of X-11-ARIMA with concurrent seasonal factors against three other feasible alternatives, for recession and non-recession periods. The optimal seasonal adjustment procedure will be the one that yields the smallest revisions.

## 2.1 - Comparisons of Four Alternative Procedures for Current Seasonal Adjustment of Labour Force Series.

There are four seasonal adjustment procedures commonly applied to obtain current seasonally adjusted values, namely:

- (1) X-11-ARIMA with concurrent seasonal factors;
- (2) X-11 with concurrent seasonal factors;
- (3) X-11-ARIMA with year-ahead projected seasonal factors; and
- (4) X-11 with year-ahead projected seasonal factors.

The revision measure used here for the evaluation of these four alternative procedures is the mean absolute error (MAE) of the seasonal factors for current seasonal adjustment defined by:

$$MAE = \sum_{t=1}^N |\hat{S}_t^C - \hat{S}_t^F| / N \quad (1)$$

$\hat{S}_t^C$  denotes the current seasonal factor value which can be either a concurrent or a year-ahead projected seasonal factor from X-11 or X-11-ARIMA.  $\hat{S}_t^F$  denotes the "final" seasonal factor value in the sense that it will not change significantly when the series is augmented with new data. For X-11 and X-11-ARIMA a current seasonal factor becomes final when at least three and a half years of data are added to the series (Young, 1968 and Wallis 1974). The eight Canadian series of employment and unemployment analysed here start in January 1966 and end in October 1982.

To use the ARIMA extrapolation option of the X-11-ARIMA at least five years are necessary to produce a seasonally adjusted series, therefore, the first year for which total revision measures can be calculated is 1971. Taking into account the need for at least three and a half more years for a current estimate to become final, the last year for which MAE can be obtained is 1977. Within this seven-year span of revisions, we distinguished two years of recession and five years of non-recession.

The recession period includes data from August 1974 until July 1975 and June 1976 until May 1977. These two years were considered recessionary because they showed high increases (greater than 25%) in the annual levels of total unemployment due mainly to large inflows of job losers.

Another important aspect taken into consideration is the kind of decomposition model used for the seasonal adjustment of each series. The X-11 and the X-11-ARIMA provide both additive and multiplicative decomposition models. There are no theoretical reasons for one model to be preferable to the other. They are based on different assumptions concerning the generating mechanism of the seasonal component.

In an additive model, the components of a time series (trend-cycle, seasonal variations and irregular fluctuations) are assumed to be independent and, therefore, the seasonal effect is not affected by the level of the economic activity conditioned by the stages of the business cycle.

On the other hand, in a multiplicative model, the seasonal effect is proportional to the trend-cycle. If the seasonal factors are constant, it means the higher the level of the seasonally adjusted series, the higher the seasonal effect.

The problem of model selection, however, becomes very important when approached from the viewpoint of the estimation of the seasonal component of the most recent years, particularly, of series with a rapidly growing trend-cycle. The asymmetric filters used for the end points estimation particularly those of the X-11-method, introduce large systematic errors if the seasonal estimates are changing fast (Dagum, 1978). In fact if the underlying decomposition model is that of a rather stable multiplicative seasonality, an additive seasonal adjustment will produce seasonal estimates that appear to vary with the trend-cycle. Reciprocally, if stable additive seasonality is the norm, a multiplicative adjustment will produce seasonal factors that look unstable or fast moving.

From the viewpoint of seasonal adjustment, it is then preferable to choose the decomposition model that yields the most stable seasonal estimates. The tests developed by Morry (1975) and Higginson (1977) have been applied to the eight series to determine the preferred decomposition models.



The results of these tests indicated that only two series, unemployment of adult and young women, follow an additive model; the remaining series are of the multiplicative type.

In this study, however, we have analysed the mean absolute revisions under both assumptions, that is, the components of each series are either multiplicatively or additively related.

The calculations shown in the following tables are obtained from multiplicative seasonal adjustment. The results from additive adjustment are discussed in section 3.

Table 1 shows the mean absolute error (MAE) of the seasonal factors of X-11-ARIMA and X-11 applied for current seasonal adjustment during recession years. It is apparent that X-11-ARIMA with concurrent seasonal factors yields the smallest revisions. This result agrees with the theoretical findings discussed above that the use of the ARIMA extrapolation option with concurrent seasonal factors significantly reduces filter revisions.

TABLE 1. MEAN ABSOLUTE ERRORS (MAE) OF SEASONAL FACTORS OF X-11-ARIMA AND X-11 DURING RECESSION YEARS(a)

Series	Concurrent Seasonal Factors		Year-ahead Projected Seasonal Factors	
	X-11-ARIMA (1)	X-11 (2)	X-11-ARIMA (3)	X-11 (4)
UNEMPLOYMENT				
Men 25 years & over	1.95	2.75	2.74	3.35
Women 25 years & over	1.94	2.94	3.43	4.70
Men 15-24 years	2.16	3.02	3.49	4.33
Women 15-24 years	1.25	1.73	2.48	3.44
EMPLOYMENT				
Men 25 years & over	.08	.12	.12	.16
Women 25 years & over	.23	.29	.33	.42
Men 15-24 years	.41	.53	.66	.76
Women 15-24 years	.50	.70	.81	.97

(a) August 1974-July 1975 and June 1976-May 1977.

For six out of the eight series analysed, X-11 with concurrent seasonal factors ranks second but shows the same MAE as X-11-ARIMA with year-ahead seasonal factors for the two most important series, unemployment and employment of adult men. Finally, the least accurate estimates are obtained from X-11 with year-ahead projected seasonal factors.

Table 2 shows the relative size of the revisions from each alternative procedure with respect to X-11-ARIMA with concurrent seasonal factors. All the values are greater than one indicating that none of the alternative options gives revisions smaller than X-11-ARIMA concurrent.

TABLE 2. COMPARISON OF MAE FROM THREE ALTERNATIVE PROCEDURES VERSUS X-11-ARIMA CONCURRENT FOR MULTIPLICATIVE SEASONAL ADJUSTMENT OF EMPLOYMENT AND UNEMPLOYMENT SERIES IN RECESSION YEARS.

Series	MAE	MAE	MAE
	X-11	X-11-ARIMA	X-11
	(Concurrent)	(Projected factors)	(Projected factors)
	X-11-ARIMA- (Concurrent)	X-11-ARIMA (Concurrent)	X-11-ARIMA (Concurrent)
	(1)	(2)	(3)
UNEMPLOYMENT			
Men 25 years & over	1.41	1.40	1.72
Women 25 years & over	1.52	1.77	2.41
Men 15-24 years	1.40	1.61	2
Women 15-24 years	1.38	1.98	2.75
EMPLOYMENT			
Men 25 years & over	1.50	1.50	2
Women 25 years & over	1.26	1.43	1.83
Men 15-24 years	1.29	1.61	1.85
Women 15-24 years	1.40	1.62	1.94

(1) equals column (2) ÷ column (1) of table 1

(2) equals column (3) ÷ column (1) of table 1

(3) equals column (4) ÷ column (1) of table 1

The non-recession period includes data from January 1971 until December 1977 excluding the recession years. Table 3 shows the MAE of the current seasonally adjusted series for the four procedures during these years. Similarly to Table 1, X-11-ARIMA with concurrent seasonal factors yields the smallest revisions for all the series due to minimal filter revisions as pointed out before. For seven out of the eight series X-11 concurrent ranks

second with values relatively close to those shown for X-11-ARIMA with year-ahead projected factors. Finally, the worst procedure in terms of the magnitude of the revision is X-11 with year-ahead seasonal factors.

The relative increase of revisions of the three alternative procedures with respect to the official procedure are shown in Table 4. The figures in column (1), however, are smaller than those shown in column (1) of Table 2 which would indicate that during recession years it is even more important to use X-11-ARIMA with concurrent factors.

Finally, Table 5 compares the size of the revisions during recession versus non-recession years for the two best procedures. The results show that the X-11-ARIMA concurrent which is Statistics Canada official procedure gives smaller values as compared to the second best alternative, X-11-concurrent. Most of the ratios are very close to one in the first column, indicating that the revisions in times of recession are similar in size to those in non-recession years when using the ARIMA extrapolation option. If X-11 with concurrent seasonal factors is applied, the size of revisions is significantly higher in most series during recession than in 'normal' times. This is due to the fact that the rapid change in the level of the series, introduced by the new observations of the recession years, is not estimated as well by the end filters. In fact, gradual movements and some of the level increase is passed to the seasonal component.

The only exception is the series, unemployed women 15 to 24 where revisions with both methods are smaller during economic hardship. This can be explained by the special behaviour of this series during the period analysed, which is characterized by large annual increases of about 15% for 1966-73 and 8.5% for 1973-80 and a seasonal component, independent of the business-cycle (i.e. the change in level reflected more the changing behaviour of young women than the effect of the business-cycle).

Another special case is the series unemployed men 25 years and over. Here recession years were characterized by much larger revisions than non-recession periods even with ARIMA extrapolation as indicated by a ratio of 1.42. This large discrepancy between the two periods is a result of the drastic composition changes in seasonality that this series undergoes during



recession years as discussed before. Without ARIMA extrapolation, the revision sizes deviate even more (the ratio is 1.59) since apart from the changes in composition the inadequate partitioning of the innovations during recession introduces added discrepancies.

TABLE 3. MEAN ABSOLUTE ERRORS (MAE) OF SEASONAL FACTORS OF X-11-ARIMA AND X-11 DURING NON-RECESSION YEARS<sup>(a)</sup>

Series	Concurrent Seasonal Factors		Year-ahead Projected Seasonal Factors	
	X-11-ARIMA (1)	X-11 (2)	X-11-ARIMA (3)	X-11 (4)
UNEMPLOYMENT				
Men 25 years & over	1.37	1.73	2.22	2.73
Women 25 years & over	1.84	2.41	2.92	3.55
Men 15-24 years	1.97	2.66	3.17	3.96
Women 15-24 years	1.93	2.87	2.59	3.18
EMPLOYMENT				
Men 25 years & over	.08	.10	.12	.13
Women 25 years & over	.23	.27	.33	.34
Men 15-24 years	.39	.46	.58	.69
Women 15-24 years	.43	.49	.68	.80

(a) From January 1971 until December 1977 excluding data of recession periods defined in Table 1 footnote (a).

TABLE 4. COMPARISON OF MAE FROM THREE ALTERNATIVE PROCEDURES VERSUS X-11-ARIMA (CONCURRENT) FOR MULTIPLICATIVE SEASONAL ADJUSTMENT OF EMPLOYMENT AND UNEMPLOYMENT SERIES IN NON-RECESSION YEARS.

Series	MAE X-11(Concurrent)	MAE X-11-ARIMA (Projected Factors)	MAE X-11 (Projected Factors)
	X-11-ARIMA (Concurrent) (1)	X-11-ARIMA (Concurrent) (2)	X-11-ARIMA (Concurrent) (3)
UNEMPLOYMENT			
Men 25 years & over	1.26	1.62	1.99
Women 25 years & over	1.31	1.59	1.93
Men 15-24 years	1.35	1.61	2.01
Women 15-24 years	1.49	1.34	1.65
EMPLOYMENT			
Men 25 years & over	1.25	1.50	1.62
Women 25 years & over	1.17	1.43	1.48
Men 15-24 years	1.18	1.49	1.77
Women 15-24 years	1.14	1.58	1.86

(1) equal to column (2) ÷ column (1) of Table 3

(2) equal to column (3) ÷ column (1) of Table 3

(3) equal to column (4) ÷ column (1) of Table 3

TABLE 5. COMPARISON OF MAE OF CONCURRENT SEASONAL FACTORS OF X-11-ARIMA AND X-11 FOR RECESSION VERSUS NON-RECESSION YEARS USING THE MULTIPLICATIVE OPTION

Series	X-11-ARIMA (Concurrent) Recession Years Non-Recession Years (1)	X-11 (Concurrent Recession Years Non-Recession Years (2)
UNEMPLOYMENT		
Men 25 years & over	1.42	1.59
Women 25 years & over	1.05	1.22
Men 15-24 years	1.01	1.35
Women 15-24 years	.44	.60
EMPLOYMENT		
Men 25 years & over	1	1.20
Women 25 years & over	1	1.07
Men 15-24 years	1.05	1.27
Women 15-24 years	1.16	1.54

(1) equal to column (1) of Table 1 ÷ column (1) of Table 3

(2) equal to column (2) of Table 1 ÷ column 2 of Table 3

### 3 - COMPARISON OF ADDITIVE VERSUS MULTIPLICATIVE CURRENT SEASONAL ADJUSTMENT DURING RECESSION AND NON-RECESSION PERIODS

It is often argued that during recession periods the use of an additive instead of a multiplicative decomposition model is to be preferred from the viewpoint of the minimization of revisions. The main reasons given for this are: (1) in an additive model, the time series components are assumed to be independent and, therefore, the seasonal effect is not affected by the level of the trend-cycle contrary to what occurs with a multiplicative model; and (2) the inflexibility of the end-point filters to estimate adequately fast-moving seasonality.

The eight labour force series analysed in the previous section have been additively seasonally adjusted in order to assess this new alternative. The results obtained confirm the ranking given by the multiplicative option, namely, the X-11-ARIMA concurrent yields the smallest revisions followed by the X-11-concurrent and the X-11-ARIMA year-ahead projected factors, in that order. The least accurate estimates are obtained with X-11-year-ahead projected factors. It is important to note that "factors" of additive seasonal adjustment mean "implicit" factors in the sense that they result from the quotient between the original series and the seasonally adjusted series.

Tables 6 and 7 show the relative size of the revisions from each alternative procedure with respect to X-11-ARIMA-concurrent, for the recession and non-recession periods, respectively. All the values are greater than one indicating that none of the alternative procedures gives smaller revisions than X-11-ARIMA concurrent. Since the latter ranks first for both additive and multiplicative seasonal adjustment options, we compare for each series which of the two decomposition models gives the smallest revisions.



TABLE 6 - COMPARISON OF MAE FROM THREE ALTERNATIVE PROCEDURES VERSUS X-11-ARIMA (CONCURRENT) FOR ADDITIVE SEASONAL ADJUSTMENT OF EMPLOYMENT AND UNEMPLOYMENT SERIES IN RECESSION YEARS

Series	X-11-(concurrent)	X-11-ARIMA(projected implicit factors)	X-11(projected implicit factors)
	X-11-ARIMA (concurrent)	X-11-ARIMA (concurrent)	X-11-ARIMA (concurrent)
UNEMPLOYMENT			
Men 25 years & over	1.18	1.29	1.38
Women 25 years & over	1.16	1.49	1.75
Men 15-24 years	1.21	1.48	1.70
Women 15-24 years	1.33	1.74	1.84
EMPLOYMENT			
Men 25 years & over	1.44	1.69	2.08
Women 25 years & over	1.26	1.33	1.65
Men 15-24 years	1.02	1.05	1.34
Women 15-24 years	1.50	1.50	2.05

TABLE 7 - COMPARISON OF MAE FROM THREE ALTERNATIVE PROCEDURES VERSUS X-11-ARIMA (CONCURRENT) FOR ADDITIVE SEASONAL ADJUSTMENT OF EMPLOYMENT AND UNEMPLOYMENT SERIES IN NON-RECESSION YEARS

Series	X-11-(concurrent)	X-11-ARIMA(projected implicit factors)	X-11(projected implicit factors)
	X-11-ARIMA (concurrent)	X-11-ARIMA (concurrent)	X-11-ARIMA (concurrent)
UNEMPLOYMENT			
Men 25 years & over	1.31	1.65	1.88
Women 25 years & over	1.20	1.59	1.71
Men 15-24 years	1.22	1.57	1.89
Women 15-24 years	1.05	1.20	1.26
EMPLOYMENT			
Men 25 years & over	1.16	1.24	1.54
Women 25 years & over	1.10	1.27	1.30
Men 15-24 years	1.22	1.31	1.55
Women 15-24 years	1.41	1.68	2.16

Table 8 shows that for the two most important series of the unemployment rate, that is, the unemployment and employment of adult men, the multiplicative option is to be preferred during recession as well as non-recession years. For the most part, the results of table 8 confirm the decomposition models chosen by Statistics Canada according to the model tests (Morry, 1975; and Higginson, 1977). The only apparent exception is the series Employed Men 15-24 which would do better with an additive model but given the fact that the size of the revisions is already very small, this improvement is of no consequence. The MAE's from the multiplicative adjustment are .41 (recession period) and .39 (non-recession period) and are reduced by the additive options to .33 and .31 respectively.

Finally, we observe that the unemployment of adult women would have smaller revisions with a multiplicative instead of an additive seasonal adjustment during recession years.

TABLE 8 - COMPARISON OF MAE OF SEASONAL FACTORS FROM ADDITIVE VERSUS MULTIPLICATIVE X-11-ARIMA (CONCURRENT) SEASONAL ADJUSTMENT DURING RECESSION AND NON-RECESSION PERIODS

Series	Recession Period	Non-Recession Period
	Additive X-11-ARIMA (Concurrent)	Additive X-11-ARIMA (Concurrent)
	Multiplicative X-11- ARIMA (Concurrent)	Multiplicative X-11- ARIMA Concurrent)
UNEMPLOYMENT		
Men 25 years & over	1.25	1.15
Women 25 years & over	1.14	.88
Men 15-24 years	1.23	1.05
Women 15-24 years	.93	.85
EMPLOYMENT		
Men 25 years & over	1.25	1.25
Women 25 years & over	1.00	1.00
Men 15-24 years	.80	.80
Women 15-24 years	1.14	1.17

#### 4 - CONCLUSIONS

Some labour series undergo abrupt seasonal changes during recession periods because of drastic variations in their composition. A case in point is the total unadjusted unemployment in Canada that rose from 790,000 in August 1981 to 1,494,000 in December 1982, with the majority of the new unemployed being regular workers from the manufacturing and services industries which are characterized by seasonal variations of small amplitudes and different patterns than the average unemployed prior to the recession. The rapid changes in the size and composition of this series raise the question whether the seasonal adjustment procedures applied during non-recession ('normal') years are still valid.

This study has assessed several options available in the X-11-ARIMA method adopted by Statistics Canada, the U.S. Bureau of Labor Statistics and other foreign government agencies. The following feasible alternatives have been compared: (1) X-11-ARIMA with concurrent seasonal factors (Statistics Canada's official procedure); (2) X-11-with concurrent seasonal factors; (3) X-11-ARIMA with year-ahead projected seasonal factors; and (4) X-11 with year-ahead projected seasonal factors.

The selection of the best procedure was made based on the minimization of the mean absolute error (MAE) of the seasonal factors that can be used for current seasonal adjustment.

The eight Canadian employment and unemployment series analysed, start in January 1966 and end in October 1982. Taking into consideration the need for at least three and a half more years for a current estimate to become final, the last year for which MAE's can be obtained is 1977. Within the seven-year span of revisions, we distinguished two years of recessions and five years of non-recessions.

We also took into consideration the kind of decomposition model to be applied for seasonal adjustment, that is, additive versus multiplicative. The results of sections 2 and 3 show:

- (1) the X-11-ARIMA with concurrent seasonal factors gives the smallest revisions for each series, whether an additive or a multiplicative seasonal adjustment is made, during both recession and non-recession years.



- (2) The comparisons of the magnitude of the revisions from additive versus multiplicative seasonal adjustment with the X-11-ARIMA concurrent, indicate clearly that the two most important series, unemployment and employment of adult men are of the multiplicative type during recession as well as non-recession periods.
- (3) During recession years, the use of X-11-ARIMA with year-ahead factors and of X-11-concurrent yields equal MAE's for employment and unemployment adult men. For the six remaining series, however, the X-11-concurrent is the second best alternative.
- (4) The least accurate current seasonal adjustment estimates for all series in all the situations discussed are obtained with X-11 year-ahead projected seasonal factors.
- (5) The comparisons of the revisions during recession versus non-recession periods from X-11-ARIMA concurrent show that they are relatively of similar magnitude with the important exception of Unemployment men 25 years and over, where revisions are much higher in recession years. This agrees with the fact that this series undergoes abrupt seasonal changes because of drastic variations in its composition. The larger revisions are mainly due to these new innovations.

On the other hand, the use of concurrent seasonal factors with X-11 shows, for most series, large discrepancies in the size of the revisions of these two periods. An indication that revisions result mainly from the inadequacy of the end filters to estimate well the rapidly changing levels of recession periods.

For only one series, Unemployment Women 15-24 years, the two best procedures yield revisions significantly larger in non-recession years compared to the recession period. This can be explained by the special behaviour of this series during the analysed period which is characterized by large annual increases of about 15% for 1966-73 and 8.5% for 1973-80 obscuring the effect of the business-cycle; and, a seasonal component independent of the business-cycle.

Given the above observations, we can feel confident that the official seasonal adjustment procedure at Statistics Canada will give optimal estimates during the current recession. However, it is expected that because of the severity of the

economic downswing we are experiencing at the present most of the unemployment series will undergo structure changes in composition which will lead to very large revisions of the seasonally adjusted estimates.

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