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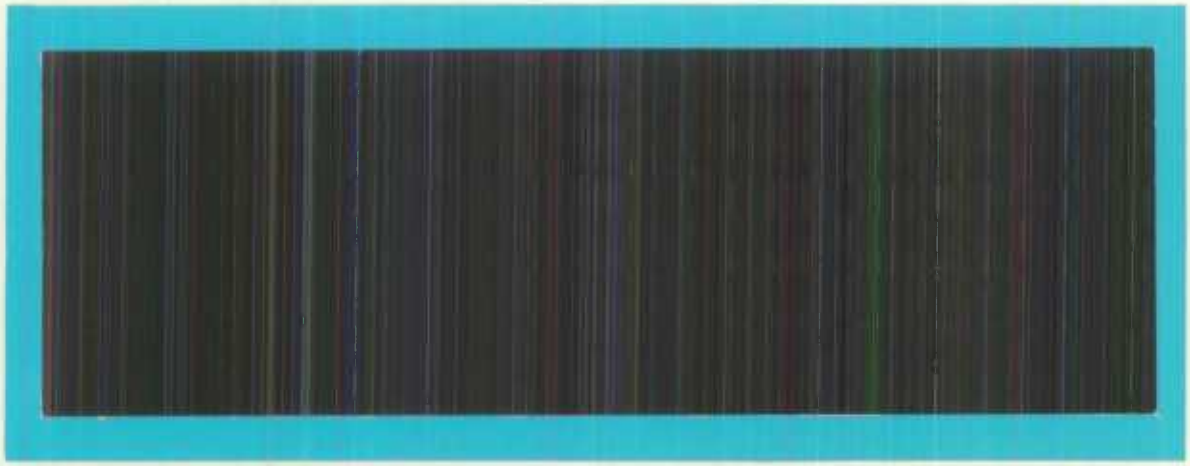

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METHODOLOGY BRANCH

LABOUR FORCE SURVEY RELEASE RULES:
An Examination for Monthly and Annual Average Estimates

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ABSTRACTS:

This report documents the results of a study undertaken to asses the release rules for the Canadian Labour Force Survey (LFS). Release rules are presented for both the monthly and the annual average estimates at provincial and national levels. Two different approaches are used to derive the release rules for monthly and annual average estimates respectively. We use the rules derived from LFS post 1985 redesign information to compare with those from the pre-redesign. We then extend the concepts of the monthly release reliability criteria to develop the release rules for annual average estimates. The evaluation is conducted to assess the performance of the proposed release rules.

Key Words: Release criteria, data quality, annual averages, evaluation.

RÉSUMÉS

Ce rapport fait état des résultats d'une étude réalisée en vue d'évaluer les règles de diffusion de l'Enquête sur la population active (EPA) du Canada. Les règles de diffusion sont présentées pour les estimations des moyennes mensuelles et annuelles aux niveaux provincial et national. Deux différentes approches ont servi à établir les règles de diffusion pour les estimations des moyennes mensuelles et annuelles respectivement. Nous utilisons les règles établies d'après les données consécutives au remaniement de 1985 de l'EPA aux fins de la comparaison avec celles visant la période préalable au remaniement. Puis nous étendons les concepts des critères de fiabilité des données mensuelles en vue d'établir les règles de diffusion des estimations des moyennes mensuelles. L'évaluation est menée pour juger le rendement des règles de diffusion proposées.

Mots clés : critères de diffusion, qualité des données, moyennes annuelles, évaluation.

1. Introduction

The purpose of the Canadian Labour Force Survey release rules is to prevent the disclosure of estimates with poor quality, such as those with a high coefficient of variation (C.V.). These rules must be developed such that they are statistically sound and easy to implement for provincial and national level estimates.

The present rules governing the release of monthly and annual average estimates from the Labour Force Survey (LFS) in the publications, "The Labour Force" and "The Labour Force Annual Averages", are uniform for all estimates at provincial and Canada levels. An estimate of total first rounded to the nearest thousand, is not published if the rounded estimate is less than 4,000 and/or its coefficient of variation (C.V.) is higher than 33.3%. However, in most situations, the C.V.'s for the estimates are not available at the time of release, thus the value of 4,000 is the sole cut-off point for publishing those estimates at provincial and Canada levels. Kumar (1982a) studied the rounding of estimates to the nearest hundreds and proposed a set of release rules for provincial and national estimates for those based on the sample redesign which took place in 1976. The proposed procedures and rules are not used for the rounding and releasing in the two publications. However, a minor modification of this set of rules, in order to use a more uniform value across a region for operational reasons is currently used for releasing data to meet ad-hoc requests. For simplicity of discussion, these release rules developed by Kumar are referred to as 1976 rules (based on 1976 redesign).

The LFS underwent another redesign in 1985. A re-evaluation of these rules becomes necessary to reflect changes due to this redesign. The new rules (referred to as 1985 rules) which are based on post 1985 LFS information, will be developed and evaluated. We also

evaluate the performance of 1976 rules as applied to the release of post 1985 estimates.

Since the annual average estimates are computed using 12 monthly estimates, it is reasonable to use different release rules as the annual average estimates have lower C.V.'s than the monthly estimates (assuming the estimates have approximately the same magnitudes). As a result, this will enable us to release more annual estimates than is presently the case.

This study has the following three specific objectives:

1) To develop 1985 rules for releasing monthly estimates based on post 1985 redesign information;

2) To evaluate the performance of the 1976 and 1985 rules by applying them to the post 1985 monthly estimates;

3) To develop different release rules for annual average estimates.

The following sections describe the concepts and derivations leading to the development of the 1985 rules. Specifically, Section 2 includes the concepts from the previous study of the releasing monthly estimates. Two different approaches were used which yielded almost identical results. In Section 3, we apply the same concepts and formulae and use the post 1985 sample design information to derive the new cut-off points. Note that the release rules and cut-off points are used interchangeably hereafter, i.e. estimates having magnitude less than this number (cut-off point) will not be released. The comparison and evaluation results are provided in Section 4. In Section 5, we extend the concepts of Section 2 to develop the release rules for annual average estimates. An approach which exploits the relationship between the monthly and the annual average estimates is also developed. The 1985 release rules for annual average estimates are presented in Section 6 along with some evaluation results.

2. Concepts and Derivations

In Kumar's (1982a) investigation of the rounding and release criteria, it was first concluded that the policy of rounding an estimate of total to the nearest hundred was better to improve the rounding and release procedures than the practice of rounding to the nearest thousand. Two different approaches were subsequently studied for releasing estimates rounded to the nearest hundreds. See Kumar (1982a, 1982b) for more details.

These two approaches are briefly described below. Let $\hat{X}$ be an estimate of the population total X and $\hat{X}_h$ be the rounded estimate obtained from $\hat{X}$ by rounding to the nearest hundred. E(.) denotes the expectation, and V(.) and RMSE(.) denote the variance and the root mean square error.

1) In the first approach, the rounded estimate $\hat{X}_h$ meets the release reliability (RR) criterion if

$$C.V.(\hat{X}) \leq \frac{1}{3} \tag{2.1}$$

and

$$\frac{E(|\hat{X}_h - X|)}{\sqrt{V(\hat{X})}} \leq 0.2. \tag{2.2}$$

2) In the second approach, the estimate $\hat{X}_h$ meets the RR criterion if

$$RMSE(\hat{X}_h) = \sqrt{E(\hat{X}_h - X)^2} \leq \frac{1}{3}\hat{X}_h \tag{2.3}$$

The above release criteria posed certain operational problems as they required the computation of $V(\hat{X})$ and $C.V.(\hat{X})$ or $RMSE(\hat{X}_h)$. Hence, modifications to these theoretical rules were necessary. The modification was done by expressing the C.V. as the function of the design effects of the characteristic of interest and by considering empirically the design effects of the characteristic "Unemployed" in the provinces under study. In the 1982 study, 60 monthly values (1976-1980 period) of the design effects of "Unemployed" were used. It was also assumed that these values represented the possible range of design effects values for various characteristics of interest. This assumption would result in a conservative cut-off values for all other characteristics. The 60 design effects were ordered and the value for which at least 95% of the design effects were smaller was used to derive the cut-off point X_c, that is, release $\hat{X}_h$ if $\hat{X}_h >= X_c$.

The results from these two different approaches were shown to be in general agreement, i.e., the development of the cut-off points from considering the C.V. from the unrounded estimates (2.1) in conjunction with rounded bias (2.2) is similar to the method considering the mean square errors of the rounded estimates (2.3). The second approach tend to be slightly more conservative than the first one.

3. Development of the Release Rules for Monthly Estimates

Since March, 1985, the LFS redesigned sample has been used and estimates are produced from this design. Henceforth, the term redesign refers to 1985 redesign. In this sample, a new set of sample sizes for different provinces was allocated. This was to reflect changes in population, as well as to reduce the cost in data collection and to incorporate other

methodological developments. Therefore, a new set of release rules may be necessary to reflect the new sample sizes and design effects. For instance, after consultation with the subject-matter analysts, it was suspected, that the cut-off points for P.E.I. could be lower and those for Ontario and Quebec (and hence for Canada) might have to be changed from the previous value of 4,000 to a higher value.

The examination of the release rules could be done either by evaluating the current cut-off points (i.e. 1976 rules) with the estimates produced from the redesign or by developing a new set of cut-off points by using the data from redesign. It is more beneficial to conduct both of these procedures to examine the impact of the redesign upon the release rules. If the results from these procedures are not satisfactory, a different approach may have to be developed.

To obtain a new set of cut-off points from the redesigned data, the approaches mentioned in section 2 are used by applying the new design effects, population sizes and sampling weights. The data from March, 1985 to April, 1988 are used. These 38 months of design effects F_i of the characteristic "unemployed" are ordered and the value $F_{(36)}$ which represents at least 95% of the ordered $F_{(i)}$ is used in the derivation of the cut-off points.

In Table 1, the release rules, which are developed using the redesigned data based on the two approaches for estimates rounded to the nearest hundred, are shown for different provinces. The cut-off points from the second approach are always higher than the ones in the first approach but not by significant margins. The same results hold for the 1982 study (Kumar, 1982a and 1982b). This indicates that the RMSE method is more

conservative than the first approach. Chen (1989) provided more details on the development of these cut-off points. The supplementary Table 6 and Table 7 in Chen (1989) attempt to explain the reasons for the changing cut-off points from the pre-redesign.

Based on the results from the two different approaches presented in Table 1, a new set of cut-off points is proposed in Table 2. Considerations are given to take into account the operational and historical constraints such as a more uniform cut-off value across a region and values more consistent with current practice. In Table 2, we also include the current release rules. This is in the column of 1976 rules.

There are no major differences in these two set of release rules for monthly estimates except in P.E.I and Alberta. We then apply both set of cut-off points to the post 1985 redesign monthly estimates and evaluate their performance.

4. Evaluations on the Monthly Cut-off Points

The proposed 1985 rules which are presented in Table 2 do not indicate a major deviation from the ones based on the Kumar (1982a) study. They do, however, suggest that a lower cut-off point for P.E.I. is feasible. As far as the cut-off points for Ontario and Quebec are concerned, the present level of 4,000 is suggested. This also implies that the cut-off point at the national level remains unchanged. The theoretical values of cut-off points for these two provinces were at 4,600 in the 1982 study. However, a level of 4,000 was recommended in order to conform to the practice used at that time. Also, it made no practical difference as very few estimates are in the range from 4,000 to 4,600. Another significant decrease in cut-off point is seen in Alberta. It decreases from 2,800 to 2,000,

probably because the extra samples were added in the 1985 redesign.

The evaluation procedure is designed to find the occurrence of estimates which do not meet release criteria (2.1) and (2.2) but are eligible for release under the 1985 or 1976 rules. The performance of these cut-off points was evaluated by applying them to all provincial and national monthly published LFS estimates (Variance Summary Tables) for 58 months from March, 1985 to December, 1989.

The results indicate that 283 estimates would have been released without meeting the RR criteria of (2.1) and (2.2) under the 1985 rules (See Table 3). There are 72 estimates which would have been released with a C.V. more than 33.3%. However, the majority (211 of them) not meeting the RR criteria are from P.E.I., and they fail to meet rounding bias criterion (2.2).

Among these 211 estimates in P.E.I., 34 are at a level between 1,000 and 1,300. (Note that 177 of them do not meet the release criteria under the 1976 rules of 2,000). All the other estimates in P.E.I. which do not meet the rounding bias criterion are with a estimate significantly higher than 3,000. Most of them are concentrated in the Male category, especially in age groups between 25 to 34, 35 to 44, 45 to 54 and 55 to 64 under the characteristic "in Labour Force". Since the rounding bias $E|\hat{X}_h - X|$ is assumed to be 25 in (2.2), estimates which violate (2.2) are those with variance less than or equal to 15,625. Because the Variance Summary Table used for evaluation only gives variances in steps of ten thousand, a cut-off value of twenty thousand was used instead of 15,625. This conservative approach resulted in a larger number of failed estimates in P.E.I., i.e., 211 is an over estimate. The suggested release cut-off point for P.E.I., therefore remains at 1,000 for operational reasons since the bias of these estimates is very small in comparison

to the magnitude of the estimates.

As in Quebec and Ontario, the estimates which failed the RR criteria have a value much larger than 4,000. As mentioned before, there are also very few estimates in the range between 4,000 and 4,600, therefore the cut-off points at 4,000 for these two provinces are reasonable choices.

Generally speaking, the performance results from the evaluation of the 1985 monthly rules are satisfactory. With the exception of the problem in P.E.I. mentioned above, the cut-off levels for all the other provinces perform very well. The total number of failed estimates, in fact, is an extremely small fraction of the total number of estimates evaluated. For instance, in P.E.I, less than 1% of the estimates under evaluation failed the release criteria.

5. Derivations Release Cut-offs for Annual Average Estimates

In this section, we consider the development of the release cut-off points for annual average estimates. Two different methods are used to develop the cut-off points. In Method 1, due to the lack of data available to properly derive the release rules for rounded annual average estimates and the fact that the second approach in Section 2 provides more conservative results than the first one, we first use the variance reduction factor (See Appendix 1) to develop the cut-off points for rounded estimates based on the RMSE method.

In Method 2, however, we explore the relationship between the monthly estimates and the annual average estimates. Using this relationship the cut-off points for annual average estimates can be derived in terms of monthly cut-off points. Again, the release rules for annual average estimates are developed for the estimates rounded to the nearest hundred.

This is consistent with the recommended monthly cut-off points. See Appendix for the mathematical derivations of these two methods.

In summary, we present the release rules for the rounded annual average estimates $\hat{Y}_h$ based on above two methods:

1) Release $\hat{Y}_h$ if $\hat{Y}_h >= G_h(F)$, or

2) Release $\hat{Y}_h$ if $\hat{Y}_h >= .76X_c$, where X_c is the monthly cut-off point.

The explanations for $G_h(F)$ and the constant factor of 0.76 are contained in the appendix. These two release rules are based on two different methods respectively. However, we make use of the empirical results from second method along the information obtained from first method in order to recommend the release rules for annual average estimates.

6. Development and Evaluation of Release Rules for Annual Average Estimates

The development of the release rules for annual average estimates is based on two methods discussed in Section 5. In Method 1, the data used in the computation is the same as that used for monthly release cut-off points. That is, the data used is from March, 1985 to April, 1988. The characteristic "employment" is used to compute the variance reduction factor K. This reduction factor is assumed to represent various characteristics of interest. This assumption will result in a conservative approach since most other characteristics will have a lower reduction factor.

The design effects of the characteristic "unemployed" F_i from March, 1985 to April, 1988 are ordered. The reduction factor K and $F_{(36)}$ are used in (A1.8). As in the monthly derivations, this $F_{(36)}$ is thought to be representative of at least 95% of the design effects of all the characteristics of interest for annual average estimates.

In Method 2, we use the characteristic "Employed in Agriculture" to compute correlation coefficient. According to a recent study (see [1]), this characteristic has the highest month to month correlation among many other variables. This highest correlation will also result in a conservative approach in the derivation of the cut-off points for other characteristics.

The cut-off points based on these two methods are presented in Table 4. The release rule at the Canada level is set equal to the maximum of the provinces' estimates. Generally speaking, the second method will have more conservative results than the first one since X_c are conservative monthly cut-off points.

The suggested release rules for annual average estimates are also presented in Table 4, i.e. release $\hat{Y}_h$ if $\hat{Y}_h >= Y_c$. This set of release rules is based on the information from Methods 1 and 2 rounded up to the nearest hundred. Also, more importantly, this set of release rules is based on operational constraints and the relationships between the monthly cut-off points. That is, the release rules for annual average estimates turn out to be roughly 75% of those for monthly estimates.

The annual average estimates from 1986 to 1989 are used to examine the performance of the these cut-off points. The evaluation is carried out to determine the occurrence of estimates which do not meet the criteria but are eligible for release. In other words, the estimates might be larger than the cut-off points but the C.V.'s could well be larger than 33.3%. The 1986 to 1989 estimates are rounded to the nearest hundreds and the occurrences of such estimates are recorded. Only 5 out of all the published estimates (from Annual Average Variance Estimates files) fail the evaluation criteria.

7. Concluding Remarks

The release rules for monthly and annual average estimates are presented in Table 2 and Table 4 respectively. The release rules for the annual average estimates are roughly 75% of those for the monthly estimates.

We conclude from our results that the release rules developed using data from post-redesign in 1985 are similar to those developed under the pre-redesign for the monthly estimates with the exception of a few provinces. However, the new set of release rules enables us to release more estimates without violating the release reliability. We furthermore concentrate the work on developing the cut-off points for the annual average estimates.

As mentioned before, the suggested release rules for the post-redesign estimates have taken operational and historical constraints into consideration (i.e. more consistent value within a region and values consistent with the current practice). These cut-off points however, are the minimum acceptable values, especially for the monthly estimates. In other words, if these cut-off points are to be modified, say for a uniform value across a region, then they can only be changed upward. There is no theoretical justification or empirical evidence to support lower values.

The evaluation results based on these cut-off points prove to be satisfactory. The results perform extremely well in the annual average estimates evaluation. In fact, many estimates with values much less than the cut-off points have C.V.'s less than 33.3%.

It is recommended that this new set of release rules be implemented. More reliable estimates can be released without violating the release reliability criteria. Only the level estimates are considered in this study. The release cut-off points for an estimate of a ratio , such as unemployment rate, can be further studied if deemed necessary.

Table 1. The Derivation Results of Two Approaches

for Rounded Monthly Estimate $\hat{X}_h$ using Post 1985 data

PROV.	Approach 1	Approach 2
NFLD.	2200	2300
P.E.I.	600	700
N.S.	1600	1700
N.B.	1800	1900
QUE.	4200	4300
ONT.	3900	4000
MAN.	1200	1300
SASK.	1200	1300
ALTA.	1800	1900
B.C.	2600	2700

Table 2. The Cut-off Points X_c from Both Designs

Release $\hat{X}_h$ if $\hat{X}_h >= X_c$

PROV.	1976 Rules	1985 Rules	Difference (Col 3-Col 2)
NFLD.	2000	2000	0
P.E.I.	2000	1000	-1000
N.S.	2000	2000	0
N.B.	2000	2000	0
QUE.	4000	4000	0
ONT.	4000	4000	0
MAN.	2000	1600	-400
SASK.	2000	1600	-400
ALTA.	3000	2000	-1000
B.C.	3000	3000	0
CANADA	4000	4000	0

1976 Rules = Currently used cut-off points
1985 Rules = Proposed cut-off points.

Table 3. Evaluation Results of the Total Number of Monthly Estimates Not Meeting the Release Criteria

	1976 Rules			1985 Rules		
	Total	CV > = 1/3	Biased	Total	CV ≥ 1/3	Biased
NFLD.						
P.E.I.	177	0	177	211	0	211
N.S.						
N.B.	2	2	0	2	2	0
QUE.	21	21	0	21	21	0
ONT.	7	7	0	7	7	0
MAN.	2	2	0	2	2	0
SASK.						
ALTA.				1	1	0
B.C.	34	34	0	34	34	0
CANADA	5	5	0	5	5	0
Total	248	71	177	283	72	211

Note: Based on performance results from March, 1985, to December, 1989.
1976 Rules = Under 1982's suggested cut-off points.
1985 Rules = Under proposed cut-off points.

Table 4. The Cut-off Points from the Two Methods and the Proposed Release Rules for Annual Average Estimates

PROV.	K	Method 1	Method 2	Y_c
NFLD.	.3972	977	1520	1500
P.E.I.	.3805	361	760	800
N.S.	.4041	747	1528	1500
N.B.	.5022	986	1520	1500
QUE.	.4619	2037	3040	3000
ONT.	.3975	1630	3040	3000
MAN.	.4154	615	1216	1000
SASK.	.4110	612	1216	1000
ALTA.	.4406	909	1520	1500
B.C.	.3682	1064	2280	2000
CANADA		2037	3040	3000

Note: The variance reduction factor K is for "Employment".
The cut-off points Y_c, i.e. release $\hat{Y}_h$ if $\hat{Y}_h >= Y_c$.

APPENDIX

Derivation of Release Rules for Annual Average Estimates

1. Method 1

Let the $\hat{X}_i$ be estimated totals for month i, i = 1,2,... 12, then the annual average $\hat{Y}$ is

$$\hat{Y} = \sum_{1}^{12} \frac{\hat{X}_i}{12} \qquad \text{(A1.1)}$$

We denote the variance of monthly estimate $\hat{X}$ as $V(\hat{X})$ and variance of $\hat{Y}$ as $V(\hat{Y})$, then the variance reduction factor K is defined as

$$K = \frac{V(\hat{Y})}{\bar{V}(\hat{X})} \qquad \text{(A1.2)}$$

where $\bar{V}(\hat{X})$ is the average variances of the monthly estimates. We assume later on that $\bar{V}(\hat{X}) = V(\hat{X})$ and the magnitude of the estimate $\hat{Y}$ is the same as $\hat{X}$.

The release criterion in releasing $\hat{Y}_h$ is

$$RMSE(\hat{Y}_h) = \sqrt{E(\hat{Y}_h - Y)^2} \leq \frac{1}{3}\hat{Y}_h \qquad \text{(A1.3)}$$

Similar to Kumar (1982a) development and assumptions on using RMSE approach, where the rounding bias is assumed to be 50, (A1.3) can be satisfied if

$$\sqrt{V(\hat{Y}) + 2500} \leq \frac{1}{3}\hat{Y}_h \qquad \text{(A1.4)}$$

Since $\hat{Y}_h >= \hat{Y} - 50$, then (A1.4) is satisfied if

$$\sqrt{V(\hat{Y}) + 2500} \leq \frac{1}{3}(\hat{Y} - 50). \qquad \text{(A1.5)}$$

It is well known that

$$V(\hat{Y}) = KF(W-1)\hat{Y}(1-\frac{\hat{Y}}{P}), \qquad \text{(A1.6)}$$

where the variables F, W and P are the design effects, sampling weights and population totals respectively. K is the variance reduction factor defined in (A1.2). Substitute (A1.6) to (A1.5) and solve the quadratic form inequality, then (A1.3) is satisfied if

$$\hat{Y} \geq G(F) \qquad \text{(A1.7)}$$

where

$$G(F) = \frac{1}{2(P + 9KF(W-1))}(100P + 9KF(W-1)P + \sqrt{(100P + 9KF(W-1)P)^2 + 80000P(P + 9KF(W-1))}) \qquad \text{(A1.8)}$$

We propose that release $\hat{Y}_h$ if $\hat{Y}_h >= G_h(F)$, $G_h(F)$ is obtained from G(F) by rounding it to the nearest hundred.

2. **Method 2:**

In Method 2, a different approach is used. The relationship between the annual average estimates $\hat{Y}$ and the monthly estimates $\hat{X}_i$ is explored, that is, the release rules for the annual average estimates can be expressed in terms of the recommended monthly cut-off points X_c.

Based on the development of the monthly release cut-off points, the criterion

$$C.V.(\hat{X}) = \frac{\sqrt{V(\hat{X})}}{\hat{X}} \leq \frac{1}{3} \qquad \text{(A2.1)}$$

implies equivalently that

$$\hat{X} \geq 3\sqrt{V(\hat{X})}. \qquad \text{(A2.2)}$$

In order to release $\hat{X}_h$, we choose the monthly cut-off point $\hat{X}_c$ such that the following condition must be satisfied

$$\hat{X}_h \geq X_c \geq 3\sqrt{V(X)}. \qquad \text{(A2.3)}$$

Similarly, we have the release reliability criterion of the annual average estimate $\hat{Y}$ as

$$C.V.(\hat{Y}) = \frac{\sqrt{V(\hat{Y})}}{\hat{Y}} \leq \frac{1}{3}, \qquad \text{(A2.4)}$$

then we have

$$\hat{Y} \geq 3\sqrt{V(\hat{Y})}. \qquad \text{(A2.5)}$$

This relationship combined with (A1.1) results in

$$3\sqrt{V(\hat{Y})} = 3\sqrt{\frac{1}{144}\left(\sum_{1}^{12} V(\hat{X}_i) + \sum_{i \neq j}^{12} Cov(\hat{X}_i, \hat{X}_j)\right)}. \qquad \text{(A2.6)}$$

We assume $V(\hat{X}_i) = V(\hat{X}_j) = V(\hat{X})$, for all i and j in order to simplify (A2.6). This gives the equation

$$3\sqrt{V(\hat{Y})} = \frac{1}{4}\sqrt{12V(\hat{X}) + \sum_{i=1}^{11} (24-2i)\hat{\rho}_i V(\hat{X})}, \qquad \text{(A2.7)}$$

where ρ_i are the month-to month correlation coefficients. We choose the correlation from the characteristic "employed in agriculture" as a representative of all the characteristics of interest. This relatively high correlation coefficient enables us to develop the upper bound. According to a recent study (Boyer, 1990), the expression in (A2.7) by using the estimated correlations of the characteristic "employed in agriculture" at national level is

$$\sum_{1}^{11} (24-2i)\hat{\rho}_i = 71.$$

Then (A2.7) is

$$3\sqrt{V(\hat{Y})} \leq \frac{1}{4}\sqrt{83\, V(\hat{X})} \qquad \text{(A2.8)}$$

for all characteristic Y. From (A2.3), this is further reduced to

$$3\sqrt{V(\hat{Y})} = \frac{\sqrt{83}}{12} 3\sqrt{V(\hat{X})}$$
$$\leq \frac{\sqrt{83}}{12} X_c$$
$$= .76X_c . \qquad \text{(A2.9)}$$

Therefore, we release $\hat{Y}_h$ if $\hat{Y}_h >= Y_C = .76X_c$, X_c is the recommended monthly cut-off points.

REFERENCES

1. Boyer, R. (1990), "Second Study on Correlation from Month to Month in LFS", Internal Memorandum, Statistics Canada.

2. Chen, E. (1989), "Examination of the Labour Force Survey Release Criteria (for monthly estimates)", Internal report, Social Survey Methods Division, Statistics Canada.

3. Kumar, S. (1982a), "Investigation of the Labour Force Survey Rounding and Release Criteria", Technical Report, Social Survey Methods Division, Statistics Canada.

4. Kumar, S. (1982b), "Notes on the Labour Force Survey Rounding and Release Criteria", Technical Report, Social Survey Methods Division, Statistics Canada.

5. Statistics Canada, "The Labour Force Annual Averages", Catalogue 71-001, January, 1990.