ROTATION GROUP BIAS IN THE LFS ESTIMATES [1]

P.D. GHANGURDE [2]

The paper attempts to evaluate the impact of non-response adjustment by rotation groups on rotation group bias in the estimates from the Canadian Labour Force Survey. Results on bias and non-response characteristics are presented and discussed. An index used to measure rotation group bias is given and some empirical results are analyzed.

1. INTRODUCTION

In the Canadian Labour Force Survey (LFS) sample design each month one-sixth of the households rotate out of the sample and one-sixth rotate in. The sample is thus composed of six panels or rotation groups. In any given month households in a rotation group have been in the survey from one to six months, including the current month. It is well-known that in household surveys with rotation sample designs estimates for the same characteristics from different rotation groups could have different expected values. This phenomenon, called rotation group bias, has been studied for the LFS and other household surveys with rotation sample designs (see [1], [5], [7] and [8]).

Rotation group bias can be attributed to several factors. In the LFS the non-response rates at household level are known to differ between rotation groups i.e. number of months a household is in the survey. It is also known that non-respondent households tend to have different characteristics as compared to respondent households. Both these factors can contribute to bias. Due to conditioning of the respondent or familiarity with the survey

---

[1] Presented at the American Statistical Association Meeting in Cincinnati, August 1982.

[2] P.D. Ghangurde, Census and Household Survey Methods Division, Statistics Canada.

over a period of six months, response bias in the data from successive months can be of different magnitude. There is some evidence from the LFS reinterview data of such differential bias over the period of six months. However, in the literature it has also been hypothesized that rotation group biases can be attributed to differences in non-response probabilities between rotation groups [7]. Although individual probabilities are not known, their averages can be estimated by non-response rates.

In this paper an attempt is made to evaluate the impact on rotation group bias of non-response adjustment by rotation groups. In section 2 some results on bias are introduced and their implications on the bias in the estimates from different rotation groups are discussed. Section 3 presents some data on nonresponse rates in the LFS and characteristics of respondents and non-respondents by months in the survey and their contribution to rotation group bias. Section 4 explains the adjustment of LFS weight for non-response by rotation groups and its impact on the rotation group bias and an index used as a measure of rotation group bias. In section 5, some data on the index for labour force status categories, based on 1981 surveys, are analyzed.

2. THE STATISTICAL MODEL

We introduce a model which provides expressions for contribution to bias of differences in non-response rates, differences in characteristics of respondents and non-respondents and response bias for any groups of the sample in which adjustment of weight for non-response can be done. Rotation groups can be considered as a particular case of these groups.

A population of size N is assumed to be divided into "strata" of respondents and non-respondents of sizes N_1 and N_2 respectively. A simple random sample of size n is drawn and responses are obtained from n_1 units and $(n-n_1)$ units are non-respondents.

Suppose the sample can be divided into K groups such that non-response rates and characteristics of respondents and non-respondents differ between the groups. The data collection methods used in these groups and the extent of conditioning of respondents or their familiarity with the survey could be different leading to differences in non-response rates and characteristics and also possibly to different response biases. By an extension of a result in [2] and [6] to include response bias component, the bias of the sample mean $\bar{y}$ of n_1 units (without adjustment of weight for non-response within groups) is given by

$$B(\bar{y}) = \frac{1}{\bar{R}} \sum_{i=1}^{K} P_i \bar{Y}_{1i} (R_i - \bar{R}) + \sum_{i=1}^{K} P_i (1-R_i) (\bar{Y}_{1i} - \bar{Y}_{2i})$$

$$+ \frac{1}{\bar{R}} \sum_{i=1}^{K} \bar{P}_i \; R_i \; \beta_i, \qquad (1)$$

where $\bar{Y}_{1i}$ and $\bar{Y}_{2i}$ are population means of respondents and non-respondents in the i^{th} group, R_i, response rate for the i^{th} group, P_i, proportion of total population in the i^{th} group, $\bar{\beta}_i$, mean response bias in the i^{th} group and $\bar{R} = \sum_{i=1}^{K} P_i R_i$, overall response rate.

The above expression shows the decomposition of bias into three components. The first shows contribution of differential response rates, the second due to differences in characteristics between respondents and non-respondents and the third due to response bias. For simplicity, we consider in this paper characteristics based on attributes, e.g., proportions of "employed" and "unemployed". We now consider the estimate $\bar{y}_a$, with adjustment for non response by inverse of response rate done within each group. Thus

$$\bar{y}_a = \frac{1}{n} \sum_{i=1}^{K} n_{.i} \; \bar{y}_i,$$

where $n_{.i}$ is sample size in the i^{th} group and $\bar{y}_i$ is mean of n_{1i} units in the i^{th} group. The bias of $\bar{y}_a$ is given by

$$B(\bar{y}_a) = \sum_{i=1}^{K} P_i (1-R_i) (\bar{Y}_{1i} - \bar{Y}_{2i}) + \sum_{i=1}^{K} P_i \bar{\beta}_i. \qquad (2)$$

The first component of bias in (1) due to differential response rates between groups is eliminated, the second component due to differences in characteristics remains the same and the third component due to response bias could be different from that in (1).

Based on a framework of response non-response error model involving response probabilities at unit level, the bias has been decomposed into components due to non-response and response errors [3]. The above decomposition of bias does not use response probabilities at the level of individual units but is simple enough for empirical evaluation of the components.

If response rates do not differ between the groups the first component is zero so that, (1) is identical to (2); hence non-response adjustment within the groups does not lead to reduction in bias. The difference in the bias of $\overline{y}$ and $\overline{y}_a$ is given by

$$B(\overline{y}) - B(\overline{y}_a) = \frac{1}{\overline{R}} \sum_{i=1}^{K} P_i \, (\overline{R}_i - \overline{R}) \, (\overline{Y}_{1i} + \overline{\beta}_i). \qquad (3)$$

Thus if response rates are different, and $\overline{Y}_{1i}$ and $\overline{\beta}_i$ do not differ between the groups, there is no change in the bias after non-response adjustment within the groups. If the means $\overline{Y}_{1i}$ and $\overline{\beta}_i$ differ between the groups there is a decrease in bias if the term on the right-hand side of (3) is positive and an increase, if it is negative. The change in absolute bias from $|B(\overline{y})|$ to $|B(\overline{y}_a)|$ as result of adjustment will depend upon the sign and magnitude of the term on the right hand side of (3).

The bias of estimate of mean for i^{th} rotation group, without adjustment and with adjustment of weight for non-response by rotation groups, is obtained from (1) and (2) by simple substitution of $P_i = 1$ and keeping the terms corresponding to the rotation group. Also, from (3) the difference in biases of estimate for i^{th} rotation group is given by

$$B(\overline{y}_i) - B(\overline{y}_{ia}) = \left(\frac{R_i - \overline{R}}{\overline{R}} \right) (\overline{Y}_{1i} + \overline{\beta}_i), \qquad (4)$$

where $\overline{y}_i$ and $\overline{y}_{ia}$ are estimates for i^{th} rotation group before and after adjustment. Assuming $(\overline{Y}_{1i} + \overline{\beta}_i) > 0$ for all i, if $R_i < \overline{R}$, the bias for i^{th} rotation group increases after adjustment and if $R_i > \overline{R}$, it decreases.

Since the population of respondents in a survey month is the same for various rotation groups, it may be argued that the proportions $\overline{Y}_{1i}$ could be the same for all rotation groups or months in the survey. However, the differences in exposure to survey or conditioning of the respondents can produce different response biases, $\overline{\beta}_i$, between rotation groups. Thus the difference in the bias of $\overline{y}$ and $\overline{y}_a$ is given by

$$B(\overline{y}) - B(\overline{y}_a) = \frac{1}{\overline{R}} \sum_{i=1}^{K} P_i (R_i - \overline{R}) \overline{\beta}_i. \qquad (5)$$

However, the difference in bias of estimates for rotation group i is given by (4).

It may also be noted that under the assumption of constant $\overline{Y}_{1i}$ and $\overline{\beta}_i$ for all i and differential response rates, non-response adjustment by rotation groups does not change the bias of estimate based on all rotation groups. However, the change in the biases of individual rotation groups after non-response adjustment are accounted for by different response rates.

The above results are useful in the evaluation of contribution of various factors to rotation group bias and the impact of adjustment of weight by rotation groups on the estimates of rotation group bias.

The LFS is a monthly national household survey with a sample size of 55,000 households. Each of the ten provinces in Canada is divided into economic regions, which consist of groups of counties with similar economic structure. The economic regions are divided into homogeneous strata on the basis of distribution of employed persons in various industry-occupation groups in the last Census. The sample design is stratified multi-stage sampling with two stages in the self-representing (SR) urban areas and three or four stages in the non-self-representing (NSR) rural areas of the design. The sample selection in the initial stages is with probability proportional to population size and that in the last stage, where dwellings are selected from clusters, being systematic. The selected clusters are assigned six rotation numbers independently within each stratum. In any survey month one-sixth of the households have been in the survey from 1 to 6 months. Thus the entire sample is divided into six equally representative sub-samples of equal sizes [4]. The rotation numbers for six rotation groups can be converted to number of "months in the survey" by a simple transformation.

The adjustment of weight for non-response is done for the entire sample in balancing units by ratio of households in the sample to responding households. In the NSR areas each primary sampling unit (PSU) is divided into two balancing units consisting of urban and rural parts. In the SR areas of the design, strata (called sub-units) form balancing units. The number of balancing units thus exceeds 900 in NSR areas and 800 in SR areas.

In order to evaluate the rotation group bias in the LFS estimates, with and without adjustment, data on non-response rates $(1-R_i)$ and $\overline{Y}_{1i}$ and $\overline{Y}_{2i}$, proportions for the characteristics "employed" and "unemployed" for respondents and non-respondent respectively in twelve surveys in 1981 are presented and analyzed in Section 3. The "months in the survey" represents number of months (including the current month) a rotation group is in the survey. No data on response biases, $\overline{\beta}_i$, are presented.

3. ANALYSIS OF LFS DATA

Table 1 shows average non-response rates, $(1-R_i)$, by months in the survey for calendar months in 1981. It can be seen that the rates differ substantially between the two areas and between months in the survey for a given area. In both the areas and at Canada level, non-response rates are high in the first month, decrease substantially in the second month and decrease slowly over the succeeding months. The high non-response rates in the first month are contributed by "temporary absent" and "no-one-at home" type households. In the later months the rates reduce due to interviewer's knowledge about the best time to call on these households. The rates are higher in SR areas, especially apartments (not shown in the table) as compared to NSR areas. During processing, for approximately 1/2% households data are carried forward from the previous month. The non-response rates presented in the tables are obtained by considering those households as respondent. It may be noted that difference of rates from their mean $(R_i - \overline{R})$, is negative in the first and in some cases in the second month in the survey and positive in the following months. The mean rate $\overline{R}$ is approximately equal to R_2. Thus from (4) relative bias for first month in the survey is expected to increase, if $(\overline{Y}_{1i} + \overline{\beta}_i)$ and population mean $\overline{Y}_i$ are assumed constant; for months 3 to 6, the relative bias is expected to decrease after adjustment of weight for non-response.

Table 2 shows estimated proportions, $\hat{\overline{Y}}_{1i}$ and $\hat{\overline{Y}}_{2i}$, of employed and unemployed heads of households by months in the survey for respondent and non-respondent households respectively. The estimates were obtained from LFS longitudinal files for the period March - August 1976 and are based on unweighted counts. The data on non-respondents, who responded at least once during the six month period, were obtained from months in which they responded. Non-respondent households tend to have greater proportion of employed heads and lesser proportion of unemployed heads as compared to respondent households. It is known that the difference of proportions between respondents and non-respondents for employed persons tends to be 0.10 and that for unemployed persons tends to be about 0.005, the signs of differences remaining the same. No particular trend over months in the survey can be observed in the proportions of employed and unemployed heads among respondent and non-respondent households.

The contribution of the first month to the first component is negative in all calendar months for both unemployed and employed. This indicates that the bias for the first month in the survey is expected to increase after adjustment for non-response.

The analysis in sections 2 and 3 isolates rotation groups as groups considered for non-response adjustment. For real data, the same relative changes may not be seen due to impact of differential response rates in other groups and changes in magnitude of $\overline{Y}_{1i}$ and $\overline{\beta}_i$ during the six month period. In section 5, we analyze the impact of non-response adjustment by rotation groups on rotation group bias in the LFS estimates and attempt to explain the results on the basis of the model.

It may be noted that non-response adjustment in the present weighting of LFS data is done within balancing units which are much smaller than NSR and SR areas within a province. Thus the estimates of rotation group bias based on the present weighting and non-response adjustment are corrected for differential non-response rates between the two areas but not for those between rotation groups.

4. WEIGHT-ADJUSTMENT BY ROTATION GROUPS

The LFS final weight is composed of five factors: (1) mathematical weight, (2) rural-urban factor, (3) cluster sub-weight (4) balancing factor and (5) age-sex factor. The mathematical weight for a household is the inverse of overall sampling ratio for the household, based on the sample design. Within each province the weight is the same within urban (SR) and rural (NSR) strata except in a few cases, resulting in twenty areas at Canada level with the same mathematical weight. The cluster sub-weight is the inverse of sampling ratio within a cluster. The balancing factor adjusts the weight for non-response and age-sex factor is a ratio adjustment factor based on projected population within age-sex groups at province level.

As explained in section 2, adjustment of weight for non-response is done within balancing units for the sample of households. For the evaluation of impact of weight adjustment by rotation groups, it was decided to use progressively smaller areas (as balancing units) starting with rotation groups at province level. The adjustment of final weight within rotation groups in these areas was done by multiplying by adjustment factors:

$$R_{H(i)} = \frac{\text{respondent households in the sample}}{\text{respondent households in rotation group (i)}}$$

$$R_{p(i)} = \frac{\text{respondent persons in the sample}}{\text{respondent persons in rotation group (i)}}$$

The first factor weights up the estimate of households within a rotation group in a balancing unit to the level of sample of respondent households. The balancing factor weights it up to the level of sample of households within the balancing unit. The second factor, based on the count of respondent persons weights up the estimates to the level of the entire sample of respondent persons and thus corrects the estimates for different household sizes or coverage of persons within households. It is known that non-respondent households tend to have smaller sizes as compared to respondent households. The difference in non-response rates between rotation groups may result in differences in average household sizes.

If $\hat{Y}(i)$ is estimates total of i_{th} rotation group and $Y(i)$, true value of i_{th} group total, then the estimate of relative bias of estimated total of i_{th} rotation group is given by

$$B_y(i) = \frac{\hat{Y}(i) - Y(i)}{Y(i)} \; ; \; i = 1,2,...6. \qquad (6)$$

Since $Y(i)$'s are not known and can be assumed to be approximately equal (since rotation groups have equal expected sizes at large area level) $\hat{\hat{Y}}(.)$, the mean of six rotation group total estimates can be used in place of $Y(i)$. The rotation group bias index for i_{th} rotation group is given by

$$I_y(i) = \frac{\hat{Y}(i)}{\hat{\hat{Y}}(.)} . \; 100 = 1 + \beta_y(i) . \; 100 \qquad (7)$$

It may be noted that, since the mean of estimates of six rotation group totals is used instead of true values, $I_y(i)$ may be biased but is useful as a measure for evaluation of difference in relative biases between rotation groups for various sub-groups of the population and adjustment of weight based on household and person counts. Similarly, $P_y(i)$, the rotation group bias of population estimate can be defined for individual rotation groups. The values of the index $I_y(i)$ above 100 indicate positive relative bias and the values below 100 indicate negative relative bias. Similarly, the index $I_p(i)$ can be interpreted.

5. ANALYSIS OF DATA ON ROTATION GROUP BIAS INDEX

In the following tables data on rotation group bias index for population and labour force status categories by type of area and age-sex groups are presented and analyzed. The index values are obtained by using final weights and the same adjusted for non-response by rotation groups using each of the two factors based on household and person counts. A comparison of index values based on adjusted and unadjusted weights is used in evaluation of impact of weight adjustment on estimates of rotation group bias. The adjustment of weight by rotation groups, using household counts, was done at province level. Thus the final weights for households in the six rotation groups in each province were multiplied by adjustment factors $R_H(i)$; i = 1,2,...6. Similarly, the adjustment based on count of persons was done at province level by factors $R_P(i)$; i = 1,2,...6. In order to evaluate the impact of these adjustments on estimates of population we present Table 3 showing rotation group bias index for population estimates by type of area and months in the survey for twelve surveys in 1981. The index values based on unadjusted weight indicate that there is relative underestimation of persons in the first and the sixth month in both SR and NSR areas. The index values based on weight adjustment using household counts show some improvement in bias; however, this adjustment assumes that household size is the same in six rotation groups. The index values based on weight adjustment using counts of respondents are closer to 100.0 in both the areas, as compared to those based on household adjustment. Thus, the adjustment based on count of persons seems to correct the estimates for differential bias better than the adjustment based on household counts. The higher index values in earlier months and lower in later months could be due to changes in size of non-responding households by month in the survey.

Tables 4 and 5 present data on average index values by type of area and age-sex groups for twelve surveys in 1981. Index values by type of area based on unadjusted weight indicate that relative bias of estimates of unemployed tends to be positive in the first two months and shows a decreasing trend in the later months. Those for employed and in labour force tend to be negative in the first month and positive in the following months. Data on index values by age-sex groups show similar trends as those by type of area.

The adjustment of weight for non-response based on household counts tends to increase the index values in the first month and also fifth and sixth months. The index values in other months tend to decrease. This is true for index values for labour force status by type of area and age-sex groups. The increase in index values in the first month can be attributed to lower than average response rates and the decrease in index values in the following months to higher than average response rates. The decrease in the last two months can not be explained on the basis of higher than average response rates if $(\overline{Y}_{1i} + \overline{\beta}_i)$ is assumed constant.
The adjustment of weight for non-response based on count of persons tends to increase the index values in the first month and decrease the index values in the third to sixth month. The index values for the first month based on adjustment using count of persons tend to be greater than those based on household adjustment. The adjustment based on count of persons seems to correct the estimates for differential response between rotation groups. The response rates are low in the first month resulting in increase in relative bias after adjustment. The decrease in the relative bias in the third to sixth month seems to be due to lower than average response rates at household level, corrected for differential household size between rotation groups.

6. SUMMARY AND CONCLUDING REMARKS

This paper considers a model which decomposes overall bias into three components, showing the contribution due to differences in response rates, response biases and characteristics of respondents and non-respondents between groups of a sample. Rotation groups can be considered as a particular case of these groups in which adjustment of weight for non-response can be done separately. The model also shows contribution of various factors to rotation group bias.

If response rates differ between rotation groups, and the proportion of a characteristic for respondents and the associated response bias is equal for all rotation groups, non-response adjustment by rotation groups does not change the bias of estimates. However, rotation group bias can increase or decrease, according as response rate is lesser or greater than the mean response rate. This is corroborated by data on index values before and after adjustment of weight, based on count of persons.

It is proposed to analyze index values for labour force status and other characteristics for larger data sets and to study the impact of differences in average household sizes between rotation groups and respondent and non-respondent households on estimates of rotation group bias. The contribution of differential response rates and response biases to rotation group bias, after adjustment for non-response by rotation groups, will also be analyzed.

ACKNOWLEDGEMENTS

The author would like to thank R. Vettore and R. Barnes for the development of computer programs and the referees for helpful comments.

REFERENCES

[1] Bailar, B.A., (1975), The Effect of Rotation Group Bias on Estimates from Panel Surveys, JASA, Vol. 70, pp 23-30.

[2] Bailar, B.A., Bailey, L. and Corby, C., (1978), A Comparison of Some Adjustment and Weighting Procedures for Survey Data, Survey Sampling and Measurement, Academic Press, pp 175-198.

[3] Platek, R., Singh, M.P. and Tremblay, V., (1978), Adjustment for Non-Response in Surveys, Survey Methodology, Vol. 3, No. 1, pp 1-24.

[4] Statistics Canada (1976), Methodology of the Canadian Labour Force Survey, Catalogue 71-526, Occasional.

[5] Tessier, R. and Tremblay, V., (1976), Findings on Rotation Group Biases, Internal Technical Memorandum, Statistics Canada.

[6] Thomsen, I., (1973), A Note on the efficiency of Sub-class Means to Reduce the Effects of Non-response when Analyzing Survey Data, Statistical Review, Published by the National Central Bureau of Statistics, Stockholm, Sweden, Vol. 11, No. 4.

[7] Williams, W.H. and Mallows, C.L., (1970), Systematic Biases in Panel Surveys Due to Differential Non-Response, JASA, Vol. 65, No. 331.

[8] Woltman, H. and Bushery, J., (1975), A Panel Bias Study in the National Crime Survey, presented at Annual ASA Meeting.

TABLE 1. % Non-Response Rates for Households by Months in Survey and Type of Area (1981)

Months	Type of Area NSR†	SR	Canada†
1	6.6	7.9	7.3
2	4.0	4.6	4.4
3	3.5	4.4	3.9
4	3.5	4.1	3.8
5	3.2	3.8	3.6
6	3.1	3.6	3.4
Average No. of Households	26,707	28,645	55,352

† excluding special areas

TABLE 2. Estimated Proportions of Employed and Unemployed Heads in Respondent and Non-Respondent Households

Months	Respondents $\hat{\bar{Y}}_{1i}$		Non-Respondent $\hat{\bar{Y}}_{2i}$		$\hat{\bar{Y}}_{1i} - \hat{\bar{Y}}_{2i}$	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
1	0.6893	0.0383	0.7839	0.0335	-0.0946	0.0048
2	0.6962	0.0344	0.7841	0.0321	-0.0879	0.0023
3	0.7006	0.0311	0.7851	0.0300	-0.0845	0.0011
4	0.7006	0.0364	0.7877	0.0281	-0.0871	0.0083
5	0.6972	0.0317	0.7821	0.0317	-0.0849	0.0000
6	0.6927	0.0331	0.7767	0.0320	-0.0840	0.0011
Average	0.6961	0.0342	0.7833	0.0311	-0.0872	0.0031

TABLE 3. Rotation Group Bias Index for Population by Type of Area

Weight	Type of Area	Month in the Survey 1	2	3	4	5	6
Unadjusted	SR	97.0	101.1	101.2	100.6	100.2	99.7
	NSR	97.7	101.0	100.8	100.9	100.2	99.4
Household adjusted	SR	98.7	98.7	99.4	100.0	101.1	102.1
	NSR	99.3	98.6	99.0	100.3	101.1	101.8
Population adjusted	SR	100.4	100.5	100.2	99.7	99.6	99.5
	NSR	100.9	100.3	99.8	99.9	99.6	99.4

TABLE 4. Rotation Group Bias Index by Type of Area (1981)

Weight	Character-istics	Type of Area	Month in the Survey 1	2	3	4	5	6
Unadjusted	Employed	SR	99.9	101.0	101.3	100.7	100.4	99.8
		NSR	96.8	100.9	100.6	101.2	100.7	99.9
	Unemployed	SR	99.1	102.6	101.3	100.4	97.7	98.9
		NSR	103.3	101.5	101.4	99.8	96.5	97.6
	In LF	SR	97.0	101.1	101.3	100.7	100.2	99.7
		NSR	97.3	100.9	100.7	101.1	100.3	99.7
Household adjusted	Employed	SR	98.6	98.5	99.5	100.1	101.2	102.1
		NSR	98.3	98.4	98.7	100.6	101.6	102.4
	Unemployed	SR	100.8	100.3	99.5	99.8	98.5	101.1
		NSR	104.9	99.2	99.6	99.2	97.3	99.8
	In LF	SR	98.7	98.7	99.5	100.1	101.0	102.0
		NSR	98.9	98.4	98.8	100.5	101.2	102.1
Population adjusted	Employed	SR	100.2	100.3	100.4	99.7	99.7	99.6
		NSR	100.0	100.2	99.6	100.2	100.1	99.9
	Unemployed	SR	102.4	102.1	100.4	99.4	97.1	98.6
		NSR	106.4	100.8	100.5	98.9	96.0	97.4
	In LF	SR	100.4	100.5	100.4	99.7	99.5	99.5
		NSR	100.6	100.2	99.7	100.1	99.8	99.6

TABLE 5. Rotation Group Bias Index by Age-Sex Groups (1981)

Weight	Character-istics	Age-Sex Group	Month in the Survey 1	2	3	4	5	6
Unadjusted	Employed	M 15-24	96.5	99.7	100.7	101.0	101.1	101.1
		F 15-24	96.0	99.7	101.1	100.9	101.2	101.1
		M 25+	97.0	101.4	101.3	100.7	100.1	99.5
		F 25+	96.9	101.2	101.2	101.0	100.5	99.3
	Unemployed	M 15-24	100.9	102.3	101.1	100.7	96.9	98.2
		F 15-24	102.4	102.7	97.7	98.9	100.0	98.2
		M 25+	98.0	102.1	101.6	100.3	98.0	100.1
		F 25+	100.1	102.3	104.5	100.4	95.3	97.4
	In LF	M 15-24	97.2	100.1	100.8	100.9	100.4	100.6
		F 15-24	96.8	100.0	100.7	100.7	101.0	100.8
		M 25+	97.1	101.4	101.3	100.7	100.0	99.5
		F 25+	97.1	101.3	101.4	101.0	100.1	99.1
Household adjusted	Employed	M 15-24	98.2	97.2	98.8	100.3	101.9	103.5
		F 15-24	97.6	97.2	99.3	100.3	102.1	103.5
		M 25+	98.7	98.9	99.4	100.1	101.0	101.8
		F 25+	98.6	98.8	99.3	100.3	101.3	101.6
	Unemployed	M 15-24	102.6	100.0	99.3	100.1	97.7	100.3
		F 15-24	104.2	100.3	96.0	98.3	100.8	100.4
		M 25+	99.6	99.8	99.8	99.7	98.8	102.3
		F 25+	101.8	100.0	102.6	99.8	96.1	99.6
	In LF	M 15-24	98.9	97.6	98.9	100.3	101.3	103.0
		F 15-24	98.5	97.6	98.8	100.0	101.9	103.2
		M 25+	98.8	99.0	99.5	100.1	100.8	101.0
		F 25+	98.8	98.8	99.6	100.3	101.0	101.5
Population adjusted	Employed	M 15-24	99.9	99.0	99.7	100.0	100.5	101.0
		F 15-24	99.3	99.1	100.2	100.0	100.6	101.0
		M 25+	100.4	100.7	100.3	99.7	99.5	99.3
		F 25+	100.3	100.6	100.2	100.0	99.9	99.1
	Unemployed	M 15-24	104.2	101.7	100.1	99.7	96.3	98.0
		F 15-24	105.8	102.0	96.8	98.0	99.4	98.0
		M 25+	101.2	101.6	100.7	99.4	97.4	99.8
		F 25+	103.4	101.7	103.5	99.5	94.8	97.1
	In LF	M 15-24	100.5	99.4	99.8	99.9	99.8	100.5
		F 15-24	100.2	99.4	99.7	99.7	100.4	100.6
		M 25+	100.4	100.8	100.3	99.7	99.4	99.3
		F 25+	100.5	100.6	100.4	99.9	99.5	98.9