Research & Analysis Directorate

STATISTICAL ANALYSIS OF CENSUS DATA FROM 1971-1991 REGARDING ITS USE FOR A PROPOSED PUBLICATION ABOUT SOCIAL TRENDS ON RESERVE

Direction de la recherche et de l'analyse

Indian and Northern Affairs Canada
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Prepared For:
Indian and Northern Affairs Canada

Prepared By:

Goss Gilroy Inc.
Management Consultants
Suite 900, 150 Metcalfe Street
Ottawa, Ontario
K2P 1P1
(613) 230-5577

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The views expressed in this report are those of the authors and not necessarily those of the Department of Indian Affairs and Northern Development.

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1.0 Introduction

1.1 Background

Indian and Northern Affairs Canada (INAC) is considering the production of a departmental publication presenting trends in socio-economic well-being for registered Indians on-reserve. This publication would concentrate primarily on the years 1971-1991. A variety of concerns would be addressed in this publication ranging from (1) conditions and changes in conditions for the registered Indian population on-reserve to (2) comparative conditions and changes in conditions relative to those of Canadians in general. An integral component in this publication would be the use of Census data to produce statistical pictures of conditions and changes.

Before proceeding with the publication, it is necessary to determine if Census data can be used to produce a reliable, credible and understandable picture of trends from 1971-1991. And if so, do the data need to be treated and/or qualified in any way to prepare satisfactory information for the publication.

1.2 Overall Objectives

The study objective is to provide an assessment of the applicability of Census data including, in particular, the data presenting trends in socio-economic well-being for Registered Indians on-reserve from 1971-1991 for the purposes of the proposed publication. This assessment will provide answers and recommendations in the use, if any, of such Census data within the proposed publication of social trends on-reserve. A number of key questions will also be addressed from the analysis that will lead to recommendations and suggestions on the use of Census data.

1.3 Organization of the Report

This report is divided into the following sections:

- Section 1.0 provides an introduction and overview of the report;
- Section 2.0 provides a summary of the overall approach and methodology in carrying out the analysis;
- Section 3.0 presents the findings from the analysis on Census data; and,
- Section 4.0 presents the conclusions and recommendations.

2.0 Approach and Methodology

2.1 Study Approach

The study approach involved conducting a number of activities in close liaison with the client; namely,

- participate in a startup meeting, and subsequent meetings, to review and discuss the study's research plan, analyses, and outputs;
- review any previous documentation pertaining to relevant information on the use of Census data in evaluating socio-economic conditions on-reserve;
- interview other experts (e.g., knowledgable INAC personnel and Statistics Canada researchers) regarding Census data in the context of on-reserve populations;
- review Census data and selected corresponding data;
- prepare selected data for manipulation;
- conduct a statistical analysis of selected Census data from 1971-1991 to address confounders in relation to the objective of the report; and,
- report on the key research findings.

The study focused its effort on researching the "best" answers to the following questions:

(1) Can four-points-in-time Census data be used to interpolate trends with validity?
(2) Do we need to control for inconsistency in Census participation by First Nations?
(3) Do we need to age standardize comparisons?
(4) Do we need to control for age structure across time?
(5) Do we need a second comparison population that reflects the conditions of Canadians in general who live in similar geographical circumstances? How can this be done?
(6) Could analysis present gender-specific statistics?
(7) Could analysis present regional/provincial statistics?

These questions (and respective answers), particularly the first two, underpin the rationale and methodology for proceeding (or not) with the proposed publication.

2.2 Questions and Methodology

The following subsections discuss the highlights of our methodology and approaches for addressing the questions posed in section 2.1. We first context the subsections below with a description of pertinent documents and variables used for the analysis (the findings will be given in section 3.0).

Review of Pertinent Documents: Several documents were reviewed concerning Census data and the inherent accuracy of data on Indian reserve communities over time. Two documents in particular discuss the comparability of 1981 and 1986 Census data [1]. They both focus on the impact of refusal communities in the 1986 Census, each highlighting for different variables the impacts/effects of the refusal communities on patterns in the Census data over the period 1981 to 1986. This issue is one of the primary concerns and key questions to address in assessing socio-economic characteristics over time. That is, to what extent would non-participating reserves, in any Census, effect results based on the participating reserves. (This issue is elaborated on in the sections below, and findings given in section 3.0).

Key Variables for Analysis: A number of key variables were defined by INAC for inclusion in the pending social trend publication. These variables encompassed: health, shelter, education, labour force, and income. All these areas except health have related Census data. A brief examination of the health data indicated that they may be assembled and profiled from Health Canada sources, thus no further analysis was carried out on these data.

Census data available on shelter include statistics related to households in need of major repair and crowding. Crowding variables include ratio of people per room and the percentage of households with more than one person per room. Analysis of these

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[1] The two Statistics Canada documents are: Assessment of the Comparability of the 1981 and 1986 Census Data for the Population in Indian Reserve Communities in Canada, J. Phillip Nicholson, Policy and Management Consultants Inc., October 31, 1988; and, On the Comparability of 1981 and 1986 Census Data for the Population in Indian Reserve Communities in Canada, Josephine K. Stanic, Employment Equity Section, Housing, Family and Social Statistics Division, March 13, 1989.

variables in the Indian reserve population could convey whether or not conditions in on-reserve housing changed over time.

The education data proposed for this study included the amount of education attained by those 15 years and older living on-reserve. Two key variables available from the Census data are: 1) percentage of those 15 years old and older with less than grade 9, and 2) the percentage of people with a completed non-university (post-secondary) certificate or a completed university degree. Both of these variables look at the amount of completed education within the on-reserve population for a given Census year. While a large number of older people on-reserve go to school, the reserve population is typically made up of a greater proportion of young people. Therefore, limiting the base to those 15 years old and older will provide a better understanding of educational attainment for each of the Census years.

The labour force activity on a reserve can be examined by profiling unemployment rates, participation rates and employment ratios for various Census years. These variables can assist in determining the levels of labour force activity and employment success on a reserve. Note that each variable lends particular insight to the analysis. For example, employment ratios are to more likely reflect real conditions for the entire registered Indian population in terms of employment success than is the unemployment rate [2].

Income data available for analysis are average and median total incomes of individuals, and average per capita income ratios for on-reserve population. The source of income can be from employment or from the government in the form of transfer income. The analysis concentrated on the amount of cash flow individuals have at their disposal over the years, since cash income is required to carry on life in reserve communities. Similar to the choice of labour force variables above, each selected income variable lends particular insight to the analysis. For example, for gauging income success, the per capita income ratio was considered the most useful variable since it reflects income for

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[2]The unemployment rate is influenced not only by employment success but also by the proportion of people who might be in a position to work, but are discouraged and not actively looking for work. Also, many traditional activities, such as hunting, trapping and fishing are often not considered and reported as work. This is a chronic bias for all Census years, resulting in an under-estimation of the labour force participation of reserve residents. Therefore, any absolute levels of labour force data from reserves should be treated with caution, as the true levels are unknown.

the entire population, as opposed to average income that only looks at income success for those with income.

2.2.1 Interpolation from Census Data

The question, *Can four-points-in-time Census data be used to interpolate trends with validity?*, should first be answered for the Canadian population as a whole [3]. If annual trends for key variables on the Canadian population cannot be reasonably/consistently interpolated using four points in time from Census data, then we would conclude with a "strong no" to this first question. Furthermore, analysis of any subsets of Census data would not be considered valid. Our methodology and approach for addressing this point is given next.

This question can best be answered by analyzing variables collected during the Census years against the same variables collected on an annual basis from another reliable source during the same time period. The four points in time represent Census years 1971, 1981, 1986 and 1991. (Note that 1976 data are available from the Canadian population on a smaller range of socio-economic variables but not from the registered Indian population, and therefore are not used throughout this report).

Labour force statistics are readily available from the Labour Force Survey, which collects data on an annual basis. Conclusions can be drawn by simple, comparative time series graphs that show how well four points (1971, 1981, 1986, and 1991) in time can approximate 20 points (years 1971 through 1991) for a single variable (key variables for this study). In other words, conclusions can be drawn as to the degree of correspondence between the corresponding sets of data vis à vis magnitude and trends. Participation rate and unemployment variables were examined using this methodology, and are reported on in section 3.1.1. Although data on other study variables (shelter, education, income) were not readily available for this type of comparison, it is felt that similar results as shown in section 3.1.1 would likely be found.

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[3]Ideally, this question should be analyzed in the context of the registered Indian population on-reserve, but the data required for this approach does not exist for this population.

2.2.2 Internal Validity of Indian Reserve Population Data

Another aspect of the first question noted above is whether or not the data collected for on-reserve population during the census years in question are internally valid. That is, *do Census data provide reliable measures of what they are intended to measure?*

The approach taken was to have knowledgable individuals (i.e., an Aboriginal member of our consulting team and knowledgable INAC personnel) identify sets of reserves with relatively good and relatively poor conditions (in terms of variables captured by the Census) and to determine whether or not Census data are sufficiently discriminating to capture the differences. There is, of course, a risk that the opinion givers may be in error; however, this potential bias/variability was controlled by having several experts independently choose their sets of reserves under a standardized criterion. Indeed, the criterion used to make this distinction was posed as a question to the experts as follows: *"Can you identify several First Nations, in 1990-1991, with particularly good conditions and several with relatively poor conditions in the context of the types of conditions covered by the Census, namely highest level of education, income, employment success and housing in terms of condition and crowding"* [4].

To comprehend and assess the internal validity of the data, graphical displays of the key variables, for 1991, were produced *by aggregating (these predefined) High and Low groups for each region.* This analysis should reveal if the Census data are demonstrating consistent differences (between High and Low groups) throughout each region. This would support internal knowledge about the reserves and validate the Census data as to its usefulness in further trend analysis. The findings of this analysis are given in section 3.1.2.

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[4] A list of reserves that participated in all four of the Censuses had been prepared by C. Yaffa for Indian and Northern Affairs Canada, 1993. These aforementioned experts chose the reserves from this predefined list of participating reserves in each Census year from 1971 to 1991. Data were then compiled by the consultant team for those reserves for the key study variables from published Statistics Canada tables from 1981 to 1991.

2.2.3 Inconsistent Participation by First Nations

For the question, *Do we need to control for inconsistency in Census participation by First Nations*?, we first reviewed the aforementioned descriptive documents that Statistics Canada produced on this topic (see Footnote 1). These documents addressed the comparability of the 1981 and 1986 Census data for the population in Indian reserve communities in Canada. Statistics Canada did not draw detailed conclusions, but the data are sufficient to support our analysis and conclusions on this issue (see section 3.1.3). Note that for 1971 all reserves participated in the Census, so non-participation was not a problem. However, non-participation of reserves also occurred in 1991 and Statistics Canada did not perform an analysis of differences between the participating/non-participating reserves. Such analysis is currently planned for late 1996 by Statistics Canada, as personally communicated to us by Statistics Canada personnel.

In particular, our methodology covered the participation and non-participation rates of First Nations for the key study variables addressed by Statistics Canada. This review focused on whether the non-participating (non-enumerated) Indian reserve population differs significantly from the participating (enumerated) population. If significant differences were observed, the next question to address is: "are these statistical indications of changed conditions attributable to biased coverage or do they reflect real changes in conditions?" In addition to vetting what the Statistics Canada reports concluded on this question, we sought advice from experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. Our findings are highlighted in section 3.1.3.

Secondly, we also took the High and Low reserves defined in section 2.2.2, and created a mini-sample of reserves that participated in all three Census years 1981, 1986, and 1991. This mini-sample (i.e., pooled data for the Highs and Lows across Canada) represented a sub-population for which non-participation was not a factor [5]. Aggregated data from the mini-sample was then compared to that for all participating reserves in each given Census year. In this way, if the results showed values for the mini-sample having a different rank than the overall population over this time period - i.e., one data set has higher values in one Census year and then reverses in the next Census year, then this

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[5]That is, any confounding due to the non-participation of reserves in the various Censuses would be eliminated, thereby strengthening the validity of the subsequent trend analysis comparisons between the High and Low groups for each region.

may suggest that there is a data inference problem due to the varying magnitude/nature of the non-participating reserves. Our analysis and conclusions are given in section 3.1.3.

2.2.4 Controlling for Age

For the questions, *Do we need to age standardize comparisons?* and *Do we need to control for age structure across time?* there are good à priori arguments for controlling for age between on-reserve and general Canadian populations, as it has been established by previous INAC work that key indicators such as mortality, education, employment and income are associated with age. For example, an aging population can result in elevated mortality rates even though the population is getting healthier and living longer. Or, an aging population can show improved employment rates, even if the employment ratio in each age-level of the population is decreasing.

Sub-questions to address under this research theme were: is the degree of change in age structures of the on-reserve registered Indian population and proposed comparison populations sufficient to control for changes in age structure through time? (For example, this question may be answered negatively, if age structures are changing at equivalent rates or changing only gradually). Also, if controls are required, is it preferable to standardize or to focus on specific age-levels? For example, for the latter control, one could look at mean income for those ages 25-35 with a university degree as a means of looking at trends in income while controlling for the confounding variables of age and education on income.

Our methodology consisted of reviewing this INAC work and related literature, and eliciting expert opinion from experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. Our findings are highlighted in section 3.1.4.

2.2.5 Comparing to Mainstream: Geographical Considerations

The question, *Do we need a second comparison population that reflects the conditions of Canadians in general who live in similar geographical circumstances?*, arises from the significant differences already known to exist between the Indian populations and the general Canadian population. For example, in 1986, 94% of registered Indians living on-reserve lived in rural areas compared to 24% of all Canadians. It is well known that rural and urban populations, whether of Aboriginal origin or not, live in different economic regimes. Thus, for comparisons of conditions affected by location, it may be more appropriate to compare registered Indian on-reserve populations with populations

residing in similar geographic locations. In this way, indicators of socio-economic circumstances such as employment ratios would not result in comparisons between a largely rural Indian population and the mostly urban Canadian population.

Three different approaches were briefly examined for comparing Indian reserve communities with the Canadian population; namely:

1) *with rural Canada* (i.e., create zones, like those used in the publication Rural Canada: A Profile [6], so as to compare registered Indians on-reserve with Canadians in prespecified zones which correspond better with the on-reserve population than does Canada as a whole;

2) *with (preselected) non-Indian comparison communities* (i.e., as similarly done in Caron and Hunt, 1995 [7]), determine a set of "control" communities (i.e., of somewhat similar size and location as reserves) in the general non-Indian Canadian population that is valid/useful for comparison purposes with the Indian on-reserve population; and,

3) *with locational/spatially-standardized comparison areas* (i.e., similar to the technique of age-standardization), generate geographically-standardized "comparison cohorts" from the general Census data. Under this approach, statistics are

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[6] Rural Canada: A Profile, Government of Canada document (1995), resulting from recent work of the Research Sub-Committee of the Interdepartmental Committee on Rural and Remote Canada. This report briefly discusses Aboriginal issues (demography and socio-economic circumstances of the Canadian Aboriginal population), and compares conditions for Aboriginal populations with populations in rural areas, which are defined as areas with populations of fewer than 1,000 people and population densities of less than 400 inhabitants per square kilometre (or, 2,500 people or less for housing indicator comparisons). This is the standard Statistics Canada definition of rural. Most of the statistics in the report (i.e., for all Canadians) divide the rural population among three types of rural areas: rural metro adjacent, rural metro non-adjacent, and rural north.

[7] Socio-economic Indicators in Indian Reserves and Comparable Communities, Daniel Caron and Terry Hunt, Departmental Audit and Evaluation Branch, Department of Indian Affairs and Northern Development, June, 1995.

derived on conditions for representative non-Aboriginal people drawn from each Census division in numbers equal to the respective numbers of Indians living on-reserve. This would then create a comparable measure of conditions for non-Aboriginal Canadians, controlling for differences attributable to location at a regional level.

Our methodology consisted of reviewing the INAC work and related literature, and eliciting expert opinion from experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. Our findings are highlighted in section 3.1.5.

2.2.6 Sub-Aggregate Considerations

The questions, *Could analysis present gender-specific statistics*? And *Could analysis present regional/provincial statistics*? were addressed throughout all the various analyses done under each of the foregoing questions. For example, the analyses for the questions "interpolation from Census data", "internal validity", and "inconsistent participation by First Nations" encompassed the regional/provincial-levels wherever feasible, thus, directly contributing to the conclusions on the aforementioned latter question. Also, analysis of the Statistics Canada reports noted above (i.e., in terms of their findings with respect to gender-specific and regional/provincial statistics) were conducted, as well as seeking advice from experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. Our findings are highlighted in section 3.1.6.

2.3 Constraints

Various constraints associated with the Census data are summarized below. These constraints limited, to some extent, the amount and insightfulness/quality of data analysis possible on the foregoing research questions. In all cases, qualitative analysis (e.g., through literature review and expert opinion) was used to address such shortcomings.

Census participation of reserves varied substantially over the years, especially in 1986 and 1991. Statistics Canada has reported on the various impacts/effects on Census data profiles of the 1986 non-participating reserves, but has not yet conducted any similar research for the 1991 Census year. Note, however, that this shortcoming is considered minor overall to this analysis. Much of the analysis was conducted on special Census tabulations made available from INAC for a subset of all completely enumerated Indian

reserves identified in each of the Censuses 1971, 1981, 1986, and 1991 [8]. Along with expert opinion from INAC personnel and Statistics Canada researchers, these analyses significantly helped in understanding the non-participating reserve impacts/effects on the 1991 Census data and in addressing the research questions of this study (see sections 3.1.2 and 3.1.3).

Data on the Census year 1971 at the geographical levels required for these analyses were not readily available from Statistics Canada (i.e., available on microfiche only, and only at highly aggregated levels of geography for many of the study variables), thus, many of the required data analyses for this study were performed on Census data for 1981, 1986 and 1991.

Detailed profiles of Census data often contain suppressed data or rounded numbers (to the nearest five), particularly for small Indian reserve communities. Many of the individual reserves used for this study are small with an average size of approximately 200. Any data reflecting small percentages can be misleading when comparing small reserves or groups of small reserves against each other. It was found that a more sound and practical method of comparison involved requesting/performing special runs at Statistics Canada with the original reserve-level *and/or* grouping reserves together and comparing aggregated data counts. Throughout our analyses, such data concerns were taken into account wherever feasible, thus, the findings (section 3.0) reflect the consultants' (and INAC's) best efforts to fully address the project's objectives in the most unbiased/accurate manner possible.

Published tables of Census data for Indian reserves also include non-Indian residents (i.e., everyone living on-reserve, not just registered Indians). Although reserves do include mostly registered Indians, the use of such tabulated data that have small counts may be affected by the number of non-Aboriginals living on reserve, such as those working in schools and health centres. Ideally, all data analysis should be confined to registered Indians only. At aggregated (national) levels of comparisons, the impacts/effects of these inclusions are negligible; however, at disaggregated (regional/provincial) levels for selected variables (e.g., university degree), special runs from Statistics Canada were necessary to eliminate this (misleading) bias.

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[8] A list of reserves that participated in all four of the Censuses was prepared by C. Yaffa for Indian and Northern Affairs Canada, 1993.

With respect to labour force activity, the quality of Census data for the population resident on reserves has been problematic as described in Stanic's 1989 Statistics Canada document. Many traditional activities, such as hunting, trapping and fishing are often not considered and reported as work. This is a chronic bias for all Census years, resulting in an under-estimation of the labour force participation of reserve residents. Therefore, any absolute levels of labour force data from reserves should be treated with caution, as the true levels are unknown. Because of the consistency of the Census use of the same questions and concepts for labour force activity, comparisons across reserves for different Census years and/or with Canadian labour force activity data are still valid and relevant for the purposes of the proposed INAC social trend publication.

With respect to income data, although data trends do not indicate income adequacy, income data can indicate whether or not the on-reserve population has access to relatively more or less income between Census years. From the noted Statistics Canada documents, there were noteworthy problems with income data for persons resident on-reserve. In 1981 there was 1) substantial non-response for reported income on-reserve, and 2) there was difficulty in identifying and reporting the correct status (Aboriginal, non-Aboriginal) of those persons reporting income on-reserve. An imputation procedure was used to adjust for the non-response of income. However, this imputation procedure matched, in part, non-aboriginal persons living near, but off, reserves, with Aboriginal persons living on reserve, thereby causing an upward bias in Census reported income of the Indian reserve population. In 1986, revised edit procedures were implemented for the 1986 data to correct the sorts of biases incurred in 1981. Therefore, 1981 data for on-reserve income should be treated with caution in all subsequent analysis.

Finally, with respect to comparing the mainstream population in the context of the different geographical considerations noted above, we note the following: (internal communication with INAC personnel)

i) all methods of "comparison geographies" have their strengths and weaknesses, no one method can be clearly proven to be superior in all cases, and all such developments of rural indicators are definition-bound. That is, all such methods first must (qualitatively) address the question *what is rural* and then *what geographical frame usefully defines rural populations for the statistical purposes at hand.*

ii) the usual *rural/urban dichotomy* masks important differences as to what is happening in different rural systems. The usual approach to defining rural

areas based on population densities of established administrative areal units potentially results in misleading statistics and/or boundary configurations that discredits the statistics.

It is not the purpose of this study to definitively address which of the three methodologies is fully valid or best. Rather, it is our intention to outline the key arguments (pro/con) for using each of the three methods above, given that a "second comparison population" is already a highly desirable conclusion. Ideally, this comparison population is one that does not have major biases towards those living in urban areas and reflects the conditions of Canadians in general who live in similar geographical circumstances to those registered Indians living on-reserve. See section 3.1.5 for our findings.

3.0 Findings

3.1 Findings Vis à Vis Questions

The following six subsections highlight our findings and answers to the Questions posed in section 2.2 above.

3.1.1 Interpolation from Census Data

Graphical displays of Census data versus annual data on participation and unemployment rates - by province and Canada - are given in Appendix A (A1 for participation rates; and, A2 for unemployment rates).

With respect to ***participation rate*** comparisons, it can be observed that:

- the four-points-in-time Census data closely follow the annual trend line at the Canada level -

  *... this suggests that there is strong validity for the use of **participation rate** comparisons **at the national level** in conducting further analyses on subsets of the Census data.*

- at the provincial level, the resulting graphs show some consistent variability in the Census data (about 10% above annual trend line) for some provinces (i.e., Atlantic provinces), while others (i.e., Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and BC) all show an extremely close fit [9] -

  *... this suggests that there is strong validity for the use of **participation rate** comparisons **at all provincial levels** in conducting further analyses on subsets of the Census data,*

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[9] It is worth noting that the Census data represent the status of individuals for Census week, whereas the Labour Force Survey figures are an average for the year. Differences between the two sources (especially as seen in Appendix A1) may well reflect seasonal versus annual differences. This observation may explain the observed Atlantic differences between the two sources, since the Atlantic provinces' economy has a relatively high seasonal labour component.

keeping in consideration the modest (about 10%) upward variability in the Census data for the Atlantic provinces from 1981 to 1991.

With respect to ***unemployment rate*** comparisons, it can be observed that:

- the annual unemployment rates both at the Canada and provincial levels show an oscillating but clearly upward trend over the 1971-1991 period. The four-points-in-time Census data accurately reflect the overall trend line for this period both at the national and provincial levels, but, as expected, the four points cannot mimic these oscillations that often occur in varying lengths (i.e., sometimes shorter/longer than the period of time for the Census data) -

  ... this suggests that there is reasonable validity for the use of ***unemployment rate*** *comparisons* ***at the national and provincial level*** *in conducting further analyses on subsets of the Census data, keeping in consideration that the data are most accurate/useful at the overall trend level for the 1971-1991 period.*

3.1.2 Internal Validity of Indian Reserve Population Data

Appendix B summarizes the graphical displays of key variables for comparing aggregated individual reserves for the 1991 Census year. The reserves reflect a predetermined grouping into High and Low categories vis à vis their relative conditions by knowledgeable/experienced individuals. The key variables are profiled by province, and/or by male and female, and are listed below:

- ***education***: percentage of individuals with: 1) less than Grade 9; and, 2) non-university certificate or university degree for all 15 years old and older;
- ***labour force***: employment ratios for all 15 years old and older, and 15-64 age group, who are employed;
- ***income***: per capita income ratios; and,
- ***shelter***: percentage of households with more than one person per room, and the ratio of people per room.

With respect to ***education*** comparisons, it can be observed that:

- both education variables show differences in High and Low reserves for each regional/provincial level that are strongly consistent with expectations. This

clearly demonstrates that the Census data are sufficiently discriminating to capture (expected) differences in such education variables; more importantly,

... this suggests that there is reasonable internal validity that the Census data can provide reliable (consistent) measures of ***education****, useful for Indian reserve comparisons* ***at the regional/provincial level.***

With respect to ***labour force*** comparisons, it can be observed that:

- with the slight exceptions of Saskatchewan [10] (in all displays) and of BC (only for employment ratio, females, 15 years old and over), both labour force variables show differences in High and Low reserves for each regional/provincial level that are strongly consistent with expectations. This demonstrates that the Census data are sufficiently discriminating to capture (expected) differences in such labour force variables; more importantly,

  ... this suggests that there is reasonable internal validity that the Census data can provide reliable (consistent) measures of ***labour force****, useful for Indian reserve comparisons* ***at the regional/provincial level.***

With respect to ***per capita income ratio*** comparisons, it can be observed that:

- with the slight exceptions of Saskatchewan (only for per capita female income ratio) and of Alberta (only for per capita male income ratio), the per capita total income ratio variable clearly shows differences in High and Low reserves for each regional/provincial level that are consistent with expectations. This demonstrates that the Census data are sufficiently discriminating to capture (expected) differences in per capita income ratio variables; more importantly,

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[10] This failure to distinguish between high/low First Nations in Saskatchewan is not completely unexpected. A forthcoming research paper shows that (in 1986) First Nations in Saskatchewan had relatively little variation in terms of socio-economic conditions. Reference: A First Nations Typology: Patterns of Socio-Economic Well-Being, R. Armstrong and T. Rogers, Research and Analysis Directorate, Department of Indian Affairs and Northern Development, Ottawa, March, 1996.

*... this suggests that there is reasonable internal validity that the Census data can provide reliable (consistent) measures of **income**, useful for Indian reserve comparisons at the **regional/provincial level.***

With respect to ***shelter*** comparisons, it can be observed that:

- both shelter variables show differences in High and Low reserves for each regional/provincial level that are strongly consistent with expectations (except for Saskatchewan, which shows a weaker, but consistent, pattern). This clearly demonstrates that the Census data are sufficiently discriminating to capture (expected) differences in such shelter variables; more importantly,

  *... this suggests that there is reasonable internal validity that the Census data can provide reliable (consistent) measures of **shelter**, useful for Indian reserve comparisons at the **regional/provincial level.***

3.1.3 Inconsistent Participation by First Nations

In 1971, all reserves participated in the Census. All but six, representing about 10,000 people, participated in the 1981 Census. However, the 1986 and 1991 Censuses were marked by substantial non-participation by First Nations.

In 1986, 90 First Nations, 136 reserves, representing an estimated 45,000 people, were not enumerated. In 1991, there was some improvement, but 64 First Nations were not enumerated, representing 78 reserves and an estimated 38,000 individuals. Some of the reserves that participated in 1986 did not participate in 1991 and, conversely, some reserves that did not participate in 1986, did in 1991. At the extreme, non-enumeration could be as high as 21% and 16% respectively for these two Census years (based on a comparison between Census counts and figures from the Indian Register).

Review of Statistics Canada Studies. We first addressed this non-response issue by performing a detailed review of the aforementioned Statistics Canada documents (see Footnote 1), which specifically addressed the impact of non-participating reserves in the 1986 Census - with detailed comparisons to the 1981 Census. Our main observations are summarized as follows:

- about 50% of the refusals in 1986 (i.e., 22,000) occurred in Ontario and Alberta, and about 30% (or, 15,000) in Manitoba and Quebec. The remainder (20%, or,

8,000) was in British Columbia, Saskatchewan and New Brunswick. Prince Edward Island, North West Territories, and Yukon all had no refusal reserves. No reserve communities existed in Newfoundland in the 1981 and 1986 Censuses. Extrapolating from 1981 population counts, there was considerable variation in non-participation regionally. Ontario and Alberta had non-participation rates of over 30%. The rates for Manitoba and Quebec were in the range of 23% to 26%. British Columbia and the Atlantic Canada had non-participation rates of 12%, while Saskatchewan had a rate of 2%.

- *there were no significant differences or impacts in the male/female ratios for participating and non-participating reserve communities for the 1981-1986 Census years.*

- 1981-1986 comparisons of the percentages of the population by age groups (i.e., 0-14, 15-64, 65+) between participating and non-participating reserves resulted in similar and consistent trend results at the national level and for all regions/provinces, with the notable exception of Quebec. For example, in Quebec for the 0-14 age group, the "real" (i.e., use of participants in both Census years 1981 and 1986) downward trend of 3.3% was contrasted by the "apparent" (i.e., use of simple Census count comparison of 1981 and 1986 results) upward trend of 0.9%. *This suggests that simple age group comparisons (1981-1986) will generally reflect real changes in conditions at the national level, and for most provinces/regions, excepting Quebec.*

- in terms of labour force activity, the proportion of the reserve population aged 15 years and over which is part of the labour force showed a national (real/apparent) trend increase from (40/41)% to 45% from 1981 to 1986. Every region/province correspondingly indicated a (consistent) upward trend, except for Quebec which indicated no apparent trend between 1981 and 1986 (i.e., 41% to 41% from 1981 to 1986; whereas the real trend was 35% to 41%). This anomalous result for Quebec was caused by their refusal pattern in 1986 for the 15 and over population (i.e., 55% of this refusal population were in the labour force compared to only 35% on participating communities). Nevertheless, *these overall findings suggest that simple labour force comparisons using the 15 years and over group comparisons (1981-1986) will generally reflect real changes in conditions at the national level, and for most provinces/regions, excepting Quebec.*

- also, in terms of labour force activity, the unemployed as a percentage of the labour force population in reserve communities showed a large national

(real/apparent) trend increase from (18/17)% to 32% from 1981 to 1986. All regions/provinces showed a similar significant upward trend (real/apparent) for this variable. *This suggests that simple labour force comparisons using the unemployed as a percentage of the labour force population in reserve communities will generally reflect real changes in conditions at both the national and regional/provincial levels.*

- in terms of education, the percentage of the reserve population aged 15 years and over for the highest level of schooling (i.e., no formal schooling; grades 1-8; grades 9-13 without/with certificate; ... ; university without/with degree) generally showed consistent trend patterns (real/apparent) at the national level. (Note: no data were given for this variable at the regional/provincial level). *This suggests that simple education comparisons of the reserve population aged 15 years and over for the highest level of schooling from 1981 to 1986 will generally reflect real changes in conditions at the national level.*

- in terms of the labour force population and education, the percentage of the labour force population in reserve communities for the highest level of schooling (i.e., no formal schooling; grades 1-8; grades 9-13 without/with certificate; ... ; university without/with degree) generally showed consistent trend patterns (real/apparent) at the national level. (Again, no data were given for this variable at the regional/provincial level). The only exception occurred in the trend for "grades 9-13 with certificate", where the real upward trend (1981: 6.1%; 1986: 6.3%) was not parallelled by the apparent trend (6.7%; 6.3%). This anomaly was likely due to the fact that the reserve communities which did not participate in 1986 were generally better educated than those reserves which participated in both the 1981 and 1986 Censuses. In sum, *these findings suggest that simple - and, especially aggregated* [11] *- labour force population-education comparisons of the reserve population for the highest level of schooling from 1981 to 1986 will generally reflect real changes in conditions at the national level (and, indeed, even at the regional/provincial levels for some aggregated data variables; e.g., see Footnote 9).*

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[11] For example, *all trends* - both real and apparent - showed consistent patterns for the *aggregated* data comparisons at the *national* and *regional/provincial* levels for: 1) no formal schooling or less than grade 9; and, 2) post-secondary or higher education. Reference: On the Comparability of 1981 and 1986 Census Data (Sample Variables) for the Population in Indian Reserve Communities in Canada, J.K.Stanic, Statistics Canada report, March, 1989, pp.27-28.

- finally, in terms of the household size composition (average size, distribution by size, small and large size groupings), an appreciably higher proportion of the non-participating than participating households in 1986 consisted of very small households (i.e., one and two-person households). This particular non-response bias had a significant impact on the household size variables and trend analysis at both the national and regional/provincial levels. As noted in the aforementioned Statistics Canada report (see Footnote 9):

  "for example, about 25% of the non-participating households in 1986 (based on 1981 participants) were single-person households compared to only about 13% of the participating households. As a consequence, the apparent trends from 1981 to 1986 (i.e., as suggested by the unadjusted Census counts) differ appreciably from the real trends for the comparable populations (i.e., those which participated in both Censuses) ... in the case of Quebec (in particular), there resulted the very significant 2.2 average persons per household among the non-participating reserve communities compared to 5.5 among the participating reserve communities". (Note: all other provinces/regions did not differ in this regard more than 2 persons per household (participating compared with non-participating) versus Quebec's 3.3 difference reported here).

  In sum, *this suggests that the various household size statistics both nationally and regionally/provincially have appreciable magnitude and trend differences that do not reflect real changes in conditions but rather are attributable to biased coverage. Therefore, when using household size-related variables for trend analysis using given Census data, these results should be treated with considerable caution.* (Note: alternatively, to overcome such data shortcomings, one could use "preselected cohorts" (i.e., a predefined set of reserves participating in all Censuses that can be traced over time) of Census data to ensure valid and unbiased trend analysis for this variable).

Comparison of Social Trends of Aggregated Individual Reserves Versus All Participating Reserves. Secondly, we addressed the inconsistent participation by First Nations issue by directly comparing selected trend data of an aggregated set of reserves from across Canada that participated in each of the 1981, 1986, and 1991 Censuses (i.e., of those high/low reserves identified in section 2.2.2) with data of all participating reserves in each of the three Census years 1981, 1986, and 1991. (See section 2.2.3 for details of the purpose of this comparison). Appendix C summarizes in graphical fashion the comparative results (which are mostly self-explanatory). The selected variables for this comparison were taken from published Statistics Canada Census tables from 1981 to 1991; namely:

1) percentage of the population 15 years old and older;
2) percentage of people (15 and older) with highest level of schooling less than grade 9;
3) percentage of people (15 and older) employed;
4) percentage of people (15 and older) participating in the labour force (male, female, total);
5) average male income;
6) average female income;
7) average total income; and,
8) per capita total income.

Our main observations are summarized as follows:

- generally, for all the aforementioned variables (with the slight exception of average income) both the magnitude and trend comparisons for the aggregated individual reserves and all participating reserves in each Census year and over the period 1981 to 1991 show strong consistency -

  ... *this suggests that there is strong validity for the (further) use of Census data in trend analysis* ***at the national level.*** Based on these observations it is highly probable that *appreciable magnitude and trend differences would reflect real changes in conditions and not be attributable to biased coverage due to the inconsistent participation by First Nations (i.e., varying magnitude/nature of the non-participating reserves), particularly in the 1986 and 1991 Census years.*

- specifically, for the income variables, we note that:

  - in terms of magnitudes, the comparison groups have similar magnitudes for the income variables (within 15% for average incomes; within 10% for per capita total income), with per capita total income showing a slightly better fit between the comparative groups;

  - in terms of trend, the average incomes (male, female, total) follow similar consistent trends between the comparison groups for 1981-1986, but then all show dissimilar (inconsistent) trends from 1986-1991; *this suggests that average income statistics have been in some way confounded and that they do not reflect real changes in income conditions in the Indian reserve population at the national level,* as

these inconsistent results suggest some type of data inference problem with this statistic;

- in terms of trend, the per capita total income, however, shows consistent trends between the comparison groups for the entire 1981-1991 period. *This suggests that per capita total income is a reasonably valid indicator for depicting real changes in income conditions in the Indian reserve population at the national level.*

Views and Suggestions from Experts. Finally, the above analysis, findings and conclusions were also discussed with experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. *Overall, their advice was consistent with the findings as reported above.* In summary, they suggested:

i) with respect to the issue of "inconsistent participation by First Nations" in the Census years 1981, 1986, and 1991:

- it is first very important to remember that *the overall response rates of the participating reserves to total reserves for each Census were very high;* namely, 100% in 1971; 99% in 1981; 80% in 1986; and, 88% in 1991. As well, it should be noted that Part 2B of the Census (socio-economic data) is taken as a 100% sample on-reserve as opposed to a 20% sample in the rest of Canada, outside of the territories.

ii) with respect to the validity (non-response bias) issue underlying the use of Census data, especially for 1981 to 1991 trend analysis comparisons between the Indian reserve and the general Canadian population:

- *it was felt that valid (consistent) data comparisons would result if the trend analysis focused* ***on the national level*** *- with the exception of Census income, where caution must be exercised in its straightforward use.* This opinion was based on several years of related-experience with Census data applications, where the various effects on Census data comparisons due to non-response biases tend to balance or cancel themselves out *at the national level,* both in terms of magnitude and time trends.

iii) with respect to outstanding research issues and work still needed to be done:

- it was felt that the non-participating reserves have been well defined by researchers, both geographically and by their particular Aboriginal cultural group. However, it was also felt that more fully understanding the context and patterns underlying the non-participating reserves assists in better understanding the inherent biases in these data; thus, the non-response or bias-problem associated with the non-participating reserves in 1981 to 1991 is both very related to remedying the various substantive/qualitative interpretation issues underlying the Census data (e.g., understanding more fully why certain reserves did not participate) and to providing technical/quantitative solutions (e.g., involving the statistical manipulation of the Census data, such as the use of special runs [12]). In sum, *more work remains in investigating the biases at lower levels of aggregation to identify biases and devise steps to deal with the biases, such as the use of cohorts of reserves for provincial-level statistics.*

3.1.4 Controlling for Age

As noted in section 2.2.4 above, *previous INAC work has shown that indicators such as mortality, education, employment and income are generally associated with age, and controlling for age between on-reserve and the general Canadian population would likely be needed* to remedy any biased comparisons between these indicators. On the other hand, controls would not be necessary if the age structures of the comparison groups are changing at equivalent rates or changing only gradually.

Therefore, in further analyzing this issue we asked for *the opinion of experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada. Generally, they concurred with this INAC analysis,* suggesting the following:

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[12] These statements were opinions based on the experiences of the interviewed experts, and are not substantiated by research. These experts stressed that the most conservative approach to take in providing technical/quantitative solutions if severe doubts persisted (i.e., in our particular context and use of the Census data) as to the Census' validity due to the inconsistent participation by First Nations in 1981 to 1991, would be to use a "cohort" of participating reserves as a control, and focus on data comparisons and detailed analyses only at the national level.

" for Labour Force type variables and/or other age-sensitive data, it may be a good idea to age-standardize the data when comparing on-reserve and the general Canadian populations since the distributions are very different" [13].

However, there is an exception to this general advice. Before invoking such standardization procedures, the comparison groups under study need first be examined to confirm that the variables in the comparison are indeed age-sensitive; otherwise, there would not be a need to age-standardize the data or control for the age structure across time. For example, if the comparison groups under study were the on-reserve population and an equivalent rural population that had a similar national-level age distribution for some particular variables of interest, then age-standardization would not be necessary for this type of comparison. Ultimately, the final decision will rest with which data and/or variable comparisons are actually performed; for national level profiles, it would seem prudent to first investigate the possible bias of using non-age adjusted comparisons, and fine-tuning (age adjust) the final data comparisons as appropriately required by these initial analyses. This advice applies to both the analysis of comparisons in points in time or across time.

Finally, if age controls are required, several methods are possible: such as age-standardization across the entire age distribution, or focusing on a particular age sub-group that is further partitioned (controlled) by relevant (non-age sensitive) variables. The definitive (control) method is likely data (and cost) dependent and could be chosen after examining some trial data encompassing both comparison groups and variables of interest.

3.1.5 Comparing to Mainstream: Geographical Considerations

The answer to the basic question, *Do we need a second comparison population that reflects the conditions of Canadians in general who live in similar geographical circumstances?* is generally "yes". This response was alluded to in sections 2.2.5 and 2.3 above, which described the main arguments underlying improper comparison groups. That is, when specific variables (particularly those of a economic nature) are used to compare the Indian on-reserve population with the Canadian population, the issue of comparing (very different)

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[13] Note that this advice would apply for both one point in time comparisons and for comparisons across time, where age remains a sensitive variable over time.

rural economies with urban-dominated economies will seriously dominate (bias) the resulting contrasts.

Furthermore, section 2.2.5 outlined three different approaches for comparing Indian reserve communities with the Canadian population so that appropriate geographical comparison groups could be used to ameliorate such (especially economic) contrasts. The corollary question now becomes, *Which of these approaches is preferable, and should, therefore, be used in the pending INAC publication work?* The response of experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada suggested:

"with respect to comparing Indian reserve communities *with the Canadian population;* namely:

i) *with rural Canada* (see section 2.2.5 for definition), this approach is a good approach, very intuitive and easy to explain to users, easy to control (as the comparison zones are prespecified by the researcher), and relatively inexpensive as a data tool/methodology to employ for such comparisons. In addition, the data retrievals for splitting the urban and rural data subsets are a straightforward systems task.

ii) *with (preselected) non-Indian comparison ("control") communities,* this approach is generally difficult to explain and defend to users (more difficult than the first approach). These difficulties are related mainly to the subjectivity underlying both the specific communities chosen and the actual number of comparison communities used. Thus, this approach generally requires much analysis to defend its basis, and costs more to implement than the first approach above.

iii) *with locational/spatially-standardized comparison areas,* this approach is the most sophisticated of the approaches discussed here (with possibly the most to gain in terms of "optimum" comparison areas), and would likely be the most expensive to implement [14]; however, it is not clear what the specific benefits would be until it was implemented. One way to (inexpensively) address this

[14]This statement was an opinion based on the experiences of an interviewed expert, and is not substantiated by research.

latter shortcoming would be to pilot test this approach, say, for one province, take the potential benefits (e.g., more valid/precise comparisons), and then properly weigh the benefits against the competing approaches above. Upon this benefit/tradeoff analysis, a final choice would be made as to the preferred approach".

"In sum, whatever approach is chosen, empirical analysis will be required to test and validate the underlying assumptions. If simplicity and cost constraints are leading considerations in the choice of the approaches above, then the first approach is the preferred approach. If rigor is the leading consideration and cost is not a priority, then the third approach seems best."

3.1.6 Sub-Aggregate Considerations

With respect to the questions, *Could analysis present gender-specific statistics?* And *Could analysis present regional/provincial statistics?*, detailed responses were given in sections 3.1.1, 3.1.2, and 3.1.3. The detailed responses vary by province/region and by variable, and are not repeated here.

In general, it may be concluded that it is statistically acceptable (valid) to present gender-specific (and most other Census-derived [15]) statistics at the national level, and for selected provinces/regions [8], excepting Quebec.

In particular, with respect to gender-specific statistics at the national level, no significant gender differences were found in the comparison of the participating versus non-participating reserves.

With respect to provincial/regional tabulation comparisons between the participating and non-participating reserves, caution needs to be exercised with data from Quebec and for some variables (see below).

It is emphasized that for income variables, the use of per capita income is the preferred statistic, as the mean income measure seems to be confounded and not reflective of real changes in (male, female) income. In addition, opinion of experts from Statistics Canada affirmed that the inherent (but, generally small) biases due to the non-participating

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[15] That is, for the variables described in the aforementioned sections.

Indian communities for the 1991 Census would most likely replicate to a lesser degree those observed (and analyzed - see Footnote 1) for the 1986 and 1981 Censuses. Therefore, this statement above applies for all Census years 1981, 1986, and 1991. (Note Indian non-response was not an issue in 1971, thus the complete 20 year period applies).

3.2 Other Findings

The following two subsections highlight our findings and lessons learned with respect to: 1) the use of the registered Indian data versus the total population on-reserve data (section 3.2.1), and 2) the selection of variables used during the special runs produced for Appendices B and C of this report.

3.2.1 Use of Registered Indian versus Total Population on Reserve

For most variables the use of registered Indian data versus the Total Population on Reserve data did not substantially produce different profiles. In other words, the proportion of non-registered Indians and/or non-Aboriginal living on reserves did not, in general, substantially affect any of the resulting comparisons *for most variables*.

One notable exception to this latter statement was the variable "university education." It was found that the published Statistics Canada on-reserve tabulations include non-Aboriginals, of which a significant number had university degrees - thereby, significantly affecting/confounding the accurate profiling of this variable for the population of registered Indians on-reserve. Therefore, special runs, as exemplified by the data profiles in Appendices B and C, were performed for all the education variables of registered Indians living on-reserve; this approach directly remedied this problem.

The lesson learned in this case is two-fold: 1) know exactly what is included and excluded in published Statistics Canada publications for "registered Indians living on-reserve"; and, 2) be ready to use special runs (and/or statistics) to remedy any known confounding situations due to the inclusion of unwanted sub-populations in the published tables.

3.2.2 Selection of Variables

During the course of the analysis, it was also learned that the selection of variables (including derived statistics) was critical to producing more consistent (valid) and useful

profiles of registered Indians living on-reserve from Census data. For example, it was found that:

- the (derived) *per capita income* statistic was clearly a better indicator than *mean income* for measuring "income success" for registered Indians living on-reserve; per capita income not only produced more consistent (valid) results (as demonstrated in the comparisons of Appendix B (see analysis for income in section 3.1.3), but it was a more useful indicator for depicting community circumstances, since mean income statistics reported only on those individuals with income;

- the use of employment ratios versus unemployment and/or participation rates was also a better indicator for measuring "employment success"; the use of employment ratios allowed a direct focus on (unconfounded) results (as performed on the Appendix B data; see section 3.1.3 [16]), whereas the unemployment and/or participation rates could not be as easily analyzed without being subject to confounders (e.g., unemployment looks at only those self-identifying as being in the labour market).

[16] For example, this clear focus on the profiled results of Appendix B verified our being "better" able to distinguish between 'high/low' reserves when using "better variables" (i.e., use of employment ratios, rather than unemployment/participation rates).

4.0 Conclusions and Recommendations

The study provided a statistical analysis of Census data including, in particular, the data presenting trends in socio-economic well-being for registered Indians on-reserve from 1971-1991. The findings have provided answers, recommendations and lessons learned in the use of such Census data for the proposed publication of social trends on-reserve. The key questions addressed in the analysis, and the corresponding "best answers and recommendations" are summarized below [17].

Q1) ***Can four-points-in-time Census data be used to interpolate trends with validity?*** (see Section 3.1.1)

A1) With respect to *participation rate* comparisons,

- *there is strong validity for the use of participation rate comparisons at the national level in conducting further analyses on subsets of the Census data.*

- *there is strong validity for the use of participation rate comparisons at all provincial levels in conducting further analyses on subsets of the Census data, keeping in consideration the modest (about 10%) upward variability in the Census data for the Altantic provinces from 1981 to 1991.*

With respect to *unemployment rate* comparisons,

- *there is reasonable validity for the use of unemployment rate comparisons at the national and provincial level in conducting further analyses on subsets of the Census data, keeping in consideration that the data are most accurate/useful at the overall trend level for the 1971-1991 period.*

Although data on *other study variables (shelter, education, income)* were not readily available for addressing Question 1), it is felt that *similar results as shown here would likely be found.*

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[17] These questions - and respective answers, *particularly the first two*, underpin the rationale and methodology for proceeding (or not) with the proposed publication.

In sum, *Question 1 is answered in the affirmative*, whereby conclusions can be drawn from four-points-in-time Census data as to the degree of correspondence between the corresponding sets of data vis à vis magnitude and trends.

Q1a) Another aspect of the first question noted above is whether or not *the data collected for on-reserve population* during the census years in question are *internally valid*. That is, ***do Census data provide reliable measures of what they are intended to measure?*** (see Section 3.1.2)

A1a) With respect to *education, labour force, per capita income ratio, and shelter* comparisons,

- *there is reasonable internal validity that the Census data can provide reliable (consistent) measures of these variables/statistics, useful for Indian reserve comparisons at the regional/provincial level.*

Q2) ***Do we need to control for inconsistency in Census participation by First Nations?*** (see Section 3.1.3)

A2a) the review of Statistics Canada studies found:

- *there were no significant differences or impacts in the male/female ratios for participating and non-participating reserve communities for the 1981-1986 Census years.*

- *that simple age group comparisons (1981-1986) will generally reflect real changes in conditions at the national level, and for most provinces/regions, excepting Quebec.*

- *that simple labour force comparisons using the 15 years and over group comparisons (1981-1986) will generally reflect real changes in conditions at the national level, and for most provinces/regions, excepting Quebec.*

- ***that simple labour force comparisons using the unemployed as a percentage of the labour force population in reserve communities will generally reflect real changes in conditions at both the national and regional/provincial levels.***

- *that simple education comparisons of the reserve population aged 15 years and over for the highest level of schooling from 1981 to 1986 will generally reflect real changes in conditions at the national level.*

- *that simple - and, especially aggregated labour force population-education comparisons of the reserve population for the highest level of schooling from 1981 to 1986 will generally reflect real changes in conditions at the national level - and, indeed, even at the regional/provincial levels for some aggregated data variables.*

- *that the various household size statistics both nationally and regionally/provincially have appreciable magnitude and trend differences that do not reflect real changes in conditions but rather are attributable to biased coverage. Therefore, when using household size-related variables for trend analysis using given Census data, these results should be treated with considerable caution.*

A2b) the comparison of social trends of aggregated individual reserves versus all participating reserves - for the selected variables taken from published Statistics Canada Census tables from 1981 to 1991; namely:

1) percentage of the population 15 years old and older;
2) percentage of people (15 and older) with highest level of schooling less than grade 9;
3) percentage of people (15 and older) employed;
4) percentage of people (15 and older) participating in the labour force (male, female, total);
5) average male income;
6) average female income;
7) average total income; and,
8) per capita total income,

found the following:

- *for all the aforementioned variables (with the slight exception of average income) both the magnitude and trend comparisons for the aggregated individual reserves and all participating reserves in each Census year and over the period 1981 to 1991 show strong consistency.*

- *that there is strong validity for the (further) use of Census data in trend analysis at the national level. It is highly probable that appreciable magnitude and trend differences would reflect real changes in conditions and not be attributable to biased coverage due to the inconsistent participation by First Nations, particularly in the 1986 and 1991 Census years.*

- *that average income statistics have been in some way confounded and that they do not reflect real changes in income conditions in the Indian reserve population at the national level.*

- *that per capita total income is a reasonably valid indicator for depicting real changes in income conditions in the Indian reserve population at the national level.*

A2c) the views and suggestions from experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada found:

- that, *overall, their advice was consistent with the findings as reported above.*

- *that valid (consistent) data comparisons between the Indian reserve and the general Canadian population - especially for the 1981 to 1991 Census data years - would result if the trend analysis focused on the national level - with the exception of Census income, where caution must be exercised in its straightforward use.*

***In summary**, we conclude that one can safely construct national level trends using the data collected from all participating reserves for variables pertaining to education, labour force activity and demographic characteristics. Household size and income statistics, with the possible exception of per capita income, require special manipulation to control for biases. Quebec data are problematic, and the construction of trends at province/region aggregations should also control for variation on participation. The effects of non-participation on other variables that were not examined, such as language and mobility, are unknown and would have to be assessed on a case by case basis unless the data were manipulated in advance (cohort of reserves) to control for non-participation.*

Q3) *Do we need to age standardize comparisons?* (see Section 3.1.4)

A3) Our findings found concurrence between previous INAC research and independent expert opinion; that is:

- from previous INAC research *that indicators such as mortality, education, employment and income are generally associated with age, and controlling for age between on-reserve and the general Canadian population would likely be needed* to remedy any biased comparisons between these indicators; and,

- based on the opinion of experts on Aboriginal data from the Royal Commission on Aboriginal Peoples and Statistics Canada *that for Labour Force type variables and/or other age-sensitive data, it may be a good idea to age-standardize the data when comparing on-reserve and the general Canadian populations since the distributions are very different".*

Q4) *Do we need to control for age structure across time?* (see Section 3.1.4)

A4) The main findings obtained from previous INAC research and independent expert opinion were:

- *age standardization controls would not be necessary if the age structures of the comparison groups are changing at equivalent rates or changing only gradually.*

- *before invoking standardization procedures, the comparison groups under study need first be examined to confirm that the variables in the comparison are indeed age-sensitive; otherwise, there would not be a need to age-standardize the data or control for the age structure across time.*

- *ultimately, the final decision will rest with which data and/or variable comparisons are actually performed; for national level profiles, it would seem prudent to first investigate the possible bias of using non-age adjusted comparisons, and fine-tuning (age adjust) the final data comparisons as appropriately required by these initial analyses. This advice applies to both the analysis of comparisons in points in time, or across time.*

- *if age controls are required, the definitive (control) method is likely data (and cost) dependent and could be chosen after examining some trial data encompassing both comparison groups and variables of interest.*

Q5) ***Do we need a second comparison population that reflects the conditions of Canadians in general who live in similar geographical circumstances? How can this be done?*** (see Section 3.1.5)

A5) Based on previous INAC research and opinion of independent experts, we found:

- generally, *"yes", there is a need for a second comparison population that reflects the conditions of Canadians in general who live in similar geographical circumstances? Otherwise, the issue of comparing (very different) rural economies with urban-dominated economies will seriously dominate (bias) the resulting contrasts.*

- *in terms of how this can be done,* three approaches were examined and compared (see Sections 2.2.5 and 3.1.5); the results are summarized as follows: with respect to comparing Indian reserve communities *with the Canadian population*; namely:

  i) *with rural Canada*: this approach is a good approach, very intuitive and easy to explain to users, easy to control (as the comparison zones are prespecified by the researcher), and relatively inexpensive as a data tool/methodology to employ for such comparisons. In addition, the data retrievals for splitting the urban and rural data subsets are a straightforward systems task.

  ii) *with (preselected) non-Indian comparison communities*: this approach is generally difficult to explain and defend to users (more difficult than the first approach). This approach generally requires much analysis to defend its basis, and costs more to implement than the first approach above.

  iii) *with locational/spatially-standardized comparison areas*: this approach is the most sophisticated of the approaches (with possibly the most to gain in terms of "optimum" comparison areas), and likely

the most expensive to implement; however, it is not clear what the specific benefits would be until it was implemented.

In sum, whatever approach is chosen, empirical analysis will be required to test and validate the underlying assumptions. If simplicity and cost constraints are leading considerations in the choice of the approaches above, then the first approach is the preferred approach. If rigor is the leading consideration and cost is not a priority, then the third approach seems best.

Q6) ***Could analysis present gender-specific statistics?*** (see Section 3.1.6)

A6) The analysis showed:

- *that it is statistically acceptable (valid) to present gender-specific (and most other Census-derived [18]) statistics at the national level, and for selected provinces/regions [8], excepting Quebec.*

- *with respect to gender-specific statistics at the national level, no significant gender differences were found in the comparison of the participating versus non-participating reserves.*

Q7) ***Could analysis present regional/provincial statistics?*** (see Section 3.1.6)

A7) In general, it was found:

- *that it is statistically acceptable (valid) to present Census and Census-derived statistics at the national level, and for selected provinces/regions (given the following context/recommendation).*

- *with respect to provincial/regional tabulation comparisons between the participating and non-participating reserves, more work remains in investigating the biases at lower levels of aggregation to identify biases and*

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[18] That is, for the variables described in the aforementioned sections.

devise steps to deal with the biases, such as the use of cohorts of reserves for provincial-level statistics. In sum, it is recommended at this time not to construct trends at these levels using unmanipulated data, and that caution be exercised with data from Quebec and for some variables [19].

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[19] Other *exceptions to the foregoing statement - in terms of variables, statistics, and/or provinces/regions - are detailed throughout the sections referenced above.*

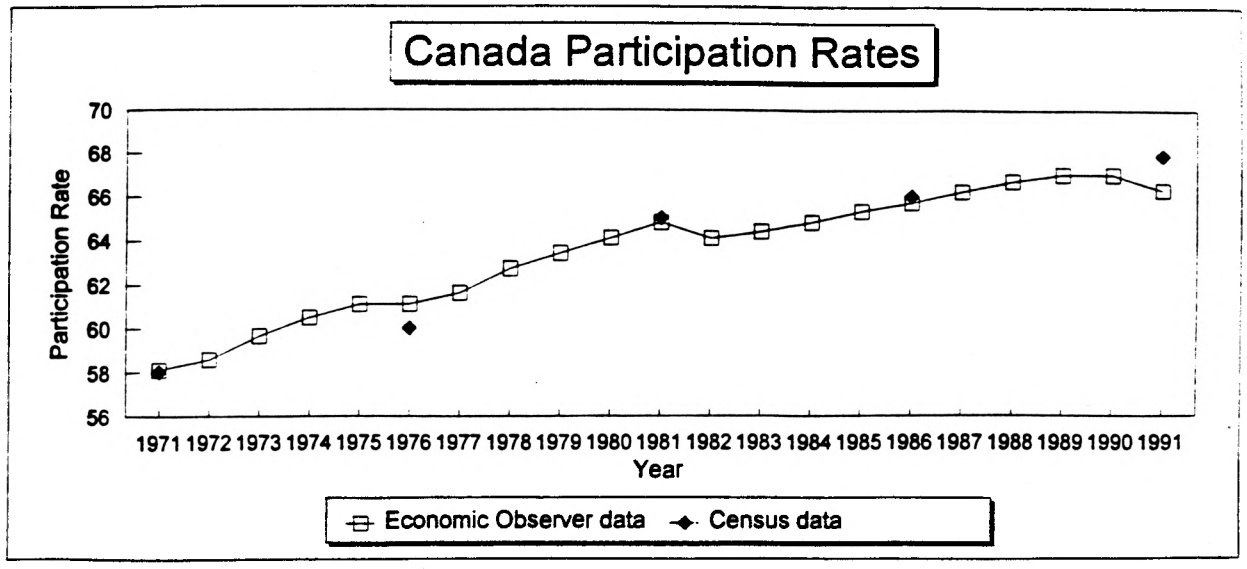
Appendix A:

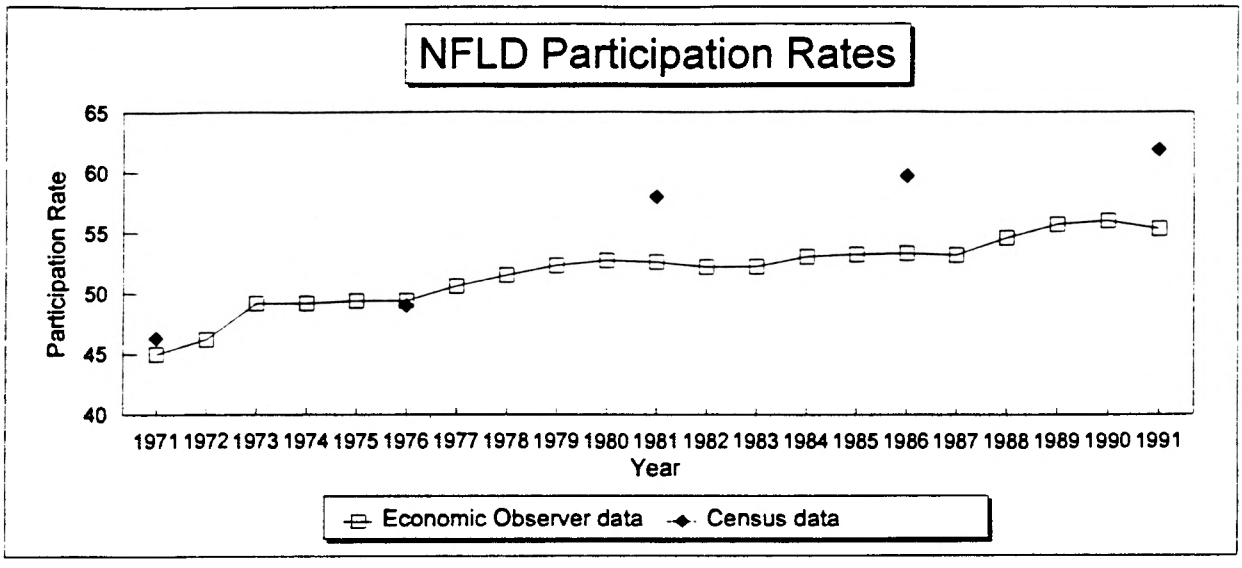
Comparison of Census Data versus Annual Data on Labour Force Activity from 1971 to 1991

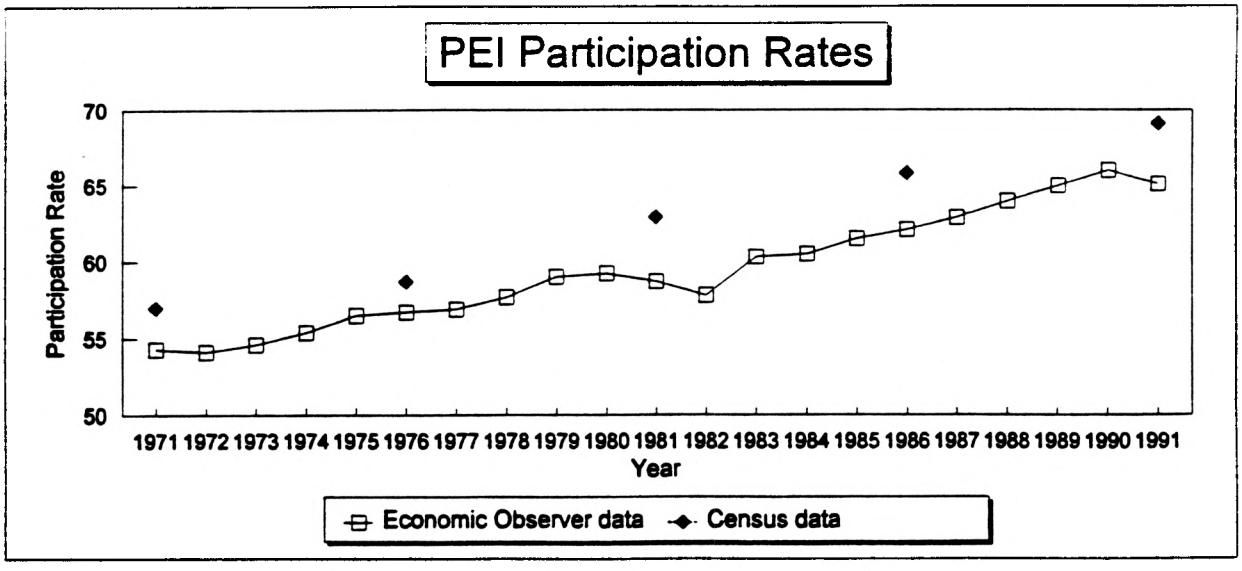
Graphical Displays of Census Data versus Annual Data

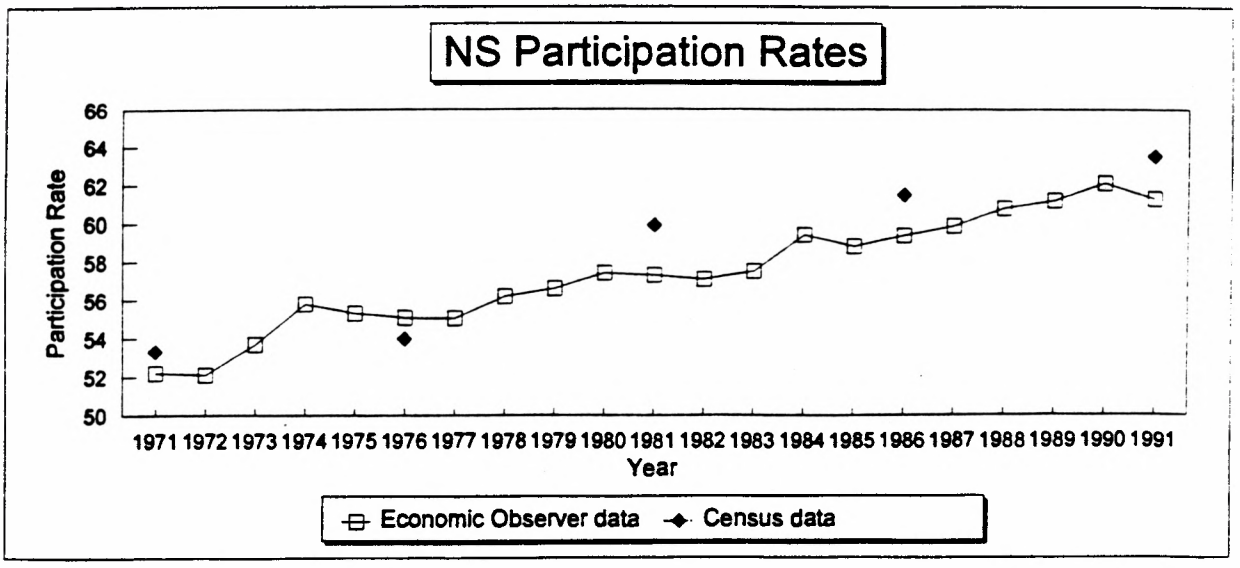
Data was collected on participation and unemployment rates from census tables in Statistics Canada publication 93-324 Table 3 and annual data from the Canadian Economic Observer,11-210,table 8 and 40. Figure A1 displays the participation rates by province and Canada and Figure A2 displays the unemployment rates by province and Canada.

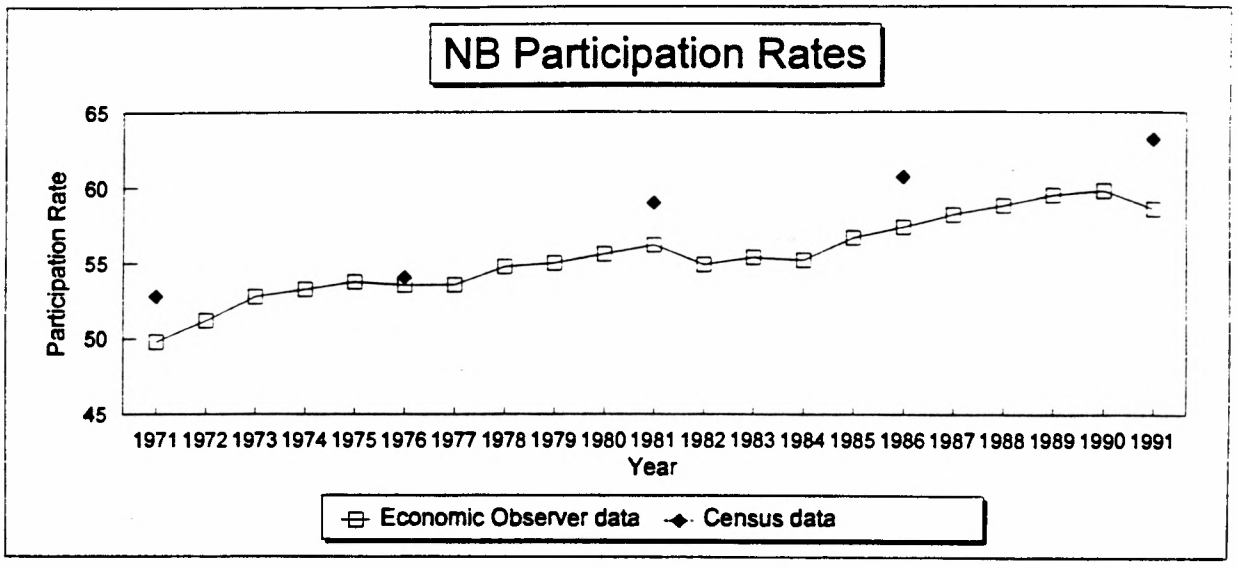
FIGURE A1. Participation Rates by Province and Canada

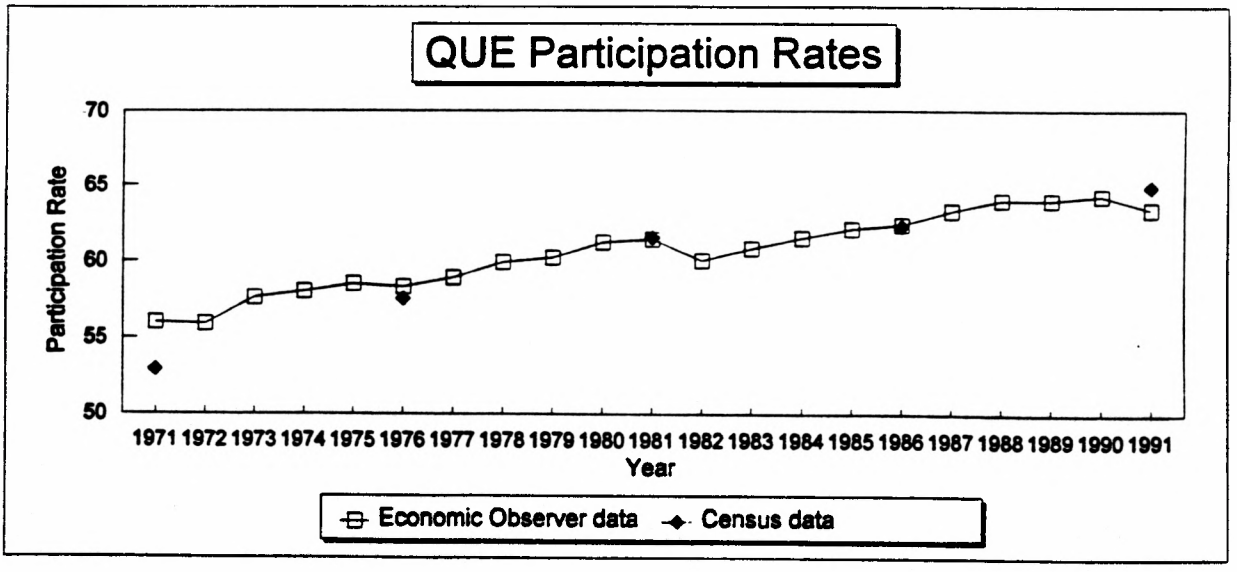

Canada Participation Rates
Participation Rate
70
68
66
64
62
60
58
56
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

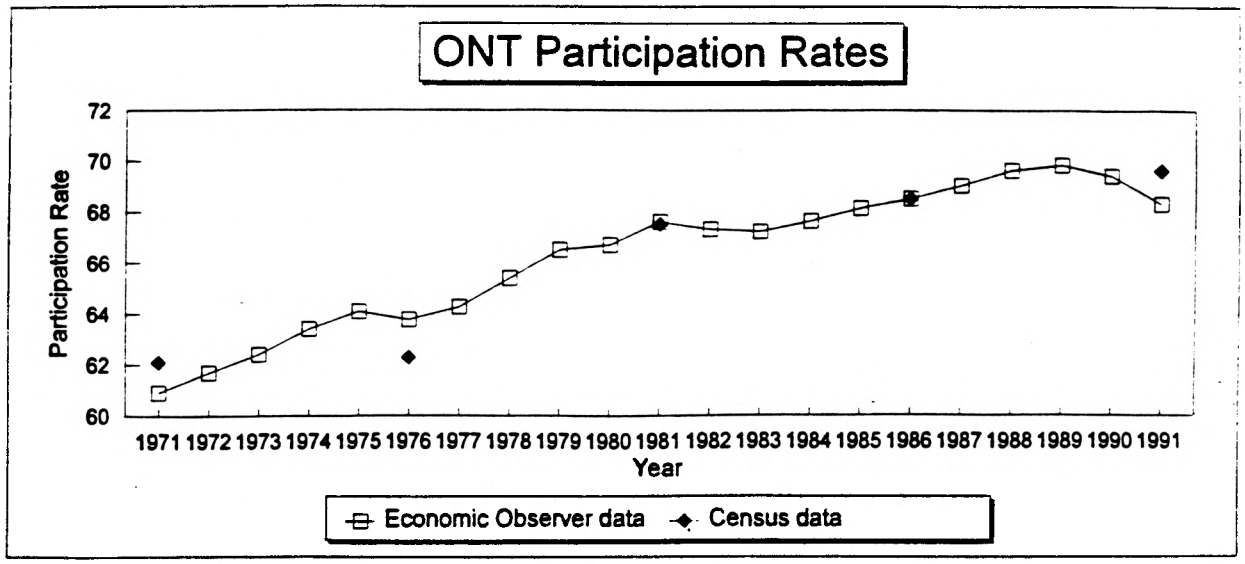

NFLD Participation Rates
Participation Rate
65
60
55
50
45
40
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

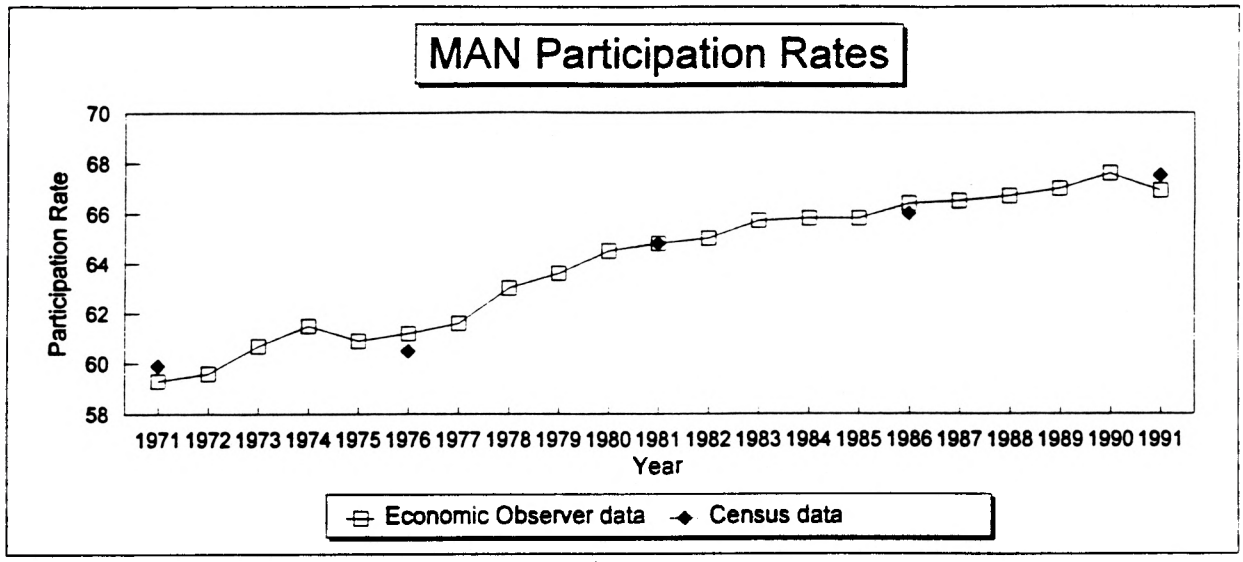

PEI Participation Rates
Participation Rate
70
65
60
55
50
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

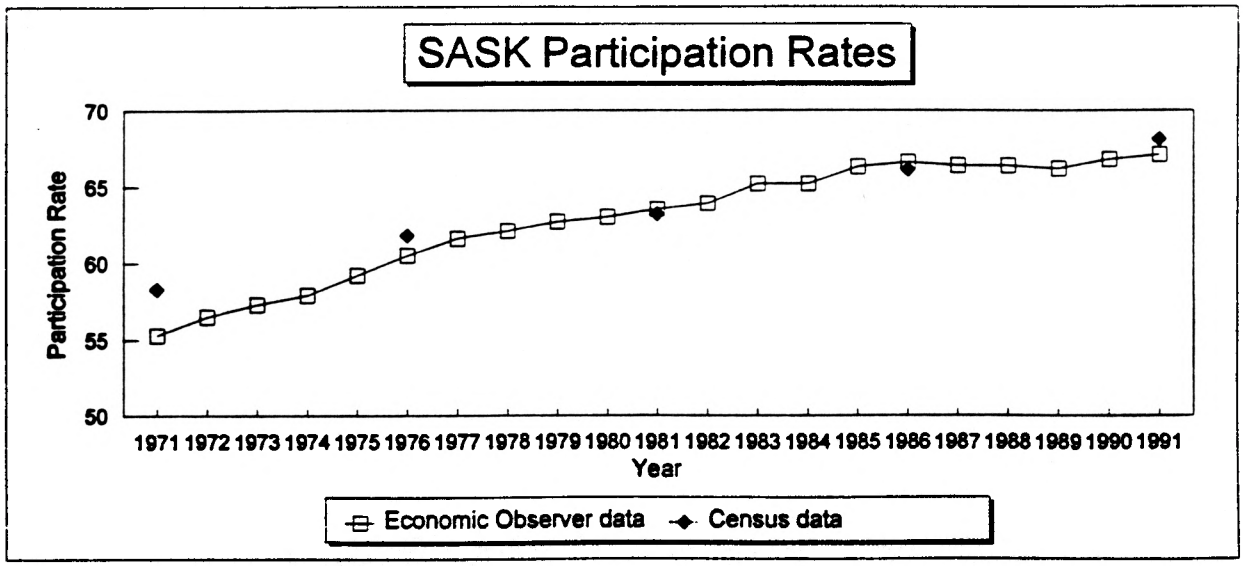

NS Participation Rates
Participation Rate
66
64
62
60
58
56
54
52
50
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

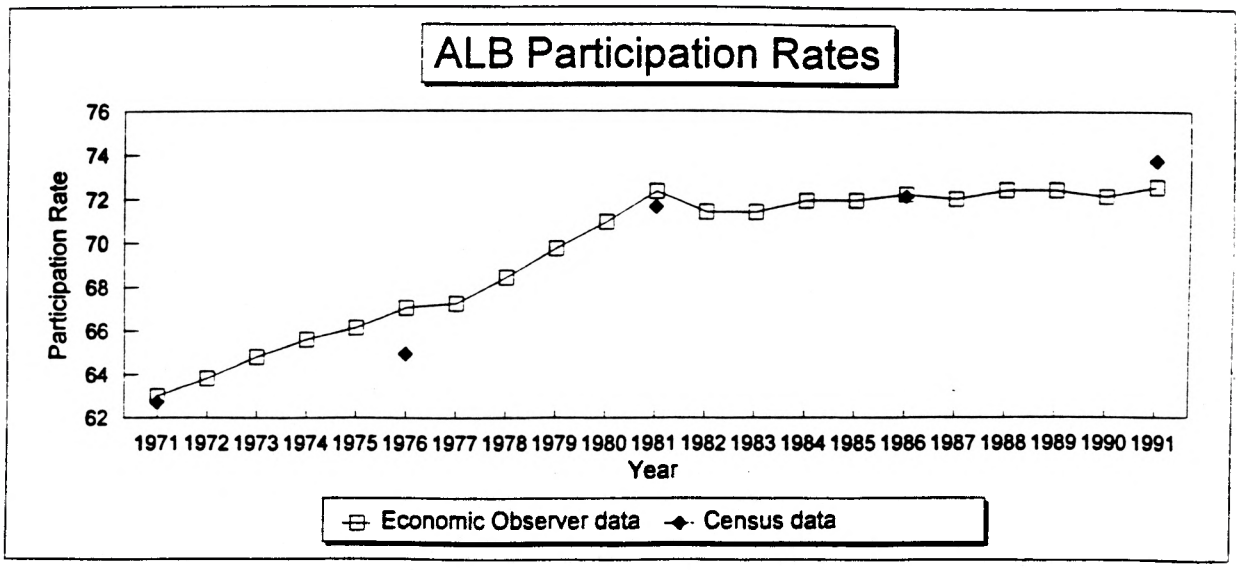

NB Participation Rates
Participation Rate
65
60
55
50
45
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


QUE Participation Rates
Participation Rate
70
65
60
55
50
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


ONT Participation Rates
Participation Rate
72
70
68
66
64
62
60
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


MAN Participation Rates
Participation Rate
70
68
66
64
62
60
58
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


SASK Participation Rates
Participation Rate
70
65
60
55
50
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


ALB Participation Rates
Participation Rate
76
74
72
70
68
66
64
62
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

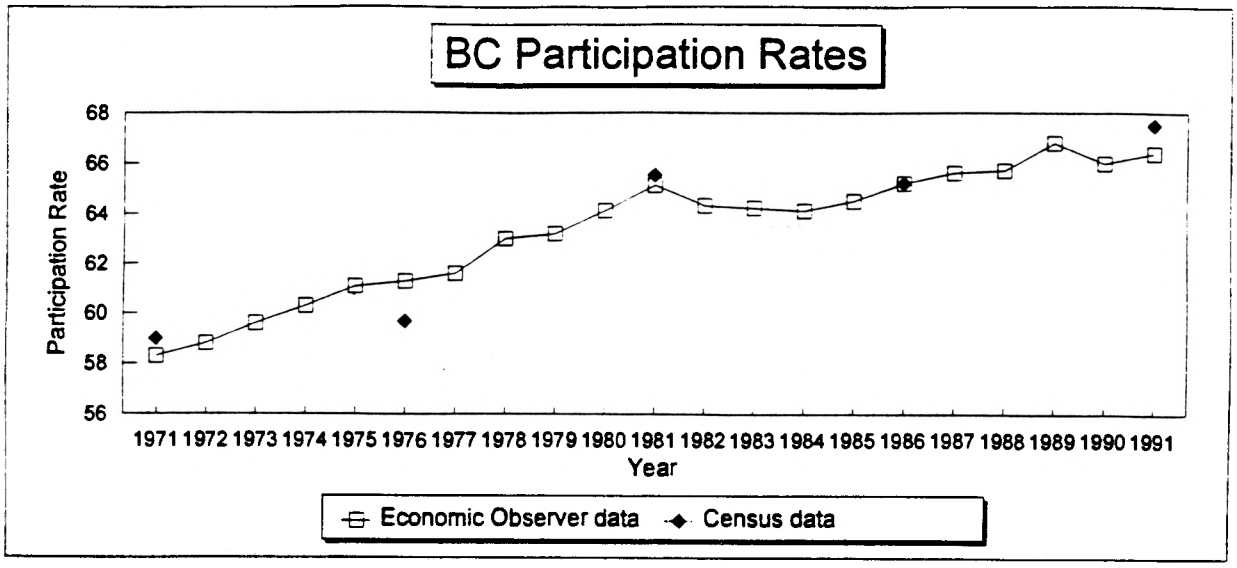
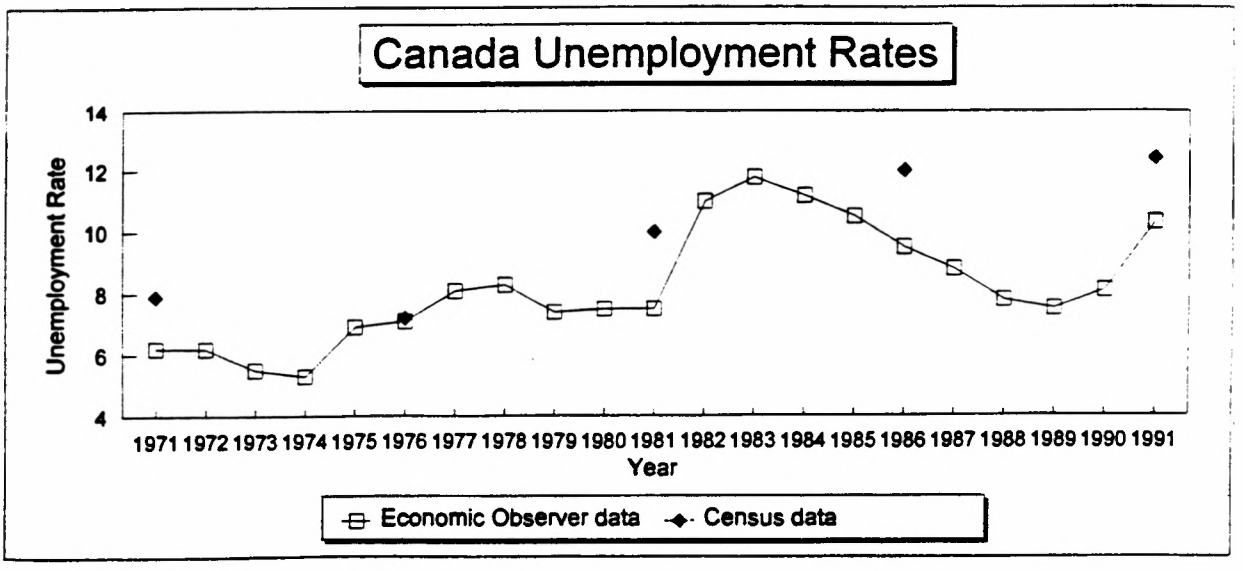
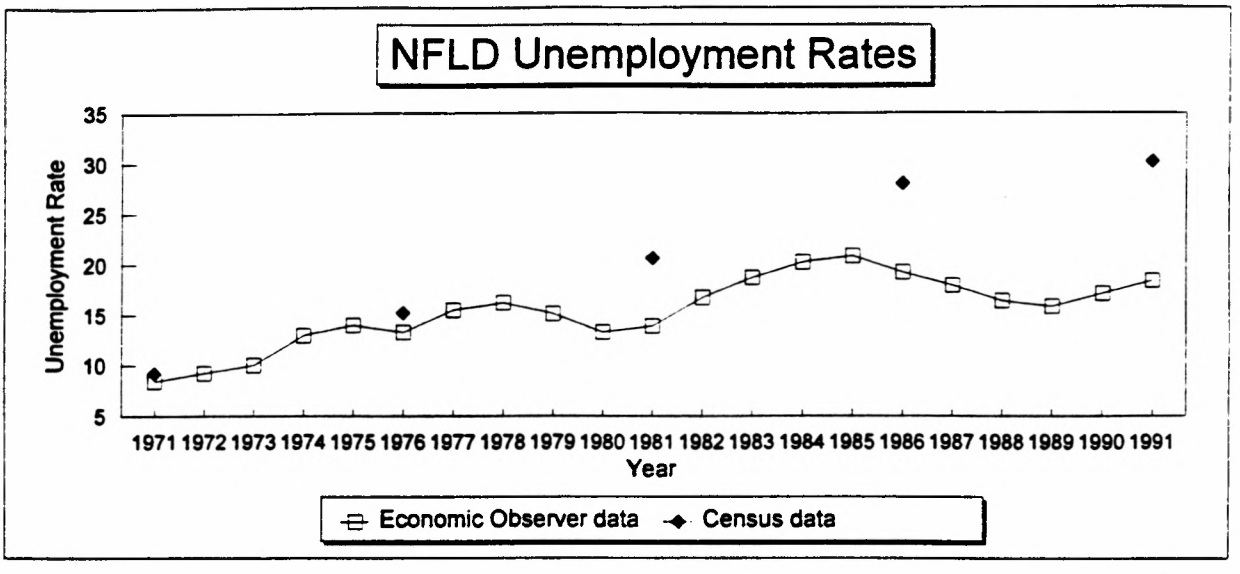
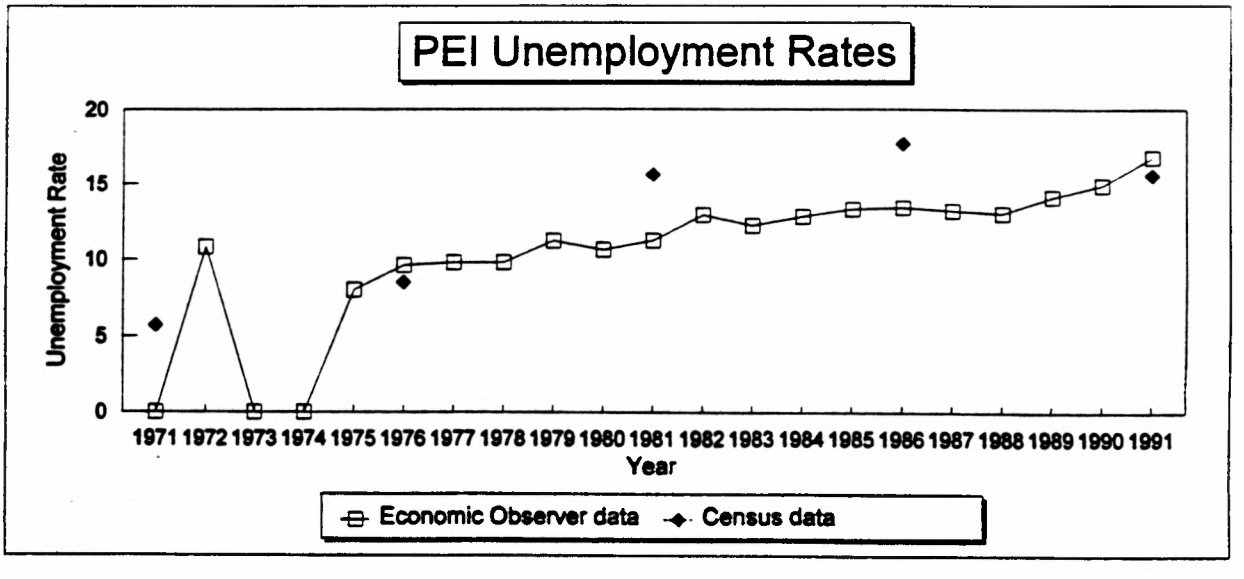
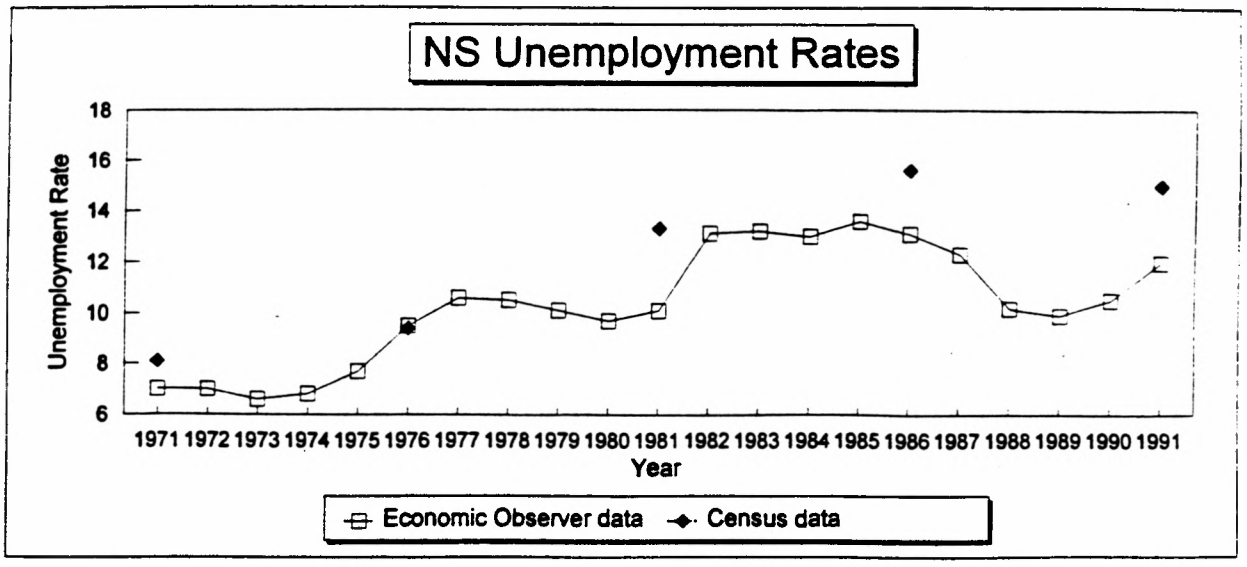

BC Participation Rates
Participation Rate
68
66
64
62
60
58
56
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

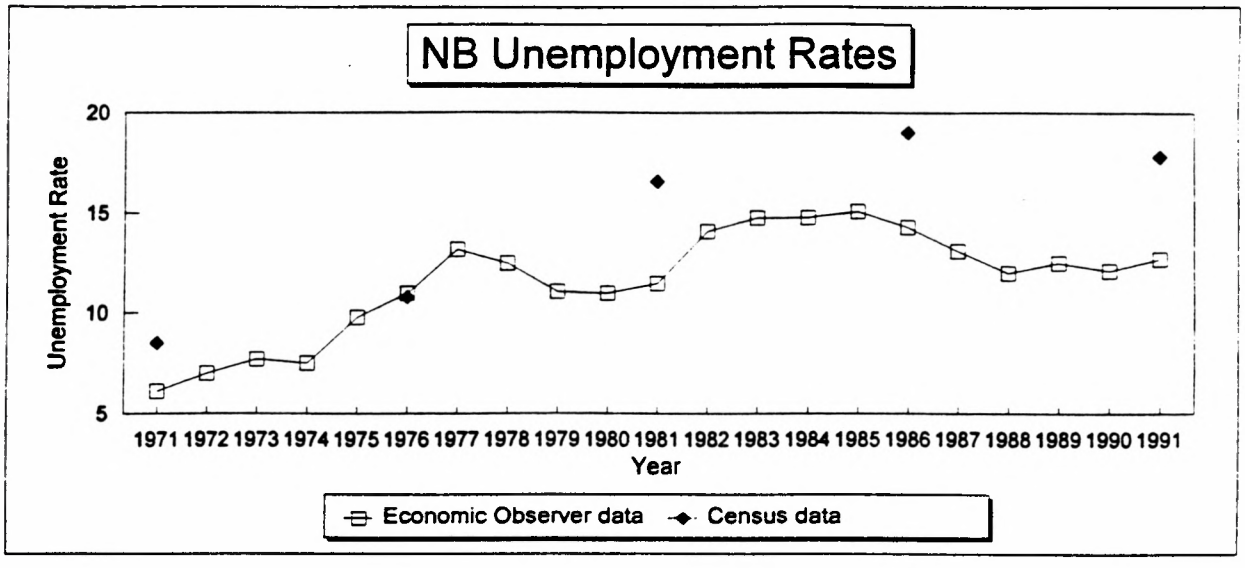
FIGURE A2. Unemployment Rates by Province and Canada

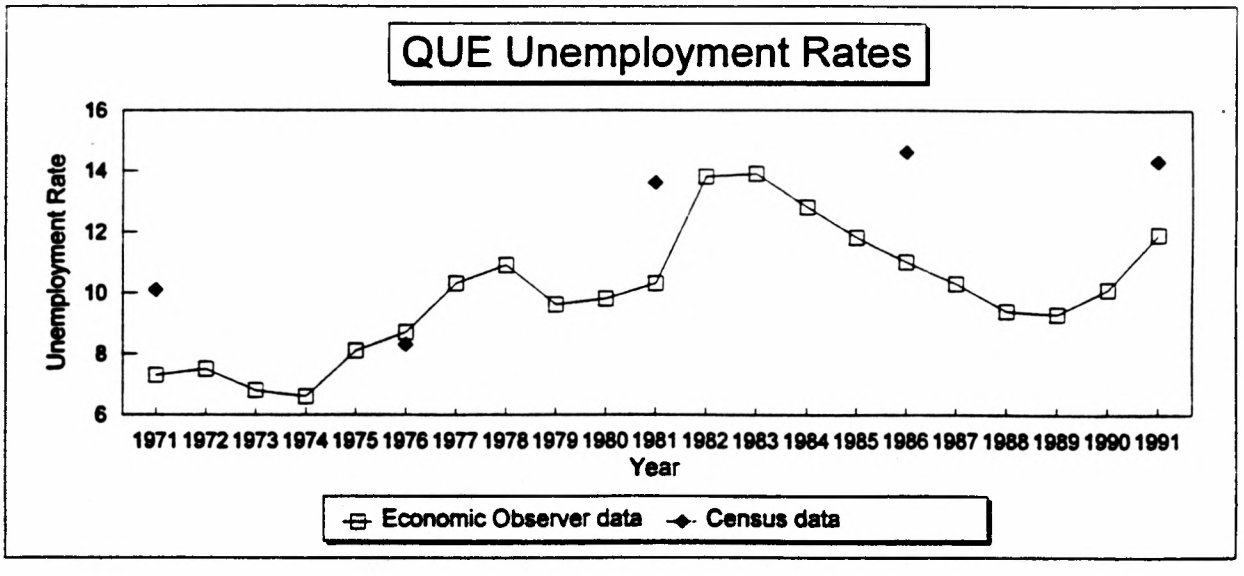

Canada Unemployment Rates
Unemployment Rate
14
12
10
8
6
4
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

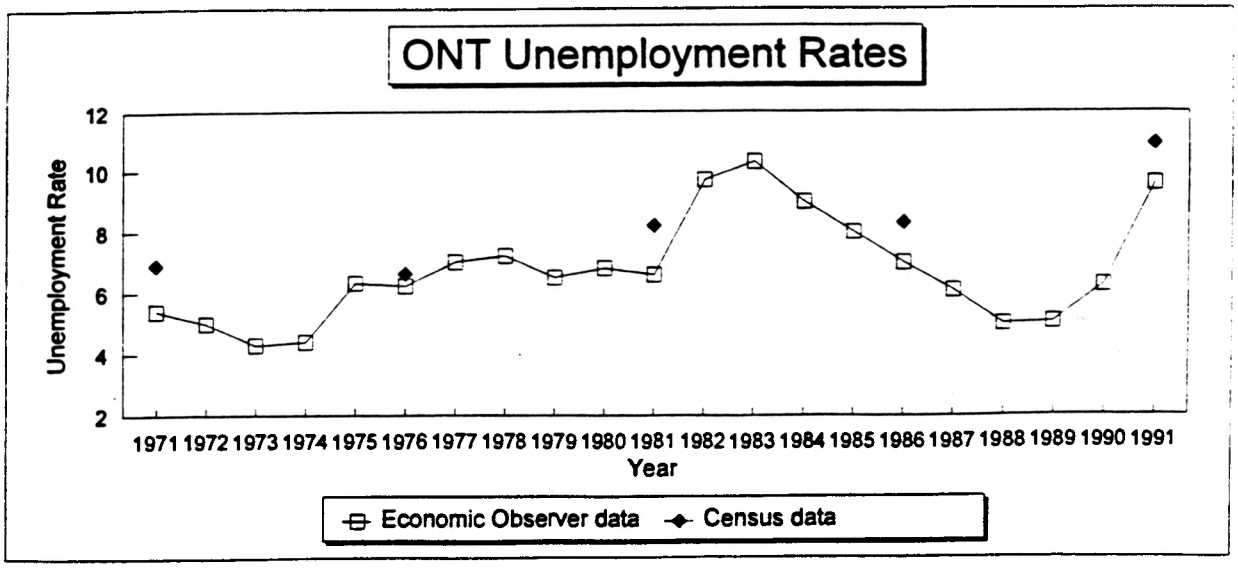

NFLD Unemployment Rates
Unemployment Rate
35
30
25
20
15
10
5
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

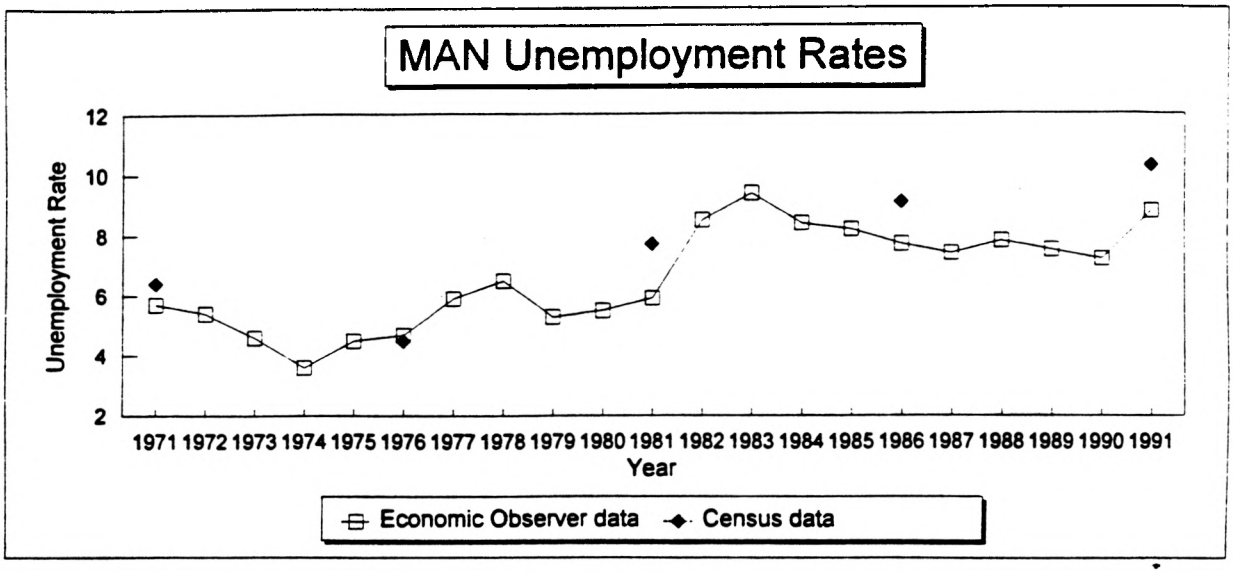

PEI Unemployment Rates
Unemployment Rate
20
15
10
5
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

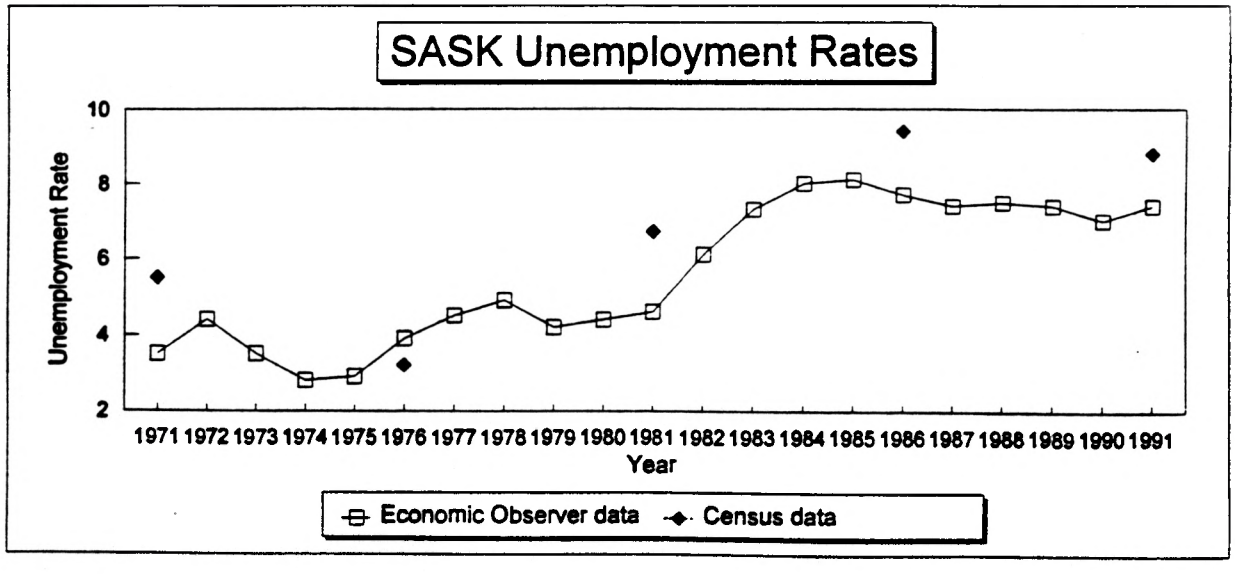

NS Unemployment Rates
Unemployment Rate
18
16
14
12
10
8
6
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

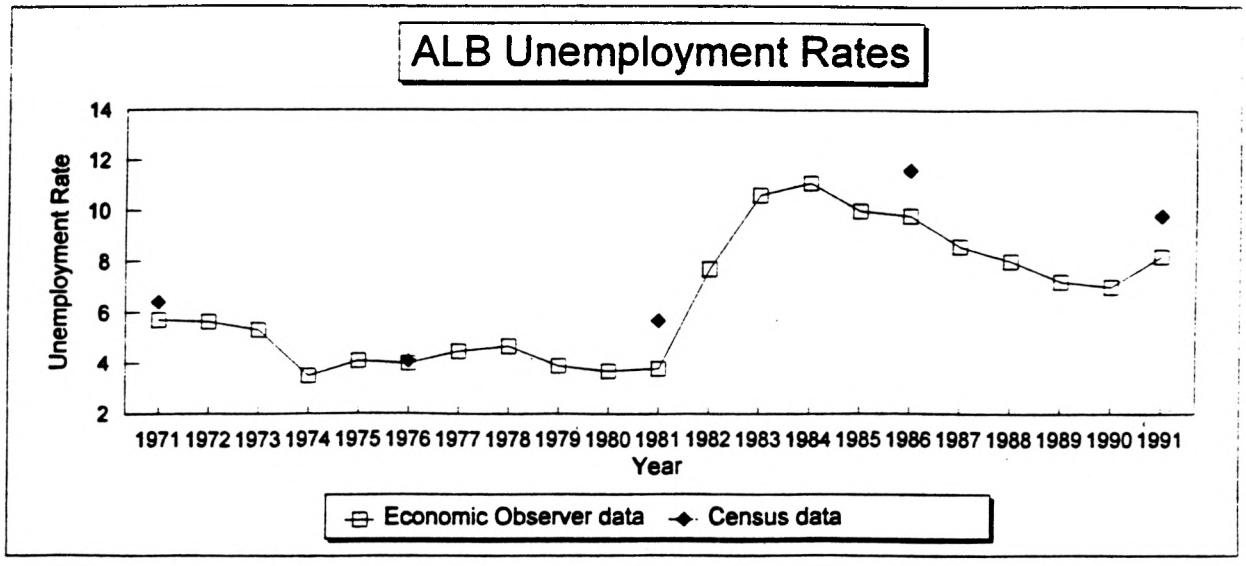

NB Unemployment Rates
Unemployment Rate
20
15
10
5
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

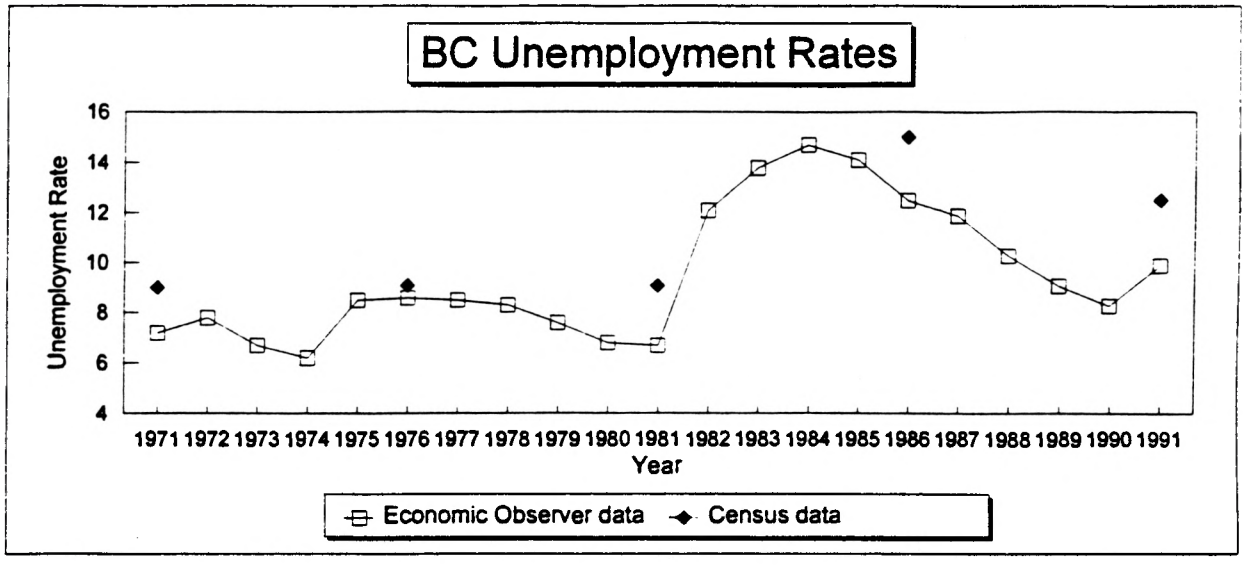

QUE Unemployment Rates
Unemployment Rate
16
14
12
10
8
6
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


ONT Unemployment Rates
Unemployment Rate
12
10
8
6
4
2
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


MAN Unemployment Rates
Unemployment Rate
12
10
8
6
4
2
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


SASK Unemployment Rates
Unemployment Rate
10
8
6
4
2
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


ALB Unemployment Rates
Unemployment Rate
14
12
10
8
6
4
2
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data


BC Unemployment Rates
Unemployment Rate
16
14
12
10
8
6
4
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Year
Economic Observer data
Census data

Appendix B:

Comparisons of Aggregated Individual Reserves, Census Year 1991

Graphical Displays of Aggregated (High vs. Low) Reserves

The following graphs display aggregated totals based on reserves grouped into High or Low categories for each province. Data was collected from INAC resources for Registered Indians in census year 1991 only. Income data, due to suppression by Statistics Canada, were not available for reserves with populations less than 250. However, income data for these reserves were available directly from Statistics Canada under an aggregated total. Graphs using data from Statistics Canada are referenced in the title and displayed on the last page of this Appendix. The following variables used are outlined below:

less than grade 9: education variable, percentage of all 15 year olds and older that had not attended school beyond grade 8.

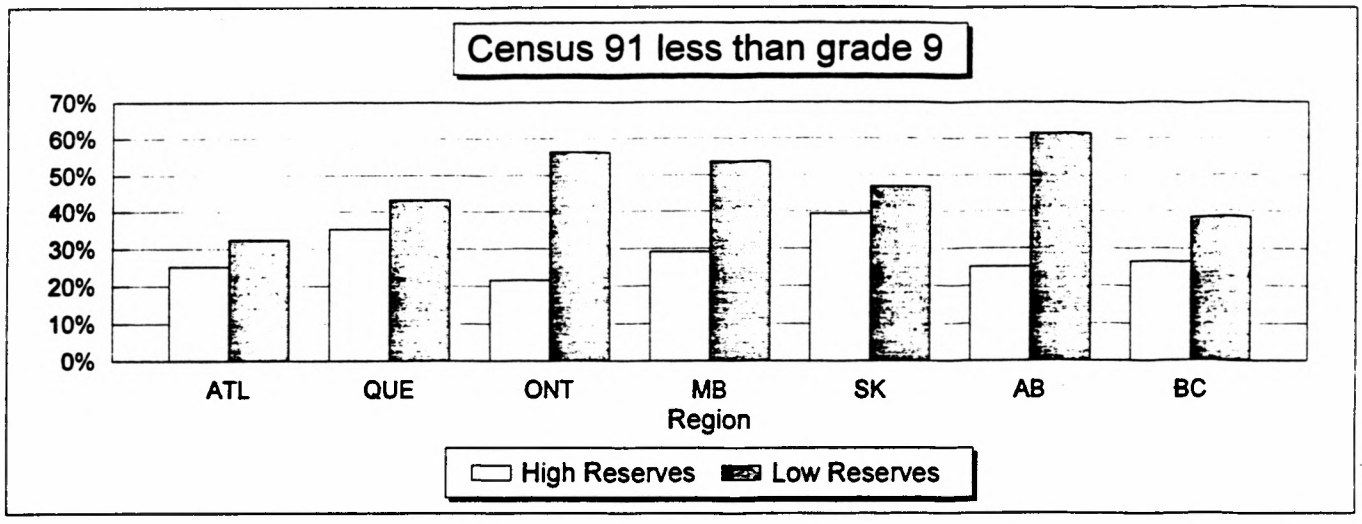
non-univ cert. or univ degree: education variable, percentage of all 15 years old and older that received either a completed non-university (post-secondary) certificate or a completed university degree.

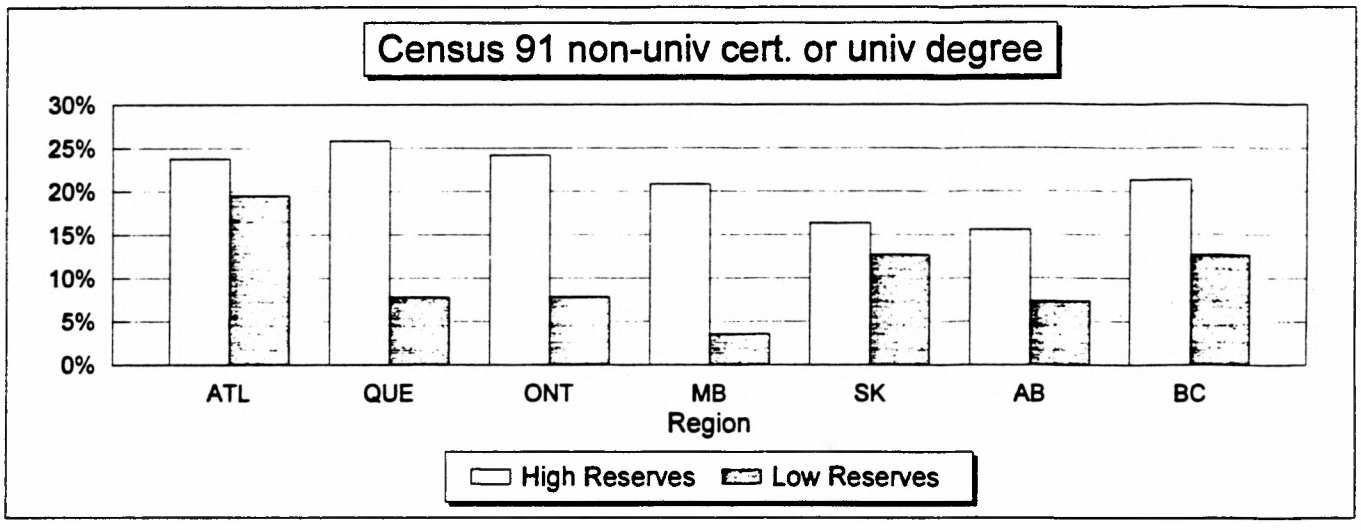
employment ratios: labour force variable (total, male, and female), percentage of all 15 years old and older who are employed. Also displayed are ratios using 15-64 age group as base population.

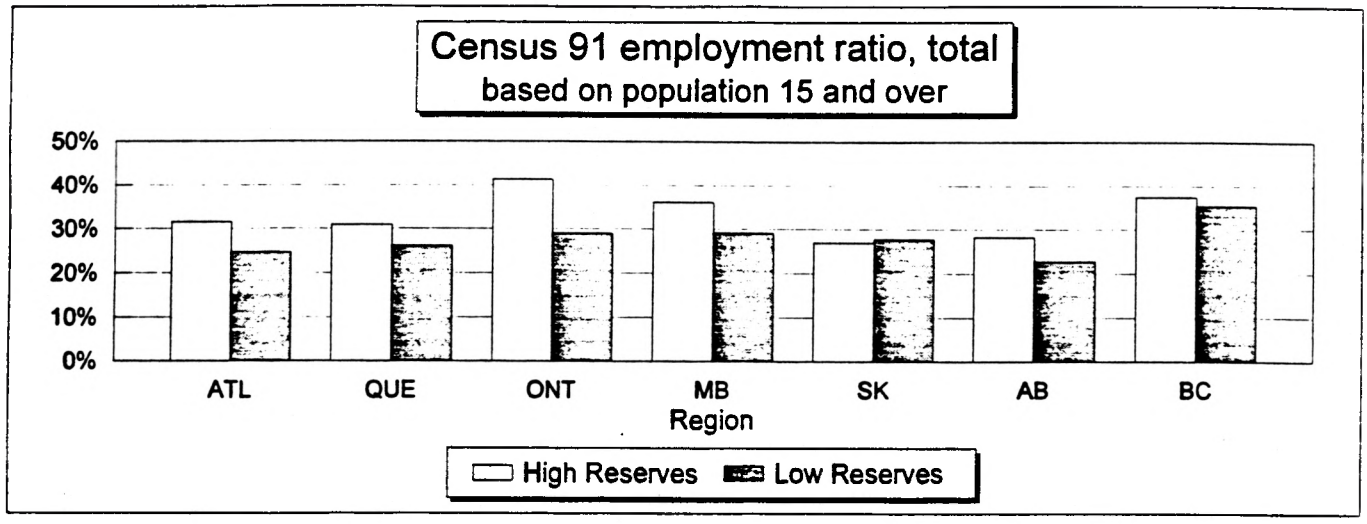
per capita income ratios: income variable (total, male, and female), ratio of total employment income from 15 year olds and older divided by total Registered Indian population (all ages). Data from Statistics Canada refers to total income only.

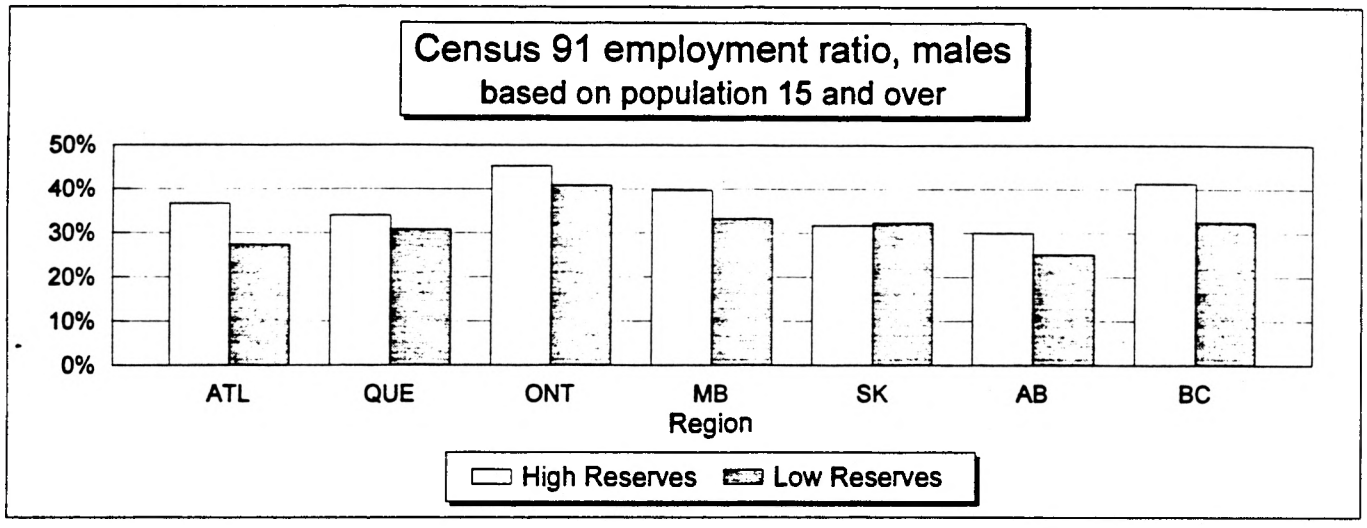
percentage of households > than 1 person/room: shelter variable, from Statistics Canada. This variable take the number of households with more than one person per room and divides by the total number of households.

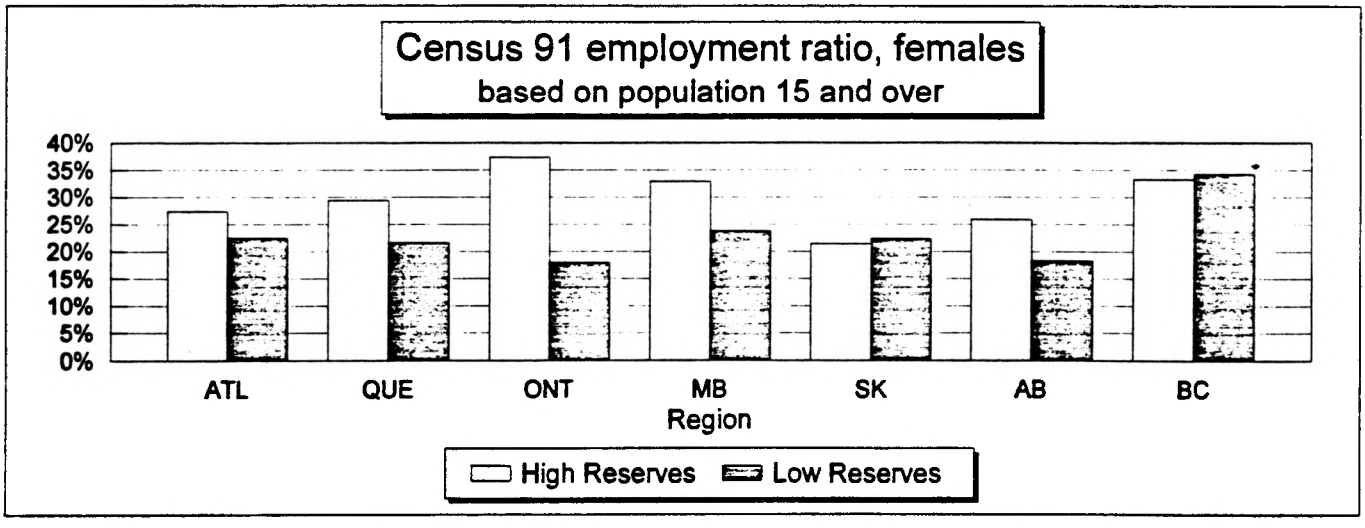
Ratio of people per room: shelter variable, from Statistics Canada. This variable takes the total number of persons living in all households and divides by the total number of rooms found in all the households.

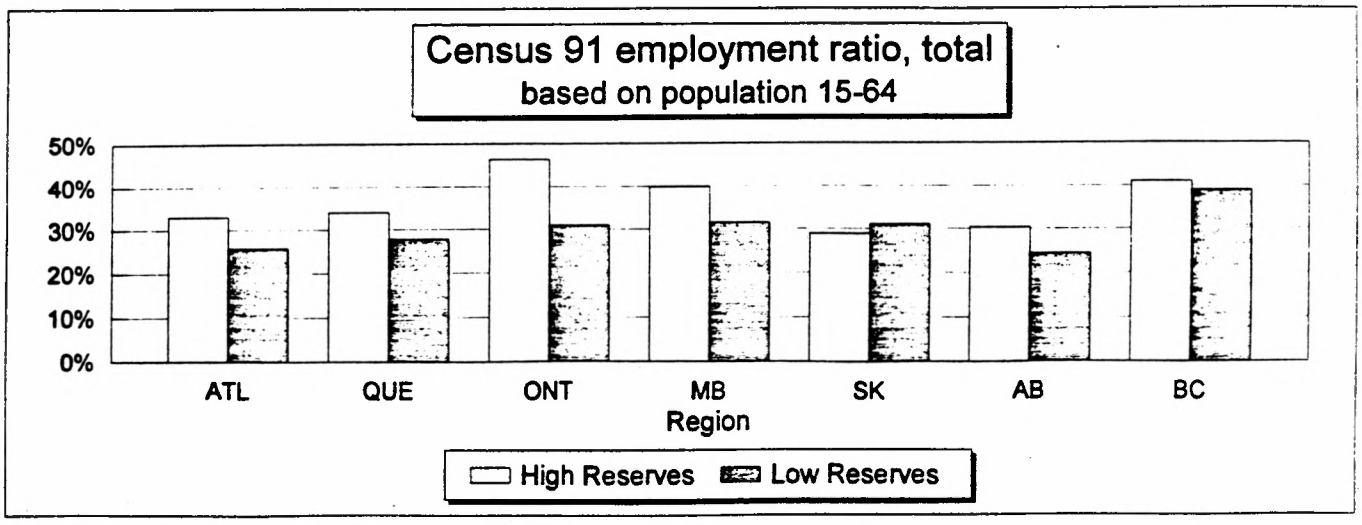

Census 91 less than grade 9
70%
60%
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

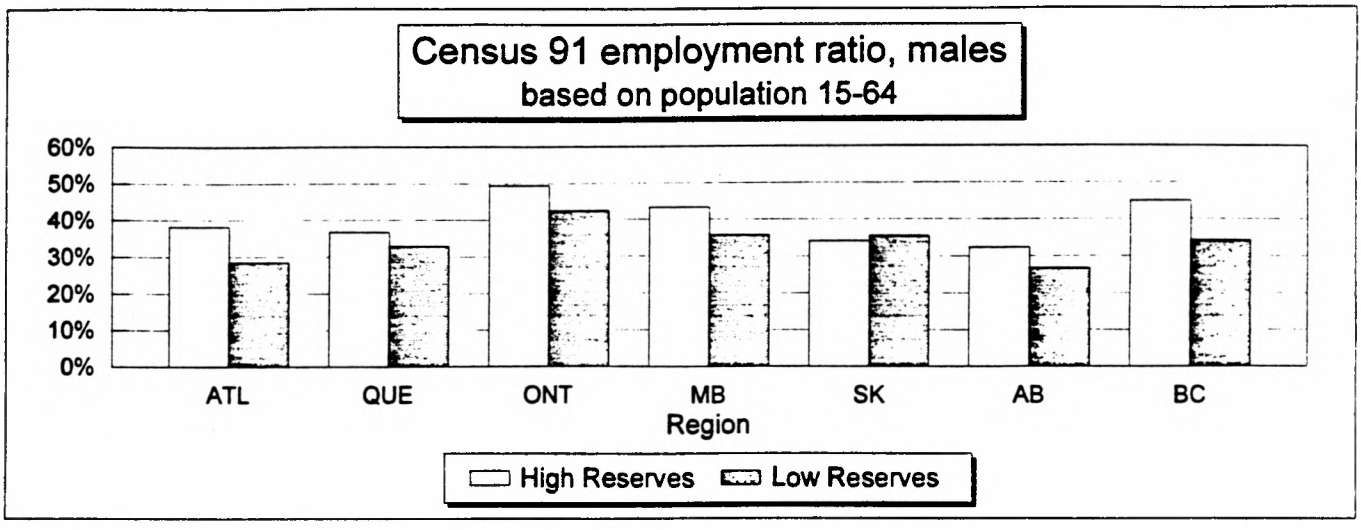

Census 91 non-univ cert. or univ degree
30%
25%
20%
15%
10%
5%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

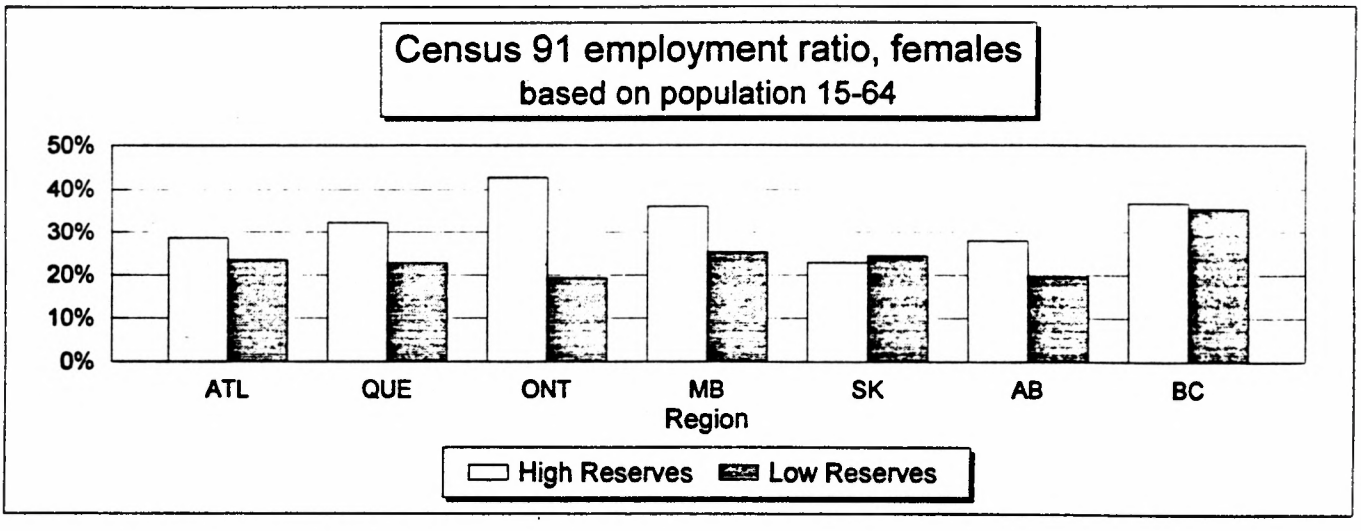

Census 91 employment ratio, total
based on population 15 and over
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

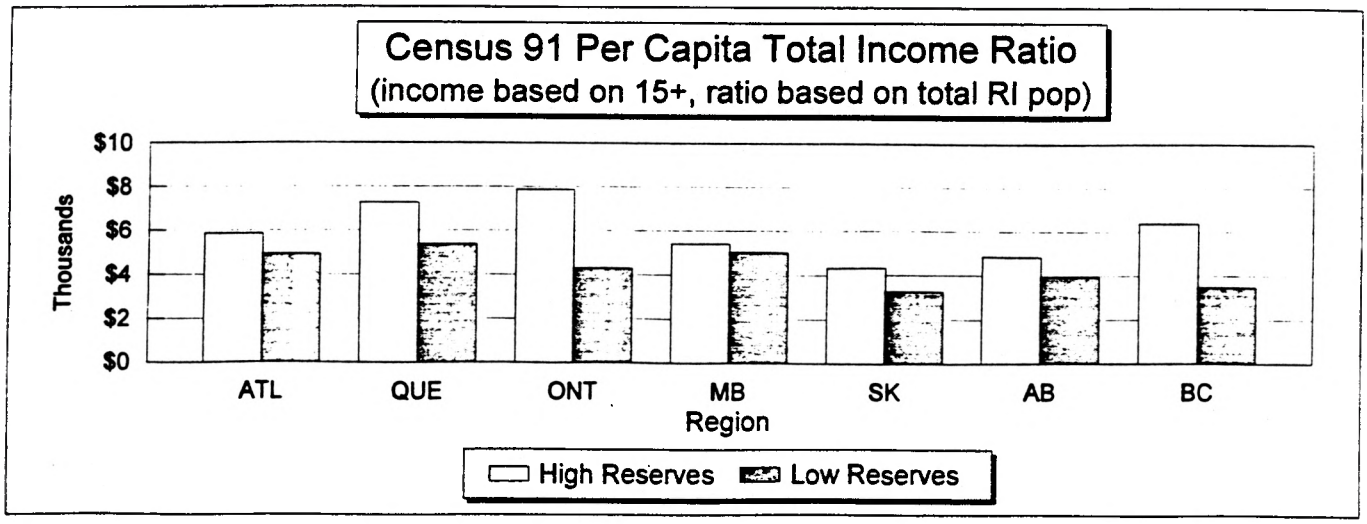

Census 91 employment ratio, males
based on population 15 and over
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

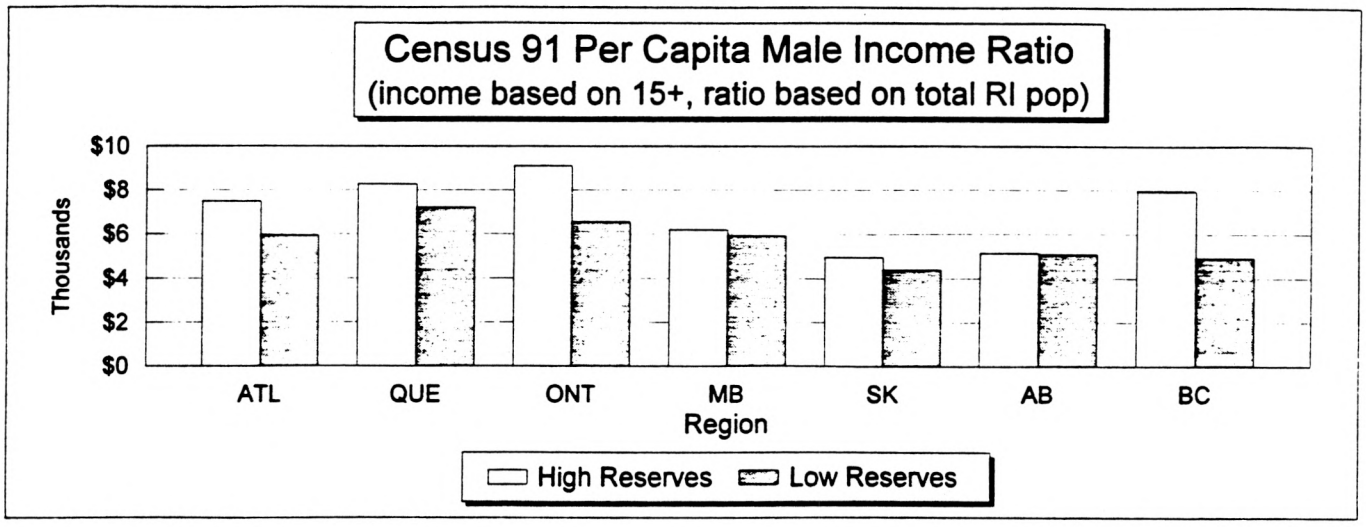

Census 91 employment ratio, females
based on population 15 and over
40%
35%
30%
25%
20%
15%
10%
5%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

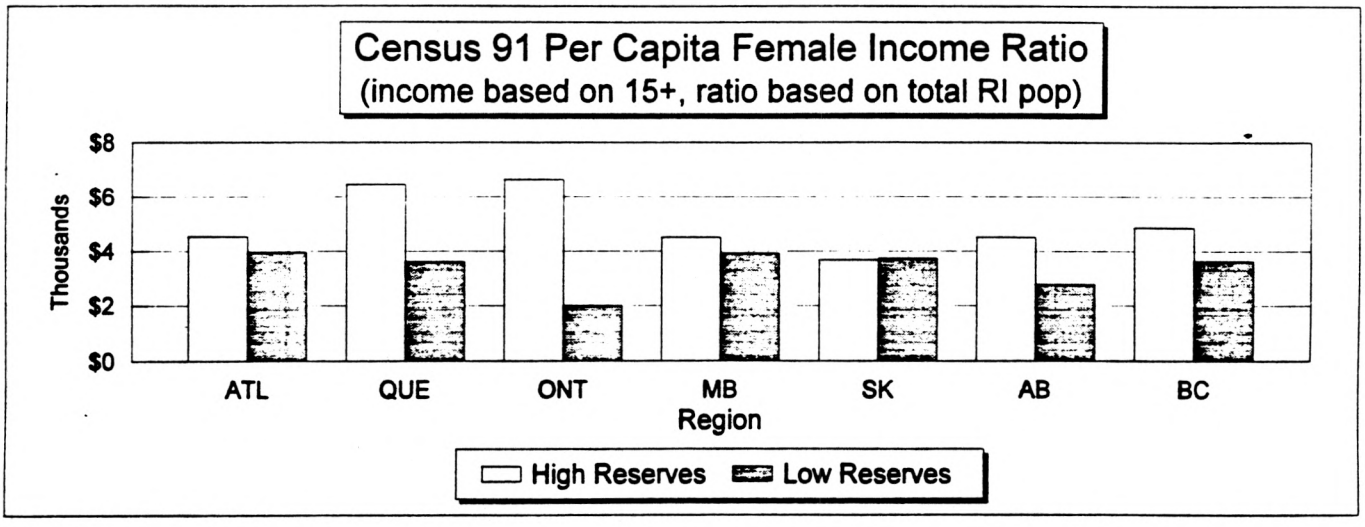

Census 91 employment ratio, total
based on population 15-64
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

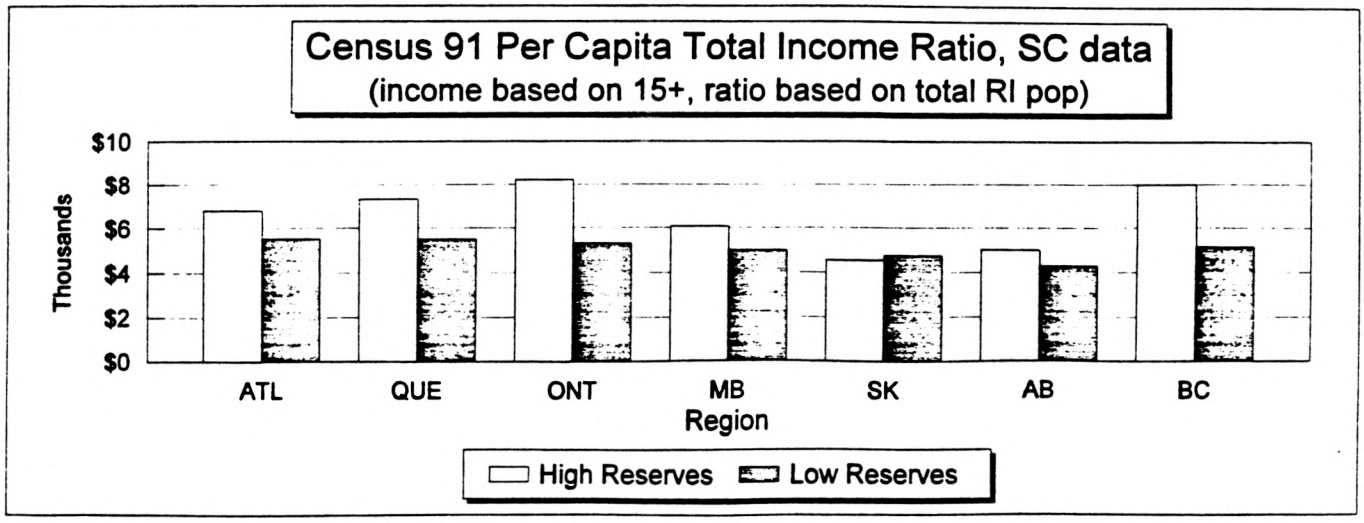

Census 91 employment ratio, males
based on population 15-64
60%
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

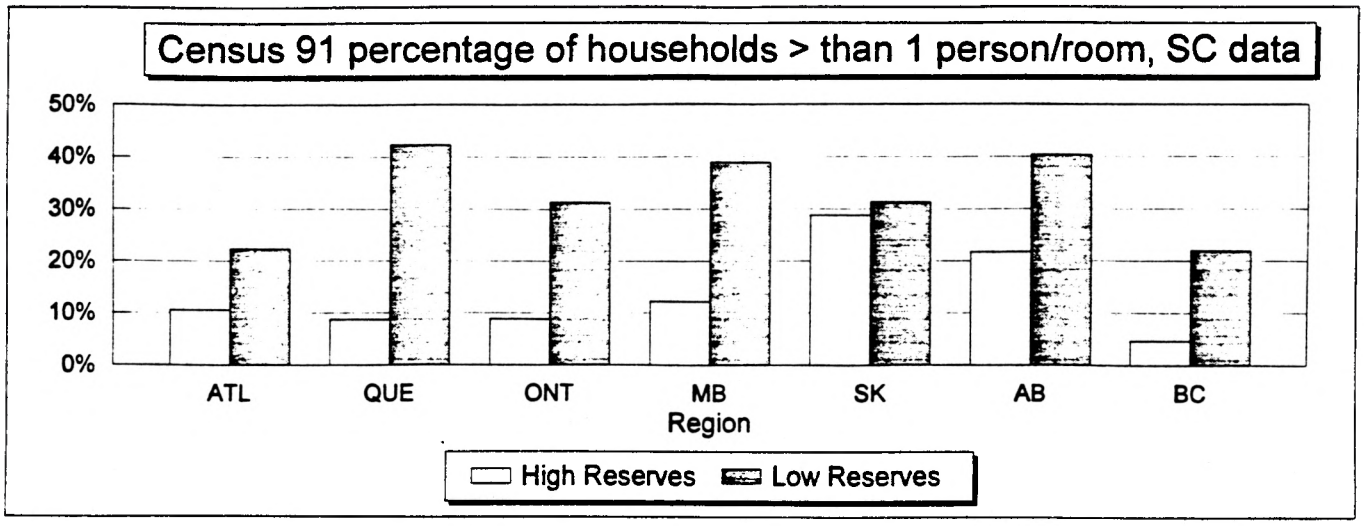

Census 91 employment ratio, females
based on population 15-64
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

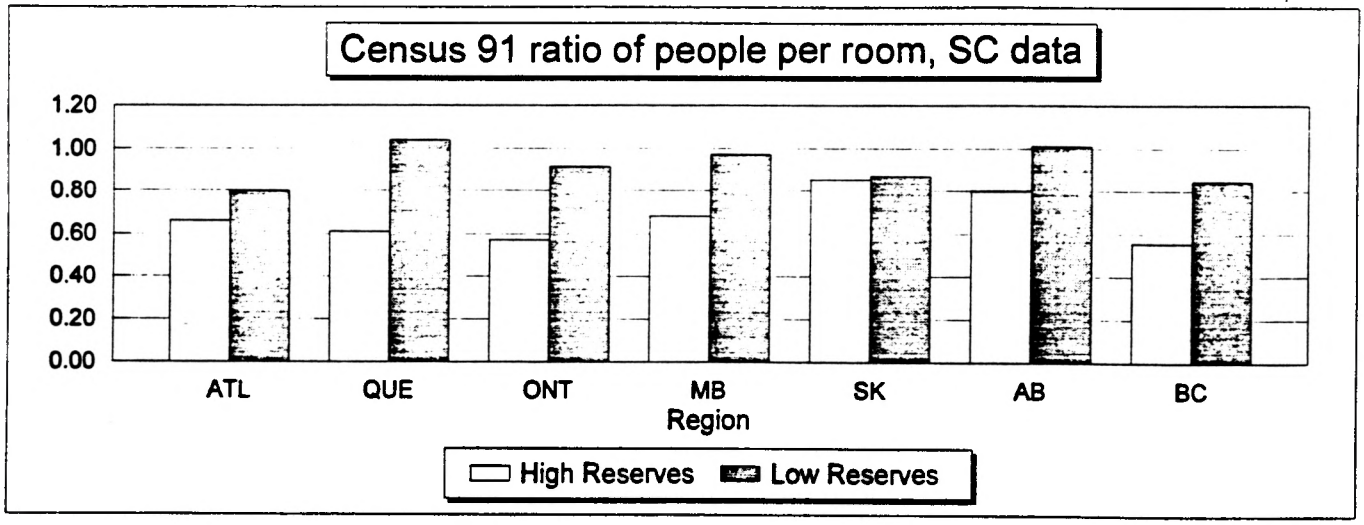

Census 91 Per Capita Total Income Ratio
(income based on 15+, ratio based on total RI pop)
Thousands
$10
$8
$6
$4
$2
$0
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves


Census 91 Per Capita Male Income Ratio
(income based on 15+, ratio based on total RI pop)
Thousands
$10
$8
$6
$4
$2
$0
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves


Census 91 Per Capita Female Income Ratio
(income based on 15+, ratio based on total RI pop)
Thousands
$8
$6
$4
$2
$0
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

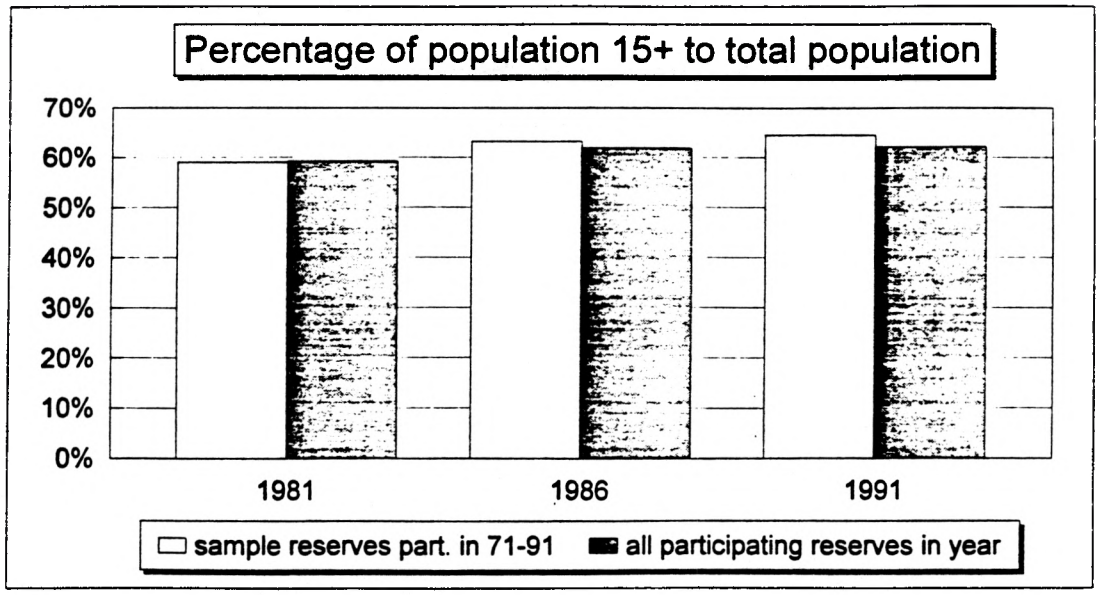

Census 91 Per Capita Total Income Ratio, SC data
(income based on 15+, ratio based on total RI pop)
$10
$8
$6
$4
$2
$0
Thousands
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

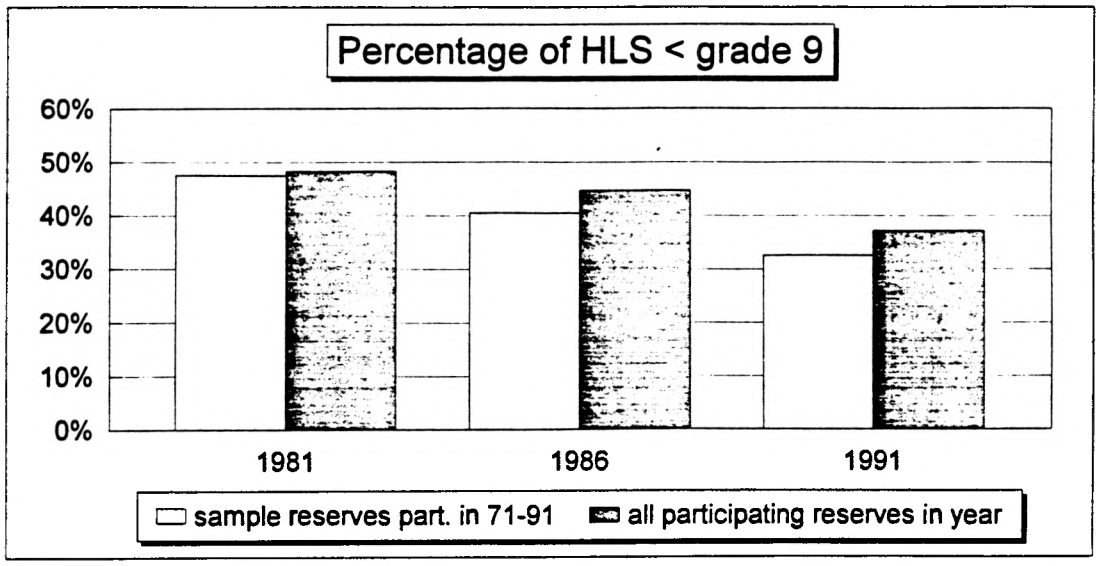

Census 91 percentage of households > than 1 person/room, SC data
50%
40%
30%
20%
10%
0%
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

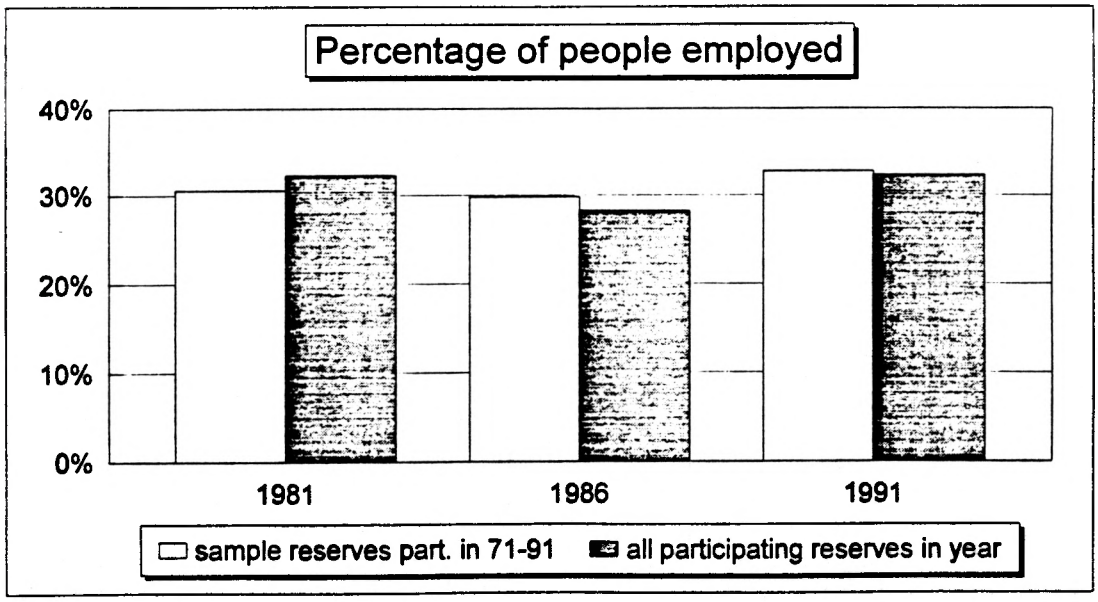

Census 91 ratio of people per room, SC data
1.20
1.00
0.80
0.60
0.40
0.20
0.00
ATL
QUE
ONT
MB
SK
AB
BC
Region
High Reserves
Low Reserves

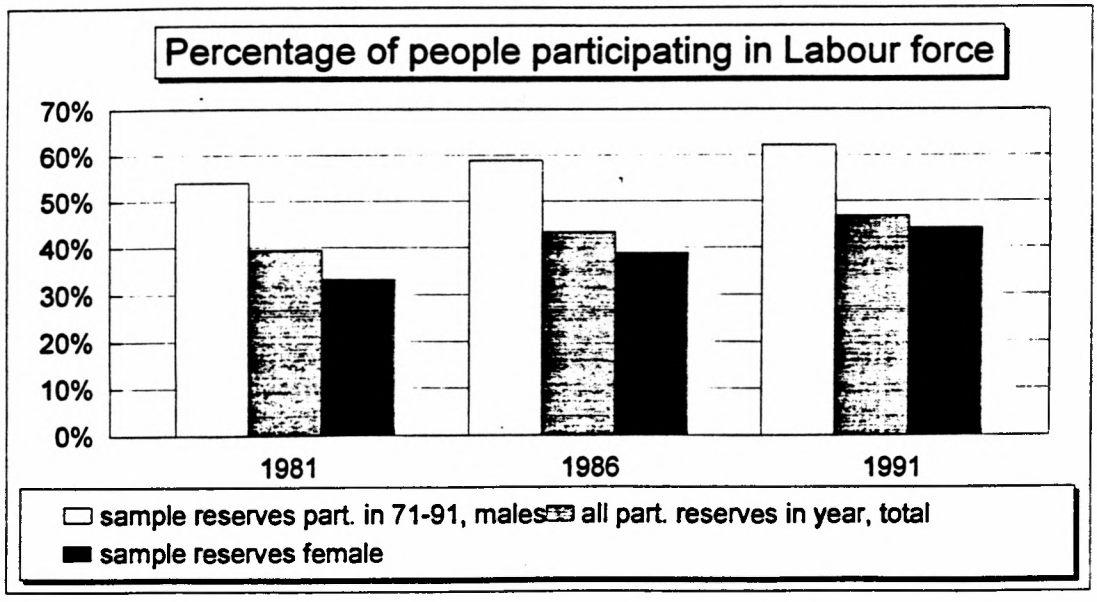
Appendix C:

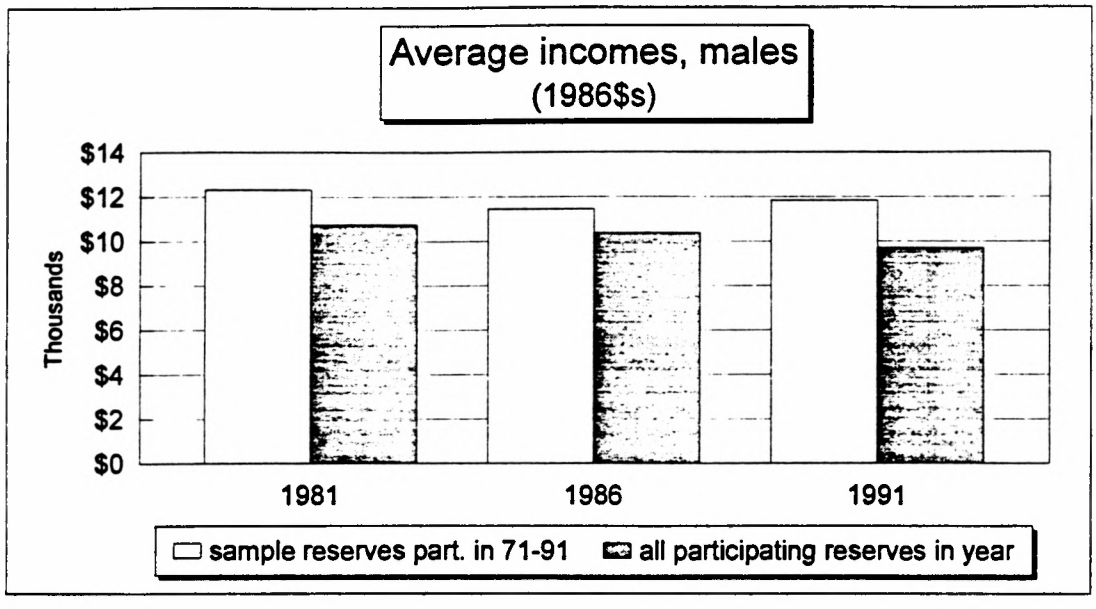
Social Trend Comparisons of Aggregated Individual Reserves vs. All Participating Reserves in each Census Year 1981 through 1991

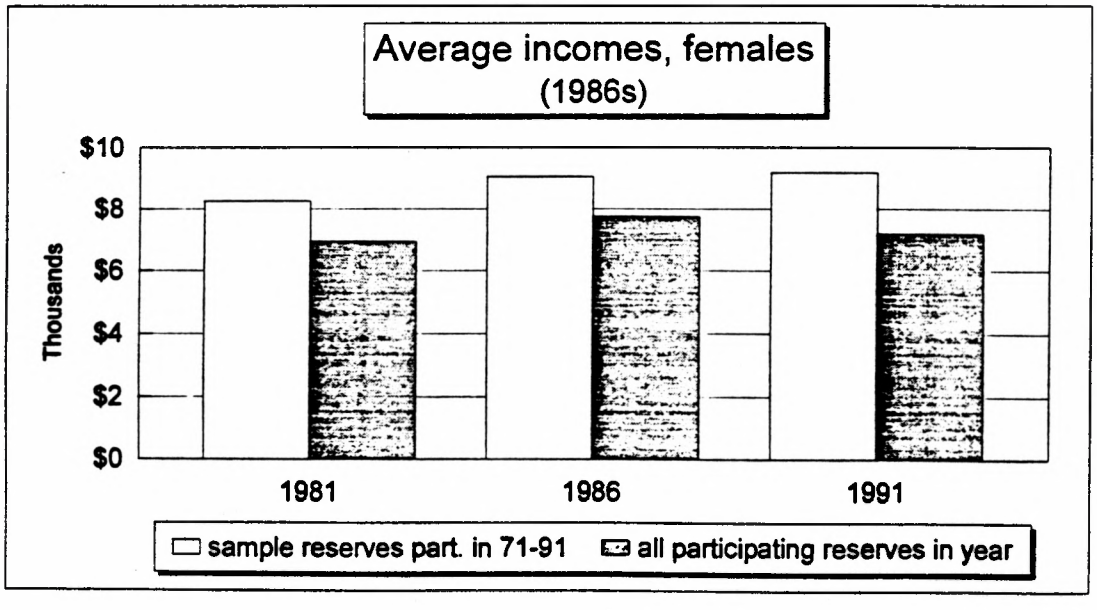

Percentage of population 15+ to total population
70%
60%
50%
40%
30%
20%
10%
0%
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year

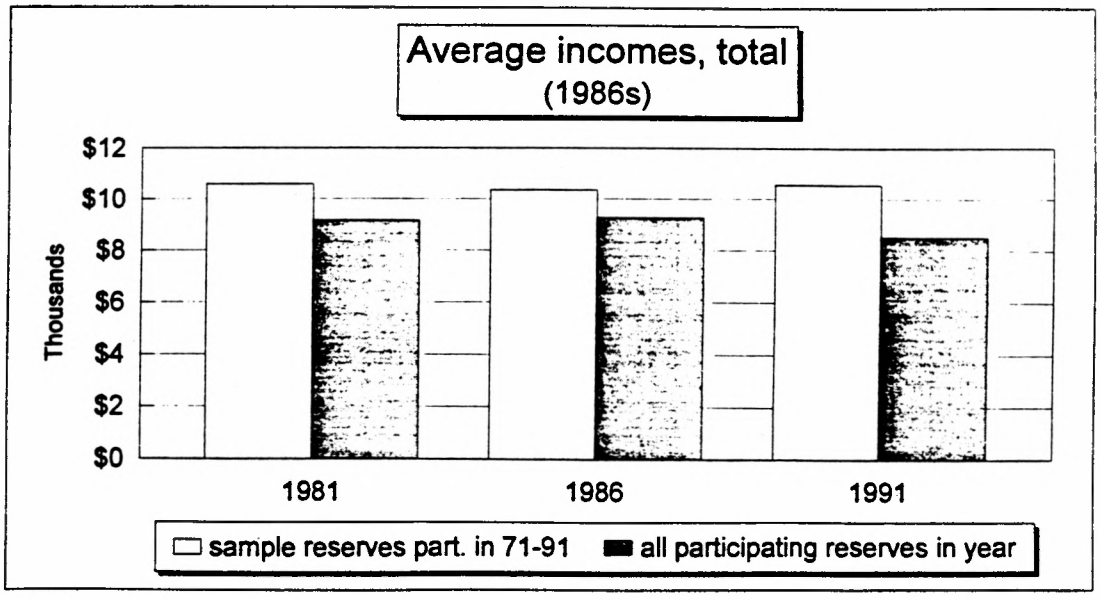

Percentage of HLS < grade 9
60%
50%
40%
30%
20%
10%
0%
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year

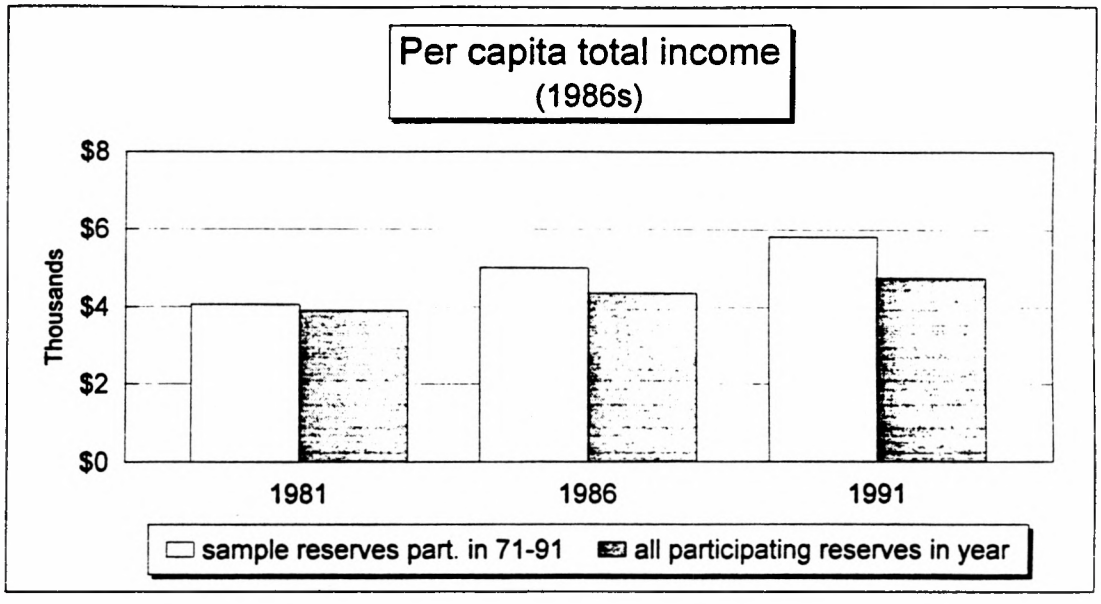

Percentage of people employed
40%
30%
20%
10%
0%
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year


Percentage of people participating in Labour force
70%
60%
50%
40%
30%
20%
10%
0%
1981
1986
1991
sample reserves part. in 71-91, males
all part. reserves in year, total
sample reserves female


Average incomes, males
(1986$s)
Thousands
$14
$12
$10
$8
$6
$4
$2
$0
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year


Average incomes, females
(1986s)
Thousands
$10
$8
$6
$4
$2
$0
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year


Average incomes, total
(1986s)
Thousands
$12
$10
$8
$6
$4
$2
$0
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year


Per capita total income
(1986s)
Thousands
$8
$6
$4
$2
$0
1981
1986
1991
sample reserves part. in 71-91
all participating reserves in year