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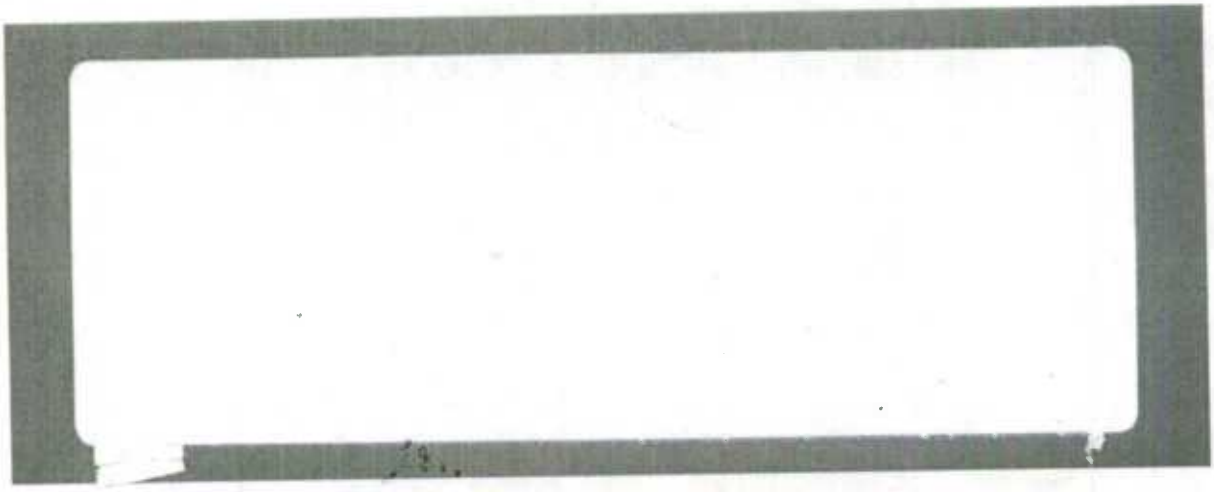

Methodology Branch

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Canada

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INTERNATIONAL TRAVEL SURVEY - REVISING PRE-2000 ESTIMATES

HSMD-2005-001E

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ABSTRACT

The International Travel Survey (ITS) program began publishing statistical series on travel between Canada and other countries in the early 1920's. The last overall survey redesign of the ITS took place in 1976. Since then, incremental adjustments have been made so as to adapt to requirement and logistical changes as they arose. In partnership with the Canadian Tourism Commission and the provincial tourism departments, Statistics Canada experimented with various methods to improve the ITS between 1997 and 1999. These tests led to the adoption of a number of methodological changes to the ITS starting with survey year 2000. These changes caused a break in the historical time series for the ITS. This paper reports on a feasibility study to revise ITS estimates prior to 2000, so that these estimates could be more comparable to the estimates since 2000.

Key words: Historical revision; international travel; bias adjustment; regional weighting; raking ratio.

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ENQUÊTE SUR LES VOYAGES INTERNATIONAUX - RÉVISION DES ESTIMATIONS ANTÉCÉDENTES À L'AN 2000

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RÉSUMÉ

Le programme de l'Enquête sur les voyages internationaux (EVI) a commencé à publier des séries statistiques sur les voyages entre le Canada et d'autres pays au début des années 1920. Le plus récent remaniement global de l'EVI s'est fait en 1976. Depuis, on a apporté des rajustements au fil de l'évolution des besoins et de la logistique. De 1997 à 1999, Statistique Canada a testé sur l'EVI différents moyens d'amélioration de concert avec la Commission canadienne du tourisme et les ministères provinciaux du tourisme. Les essais ont permis de modifier des aspects de la méthodologie dès l'année d'enquête 2000. Les modifications ont occasionné une rupture des séries chronologiques de l'EVI. Le présent document traite d'une étude de faisabilité de réviser des estimations de l'EVI antérieures à l'an 2000 qui doit permettre d'en accroître le degré de comparabilité aux estimations obtenues depuis l'an 2000.

Mots clés : Révision historique; voyages internationaux; ajustement pour biais; pondération régionale; méthode itérative du quotient.

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1. INTRODUCTION

The International Travel Survey (ITS) program began publishing statistical series on travel between Canada and other countries in the early 1920's, primarily as a requirement for the Canadian Balance of International Payments. As travel gained in size and importance, the need for detailed information on the characteristics of travellers for market research and industry planning was recognized. The questionnaires were gradually expanded to meet this need and the most recent questionnaire redesign took place in 1990 in response to the recommendations of the National Task Force on Tourism Data.

The last complete overhaul of the ITS sample design took place in 1976. Stint sampling was introduced at land ports at that time and gradually extended to all ports in 1979. On several occasions, the ITS sample was also adjusted to include the coverage of new ports and traffic flows. One of the most notable changes in survey coverage took place in 1990 when the ITS was expanded to include the survey of US visitors to Canada, which had been previously conducted by the US Department of Commerce. Furthermore, the ITS sample distribution at all ports is adjusted every year according to the travel volume in the previous year.

Major clients for the ITS data include the Canadian Tourism Commission (CTC) and provincial tourism departments and agencies. The US Department of Commerce uses the ITS data heavily in the construction of US travel statistics. The data have been used to generate profiles of specific subprovincial tourism markets. Microdata files, which have been marketed since the questionnaire redesign in 1990, are also increasingly in demand.

In partnership with the CTC and the provincial tourism departments, Statistics Canada experimented with various methods to improve the ITS between 1997 and 1999. These tests led to the adoption of a number of methodological changes to the ITS starting with survey year 2000. Consequently, a question was raised as to whether the ITS estimates prior to year 2000 could be revised to make them more comparable to the estimates since 2000. A study was then conducted into the feasibility of making such data revisions.

The objectives of this feasibility study were set by the ITS Task Force of the CTC Research Committee[3] in December 2003. In May 2004, the ITS Task Force met to discuss the study and its preliminary findings. It approved the approach adopted by study and gave additional guidance[4].

This document reports on the study, its findings and its recommendations. As background information, sections 2 to 4 describe briefly the objectives and pre-2000 methods of the ITS and the methodological changes implemented since 2000. Section 5 summarizes the objective of the feasibility study. Section 6 identifies the factors to consider in the revision. Section 7 describes the proposed methods of revision and the results of a simulation study which assessed the efficacy of the proposed methods. Finally, section 8 presents the conclusion and recommendations of the feasibility study.

2. OBJECTIVES OF THE ITS

To date, the ITS has surpassed its initial objective of estimating travel receipts and payments for the Canadian Balance of International Payments. In response to the growing data needs of the tourism industry, the ITS fully implemented in 1990 all the content changes recommended by the National

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[3] Statement of Work for ITS Methodologist on Historical Data Adjustment. Document of the Canadian Tourism Commission, December 2003.

[4] Minutes of the ITS Task Force Meeting in Vancouver, May 20, 2004. Document of the Canadian Tourism Commission, September 9, 2004.

Task Force on Tourism Data (1984-1986). The ITS continues to be a main data source for tourism market research and industry planning. The data from the ITS are used to obtain detailed characteristics of travellers and their trips, travel expense estimates and additional data for the Canadian Tourism Satellite Account and the National Tourism Indicators. Some of the key external users of the data include the Canada Border Services Agency, the Canadian Tourism Commission, provincial tourism departments and agencies and the United States Department of Commerce. The data are also used for international comparisons by the World Tourism Organization, the Organization for Economic Co-operation and Development and the Pacific Asia Tourism Association.

3. ITS METHODOLOGY PRIOR TO 2000

This section describes briefly the data collection and survey estimation methodology in the ITS prior to survey year 2000.

The ITS had (and continues to have) two survey systems: the Frontier Counts and the Questionnaire Surveys. Both these systems depend greatly on the co-operation of Canada Border Services Agency (CBSA or formerly CCRA) in collecting the number of border crossings and distributing travel questionnaires.

3.1 Frontier Counts

The number of travellers entering into Canada was (and continues to be) determined at all border entry points (ports of entry). Information collected includes the number of travellers by country of residence type of transportation and other characteristics and, in the case of highways and ferry ports, the number of cars and trucks. Land ports collect frontier counts on a census basis, using computer recording or manual tally, depending on the size of the land port and the type of vehicles (e.g. private cars, buses or foot pedestrians). Most air travellers enter Canada by commercial flights and complete a Customs Declaration Card (E311). Until 1999, individual travellers completed their own cards. These cards were sorted manually and counted by machine so as to produce frontier statistics. Starting in mid-1999, a single card can be completed by several members of the same family. Because it would be too expensive to produce frontier statistics by counting all travellers recorded on every card, the ITS then estimates the number of air travellers based on samples drawn from all completed E311 cards. Different sampling rates are used depending on the size of the airport and the country of traveller, e.g. from 5% for Canadian and US air travellers who enter Canada in Toronto (one of the largest airports) to 100% of international travellers entering the St. John's Airport. A census count is taken for all air travellers who enter Canada on non-commercial flights.

Census counts of passengers entering by train or by sea are also recorded by Customs officials and sent to Statistics Canada.

To ensure the quality of frontier reports, detailed instructions were (and continue to be) provided to aid Customs officials in the task of collecting data. A continual liaison function is performed by the ITS with Customs to review, discuss and resolve inconsistencies in the reported data. A monitoring system also exists which allows the comparison of incoming data with information available from independent sources, such as airport management reports, toll figures, provincial road counters, etc. In addition, reference to weather reports, calendars of special events and direct contact with port authorities, permit the verification and explanation of irregular fluctuations in the reported figures.

3.2 Questionnaire Surveys

Survey questionnaires were (and continue to be) used to collect data on travel expenditures and other characteristics of international trips. These questionnaires are handed out to the travel party on entry (non-residents) and re-entry (residents of Canada) by Customs officials according to pre-arranged schedules. In 1990, ITS instituted its questionnaire surveys of US travellers to Canada, a survey component which had previously been carried out by the U. S. Department of Commerce.

Prior to 1976, specific start and end days were selected for distributing questionnaires in individual ports of entry. Questionnaires were handed out to all travel parties during the entire sample period. In 1976, the method of stint sampling was tested successfully in some land ports and gradually adopted at all ports of entry in the following three years.

A stint consists of a selected period of several days during which questionnaires are distributed to eligible travellers. Each port involved in this scheme receives, for each of its stints, a specific quantity of numbered questionnaires and a date on which to start the distribution. The number of survey questionnaires to be distributed at each port is proportional to the volume of the traffic flow at the port in the reference period of the previous year. On the start date, Customs officers hand out the questionnaires on a continuous basis to the appropriate travelling population until they have all been distributed. As such, the actual length of the stint period is undetermined (compared to the previous methodology) and depends on the quantity of questionnaires assigned to the port and the rate of eligible travellers entering the port. The ITS liaison staff call each port the day before the stint is to start to make sure that the questionnaires have arrived and to remind the officers to start the distribution the next day. Approximately ten days after the start of the stint, the port is contacted again to ascertain the finishing date. In this way, the response rate of the traffic and the length of the stint can be used as a measure of the performance of each stint.

Five questionnaires were (and continue to be) used in these surveys: two short questionnaires (i.e. a card) respectively for Canadian and US same-day travellers by automobile, and three long questionnaires respectively for other Canadian and US travellers and for non-US visitors to Canada. The wordings of these questionnaires are all specific to the travellers of the corresponding traffic flow. The questionnaires are packaged to be returned to Statistics Canada with pre-paid postage. US visitors are requested to mail their completed questionnaires to a collection point in the US. Canadian and overseas travellers are requested to mail their questionnaires in Canada. About one million questionnaires are sent to Customs ports for distribution each year. Overall, the rate of questionnaires returned to Statistics Canada has been low historically.

In order to reduce estimation bias, Port Factor Groups were constructed to group similar travel parties in terms of port of entry, type of transportation, length of trip and type of travel flow. The usable questionnaire returns were (and continue to be) treated as a simple random sample of travel parties from the total traffic in each Port Factor Group by quarter. The ITS estimation method ensures that the survey estimate of the number of person-trips would be identical to the frontier counts for each Port Factor Group.

4. CHANGES TO THE ITS METHODS SINCE 2000

Notwithstanding the many important achievements made over its long history, ITS continues to face many challenges and opportunities, arising from new data needs, organizational changes in the government and technological changes. In partnership with the CTC and the provincial tourism departments, Statistics Canada experimented with various methods between 1997 and 1999, to improve the ITS. The results of these tests were discussed by the ITS sub-committees of the CTC Research Committee, which led to the adoption of a number of methodological changes to the ITS

starting in year 2000. The main goal of these changes was to improve both the quality and the reliability of estimates on the characteristics of international travellers and trips.

4.1 Methodological Changes

This subsection describes briefly the specific methodological changes adopted in 2000, in relation to the scope of this feasibility study. A more detailed description of all of the changes is available in a separate document (Statistics Canada, 2002)[5].

4.1.1 Air Exit Survey (AES) of Overseas Visitors

The Air Exit Survey of Overseas Visitors (AES) is now part of the International Travel Survey and has been conducted by Statistics Canada since 2000. The primary objective of the Air Exit Survey is to improve the quality and reliability of estimates of trip and traveller characteristics for overseas air visitors. The Air Exit Survey is designed to collect information on overseas travellers leaving Canada on direct flights to overseas destinations.

As the initial stage of implementation, interviews are conducted only in designated airports. When new resources become available, the AES would eventually be implemented in all Canadian international airports. The cities in which the survey is being held are Halifax, Montréal (Dorval[6] and Mirabel), Toronto (Pearson International), Calgary and Vancouver. Interviews are not, however, always conducted in each airport every month. Interviews are conducted by the Statistics Canada Regional Office staff who either interview respondents directly or have the respondents fill in the questionnaires. Travellers are approached once they have cleared security and are waiting to board selected direct flights to overseas destinations. Flights are selected from a list of direct flights to overseas based on a number of factors such as size of airport, type of flight (scheduled vs. non-scheduled), time of year, weekday vs. weekend, and countries being targeted. Interviewers have up to five days to conduct the interviews assigned to them during a given month.

The countries targeted are those from whom we attract the most visitors. They include principally the United Kingdom, France, Germany, and Japan, as well as a number of smaller markets, such as Taiwan, the Netherlands, and Hong Kong. The targeted overseas countries account for about 85% of total overseas direct travellers to Canada.

Because of the diversity of the respondents in the survey, not only do our interviewers speak a number of different languages, but the questionnaires are also produced in ten languages. These are French, English, German, Dutch, Italian, Spanish, Portuguese, Japanese, Korean and Chinese.

The Air Exit Survey supplements mail-back questionnaires distributed by Customs officers. While the traditional method of data collection has resulted in a return rate of less than 5%, the Air Exit Survey achieves co-operation rates of over 95%.

The production of quarterly estimates and files is done incorporating the Air Exit Survey questionnaires collected for the quarter. In the absence of reliable administrative data for weighting the AES data up to the population of exiting travellers, the AES questionnaires are pooled with the mail-back questionnaires (obtained by the traditional method) according to the ***entry*** information supplied by the respondents. The weighting of the survey data for producing ITS quarterly estimates is further described in the next subsections regarding bias adjustment and regional weighting.

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[5] Statistics Canada, (2002). "Description of new initiatives in the International Travel Survey". Document of the Tourism Statistics Program, Statistics Canada, August 2002.

[6] Dorval Airport has been recently re-named as Pierre Elliot Trudeau International Airport.

4.1.2 Bias Adjustment

One main challenge with the ITS traditional data collection method (of CBSA handing out questionnaires to travellers on entry and of respondents mailing back their completed questionnaires to Statistics Canada) has been the very low return rates achieved. This leads to the possibility that the questionnaires returned are not necessarily representative of the travelling population and could result in the presence of a bias in the estimates.

In order to reduce the potential presence of bias in the estimates for international air travellers, the procedure for weighting the questionnaires returned by these travellers has been modified to incorporate the information on the purpose and duration of trip, captured from a large sample of Customs Declaration (E311) cards remitted by these travellers. The CBSA uses the E311 card to record, on a census basis, travellers entering or returning to Canada by commercial plane in all major international airports.

Previously, estimates of traveller counts by port/type[7] of entry and country of residence, derived from the E311 cards, were used to weight the questionnaires received from the air travellers. The weight assigned to each questionnaire was such that the total weighted number of air travellers derived from the questionnaires for a given port/type of entry and country of residence matched the E311 card traveller counts for the same port/type of entry and country of residence.

In January 2000, the capture system for the E311 cards was modified to capture the purpose of trip for all flows of air travellers. In addition, the system was modified to capture, on a sample basis, the duration (or expected duration) of trip for a major portion of the Canadian, US and overseas air travellers.

With this additional information captured from the E311 cards, estimates of traveller counts by port/type of entry, country of residence, purpose and duration of trip can be used as benchmark data to weight-up questionnaires received from the air travellers.

Accordingly, the weighting procedure has now been enhanced so that the total weighted number of air travellers derived from the questionnaires matches the travellers counts by port/type of entry, country of residence, purpose and duration of trip.

By using more data from the E311 cards, the procedure for weighting air traveller questionnaires has become more accurate. The use of more refined weights provides better quality estimates and limits the possibility of bias in the questionnaire results obtained for air travellers.

4.1.3 Regional Weighting of Overseas Questionnaires

Being a legacy from 1976, the traditional methodology of the ITS is not designed to produce reliable sub-national estimates for the overseas flow because the weighting of overseas questionnaires was done nationally, and not at the sub-national level.

This method, which used the direct weighting method, assigned a weight to each questionnaire so that the estimated number of travellers derived from the questionnaires matched exactly the frontier count of overseas travellers by place of residence and type of entry. The place of residence represented 59 groupings of country of residence. The type of entry included four categories:

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[7] The port of entry is used for assigning weights to Canadian and U.S. questionnaires, while the type of entry (directly from overseas, via the U.S.) is used in the case of overseas questionnaires.

directly from overseas, via the US by land for same-day trips, via the US by land for trips of one or more nights, and via the US by air or sea.

However, the absence of a regional stratification in the weighting procedure, combined with the increasing lack of proportionality in the questionnaire returns by region of entry, led to imprecise results when producing regional estimates. In recent years, we noticed large differences between actual frontier counts and those estimated from the questionnaires at the region of entry level. This resulted in a significant overestimation or underestimation of overseas travellers' characteristics at the regional level.

For these reasons, the procedure for weighting overseas questionnaires was modified to take into account the region of entry of the travellers. The provincial composition of the five regions used in the process is as follows: Atlantic (Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick), Quebec, Ontario, Prairies (Saskatchewan, Manitoba, Alberta) and British Columbia (including Yukon, Northwest Territories and Nunavut).

However, the limited number of questionnaires received from several overseas markets prevents the use of the direct weighting method to weight the questionnaires across all combinations of place of residence, type of entry and region of entry. Accordingly, the new procedure includes the direct weighting of questionnaires for certain combinations of place of residence, type of entry and region of entry, and the use of a raking-ratio adjustment method for weighting the questionnaires for the remaining combinations.

In the new procedure, all questionnaires obtained from 61 groups of travellers, which are referred to as Direct Weighting Groups (DWGs), are weighted using the direct weighting method. These DWGs, which are defined in terms of place of residence, type of entry and region of entry, represent portions of the overseas traveller population that are considered to be important and from which we obtain a sufficient number of questionnaires. For these traveller groups, the new estimates of frontier counts match the actual counts exactly.

For the remaining groups of travellers, who are also defined in terms of place of residence, type of entry and region of entry, questionnaires are weighted using the raking-ratio weight adjustment method. The raking-ratio method is a two-stage iterative process that ensures that the frontier counts and the weighted estimates of the number of travellers match exactly at the national level and very closely at the regional level by type of entry.

Overall, the new method gives national estimates that are very similar to those obtained with the previous method, although the regional and provincial estimates are significantly different. Benchmarking on regional frontier counts enables the production of more consistent and reliable estimates on the characteristics of overseas travellers at the regional level. Estimates for provinces which form only a part of their region can still vary from the corresponding provincial frontier counts, though the magnitude of such differences is much reduced when compared to those obtained by the pre-2000 methodology. Since the new methodology provides an improved weighting system, estimates of year to year variations at the regional level are more reliable, which will allow for improved estimates of trends in overseas travellers' characteristics.

4.1.4 Inclusion of "Unused" Records

Previously, two types of questionnaire returns were excluded from the production of estimates on the characteristics of international travel between Canada and other countries: those missing values in transportation fares and/or total trip spending and those regarded as late returns. In the case of mail-back questionnaires, late returns refer to those that were received after the survey production

cut-off date for the reference quarter. In the context of the AES, the late returns represent those travellers with their date of entry preceding the reference quarter or the date of exit later than the quarter's cut-off date.

In the new methodology, transportation fares and /or total trip spending are imputed for those questionnaires that are missing only these data. Ten separate and multi-step procedures are used to impute total spending on the short Canadian questionnaires, total spending on the short American questionnaires and the two missing expenditure fields on the Canadian long questionnaires, the US long questionnaires, the overseas questionnaires and the air-exit questionnaires.

The inclusion of these imputation procedures in the methodology enables us to use many questionnaires that were previously discarded from production. The addition of these and the late questionnaires on the files results in the production of more accurate estimates on the characteristics of international travellers. The late questionnaires are included only in the final survey files for each reference period.

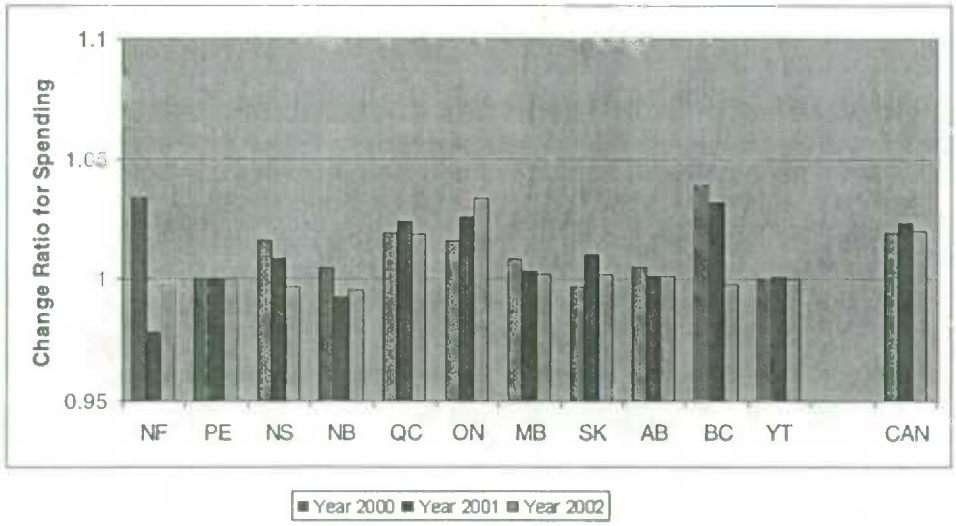
4.2 Overall Impact of All Methodological Changes

This subsection discusses the overall impact of all the methodological changes on the ITS estimates.

The impact of all the methodological changes on estimates for Person-trips, Total Spending (excluding international fares) and Person-nights at the national and provincial levels is presented in Section 1 of Attachment 1. Provincial estimates are presented both by province of entry and province of visit (or province of residence in the case of Canadian residents). In addition, the overall impact is presented for the three country flows (i.e. Canadian, US and overseas) plus individually for the top four overseas markets (i.e. UK, France, Germany and Japan). Figure 1 below is a typical example of the histogram graphs found in Attachment 1:

Figure 1

Impact of All Changes for Travellers from Canada by Province of Entry



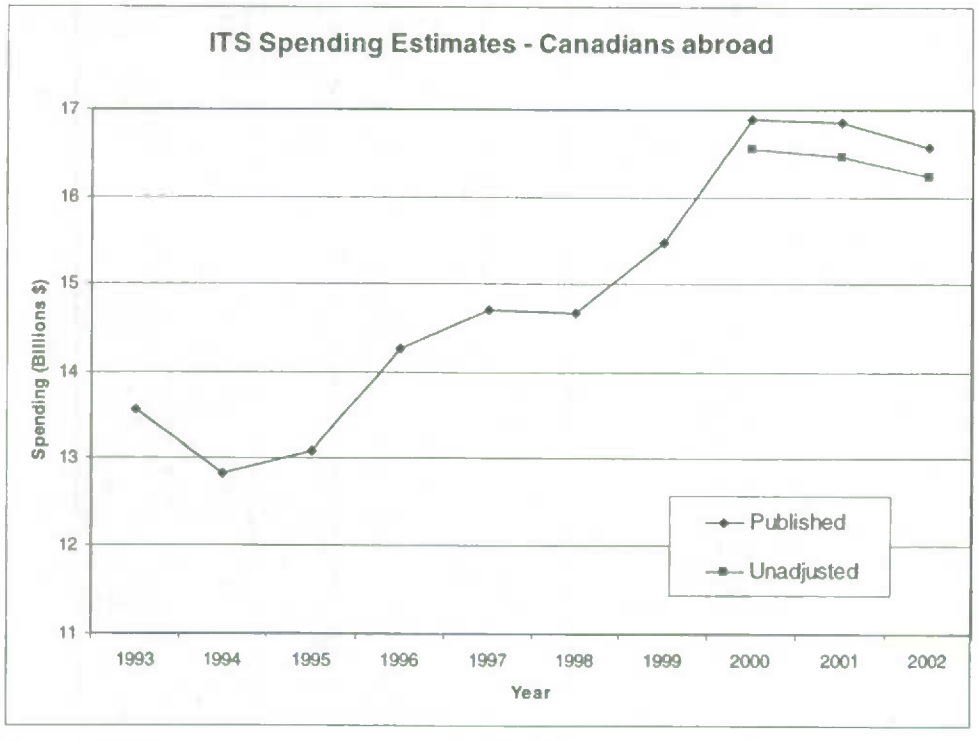
The impact on each estimate is displayed as the ratio of the *final* annual estimate (which incorporates all methodological changes) to the *unadjusted*[8] annual estimate (which does not incorporate late returns, bias adjustment and/or regional weighting) over three years (between 2000 and 2002). The *unadjusted* estimates mirror those which would have been obtained using the pre-2000 methodology but based on more questionnaires.

The inclusion of AES data for this analysis is consistent with the working assumption adopted by the ITS production procedure. Insofar as the AES questionnaires do not represent late returns, it is assumed that they are equally representative as the mail returns for travellers who have the same entry characteristics (e.g. port and type of entry, trip duration and country of residency). As noted in section 4.1.1, it is necessary to adopt this strong assumption until an alternative survey weighting methodology becomes feasible.

A bar in the histogram above the unity line indicates that the methodological changes caused an increase to the traditional estimates (base on the pre-2000 methodology). It should be noted that all the methodological changes implemented, by design, do not change the Person-trip estimates for Canadian and US residents at the national level and by province of entry, nor for the national Person-trip estimates for overseas residents. The methodological changes ensure that such high level estimates continue to match the frontier counts as before. In contrast, overseas Person-trip estimates by province of entry do change considerably due to the effect of regional weighting.

For the Spending and Person-night estimates, considerable differences can be observed between the two methodologies for various traveller groups, as shown in Attachment 1.

Figure 2: Time series of ITS estimates, 1993-2002



As another way to show the impact of the methodological changes on the ITS estimates, the time series of ITS national estimates for Spending and Person-nights between 1993 and 2002 are

[8] In this study, the *unadjusted* estimates (between 2000 and 2002) incorporate the use of those questionnaires from the AES interviews and the imputable unused records received before production cut-off date.

presented in Attachment 3. For our current purpose, the focus is on the *published*[9] (black) and the *unadjusted* (red) graph lines. (The other graph lines will be explained in section 7.) An example of these graphs is shown in Figure 2. From these graphs, we observe that, wherever a noticeable difference exists between the *published* and *unadjusted* lines, the *unadjusted* estimates appear to be closer to the pre-2000 levels.

5. FEASIBILITY STUDY INTO METHODS TO REVISE PRE-2000 ESTIMATES

The data in the preceding section demonstrate clearly that the introduction of the methodological changes in 2000 resulted in a break in the time series for the international traveller and trip characteristics. In partnership with the CTC and provincial tourism departments, this study examines the feasibility of developing a methodology for revising the pre-2000 data so as to better reflect the changes introduced and implemented in the data since 2000. By having this methodology developed, it would be possible, for instance, to carry out more meaningful longer-term trend analyses.

In proposing the methodology, this feasibility study will identify the scope (Canadian, US, Overseas), the level (macro vs. micro) and the years for which the adjustments can be produced. The actual implementation of the revisions will be determined after a thorough review of the proposed methodology and then will be funded through a broader partnership of STC, provinces and CTC.

6. APPROACH TO THE STUDY

The approach for this study was selected after an investigation into the various revision methods adopted by a variety of surveys at Statistics Canada. Some examples of these surveys are the Canadian Travel Survey, the Labour Force Survey and a number of surveys of Canadian businesses. This approach also favours a simple revision method whenever possible, recognizing the risk that an over-precise revision method may result in reducing the overall robustness of the ITS against the other unmeasured data variations and source of errors.

Our study started with identifying the overall factors which caused changes to the ITS estimates. The impact of each change factor is then measured and evaluated so as to determine if a revision method may be applicable.

There are three overall change factors: the inclusion of late returns, the procedure of bias adjustment and the procedure of regional weighting. It should be noted that we have opted to present the combined impact of bias adjustment and regional weighting for the overseas flow, in the interest of shortening this report.

6.1 Late Returns

This section discusses the impact of late returns and the adjustment for this factor. Late returns apply to the Canadian, US and overseas flows.

6.1.1 Definition and Volume of Late Returns

As we noted in section 4.2, we consider all the questionnaires received before the preliminary cut-off date for survey processing as equally representative of the traveller population given their classification according to the entry characteristics. This definition applies to the regular mail

[9] The published estimates are those that appear in the ITS publications over the survey years examined. These estimates hence were constructed based on different methodologies around year 2000.

returns, interview responses to the AES and some of the unused records which require imputation for completing the Spending and International Fares questions. All questionnaires which the ITS received after the production cut-off date are considered to be late returns. In the case of foreign visitors, the late returns may correspond to longer visits and thus may possess unusual traveller and trip characteristics. In the case of Canadian residents who received the survey questionnaire on their re-entry (at the end of their trip), the reason for their late returns is less clear.

Table 1: Late return questionnaires - Canadian

ITS Questionnaire Counts, 2002

Canadian

	All				On Time				Late			
	Total		Unused		Total		Unused		Total		Unused	
Quarter	#	%	#	%	#	%	#	%	#	%	#	%
1	11,566	100%	616	5.3%	11,490	99.3%	607	5.2%	76	0.7%	9	0.1%
2	13,233	100%	767	5.8%	13,145	99.3%	756	5.7%	78	0.6%	11	0.1%
3	12,951	100%	485	3.7%	12,890	99.5%	477	3.7%	61	0.5%	8	0.1%
4	8,809	100%	380	4.3%	8,770	99.6%	373	4.2%	39	0.4%	7	0.1%

Table 2: Late return questionnaires - US

ITS Questionnaire Counts, 2002

US

	All				On Time				Late			
	Total		Unused		Total		Unused		Total		Unused	
Quarter	#	%	#	%	#	%	#	%	#	%	#	%
1	6,969	100%	328	4.7%	6,909	99.1%	318	4.6%	60	0.9%	10	0.1%
2	12,923	100%	808	6.3%	12,782	98.9%	786	6.1%	141	1.1%	22	0.2%
3	13,377	100%	887	6.6%	13,288	99.3%	872	6.5%	89	0.7%	15	0.1%
4	6,868	100%	333	4.8%	6,827	99.4%	330	4.8%	41	0.6%	3	0.0%

Table 3: Late return questionnaires - Overseas

OVS Questionnaire Counts, 2002

	All						On Time						Late					
Quarter	Total			Unused			Total			Unused			Total			Unused		
	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS
1	2,290	1,628	662	104	25	79	2,198	1,546	652	104	25	79	92	82	10	0	0	0
2	4,460	1,915	2,545	308	20	288	4,326	1,829	2,497	297	18	279	134	86	48	11	2	9
3	3,986	2,166	1,820	405	28	377	3,635	1,848	1,787	397	25	372	351	318	33	8	3	5
4	2,046	1,282	764	109	9	100	1,918	1,167	751	107	8	99	128	115	13	2	1	1

OVS Questionnaire Percentages, 2002

	All						On Time						Late					
Quarter	Total			Unused			Total			Unused			Total			Unused		
	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS	AES+ITS	AES	ITS
1	100%	71%	29%	5%	24%	76%	96%	70%	30%	5%	24%	76%	4%	89%	11%	0%	0%	0%
2	100%	43%	57%	7%	6%	94%	97%	42%	58%	7%	6%	94%	3%	64%	36%	0%	18%	82%
3	100%	54%	46%	10%	7%	93%	91%	51%	49%	10%	6%	94%	9%	91%	9%	0%	38%	63%
4	100%	63%	37%	5%	8%	92%	94%	61%	39%	5%	7%	93%	6%	90%	10%	0%	50%	50%

Tables 1 and 2 show that the volume of late returns is lower for Canadians than for US visitors. In any event, these rates are low, about or below 1% of the total questionnaires received for Canadians and US travellers.

Table 3 shows that the late returns from overseas visitors are both higher in volume and in percentage than for the Canadian and US flows. A high percentage of these late returns come from the AES respondents, an observation consistent with the nature of the method of AES interviews.

6.1.2 Impact of Late Returns

The impact of late returns on the ITS estimates is presented in Section 2 of Attachment 1 in the form of change ratios. In addition, there is a dual presentation of the change ratios, showing the net impact of late returns with and without involving the other methodological changes. The first method of presentation, indicated by the number 1 in the title of the graphs, defines the change as the ratio of the *final* estimate to the *preliminary* estimate for the same variable. The *final* and *preliminary* estimates have both been adjusted for bias (and regional weighting in the case of overseas visitors). As such, the first method displays the net impact of late returns after cancelling the effects of other methodological changes. The second method, indicated by the number 2 in the title of the graphs, defines the change as the ratio of the *unadjusted* (traditional) ITS estimate for a variable with the late returns included, to the *unadjusted* (traditional) estimate for the same variable without including the late returns. This second method displays the effect of late returns without involving the other methodological changes.

In the case of Canadian and US residents, the impact of late returns appears in many provinces. Caution should be taken with the results based on very small samples. In general, the impact of late returns is very small, which is consistent with the small volume of such questionnaires as shown in the preceding subsection. In the few instances when the impact seems appreciable, the magnitude and direction of the impact do not appear to be systematic. These observations apply equally to the dual presentations of the impact.

In the case of overseas visitors, the impact of late returns is more substantial for some provinces, and more so for Person-nights than for Spending. This finding is consistent with the fact that the late returns from the AES interviews represent longer visits[10] to Canada. Indeed, the recognition of this effect has led to the decision that the ITS adds the late returns to its production of the series of *final* estimates. Again unfortunately, the direction and magnitude of this impact appears to lack any systematic pattern.

The intractable impact of late returns has led us to conclude that there is no feasible method to revise pre-2000 estimates for the effect of the late returns.

6.2 Bias Adjustment

Bias adjustment is applied to ITS data for all three country flows. This section provides more details about this methodological procedure and presents its impact on the ITS estimates.

Table 4 shows more specifically which ITS data groups are affected by bias adjustment. The selection of these data groups have been determined based on budget and subject matter considerations. Corresponding to the traveller group in the first column, the second column

[10] The AES encounters respondents after their long visit in Canada. These visitors are most likely missed (i.e. become non-respondents) by the traditional ITS data collection method.

indicates the source of E311 data for obtaining benchmark estimates. The third column indicates the area of entry of the traveller group (or port factor group) to which bias adjustment is performed.

For the Canadian and US flows, bias adjustment is applied to air travellers who enter Canada (from the US or directly from overseas) in Quebec, Toronto (all three terminals) and Vancouver. The adjustment is made using benchmark estimates of air travellers by trip purpose and trip duration that were obtained from very large samples of E311 cards. ITS data are adjusted so that its estimates would match the benchmark estimates for these traveller groups. There are two categories defined by trip purpose (i.e. business and other) and three categories by trip duration (i.e. less than 1 week, one to two weeks, and more than 2 weeks), forming six adjustment cells for each pre-defined traveller group. To balance the benefits of bias adjustment and the stability of ITS estimates, the adjustment procedure is applied only when an adjustment cell has at least 15 survey questionnaires. Failing that, the cells are collapsed in a pre-determined fashion until the minimum number of questionnaires is achieved. In the extreme case when the sample size is very small, all six adjustment cells are collapsed into one, reverting back to the original port factor group, without benefiting from the advantage of bias adjustment.

Table 4: ITS data sets affected by Bias Adjustment

Air traveller flow	Airport supplying E311 data	Area of entry to be adjusted
Canadian travellers direct from overseas	Vancouver International	Vancouver
	Pearson International	Toronto
	Mirabel	Mirabel
	Dorval	Rest of Quebec
US & Canadian travellers (direct) from the US	Vancouver International	Vancouver
	Pearson International	Toronto
	Mirabel + Dorval	All of Quebec
Overseas travellers direct from the 4 top markets	All international airports	Individual country group

The impact of bias adjustment for Canadian and US travellers is presented in Section 2 of Attachment 1. Two perspectives of the impact are presented, i.e. the impacts of bias adjustment with and without involving the late returns. The impact of bias adjustment for Canadians and US visitors appears only in three provinces of entry, corresponding to the airports in Table 4. However, the effect of this adjustment spreads to all provinces of visit (or residence). For the Canadian and US flows, the bias adjustment resulted in important changes to the ITS estimates for Spending and Person-nights, both at the national and provincial level in 2000 to 2002.

For overseas travellers, the bias adjustment is performed at the national level but separately for each of the four top overseas markets, namely the UK, France, Germany and Japan. The benchmark data are obtained based on E311 data from all international airports (as opposed to the selected airports for Canadian and US travellers). The same rules as for the Canadian and US flows are applied to forming adjustment groups and collapsing groups. In this report, we have opted not to present the impact of bias adjustment separately for the overseas flow (but to do so by combining it with the effect of regional weighting in Section 2 of Attachment 1). Since the adjustment is

performed at the national level for each country, considerable impact on the ITS estimates can be expected at the sub-national levels.

In summary, the method of bias adjustment has an important impact on the ITS estimates for traveller and trip characteristics in 2000 to 2002. The same could be expected if the pre-2000 estimates are similarly adjusted. It is a factor that needs to be addressed for the revision. A method for this revision factor is presented in section 7.1.1.

6.3 Regional Weighting

The method of regional weighting is implemented for the overseas flow only. This section provides more details on this weighting procedure and presents its impact on the ITS estimates.

As noted in section 4.1.3, regional weighting attempts to rebalance the ITS estimates so that the Person-trip estimates closely match the frontier counts by region of entry, type of entry and country grouping. Among all the combinations defined by these three classification variables, 61 are referred to as Direct Weighting Groups (DWGs) which represent portions of the overseas traveller population that are considered to be important and from which we obtain a sufficient number of questionnaires. For these traveller groups, the new estimates of frontier counts match the actual counts exactly. For the remaining groups of travellers, questionnaires are weighted using the raking-ratio weight adjustment method. The raking-ratio method is a two-stage iterative process that ensures that the frontier counts and the weighted estimates of the number of travellers match exactly at the national level and very closely at the regional level by type of entry.

More specifically, Table 5 below illustrates the classification of adjustment groups with regional weighting. The rows indicate the combinations of type of entry and region. The columns represent the country groupings, which can extend to include all 59 country groupings defined in the ITS. For our present purpose, the shaded cells (both grey and black) represent the DWGs adopted by the ITS since 2000. (The difference between the black and grey cells will be discussed in section 7.2.1.) The adjustment procedure ensures that Person-trip estimates for DWGs match exactly their corresponding frontier counts. In addition, the procedure yields exact matching for each column (i.e. country) total and approximate matching for each row total.

As noted in section 6.2, this report has opted to present the combined effect of the bias adjustment and regional weighting (in Section 2 of Attachment 1). From the methodological standpoint, regional weighting is expected to cause considerable impact on the ITS estimates for trip and traveller characteristics. Previous studies have shown that regional weighting explains a bigger share of the estimate change than the other methodological changes. Results of these past studies were presented to the ITS subcommittee of the CTC Research Committee (in St Andrews, New Brunswick) in September 2001. At that time, this finding was found to be consistent with the expectations of the tourism industry experts. In a consistent manner, the combined impact presented in Section 2 of Attachment 1 also displays the considerable change to the traditional estimates. In particular, the largest impact appears to be for the east and west coastal regions.

6.4 Summary of the Impacts Observed in 2000 to 2002

To summarize, our study considered the main three factors of revision – the effects of late returns, bias adjustment and regional weighting.

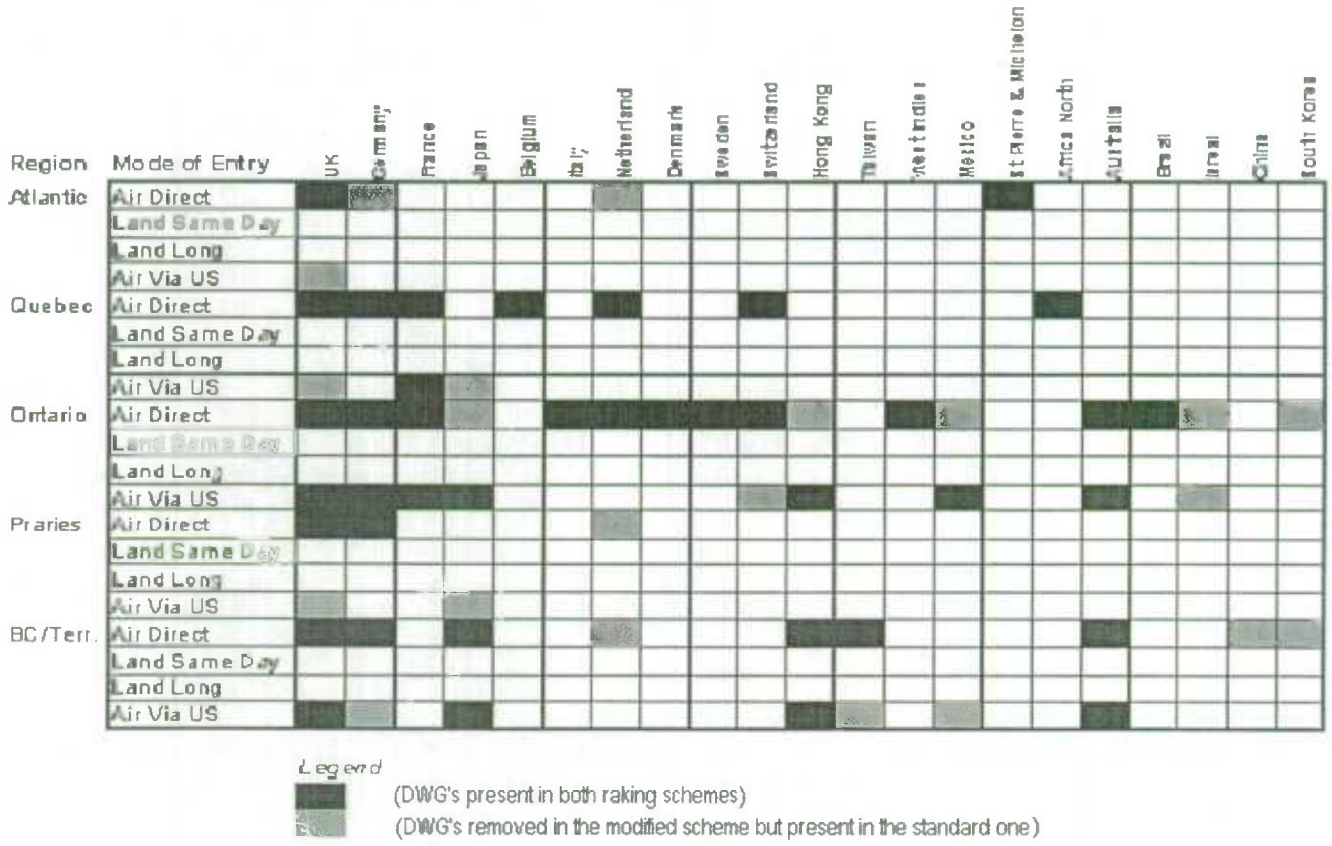
The impact of late returns for the Canadian and US flows appears to be small and lack of systematic patterns. The impact for the overseas flow is more appreciable but again without any systematic

patterns. For all three country flows, we are unable to propose a systematic and objective methodology of revising pre-2000 estimates in order to account for the effect of late returns.

For the Canadian and US flows, the impact of bias adjustment is substantive. We shall consider methods to adjust for this factor in the next section.

For the overseas flow, both regional weighting and bias adjustment have caused important changes to the ITS estimates at the national and sub-national levels. In the next section, we shall consider methods to adjust for these two factors.

Table 5: Direct Weighting Groups (DWGs) - Standard vs. Modified Raking (1993-2002)



7. METHODS TO REVISE PRE-2000 DATA

This section discusses two revision methods to account for the effects of bias adjustment and regional weighting.

7.1 Revision for the Effect of Bias Adjustment

The next two subsections (7.1.1 and 7.1.2) present the proposed revision method to account for the effect of bias adjustment and the results obtained by simulating the use of this method.

7.1.1 Proposed Revision Method for Bias Adjustment

Ideally, one would apply the method of bias adjustment to the pre-2000 ITS data using the actual benchmark data for each survey period. Such an undertaking however is impossible because the

E311 data for the past years are no longer available. Instead, we propose to apply the bias adjustment method to the pre-2000 data using the benchmark data available since 2000.

To support this proposal, we used the 2000-2002 benchmark data to analyze the percentage mix of air travellers by trip purpose and trip duration for all traveller groupings (i.e. by port/type of entry, quarter and country of residence). We used the statistical method of Analysis of Variance (ANOVA) to test the null hypothesis that the percentage mix of travellers in the six combinations (cells) of trip purpose and duration for a given traveller grouping is the same (stable) between 2000 and 2002.

Table 6 is an example of the percentage mix for a particular flow of air travellers, as obtained from a very large sample of E311 cards. Six cells are defined by classifying trip purpose and trip duration. The ANOVA test is performed separately and independently for each block of 6 (purpose-duration cells) x 3 (year) lattice, testing for the joint equality of the row percentages over the three years (columns). The number of blocks corresponds to all combinations of quarter, port/type of entry and selected country of residence.

Table 6: Percentage mix of air travellers by trip purpose and duration - Canadians (from US) who entered by Quebec

	Q1			Q2			Q3			Q4		
Cell/Year	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
1	20.3	21.5	20.5	31.8	26.4	32.0	30.7	19.8	25.0	30.2	26.5	29.9
2	23.5	26.5	23.1	30.0	31.6	29.6	25.3	29.5	25.4	32.7	31.4	29.6
3	1.9	2.0	2.0	2.8	2.2	2.5	3.0	2.2	2.0	2.7	2.4	2.6
4	30.5	28.4	30.4	17.4	22.1	18.0	19.4	25.9	21.5	17.8	22.1	17.5
5	1.3	1.4	1.1	2.1	1.7	1.9	2.4	2.0	2.2	2.3	2.3	2.5
6	22.6	20.2	22.8	15.8	16.0	16.1	19.2	20.7	23.8	14.2	15.2	18.0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Cell definition

1: < 1 week, business	3: 1-2 weeks, business	5: 2+ weeks, business
2: < 1 week, other	4: 1-2 weeks, other	6: 2+ weeks, other

More specifically, we adopt the data model for each traveller flow, port and quarter,

$y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$, for $i = 1, 2, \ldots, 6$ (the cell number) and $j = 2000, 2001, 2002$ (year)

where

$y_{ij} = \arcsin(\sqrt{p_{ij}})$, with p_{ij} = percentage of travellers in cell i and year j;

α_i representing the fixed effect of cell i, with $\sum_{1}^{6} \alpha_i = 0$;

β_j representing the fixed effect of year j with $\sum_{2000}^{2002} \beta_j = 0$;

ε_{ij} representing the error term which is normally distributed as $N(0,\sigma^2)$.

This model appears to be adequate after verifying the residual plots. We proceeded to test if the cell percentages were stable over the years 2000 to 2002. This amounts to testing H_0: $\beta_j = 0$ for all j. Further details on this statistical testing are given in Attachment 2. The main results show that the

column differences are not statistically significant, and in all cases with confidence far exceeding 95%.

It must be noted that our proposal to revise pre-2000 data using the benchmark data available since 2000 still rests on the assumption that the percentage mix of air travellers remains unchanged for the revision years. Unfortunately, we cannot validate this assumption. Considering the impact of many important events which affected the tourism and travel industry between 2000 and 2002, the stability that we have observed with the percentage mix of air travellers over these years may give some support to the proposed assumption.

Under the assumption that the percentage mix of air travellers is applicable to each revision year, we proposed that the average percentage mix since 2000 be used to provide benchmarks for bias adjustment over the revision years.

7.1.2 Simulation Result

To assess the efficacy of our proposal, we have simulated the results of using the 2000-2002 average percentage mix for performing the bias adjustment to the ITS data from 1993 to 1999. For each group (block) of ITS data to undergo bias adjustment, we calculate the average percentage for each of the 6 (purpose-duration) cells, weighted by the total traveller volume across the three years. For the purpose of illustration, let us use Table 6 as an example. Equivalent to the method of weighting, these average percentages can also be computed using the volume count for each year-cell combination, instead of the percent value.

Table 7: Calculation of Average percentage mix - Canadians (from US) who entered by Quebec, Q1

	Number of air travellers				Average
Cell	2000	2001	2002	Total	% mix
1	50,511	51,955	36,283	138,749	20.8%
2	58,445	63,875	40,873	163,193	24.5%
3	4,732	4,839	3,518	13,089	2.0%
4	75,835	68,464	53,687	197,985	29.7%
5	3,179	3,348	1,984	8,510	1.3%
6	56,237	48,705	40,308	145,251	21.8%
Total	248,938	241,186	176,653	666,777	100.0%

Cell definition

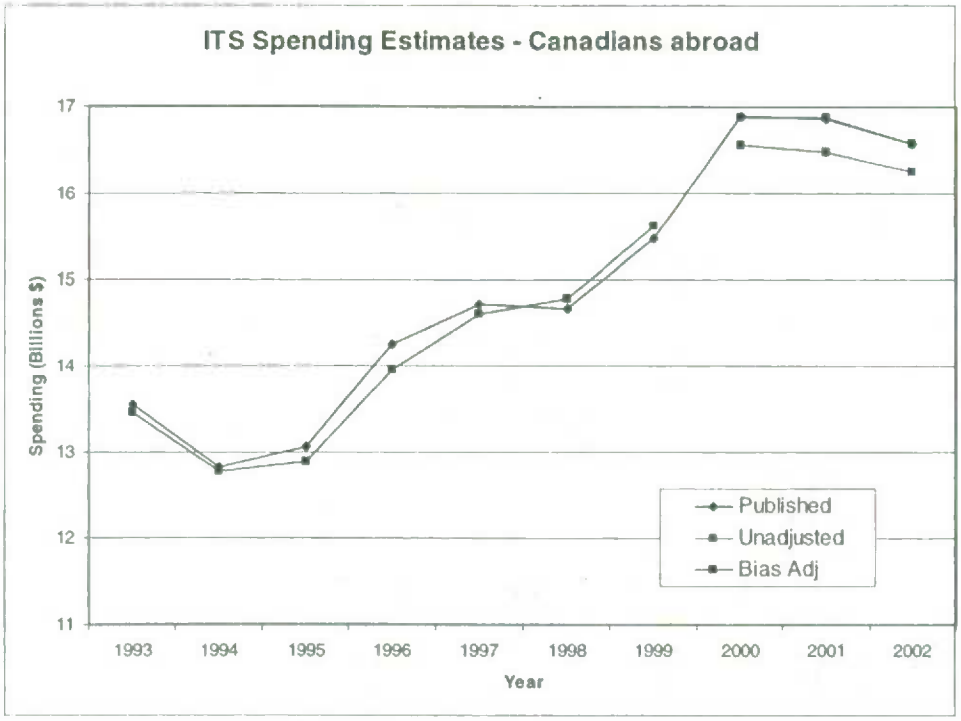
1: < 1 week, business
2: < 1 week, other
3: 1-2 weeks, business
4: 1-2 weeks, other
5: 2+ weeks, business
6: 2+ weeks, other

Table 7 gives an example of this computation corresponding to the first block in Table 6. The (weighted) average percentage for each cell (i.e. row of the block) is calculated by summing the corresponding traveller volumes in the row (across years 2000 to 2002), and then dividing this sum by the grand total traveller volume for the block.

With the average percentages calculated for each combination of port/type of entry, quarter and selected country of residence, the method of bias adjustment was applied to the ITS microdata (questionnaires) for all the years between 1993 and 2002, in the way similar to how the survey data revision would be implemented.

The study revealed one special situation with Mirabel and Dorval airports. Before September 1997, US (inbound and outbound) flights were assigned to Dorval whereas overseas flights were assigned to Mirabel. Since then, a change of flight assignments has taken place between these two airports. All regular (non-chartered) flights regardless of origin and destination are assigned to Dorval and all chartered flights are to Mirabel. As a result, the mix of travellers through these two airports has changed substantially, hence making it invalid to simulate bias adjustments separately for the two airports for the time period before the change. For this reason, the simulation used the combined average percentage mix for these two airports over the 2000-2002 period in order to do a combined bias adjustment for the survey periods before the 4th quarter of 1997.

Figure 3: Published and simulated time series of ITS annual estimates



The results of this simulation are presented in Attachment 3 in the form of time series of national estimates and in Attachment 4 for those of the provincial estimates.

For illustration purposes, Figure 3 is an example of the graphs presented for the Canadian and US flows. The *published* (black) and *unadjusted* (red) lines are as shown in Figure 2. The line labelled as "Bias Adj" (blue) is the result of simulated revisions using the (average) benchmark values from 2000 to 2002. For the overseas flow, the graphs contain the simulated results of performing both the bias adjustment and regional weighting. For simplicity, discussion of the results from simulation for the overseas flow is deferred to the next section where regional weighting is discussed.

For the Canadian and US flows, the first observation is that there is no appreciable difference between the published and simulated estimates between 2000 and 2002. This affirms the results of

the ANOVA tests in section 7.1.1, which concluded that the differences in the percentage mix of air travellers between 2000 and 2002 are not statistically significant.

The next observations relate to the comparison between the published (black) and simulated (blue) series between 1993 and 1999. In this example, the simulated series tracks the published series closely in magnitude and trend, except for one time point in 1998. In addition, the overall trend line based on the simulated estimate appears to be smoother, especially for Spending, over the ten year period. These observations apply to the majority of the results presented in Attachments 3 and 4. As expected, more variability is observed at the provincial level or for smaller traveller groups.

Overall, the proposed method of revising pre-2000 ITS data to account for the effects of bias adjustment seems to produce reasonable results for the Canadian and US flows.

7.2 Revision for the Effect of Regional Weighting

This section discussed the proposed method for revising pre-2000 ITS data to account for the effect of regional weighting. Regional weighting applies to the overseas flow only.

7.2.1 Proposed Revision Method for Regional Weighting

As described in section 6.3, the method of regional weighting makes use of frontier counts available at the national and sub-national levels for all overseas country groupings. The historical series of frontier counts continues to be available at the present time. It seems therefore feasible and appropriate to apply this method of ITS adjustment for the years prior to 2000.

One problem, however, arises due to the relatively small overseas samples that the ITS had before the introduction of the AES. To address this weakness, we propose to modify the number of Direct Weighting Groups (DWGs) for the revision. The same principles as for the post-1999 years were applied to the ITS samples between 1993 and 1999, in determining which DWGs to select. Table 5, which is presented in section 6.3, compares the DWGs selected for the two time periods. The partially shaded (grey) cells represent the groups which could not remain as DWGs for the revision.

7.2.2 Simulation Result

Again to assess the efficacy of the revision methods (for both bias adjustment and regional weighting) for the overseas flow, a simulation of these methods were performed for the years 1993 to 2002. The results are presented in the form of time series in Attachment 3 for the national annual estimates and in Attachment 4 for the provincial annual estimates.

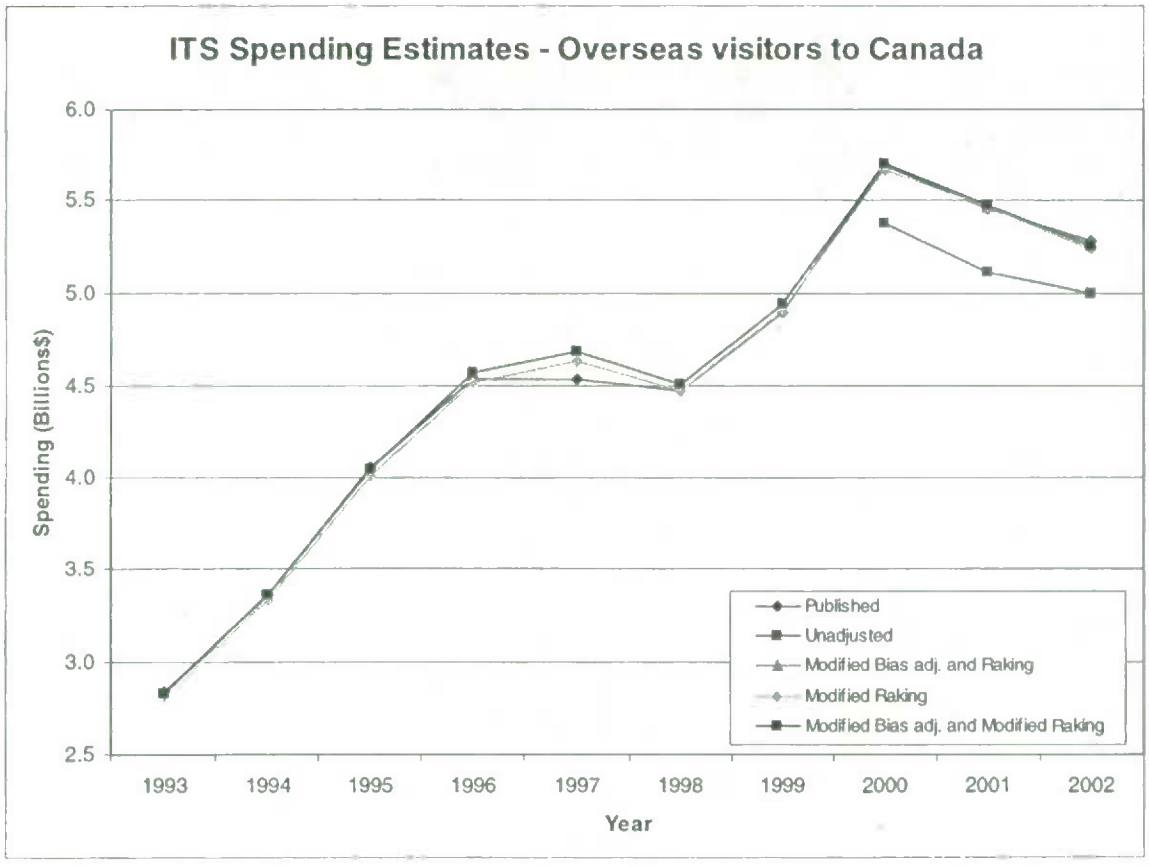
For illustration purposes, Figure 4 is an example of the graphs presented for the overseas flow. As discussed before, the *published* (black) line represents the *final* estimates of the ITS. The *unadjusted* (red) line represents the traditional (*unadjusted*) estimates between 2000 and 2002 based on the pre-2000 methodologies. The "*modified bias adj. and modified raking*" (blue) line represents the simulated estimates with the proposed revision methods for bias adjustment and regional weighting.

The first observation is the closeness between the simulated estimates and the published estimates between 2000 and 2002. It shows that the modified parameters of bias adjustment and regional weighting have little impact on the estimates between 2000 and 2002. This observation holds for most national and provincial results, and is similar to the one about the simulated effect of bias adjustment in the case of Canadian and US flows. Again, more variability occurs with smaller traveller groups.

Regarding the pre-2000 years, the simulated (blue) estimates appear to track the published estimates reasonably well, especially for Spending. The overall trend line in the majority of cases also seems smoother compared to the traditional estimates.

The graphs also contain two more series - the "*modified bias adj. and raking*" (green) and the "*modified raking*" (grey) lines. The former (green line) shows the effect of implementing both the modified bias adjustment method (i.e. with average percentage mix) and the current regional weighting (i.e. raking with the current number of DWGs) for the 2000-2002 period. The grey line shows the effect of implementing only the modified regional weighting ((i.e. raking with the reduced number of DWGs) over the 1993-2002 period. One interesting observation is noted when comparing the series with only modified regional weighting (grey line) to the published (back line) and final simulated estimates (blue line). In almost all the cases, the modified regional weighting is responsible for a large part of the adjustment from the published estimate to the final estimate. This finding is consistent with the results of previous studies when comparing the relative impacts of regional weighting and bias adjustment, as mentioned in section 6.3.

Figure 4: Published and simulated time series of ITS estimates for the overseas flow



8. CONCLUSIONS AND RECOMMENDATIONS

This feasibility study analyzed the three revision factors: late returns, bias adjustment and regional weighting. Results of the analysis suggest that revision methods should be considered to account for the effects of bias adjustment and regional weighting. In contrast, no feasible methods appear to be available to account for the effect of late returns.

Correspondingly, we propose two technically feasible methods to revise the pre-2000 data, so that long-term trend analysis would be more meaningful, in response to the methodological changes implemented in the ITS since 2000. The two revision methods are respectively for the bias adjustment and regional weighting. Bias adjustment would use the benchmark data of traveller mix available since 2000. A slight modification to the method should be made in revising the Quebec data, corresponding to the change of flight assignments between Dorval and Mirabel airports beginning in September 1997. Applying regional weighting to the pre-2000 data is technically feasible and we recommend reducing the number of Direct Weighting Groups due to the much smaller overseas samples before the implementation of the Air Exit Survey. The proposed revision methods implement new survey weights to the records of the ITS data files for all three country flows (i.e. Canadian, US and overseas travellers) for the 1993-1999 period.

To assess the efficacy of the recommended revision methods, a simulation study was carried out to revise ITS data from 1993 to 2002 using the benchmark data available for years 2000 to 2002. Results of the simulation suggest that the revised estimates in the majority of cases track the published data well and overall appear to result in smoother trend lines.

ACKNOWLEDGEMENT

The author wishes to acknowledge several colleagues who helped tremendously in undertaking the study and this report: Daniel Rogers, HSMD, for his excellent efforts in processing the huge amount of data required and his contributions to the preparation of attachments 3 and 4 of this report; Maher Saleh, HSMD, for his contributions to attachments 1 and 2 of the report; Takis Merkouris and Sylvain Perron, HSMD, for their very good advice through out the study; and Jocelyn Lapierre and Trish Horricks, CTCES, for their very helpful comments on the early drafts of this document.

ATTACHMENT 2

Testing the Stability of the Mix of Air Travellers Across Years

Objective

Starting in the survey year 2000, the International Travel Survey (ITS) has adjusted its survey estimates in order to reduce the potential impact of non-response bias due to the low response rate it experiences. This adjustment makes use of the frontier data on the mix of air travellers, which are derived from the Customs Declaration (E311) Cards for each quarter of the year, port (or grouping of ports) of entry and traveller type (i.e. flow). A question arises whether or not the same frontier data could be re-used on ITS data prior to survey year 2000 as a way of revising the historical ITS estimates. Such a method of revision would be meaningful under the assumption that the mix of air travellers is sufficiently stable over the years of interest. As the first step in verifying this assumption, this study aims to test the year-to-year stability of the traveller mix from 2000 to 2002.

The method of statistical testing employed by this study is the analysis of variance (ANOVA) which is often used for testing equality of one or more dimensions of random values. In our case, we would be testing for the quality of traveller mix among years after having accounted for the differences due to the purpose and length of trip.

Definitions

Each record is assigned a cell number based on length and purpose of trip as follows: 1) less than 1 week stay for business purposes, 2) less than one week stay for other reasons, 3) 1-2 week stay for business, 4) 1-2 week stay for other reasons, 5) 2+ week stay for business, and 6) 2+ week stay for other reasons.

There are four traveller groups in all: 1) Canadian travellers returning from overseas directly, 2) Canadian travellers arriving from the United States, 3) Visitors from the United States, and 4) Visitors from overseas.

For Canadians returning from overseas, four subgroups are designated by port of entry: 1) Vancouver International Airport, 2) Pearson International Airport in Toronto, 3) Mirabel, and 4) other ports of entry in the province of Quebec. For US visitors, there are only three subgroups by port of entry: 1) Vancouver, 2) Toronto, and 3) Quebec. For overseas visitors, bias adjustment is applied to visitors from the four largest markets respectively. The four largest markets are: 1) the United Kingdom, 2) France, 3) Germany, and 4) Japan.

Methodology

ITS data from the years 2000-2002 were tabulated by the cell number and year on the axes. A separate table (referred to as a block in sections 7.1.1 and 7.1.2 of the main report) is produced for each unique combination of traveller type, group (port or country), and quarter (of the year). The traveller percentages in each table based on total traveller volume over the 6 cells (per year) are calculated. An analysis of variance (ANOVA), making use of the F-test, is conducted to determine whether the year factor is statistically significant. The validity of the F-test requires that random error be normally distributed. The raw percentages do not meet this requirement and thus a transformation of values must be applied before the ANOVA is conducted. Each percentage is transformed into an angle value which is the inverse sin of the square root of the percentage. The ANOVA is performed on the resulting angle values.

The F-test is conducted by calculating the mean sum of squares of the variable in question, in this case the year factor, and dividing it by the mean square error. In other words, the total sum of squares attributed to the year factor is divided by the degrees of freedom (i.e. 2) to obtain the mean sum of squares for the year factor. The mean square error is calculated similarly with 10 degrees of freedom. The ratio of these two mean squares produces the F statistic which is used to determine the significance of the year factor. A separate statistic is calculated for each traveller type, group and quarter for a total of fifty-six (56) statistics in all. The null hypothesis of the analysis model in this test is that the year factor is not of significance. We may reject the null hypothesis if Pr>F is 5% or less.

Results

The results of the analysis of variance are outlined in the attached tabulations. Each tabulation represents a different group of travellers. Each traveller group is listed by port of entry or country of origin and which quarter of the year they arrived in Canada. The mean square year is the sum of squares attributed to the year factor divided by its degrees of freedom (=2). The mean square error is listed in the following column. F-statistics were calculated as a quotient of the mean square attributed to the year factor over mean square error for each subgroup, and are listed in the penultimate column of each tabulation. The final column presents the associated Pr>F for each F-statistic.

Conclusion

In each case the Pr>F are well above the 5% threshold required to reject the null hypothesis. Since there is no evidence that the survey year is of significance in the model, the test for the year-to-year stability of the traveller mix has concluded successfully.

Tabulations

Canadian travellers returning from overseas direct

Type	Port	Quarter	Mean Square Year	Mean Square Error	F Value	Pr > F
Can OVS Dir	Mirabel	1	0.00006424	0.00129276	0.05	0.95
Can OVS Dir	Mirabel	2	0.00019756	0.00017815	1.11	0.37
Can OVS Dir	Mirabel	3	0.00010986	0.00037137	0.30	0.75
Can OVS Dir	Mirabel	4	0.00011159	0.00065256	0.17	0.85
Can OVS Dir	Toronto	1	0.00001061	0.00012920	0.08	0.92
Can OVS Dir	Toronto	2	0.00001817	0.00008632	0.21	0.81
Can OVS Dir	Toronto	3	0.00002301	0.00009697	0.24	0.79
Can OVS Dir	Toronto	4	0.00002908	0.00022169	0.13	0.88
Can OVS Dir	Vancouver	1	0.00000853	0.00078230	0.01	0.99
Can OVS Dir	Vancouver	2	0.00001743	0.00012728	0.14	0.87
Can OVS Dir	Vancouver	3	0.00004007	0.00027021	0.15	0.86
Can OVS Dir	Vancouver	4	0.00003659	0.00033811	0.11	0.90
Can OVS Dir	other Quebec	1	0.00001160	0.00105379	0.01	0.99
Can OVS Dir	other Quebec	2	0.00000511	0.00071543	0.01	0.99
Can OVS Dir	other Quebec	3	0.00001457	0.00069635	0.02	0.98
Can OVS Dir	other Quebec	4	0.00000916	0.00040083	0.02	0.98

Canadian travellers returning via the United States

Type	Port	Quarter	Mean Square Year	Mean Square Error	F Value	Pr > F
Can from US	Quebec	1	0.00000403	0.00020753	0.02	0.98
Can from US	Quebec	2	0.00001252	0.00050980	0.02	0.98
Can from US	Quebec	3	0.00002379	0.00146839	0.02	0.98
Can from US	Quebec	4	0.00000594	0.00050797	0.01	0.99
Can from US	Toronto	1	0.00000028	0.00003696	0.01	0.99
Can from US	Toronto	2	0.00000831	0.00005235	0.16	0.86
Can from US	Toronto	3	0.00002504	0.00057892	0.04	0.96
Can from US	Toronto	4	0.00001968	0.00013750	0.14	0.87
Can from US	Vancouver	1	0.00002282	0.00017654	0.13	0.88
Can from US	Vancouver	2	0.00001256	0.00026167	0.05	0.95
Can from US	Vancouver	3	0.00001761	0.00060690	0.03	0.97
Can from US	Vancouver	4	0.00004580	0.00053101	0.09	0.92

Overseas visitors

Type	Country	Quarter	Mean Square Year	Mean Square Error	F Value	Pr > F
Overseas	France	1	0.00000040	0.00021735	0.00	1.00
Overseas	France	2	0.00005140	0.00073060	0.07	0.93
Overseas	France	3	0.00001365	0.00041864	0.03	0.97
Overseas	France	4	0.00000816	0.00046806	0.02	0.98
Overseas	Germany	1	0.00003803	0.00061817	0.06	0.94
Overseas	Germany	2	0.00007151	0.00056008	0.13	0.88
Overseas	Germany	3	0.00001400	0.00019049	0.07	0.93
Overseas	Germany	4	0.00002165	0.00030826	0.07	0.93
Overseas	Japan	1	0.00014108	0.00069281	0.20	0.82
Overseas	Japan	2	0.00001240	0.00025987	0.05	0.95
Overseas	Japan	3	0.00008496	0.00020626	0.41	0.67
Overseas	Japan	4	0.00087697	0.00160590	0.55	0.60
Overseas	UK	1	0.00004107	0.00035912	0.11	0.89
Overseas	UK	2	0.00001439	0.00021586	0.07	0.94
Overseas	UK	3	0.00004423	0.00011614	0.38	0.69
Overseas	UK	4	0.00000284	0.00024477	0.01	0.99

Visitors from the United States

Type	Port	Quarter	Mean Square Year	Mean Square Error	F Value	Pr > F
US	Quebec	1	0.00006571	0.00073319	0.09	0.92
US	Quebec	2	0.00000025	0.00026748	0.00	1.00
US	Quebec	3	0.00000659	0.00048532	0.01	0.99
US	Quebec	4	0.00003003	0.00041463	0.07	0.93
US	Toronto	1	0.00007009	0.00058953	0.12	0.89
US	Toronto	2	0.00001085	0.00021401	0.05	0.95
US	Toronto	3	0.00001017	0.00065576	0.02	0.98
US	Toronto	4	0.00011742	0.00025542	0.46	0.64
US	Vancouver	1	0.00002820	0.00059131	0.05	0.95
US	Vancouver	2	0.00001718	0.00028149	0.06	0.94
US	Vancouver	3	0.00002300	0.00013762	0.17	0.85
US	Vancouver	4	0.00001195	0.00126886	0.01	0.99