



**INTERNATIONAL TRADE ADMINISTRATION
TOURISM INDUSTRIES
IN-FLIGHT SURVEY OF
INTERNATIONAL AIR TRAVELERS**

**DESCRIPTION OF EXPANSION PROCEDURES
FOR ESTIMATING NON-RESIDENT AND RESIDENT
INTERNATIONAL AIR TRAVELER ACTIVITY**

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SEPTEMBER 28, 1999



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INTRODUCTION

CIC Research, Inc. began working on the International Trade Administration Tourism Industries' (formerly United States Travel and Tourism Administration) "In-Flight" survey of international air travelers in 1985. Initially, the expansion procedures used by CIC Research, Inc. for the ITA-TI database were based on the **Weighting Procedures** manual prepared by Response Analysis Corporation, August 28, 1985. These procedures were translated into FORTRAN and SAS computer language programs by CIC staff during the start up phase of the project and were used to produce the ITA-TI expanded estimates for non-residents from April 1985 to December 1989 and for residents from April 1985 to present.

During 1990, a new expansion methodology was developed by CIC Research for the non-resident database. This action was initiated as a result of the desire of ITA-TI to provide government and industry more timely and accurate statistics. By replacing the U.S. Justice Department Form I-92 with the Immigration and Naturalization Service (INS) form I-94, the expansion procedures could occur within three months of the end of the quarter.

The new process was then used to create the expanded estimates for non-residents to the United States based on control totals taken from the INS Form I-94. The I-94 control totals are directly proportioned to the questionnaire by country of residence and port of entry (customs) responses.

The procedure for expanding the resident database has remained essentially the same since 1985. During the period when the new non-resident expansion procedures were being developed, the computer programs for the resident expansion procedure were updated. The changes included streamlining and restructuring the report production effort and adding internal documentation to the programs. The methodology remains the same as the procedure that was followed by Response Analysis in 1985.



ITA-TI In-Flight Survey of International Air Travelers Description of Expansion Procedures for Estimating Non-Resident International Air Traveler Activity

The estimation of Non-Resident international air travel activity is a multi-step expansion process of the ITA-TI In-Flight Survey of International Air Travelers (IFS) data. There are a series of data preparation steps performed prior to initiating the expansion procedures outlined below. These initial steps take the raw data file through the creation of the working database, computer editing, and outlier analysis. A discussion of these steps will not be presented in this document.

The primary activity for the expansion process is contained in several computer programs that are run in sequence. The Immigration and Naturalization Service (INS) Form I-94 data containing summarized port of entry by country of residence information is used as control totals during the expansion process of the International Air Travelers Non-Resident database. The I-94 data is received from the U.S. Department of Commerce on a quarterly basis.

Step 1: Initial Survey Expansion

This step accounts for the children traveling with each responding adult. The initial expansion factor is one, unless children are a part of the travel party. The composition of the travel party is taken from the IFS data. If children are present, the initial expansion factor has a value greater than one. The exact value of the factor is dependent on the number of children and adults in the party. The formula for the initial expansion factor can be expressed as follows:

$$\text{Initial expansion} = 1 + (\text{children count}/\text{adult count})$$

Step 2: I-94 Data Conversion

This step converts the codes in the I-94 data to compatible codes that have been predefined for the In-Flight Survey of International Air Travelers. The effected variables are the country of residence and port of entry.

Control totals from the I-94 data are generated at this time. The control total is a summation of the count of non-residents for each port by country of residence and is used throughout the expansion process.

Step 3: Summarize Survey Data

The IFS data using the country of residence and port of entry codes is summarized during this step. First, the I-94 data and the IFS are merged by country code and port of entry code. The resulting file contains the summarized counts from the I-94 data and the count of responses from the IFS, by country of residence and port of entry. The merged data is compared with the control total to ensure it matches.

Step 4: Divide In-Flight Survey of International Air Travelers Survey Data

Next, the file containing the summarized I-94 and IFS data is sorted, processed and divided into three different classifications.

- 1) Records that contain both the I-94 count, the Survey of International Air Travelers count, and country of residence and U.S. port of entry codes. (The majority of the data.)
- 2) Records that have missing country of residence or U.S. port of entry codes in the IFS data. (No match with the I-94 data.)
- 3) Records that hold I-94 data, for a country of residence and a U.S. port of entry but have no corresponding IFS data. (No match with the IFS data.)

Of the three record classifications identified, the last two types require further explanation.

Type two records do not have a matching pair of country of residence and port of entry codes with the I-94 data. Therefore, initial expansion generated for the number of adults and children is reset to zero so they will not be added into the control total.

The type three records are derived from the I-94 data and do not have any corresponding matches in the IFS data. A new "dummy" record is generated containing a final expansion factor, country of residence, and port of entry. This ensures the summation of the final expansion by country of residence and port of entry will equal the I-94 control total.

The total of the three sections will match the I-94 control total by country of residence and U.S. port of entry.

Step 5: Sort and Merge Data -- Create Final Expansion

In this step, the Non-Resident file is read and sorted by the country of residence and port of entry.

The initial expansion values in the IFS file are summarized by country of residence and port of entry. This value will be used to proportion the I-94 expansion by the number of adults and children.

A respondent's final expansion value is created by taking the proportion of the respondent's initial expansion value to the sum of all initial expansion values (by country of residence and port of entry) multiplied by the I-94 totals by country of residence and port of entry. The calculation appears as follows:

$$\text{final expansion} = ((\text{initial expansion} / \text{sum of initial expansion}) * \text{I-94 count})$$

The total of the final expansion value for all records in the Survey of International Air Travelers database will equal the I-94 control total.

Step 6: Create Comparison Table

The final step is run to check the I-94 table "Port of Entry by Country of Residence (Air Mode Only)" against the expanded estimate values in the IFS database. The results are shown in a crosstabulation table by world region and port of entry. The sum of the overseas visitors and the Mexican Air visitors from the IFS will equal the I-94 table control total.



ITA-TI In-Flight Survey of International Air Travelers Description of Expansion Procedures for Estimating Resident International Air Traveler Activity

The estimation of Resident international air travel activity is a multi-step expansion process of the ITA-TI In-Flight Survey of International Air Travelers data. There are a series of data preparation steps performed prior to initiating the expansion procedures outlined below. These initial steps take the raw data file through the creation of the working database, computer editing, and outlier analysis. A discussion of these steps will not be presented in this document.

The specific algorithms for the expansion process are contained in several computer programs that are run in sequence. The I-92 International Air Passenger Statistics data sets containing detailed daily flight information and summarized city pair information are used as control totals during the expansion process of the International Air Travelers Resident database. The I-92 data is received from the U.S. Department of Transportation.

Step 1: Initial Expansion Factor (INITEF)

This accounts for the children traveling with each responding adult. The initial expansion factor is one, unless children are a part of the travel party. The composition of the travel party is taken from the In-Flight Survey of International Air Travelers (IFS) information. If children are present, the initial expansion factor has a value greater than one. The exact value of the factor is dependent on the number of children and adults in the party. The formula for the initial expansion factor can be expressed as follows:

$$\text{INITEF} = 1 + (\text{children count}/\text{adult count})$$

At this point, each respondent is designated as either a citizen or an alien. This classification relies on the IFS response and the I-92 data set. The I-92 data has a count of the number of citizens and aliens on each flight. For the purposes of this expansion process, a respondent is classified as a citizen if the respondent is a resident citizen, a resident alien, or a non-resident citizen. If the respondent is a non-resident alien, the classification is alien. Once all respondents have been classified, the alien group is dropped from the IFS file. An initial expansion factor is assigned to each of the resident respondents.

Step 2: Flight Expansion Factor (FLTEF)

Step 2 generates the expansion factor of each of the sampled flights. This effort involves adjusting for the non-response group. The non-response group comprises those individuals who did not complete a questionnaire but were aboard the sampled flight. Total passengers per sampled flight are determined by matching flights in the detailed I-92 daily files with the respective IFS flight. For each IFS flight, the I-92 count of citizens (I92FLT) is extracted. In cases where the IFS flight does not match the I-92 files for either airline or flight number or date, an estimate is

calculated. Once each IFS flight has a corresponding I-92 total passenger figure, the flight expansion factor is computed as follows:

$$FLTEF = I92FLT / INITEF$$

Where:

I92FLT = I-92 flight counts for citizens on a selected flight
 INITEF = sum of initial expansion factors for citizens on a selected flight
 FLTEF = flight expansion factor for citizens

Step 3: Stratum Expansion Factor (STREF)

A stratum consists of all flights from which a sampled flight was selected. The stratification criteria include the air carrier and world region of travel. The expansion factor generated in this step creates a value for each respondent that represents all travelers on all flights in the stratum. The computations in this step are carried out using the summarized I-92 counts from the monthly data file as control totals.

Each I-92 flight is assigned a stratum number. The stratum numbers are broken down as follows:

100 - 500 A unique number is assigned to flights that comprise a given strata and meet sample criteria. The strata are defined during the sampling process of the survey.

800 Number assigned to all flights of participating airlines not included in the sampling frame. These flights fail to meet the criteria for being included in the sampling frame.

900 Number assigned to all flights of non-participating airlines in a given month.

After the I-92 data have been assigned stratum numbers, all records are summed for each stratum (numbers 100 - 500). This creates the variable I92STR (sum of all citizens on flights in a given stratum).

$$I92STR = \text{citizen count by stratum}$$

For each IFS flight, a sum flight figure for citizens is computed as follows:

$$SUMFLT = INITEF * FLTEF$$

Where:

INITEF = initial expansion figure for citizens on a selected flight
 FLTEF = flight expansion figure for citizens on a selected flight

This variable is then summed for each stratum to produce a IFS stratum total (SUMSTR).

$$SUMSTR = \text{SUMFLT by stratum}$$

To compute the final stratum expansion factor, the I-92 summary figure is divided by the IFS summary figures. The final computation to produce the stratum expansion figure is as follows:

$$\text{STREF} = \text{I92STR} / \text{SUMSTR}$$

Where:

I92STR = I-92 stratum totals for citizens
SUMSTR = IFS stratum totals for citizens
STREF = Stratum expansion figure for citizens

The calculated value for a given STREF is then assigned to all flights in a stratum.

Step 4: Preliminary Expansion Factor (PRELEF)

The three expansion factors (the initial expansion factor, the flight expansion factor, and the stratum expansion factor) generated above are now multiplied together and the product is defined as the preliminary expansion factor. The equation for this factor is as follows:

$$\text{PRELEF} = \text{INITEF} * \text{FLTEF} * \text{STREF}$$

Where:

INITEF = initial expansion figure for citizens
FLTEF = flight expansion figure for citizens
STREF = stratum expansion figure for citizens

Step 5: Ratio Expansion for all International Air Travelers by Country/Region of Debarkation

A port of debarkation is assigned to each respondent. For respondents with no port of debarkation, the last US port from the OAG information on that flight is assigned.

The summarized I-92 monthly data is incorporated into the expansion by country of debarkation for both participating and non-participating airlines in the survey.

The preliminary expansion factors from the IFS file are summed for each country of debarkation creating the variable PRELEFS. Also, the I-92 monthly counts of citizens are summed for each country of debarkation creating the I92D variable.

PRELEFS = preliminary expansion factor by country of debarkation
I92D = I92 citizens by country of debarkation

The countries of debarkation (summarized I-92 monthly data), which are represented in the IFS file, must be proportionately increased to include regional totals for the I-92 monthly data which are not represented in the IFS file. The I-92 monthly data totals are summed for all countries in the region of debarkation (RI92) and for those countries in the region of debarkation which have matches in the IFS file (I92IFS). Each I-92 monthly data country of debarkation total is adjusted as follows:

$$\text{ADJI92} = (\text{I92D} * \text{RI92}) / \text{I92IFS}$$

Where:

I92D = I-92 totals by country of debarkation
RI92 = I-92 totals by region of debarkation
I92IFS = I-92 totals by region of debarkation having IFS match

For each country of debarkation in the IFS file, a final ratio adjustment is then computed:

$$I92RAT = ADJI92 / PRELEFS$$

Where:

ADJI92 = port of debarkation adjustment
PRELEFS = IFS preliminary expansion by country of debarkation

Step 6: Intermediate Expansion Factor (INTEREF)

The preliminary expansion factor for each respondent is multiplied by the I-92 ratio adjustment (for each country of debarkation represented in the IFS file) to yield an intermediate expansion factor. The intermediate expansion factor is calculated as follows:

$$INTEREF = PRELEF * I92RAT$$

Where:

PRELEF = preliminary expansion factor for citizens
I92RAT = I-92 country ratio adjustment for citizens

Step 7: Truncate Expansion Factor to Minimize Effect of Extreme Values

The final step in the expansion process is to evaluate the relative sizes of the expansion factors for each respondent and each country of debarkation. Two criteria were established for the evaluation process. No expansion factor can exceed either five times the average expansion factor for the respondent's country of debarkation or exceed ten times the overall average expansion factor for all respondents.

If the expansion factor is less than five times the average expansion factor for the country of debarkation no adjustment is made. If the expansion factor is greater than five times the average then the expansion factor is truncated to the five times average value. Should the expansion factor for any respondent exceed ten times the overall average expansion factor for all respondents, it is set to the ten times value. In order to ensure that the new expansion factors yield the appropriate control totals, a final proportional adjustment is made to all expansion factors.

The final expansion factor (FINAL) for each respondent has now been computed.