U.S. Census Bureau Measurement of Net International Migration to the United States: 1990 to 2000

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ABSTRACT

The U.S. Census Bureau produces national population estimates on an annual basis using methodology that incorporates the three main determinants of population change: births, deaths, and net migration. Net international migration plays an integral role in determining both the size and demographic composition of the population at the national level. It is the most complex determinant of population change, and its complete measurement involves the measurement of several sub-components, each one using separate methodology. In view of the fact that these sub-components are estimated separately, each is subject to differing levels of uncertainty or bias. This paper provides a detailed discussion of the definitions, methodologies, assumptions, and data sources used to measure net international migration, including a brief description of estimates for geography and demographic characteristics. Following the discussion of the sub-components of net international migration, the strengths and limitations of each are presented along with potential research and developments.

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I.   INTRODUCTION

The U.S. Census Bureau produces national population estimates on an annual basis using methodology that incorporates the three main determinants of population change: births, deaths, and net migration. Net international migration plays an integral role in determining both the size and demographic composition of the population at the national level. It is the most complex determinant of population change, and its complete measurement involves the measurement of several sub-components, each one using separate methodology. In view of the fact that these sub-components are estimated separately, each is subject to differing levels of uncertainty or bias. This paper provides a detailed discussion of the definitions, methodologies, assumptions, and data sources used to measure net international migration, including a brief description of estimates for geography and demographic characteristics. Following the discussion of the sub-components of net international migration, the strengths and limitations of each are presented along with potential research and developments.[1]

Post-censal national population estimates

The U.S. Census Bureau produces national population estimates for the resident population of the United States by single year of age, sex, race, Hispanic origin, and nativity.[2] These estimates are developed using the component method, described by the "balancing equation" (Equation 1). This method accounts for the change in national population trends derived from the three major components of population change: births, deaths, and net migration. The estimate series begins with a base population derived primarily from decennial census results, and is updated each year using the most recent administrative data available on births, deaths, and net migration. Because new data continue to become available and revisions are made to historical series, each new annual series requires the development of the estimates from census date forward to the new estimate date.[3] Therefore, the series produced each year reflects demographic change experienced throughout the decade using the most recent data available. The estimates also account for the movement of the Armed Forces overseas and civilian citizens to the United States, which are included separately from the net international migration component.

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[1] This paper reflects updated research of net international migration at the national level reported by Word (1992) in "The Census Bureau Approach for Allocating International Migration to States, Counties and Places: 1981-1991," Population Estimates and Projections Technical Working Paper No. 1.

[2] The resident population includes people who reside in the 50 states and the District of Columbia. It excludes residents of the Commonwealth of Puerto Rico, and residents of outlying areas under United States sovereignty or jurisdiction (principally American Samoa, Guam, U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands). The estimates exclude the United States Armed Forces overseas, as well as civilian United States citizens whose usual residence is outside the United States. The foreign-born population is designated by the absence of United States citizenship at birth and includes naturalized citizens and non-citizens residing in the United States. Consequently, a person is considered "native" if he or she is born in the United States or is born abroad to at least one parent with U.S. citizenship.

[3] Hereafter, these revisions are referred to as a "vintage." For example, "vintage 2000 estimates" refers to the revision produced in the year 2000.

Equation 1. $$P_t = P_{t-1} + B_{t-1,t} - D_{t-1,t} + NIM_{t-1,t} + NCM_{t-1,t} \qquad (1)$$

where

$P_t =$	population at time t;
$P_{t-1} =$	population at time t-1;
$B_{t-1,t} =$	births, in the interval from time t-1 to time t;
$D_{t-1,t} =$	deaths, in the interval from time t-1 to time t;
$NIM_{t-1,t} =$	net international migration, in the interval from time t-1 to time t; and
$NCM_{t-1,t} =$	net movement of U.S. Armed Forces and civilian citizens to the United States.

Once the base population (P_{t-1}) for estimates is established for April 1 of the decennial year, estimates for future designated time intervals (P_t) are made by adding the number of births ($B_{t-1,t}$), subtracting the number of deaths ($D_{t-1,t}$), and adding estimates of the two net migration components shown in Equation 1 to the census base population. Administrative data on births and deaths for U.S. residents are tabulated by the National Center for Health Statistics (NCHS). Data on net international migration are primarily collected by the Immigration and Naturalization Service (INS). The INS data, along with other administrative sources, will be discussed in detail below.

Table 1 presents the latest estimates for the total resident population and the net international migration component (vintage 2000).[4] Throughout the decade, the population increased from 248.8 million as of April 1, 1990, to 274.6 million as of April 1, 2000, an increase of 25.8 million people, or 9.4 percent.[5]

Net international migration to the United States

Migration is typically defined as a permanent geographic or spatial change in usual residence from one defined area to another. International migration consists of people changing permanent residence across national boundaries. U.S. immigration law defines immigration as the acquisition of legal permanent residence in the United States by non-citizens. In reference to the national estimates, net international migration to the United States is the net of 1) migration to the United States and 2) permanent departure from the United States. Currently, this component is construed to also include net migration from Puerto Rico and the movement of the unauthorized population. Temporary international movement of U.S. citizens, including the Armed Forces and their dependents, is not included in net international migration and is treated separately, as shown in Equation 1.

Among the 25.8 million people added to the total U.S. population throughout the decade, more than 8 million were estimated to be added as a result of the net international migration component (Table 1). The amount of net international migration generally increased throughout the decade, from 699,000 in 1990-91 to 931,000 in 1996-97. After 1997, net international migration remained relatively stable between 884,000 for 1997-98 and 863,000 for 1998-99.

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[4] The estimates, referred to as vintage 2000 estimates, were prepared for evaluation of Census 2000.

[5] Hereafter, year refers to the year ending June 30, which begins on July 1 of the previous year.

For the purposes of the national estimates, net international migration is divided into several sub-components (Equation 2): 1) legal immigration; 2) movement of refugees; 3) net unauthorized migration; 4) emigration; 5) net temporary migration; and 6) net migration from Puerto Rico.

Equation 2. $$NIM_{t-1,t} = LPR_{t-1,t} + RE_{t-1,t} - E_{t-1,t} + NU_{t-1,t} + NT_{t-1,t} + NPR_{t-1,t} \tag{2}$$
where

$LPR_{t-1,t} =$	legal immigration, in the interval from time t-1 to time t;
$RE_{t-1,t} =$	movement of refugees from time t-1 to time t;
$E_{t-1,t} =$	emigration of legal residents from time t-1 to time t;
$NU_{t-1,t} =$	net unauthorized migration from time t-1 to time t;
$NT_{t-1,t} =$	net temporary migration from time t-1 to time t; and
$NPR_{t-1,t} =$	net migration from Puerto Rico from time t-1 to time t.

Table 2 displays the estimates used for each sub-component from 1990 to 2000 for the national estimates produced in 2000, referred to as vintage 2000. *Legal immigration* (*LPR*), the largest contributing sub-component to net international migration, refers to immigrants admitted to the United States for legal permanent residence, as defined by INS (INS 2000). Under the Immigration Act of 1990, immigrants entering as legal immigrants are admitted under several categories of admission including family sponsorship (close relatives of U.S. citizens or legal permanent residents) and employment preference, among others. Throughout the decade, the number of legal immigrants added annually ranged from 577,000 migrants in 1990-91 to 883,000 migrants in 1996-97 (Table 2).

The second largest contributing sub-component, *net unauthorized migration (NU)* is an estimate of the annual addition of migrants residing in the United States without legal status net of mortality and emigration. Unauthorized migrants include those who entered the United States without prior authorization and those who violated the terms of or overstayed a temporary (nonimmigrant) visa. The estimates for this population are produced using indirect methods and are currently assumed to be a constant net annual addition of 225,000 migrants each year.

Refugees (RE) are defined as those people outside their country of nationality who are unable or unwilling to return to that country because of persecution or a well-founded fear of persecution, which coincides with the definition determined by the 1967 United Nations Protocol on Refugees (United Nations 2000). The estimated number of refugees is based on data provided by the Office of Refugee Resettlement (ORR) of the Department of Health and Human Services (DHHS), and fluctuates each year depending on the occurrence of foreign political upheavals and U.S. policy with respect to their victims. For the 1990-2000 decade, the number of refugees added annually ranged between a low of 78,000 in 1997-98 and a high of 128,000 for 1994-95.

The Census Bureau also makes an allowance for the *net movement from Puerto Rico (NPR)* to the United States. This allowance is based on trends during the 1980s, and is assumed to be a constant net annual addition to the United States of 12,646 migrants each year for the 1990-2000 decade.

Net temporary migration (*NT*), also known as "nonimmigrants," represents migrants legally admitted into the United States on a temporary visa, who reside in the United States for a specified period of time. Theoretically, this population includes temporary visitors for business and/or pleasure, foreign government officials, treaty officials, foreign and exchange students,

temporary workers, and religious workers, among others.[6] Some classifications of this movement are estimated by indirect means; either from supplementary data sources or by assuming the number of such people residing in the United States remains constant over time. Throughout the 1990-2000 decade, the number of nonimmigrants added annually ranged from 669 migrants (multiple years) to 72,000 for 1998-99.

Particular sub-components discussed above are migratory flows in a single direction ("in" or "out"), while others represent net flows, or the difference of "in" minus "out." *Emigration (E)*, defined as the permanent departure from a country of residence, is the one-way flow of United States permanent residents leaving the United States to reside abroad differentiated by nativity status. This definition excludes the departure of unauthorized migrants, migrants to Puerto Rico, and nonimmigrants, as their respective sub-components are already estimated net of emigration. The estimated number of annual emigrants for the 1990-2000 decade increased from 252,000 migrants in 1990-91 to 279,000 migrants in 1998-99.

Net international migration to the United States is the sum of these independently derived sub-components (Equation 2). The estimation of net international migration to the United States, therefore, is not simply the tabulation of gross immigration to and gross emigration from the United States. Because some of the sub-components are estimates of *net* migration and are not estimated as separate flow measures in or out of the United States, we are unable to distinguish the *gross* movement of each group. Estimates of each sub-component require the use of different data sources and both direct and indirect estimation techniques, resulting in differing levels of data quality. Depending on the source, data are collected at different points throughout the year or on an annual basis. In addition, the determinants for each sub-component are diverse. Consequently, net international migration to the United States represents the most difficult and problematic component of demographic change to estimate. The following sections discuss each sub-component of net international migration, review the strengths and limitations of their measurement, and present potential research and developments.

II.   MAJOR SUB-COMPONENTS OF NET INTERNATIONAL MIGRATION

Legal immigration

The sub-component of net international migration, *legal immigration (LPR)*, refers to non-citizens who are granted *legal permanent residence* in the United States by the federal government, or who reside in the United States and will ultimately be granted this status. Legal permanent residence includes the right to remain in the country indefinitely, to be gainfully employed, and to seek the benefits of U.S. citizenship through naturalization.

The character of legal immigration is highly dependent on current immigration law. Major revisions of the U.S. immigration code include the Immigration and Nationality Act

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[6] For the purposes of population estimates, temporary visitors for business and pleasure are not considered residents, and therefore are not included in this sub-component.

Amendments of 1965. Under this Act, numerical limitations were placed on various categories of immigration. Moreover, the Act was groundbreaking in the sense that it defined one class of immigrants--immediate relatives of U.S. citizens--that was not subject to a numerical limitation. A major overhaul of the Act in 1990 established a special class of immigrants known as "diversity immigrants" who are chosen by lottery from countries that have a history of being underrepresented among immigrants. Finally, the Act established a set of "preferences," or priorities, among other family-sponsored immigrants (besides immediate relatives of citizens) and employment-based immigrants, with an elaborate formula by which numerical limitations were imposed on the resulting preference groups. Table 3 summarizes the distribution of the major legal immigrant categories and identifies whether they are subject to numerical limitations. The majority of legal immigrants granted permanent residence in FY1998 were immediate relatives of U.S. citizens, followed by family sponsorship preference migrants and employment preference migrants.

Legal immigrants obtain permanent resident status through two separate mechanisms that do not differ in legal requirements, depending on where they live at the time of application. The INS accepts the applications for permanent resident status for people living in the United States when they apply. Referred to as *adjustees*, this category generally consists of, but is not limited to, nonimmigrants, refugees, asylees (people granted political asylum), and unauthorized residents. In contrast, the U.S. Department of State (DOS) accepts applications and issues visas from consular offices abroad to potential immigrants residing outside the United States, which are processed as they enter the United States. These immigrants are referred to as *new arrivals*. Consequently, applicants can obtain permanent residence in the United States with or without changing geographic residence before immigration. In fact, immigrants may be living in the United States for a number of years while awaiting adjustment to immigrant status. During this time, they are likely to view themselves as U.S. residents, and are therefore in the U.S. population for the purposes of population estimates. As of 1995, the number of adjustees and new arrivals remained about equal in proportion, with adjustees generally outnumbering new arrivals each year.

In preparing estimates of the legal immigrant sub-component of international migration, we treat new arrivals and adjustees differently, although both are sizeable contributors to this category. The treatment of new arrivals is relatively simple because their month and year of admission, as well as various demographic characteristics (age, sex, country of birth, location of intended residence) are indicated in the INS immigrant data, and can be assumed to apply as of the time of their entry into the United States. For adjustees, the situation is more complex. Because adjustees arrive in the United States prior to being granted legal permanent residence, their date of admission does not define when they came to live in the United States. For some classes (refugees and some asylees), the time series of actual arrivals can be determined more effectively from non-INS data sources (see the Migration of refugees section). The methodology for the inclusion of adjustees, both with respect to the timing of their arrival and assignment of characteristics, is discussed below. International migration of legal immigrants in a given time period consists of the following:

    1) "New arrival" immigrants with date of admission in the given time period.

2) An estimate of nonimmigrant entries, derived from the number of adjustees and adjustee applicants in the given time period, but *excluding* the following:
   a) Refugees and some Cuban and Haitian asylees, whose records must be excluded from the INS data. These are included as a separate sub-component (see the Migration of refugees section).
   b) Legal temporary residents who will not become legal permanent residents. These are included as a separate sub-component (see the Net temporary migration section).
   c) Unauthorized migrants who will not become legal permanent residents. These are included as a separate sub-component (see the Net unauthorized migration to the United States section).
   d) A small number of people admitted under special, "one-time" laws who also have a nonimmigrant arrival date before the 1990 census. These people should neither be included for themselves (given that they could be included in the base population) nor serve as proxies for other groups (because of the circumstances of their admission).

Legal immigration accounts for the largest contribution to the annual addition of net international migrants. As shown in Table 4, throughout the decade, legal immigration comprised more than 80 percent of the net international migration component each year, adding more than 7 million legal residents. The number of legal immigrants can fluctuate from year to year, irrespective of the numeric limits determined by government policy. The number of legal immigrants granted permanent status increased early in the decade with the exception of a decline in 1993-1994. Following 1995, the number and growth rate for legal immigrants declined. As displayed by the numeric and percent change for the decade, the number of legal immigrants admitted by the INS and the Department of State combined has declined consistently since 1996-1997.

A likely factor in both the increase and decline of legal immigration during the 1990-2000 decade has been the secondary effect of the Immigration Reform and Control Act (IRCA) of 1986. This law granted amnesty to a large class of unauthorized residents in 1987 and 1988, allowing them to remain in the country, later seek legal permanent residence, and ultimately obtain U.S. citizenship. IRCA beneficiaries, in turn, could sponsor immediate relatives who were then granted legal permanent residence. For sponsors who were legally resident non-citizens, the number of secondary immigrants was numerically limited; however, for U.S. citizen sponsors, the number of immediate relatives was unlimited. This may have partly explained the increase in legal immigration during the early 1990s. In the later years of the decade, a slow-down in the processing of adjustee applications meant that many immigrants who applied under these provisions had their processing delayed. In addition, the supply of potential immigrants may have been partially absorbed, given the limitation in the number of potential sponsors. This could provide an explanation for some of the decline in legal immigration that occurred.

Data sources

Legal immigrants are estimated annually by single year of age, sex, race, Hispanic origin, and county of intended residence in the United States. County of intended residence is estimated from the zip code of intended residence to a respective county. The county level data are then aggregated to estimate the total number of legal immigrants at the state and national level. The

numbers of legal immigrants are estimated by *month of admission* and are projected beyond the last available fiscal year of INS data, generally ending in September prior to the year the estimates are produced.

Estimation of legal immigration is dependent on microdata on legal immigrants supplied by the INS. The INS provides the Census Bureau annually with a file containing non-identifiable individual records of legal immigrants admitted during the federal fiscal year of October 1 to September 30. Variables included in the data set pertain to time of admission, class of admission (identifying the law under which the immigrant was admitted and whether the immigrant is a new arrival or adjustee), demographic characteristics, and intended residence. The following are the primary variables available on the INS microdata file that are used to produce the estimated legal immigrant detail:

      a. month of admission
      b. year of admission
      c. class of admission[7]
      d. country of birth
      e. sex
      f. age
      g. zip code of intended residence
      h. nonimmigrant year of arrival (adjustees only)

The data set does not include information on any personal identifiers including race and Hispanic origin.

To supplement the microdata file, the INS also provides provisional data on the number of adjustee applicants by fiscal year. In addition to INS data, the Census Bureau utilizes an internal data set providing information on geographic identification of zip codes and decennial census data on race and Hispanic origin of the foreign-born population by country of birth.

Methodology

There are a number of steps involved in converting the INS immigrant microdata file to the estimates of legal immigration used for the population estimates program, including geographic and demographic detail. The steps are summarized below:

1) <u>Distinguishing arrivals from adjustees:</u> Class of admission is a coding of the legal provision under which an immigrant is admitted, and is used to identify how each case is to be included in the accounting of population change. Most importantly, this variable distinguishes new arrivals from "adjustees" who previously resided in the United States in a nonimmigrant legal status. Within the category of adjustees, class of admission indicates which immigrants previously entered as refugees, to be included from another data source (hence discounted at this point), and which ones must be used as "proxies" for nonimmigrants not counted elsewhere who

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[7] Microdata files provided by the INS did not include immigrants granted legal permanent residence from 1990-2000 under the Immigration Reform and Control Act (IRCA) of 1986. Eligibility for legal permanent residence under IRCA pertained to those illegally present or working in the United States between 1982 and 1986. Therefore, in theory these immigrants were enumerated in the 1990 census as criteria

will become immigrants at a later time. Because immigration law changes from year to year and class-of-admission coding changes, its interpretation is updated accordingly.

2)   Estimating county of intended residence: Zip code of intended residence (a postal designation) is used to impute political geography, including state and county of residence. This is somewhat problematic, because zip codes are defined to further the delivery of mail, and tend to relate more to the location of branch post offices and mail processing centers, and bear no necessary relationship to local political boundaries. Developed by the Census Bureau in cooperation with the U.S. Postal Service, the tool used to complete this task is an electronic catalog that identifies a "dominant" county for each zip code (Sater 1994). For the small number of cases where the zip code is either not provided or is not valid, we impute the state and county from known cases with known geography with the same country of birth.

3)   Estimating the age and sex composition: Age and sex are included on the INS microdata file. For small numbers of cases, sex is imputed because it is missing on the file. Imputation is done using cases where sex is known for the same country of birth. Similarly, age at time of admission to immigrant status is imputed for a small number of cases for whom it is not coded in the file, using the age composition of known-age cases of the same sex and country of birth. For adjustees (even those not included in the accounting at this stage), we must estimate the age at entry into the United States. This is done using age at adjustment to immigrant status and year of nonimmigrant arrival. This procedure is complicated somewhat because nonimmigrant year of arrival is stated in calendar year, with no information on month. Year of nonimmigrant arrival must be allocated for some cases where it is not coded.

4)   Estimating race and Hispanic origin: Race and Hispanic origin of immigrants are imputed from country of birth. This is done by proration, based on a cross-classification of country of birth by sex by race by Hispanic origin from 1990 census data. Immigrants of a given country of birth and sex are assumed to have the same composition by race and Hispanic origin as the foreign-born population of the same country of birth and sex enumerated in the 1990 census, and who arrived during the 1985 to 1990 period. This assumption is strong for the vast majority of countries of birth where the race and Hispanic origin composition is homogeneous; so large proportions of the population are of a single group (e.g., Hispanic for Latin American countries and Spain, non-Hispanic Asian and Pacific Islander for East- and South-Asian countries, non-Hispanic Black for some Caribbean countries, non-Hispanic white for Europe). A notable exception is Canada, which supplies a substantial number of immigrants who are racially diverse. For each country of birth, the distribution by race is assumed to remain constant over time.

5)   Accounting for adjustee "backlog": For some years, delays in INS processing of adjustee applications resulted in a large number of accepted adjustee applicants that had not become legal permanent residents. Under these circumstances, it is more logical to base the series of entries on the number of applications, rather than the number of those granted legal permanent residence. For fiscal years 1995 and later, an adjustment must be made for the effects of the application backlog at INS. This problem affects only the class of migrants estimated to be arriving based on the number of current adjustees from nonimmigrant to legal immigrant status. This group, however, may comprise a quarter to a third of the immigrants included in the

population accounting. We assume that the time series of adjustees (other than refugees) serves as a proxy for the time series of arriving legal nonimmigrants who will later become legal immigrants. We base this series on the number submitting applications to the INS as opposed to the number of applications that INS successfully processes. Until fiscal 1994, there was little distinction between the two. Beginning in fiscal 1995, a change in immigration law greatly increased the number of immigration applications that had to be processed by INS (as opposed to the Department of State), rendering the INS unable to keep up with the number of adjustee applications. To make allowance for this, adjustee cases from later years were "moved" backward in time, so that the number of adjustees included from a given year matched the number of applications–making allowance for applications denied, or cases where successful applicants decided not to adjust status. We used the class of admission variable to ensure that no such "moves" would result in exceeding a numerical limit for any admission category. When the supply of adjustees from later years' data was exhausted, we replicated cases from existing data files, reasoning that current successful applicants who would be adjusted in a later year had characteristics similar to those who had been adjusted already. This process had the effect of substantially increasing immigration for years where there was an excess of applications over adjustments, and reducing it somewhat for one–FY 1996–where the backlog from the previous year was partially absorbed by an excess of adjustments over applications.

6)   Identifying year of arrival for "one-time" admission laws: A small number of immigrant adjustees in the file were admitted under special legal provisions, and would therefore not represent valid proxies for currently entering nonimmigrants who will adjust status later. These immigrants are included in principle, but as of their date of arrival, rather than their date of immigration provided that the latter falls after the 1990 census. An example of this situation is an employment immigration provision known as the Chinese Students' Protection Act, which allowed people born in China to adjust to legal immigrant status as a result of the Tiananmen Square incident in Beijing.

7)   Projecting immigration to last estimate date: In view of the fact that the last available fiscal year of immigrant data ends with September 30 of the year prior to the July 1 population estimates date, a short-term projection is necessary to extend the immigration series to the terminal date of the estimates series. Generally, this projection covers a minimum of nine months. The projection was confined to immigrants actually included in the population accounting (e.g., refugees were excluded). During the late 1990s, we simply assume the number of immigrants in each month matches the number of immigrants 12 months earlier. The distribution by country of birth is assumed to match that of the last year for which data are available. Once having established country of birth, the imputation of the other demographic characteristics and geography as of time of arrival follows the logic used to impute missing values of characteristics within the data series.

8)   Preparing tabular inputs to population estimates: As a final step in the process, the modified microdata are tabulated to yield the annual number of legal immigrants. Microdata are converted to tabular files for use in population estimates at the national and sub-national level. Hence, refugees and other immigrants not included in this step are excluded from the tables and are retained in a separate file. This file is used to impute characteristics to population totals derived from other sources, to be described in the sections that follow.

Strengths and limitations

As is the case with most administrative data, immigration data are collected and maintained to account for a legal process, rather than to measure population change. We assume the linkage between future immigrants entering the country as nonimmigrants, and current immigrants who entered in the past as nonimmigrants is extremely tenuous. While our methodology of adjusting the immigrant series to account for a backlog in the processing of adjustee applications may address the issue, it can only address one part of it. We must assume adjustee applications themselves follow the trend in the nonimmigrant entry of future immigrants.

A high priority for continuing research in the area of legal immigration is to reevaluate the measurement of nonimmigrants that eventually become legal immigrants. One alternative method would be to tag all such entries into the country by their nonimmigrant year of arrival (with possible allowance for multiple arrivals), and then create a projection for those who have not yet arrived–rather than relying on the "proxy rule" that is currently used. This would have the advantage of being more accurate on an immigrant-by-immigrant basis. The difficulty would arise in the determination of a projection for those not yet arrived. Unfortunately, the existing procedure has been developed incrementally. It might indeed have been optimal before the adjustee application backlog occurred. When the backlog emerged as an issue, the solution at hand was to address that issue directly rather than to rethink the entire method by which this group is estimated. After several years of persistent backlog, the inadequacies of the incremental solution are becoming apparent.

A second assumption that is highly problematic relates to geographic distribution of legal immigrants. Although we can impute political geography from postal zip codes, we are less certain that "intended residence" effectively measures actual residence. Moreover, subsequent internal migration is currently estimated from data on matched tax returns. This means we tacitly assume that the locality in which an immigrant intends to reside matches the locality where he or she will first appear as the filer or as an exemption on a tax return.[8] This assumption is good if the immigration is employment-based, or if the immigrant is an immediate relative of an employed person. If, on the other hand, the immigration event is associated with a temporary sojourn in one locality during which a search for employment ensues that will ultimately result in a move, the assumption fails. Moreover, one is inclined to suspect that the failure would spuriously favor immigrant enclaves over areas that may feature greater job opportunities but fewer immigrants. This represents a second useful area for research through alternative data sources.

Migration of refugees

Refugees (RE) consist of people outside their country of nationality who are unable or unwilling to return to that country because of persecution or a well-founded fear of persecution. After residing in the United States for a minimum of one year (depending on the provisions of their admission as refugees), they are allowed to adjust to legal immigrant status. Other classes of

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[8] To estimate internal migration, IRS tax returns are collected and linked across years by the filer's social security number. Estimates in a specific geographic unit are created using data on each filer and the number of dependents claimed.

adjustees in the INS file are included via a "proxy rule" whereby we assume them equal in number to people currently entering who will adjust in the future. There are two reasons that refugees are treated differently. First, refugee movements are prompted by international humanitarian crises and political upheavals, so refugee entries often occur in "waves" of arrivals. A historical example of this was the Mariel boatlift, which brought 120,000 people into the United States from Cuba over a matter of days in early 1980. Furthermore, because refugees arrive through administrative decisions and receive financial aid from the government, there is a viable administrative data source that provides numbers of refugees at time of arrival, rather than at time of adjustment to immigrant status.

The number of refugees allowed to resettle in the United States each fiscal year is determined by the President after consultation with Congress in relation to existing international humanitarian developments. The President can also lift this ceiling throughout the year. Therefore, the estimated number of refugees from 1990 to 2000, presented in Table 2, fluctuated annually between a low of 78,000 in 1997-98 and a high of 128,000 in 1994-95. This sub-component represents the third largest contributor to net international migration to the United States behind legal immigration and unauthorized immigration.

Data sources

Estimates of the refugee population are based primarily on data provided by the Office of Refugee Resettlement (ORR) of the Department of Health and Human Services (DHHS). This data set reports the number of refugees by month of entry and the country of citizenship who are eligible to receive benefits from DHHS. Although data are supplied on a monthly basis and tend to be current, it is necessary to project a few additional months in a given cycle of population estimation. Data sets used to impute characteristics for this population include the INS microdata file and the 1990 decennial census.

Methodology

Although ORR tabulates the necessary data monthly, we must define them in such a way as to facilitate a parallel exclusion of its members from the INS immigrant data for the fiscal year in which they adjust status. Fortunately, refugee status is clearly identified in the laws governing adjustment to immigrant status, and is therefore identifiable in the INS immigrant microdata via class of admission. For example, migrants from the Mariel boatlift of 1980 were non-refugee "parolees" who arrived in the United States and sought asylum. While asylees could be identified as such in the INS data, it is not easy to identify the subset of these asylees for whom separate administrative sources provide the number of total arrivals. Consequently, the treatment of such situations in population accounting must be determined individually from their historical context. In the case of Cubans, there was a blanket provision (until the late 1990s) allowing virtually any Cuban arriving in the United States to adjust to immigrant status, usually after a very brief interval of time. Fortunately, data on Cuban parolees have been available to the ORR, so they could be included upon arrival and excluded from INS data for adjustments. A similar but more limited provision existed for Haitians in the early 1980s. A small flow of Haitians continued to arrive sporadically during the 1990s, and we received data on this group from ORR as well. In the INS data, our strategy was to assume that this group was congruent with Haitian-

born people adjusting to permanent resident status as asylees, so we excluded the latter group from the immigrant data accordingly.

There remains the task of assigning demographic and geographic detail to the series. Three fundamental assumptions are made in order to do this. The first is that the age and sex composition of a given country of origin can be measured from INS data on refugees adjusting to immigrant status, after adjusting age to account for the time elapsed from nonimmigrant arrival to adjustment to legal permanent resident status. The second is that geography of intended residence for refugees of a given country of origin at time of adjustment to immigrant status is indicative of their geography of residence when they first appear on a tax return. The reason for the emphasis on first tax return is that subsequent internal migration depends on an initial location of tax filing. While this assumption is vulnerable to error, we deem it more robust than an assumption that first appearance on a tax return would match the actual first residence of a refugee on arrival in the country. The third assumption–familiar from our treatment of legal immigrants–is that race and Hispanic origin composition can be deduced from the race and Hispanic origin composition of recent foreign-born migrants to the United States of the same country of birth in the 1990 census. All of these assumptions are made within country groups, and for this purpose we assume that country of citizenship in the refugee data matches country of birth in the INS immigrant data and 1990 census data on foreign-born migrants.

Having made these three assumptions, the assignment of characteristics is carried out by simulating a microdata file, and using the assumptions to impose characteristics on simulated records. Records are simulated to replicate the precise number of refugees and entrants from the ORR series by month and country of citizenship. For each country group, the distribution by state and county observed in the INS immigrant file for refugee adjustees is pro-rated to sum to the refugee total for each fiscal year, and the resulting distribution is randomized ("without replacement," to yield a perfect match of the aggregate distribution) on the simulated refugee microdata. A similar procedure is carried out for age and sex, using the refugee adjustees in the INS file as a data base once again, and for race and Hispanic origin, but using the 1990 census data on foreign-born migrants from 1985 to 1990 as a data base.

Strengths and limitations

Data for refugees are of high quality, because they rely directly on administrative sources. A possible limitation, albeit small, to the quality of our estimates of total refugees at the national level arises from assuming that people adjusting to immigrant status under a refugee provision, or as asylees for the limited number we have assumed, are in fact the same people as those who arrived and were included in the ORR data.

More problematic is the assignment of geographic detail based on the geographic patterns of refugees adjusting to legal permanent resident status, and the assumed relationship of the latter to location at time of first tax filing. Because the number of countries that are major suppliers of refugees is rather small, understanding refugee groups through ethnographic case studies is relatively promising.

Net unauthorized migration to the United States

Often referred to as the "illegal" or "undocumented" population, the unauthorized migrant population consists primarily of two groups: those entering the United States (primarily across land borders) without inspection, and those entering the United States with legal temporary visas who violate the terms or stay beyond the specified time allotment of their visa. This population, by definition, is elusive and administrative data are impossible to collect. Therefore, indirect estimation methods must be used to measure unauthorized migration patterns. Because it represents a major contribution to net international migration, after legal migration, unauthorized migration estimates may be the largest source of bias in the estimates of international migration.

Similar to other sub-components of net international migration, demographic changes in the unauthorized population are influenced by changes in immigration law. A change in immigration law that produced a substantial effect on the unauthorized population was the Immigration Reform and Control Act (IRCA) of 1986. As noted in the legal immigration section, this law granted legal status to a sizeable group of unauthorized residents in 1987 and 1988. More specifically, IRCA enabled about 1.6 million illegal immigrants to obtain legal permanent residence in the United States by demonstrating that they had been continuously resident in the United States since before January 1, 1982. A separate set of provisions also extended legal permanent residence to about 1.1 million Special Agricultural Workers (SAWs) who worked in perishable agricultural commodities at least 90 days in the United States in each of three years before May 1, 1986, or for at least 90 days during the year ending May 1, 1986 (Smith et. al. 1996, INS 2000).

Beginning in 1985, the Census Bureau incorporated estimates of net unauthorized migration in the national population estimates. Using a residual technique that examines the total foreign-born and the legal foreign-born population, Warren and Passel (1987) estimated that approximately 2.1 million undocumented migrants were enumerated in the 1980 census. These estimates combined with additional research using the Current Population Survey (CPS) from 1980 to 1983 provided the foundation to establish an estimate of a net annual increase of 200,000 unauthorized migrants for each year from 1980 to 1990 (U.S. Census Bureau 1986).

During the 1990s, the Census Bureau revised its estimates for unauthorized migration. Prior to the release of 1990 census data, the results of two studies were combined to provide a preliminary "point estimate" of 3.3 million unauthorized migrants living in the United States as of April 1, 1990 (Woodrow 1991).[9] Using several alternative estimates produced in the early 1990s, researchers reached a consensus estimate of 225,000 net annual additions to the unauthorized population resulting from net migration for the 1990 decade (Robinson 1994). From 1994 to the present, the constant assumption of 225,000 net unauthorized migrants was applied to the national estimate for years ending June 30.

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[9] For a detailed discussion of the preliminary April 1, 1990, stock estimate, refer to Woodrow, K.A. 1991. "Demographic Analysis Evaluation Project D2: Preliminary Estimates of Undocumented Residents in 1990." 1990 Decennial Census, Preliminary Research & Evaluation Memorandum no. 75.

Data sources

In order to estimate net unauthorized migration for the 1990-2000 decade, multiple studies using several data sets contribute to the final point or consensus estimates. Data sets used include: 1) INS estimates of the unauthorized population; 2) the legal immigration file applied to the national estimates described in the respective section; 3) 1990 decennial census data; 4) the Current Population Survey (CPS); and 5) data collected for those granted legal status under IRCA.

Methodology

In the early 1990s, several sets of independent estimates of the unauthorized population were produced. Ranges of these alternative estimates were averaged to create the assumed number of unauthorized foreign-born residents for inclusion in the production of national estimates. The Urban Institute (Clark et. al. 1994) and the Census Bureau (Robinson 1994) produced these independent estimates of the unauthorized population for 1990. The Census Bureau created two separate sets of estimates, one adjusting for the undercount of the foreign-born population in the 1990 census, and the other not adjusting for undercount. Each set of estimates was measured by using a residual technique that subtracts the *legal resident foreign-born (LFB)* population from *the total foreign-born (FB)* population for each annual entry cohort of immigrants by country of birth, who entered the United States between 1985 and 1990. Equation 3 presents the residual equation used. To measure the number of legal permanent residents, the Census Bureau used the legal immigration file (described in the Legal immigration section) combined with refugee estimates (described in the Migration of refugees section). Similarly, the Urban Institute tabulated the number of legal permanent residents by processing the INS microdata file internally.

Equation 3. $NU_{t-1, t} = FB_{t-1, t} - LFB_{t-1, t}$ (3)
where

$NU_{t-1, t} =$ unauthorized immigrant population, arrived in the interval from time t-1 to time t;
$FB_{t-1, t} =$ foreign-born population arrived from time t-1 to time t; and
$LFB_{t-1, t} =$ legal resident foreign-born population arrived from time t-1 to time t.

Two estimates of net annual unauthorized migration were produced for each study. One estimate measured the net annual migration based on those entering between 1985 and 1990; the second estimate accounted for entrants from 1987 to 1990. Table 6 presents the range of net unauthorized estimates produced. Averages of the preliminary estimates were created using potential scenarios. The resulting averages range between a low of 211,000 net annual entrants and a high of 245,000 net annual entrants (data not displayed). After averaging the resulting averages, we selected 225,000 as an appropriate number to represent the net annual addition of unauthorized migrants for the 1990-2000 decade. The estimate of 225,000 represents net annual additions to the unauthorized population caused by migration only.

An independent estimate, produced by the INS (Warren 1992), further supported the final assumption of an annual addition of 225,000 net unauthorized migrants. Using internal INS data, the Current Population Survey, and the 1980 census, the INS estimate identified those who overstay or violate their visa terms, those who enter without inspection, and those legalized under IRCA. In addition, the estimate theoretically captures those potentially undercounted in

the decennial census. The INS estimated that from 1988 to 1992, the United States experienced a net annual increase of approximately 299,000 unauthorized migrants. Based on research by Woodrow (1991) of the Census Bureau, the estimates of undercount of the total unauthorized population in the 1990 census is assumed to range from 20 to 30 percent. If an assumption of a 25 percent undercount for the unauthorized population were applied to the INS net estimate, the INS net estimate is reduced to approximately 224,000, an estimate near the final Census Bureau assumption of 225,000.

After estimating net annual unauthorized migration, demographic characteristics were imputed. For purposes of the vintage 2000 national estimates, the race and Hispanic origin distributions for unauthorized net migration were derived from INS estimates of the unauthorized population by country of birth for 1996 (Warren 1997). These estimates encompass both those entering without inspection and nonimmigrants that overstay or violate the terms of their visa. After categorizing the country of birth as mentioned in the Legal immigration section, these estimates indicate that approximately 53 percent were born in Mexico, 26 percent were born in Other North, Central, and South America (excluding Mexico, Cuba, and Canada), and 21 percent were born in the remaining countries of the world. The age and sex distributions were imputed from the data of unauthorized immigrants legalized in 1987 and 1988 under the IRCA law. The age distribution was backdated from the year of legalization to the year of arrival.

Strengths and limitations

The strength of the Census Bureau's methodology is in its partial use of decennial census data. These data are more reliable than CPS data as the census data are collected from approximately one in every six U.S. households, in comparison to the monthly sample of approximately 50,000 households participating in the national survey. Another important attribute of census data is that it lends itself to *census-level* estimates of unauthorized migration because it excludes people that would not be enumerated by a census, hence out of the population estimates universe. Its limitations are primarily in its inability to track fluctuations in annual migration. Addressing this weakness might entail examining alternative data sources and alternative methods for the estimation of this hard-to-count population.

Currently, the estimates of the unauthorized population produced by the INS (Warren 1999) are the most comprehensive and up to date. In comparison to the INS estimates published in 1996, new estimates are created using a revised methodology based primarily on detailed demographic analysis of annual INS administrative data and monthly CPS-based estimates of the foreign born published by the Census Bureau. The INS has applied this methodology to create annual estimates of the unauthorized population for the 1987 to 1997 period. In summary, the resulting product provides estimates of the annual unauthorized population by sex and region of birth. The main advantage to applying the current INS estimating technique is the availability of information for annual trends, in contrast with the Census Bureau assumption of constant trends throughout the 1980s and 1990s. Unfortunately, the estimates of country of birth do not provide adequate detail for Census Bureau international migration estimates purposes because they are aggregated for the following regions: Mexico, the rest of the Western Hemisphere, and the Eastern Hemisphere.

Emigration

Emigration (E) refers to the permanent departure from a country of residence. As a sub-component of net international migration, emigration is defined as the number of U.S. permanent residents departing from the United States to reside abroad. This population accounts for the departure of both native and foreign-born legal residents. The departure of unauthorized migrants, migrants from Puerto Rico, and temporary migrants, are excluded from this sub-component in view of the fact that their respective components are already estimated net of emigration.

Prior to 1957, the INS collected data on the annual number of emigrants leaving the U.S allowing the Census Bureau to use this data for the national estimates. After 1957, the INS discontinued collecting emigration data and the Census Bureau began using indirect methods to measure this sub-component. Currently, estimates of the number of emigrants are produced using two indirect techniques, differentiated by nativity status. Because neither method yields current data, we projected constant trends for the decade.

According to estimates produced for the 2000 vintage, the number of emigrants increased each year from 252,000 in 1990-91 to 279,000 in 1998-99. Throughout the decade (April 1, 1990 to March 31, 2000), the total number of emigrants accumulated throughout the decade nearly 2.7 million.

Data sources

The sources of information used to estimate native and foreign-born emigration are entirely different. The estimates of native emigration used foreign censuses and U.S. Department of State data collected on citizens living abroad. Methodology used to estimate foreign-born emigration is based on a residual technique comparing the foreign-born population in two censuses.

Methodology: emigration of U.S. natives

Estimates of emigration for the native population are derived from research conducted by Fernandez (1995). Data were collected from two separate types of sources, depending on the availability for each country. The first of the sources, a pair of consecutive foreign censuses for countries that enumerate their U.S.-born residents, was applicable for 11 countries (Australia, Brazil, Canada, France, Great Britain, Ireland, Mexico, New Zealand, Sweden, Switzerland, and Venezuela). Most of these sources provided age and sex of U.S. emigrants. The censuses yielded an estimate of 20,977 emigrants for 1980.

The number of native U.S. emigrants estimated for the remaining countries without adequate census data were derived using U.S. Department of State data. The Department of State collects data on the number of U.S. residents that register at a U.S. post. Data for the total number of residents were collected for 1970 and 1980. The age and sex distributions for each country were imputed from the results of the foreign censuses reporting U.S. born people with a "similar cultural background," and are reported to "center" around 1980 (Fernandez 1995). The emigrant

population was survived forward using the cohort survival method, resulting in an annual average estimate of 27,204 U.S. emigrants for 1980.

The summation of the estimates from both sources resulted in an annual estimate of 48,000 native emigrants for 1980. For a detailed discussion of the methodology, consult the Population Estimates and Projections Technical Working Paper No. 10. Again, this estimate is assumed to remain constant each year.

Methodology: emigration of foreign-born legal residents

Estimates of foreign-born emigration are based on rates rather than the number of emigrants, as is used for the native population. The annual rates are currently defined as the number of foreign-born emigrants exiting the United States per year divided by the total number of legally resident foreign born in the United States by age, sex, and country of birth (14 country groupings). In 1994, Ahmed and Robinson published estimates of the number of foreign-born emigrants who left between 1980 and 1990 in Population Estimates and Projections Technical Working Paper No. 9.

Ahmed and Robinson used a residual technique pioneered by Warren and Peck (1975) that involved comparing the foreign-born population in the 1990 census with the foreign-born population enumerated in the 1980 census. In summary the *expected* foreign-born population is calculated and compared to the foreign-born population enumerated in the 1990 census for two different periods of entry, the foreign born that entered before 1980 and those entering between 1980 and 1990. Theoretically, the only events that should distinguish the two populations (the expected vs. the enumerated) are mortality and emigration during the two periods. Mortality is estimated by the application of life table survival rates to the foreign-born population by age and sex to determine the size and characteristics of the population that would survive to a designated period in the absence of emigration. Subtraction of the expected population from the foreign-born population self-identified as arriving before 1980 yields an estimate of emigration during the decade.

Unfortunately, the coverage of the foreign-born population by the two censuses was inconsistent, which produced bias in the results of any residual method that relied on intercensal comparisons. Ahmed and Robinson addressed this issue by comparing about 40 country-of-birth categories, and different decades of arrival, which allowed the identification of cross-categories of country and period of arrival for which results were implausible. The most implausible results were observed for countries that had a substantial component of unauthorized residents, whose undercounts in the two censuses were large and inconsistent. Allowances were made for these inconsistencies by imputing rates of emigration for countries with implausible results from countries with similar but more plausible results. Ultimately, a schedule of rates of emigration for four large country groups, age, and sex were determined that could be applied to the groups during the intercensal decade, to produce an estimate of roughly 1.95 million emigrants from 1980 to 1990.

The estimate of emigration changed in the course of the 1990-2000 decade. Prior to 1994, we assumed that there were 133,000 foreign-born emigrants per year (Ahmed and Robinson 1994).

Beginning in 1994 and extending through 1996, we used an estimate of 195,000 per year, which was adopted from research by Ahmed and Robinson. Although not explicit, the research by Warren and Peck and Ahmed and Robinson suggest that the amount of emigration is related to the previous flow of immigrants. To accommodate this finding, in 1997 we adopted a technique whereby we estimate foreign-born emigration by crude rates applied to provisional legal foreign-born population totals for 40 countries. In 1998, we used some of the intermediate results of the analysis by Ahmed and Robinson to generate annual age-specific rates of emigration–applicable to the 1980s decade–for 14 country-of-birth groups (Oosse 1998). Because these rates were generated from rate schedules for four groupings of countries, any inter-country variation among the 14 was understated to non-existent. Nonetheless, these rates had the advantage of allowing for a differentiation in the propensity to emigrate by age.

The resulting rates were assumed constant through the following decade of the 1990s, and when applied to estimates of the legal foreign-born population as they were produced, by calendar quarter, yielded current estimates of foreign-born emigrants. Age, sex, race, Hispanic origin, and county of pre-emigration residence were imputed as a pro-rata of the foreign-born population enumerated in the 1990 census.

Strengths and limitations

Emigration, similar to unauthorized migration, is a sub-component of net international migration that is fraught with uncertainty. The estimates do not include current information, relying instead on a constant projection (whether of numbers or rates) from a prior decade. The lag in the availability of census data renders it impossible to update research on emigration of the sort carried out by Ahmed and Robinson until about three years into the following decade.

In addition, the population universe enumerated in each census includes unauthorized immigrants. Therefore, in order to estimate the emigration of the legal foreign-born population, Ahmed and Robinson made assumptions about emigration trends from particular countries of birth that are traditional sources of unauthorized migration to the United States. These assumptions however may not have adequately accounted for the emigration of the unauthorized population. Consequently, the estimates of annual emigration of the legal foreign-born population may be overstated.

Net migration from Puerto Rico

Estimating migration flows between the United States and outlying areas under U.S. jurisdiction presents a special problem because these flows represent migration of U.S. citizens. These outlying areas principally include Puerto Rico, American Samoa, Guam, U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands. While we assume population movement to and from most of these areas to net to zero, the estimated size of migration between Puerto Rico and the United States is large enough to justify its incorporation as a sub-component of net international migration. Little information is available about the current migration patterns from Puerto Rico. Because Puerto Rico is an U.S. territory and most residents are citizens of the United States, movement between the two places is not restricted; more importantly, it is not a registered event. Therefore, we cannot rely on administrative data to estimate this migration

pattern. We estimated a net annual addition of 12,646 migrants from Puerto Rico to the United States each year, and assumed this was constant throughout the decade. The demographic characteristics were also held constant throughout the decade.

Data and methodology

While a number of different approaches have been considered or attempted for estimating migration to the United States from Puerto Rico, our current method depends on a projection of constant net migration, based on a previous decade. The use of this projection entails three distinct assumptions. First, we compute migration using the residual technique for the intercensal period between the 1980 and 1990 censuses of Puerto Rico. Estimates of the net migration from Puerto Rico by age and sex during the 1980s were derived by the International Programs Center (IPC) of the U.S. Census Bureau. A 1980-based zero-migration estimate of the population of Puerto Rico by age and sex for April 1, 1990, was created using the cohort component method with vital registration data for births by sex and deaths by age and sex to estimate a decade of population change, assuming the absence of migration to or from the island. Subtracting this population (by age and sex) from the population enumerated in the 1990 census yielded an estimate of the net effect of migration during the decade. This estimate excludes deaths and includes births occurring to migrants after their arrival in Puerto Rico. Projecting the surviving net migrants back to an estimated year of arrival using the cohort component method and fertility and mortality rates by age and sex yielded an estimate of net migration excluding births and including those who died. The resulting number is divided by 10 to produce an annual estimate of net migration to Puerto Rico from the rest of the world during the decade. Potential constraints for this estimate include differential underenumeration between the two Puerto Rican censuses, as well as problems in the registration of births and deaths, including errors in the identification of the place of residence between Puerto Rico and elsewhere.

This estimate of intercensal net migration to Puerto Rico includes not only the exchange of migrants between the island and the 50 states and the District of Columbia, but also the exchange between the island and the rest of the world. This leads to our second major assumption, which is that the net of unauthorized migration to the island, net migration from other outlying areas to the island, net movement of civilian and military personnel between the island and the rest of the world (outside the United States) and all emigration (including legal residents) from the island to the rest of the world is zero. While this assumption is plausible in an approximate sense, we have no estimate for these components that would allow us to test the assumption. This leaves one measurable component, namely legal migration from the rest of the world to Puerto Rico. We assume that this is measured by the number of legal immigrants during the 1980s, as recorded in INS public-use immigrant data files, that gave a Puerto Rican zip code for their intended residence. As expected, the numerically dominant country of birth was the Dominican Republic. Given all these assumptions, we were able to subtract this migration from the net migration to the island for the decade, to yield an estimate of net migration from the United States to the island, which we annualized by dividing by 10.

The final assumption, and probably the most vulnerable one, is that the net balance of migration between Puerto Rico and the United States during the 1980s also applied to the 1990s.

Having determined net migration by age and sex, we imputed a distribution by race and Hispanic origin. The Puerto Rican censuses of 1980 and 1990 did not include questions on race or Hispanic origin, so we relied on a tabulation of people enumerated in the U.S. census of 1990 who had resided in Puerto Rico in 1985 to establish the distribution by race and Hispanic origin.

Strengths and limitations

Although net migration from Puerto Rico ranks with the sub-components of emigration of legal residents and net unauthorized migration as being difficult to estimate, the potential for numerical error is smaller with this sub-component than with the other two.

While there are no administrative data that provide direct estimates of migration from Puerto Rico, there are alternative approaches available that involves the use of current data. Unfortunately, past results using these methods have rendered them either impractical or incapable of producing plausible results.

One alternative method tried in the past relies on passenger traffic data in and out of the San Juan airport. The registration of arrivals and departures is required of the various airlines that serve this airport, and records are tabulated by the Puerto Rico Planning Board. When implemented in the past, it produced results that were deemed implausible in the early 1990s because of two significant problems with this data series. The first is that most passenger traffic represents business travel and tourism, rather than actual changes in residence. Nevertheless, if registration were complete and unbiased, it is assumed that any resulting balance in passenger traffic should measure permanent moves in and out of Puerto Rico. On the other hand, even a relatively small bias in the registration of arrivals with respect to that of departures could have a major effect on the estimation of net migration, given that migration is such a small portion of overall passenger traffic. The second problem is that the registration of each arrival and departure is not implemented by all airlines. While this may not necessarily bias arrivals with respect to departures, it renders the estimation of migration incomplete.

A second approach considered previously, but not applied, involves estimation of net migration using IRS tax forms. This method is attractive because it is already the current method of estimating migration among the 50 states and District of Columbia. Unfortunately, only a small proportion of Puerto Rican residents are likely to appear on tax forms. Because average income levels in Puerto Rico are substantially lower than those in any of the 50 states and the District of Columbia, a large portion of wage earners have income levels below the threshold required to file tax forms. Therefore, it cannot be assumed that the migratory behavior of tax filers and their dependents would be representative of the migratory behavior of the population as a whole.

Net temporary migration

Recently, the sub-component of *net temporary migration (NT)* to the United States gained importance in regard to population change. Net temporary migration refers to immigrants that are issued temporary visas to stay in the United States for a predetermined amount of time. Unlike legal immigrants, these people are *not* granted permanent residence and are therefore referred to as *nonimmigrants*. Nonimmigrants consist largely of tourists and temporary business

visitors. Because our estimated population universe refers to the *resident* population, tourists and temporary business visitors are excluded from the estimate, as they are not likely to be enumerated in the decennial census. The majority of immigrants classified as nonimmigrants for the purposes of the national estimates generally fall under the following summarized categories: 1) foreign government officials, 2) students, 3) representatives to international organizations, 4) temporary workers, 5) transit immigrants, 6) exchange visitors, 7) North American Free-Trade Agreement (NAFTA) workers, 8) intra-company transferees, and 9) the spouses and children of many of the summarized categories (INS 2000).

During the 1990-2000 decade, the Census Bureau began accounting for nonimmigrants in the net international migration component for the national population estimates. Although certain nonimmigrants are considered residents and may be enumerated in the decennial census, the Census Bureau does not collect data on their legal permanent residence status at the time of enumeration. Those adjusting to legal permanent resident status are measured in the legal immigration sub-component using INS data described in the Legal immigration section. Administrative data for nonimmigrants collected by the INS are unsuitable to the estimate process until the nonimmigrant applies for legal permanent resident status. Therefore, indirect methods are used to identify and estimate this population. Throughout the majority of the decade, the Census Bureau relied on an assumption of constant net temporary migration, derived from an estimate of the nonimmigrant population counted in the 1990 census. In the end of the decade, the increasing number of specialty workers granted H-1B visas resulted in the need to incorporate this growth in the nonimmigrant estimate. The numbers of nonimmigrants with specialty workers assumed in the vintage 2000 estimates shown separately, is presented in Table 8.

Methodology: net temporary migration (*Column A, Table 8*)

In the early 1990s, the Census Bureau developed criteria to identify resident nonimmigrants enumerated in the 1990 census (Word 2000). These criteria are based on visa eligibility requirements and are defined by characteristics measured in the census that appear to match these requirements. Based on these specifications, the Census Bureau identified a stock estimate of 487,922 nonimmigrants enumerated in the 1990 census. This estimate provided the demographic characteristics of nonimmigrants by age, sex, race, Hispanic origin, country of birth, and place of residence. Appendix A contains a detailed discussion of the criteria developed to identify nonimmigrants in the 1990 census.

After measuring the nonimmigrant population stock, we must estimate the net annual addition of temporary migrants. Nonimmigrants are treated somewhat uniquely when estimating the U.S. population, given that they do not remain in the population indefinitely as nonimmigrants. During the course of a year, the nonimmigrant population loses people to emigration, death, or adjustment to legal permanent resident status. New nonimmigrants are also added to the resident population through migration, including some individuals who return to the United States more than once.

In producing the estimates of net annual additions, the 1990 population of nonimmigrants was projected one year using life tables. Under the assumption of constant net annual additions, the

population by age does not change during the year. Hence, subtracting the constant population by age from the one-year projection yielded the number of replacement nonimmigrants in each age group needed to maintain the initial population, including its age composition.

The difference between the projection and the constant population in the all-ages total equaled the number of deaths experienced in the nonimmigrant population. This was carried out for each cross-category of race and Hispanic origin. In this way, we assume that the balance of entries, departures, and adjustments to immigrant status are sufficient to ensure that each age-sex-race-Hispanic origin category remains the same, while taking into account the aging of nonimmigrants. Based on these assumptions and methodology, a net of 669 nonimmigrants was estimated to enter the population each year, equal to the number who died during the year.

Geographic details to the county level for the net estimate of 669 temporary migrants were obtained from the 1990 census.

**Methodology: net specialty workers (*Column B, Table 8)*

The changing composition of the nonimmigrant population in recent years demanded a reevaluation of the methodology used to identify nonimmigrants in the production of national estimates. A growing population of temporary skilled or *specialty* workers with H-1B visas, who are not specifically identified in the Census Bureau nonimmigrant estimates prior to the 2000 vintage, requires attention. In response to a demand for specialty workers, in the fall of 2000 Congress passed legislation that increased the cap on H-1B visas to 195,000 for each of the next three years (FY 2000 through 2002). The H-1B visa limit had already been raised in 1998 from 65,000 to 115,000 workers for fiscal years 1999 and 2000, in order to relieve the backlog of nonimmigrant applicants.

To measure the increase in the number of H-1B visas, a separate allowance was made for the vintage 2000 national estimates. Unlike the constant assumption used in estimates through 1999, the specialty worker population was allowed to change over time. This change is estimated by using the number of nonimmigrant H-1B visas issued each year (Lowell 2000), and deducting an allowance for deaths, emigration, and adjustment to immigrant status. Because of an increase in the number of H-1B admissions beginning in the late 1980s, the net H-1B population increased throughout the early 1990s. In response to this growth in the specialty worker population, an annual limit of 65,000 H-1B visas was imposed by Congress beginning in 1992. Until this limit was raised in 1998, the number of special temporary workers entering the United States was assumed sufficient to make up for the loss of the pre-1992 temporary workers to death, emigration, and adjustment. The outcome was a net allowance of zero H-1B workers between 1993 and 1997. The legislation that raised the limit on H-1B visas in 1998 resulted in a further substantial increase in the specialty worker component at the end of the decade. Table 8 shows the allowance for H-1B specialty workers estimated for the vintage 2000 estimates.

After producing the estimate of the annual net flow of H-1B specialty workers for 1990-2000, demographic characteristics were imputed. Country of birth was assigned using Lowell's (2000) estimates of H-1 entries by country of birth (from Department of State visa issuance data). Age,

sex, county and state of residence were allocated using INS data on nonimmigrants that adjusted their status to legal permanent resident and identified their last nonimmigrant visa category as H-1. The age of specialty workers was backdated to the age at the year of initial arrival to the United States, as was done for other sub-components. Race and Hispanic origin were imputed using 1990 census data on the foreign-born population with years of entry 1985-1990, by country of birth.

Strengths and limitations

The Census Bureau is currently considering a separate estimate for foreign students to be incorporated in population estimates. Like H-1B workers, the number of students from abroad has increased in recent years, suggesting that the assumed increase in the nonimmigrant population stock – even after allowing for specialty workers – is too low.

The criteria used to identify potential nonimmigrants enumerated in the census also must be reevaluated for future estimates. Although the basic criteria for nonimmigrants have remained the same, the characteristics of specific classes of nonimmigrants should be re-evaluated to be certain they accurately reflect eligibility requirements. The constant assumption estimate did not include certain classes of nonimmigrants (e.g. foreign government officials and North American Free-Trade Agreement workers) that should be included in future estimates. Additionally, in order to prevent possible underestimates of the nonimmigrant population, the Census Bureau should compare its estimates against estimates produced by other researchers, such as those produced by the INS and the Urban Institute (Clark and Passel 2000).

Another limitation to the current estimates of the nonimmigrant population is that by making a separate allowance for H-1B workers from the net annual addition of nonimmigrants, the H-1B population may be overcounted. In all likelihood, the original net annual estimate included some nonimmigrants with H-1B visas; therefore, a separate estimate of the H-1B population based on administrative records may include individuals already captured in the net annual estimate. However, this potential overcount is likely offset by the fact that dependents of H-1B workers were not included in the H-1B estimate, and that not all classes of nonimmigrants were included in the 1990 constant estimate.

III. CONCLUSION

The sub-components aggregated to estimate net international migration to the United States are difficult to estimate and are not simply the compilation of both gross immigration and emigration from the United States. Some estimates rely predominately on indirect methods to measure both the stock and flow of these populations. Compared to each component of change, the sub-components of net international migration, in particular emigration, net unauthorized migration, and net temporary migration, in all likelihood present the largest sources of bias to the estimates series. As a major determinant to population change, it is necessary that the Census Bureau continuously evaluates and updates the methodologies, data sources, assumptions, and definitions used to create these estimates. This document provides an avenue for discussion and

evaluation of how well the Census Bureau estimates net international migration to the United States as an input to the national estimates series.

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Table 1. The total resident population and net international migration component for the vintage 2000 post-censal national estimates: 1990 to 2000.

[Resident population. July 1 to June 30]

Year	Initial resident population [1]	Change in population		Net international migration (NIM)	Change in NIM		Crude NIM rate (per 1,000)
		Number	Percent		Number	Percent	
1990 (4/1-6/30)	248,790,925	679,614	0.3	177,456	NA	NA	NA
1990-1991	249,470,539	2,737,998	1.1	698,732	93,603	13.4	2.8
1991-1992	252,208,537	2,895,490	1.1	792,335	34,231	4.3	3.1
1992-1993	255,104,027	2,753,595	1.1	826,566	-63,302	-7.7	3.2
1993-1994	257,857,622	2,543,469	1.0	763,264	20,620	2.7	3.0
1994-1995	260,401,091	2,475,423	1.0	783,884	78,910	10.1	3.0
1995-1996	262,876,514	2,423,821	0.9	862,794	68,027	7.9	3.3
1996-1997	265,300,335	2,546,406	1.0	930,821	-46,549	-5.0	3.5
1997-1998	267,846,741	2,487,690	0.9	884,272	-21,427	-2.4	3.3
1998-1999	270,334,431	2,453,054	0.9	862,845	(NA)	(NA)	3.2
1999-2000 (7/1-4/1)	272,787,485	1,820,861	0.7	649,032	(NA)	(NA)	(NA)
Total (as of 4/1/00)	274,608,346	25,817,421	9.4	8,232,001	(NA)	(NA)	(NA)

[1] The April 1, 1990 population is generally not adjusted for underenumeration, but includes specific modifications for certain areas from the Census Test of 1995 and the Dress Rehearsal of 1998. This number also includes census count resolution corrections. The population of 248,709,873 appearing in 1990 census publications excludes these additions.

(NA) Not available.

U.S. Census Bureau

Table 2. Net international migration and its sub-components for the vintage 2000 post-censal national estimates: 1990 to 2000.

[July 1 to June 30]

Year	Net international migration	Legal immigration	Movement of refugees	Net migration from Puerto Rico	Net unauthorized migration	Net temporary migration	Emigration
1990 (4/1-6/30)	177,456	147,404	27,362	3,153	56,096	6,323	62,882
1990-1991	698,732	576,801	85,578	12,646	225,000	50,416	251,709
1991-1992	792,335	666,123	121,772	12,646	225,000	20,592	253,798
1992-1993	826,566	725,515	118,144	12,646	225,000	2,433	257,172
1993-1994	763,264	670,067	115,233	12,646	225,000	669	260,351
1994-1995	783,884	680,300	127,670	12,646	225,000	669	262,401
1995-1996	862,794	782,132	108,642	12,646	225,000	669	266,295
1996-1997	930,821	883,471	79,568	12,646	225,000	669	270,533
1997-1998	884,272	843,674	78,331	12,646	225,000	669	276,048
1998-1999	862,845	731,170	101,170	12,646	225,000	72,063	279,204
1999-2000 (7/1-4/1)	649,032	536,329	72,238	9,502	169,057	74,110	212,204
Total (as of 4/1/00)	8,232,001	7,242,986	1,035,708	126,469	2,250,153	229,282	2,652,597

U.S. Census Bureau

Table 3. Distribution of legal immigration by major class of admission from the
Immigration and Naturalization Service: fiscal year 1998.

Class of admission	Subject to numeric limit	Percent of INS legal immigration
Immediate relatives of U.S. citizens	no	43
Other family-sponsored immigrants	yes	29
Employment immigrants	yes	12
Refugees and asylees	no [1]	8
Diversity immigrants	yes	7
Other	no [2]	1
Total	(x)	100

[1] Annual numeric limits of refugees are determined by the President after consultation
   with Congress and can be lifted by the President throughout the year.

[2] "Other" contains special categories which are generally unlimited (e.g. Cuban and Haitian entrants).

Source: Immigration and Naturalization Service. 2000. "Table A Class of Admission
of Legal Immigrants: Fiscal Years 1988-98." *Statistical Yearbook of the Immigration
and Naturalization Service, 1998.* U.S. Government Printing Office: Washington: DC.

(x) Not Applicable.

U.S. Census Bureau

Table 4. Net international migration and legal immigration numeric change, percent change, and crude net legal
immigration rate for the vintage 2000 post-censal national estimates: 1990 to 2000.

[July 1 to June 30]

Year	Net international migration (NIM)	Legal immigration	Percent of NIM	Change in legal immigration		Crude net legal immigration rate (per 1,000)
				Number	Percent	
1990 (4/1-6/30)	177,456	147,404	83.1	NA	NA	NA
1990-1991	698,732	576,801	82.5	89,322	15.5	2.3
1991-1992	792,335	666,123	84.1	59,392	8.9	2.6
1992-1993	826,566	725,515	87.8	-55,448	-7.6	2.8
1993-1994	763,264	670,067	87.8	10,233	1.5	2.6
1994-1995	783,884	680,300	86.8	101,832	15.0	2.6
1995-1996	862,794	782,132	90.7	101,339	13.0	3.0
1996-1997	930,821	883,471	94.9	-39,797	-4.5	3.3
1997-1998	884,272	843,674	95.4	-112,504	-13.3	3.1
1998-1999	862,845	731,170	84.7	(NA)	(NA)	2.7
1999-2000 (7/1-4/1)	649,032	536,329	82.6	(NA)	(NA)	(NA)
Total (as of 4/1/00)	8,232,001	7,242,986	88.0	(NA)	(NA)	(NA)

(NA) Not available.

U.S. Census Bureau

Table 5. Legal immigrants by country of birth categories for the federal fiscal year ending September 30, as applied to the vintage 2000 post-censal national estimates: 1990 to 1999.

Country of birth	Federal fiscal year ending September 30									
	1990 [1]	1991	1992	1993	1994	1995	1996	1997	1998	1999
Mexico	23,589	51,071	90,429	108,345	106,649	117,986	137,159	206,781	189,291	179,533
Cuba	1,141	2,126	1,735	1,985	2,630	5,948	3,962	3,814	2,787	6,300
Canada	6,884	12,080	14,920	16,950	15,987	17,985	17,903	19,338	16,780	11,942
Latin North & Central America	28,344	73,796	80,447	92,211	79,414	74,715	75,574	83,836	68,463	75,067
Other North and Central America	21,362	42,374	31,464	38,945	37,996	45,187	49,032	58,004	46,760	47,276
South America	23,450	46,345	49,823	52,127	46,563	58,181	65,165	74,874	61,204	53,079
Europe	31,109	61,608	91,712	92,590	93,713	85,452	79,879	85,943	75,055	63,188
Former USSR	1,055	5,706	10,372	13,154	13,111	20,561	23,101	26,343	21,973	23,485
Middle East	16,413	33,776	37,470	37,361	29,863	34,923	35,923	37,220	31,969	27,648
China and Taiwan	25,186	50,476	60,009	57,616	43,870	48,863	59,666	59,205	53,340	45,832
India	14,533	31,126	34,560	39,993	34,876	40,176	47,615	48,131	44,358	35,821
Japan and Korea	17,384	26,003	29,662	24,427	21,873	25,644	24,588	27,043	26,101	21,181
Philippines	30,444	53,043	57,276	60,326	51,367	54,341	54,262	55,076	40,832	34,924
Other South and East Asia	35,206	70,808	81,358	63,278	43,896	53,263	54,809	64,740	58,577	56,050
Africa	9,275	19,677	21,198	22,858	21,381	45,548	49,333	54,961	46,072	40,633
Oceania	2,119	4,027	4,482	4,705	4,530	5,902	5,623	5,939	5,130	4,496
Abroad, at sea, and other	0	0	1	0	2	2	101	657	1,310	1,055
Total	287,494	584,042	696,918	726,871	647,721	734,677	783,695	911,905	790,002	727,510

[1] Data interval from April 1, 1990 to September 30, 1990.

Table 6. Alternative estimates of annual net additions of the unauthorized migrant population,
analyzed in selecting the estimate of 225,000 per year.

Type and source of estimate	Net annual estimate	Rationale for estimate
"Counted" Unauthorized		
Urban Institute (Clark et.al. 1994)	195,000 224,000	Residual estimates based on analysis of 1990 census and INS data. The first estimate (195,000) is implied from estimate of unauthorized residents who entered 1985-90, the second (224,000) is indicated by estimate of unauthorized residents who entered 1987-90.
Census Bureau (1)	226,000 244,000	Residual estimates based on analysis of 1990 census and INS data. The first estimate (226,000) is indicated by estimate of unauthorized residents who entered 1985-90, the second estimate (244,000) is implied from estimate of unauthorized residents.
Census Bureau (2)	249,000 266,000	Based on the same data as Census Bureau (1) above, but with one modification: an allowance is made for census undercount of the foreign-born population (using Post Enumeration Survey factors) in calculation of the residual estimates of the unauthorized resident population.
Total Unauthorized INS (Warren 1992)	299,000	Estimates based on detailed analysis of visa overstayers and data on persons who legalized under IRCA.

Source: Robinson, J.G. 1994. "Clarification and Documentation of Estimates of Emigration
          and Undocumented Immigration." Unpublished U.S. Census Bureau Memorandum.

U.S. Census Bureau

Table 7. Emigrants by nativity for the vintage 2000 post-censal national estimates: 1990 to 2000.

[July 1 to June 30]

Year	Emigrants	Change in Emigrants		Native emigrants		Foreign-born emigrants	
		Number	Percent	Estimate	Percent	Estimate	Percent
1990 (4/1-6/30)	62,882	NA	NA	11,967	19.0	50,915	81.0
1990-1991	251,709	2,089	0.8	48,000	19.1	203,709	80.9
1991-1992	253,798	3,374	1.3	48,000	18.9	205,798	81.1
1992-1993	257,172	3,179	1.2	48,000	18.7	209,172	81.3
1993-1994	260,351	2,050	0.8	48,000	18.4	212,351	81.6
1994-1995	262,401	3,894	1.5	48,000	18.3	214,401	81.7
1995-1996	266,295	4,238	1.6	48,000	18.0	218,295	82.0
1996-1997	270,533	5,515	2.0	48,000	17.7	222,533	82.3
1997-1998	276,048	3,156	1.1	48,000	17.4	228,048	82.6
1998-1999	279,204	(NA)	(NA)	48,000	17.2	231,204	82.8
1999-2000 (7/1/-4/1)	212,204	(NA)	(NA)	36,066	17.0	176,138	83.0
Total (as of 4/1/00)	2,652,597	(NA)	(NA)	480,033	18.1	2,172,564	81.9

(NA) Not available.

U.S. Census Bureau

Table 8. Nonimmigrants by special worker H-1B visa status for the vintage 2000 post-censal
national estimates: 1990 to 2000.

[July 1 to June 30]

Year	Net temporary migration (A)	Net specialty worker visas (H-1B) (B)	Total net temporary migration (A) + (B)
1990 (4/1-6/30)	167	6,156	6,323
1990-1991	669	49,747	50,416
1991-1992	669	19,923	20,592
1992-1993	669	1,764	2,433
1993-1994	669	0	669
1994-1995	669	0	669
1995-1996	669	0	669
1996-1997	669	0	669
1997-1998	669	0	669
1998-1999	669	71,394	72,063
1999-2000 (7/1/-4/1)	502	73,441	74,110
Total (as of 4/1/00)	6,690	222,425	229,282

Appendix A. Identification of nonimmigrants for the 1990 census

The estimation of temporary legal migration required the identification of a population of nonimmigrants in the 1990 census. Because legal permanent residence status is not asked by the census, various characteristics available from the census long form were used to impute nonimmigrant status.

The Census Bureau first used three basic criteria to identify potential nonimmigrants: they could not be a native or naturalized U.S. citizen on April 1, 1990; they had to have entered the United States between 1987 and 1990; and they could not be living with a spouse or a related householder who was a U.S. native or naturalized citizen.

If an individual met these basic criteria, they were then classified into one of the following nonimmigrant visa categories: foreign college students, high school exchange students, scholars, nurses, Jamaican agricultural workers, intracompany transferees, Canadian visitors ("snowbirds"), au pairs, and the spouses and children of these nonimmigrants. These categories were not exhaustive of all the nonimmigrant visa types, but they represented the majority of the temporary residents in the United States in the early 1990s.

Foreign students attending U.S. colleges or graduate schools comprise a large portion of the nonimmigrant population as estimated by the Census Bureau. According to the Census Bureau's criteria, a foreign student had to be enrolled in school and have at least a high school diploma. Since law prohibits most foreign students from being employed while studying in the United States, an individual was not classified as a foreign student unless they also were not working full-time at the time of the census. In order to be identified as a foreign student, then, a person must have also been either not currently in the labor force, had only worked 20 hours or less in the preceding week, were not at work in the preceding week, or were unemployed and their income during 1989 was less than $5,000.

The U.S. Department of State also issues separate nonimmigrant visas for the spouses and children of foreign students. In order to be classified as one of these "student dependents," a person must have been living in a household with either a spouse or a parent (natural or adoptive) who met the above criteria for a foreign student (enrolled in school, at least high school diploma, etc.). The exceptions were spouses who also themselves met the criteria for students. This condition prevented their misclassification as student dependents in cases where both spouses were foreign students. Children who met the conditions for foreign students were not excluded from the student dependent population in the Census Bureau estimates.

In addition to foreign college students, the Census Bureau also specified foreign high school exchange students in its nonimmigrant population. Foreign high school students had to be between the ages of 14 and 18, be enrolled in high school (grades 9 through 12), and could not be a relative to their householder. There must also have been at least one other child in their household who was between the ages of 14 and 18, and their householder had to be a U.S. citizen (either native or naturalized). These last criteria presumably came from knowledge of exchange student programs that place foreign high school students in the homes of families who already have a child attending the student's destination school.

A scholar had to have at least a Master's degree; they also had to have a health diagnosing (including physicians, dentists, and veterinarians) or post-secondary teaching occupation, or had to have worked in the hospital or college and university industry.

A nurse must have had at least some college, as well as an occupation in health assessment and treatment (such as nurses, pharmacists, or therapists) or health services (dental assistants, orderlies, etc.), and had to work in the hospital or nursing and personal care facilities industries.

A nonimmigrant born in Jamaica whose occupation was coded as "agricultural and related" was assumed to be a Jamaican agricultural worker.

Nonimmigrants identified as having a visa for intracompany transferees must have been at least 30 years old and had at least a Bachelor's degree on April 1, 1990. They must also have been currently employed, and reported an income of either $0 or minimum of $35,000.

Spouses and children of scholars, nurses, Jamaican agricultural workers, and intracompany transferees who did not also meet the criteria for these classifications were assumed to be dependents of these types of nonimmigrants, similar to the classification of student dependents. These dependents are also included in the nonimmigrant population.

Canadian nonimmigrants with a B-2 tourist visa, often referred to as "snowbirds," are Canadian citizens who spend part of the year in the United States. A snowbird could have any relationship to their householder (including being the householder themselves), but they must have either been born in Canada or had a spouse who was born in Canada. The underlying assumption about this category of nonimmigrants was that they were probably retired individuals who spent a significant part of the year vacationing in the United States; therefore they (or their spouse) also must have been at least 55 years old and could not be in the labor force. In addition to these criteria, Canadian B-2 nonimmigrants must have had no U.S. natives in their household, although household members who were naturalized citizens were allowed.

An additional nonimmigrant visa category identified by the Census Bureau was that of foreign private childcare workers, or au pairs. A nonimmigrant who was believed to be an au pair must have been female and between the ages of 18 and 29. She must have been born in Europe, had at least a high school diploma, not be a relative to the householder, and have had a private household service occupation. Finally, the au pair's householder must have been a native of the United States or a naturalized citizen and there had to be at least one child under age 12 in the household, who was assumed to be the subject of the au pair's care taking.

The criteria for identifying nonimmigrants enumerated in the 1990 census has not been modified by the Census Bureau since the original estimate was made in the early 1990s.

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