Discoveries and Challenges from Census 2000: Estimating International Migration at the U.S. Census Bureau

By Betsy Guzmán, Kevin Deardorff, and Melissa Therrien
Population Division
U.S. Census Bureau

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U S C E N S U S B U R E A U

The results from Census 2000 identified weaknesses in our estimates of international migration to and from the United States during the 1990s and challenged us to find new methods and data sources to measure international migration during the coming decade. Before the decennial census in 2000, the U.S. Census Bureau had used components of migration to calculate the level of international migration for use in our annual population estimates, from which we also estimated international migrants by legal status. Using these estimates to carry forward the foreign-born population from the 1990 census and comparing the results with the foreign-born population enumerated in Census 2000, however, convinced us that those previous methods no longer could measure accurately the net inflow of immigrants into the United States. In particular, these results illuminated the shortcomings in the previous methodologies and data sources used in measuring certain components of the immigrant population—most notably, the unauthorized migrant population.

This discovery spurred a variety of research aimed at uncovering the cause for the discrepancy between our estimated foreign-born population and our enumerated foreign-born population. Efforts at the U.S. Census Bureau have concentrated on the two largest sources of potential error: 1) improved coverage of the foreign-born population in Census 2000 compared with the 1990 census, and 2) underestimation of net international migration during the period between the 1990 census and Census 2000. This paper will focus on the latter of those reasons, and as such will review findings from Census 2000, discuss the previous methodology for estimating levels of international migration and the legal status of international migrants, and outline the U.S. Census Bureau's research

agenda to measure international migration and legal status for 2000 and beyond using data from the American Community Survey.

Overview of Foreign-Born Population from Census 2000

Census 2000 results indicated that the resident population of the United States was 281.4 million, considerably higher than the 274.5 million residents that the U.S. Census Bureau had estimated for 2000. Subsequent studies showed that the difference between these two numbers was due partly to improvement in census coverage between 1990 and 2000, and due partly to the understatement of growth in the population during the 1990s (Deardorff and Blumerman, 2001; Robinson, 2001). Since a large share of the population growth in the United States each year is attributed to international migration, we focused our research on estimates of the foreign-born population.

In the early stages of our research, we used data on the foreign born (more specifically, the civilian non-institutionalized foreign born) from the March Current Population Survey to compare with Census 2000 enumeration of the same population. We found that there was a significant difference in the size of the foreign-born population between the two data sources. The Census 2000 enumeration was 30.6 million compared with the Current Population Survey estimate of 28.4 million, 7.0 percent lower than the census result (Malone, 2001; Lollock, 2001). Because the Current Population Survey estimate for March 2000 used population controls consistent with postcensal population estimates based on the 1990 census that suggested there was a considerable understatement of

actual growth of the foreign-born population—more specifically international migration—in the official estimates series.

In later stages of the research, we re-weighted the March 2000 Current Population Survey using the population from Census 2000 to correct for this understatement of population growth from international migration. The resulting re-weighted estimate of the foreign-born population was 30.1 million—not statistically different from the 30.6 million estimated in Census 2000—further suggesting that the population estimates used to weight the Current Population Survey for March 2000 had indeed understated levels of international migration (Malone, 2001). Additional work by Robinson and West suggested that more than half of this difference was due to improved coverage of the foreign-born population in Census 2000 compared with the 1990 census (Robinson and West, 2005). Nevertheless, a large share of the underestimate of the foreign-born population was caused by using data sources and methodologies that failed to identify accurately the growth in the unauthorized and quasi-legal immigrant populations during the 1990s.

Overview of International Migration Estimates During the 1990s

During the 1990s, the U.S. Census Bureau had estimated net international migration to the United States at more than 800,000 (on average) annually (Mulder et al, 2001). The results from Census 2000, however, suggested that net international migration during the 1990s was closer to 1.1 million per year (Deardorff and Blumerman, 2001). Because the levels of legal migration are constrained by administrative limits, we now think that the

increase in the foreign-born population was not only larger than expected but also included many more people who were not legal immigrants. Table 1 shows estimates of the foreign-born population by migrant status for 1990 and 2000.

Table 1. Estimates of the Foreign-born Population by Migrant Status: 1990 and 2000
(in millions)

	1990 Census (April 1, 1990)	Census 2000 (April 1, 2000)
Total Foreign Born	19.8	31.1
Legal Migrants	15.5	21.6
Temporary Migrants	0.5	0.8
Residual Foreign Born	3.8	8.7
Quasi-Legal Migrants	N.A.	1.7
Unauthorized Migrants	N.A.	7.0

N.A.: Not available.
Source: U.S. Census Bureau, 1990 Census and Census 2000 evaluation (Demographic Analysis-Population Estimates project).

Component Method for Estimating Net International Migration

In the 1990s, the U.S. Census Bureau used a component method to estimate net international migration. This approach calculated net international migration as the sum of five major components (see Equation 1): legal immigration to the United States, which includes lawful permanent residents and refugees; mortality to legal immigrants; emigration of legal foreign-born immigrants; net temporary migration of the foreign born; and the residual foreign born, which includes unauthorized and quasi-legal migrants into the United States.

$$(1) \qquad NIM = [L - (M + E)] + T + R$$

where

NIM = Net international migration
L = Legal immigrants
M = Mortality to legal immigrants
E = Emigration of legal immigrants
T = Temporary (legal) migrants
R = Residual foreign born (unauthorized and quasi-legal migrants)

The largest of these components relates to the inflow of lawful permanent residents. The method for estimating legal immigration used by the U.S. Census Bureau relied on data collected by the Immigration and Naturalization Service (INS) on lawful permanent residents ("green card" holders) and information from the 1980 and 1990 censuses. By the mid-1990s, the U.S. Census Bureau was concerned that this method did not account for a growing population of temporary migrants. These temporary migrants were not lawful permanent residents, and therefore were not included in the INS statistics used by the U.S. Census Bureau (Perry et al, 2001). Rather, these temporary migrants were visa-holders who had legally entered the United States under dozens of different classes of admission including foreign students, temporary workers, foreign government officials, treaty traders and investors, intra-company transferees, teachers and researchers, and as North American Free-Trade Agreement (NAFTA) workers—or as dependents of these visa holders.

To measure the size of the temporary migrant population, the U.S. Census Bureau began using an algorithm to estimate the foreign-born population who held visas. The use of this algorithm resulted in an estimated temporary migrant population of 488,000 people in 1990 (Cassidy and Pearson, 2001). This population was large enough to provide a

preliminary indication that the administrative data used in the estimates process were inadequate for measuring flows of all legal immigrants. Using the algorithm with Census 2000 data showed that adjusting the estimates in the 1990s to include temporary migrants was not sufficient to account for the rapid increase in both the size and diversity of the temporary migrant population that had grown to nearly 800,000 people in 2000 (Cassidy and Pearson, 2001).

For other key components of international migration the estimation methodology used during the 1990s was especially problematic. Unauthorized migrants were estimated from data that were updated only once a decade, making it impossible to estimate the growth of the unauthorized migrant population during the decade. The results of Census 2000 demonstrated that the unauthorized migrant population came to represent a larger share of the total immigrant population (Costanzo et al, 2001; Deardorff and Blumerman, 2001). Even more problematic was the U.S. Census Bureau's efforts to estimate the number of foreign born leaving the United States. The methodology used to estimate foreign-born emigrants had not only become outdated because it too could only be updated once a decade, it also produced results that were not credible. The improvement in coverage rates from the 1990 census to Census 2000 (in particular for the foreign-born population) highlighted the weakness of the existing methodology to estimate foreign-born emigrants when the coverage rates between the censuses were different (Mulder et al, 2001).

In addition, the component-based methodology also did not account for "quasi-legal migrants"—those migrants who had applied for legal migrant status but whose cases had not yet been adjudicated because of administrative backlogs in processing systems. The exclusion of this group (quasi-legal migrants) from our estimates of international migrants in the 1990s contributed to the overall under-estimate of immigration during the decade (Deardorff and Blumerman, 2001).

As a result of the evaluations of the foreign-born population from Census 2000, the U.S. Census Bureau realized that the current component-based method for estimating the population during the decade and the data sources used would need to be revisited. We realized also that despite the usefulness of census data for evaluations of the components of international migration, the utility of these data are compromised by the lack of timeliness inherent in measures that can be calculated only once a decade. As a result, the U.S. Census Bureau has explored the possibility of using data collected annually on the foreign-born population from the American Community Survey to address concerns about the timeliness of other data, and has explored new methods for using these data to estimate international migration.

Data on the Foreign Born from the American Community Survey

Since 2000, the U.S. Census Bureau has conducted the American Community Survey (ACS) with the intention that it will replace the decennial census long form in 2010. The ACS has the largest sample size of any national survey in the United States. During its operational test phase from 2000 to 2004, the ACS included about 700,000 households

each year. With full implementation beginning in 2005, the sample will increase to about 3 million households per year.

The ACS provides annual updates on the size and characteristics of the foreign-born population residing in the United States. Previously, data on the foreign-born population were available only through the Annual Social and Economic Supplement to the Current Population Survey with a sample size of about 78,000 households. Questions on respondent's place of birth, U.S. citizenship status, year of entry into the United States, and residence one year earlier are included in the ACS. These data are collected monthly during the calendar year and weighted to a July 1 population for the year in which data are collected. Preliminary evaluations suggest that data on the foreign-born population are comparable in coverage to the decennial census, thereby increasing the possibility of using data from this survey to produce annual estimates of the components of international migration related to the foreign-born population other than legal migration (Malone, 2001).

An analysis of ACS data collected since 2000 provides useful insights into changes in patterns of international migration since the decennial census in 2000 and of immigrant groups (unauthorized migrants, quasi-legal migrants, and temporary migrants) because all types of foreign-born immigrants are included in the ACS sample, regardless of their legal status. These changes are important to identify because they are either not covered in administrative records, or release of these statistics is delayed for years because of administrative backlogs.

Annual changes to the foreign-born population can be calculated from the ACS (see Table 2). One must be careful when reviewing and interpreting trends in the foreign-born population from the ACS, however, because of the standard errors (250,000 or more) associated with these annual changes.

Table 2. Estimated Change in the Foreign-Born Population: 2000-2003
(in millions)

	2000-01		2001-02		2002-03	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Change in Foreign-Born Population Between Years	1.09	0.256	1.10	0.260	0.90	0.264

Source: American Community Survey, 2000-2003. Data for 2000-2002 were re-weighted to a consistent series of independent population estimates.

Current Method for Estimating International Migration

After evaluating the data on the foreign-born population from the ACS, we decided that these data provided the most accurate estimate of international migration available on an annual basis.[1] Currently, our research into using these data has focused on developing the best method to derive annual levels of international migration without producing estimates of the foreign-born population by legal status.

To improve the overall level of international migration, we focused on getting one best estimate that did not compound quality and timeliness issues in contrast with developing

[1] The largest subcomponent of international migration is the movement of the foreign born. The other subcomponents that account for movement across U.S. borders includes movement from U.S. territories and native movement out of the U.S. Although these subcomponents also need to be evaluated and updated, this papers focuses on the improvements to the largest contributor to international migration, the movement of the foreign born.

separate estimates of the components of immigration (see Equation 1). We first developed a new change-based method that was derived from estimates of the foreign-born population. Specifically, the U.S. Census Bureau's current methodology for estimating net international migration (NIM) is based on the change in the size of the foreign-born population from successive years of re-weighted ACS data as shown in Table 2, with an allotment for mortality to the foreign born (DFB)[2] during the intervening year (see Equation 2). The primary advantage of this method relative to the method used during the 1990s is its simplicity. In addition to the straightforward calculation of this model, it is unlikely for the introduction of bias to the overall estimate of international migration when projecting deaths to the foreign born because of the quality and completeness of death statistics and the small share of total deaths that occur to the foreign born.

$$(2) \qquad NIM_{0,t} = FB_t - FB_0 + DFB_{0,t}$$

where

$NIM_{0,t}$ = Net international migration from time *0* to time *t*
FB_t = Foreign-born population at time *t*
FB_0 = Foreign-born population at time *0*
$DFB_{0,t}$ = Deaths to the foreign-born population from time *0* to time *t*

A disadvantage to this approach is that it provides no estimates of the legal status of the foreign-born population as the component-based methodology used in the 1990s had done. Another disadvantage is that the standard error of the estimated annual change in

[2] Age-sex specific survival rates are derived from the NCHS life tables. The foreign-born population from time *0* is survived to time *t* to get the expected population at time *t*. The expected population is subtracted from the estimated foreign-born population in time *0*. The difference between the survived population and the estimated population at time *0* is deaths to the foreign born during the period.

the foreign-born population is relatively large in comparison to the estimated annual change. Although this method is straightforward and timelier than the methods from the 1990s, it would be preferable to develop another method that uses the ACS but that has a smaller standard error on estimated annual change.

Alternative Possibilities for Estimating International Migration Using ACS Data

As can be seen in Table 2, the measurement of annual trends in international migration with the current method is subject to relatively large standard errors. The U.S. Census Bureau is comparing results of these annual calculations with results that use multi-year averages of change to the foreign born before deriving an estimate of international migration. The purpose of these evaluations is to derive reliable trends in estimates of international migration while ensuring that actual trends in international migration are not obscured or lagged by averaging data on the change in the foreign born for multiple years.

Concurrent research also is ongoing to develop methodologies that estimate international migration using data on year of entry and residence abroad during the previous year for the foreign-born population. An evaluation of these data since 2000 suggests that the level of international migration estimated by the ACS will differ depending on the variable used in the calculations (see Table 3). The trends implied by results from these two questions appear to be consistent with each other, but the implied level of international migration is considerably higher based on data on those who entered from abroad during the past year.

Table 3. Estimates of Foreign-born Population by Residence Abroad in the Previous Year and Year of Entry of the Previous Year: 2000-2003
(in millions)

	2000		2001		2002		2003	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Residence in the Previous Year Was Abroad	1.44	0.043	1.43	0.043	1.22	0.039	1.03	0.036
Year of Entry Was the Previous Year	1.58	0.043	1.65	0.044	1.43	0.041	1.26	0.039

Source: American Community Survey, 2000-2003. Data for 2000-2002 were re-weighted to a consistent series of independent population estimates.

These trends appear to be consistent with estimates of annual change in international migration since 2000 as identified by anecdotal evidence on the decline in refugees and foreign students. More importantly, the standard errors associated with these variables are much smaller than the standard errors associated with the annual change in the foreign-born population from the ACS. Nevertheless, the levels implied by these two measures are different, and the reason for these differences is unknown. More importantly, these data reflect only net in-migration trends and would need to be combined with annual estimates of net out-migration during the same time period to estimate total net international migration (see Equation 3). The U.S. Census Bureau did not estimate emigration of the foreign born during the 1990s (Mulder et al., 2001).

(3) NIM = IM- OM

where

NIM = Net international migration
IM = Net in-migration
OM = Net out-migration

Future Work in Estimating Net International Migration

Researchers increasingly propose methodologies that combine data from administrative records, censuses, and surveys rather than the traditional method of using only one of these sources as a primary indicator of the trends in international migration. Although combining data from these various sources will not overcome all the difficulties associated with estimating international migration, a realistic goal of these efforts should be to understand the independent (and sometimes contradictory) estimates of the size and characteristics of immigrants that currently exist across data sources.

To examine the reasonableness of new estimates of the flow of international migration derived from combining data sources, the U.S. Census Bureau will have to evaluate administrative records on the flow of legal immigration from the Office of Immigration Statistics and on the flow of temporary migration through an examination of transaction-based records of visa applications from the Office of Immigration Statistics and the U.S. Department of State. These data serve as independent indicators that can be used to validate and refine our estimates of international migration derived from the change in size of the foreign-born population based on ACS data.

Additional research must also be completed so that the U.S. Census Bureau can select the most appropriate method for estimating international migration from the American Community Survey. The incorporation of alternative methods based on the flow on international migration as opposed to the change in the number of foreign born living in the United States, however, would necessitate the development of estimates of emigration from the United States. Without comprehensive statistics on emigration from the United States, the U.S. Census Bureau would need to estimate the flow of emigrants by evaluating the change in the stock of Americans living overseas. To facilitate this activity, researchers in national statistical offices would need to collaborate on the comparability of statistics across countries. The United States has begun such efforts with national statistical offices in Mexico and Canada to evaluate the international consistency of data on the foreign-born population (Deardorff et al., 2003). These collaborative efforts with statistical agencies in other countries should facilitate the exchange of data on emigrants and the discussion of alternative methodologies that will ultimately improve our ongoing estimates of international migration.

Additional work is also needed on evaluating the characteristics of immigrants, such as determining the extent to which the ACS includes all types of immigrants in its respondent pool, similar to research efforts undertaken on Census 2000. Additional research also is needed to evaluate methods for averaging data for multiple years when studying small groups (or small levels of geography), and when using categorical or characteristics data that may change over time.

Finally, and most importantly, work is also needed on estimating the legal status of migrants. We are beginning to develop methods to use data from Census 2000, administrative data sources, and surveys to create algorithms that model the characteristics of migrants by legal status. These algorithms can ultimately be used to distribute the total number of migrants into different legal status categories. Preliminary work on temporary migrants has shown that such models can be developed and successfully applied to the ACS data to create credible results (see Table 4).

Table 4. Estimates of Temporary Migrants: 2000-2003
(in millions)

Total Temporary Migrants	2000		2001		2002		2003	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Total	0.84	0.025	0.87	0.026	0.88	0.027	0.83	0.024

Source: Cassidy, Rachel. (2004) *Evaluation of ACS Temporary Migrant Estimates*. Data for 2000-2002 were re-weighted to a consistent series of independent estimates.

Summary

The findings on the foreign-born population from Census 2000 highlight the need to produce better estimates on international migration (and in turn, overall population estimates) through methodological improvements and the use of new data sources before the next decennial census in 2010. It is even more imperative to evaluate new data sources such as the ACS because the 2010 decennial census will not include questions on international migration and related topics. Research completed to date suggests that the ACS will be an important new data source to avoid the shortcomings in measuring international migration that occurred during the 1990s.

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