**COVERAGE OF POPULATION IN CENSUS 2000 BASED ON DEMOGRAPHIC ANALYSIS:
THE HISTORY BEHIND THE NUMBERS**

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Issues
- The accuracy of the historical estimates of net international migration up to 2000
- Achieving consistency of the reporting of race in the Demographic Analysis (DA) estimates with reporting of race in the census
- The assumptions regarding birth registration completeness (including the assumption that complete coverage started in 1985)
- How to measure uncertainty in the DA estimates

This paper describes the development and the history of the Demographic Analysis estimates used for the evaluation of coverage in 2000. The first section gives an overview of the demographic technique and describes the components of population changes used to construct the DA estimates. The second section addresses the individual components used to construct the DA estimates. A third section reviews the limitation of the DA method and how revisions affect the estimates over time. A final section provides a summary.

Introduction

In the United States, Demographic Analysis (DA) methods have a long history of measuring population coverage trends between censuses and differences in coverage by age, sex, and race (Black, non-Black) at the national level. Demographic Analysis is an analytic approach that has been used to measure coverage of the national population in every census since 1950 (see Coale, 1955; Siegel and Zelnik, 1966; U.S. Bureau of the Census, 1974, 1988a; and Robinson et al., 1993 for the demographic evaluations of the 1950-1990 censuses). DA has documented the long-term reduction in the census net undercount rate, yet DA also reveals the persistent and disproportionate undercount of certain demographic groups (such as adult Black men—see Figure 1). The race, age, and sex patterns of net undercount rates in 2000 mirrored that of recent censuses—higher net undercount rates of adult males than females (especially for Blacks), disproportionate net undercount rates for young children, net overcounts of older children and teenagers, and net overcounts for some older age groups (see Figure 2).

Demographic Analysis estimates serve two principal purposes in census evaluation:

1) DA estimates provide benchmarks to assess completeness of coverage in the current census and document changes in coverage from previous censuses. The national DA estimates have become the benchmark for tracking historical trends in net census undercounts and for assessing coverage differences by age, sex, and race.

2) The independence and internal consistency of the DA estimation process allows the use of the estimates to check survey-based coverage estimates; in particular, we can assess the consistency of the age-sex results. DA and the survey-based method use entirely different methodologies.[1] Because the sources and patterns of errors in the two

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[1] The Census Bureau has used two principal methods to measure the undercount in censuses. One method is Demographic Analysis, which is the topic of this paper. The other method derives coverage estimates from post-enumeration surveys and dual system estimation. This approach involves case-by-case matching

estimates are sufficiently different, any disagreement in the results is important to understand. The comparison of the DA and survey-based estimates became critical in the assessment of coverage of Census 2000. The wide difference between the initial DA estimate of population and the survey estimates (called the Accuracy and Coverage Evaluation, or A.C.E.) was a major factor in the Census Bureau's recommendation not to adjust the census for coverage error (U.S. Bureau of the Census, 2001c).

1. Description of the Demographic Analysis Method

Demographic Analysis represents a macro-level approach for measuring coverage. The approach derives estimates of net undercount by comparing aggregate sets of data or counts. In general, DA population estimates are developed for the census date by analysis of various types of demographic data independent of the census, such as administrative statistics (births, deaths, and Medicare data) and estimates of immigration and emigration. The difference between the DA estimated population (P) and the census count (C) provides an estimate of the net census undercount or overcount (u).[2] Dividing the net undercount by the DA benchmark provides an estimate of the net undercount rate (r):

$$u = P - C \qquad\qquad\qquad (1)$$
$$r = (u/P) * 100 \qquad\qquad (2)$$

The particular analytic procedure used to estimate coverage nationally for the various demographic subgroups depends primarily on the nature and availability of the required demographic data. Two principal demographic techniques are used to produce the Demographic Analysis estimates, one for the population under age 65 and another for the population 65 and over.

(1) <u>Ages under 65</u>. The DA estimates for the population below age 65 in 2000 are based on the compilation of historical estimates of the components of population change: births starting with 1935 (B) adjusted for under-registration, deaths to persons born starting with 1935 (D), immigrants born starting with 1935 (I), and emigrants born starting with 1935 (E).[3] The main reason that the component approach is not used for populations born before 1935 is that the birth registration system did not include all states until 1933. Presuming that the components are accurately measured, the population estimates (P_{0-64}) are derived by the basic demographic accounting equation applied to each birth cohort:

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of persons in an independent survey with persons in the census to determine who was missed or counted in error. The survey-based coverage measurement program associated with the 1980 Census was called the Post-Enumeration Program (PEP); in the 1990 Census it was called the Post-Enumeration Survey (PES); for Census 2000 it was known as the Accuracy and Coverage Evaluation (A.C.E). All three programs use a sample survey and the dual system estimation methodology to estimate coverage error.

[2] Equation 1 represents the traditional derivation, where a positive value denotes a net undercount (census is lower than DA) and a negative value denotes a net overcount (census is higher than DA). Alternatively, the DA estimate could be subtracted from the census (C – P) and the meaning would be reversed (positive value reflects net overcount; negative reflects net undercount).

[3] The emigration component represents the emigration of legal residents only.

$$P_{0-64} = B - D + I - E \qquad (3)$$

The size of the component estimates used to develop the DA population under age 65 for 2000 is shown in Table 1.

Clearly, births (234.9 million) represent by far the largest component in equation 3. The immigration component (32.6 million) is second largest, followed by deaths (14.8 million) and emigrants (5.5 million).

The actual calculations are carried out for single-year birth cohorts, by sex and race (Black, Non-Black).[4] For example, the estimate of the population age 48 on April 1, 2000 is based on births from April 1951 to March 1952 (adjusted for under-registration), reduced by deaths to the cohort in each year between 1951 and 2000, and incremented by estimated immigration and emigration of the cohort over the 40-year period.[5] As will be described, the immigration component is comprised of several subcomponents.

(2) <u>Age 65 and Over</u>. Administrative data on aggregate Medicare enrollments are used to estimate the population age 65 and over (P_{65+}):

$$P_{65+} = M + m \qquad (4)$$

where M is the aggregate Medicare enrollment and m is the estimate of underenrollment in Medicare. Medicare is an administrative data set from the Centers for Medicare and Medicaid Services. Although Medicare enrollment is generally presumed to be quite complete, adjustments are made to the basic data to account for individuals who are omitted. An allowance was made for the estimated 1.3 million not enrolled (3.9 percent) in 2000. Underenrollment factors are based on survey estimates of Medicare coverage and data on age at enrollment in the Medicare file.[6] The DA population aged 65 and over (34.6 million in 2000) represented 12.3 percent of the total population. For a more complete description of the Medicare data and estimation for underenrollment, see Ahmed et al., 2001, and West et al., 2010.

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[4] The historical components on births, deaths, and immigration have been compiled for three groups: White, Black, and Other Races combined (primarily American Indian-Alaskan Natives and Asians). However, the DA estimates for Other Races give implausibly large net overcounts, indicating the estimates are measuring "classification" error more than coverage error. The estimates for Whites and Other Races are combined to form the Non-Black category; the misclassification is believed to involve persons who were reported as White in the DA estimate (e.g., on the birth certificate) and are self-reporting as some other race in the census (e.g., American Indian).

[5] See Appendix Table 1 for the demographic accounting of the 1951-1952 cohort from birth to age 48 in 2000.

[6] Persons that were deceased as of April 1, 2000 are excluded from the Medicare file for purposes of developing the DA Medicare-based estimates.

<u>Total Population</u>
The demographic component estimates for the population under 65 were combined with the Medicare-based estimate for the population 65 and over to produce the total revised DA population estimate (281.8 million as of April 1, 2000).

As noted in later sections, the DA estimates undergo continuous revision, as new data are acquired, new methods are incorporated, and evaluations lead to revision of assumptions. These changes even occur within the census being evaluated, such as Census 2000. The initial DA estimate of 279.6 million was revised upward to 281.8 million (these revised DA estimates are discussed in this paper), reflecting in large part a change in the assumptions about international migration during the 1990s. While the initial DA estimates are independent of the census being evaluated, the revised DA estimates are not. As will be noted later, these revisions affect the estimated DA level and estimated amount of net coverage more than the estimated *differences* in coverage by age, sex, or race. The DA method is more robust in providing better measures of coverage differences rather than absolute coverage levels.[7]

Historical Evolution of the Demographic Analysis Estimates

The Census Bureau has used DA to evaluate the completeness of census coverage for several decades. Some studies using the demographic analysis methodology were conducted on census data prior to the 1950 census. The first demographic-based estimates of net undercount focused on the 1940 Census and specific demographic subgroups. One study looked at the completeness of enumeration of children under age 5 and found significant differences in coverage of Black and Non-Black children (U.S. Bureau of the Census, 1944). Another study examined the completeness of the 1940 Census for young men, ages 21 to 35 (Price, 1947). Price used figures from the first draft registration which started on October 16, 1940. He created comparable census figures by using demographic analysis to "age" the census count on April 1 to October 16, 1940. Black men in this age group were found to be undercounted in the census by 13 percent, compared to 3.1 percent for all men in this age group.

It was not until the 1950 census, that the coverage studies became more systematic. In the 1950s, Coale (1955) used the balancing equation of demography (combining birth, death, and migration statistics) to create an estimate of the "true" total population (classified by age group, sex, and White/Nonwhite) against which the 1950 Census could be evaluated. Coale used different analytic procedures for different age groups and assumed age misstatements and errors of omission to form similar patterns from one census to the next. He was the first to identify age-sex patterns of coverage as well as race differences.[8]

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[7] This includes the measurement of sex ratios—the number of males per 100 females, which is a unique strength of DA.

[8] The first survey-based estimates of census coverage were also developed in conjunction with the evaluation of the 1950 census (U.S. Bureau of the Census, 1960).

At the Census Bureau, Siegel and Zelnik (1966) evaluated the completeness of the 1960 Census using the DA method. Again, different analytical procedures were applied to different age-sex groups. The age, sex, race patterns of estimated undercount for 1960 were found to be similar to those in the 1950 Census. Up to age 50, the enumeration was less complete for men than for women. Up to age 60 or 65, the enumeration of Black and other races was less complete than the enumeration of Whites.

By the 1970 Census, the DA results had become a standard for measuring trends and differentials in coverage. Other developments occurred around this time. Data from the Medicare system became available for use in the DA estimates of the population 65 and over (U. S. Bureau of the Census, 1974). A new test of birth registration completeness provided adjustment factors to update the 1940 and 1950 test results.[9] The components of change method (births, deaths, net international migration) anchored the DA estimates for the population under 35, Medicare provided the basis for the population 65 and older, and indirect estimation methods were used for the population 35 to 64 (see Table 2).[10] In a sense, the "modern" DA method was first used in the coverage evaluation of the 1970 census.

The DA methodology continued to evolve, new data sources were incorporated, and the estimated components of change were improved for the coverage evaluations of the 1980 and 1990 censuses. In 1980, an explicit estimate of the number of undocumented residents was included as a demographic component for the first time (U.S. Bureau of the Census, 1988d).[11] Research was conducted to refine the methods used to estimate the immigration components and the population based on Medicare data (U.S. Bureau of the Census, 1988c, 1988e). In 1990, explicit measures of uncertainty in the DA net undercount estimates were developed for the first time (Das Gupta, 1991; Robinson et al., 1993). The issue of race consistency of the DA estimates and the census became a more important research issue (U.S. Bureau of the Census, 1991a).

In addition, a milestone was reached in 2000 when the DA estimates were based solely on the "direct" estimation methods—the demographic accounting of births, deaths and net international migration to develop the population under age 65, and the use of Medicare data to estimate the population 65 and older. The rows in Table 2 show how the reliance on indirect estimation methods diminished between 1970 and 2000. In fact, in 2010, DA estimates for the population 65 to 74 can be developed and compared from both the components of change and Medicare methods.

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[9] See Section 2 for a fuller discussion of the birth registration test results.

[10] These indirect estimates, for populations born before 1935, involved the use of mathematical modeling techniques, assumptions about coverage for certain age groups, and other adjustments. These estimates, such as the Coale and Zelnik estimates (1963) for the White population and the Coale and Rives estimates (1973) for the Black population, are not believed to be as accurate as the component-based estimates (births, deaths, migration). As shown in Table 2, the indirect methods were gradually replaced as the age groups could be estimated with the component of change approach.

[11] The DA estimates for 1970 (and earlier years) did not include an estimate of the undocumented population.

Yet at the same time, the growing importance of immigration as a component of change placed greater demands on the accuracy of that component. As noted earlier, analysis of the initial DA estimates of coverage for 2000 (DA estimate of 279.6 million, or 0.65 percent below the census enumeration of 281.4 million) indicated that immigration during the 1990s was understated, principally as a result of the underestimation of immigration (U.S. Bureau of the Census, 2001a). Extensive research was conducted in 2001 on the components of immigration and the robustness of all DA components (as part of the Demographic Analysis of Population Estimates, or DAPE), leading to the revised estimate of 281.8 million in 2000 (or 0.12 percent net undercount).

As the DA estimates have become a more integral part of the Census Bureau's coverage evaluation program, external reviews of the DA methodology have been conducted to enhance the research activities within the Census Bureau. The National Research Council has issued reviews and recommendations spanning the last two decades regarding the DA program (1985, 1994, 2008). Passel reviewed the DA program at the time of the 1990 census (Passel, 1990). Himes and Clogg (1992) provided a statistically-based assessment of the DA estimates. The Census 2000 Monitoring Board provided a review of the 2000 DA estimates, with a recommendation to increase the capacity to measure immigration (U.S. Census 2000 Monitoring Board, 2001). The Monitoring Board's report included a thorough evaluation of the DA methodology and estimates by Passel (2001).

2. Estimation of Individual Components Used to Construct the DA Estimates

In this section, we review the methodology and data used to construct the demographic analysis estimates in 2000 for the population under 65 years of age. The estimates represent the culmination of DA work over the last 40 years, as the time series of components of change are continually updated and revised based on the latest research. Appendix A provides an overview of the basic data sources and primary references.

Estimating Births

The historical data on births, B in Equation (3), come from the vital registration system and are available for all states beginning in 1933. As shown in Table 1, births are the largest component of population change involved in the demographic analysis system (234.9 million in 2000). Thus, even relatively small percentage errors in the estimates of births can have significant effects on the demographic estimates of coverage.

Adjustment for Underregistration

Tests of birth registration completeness were conducted for 1940, 1950, and 1964-1968 (see Table 3) to provide correction factors in those years; correction factors for other years are derived by interpolation and extrapolation. The estimated level of completeness was 92.5 percent in 1940 (81.9 percent for Black births) and improved to 97.9 percent in 1950 (93.7 for Black births). By 1964-68, over 99 percent of all births were registered.

Over the years, the methods to interpolate and extrapolate the birth registration test (BRT) factors have been modified, based on emerging research that identified inconsistencies in the time series of DA coverage estimates that could be related to deficiencies in the BRT results or the method of interpolation/extrapolation. Three major revisions to the corrected time series of births have been incorporated since the 1970 DA estimates were published; these revisions were used in the development of the 2000 DA estimates. The key references are given in Appendix A.

1) The 1970 DA estimates were based on the simple linear interpolation between the BRT results, specific to the factors for births occurring in hospitals and out of hospitals. For the 1980 DA work, a curvilinear interpolation of the 1940 and 1950 test results was incorporated to allow for more rapid improvement in registration completeness in the early 1940s (U.S. Bureau of the Census, 1988b).

2) Research conducted during the 1980s revealed a distinct and anomalous "cohort effect" in the net coverage rates for Blacks born between 1935 and 1945, with the conclusion that the 1940 BRT for Blacks was biased. Passel (1992) used regression methods to revise the series of registration completeness factors for Blacks from 1935 to 1950. The corrected births based on these factors were incorporated in the 1990 DA estimates. This revision led to a downward adjustment to the time series of Black births (1935-1950) and lowered the estimated net undercount for those Black cohorts.

3) For the 1970, 1980, and 1990 DA estimates, the time series of births since 1968 were based on the extrapolation of the 1964-68 BRT results. The extensive review of DA components during the evaluation of the 2000 DA estimates led to the conclusion that registration completeness continued to rise, reaching 100 percent in 1985 (coinciding with the first year that natality statistics were reported electronically from all the states), and remained at 100 percent through 2000 (McDevitt et al., 2001).[12]

Using these revised methods, the estimated number of total births and the estimated percent adjustment for underregistration for each 5-year period from 1935 to 2000 are shown in Table 4 for 2000.[13] In Figure 3, the effect of underregistration on the time series of total annual births is shown. The increase in births due to underregistration is

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[12] The revision of the birth registration completeness factors was part of the extensive DAPE review noted earlier that was conducted in the evaluation of the Census 2000 results. The revised assumption about 100 percent birth registration completeness was based largely on consultation with the staff at the National Center for Health Statistics. Their arguments were primarily on legal and logical grounds, as well as the improvements in the computerization and recordation of vital events. Everyone needs a birth certificate for establishing citizenship, enrolling in school systems, Social Security benefits, insurance claims, and other legal formalities. Very few births now occur out of hospitals (out-of-hospital births had lower registration completeness in the BRT tests). However, there is no recent test of completeness or statistical evidence to support the assumption of 100 percent completeness.

[13] For each year, preliminary data on births and deaths are released by the National Center for Health Statistics, which are replaced by the "final" data when issued. For the 2000 DA estimates, only preliminary births and deaths were available for 1999; the births (affecting the population under age 1) and deaths (for the population under age 65) for the first three months of 2000 were extrapolated. The difference between the preliminary and final data are usually very small, but the reliance on "not final" data for the last year introduces some error--and is another reason the DA estimates are always revised.

most noticeable in the years before 1950; there is no effect on broad trends or even year-to-year patterns (such as the huge increase in births after the end of World War II, and the short-term rise in births after 1970). As will be shown, these trends based on births shape the age distribution of the DA population estimates for 2000.

Race classification of births

The consistency in classification of births by race is important for making comparisons between the DA estimates and the census. DA estimates for race groups are affected by the differences between the classification of births used in the registration system and the classifications used in the census. Race at birth for a child is assigned on the basis of the race of the parents, and different algorithms can lead to different race assignments for births to multiracial couples. While not affecting DA totals, this uncertainty affects DA race estimates principally for the cohorts born after 1980. Until 1989, the National Center for Health Statistics (NCHS) assigned rules for the classification of births by race, which favored race categories other than White (the "Minority" Rule).[14] In 1989 NCHS adopted a new rule, which could be called the "Mother Rule", which assigns the mother's race to the child regardless of the father's race. Alternatively, one can develop the "Father Rule" where the child is assigned the father's race.[15]

The differences between the number of births based on the three race assignment methods are shown in Table 5. The switch from the Minority Rule to the Mother Rule had a much greater impact for the Black classification than the combined Non-Black category. For 1989, the Mother rule classified 5.1 percent fewer births as Black; this difference increased to 10 percent by 1999. The reduction in the number of Black births based on the Father Rule was about a quarter as large as the Mother Rule. The distinct trend from little difference in 1968 (the first year cross-tabulations by race of parents are available) to relatively large differences by 1999 is linked to the increase in the number of multi-race couples (Adlakha et al., 2002).

Work by Passel (1990) and U.S. Bureau of the Census (1991a) shows that the Father Rule tended to match more closely with the response patterns in the census. Special census tabulations for interracial households for 1970, 1980, and 1990 make it possible to examine which of the three racial classification procedures is most consistent with the reported race of children in the census. Based on the analysis of the children of interracial couples, the Father Rule seemed to "match" more closely with the response pattern in the census, however, the agreement was far from perfect. Estimates of births consistent with the Father Rule were used in the construction of the 1990 and 2000 DA estimates of population.[16]

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[14] Under the Minority Rule, race of birth was assigned the minority parent's race if one parent was White; race was assigned the father's race if neither parent was White, unless either parent was Hawaiian; then the child was assigned Hawaiian.

[15] If the race of the father is missing, the child is assigned the mother's race.

[16] The estimates of births based on the Father Rule are available for all years beginning in 1968; the time series of Father Rule births was extended back to 1935 by extrapolating the 1968 Father Rule/Minority Rule ratios of births (see small percent differences for 1968 in Table 5). It was assumed that there was no difference between the Father Rule and Minority Rule in 1935.

Estimating Deaths

The historical data on deaths (D in Equation 3) are based on the vital registration system. An estimated 14.8 million deaths occurred between 1935 and 2000 to the population under age 65 in 2000; the number of deaths to the cohort in each decade is shown in Table 6. Since most deaths occur at older ages, the deaths to the DA cohorts are a relatively small proportion of all deaths. This will change as we move away from relying on Medicare alone for the DA estimates of the population 65 and older.[17]

There is little information available on which to quantify empirically the possible extent of underregistration of deaths (U.S. Bureau of the Census, 1988b, 1991b). Therefore, unlike births for which the probable magnitude of underregistration can be empirically quantified, the magnitude of underregistration of deaths must be based on assumptions. With the exception of infant deaths, all deaths are assumed to be completely registered. For infant deaths before 1960, it is assumed that deaths were underregistered at one-half the rate of underregistration of births; no adjustment for infant deaths is made for years since 1960 (U.S. Bureau of the Census, 1988b).[18] In addition to actual deaths, life table survival rates were used in the estimation of attrition due to mortality in some immigration components (especially emigration and unauthorized immigration).

Unlike the birth and immigration components, deaths have undergone few revisions over the course of the development of DA estimates since 1970. For an assessment of the quality of the death statistics, see U.S. Bureau of the Census, 1988b.

Estimating Immigration and Emigration

International migration is an important component in the DA estimates. However, because administrative records for various components of international migration are incomplete or missing, assumptions about these components are particularly sensitive. Certainly, compared to births and deaths, the component of net international migration (NIM) is the most difficult to estimate with accuracy, especially in recent decades. The lack of good data on NIM was a particular complication for the 2000 DA program.

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[17] As noted in Table 2, DA estimates of the population between ages 65 and 74 in 2010 can be derived from the component-based method (which includes deaths) as well as using Medicare data.

[18] The assumption of 100 percent completeness for death registration follows the argument for birth registration—based on technical, logical, and legal reasons. It is probable that registration of deaths is complete or very nearly complete, given the strict legal requirements for registration and needs of survivors for proof of death. However, the requirements could be evaded more easily in the case of infants, especially in earlier years. While infant deaths prior to 1960 are adjusted upward by one-half the percent of birth underregistration, sensitivity tests show that the assumption of an infant death underregistration rate equal to that of birth underregistration has little impact on the DA estimates (McDevitt, 2001). These sensitivity tests could be broadened to include the possibility of underregistration of deaths of young children (for which rates were much higher before 1960 than in recent decades —especially for Blacks).

For the 2000 DA estimates, the immigration and emigration components in the demographic accounting equation had two major parts: measured migration and residual foreign-born migration (see Table 7). Measured migration consists of:

- immigrants admitted for permanent residence,
- net migration from Puerto Rico,
- nonimmigrants living in the United States temporarily (including foreign students),
- net arrival of civilian citizens who had been living abroad,
- change in the number of military personnel abroad,
- emigration (legal residents).

The residual foreign-born estimate included persons in a "quasi-legal" status as well as unauthorized migrants.[19] Of these international migration components, legally admitted permanent residents (20.33 million persons under age 65 who immigrated between 1935 and 2000) and residual foreign-born migration (9.98 million in 2000) are the largest.

We will describe the methods and data used to estimate each of the NIM components. The NIM estimates are based on two major sets of revisions—1) the estimates developed as part of the 1980 DA estimates, and 2) the estimates for 1980 to 2000 developed during the revision of the 2000 DA estimates (see U.S. Bureau of the Census, 2001b).[20]

Legally Admitted Permanent Residents

Legally admitted migrants represent the largest of the international legal migration components (20.33 million in 2000). The DA estimates on legal permanent residents for all years since 1950 are based on administrative records from the Immigration and Naturalization Service (INS).[21] Since 2000, the source has moved to the Office of Immigration Statistics (OIS), Department of Homeland Security. The Immigration and Nationality Act defines legal immigration as the process by which a non-citizen of the United States is granted legal permanent residence. Legal immigrants, as categorized by the INS (and OIS), include new arrivals to the United States admitted by the Department of State and people in the United States adjusting their migrant status to legal permanent resident through the INS. The latter category included people who initially arrived as refugees, parolees, temporary migrants, or without authorization, and subsequently qualified for legal permanent residence either through special provisions such as the Immigration Reform and Control Act of 1986 (IRCA) or by meeting normal immigration requirements and adjusting status.

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[19] The "quasi-legal" group includes persons living in the country who are awaiting action on their immigration requests.

[20] Most of the DAPE projects focused on the evaluation and revision of the NIM components used in the initial DA estimates of population and coverage.

[21] For the 1940 to 1950 decade, estimates of net immigration were based on the intercensal cohort analysis of the foreign-born population in the 1940 and 1950 censuses. The INS data on immigration were judged to be deficient because of the massive net movement of refugees and parolees to the United States during the 1940s was incompletely recorded (U.S. Bureau of the Census, 1988c).

The INS data are believed to be quite complete, relatively timely (lags of one year), and require less indirect estimation than other immigration components.[22] However, it is becoming increasingly more problematic to identify legal immigration, as defined by INS or DHS, with actual moves to the United States, as would be defined by the decennial census. Above all, rapid changes in the level of immigration and large fluctuations in temporary migration (especially in the 1990s) belie the assumption that difficult-to-measure temporary or undocumented arrivals can be approximated by the more measurable adjustments of status. A portion of this problem could be overcome by employing companion data on refugees, parolees, and asylees at time of entry, rather than time of adjustment.

Race of immigrants is not available from administrative data, and has to be estimated, based on the race of arrivals for each country-of-birth category enumerated in the last census in the years preceding the census date.

For a more complete description of the legal immigration data, see Appendix A.

Migrants from Puerto Rico

The net migration of citizens to and from Puerto Rico (0.91 million in 2000) is a component which must be estimated and is thus subject to uncertainty. Net migration from Puerto Rico for 1980 to 1990 and 1990 to 2000 is based on a residual survival method. The net migration estimates for decades before 1980 are based on the cohort component analysis of successive census data of the resident population of Puerto Rico and the Puerto Rican-born population living in the United States. For a more complete description of the method and data to estimate migration from Puerto Rico, see Appendix A.

Temporary Migrants

The Immigration and Nationality Act defines temporary migrants (also referred to as nonimmigrants) as aliens admitted to the United States for a specified purpose and temporary period, but not for permanent residence. Temporary migrants include those who would be considered residents of the United States for purposes of the decennial census, including foreign students and temporary workers, but excluding tourists and business workers. The number of temporary migrants in 2000 used in the DA construction (0.78 million) was estimated using an algorithm to identify people with characteristics like those of temporary residents (e.g., persons who are foreign-born, not citizens, going to college, and have lived in the United States for less than 3 years).[23] A similar methodology was used for the 1990 estimates of temporary migrants. For the DA estimates of earlier years (1980 and before) INS data and data on foreign students from

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[22] No allowance is made for undercoverage of immigrants in the INS data used to construct the 2000 DA estimates.

[23] The algorithms were applied to data from the Census 2000 Supplementary Survey to derive estimates of the temporary migrants in 2000.

the Institute of International Education were used. For a more complete description of the method and data to estimate temporary migrants, see Appendix A.

Civilian Citizen Migration

The temporary movement abroad of citizens of the United States (0.89 million in 2000) is another component which relies entirely on estimation and is thus subject to considerable uncertainty. The temporary movement of federally affiliated U.S. citizens from 1980 to 2000 was estimated by observing trends in the numbers from two sources: (1) the number of military dependents published by the Department of Defense, and (2) the number of civilian Federal employees overseas supplied by the Office of Personnel Management (OPM). Data from the Department of State were also used for earlier years. For more information, see Appendix A.

Armed Forces Overseas

The Armed Forces overseas (AFO) component (change of 0.32 million from 1990 to 2000) measures the net effect of three subcomponents: (1) the change in the number of Armed Forces stationed overseas, based on data provided by the Department of Defense, (2) deaths to the AFO, and (3) net recruits to the Armed Forces from the overseas civilian population. For more information, see Appendix A.

Residual Foreign-Born Migration

The component of residual foreign-born migration was based completely on estimation, and is subject to considerable uncertainty as to its true size. The number of residual foreign-born migrants in 2000 was estimated from analyses of data on the foreign-born population obtained from the 2000 census. A cohort component, or "residual" methodology was utilized. An estimate of legally admitted permanent residents was developed based on administrative data on legal migrants and estimates of deaths and emigrants. The difference (the residual) from the Census 2000 count of the foreign-born (9.98 million in Table 7) was assumed to include unauthorized immigrants counted in the census. The estimation equation is as follows:

$$R = FB - [L - (M + E)] - T \qquad\qquad (5)$$

Where FB = Census 2000 foreign-born population
      L = Legal immigrants
      M = Mortality of legal immigrants
      E = Emigration of legal immigrants
      T = Temporary (legal) migrants
      R = Residual foreign born

The residual foreign-born population is not an actual estimate of the number of unauthorized migrants. This estimate includes persons who are legally in the country but are not yet included in the official estimates of immigrants and refugees. It also includes persons in a "quasi-legal" status who are awaiting action on their immigration requests.

Since the estimate was derived from a residual methodology, any limitations in the methods or in the measurement of other migration components are reflected in the residual number.[24] Here the residual may be quite different from the actual number of unauthorized migrants.

The estimate pertained only to persons counted in the census. Other assumptions must be made about the undercount of residual foreign-born population; an assumed net undercount rate of 15 percent was used for the 2000 DA estimate.[25] For a more complete description of the methodology, see Appendix A.

Emigration

The component of emigration (5.49 million in Table 7) relies entirely on estimation, and is subject to much uncertainty. The emigration component (E) represents emigration of legal residents only. The estimation of foreign-born emigration for decades up to 1990 is based largely on using cohort component techniques applied to successive census data on the foreign born. For 1980 to 1990, emigration rates were applied to the legally resident foreign-born population to derive the estimated emigration of legal foreign-born residents (estimates of undocumented residents were removed from the foreign-born denominator). For the 1970s, the estimates were based on the analysis of INS alien registration data. The emigration estimates developed for the total foreign-born population covering years before 1970 are assumed to represent emigration of the legally resident foreign-born population (until the 1970s, the undocumented population was relatively small). The volume of emigration for the 1990s is based on simple extrapolations of emigrant levels during the 1980s; the estimates are subject to greater error because no standard technique using current empirical data has been successfully developed.[26]

Native-born emigration is estimated using analytic techniques applied to census data from overseas sources and supplemented by State Department data. For a more complete description of the methods and data to estimate emigration, see Appendix A.

In summary, the DA method relies on current administrative data for most of the demographic components. Adjustments are made to account for certain deficiencies or incompleteness of the data sets. Emigration and residual foreign-born migration are two relatively large components of population change that are based on estimation due to the lack of administrative data or large-scale survey-based sources for keeping the estimates

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[24] The residual estimate will also be affected to the extent that the foreign born, especially those who came as children, are reported as native born in the census. This tendency would also affect the estimates of emigration that are based on analysis of census counts of the foreign-born.

[25] The assumption of 15 percent compares to assumed undercoverage levels of 25 percent and 31 percent for the undocumented population in the 1990 DA and 1980 DA estimates, respectively (U.S. Bureau of the Census, 1991c, and U.S. Bureau of the Census, 1988d).

[26] The cohort component technique produced implausible negative emigration estimates when applied to 1990 and 2000 data on the foreign born. These results could be caused by change in coverage of the foreign born (improved coverage in 2000 compared to 1990—the technique assumes no change in coverage), erroneous reporting of period of entry or nativity, erroneous assumptions about undocumented residents in the census counts, or overestimating mortality (Mulder et al., 2001).

"current." For this decade, we are exploring the use of data on nativity and place of birth from the American Community Survey to update the estimates (see Bhaskar et al., 2010).

Putting it All Together: Constructing the DA Estimates of Population

Example of Construction of DA Population for Specific Age Group

With the estimates developed component by component in the previous sections, we have a large table of data that is summed across birth cohort for each decade to develop the single-year-of-age DA resident population estimate for April 1, 2000. This estimate is compared to the census count at that age; the difference between the DA estimate and the census provides the estimate of net undercount and net undercount rate (see equations 1 and 2).

This construction is illustrated in Appendix Table 1 for the population born from April 1, 1951 to March 31, 1952, for Blacks and Non-Blacks classified by sex. The birth cohort is survived to age 8 in 1960 by accounting for the estimated components of change during the decade, then carried forward to age 18 in 1970, age 28 in 1980, age 38 in 1990, and to age 48 in 2000 (for the 2010 DA estimates, the cohort will be advanced to age 58). This table displays the longitudinal nature of the DA method; the DA estimates can be compared to the census result across multiple censuses to derive a time series of net undercount rates (see column 13). These data are valuable in evaluating the internal consistency of the DA results and detecting anomalies that merit investigation (see Passel, 1991 and Robinson et al., 1990).

Construction of the DA Population Based on Estimated Components of Change

In Appendix Table 2, the cumulative component estimates are shown for the total population under age 65 by single year of age. The estimates are summed across decade for each birth cohort, and summed across race and sex (so only the first row of the detail in Appendix Table 1 appears in Appendix Table 2—but the sex-race detail is available for every age group from age 0 to age 64 in 2000).[27]

The columns in this table summarize the demographic history of each birth cohort. One key factor is the large numerical and relative impact of the births for every age, especially for the population under age 20 or so in 2000. For only one component—deaths—do the values continue to increase in size as the cohorts age. The immigration components all show the largest estimates when the cohorts are in the adult ages from about 20 to 50, depending on the component.

The numbers in Appendix Tables 1 and 2 tell us exactly how the DA population estimates in 2000 came about—based on measurements of past demographic events (plus the estimate of the population that includes undocumented residents). The detailed

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[27] The single-year-of-age DA estimates for ages 65 and over based on Medicare data (adjusted for underenrollment) are combined with the single year component-based estimates for ages under 65 shown in Appendix Table 2 to construct the DA estimates for the total population.

component estimates can provide a vehicle to systematically alter assumptions about the components and assess the effect on the DA estimates.

Illustration of Relative Contribution of Components of Change to the DA Total

An illustration of the relative impact of the DA components is given in Figures 4-6. The components of change are summarized for three groups: the total of births minus deaths (impact of vital statistics), the total of "legal" immigration components, and the residual foreign-born component (which includes undocumented immigrants).

The figures quantify what can be gleaned from examining the data in Appendix Table 2. Since mortality is low at ages under 20, Figure 4 demonstrates how births are the driving force that determines the size of the population for these younger age groups—the migration components have not accumulated to have much "leverage" on the results. By ages 20-29, however, the combined migration components (Figures 5, 6) account for 17 percent of the Non-Black male DA population estimate, 16 percent of the Non-Black female estimate, and lesser amounts for Blacks. The immigration and emigration components have had a chance to cumulate by these ages, and errors in the component estimates will impact the quality of the DA estimates. For older age groups (30 to 49 and 50 to 64), the migration impacts are about the same as for 20 to 29 (the "legal" migration components play a larger role for ages over 30 while the residual foreign-born has a pronounced impact at ages 20 to 29—especially for Non-Blacks).[28]
Also note that while the relative magnitude of the components differ some by race (migration has a greater effect on the Non-Black DA estimates), there is very little differences by sex, except for the residual foreign born. In fact, the sex ratios from the DA estimates are generally considered one of the method's more robust measures.

Figure 7 provides a final demonstration of how annual births shape the age distribution of the DA estimates. The births (adjusted for underregistration) and total DA population estimates for 2000 are displayed such that the age groups in 2000 align with the corresponding birth cohort. For example, the population aged 10 in 2000 was born in 1989-90, the population aged 30 was born in 1969-70, and the population aged 55 was born in 1944-45. While the DA levels will differ from the number of births, the shape of the DA age structure in 2000 is clearly shaped by the annual change in births—even if 55 years in the past (as in the case of the 55 year olds). The immigration components outnumber deaths to raise the DA estimate above the "beginning" birth levels for most age groups, however, the force of mortality begins to play a larger role in the older ages.

3. Limitations of the DA Estimates

Several limitations on the use of DA must be acknowledged:

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[28] The layout of the components for the 1951-52 birth cohort in Appendix Table 1 provides another way to "see" the potential for cumulative error. The error in the birth estimate affects the beginning size of the cohort; error in the many component estimates that carry the cohort through the decades can grow in size and bias the DA estimates (if the errors tend to be in the same direction, such as understating immigration and thus understating the DA population estimate).

Limited Geographic and Demographic Detail of the DA Estimates

The major DA estimates are available only at the national level and only for two broad race categories: Black and All Other Races Combined (the latter is referred to as "Non-Black"). We do not have independent data to accurately measure internal migration within the United States (needed to do "subnational" DA estimates with the cohort-component technique used for the national DA estimates). Also, historical time series of components of population change are not available for Hispanics or Asians to construct DA estimates comparable to the estimates for Blacks.[29]

Inconsistencies In Race Classifications

The race categories in the DA estimates largely reflect the race assigned in the particular administrative record at the time of the event (birth, death, or enrollment in Medicare). The DA estimates of net undercount are biased to the extent that people who are classified as Black in DA reported a different race in the census.

The effect of the new "mark one or more races" instruction for the Census 2000 question on race complicated the traditional comparison of DA estimates by race with census race tabulations. In fact, the Census 2000 tabulations do not include a category "Black" that is comparable to 1990 or earlier census tabulations. Tabulations for the Black population for 2000 contain tabulations of the number of people who reported Black only and tabulations of the number who reported Black in combination with other races.

To deal with the reporting of more than one race, we used alternative DA estimates of census undercount using two models: (1) Model 1 compares the 2000 DA estimates for Blacks with Census 2000 tabulations for people who reported Black alone, and (2) Model 2 compares the 2000 DA estimates for Blacks with Census 2000 tabulations for people who reported Black whether or not they reported any other race. At the youngest ages, the differences between the two models are the greatest. The Model 1 and Model 2 counts were averaged for derivation of the "final" 2000 DA coverage estimates (see U.S. Bureau of the Census, 2001a). These averages are not necessarily the best point estimates; current research is investigating methods to account for the inconsistencies in the classification of race in the demographic data and the census (Devine et al., 2010).

A final inconsistency affects race comparisons of DA and published census counts. In 2000, 15.4 million people (mainly Hispanics) who were tabulated as "Some Other Race alone" in the census were redistributed (for DA estimation) to the categories White; Black; American Indian, Eskimo, or Aleut; and Asian or Pacific Islander so that the

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[29] Although not of the caliber of the "core" national DA estimates, in 2000 the groundwork was laid for a systematic approach for using demographic benchmarks of housing and population to draw *inferences* about the Census 2000 coverage at the subnational level (Robinson et al., 1999; Adlakha et al., 2003). These benchmarks do not measure the net coverage for the total population like the national DA estimates, but can provide useful broad indicators of coverage patterns for specific demographic groups. Also, the Census Bureau is developing national benchmarks for the Hispanic population to provide inferences about coverage in 2010.

census counts were consistent with the race categories of the historical demographic estimates.

The inconsistencies in the race data place even more importance on the use of sex ratios for making inferences about coverage by racial categories in Census 2000. Specifically, to the extent that the inconsistencies in reporting and the numbers marking more than one race are about the same for men and women, the inconsistencies will tend to cancel out in the calculation of sex ratios. We found this assumption held true: in Census 2000, the sex ratios for people who reported Black only are nearly identical to the sex ratios for people who reported Black whether or not they reported other races.[30]

Uncertainty in DA estimates

The DA estimates contain uncertainty because the aggregate administrative data used to construct them are corrected for various types of errors and some components must be estimated. Most of these components are well measured (especially for recent decades) but several components of immigration have considerable uncertainty. Among the latter components are residual foreign-born migration, legal emigration, and the number of temporary legal migrants. Confidence or "uncertainty" measures were developed for assessing the accuracy of the 1990 DA estimates; ten separate evaluations were conducted to assess the likely range in each of the DA components (Das Gupta, 1991; Robinson et al., 1993).

This first-time assessment of potential error in the DA estimates provided useful measures of uncertainty, but there was no consensus about the validity of the models used or assumptions about the range in the component estimates (see Clogg and Himes, 1993; and Passel, 1993). For the 2000 DA, the formal uncertainty estimation was not repeated; resources went into the extensive review of the immigration components themselves (the "point" estimates) and reexamination of the birth, death, and Medicare data and assumptions.

Another assessment of the reliability of the DA estimates is to examine how the estimates vary as they are revised over time. As noted earlier, we are always conducting research to improve the DA estimates, incorporating new data sources or revisions to existing data sources when they become available and re-examining basic assumptions. The DA estimates for a previous census (e.g., 1990) are revised when the estimates for the "current" census (e.g., 2000) are produced.

Table 8 compares alternative DA estimates for the 2000, 1990 and 1980 censuses. In 2000, the initial DA estimate of a 0.65 percent net overcount was increased by almost 1 percentage point to an estimated net undercount of 0.32 percent (incorporating a larger estimate of undocumented immigrants). Yet the differences between the estimates for demographic groups (male versus female, Black versus Non-Black) did not change much (see last two rows of Table 8). Revisions to several components that led to the DA

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[30] See U.S. Bureau of the Census, 2001b, Table 8, for a comparison of census sex ratios for Blacks and for Non-Blacks based on the Model 1 and Model 2 census tabulations.

estimates released in October 2001 did lower the Black/Non-Black difference (from 3.7 to 3.1 percentage points), yet the gap is still wide. Likewise, the distinct male-female and Black/Non-Black differential undercounts remain across the three sets of revisions to the 1980 DA estimates. The historical experience shows that the DA estimates are more robust with regard to measuring broad patterns of coverage than the "point" estimates for any individual group.

It should be noted that the meaning of the differential Black/Non-Black undercount as measured by the DA estimates has changed over time. In 1950, the Non-Black population was overwhelmingly Non-Hispanic White, and largely native born (only 0.5 percent of the resident population was represented by persons of race other than White or Black, and the Hispanic population was relatively small). By 2000, the Non-Black population was more diverse; the "minority" share of the Non-Black population had increased to 21.2 percent (minority defined as the aggregate number of people who are races other than White or who are Hispanic). This trend has continued since 2000.

DA provides measures of net coverage, not separate components of coverage error

Finally, it should be noted that the principal DA estimates for race, sex, and age groups measure net coverage in the census. They do not tell us about the separate effects of net coverage error (omissions, erroneous inclusions, or duplicates) or content error. The survey-based coverage estimates for 2010 will provide information on the components of net error in the census.

4. Summary

Demographic Analysis (DA) has a long history at the Census Bureau. The DA analytic methods and underlying assumptions have evolved over time as new data or information became available. We do not start anew with each census; the body of research and data sets that constituted the DA estimates for one census becomes the starting point for the next. The estimates are subject to change, with the constant goal of improving the DA estimates and measurement of census coverage.

The logical consistency and interrelationships of the underlying demographic variables and the data used to measure them are strengths of the demographic method. The internal consistency of the demographic estimates and components of change (over the period 1935-2000) allow for the estimation of coverage in multiple censuses as the cohorts age. And with multiple observations across censuses, it becomes possible to judge the quality of the demographic estimates and possibly identify and correct for anomalous patterns for specific cohorts. Because the DA estimates are additive and internally consistent, revisions to the estimates can be easily made and automatically lead to revisions of the demographic estimates of population and coverage in previous censuses.

The historical experience has shown that the DA estimates are quite robust with regard to measurement of broad patterns of coverage. Despite the many changes and improvements incorporated into the demographic methodology over time, the age-sex-

race patterns of net coverage (and relative levels to lesser extent) for each census have not been appreciably affected by subsequent revisions.

We will continue research to assess the quality of the national DA estimates and identify ways to improve the estimates for evaluation of the 2010 Census.

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Appendix A. –Basic Data Sources and References for Demographic Analysis

I. Population Under Age 65 in 2000

A. Birth Statistics

Registered births, 1935-2000
> National Center for Health Statistics, Vital Statistics of the United States, "Natality" annual volumes and microdata files

Estimates of birth registration completeness, 1935-2000

> 1964-68 birth registration test (BRT) results
> > U.S. Bureau of the Census, Census of Population and Housing: 1970. 1973. Evaluation and Research Program, PHC(E)-2. "Test of Birth Registration Completeness, 1964 to 1968".

> 1950, 1940 BRT test results
> > U.S. Public Health Service. National Office of Vital Statistics. 1954. Vital Statistics of the United States, Volume 1, Chapter 6.

> Revision of 1935-1950 time series of BRT factors for White births based on curvilinear interpolation between 1940 and 1950 BRT results—see U.S. Bureau of the Census, 1988b. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 112, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Birth and Death Statistics, 1935-1980" by Jeffrey S. Passel and J. Gregory Robinson.

> Revision of 1935-1950 time series of BRT factors for Black births to adjust for bias in 1940 BRT test results—see Jeffrey S. Passel, 1992. "Alternative Estimates of Black Births Corrected for Underregistration: 1935-1980." The Urban Institute, Washington, D.C.

> Revision of 1968-2000 time series of BRT factors to allow for 100 percent completeness beginning in 1885—see McDevitt, Tom, Martin O'Connell, Colleen Joyce, 2001. "Evaluating the Components of Births and Deaths used in Demographic Analysis." Population Division, U. S. Census Bureau, Washington, D.C.

> See U.S. Bureau of the Census, 1988b. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 112, op. cit., for more information about the BRT test methodologies.

Race classification of births

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B. Death Statistics

Registered Deaths, 1935-2000
 National Center for Health Statistics, Vital Statistics of the United States, "Mortality" annual volumes and microdata files

Survival rates, 1940-2000 (Used in estimation of net immigration components)
   Derived from National Center for Health Statistics, United States Life Tables, 1999, 1989-91, 1979-81, 1969-71, 1959-61, 1949-51, 1949-51, and 1939-41

See U.S. Bureau of the Census, 1988b. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 112, op. cit., for more information about evaluations of the death statistics.

C. Immigration Statistics

1. Legal immigration, 1980-2000

Immigration and Naturalization Service (INS) files, data on Parolees and Asylees. For more information, see Perry, Marc J., Barbara J. Van der Vate, Lea Auman, and Kathleen Morris. 2001. "Evaluating Components of International Migration: Legal Migrants." Population Division Working Paper Series No. 59. U. S. Census Bureau, Washington, D.C.

Legal immigration, 1935-1980

INS annual reports for 1950-1980 and estimates from 1950 and 1940 U.S. census data on the foreign-born population for 1935-1950. For more information, see U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

2. Net migration from Puerto Rico, 1980-2000

Net migration from Puerto Rico for 1980 to 1990 and 1990 to 2000 is based on a residual survival method. For more information, see Christenson, Matthew. December 2001. "Evaluating Components of International Migration: Migration Between Puerto Rico and the United States," Population Division Working Paper Series No. 64, U.S. Census Bureau, Washington, D.C.

Net migration from Puerto Rico, 1940-1980

Estimated from 1980, 1970, 1960, 1950, 1940 U.S. census data on the Puerto Rican population and 1980-1970 Puerto Rican census data on the U.S.-born population. For more information, see U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

3. Temporary Migrants, 1990-2000

Estimated by applying algorithms to identify persons with characteristics like those of temporary residents (e.g., persons who are foreign-born, not citizens, going to college, and have lived in the United States for less than 3 years). Detailed data from the Census 2000 Supplementary Survey were used to develop the 2000 estimates of temporary migrants living in the U.S.; 1990 census data were used for the 1990 estimates. For more information, see Cassidy, Rachel and Lucinda Pearson. 2001. "Evaluating Components of International Migration: Temporary (Legal) Migrants." Population Division Working Paper Series No. 60, U.S. Census Bureau, Washington, D.C.

Temporary Migrants, 1940-1980

Estimated from INS tabulations for 1980 and data from the Institute of International Education for 1940-1970. For more information, see U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

4. Civilian Citizen Migration, 1940-2000

Estimated on the basis of data from the Department of Defense, Office of Personnel Management, and Department of State for 1970-2000; estimated from 1970, 1960, and 1950 U.S. census data on the civilian population overseas for 1950-1970. For more information, see U.S. Census Bureau and Bureau of Labor Statistics. 2000. *Current Population Survey: Design and Methodology,*

Technical Paper 63. Washington, D.C. and U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

5. Armed Forces Overseas, 1940-2000

Based on data from the Department of Defense. The Armed Forces overseas strength statistics were supplied by the five branches of the Armed Forces (Army, Navy, Marines, Air Force, and Coast Guard). The components of deaths to the Armed Forces overseas and net recruits are usually very small and require indirect estimation.   For more information, see U.S. Census Bureau and Bureau of Labor Statistics. 2000. *Current Population Survey: Design and Methodology, Technical Paper 63.* Washington, D.C. and U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

6. Foreign-born Emigration, 1980-2000

Level of emigration for 1980 to 1990 estimated from cohort analysis of 1980 and 1990 U.S. census data on the foreign-born population; 1990 to 2000 emigration is based on the estimate for the 1980s. For more information, see Mulder, Tammany, Betsy Guzman, and Angela M. Brittingham. 2001. "Evaluating Components of International Migration: Foreign-Born Emigrants." Population Division Working Paper Series No. 62. U.S. Census Bureau, Washington, D.C.

 Foreign-born Emigration, 1970-1980

 Level of emigration estimated from analysis of Immigration and Naturalization Service alien registration data. Age, sex, and race detail estimated from 1960-1970 emigration rates developed in Robert Warren and Jennifer Marks Peck, "Foreign-Born Emigration from the United States: 1960 to 1970," *Demography*, Vol. 17, No. 1 (February 1980), pp. 71-84.

 Foreign-born Emigration, 1950-1970

 Estimated from 1970, 1960, and 1950 U.S. census data on the foreign-born population using the methods developed by Robert Warren and Jennifer Marks Peck, "Foreign-Born Emigration from the United States: 1960 to 1970," *Demography, op. cit.*

7. Native-born Emigration, 1980-2000

Based on analytic techniques applied to census data from overseas countries and supplemented by Department of State data. For more information, see Gibbs, Jim C., Gregory S. Harper, Marc J. Rubin, and Hyon B. Shin. 2001. "Evaluating Components of International Migration: Native Emigrants," Population Division Working Paper Series No. 63, U.S. Census Bureau. Washington, D.C.

Native-born Emigration, 1940-1980

Estimated on the basis of 1981, 1971, 1961, 1951, and 1941 Canadian census data on the U.S.-born population. For more information, see U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 113, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Immigration Statistics (Legal), 1935-80," by Jeffrey S. Passel and J. Gregory Robinson.

8. Residual Foreign-born Migration, 2000 and 1990

The number of residual foreign-born migrants in 2000 is estimated from analyses of data on the foreign-born population obtained from the 2000 census. A cohort component, or "residual" methodology is utilized. An estimate of legally admitted permanent residents is developed based on administrative data on legal migrants and estimates of deaths and emigrants. The difference (the residual) from the Census 2000 count of the foreign born is assumed to include unauthorized immigrants counted in the census. Some residents in a "quasi-legal" status may also be included. The same technique was applied to 1990 census data to obtain an estimate on the residual foreign born for the 1990 DA estimate. For more information, see Costanzo, Joseph, Cynthia J. Davis, Caribert Irazi, Daniel M. Goodkind, and Roberto R. Ramirez. 2001. "Evaluating Components of International Migration: The Residual Foreign Born." Population Division Working Paper Series No. 61, U. S. Bureau of the Census, Washington, D.C.

Residual Foreign-born Migration, 1960-1980

A similar cohort-component method was used to estimate the "undocumented" population in 1980, 1970, and 1960 for the DA estimates of coveage in those censuses. For more information, see U.S. Bureau of the Census. 1988c. *1980 Census Preliminary Evaluation Results Memorandum Series,* Number 114, "Methodology for Developing Estimates of Coverage in the 1980 Census Based on Demographic Analysis: Net Undocumented Immigration," by Jeffrey S. Passel

II. Population Aged 65 Years and Over in 2000

Medicare data (individual record file used for tabulations as of April 1, 2000) Center for Medicare and Medicaid Services (formerly Health Care Financing Adminstration)

Adjustments for Underenrollment—see Ahmed, Bashiruddin, Douglas K. Sater, David L. Word, Myoung-Ouk Kim, Brenda J. Skillern. October 2001. "The Use of Medicare Data in the Demographic Analysis (DA) and in the Population Estimates Programs." Population Division, U. S. Census Bureau, Washington, D.C., and West, Kirsten, Bethany Desalvo, and Katherine Condon. 2010. "The Use of Medicare Enrollment Data for Demographic Analysis Estimates of the Population 65 and Over," Paper prepared for the Demographic Analysis Technical Review Workshop. January 8.

Table 1. DA Estimates of the Components of Change for the U.S. Resident Population: April 1, 2000

Age Group and Component	Estimate (in thousands)
Total Population	281,760
Under Age 65 in 2000	247,172
+ Births starting with 1935 (B)	234,860
- Deaths to persons born starting with 1935 (D)	14,767
+ Immigration to persons born starting with 1935 (I)	32,564
- Emigration to persons born starting with 1935 (E)	5,485
Ages 65 and over in 2000	34,587
Medicare-based population	33,245
Estimated number not enrolled	1,342

Source: See Appendix A

**Table 2. Historical Development of Demographic Analysis (DA)
Estimates of Population: Type of Component Estimate for Age Groups**

| Census | Age Group | | |
	Components of Change [1]	Indirect Estimation [2]	Medicare-based [3]
1970	0-34	35-64	65+
1980	0-44	45-64	65+
1990	0-54	55-64	65+
2000	0-64	---	65+
2010	0-74	---	65+

[1] Component of Change DA estimates are based on births since 1935, reduced
by deaths and incremented by estimates of net international migration.
[2] Indirect DA estimates involved use of other benchmark estimates not believed
to be as accurate as births, such as estimates based on mathematical modeling
and assumptions about coverage for certain age groups.
[3] Medicare-based DA estimates are based on Medicare enrollments
adjusted for underenrollment.

Note: In 2010, DA estimates for the population 65 to 74 will be available
from both the components of change and Medicare sources.

Table 3. Percent Completeness of Birth Registration by Race and Hospital-Occurrence: 1940, 1950, and 1964-68

Race and Hospital Occurrence	Year		1964-68[2]	
	1940[1]	1950[1]	Percent	Estimated Standard Error
Total	92.5	97.9	99.2	0.1
In hospitals	98.5	99.4	99.4	0.1
Not in hospitals	86.1	88.2	93.7	1.3
White	94.0	98.6	99.4	0.1
In hospitals	98.6	99.5	99.5	0.1
Not in hospitals	88.2	88.2	94.4	3.0
Black and other races	82.0	93.5	98.0	0.3
In hospitals	96.3	98.2	98.6	0.2
Not in hospitals	77.2	88.2	93.4	1.4
Black	81.9	93.7	n.a.	n.a.
In hospitals	96.3	98.2	n.a.	n.a.
Not in hospitals	78.0	88.2	n.a.	n.a.

n.a. = Completeness factors for Blacks were not published.

Source: [1] U.S. Public Health Service, National Office of Vital Statistics 1954, <u>Vital Statistics of the United States</u>, Volume 1, Chapter 6.

[2] U.S. Bureau of the Census, Census of Population and Housing: 1970, Evaluation and Research Program, PHC (E)-2, <u>Test of Birth Registration Completeness: 1964 to 1968,</u> U.S. Government Printing Office, Washington, D.C., 1973.

Table 4. Estimates of Births Corrected for Underregistration Used in Demographic Analysis Estimates, by Race: 1935 to 2000

Race and Period [1]	Estimated Total Births	Estimated Percent Registered
Total		
All periods, 1935-2000	234,860,298	98.6
1935-1940	12,192,090	91.4
1940-1945	14,272,986	95.1
1945-1950	17,581,022	97.2
1950-1955	19,622,682	98.3
1955-1960	21,336,132	98.8
1960-1965	20,908,703	99.1
1965-1970	18,087,903	99.3
1970-1975	16,791,320	99.5
1975-1980	16,625,545	99.7
1980-1985	18,277,621	99.9
1985-1990	19,349,190	100.0
1990-1995	20,228,251	100.0
1995-2000	19,586,854	100.0
Non-Black		
All periods, 1935-2000	199,541,771	98.8
1935-1940	10,638,050	92.5
1940-1945	12,540,183	96.0
1945-1950	15,421,197	97.8
1950-1955	16,961,756	98.8
1955-1960	18,291,799	99.1
1960-1965	17,828,599	99.3
1965-1970	15,300,702	99.5
1970-1975	14,099,422	99.6
1975-1980	13,909,288	99.8
1980-1985	15,351,598	99.9
1985-1990	16,137,107	100.0
1990-1995	16,737,916	100.0
1995-2000	16,324,152	100.0
Black		
All periods, 1935-2000	35,318,528	97.2
1935-1940	1,554,040	84.2
1940-1945	1,732,803	89.0
1945-1950	2,159,825	92.9
1950-1955	2,660,926	95.1
1955-1960	3,044,333	96.9
1960-1965	3,080,104	97.7
1965-1970	2,787,200	98.3
1970-1975	2,691,898	99.0
1975-1980	2,716,256	99.4
1980-1985	2,926,022	99.7
1985-1990	3,212,082	100.0
1990-1995	3,490,335	100.0
1995-2000	3,262,702	100.0

Source: See Appendix A

[1] Period represents April 1 of the beginning year to March 31 of the ending year
(e.g., April 1, 1935 to March 31, 1940; April 1, 1940 to March 31, 1945).

Table 5. Registered Births by Race Based on Alternative Classification Procedures: 1968-1999

	Non-Black					Black				
	Race Assignment Rule [1]			Percent Difference from Minority Rule [1]		Race Assignment Rule [1]			Percent Difference from Minority Rule [1]	
Year	Minority Rule [2]	Mother Rule [3]	Father Rule [4]	Mother Rule [3]	Father Rule [4]	Minority Rule [2]	Mother Rule [3]	Father Rule [4]	Mother Rule [3]	Father Rule [4]
1968	2,968,072	2,975,618	2,969,804	0.3	0.1	530,510	522,964	528,778	-1.4	-0.3
1969	3,053,078	3,061,976	3,057,054	0.3	0.1	542,710	533,812	538,734	-1.6	-0.7
1970	3,155,638	3,166,002	3,158,488	0.3	0.1	571,908	561,544	569,058	-1.8	-0.5
1971	2,987,590	2,998,796	2,989,868	0.4	0.1	564,608	553,402	562,330	-2.0	-0.4
1972	2,724,388	2,735,893	2,726,676	0.4	0.1	530,937	519,432	528,649	-2.2	-0.4
1973	2,621,282	2,633,364	2,623,480	0.5	0.1	511,500	499,418	509,302	-2.4	-0.4
1974	2,649,064	2,662,196	2,651,761	0.5	0.1	506,593	493,461	503,897	-2.6	-0.5
1975	2,629,489	2,644,210	2,632,394	0.6	0.1	510,725	496,004	507,820	-2.9	-0.6
1976	2,649,609	2,665,544	2,653,017	0.6	0.1	513,042	497,107	509,634	-3.1	-0.7
1977	2,778,429	2,795,947	2,782,119	0.6	0.1	543,149	525,631	539,459	-3.2	-0.7
1978	2,773,234	2,791,774	2,777,576	0.7	0.2	549,813	531,273	545,471	-3.4	-0.8
1979	2,898,919	2,918,678	2,903,636	0.7	0.2	575,116	555,357	570,399	-3.4	-0.8
1980	3,010,448	3,031,833	3,015,870	0.7	0.2	587,784	566,399	582,362	-3.6	-0.9
1981	3,029,666	3,052,323	3,035,566	0.7	0.2	586,042	563,385	580,142	-3.9	-1.0
1982	3,074,745	3,098,417	3,081,042	0.8	0.2	590,621	566,949	584,324	-4.0	-1.1
1983	3,040,074	3,063,188	3,046,567	0.8	0.2	584,205	561,091	577,712	-4.0	-1.1
1984	3,061,375	3,085,746	3,068,325	0.8	0.2	590,399	566,028	583,449	-4.1	-1.2
1985	3,143,081	3,169,340	3,150,981	0.8	0.3	606,726	580,467	598,826	-4.3	-1.3
1986	3,126,699	3,154,850	3,135,319	0.9	0.3	619,792	591,641	611,172	-4.5	-1.4
1987	3,160,285	3,190,575	3,169,834	1.0	0.3	640,456	610,166	630,907	-4.7	-1.5
1988	3,230,371	3,263,556	3,240,586	1.0	0.3	670,588	637,403	660,375	-4.9	-1.5
1989	3,331,563	3,367,834	3,342,511	1.1	0.3	709,395	673,124	698,447	-5.1	-1.5
1990	3,433,481	3,473,876	3,445,299	1.2	0.3	724,731	684,336	712,913	-5.6	-1.6
1991	3,385,556	3,428,305	3,397,923	1.3	0.4	725,351	682,602	712,984	-5.9	-1.7
1992	3,345,420	3,391,381	3,358,514	1.4	0.4	719,594	673,633	706,500	-6.4	-1.8
1993	3,292,213	3,341,365	3,305,575	1.5	0.4	708,027	658,875	694,665	-6.9	-1.9
1994	3,263,495	3,316,376	3,277,386	1.6	0.4	689,272	636,391	675,381	-7.7	-2.0
1995	3,241,034	3,296,450	3,255,997	1.7	0.5	658,555	603,139	643,592	-8.4	-2.3
1996	3,237,605	3,296,713	3,253,145	1.8	0.5	653,889	594,781	638,349	-9.0	-2.4
1997	3,218,102	3,280,981	3,234,483	2.0	0.5	662,792	599,913	646,411	-9.5	-2.5
1998	3,264,357	3,331,651	3,282,449	2.1	0.6	677,196	609,902	659,104	-9.9	-2.7
1999	3,283,837	3,353,447	3,302,456	2.1	0.6	675,580	605,970	656,961	-10.3	-2.8

Source: Derived from Arjun L. Adlahka, J. Gregory Robinson, and Amy Symens Smith. 2002. "Alternative Rules for Assigning
Race of Birth: Effect on Birth Totals, Implications for Vital Rates and Census Undercount Estimates by Race", paper
presented at the annual meeting of the Southern Demographic Association, Austin, Texas.

[1] All Rules - If the race is missing for one parent, the child is assigned the race of the other parent.
[2] Minority Rule - Race of birth is assigned the minority parent's race if one parent is White; race is assigned the father's
race if neither parent was White (if either parent was Hawaiian, then the child was assigned Hawaiian).
[3] Mother Rule - Race of birth is assigned the mother's race.
[4] Father Rule - Race is assigned the father's race.

Table 6. Total Deaths and Deaths Used to Develop Demographic Analysis (DA) Estimates of the Population Under Age 65 in 2000, by Race: 1935 to 2000

Race, Period, and Age of DA Cohort	Total Deaths in Period	Deaths to Cohort used in DA Estimate of Population	Percent of Total Deaths
Total			
All periods, 1935-2000	117,982,944	14,766,736	12.5
1935-1940 (Ages under 5)	7,097,824	670,532	9.4
1940-1950 (Ages under 15)	14,288,564	1,469,282	10.3
1950-1960 (Ages under 25)	15,576,654	1,553,947	10.0
1960-1970 (Ages under 35)	18,214,519	1,741,366	9.6
1970-1980 (Ages under 45)	19,324,334	1,955,827	10.1
1980-1990 (Ages under 55)	20,699,822	2,688,478	13.0
1990-2000 (Ages under 65)	22,781,227	4,687,304	20.6
Non-Black			
All periods, 1935-2000	104,031,453	11,538,496	11.1
1935-1940 (Ages under 5)	6,187,571	545,677	8.8
1940-1950 (Ages under 15)	12,601,501	1,205,048	9.6
1950-1960 (Ages under 25)	13,794,417	1,223,164	8.9
1960-1970 (Ages under 35)	16,106,886	1,344,828	8.3
1970-1980 (Ages under 45)	17,086,951	1,511,164	8.8
1980-1990 (Ages under 55)	18,258,420	2,078,624	11.4
1990-2000 (Ages under 65)	19,995,707	3,629,991	18.2
Black			
All periods, 1935-2000	13,951,491	3,228,241	23.1
1935-1940 (Ages under 5)	910,253	124,855	13.7
1940-1950 (Ages under 15)	1,687,063	264,234	15.7
1950-1960 (Ages under 25)	1,782,237	330,783	18.6
1960-1970 (Ages under 35)	2,107,633	396,538	18.8
1970-1980 (Ages under 45)	2,237,383	444,663	19.9
1980-1990 (Ages under 55)	2,441,402	609,855	25.0
1990-2000 (Ages under 65)	2,785,520	1,057,313	38.0

Source: See Appendix A

Table 7. DA Estimates of the Components of Immigration Used in the Demographic Analysis Estimates, by Decade for the Population Under Age 65 in 2000

Age in 2000	Legal Immigration (+)	Net Puerto Rican Migration (+)	Temporary Migrants (+)	Net Civilian Citizens (+)	Net Armed Forces Overseas (-)	Residual Foreign Born [1] (+)	Legal Emigration (-)
Cumulative Total	20,332,038	905,698	776,002	891,940	324,638	9,982,932	5,485,117
Under 65, 2000	6,929,730	128,156	299,405	316,570	-237,037	9,982,932	1,899,347
Under 55, 1990	6,625,945	150,908	190,257	161,372	25,559	4,259,879	1,872,578
Under 45, 1980	3,584,542	136,329	174,140	203,950	-463,069	2,090,581	985,095
Under 35, 1970	2,212,720	230,571	80,200	247,448	623,825	659,844	583,667
Under 25, 1960	821,127	226,948	32,000	-43,233	375,360	40,888	144,430
Under 15, 1950	149,351	32,786	0	5,834	0	0	0
Under 5, 1940	8,623	0	0	0	0	0	0

Source: See Appendix A

[1] The residual foreign-born estimates are not cumulative; a DA estimate of the legally resident population is developed for each census comparison and a stock estimate of the residual foreign-born/undocumented population is added.

Table 8. Comparison of Initial and Revised Estimates of Percent Net Undercount Based on Demographic Analysis for the 1980, 1990, and 2000 Census

	Census Cycle							
	2000			1990	2000	1980		1990
	April 1, 2000[1]			April 1, 1990[2]		April 1, 1980[3]		
	March 2001		Oct. 2001					
	Base	Alternative	**Revision**	Sept. 1993	**Oct. 2001**	Feb.1982	Sept. 1985	Sept. 1993
Net Undercount Total	-0.65	0.32	**0.12**	1.85	**1.65**	-0.40	1.40	1.22
Male	-0.13	0.91	**0.86**	2.79	**2.39**	0.50	2.40	2.20
Female	-1.16	-0.25	**-0.60**	0.94	**0.93**	-1.20	0.40	0.28
Black	2.80	3.51	**2.78**	5.68	**5.52**	4.80	5.90	4.50
Nonblack	-1.19	-0.17	**-0.29**	1.29	**1.08**	-1.10	0.70	0.77
Difference by Sex Male:Female	1.03	1.16	**1.46**	1.85	**1.46**	1.70	2.00	1.92
Difference by Race Black:Nonblack	3.99	3.68	**3.07**	4.39	**4.44**	5.90	5.20	3.73

Note: A minus sign denotes a net overcount.

Source: [1] U.S. Bureau of the Census. 2001a. "Accuracy and Coverage Evaluation: Demographic Analysis Results," by J. Gregory Robinson. DSSD Census 2000 Procedures and Operations Memorandum Series B-4, March 2, 2001, Table 4, Table 6.

-----. 2001b. "ESCAP II: Demographic Analysis Results," by J. Gregory Robinson. Executive Steering Committee on Accuracy and Coverage Evaluation Policy II, Report Number 1, Oct. 13, 2001, Table 4, Table 6.

[2] Robinson, J. Gregory, B. Ahmed, P. Das Gupta, and K. A. Woodrow. 1993. "Estimation of Population Coverage in the 1990 United States Census Based on Demographic Analysis." *Journal of the American Statistical Association,* 88(423): 1061-1071, Table 1.

U.S. Bureau of the Census. 2001b. "ESCAP II: Demographic Analysis Results," by J. Gregory Robinson. Executive Steering Committee on Accuracy and Coverage Evaluation Policy II, Report Number 1, Oct. 13, 2001, Table 4, Table 6.

[3] U.S. Bureau of the Census. 1982. Current Population Reports, Series P-23, No. 115, "Coverage of the National Population in the 1980 Census, by Age, Sex, and Race: Preliminary Estimates by Demographic Analysis," Washington, D.C., Table 1.

-----. 1988a. "The Coverage of Population in the 1980 Census," by Robert Fay, Jeffrey S. Passel, and J. Gregory Robinson. Evaluation and Research Reports, PHC80-E4, Table 3.2.

Robinson, J. Gregory, B. Ahmed, P. Das Gupta, and K. A. Woodrow. 1993. "Estimation of Population Coverage in the 1990 United States Census Based on Demographic Analysis." *Journal of the American Statistical Association,* 88(423): 1061-1071, Table 2.

Figure 1. Demographic Analysis Estimates of Percent Net Undercount: 1960 to 2000
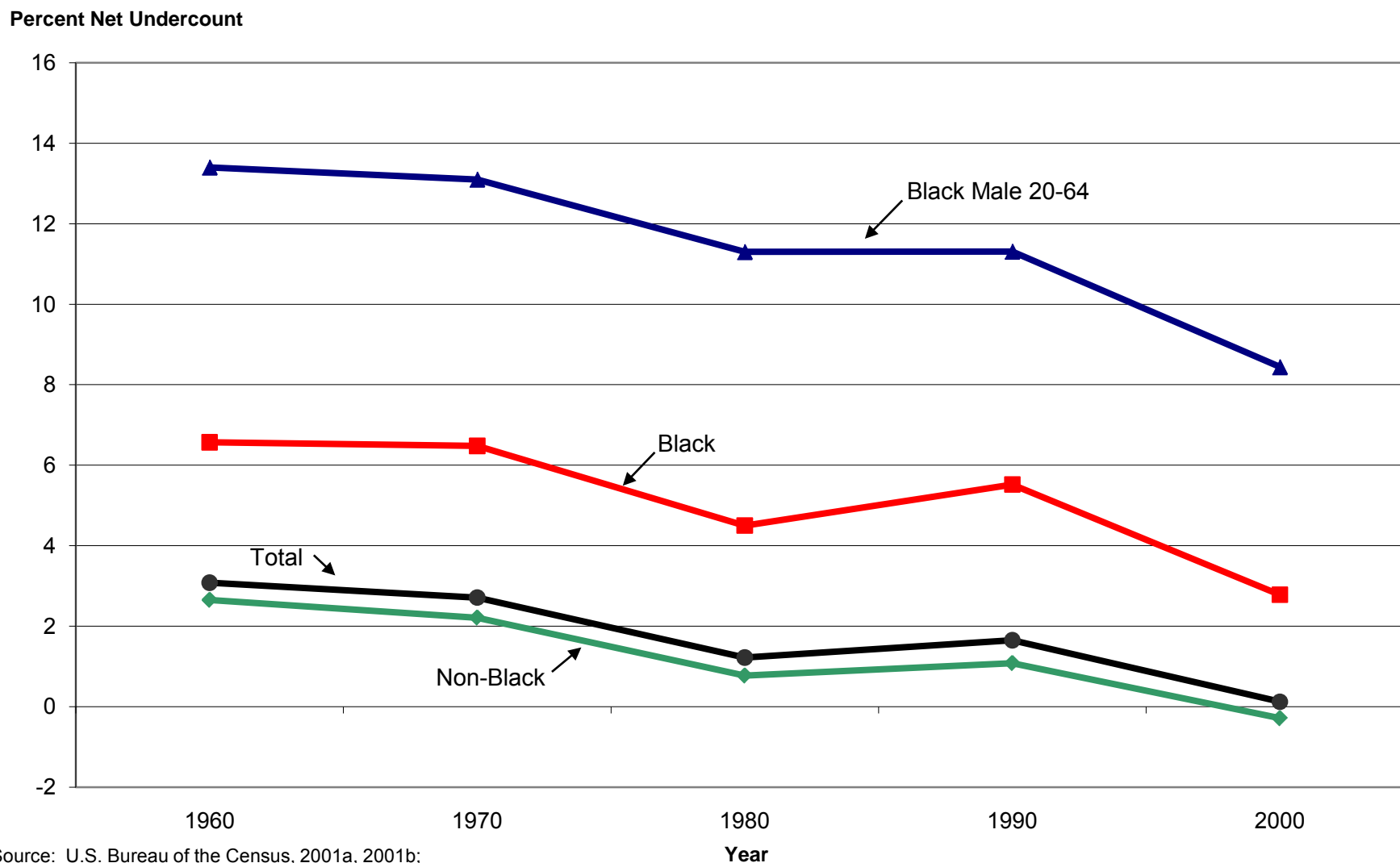
Percent Net Undercount

Figure 2.   Demographic Analysis Estimates of Percent Net Undercount By Race, Sex, and Age: 2000
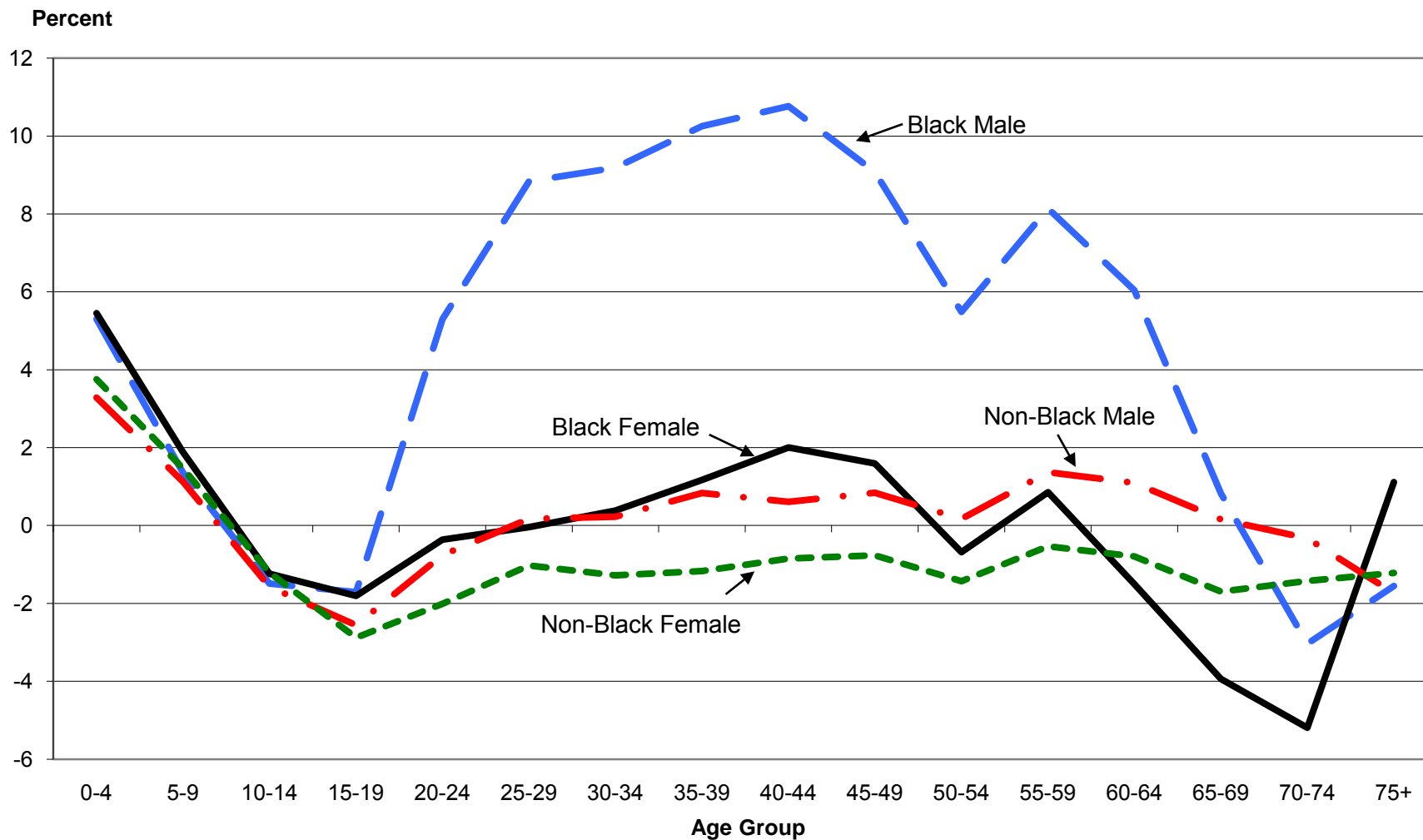
Source: Robinson et al., 2002

Figure 3. Trend in Registered Births and Births Adjusted for Underregistration: 1935-1936 to 1999-2000

Births in thousands
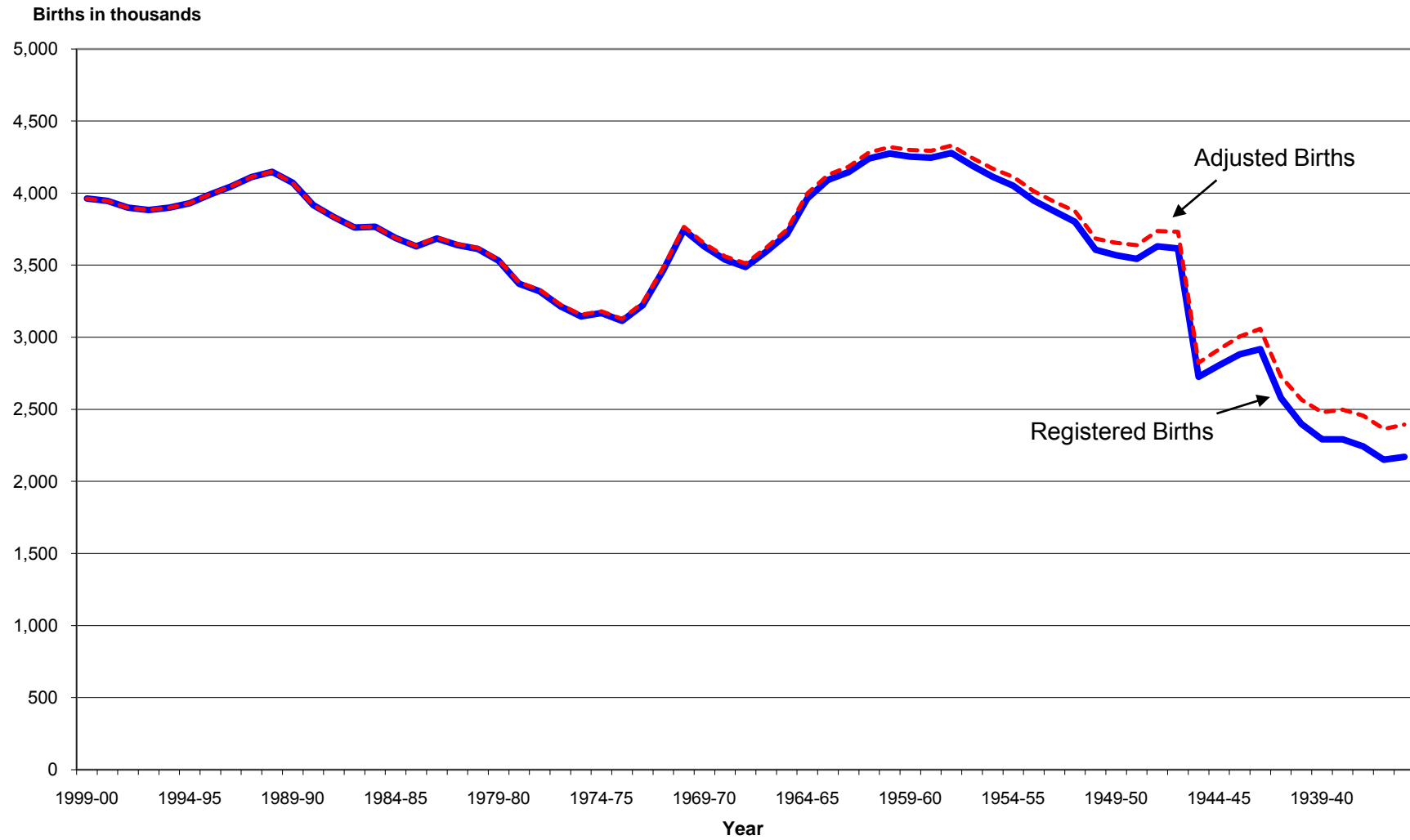
Source: See Appendix A

Figure 4. Births Minus Deaths as a Percent of the DA Population by Race, Sex, and Age: 2000

Percent of DA Total

Age Category	Non-Black Male	Non-Black Female	Black Male	Black Female
0 to 9	97	96	98	98
10 to 19	92	93	95	95
20 to 29	83	84	91	91
30 to 49	85	86	89	90
50 to 64	88	87	91	91
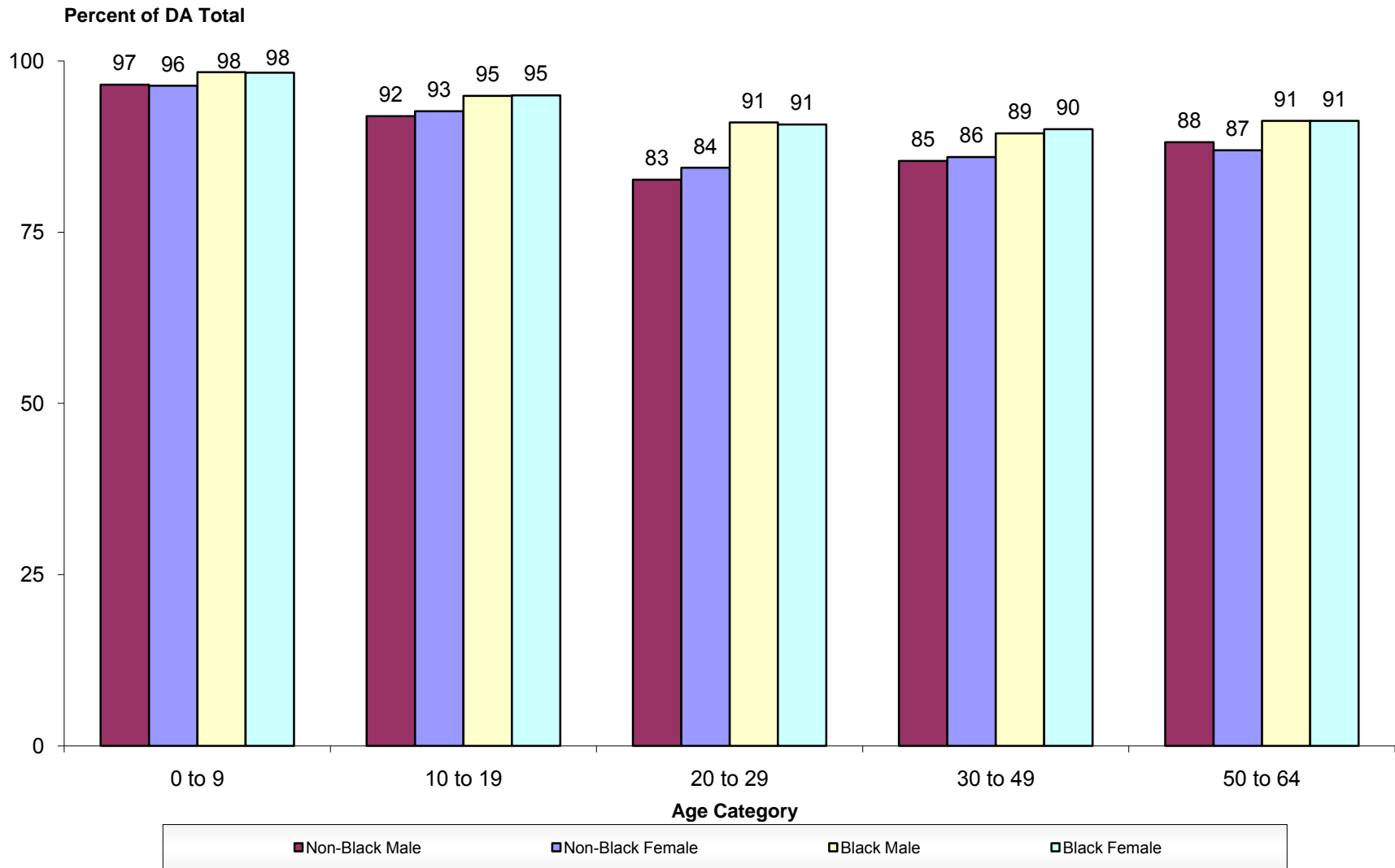
Source: Bruce et al., 2002

Figure 5. Measured Migration Minus Emigration as a Percent of the DA Population by Race, Sex and Age: 2000

Percent of DA Total

	0 to 9	10 to 19	20 to 29	30 to 49	50 to 64
Non-Black Male	0.6	2.9	5.5	10.7	10.7
Non-Black Female	0.7	2.9	6.6	10.4	11.8
Black Male	0.4	2.9	5.3	8.1	8.3
Black Female	0.4	2.8	5.9	7.9	8.4

Age Category

■ Non-Black Male   ■ Non-Black Female   □ Black Male   □ Black Female
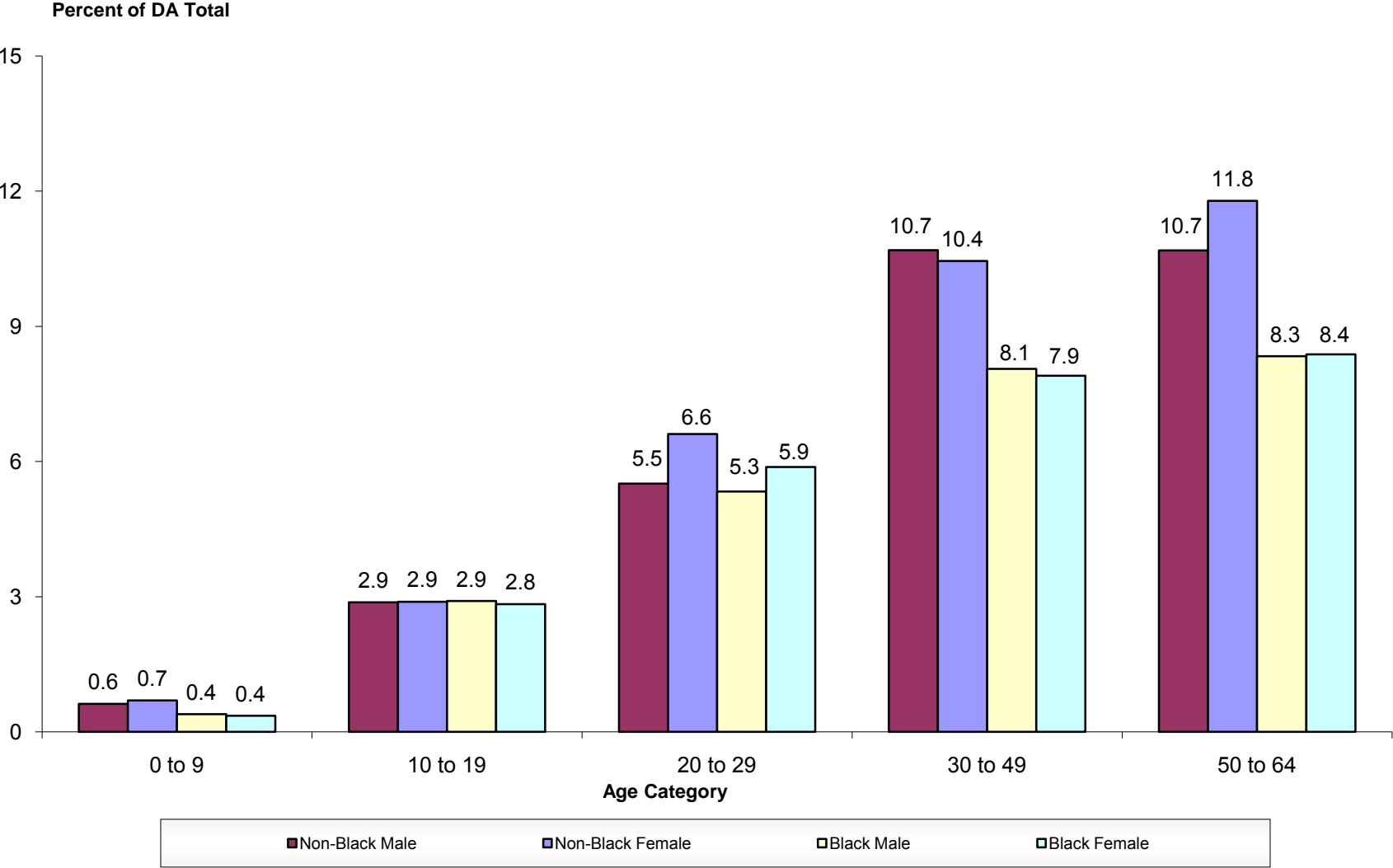
Source: Bruce et al., 2002

Figure 6. Residual Foreign Born as a Percent of the DA Population by Race, Sex, and Age: 2000

Percent of DA Total

Age Category

Non-Black Male   Non-Black Female   Black Male   Black Female
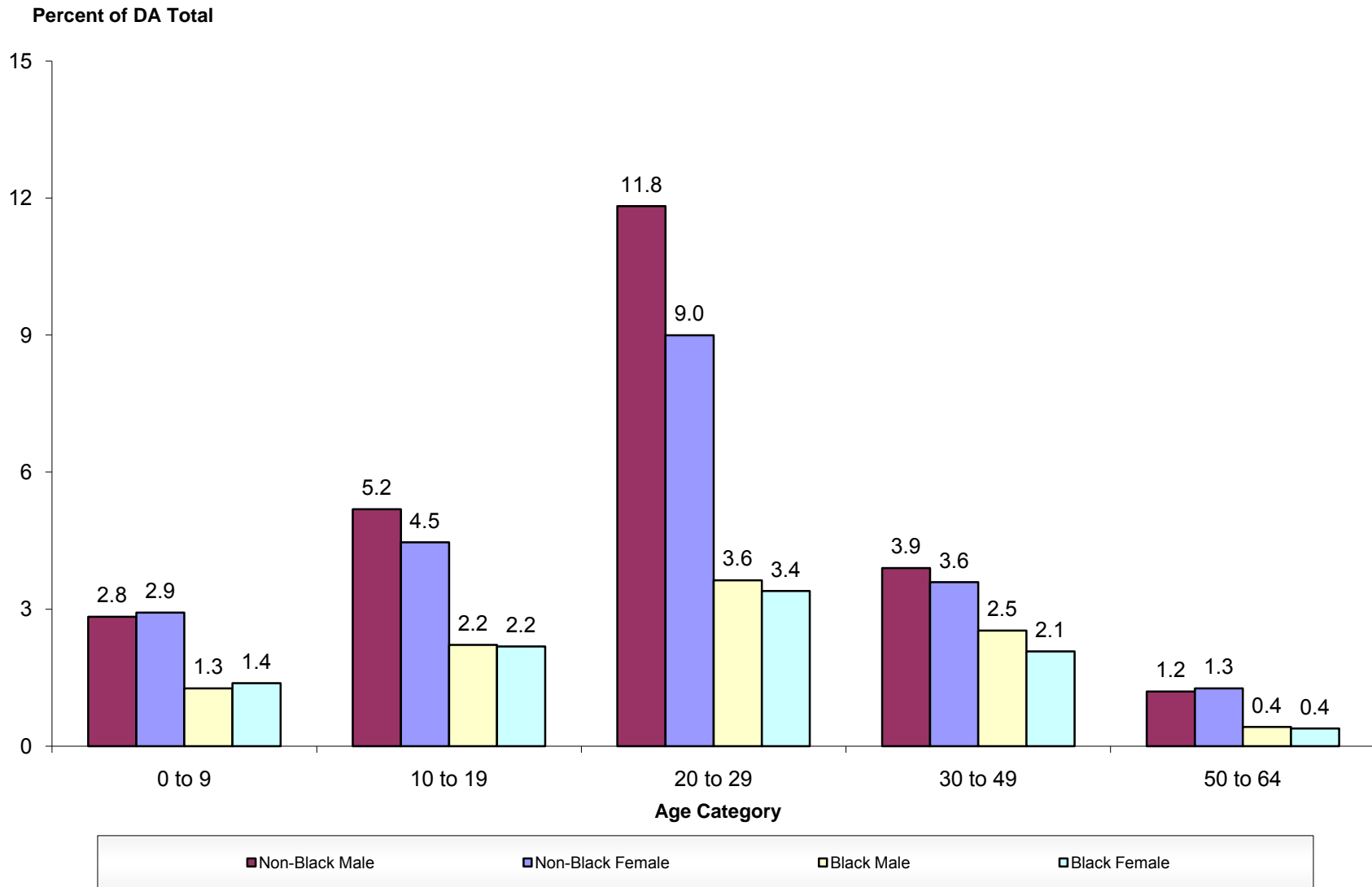
Source: Bruce et al., 2002

Figure 7. Trend in Births Adjusted for Underregistration and the Corresponding DA Population in 2000 (Ages 0 to 64)

Source: Bruce et al., 2002

Appendix Table 1. Components of Population Used to Construct the Demographic Analysis Estimates of the U.S. Resident Population
As of April 1, 2000: Component Estimates by Decade for the Population Aged 48 Years in 2000

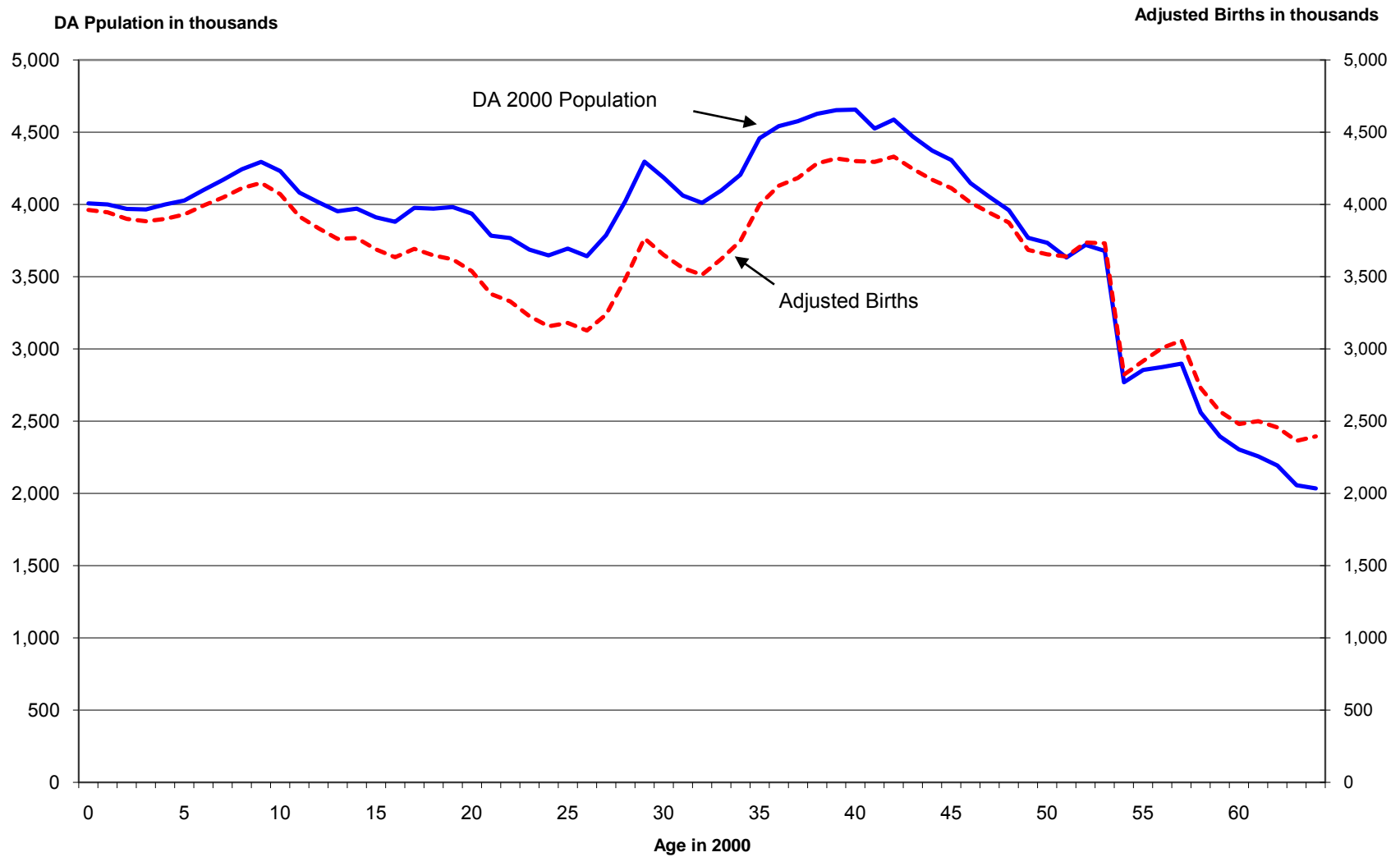| Age in 2000	Decade	Births [1] (+) 1	Deaths (-) 2	Legal Immigration (+) 3	Net Civilian Citizens (+) 4	Net Puerto Rican Migration (+) 5	Residual Foreign Born [2] (+) 6	Legal Emigration (-) 7	Temporary Migrants (+) 8	Net Armed Forces Overseas (-) 9	DA Total Resident Population 10=f(1-9)	Census Total Population 11	Difference between DA and Census 2000 12=10-11	Percent Difference 13=12/10*100
Total Population														
Age 48 in 2000		3,873,864	376,499	466,238	17,038	22,507	59,353	107,019	3,777	783	3,958,476	3,885,145	73,331	1.85
Non-Black Male														
Age 48 in 2000														
Cumulative	1950-2000	1,725,524	191,625	204,680	7,557	10,300	28,707	47,211	2,397	631	1,739,697	1,705,601	34,096	1.96
By Decade:														
Age 38 to 48	1990-2000	-	56,475	37,221	59	-751	28,707	7,551	-1,592	-6,493	1,739,697	1,705,601	34,096	1.96
Age 28 to 38	1980-1990	-	31,156	76,429	-374	85	20,975	18,846	-2,260	-5,580	1,754,562	1,625,884	128,678	7.33
Age 18 to 28	1970-1980	-	29,720	49,461	1,181	3,528	40,780	11,951	3,251	-9,302	1,744,908	1,638,134	106,774	6.12
Age 8 to 18	1960-1970	-	13,037	23,351	6,885	3,703	10,786	5,662	2,998	22,007	1,689,862	1,666,918	22,944	1.36
Birth to age 8	1950-1960	1,725,524	61,237	18,218	-194	3,735	999	3,201	0	0	1,683,844	1,628,434	55,410	3.29
Non-Black Female														
Age 48 in 2000														
Cumulative	1950-2000	1,630,723	100,798	215,012	7,879	11,205	27,216	50,313	1,380	46	1,742,260	1,736,541	5,719	0.33
By Decade:														
Age 38 to 48	1990-2000	-	27,245	47,752	2,741	-325	27,216	6,876	-1,918	-440	1,742,260	1,736,541	5,719	0.33
Age 28 to 38	1980-1990	-	12,625	60,866	2,012	385	26,115	16,059	1,322	-721	1,726,590	1,635,375	91,215	5.28
Age 18 to 28	1970-1980	-	9,996	64,380	-1,244	4,030	30,569	18,346	722	1,171	1,694,422	1,634,967	59,455	3.51
Age 8 to 18	1960-1970	-	6,034	24,335	4,476	3,440	10,411	5,950	1,254	35	1,635,889	1,639,522	(3,633)	-0.22
Birth to age 8	1950-1960	1,630,723	44,898	17,679	-106	3,676	776	3,082	0	0	1,604,768	1,563,436	41,332	2.58
Black Male														
Age 48 in 2000														
Cumulative	1950-2000	260,873	53,329	23,964	170	492	1,270	4,501	0	114	228,826	204,071	24,755	10.82
By Decade:														
Age 38 to 48	1990-2000	-	17,412	4,813	12	-51	1,270	665	-208	-1,838	228,826	204,071	24,755	10.82
Age 28 to 38	1980-1990	-	10,079	12,135	-11	16	736	2,207	-894	-2,021	239,964	196,407	43,557	18.15
Age 18 to 28	1970-1980	-	7,740	4,958	98	207	3,536	1,226	934	1,601	241,783	202,320	39,463	16.32
Age 8 to 18	1960-1970	-	2,590	1,826	361	194	957	291	168	2,372	243,574	228,540	15,034	6.17
Birth to age 8	1950-1960	260,873	15,508	232	-290	126	0	112	0	0	245,321	228,796	16,525	6.74
Black Female														
Age 48 in 2000														
Cumulative	1950-2000	256,744	30,747	22,581	1,432	510	2,161	4,995	0	-8	247,693	238,933	8,761	3.54
By Decade:														
Age 38 to 48	1990-2000	-	9,672	5,181	789	-33	2,161	609	-173	-189	247,693	238,933	8,761	3.54
Age 28 to 38	1980-1990	-	4,520	9,262	861	39	1,919	1,861	-173	-288	251,778	229,787	21,991	8.73
Age 18 to 28	1970-1980	-	2,933	5,835	-170	221	3,679	2,059	272	466	249,643	233,547	16,096	6.45
Age 8 to 18	1960-1970	-	1,278	2,055	256	166	1,252	348	74	3	246,516	235,450	11,066	4.49
Birth to age 8	1950-1960	256,744	12,344	248	-304	116	0	118	0	0	244,342	228,668	15,674	6.41

' - ' = not applicable

Sources: See Appendix A

[1] Births for April 1, 1951 to March 31,1952, adjusted for underregistration

[2] The residual foreign-born estimates are not cumulative; a DA estimate of the legally resident population is developed for each census comparison and a stock estimate of the residual foreign-born/undocumented population is added.

Appendix Table 2. Components of Population Used to Construct the Demographic Analysis Estimates of the U.S. Resident Population as of April 1, 2000: Ages Under 65

Age in 2000	Decade	Births [1] (+)	Deaths (-)	Legal Immigration (+)	Net Civilian Citizens (+)	Net Puerto Rican Migration (+)	Residual Foreign Born [2] (+)	Legal Emigration (-)	Temporary Migrants (+)	Net Armed Forces Overseas (-)	DA Total Resident Population 10=f(1-9)	Census Total Population 11	Difference between DA and Census 2000 12=10-11	Percent Difference 13=12/10*100
		1	2	3	4	5	6	7	8	9				
Total		**234,860,298**	**14,766,736**	**20,332,038**	**891,940**	**905,698**	**9,982,932**	**5,485,117**	**776,002**	**324,639**	**281,759,858**	**281,421,906**	**337,952**	**0.12**
0	1999-00	3,961,602	23,493	2,485	(1,196)	86	67,138	1,504	1,146	-	4,006,264	3,805,648	200,616	5.01
1	1998-99	3,945,403	29,679	12,513	(3,065)	256	70,347	4,564	7,186	-	3,998,397	3,820,582	177,815	4.45
2	1997-98	3,898,412	30,747	18,341	(3,111)	430	86,624	7,720	6,344	-	3,968,573	3,790,446	178,127	4.49
3	1996-97	3,882,831	32,072	22,931	(2,678)	616	90,852	10,950	13,673	-	3,965,203	3,832,799	132,404	3.34
4	1995-96	3,898,606	34,140	28,645	(2,692)	820	110,749	14,237	10,815	-	3,998,567	3,926,323	72,244	1.81
5	1994-95	3,930,609	36,739	33,324	(2,055)	1,005	107,611	17,763	11,057	-	4,027,050	3,965,103	61,947	1.54
6	1993-94	3,992,092	39,662	39,003	(461)	1,162	121,141	21,513	7,887	-	4,099,649	4,019,705	79,944	1.95
7	1992-93	4,045,919	42,623	47,522	1,473	1,330	130,788	25,269	9,151	-	4,168,291	4,118,147	50,144	1.20
8	1991-92	4,111,537	47,143	56,831	4,383	1,504	137,425	29,020	7,193	-	4,242,709	4,179,230	63,479	1.50
9	1990-91	4,148,094	48,165	68,235	5,830	1,680	144,367	32,759	5,500	-	4,292,782	4,267,320	25,462	0.59
10	1989-90	4,070,554	53,137	79,077	8,067	1,902	151,968	36,124	7,434	-	4,229,741	4,274,056	(44,315)	-1.05
11	1988-89	3,916,303	50,368	92,050	9,923	2,156	141,842	39,137	7,500	-	4,080,269	4,115,093	(34,824)	-0.85
12	1987-88	3,833,478	51,422	106,912	11,762	2,405	147,414	42,160	5,701	-	4,014,090	4,075,842	(61,752)	-1.54
13	1986-87	3,761,690	52,224	118,711	13,615	2,632	147,407	45,175	4,357	-	3,951,013	4,010,850	(59,837)	-1.51
14	1985-86	3,767,164	54,698	134,226	15,057	2,859	149,041	48,165	5,205	-	3,970,691	4,052,231	(81,540)	-2.05
15	1984-85	3,687,597	56,467	148,374	16,173	3,355	159,221	52,056	3,582	-	3,909,779	4,019,404	(109,625)	-2.80
16	1983-84	3,634,527	58,994	161,446	17,066	4,120	171,000	56,840	6,509	-	3,878,834	3,975,021	(96,187)	-2.48
17	1982-83	3,691,277	63,793	174,760	17,598	4,880	205,011	61,579	7,055	64	3,975,144	4,046,012	(70,868)	-1.78
18	1981-82	3,645,966	67,999	190,259	17,392	5,658	231,526	66,291	16,855	3,345	3,970,020	4,051,598	(81,578)	-2.05
19	1980-81	3,618,254	74,347	206,324	16,758	6,429	261,066	70,996	27,952	11,336	3,980,104	4,127,855	(147,751)	-3.71
20	1979-80	3,537,447	79,733	228,143	14,970	7,943	289,941	78,305	32,007	16,968	3,935,446	4,049,448	(114,002)	-2.90
21	1978-79	3,378,569	82,466	241,322	13,927	9,108	297,330	83,550	26,977	18,108	3,783,110	3,841,082	(57,972)	-1.53
22	1977-78	3,327,844	87,245	245,669	14,553	10,214	329,488	88,588	31,692	17,965	3,765,662	3,758,648	7,014	0.19
23	1976-77	3,226,434	91,656	252,603	15,552	11,312	353,707	93,444	28,013	16,103	3,686,419	3,673,582	12,837	0.35
24	1975-76	3,155,250	97,036	259,635	16,622	12,393	380,155	98,153	32,231	15,103	3,645,995	3,641,241	4,754	0.13
25	1974-75	3,179,680	103,301	273,623	16,887	13,683	401,125	101,857	28,560	14,527	3,693,873	3,744,539	(50,666)	-1.37
26	1973-74	3,126,844	109,521	295,167	16,735	14,519	392,867	104,578	22,636	13,647	3,641,022	3,619,660	21,362	0.59
27	1972-73	3,238,101	120,485	320,359	17,231	15,302	402,881	107,241	32,577	13,009	3,785,716	3,789,800	(4,084)	-0.11
28	1971-72	3,481,912	135,132	345,219	19,455	16,043	392,437	109,874	24,142	13,856	4,020,347	3,984,812	35,535	0.88
29	1970-71	3,764,783	150,477	371,459	22,748	16,777	366,067	112,510	27,814	12,066	4,294,594	4,242,525	52,069	1.21
30	1969-70	3,649,839	155,173	411,458	28,735	18,653	324,900	115,807	32,821	10,612	4,184,814	4,289,970	(105,156)	-2.51
31	1968-69	3,559,756	160,298	450,015	27,214	19,363	266,976	120,258	28,235	9,638	4,061,366	4,011,575	49,791	1.23
32	1967-68	3,512,133	168,385	481,650	26,537	20,016	246,330	124,423	26,193	9,209	4,010,842	3,994,121	16,721	0.42
33	1966-67	3,620,468	182,321	505,709	25,865	20,555	222,299	128,181	20,511	9,360	4,095,547	4,026,573	68,974	1.68
34	1965-66	3,745,707	201,083	524,740	25,110	21,056	213,195	131,579	17,064	9,467	4,204,743	4,188,149	16,594	0.39
35	1964-65	3,997,895	224,228	539,163	24,781	20,360	220,089	133,109	22,220	9,902	4,457,270	4,516,118	(58,848)	-1.32
36	1963-64	4,127,404	241,698	550,755	25,097	19,328	185,429	132,716	17,623	9,426	4,541,797	4,511,168	30,629	0.67
37	1963-63	4,183,515	254,842	555,255	25,938	18,662	169,862	132,126	18,762	8,775	4,576,250	4,517,060	59,190	1.29
38	1961-62	4,281,846	271,753	550,470	27,237	18,580	147,997	131,356	11,753	7,741	4,627,034	4,553,814	73,220	1.58
39	1960-61	4,318,043	286,802	548,086	28,671	18,859	145,666	130,450	15,169	6,211	4,651,031	4,608,504	42,527	0.91

Appendix Table 2. Components of Population Used to Construct the Demographic Analysis Estimates of the U.S. Resident Population as of April 1, 2000: Ages Under 65

Age in 2000	Decade	Births [1] (+) 1	Deaths (-) 2	Legal Immigration (+) 3	Net Civilian Citizens (+) 4	Net Puerto Rican Migration (+) 5	Residual Foreign Born [2] (+) 6	Legal Emigration (-) 7	Temporary Migrants (+) 8	Net Armed Forces Overseas (-) 9	DA Total Resident Population 10=f(1-9)	Census Total Population 11	Difference between DA and Census 2000 12=10-11	Percent Difference 13=12/10*100
40	1959-60	4,298,559	300,236	546,203	34,400	19,027	181,381	129,149	10,827	5,065	4,655,948	4,711,434	(55,486)	-1.19
41	1958-59	4,293,296	313,342	532,878	35,793	19,429	77,378	126,287	9,369	3,862	4,524,653	4,466,676	57,977	1.28
42	1957-58	4,330,260	326,384	526,528	35,510	19,677	117,587	123,259	10,053	3,692	4,586,281	4,547,220	39,061	0.85
43	1956-57	4,244,815	334,185	521,667	33,604	19,507	96,622	120,122	9,793	3,357	4,468,344	4,407,870	60,474	1.35
44	1955-56	4,169,202	340,805	514,553	30,673	19,084	89,726	116,892	9,716	2,886	4,372,371	4,308,663	63,708	1.46
45	1954-55	4,111,377	349,700	503,091	27,629	20,018	104,493	113,853	5,251	2,537	4,305,771	4,341,460	(35,689)	-0.83
46	1953-54	4,012,229	358,768	488,362	24,512	20,599	66,979	110,886	6,273	2,090	4,147,210	4,087,563	59,647	1.44
47	1952-53	3,940,565	368,076	478,924	20,963	21,378	61,627	108,467	3,721	1,274	4,049,360	4,019,692	29,668	0.73
48	1951-52	3,873,864	376,499	466,238	17,038	22,507	59,353	107,019	3,777	783	3,958,476	3,885,145	73,331	1.85
49	1950-51	3,684,647	378,736	461,656	13,049	23,725	66,959	106,044	4,356	1,982	3,767,630	3,758,544	9,086	0.24
50	1949-50	3,654,383	392,768	459,176	14,158	25,725	77,677	105,535	3,660	3,622	3,732,853	3,808,515	(75,662)	-2.03
51	1948-49	3,638,237	410,247	447,895	9,197	27,571	23,916	105,736	5,664	5,540	3,630,957	3,616,997	13,960	0.38
52	1947-48	3,736,153	433,717	439,338	5,906	28,429	53,505	104,955	1,932	6,842	3,719,750	3,707,436	12,314	0.33
53	1946-47	3,730,604	437,931	420,004	4,892	27,797	37,982	102,732	4,140	6,976	3,677,779	3,635,040	42,739	1.16
54	1945-46	2,821,645	397,436	395,920	5,163	26,194	19,058	99,540	2,983	6,200	2,767,788	2,817,560	(49,772)	-1.80
55	1944-45	2,915,716	418,920	380,619	5,032	24,785	46,435	97,004	2,226	4,603	2,854,287	2,850,600	3,687	0.13
56	1943-44	3,005,526	454,580	367,804	4,760	22,963	21,945	95,042	2,386	3,018	2,872,744	2,837,452	35,292	1.23
57	1942-43	3,057,883	479,446	358,608	3,943	21,406	27,435	92,722	1,599	1,868	2,896,837	2,864,020	32,817	1.13
58	1941-42	2,727,555	476,786	350,259	2,381	20,501	26,413	89,995	590	1,180	2,559,738	2,540,152	19,586	0.77
59	1940-41	2,566,306	480,991	345,943	577	19,978	29,128	87,008	1,037	452	2,394,519	2,377,013	17,506	0.73
60	1939-40	2,480,000	495,930	341,756	(768)	19,251	39,320	84,173	2,138	(816)	2,302,409	2,319,944	(17,535)	-0.76
61	1938-39	2,498,299	525,578	333,626	(1,813)	18,357	13,120	81,349	469	(175)	2,255,306	2,221,227	34,079	1.51
62	1937-38	2,456,163	555,163	327,200	(2,530)	17,460	27,517	79,223	1,574	346	2,192,651	2,171,072	21,579	0.98
63	1936-37	2,363,375	583,831	319,433	(2,874)	16,594	19,553	78,248	1,209	444	2,054,767	2,053,151	1,616	0.08
64	1935-36	2,394,253	625,143	311,889	(2,957)	15,725	16,541	77,949	2,157	577	2,033,939	2,040,053	(6,114)	-0.30

' - ' = not applicable

Sources: See Appendix A

[1] Births for April 1, 1951 to March 31,1952, adjusted for underregistration

[2] The residual foreign-born estimates are not cumulative; a DA estimate of the legally resident population is developed for each census comparison and a stock estimate of the

residual foreign-born/undocumented population is added.

Note: The DA estimates by single years of age for the population aged 65 and over are based on Medicare data (see page 4 of the text).