Unauthorized Immigration to the United States: Annual Estimates and Components of Change, by State, 1990 to 2010[1]

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We describe a method for producing annual estimates of the unauthorized immigrant population in the United Sates and components of population change, for each state and DC, for 1990–2010. We quantify a sharp drop in the number of unauthorized immigrants *arriving* since 2000, and we demonstrate the role of *departures* from the population (emigration, adjustment to legal status, removal by the Department of Homeland Security [DHS], and deaths) in reducing population growth from one million in 2000 to population *losses* in 2008 and 2009. The number arriving in the U.S. peaked at more than one million in 1999–2001 and then declined rapidly through 2009. We provide evidence that population growth stopped after 2007 primarily because entries declined and not because emigration increased during the economic crisis. Our estimates of the total unauthorized immigrant population in the U.S. and in the top ten states are comparable to those produced by DHS and the Pew Hispanic Center. However, our data and methods produce estimates with smaller ranges of sampling error.

Few demographic estimates diverge as widely as do those pertaining to the size of America's unauthorized immigrant population. Highly publicized estimates of the total number of unauthorized immigrants *residing*

in the U.S. in recent years range from 10.8 million (Hoefer, Rytina, and Baker, 2011) to 13 million (Martin and Ruark, 2011) to 20 million (Justich and Ng, 2005; Elbel, 2007).[2] Likewise, recent estimates of the gross annual number of unauthorized immigrants *entering* the U.S. range from 300,000 (Passel and Cohn, 2010) to a million (Smith, 2011).[3] Few other demographic estimates diverge as widely or receive so much public attention.

One reason that these diverging demographic estimates generate so much public attention is that they inform any number of contentious public policy discussions at the national and state levels. Should the U.S. grant amnesty to unauthorized immigrant workers? Should we support unauthorized immigrants who came to the U.S. as small children if they wish to attend college or serve in the U.S. armed forces? Should we do more to enforce immigration laws, particularly along the U.S.-Mexico border? Answers to these questions depend in part on the size of the unauthorized immigrant population – at both the national and state levels – and/or on the number of unauthorized immigrants who enter and leave the country each year. Disagreement about those numbers fuels disagreement on these and other contentious policy matters.

Beyond these several policy considerations, estimates of the unauthorized immigrant population are also relevant for academic and applied research on the changing composition and characteristics of the U.S. population. What are the economic costs to native-born workers of unauthorized immigration? How many children should a public school district expect to serve in coming years? How has the racial/ethnic composition of America changed in recent years, and what are the social and economic implications of those changes? How can city planning offices effectively forecast demand on local government services? What are the social and economic predictors of the size and character of migration streams across international borders? The answers to these sorts of questions also

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[2]Passel (1986) and others distinguish between "analytic" estimates – those based on systematic analysis of publicly available data – and "speculative" estimates based on conjecture and/or the misuse of data. In this article, we are only concerned with analytic estimates. Although speculative estimates – such as those by Justich and Ng (2005) and Elbel (2007) – often receive as much public attention as analytic estimates, they are not subject to verification or methodological improvement.

[3]Less attention is paid to estimates of the number of unauthorized immigrants who *leave* the U.S. each year (Warren and Peck, 1980; Ahmed and Robinson, 1994; Van Hook and Zhang, 2011).

depend on demographic estimates of America's unauthorized immigrant population.

Although one particular estimate – the total number of unauthorized immigrants *residing* in the U.S. – generates the most attention, there are important policy and research questions that require more detailed and disaggregated estimates. For example, we believe that it is just as important to understand net annual change in the size of that population, as well as the components of that change. This requires information about how many unauthorized immigrants *enter* the U.S. each year and how many *depart* via removal by the Department of Homeland Security (DHS), voluntary emigration, or death. It is also important to understand where unauthorized immigrants come from, what their destination states are, and how these patterns have changed over time. In this article, we describe a method for producing reliable annual estimates of the unauthorized immigrant population and of the components of change in that population, all disaggregated by state. Our methods improve upon other available estimates, provide more useful levels of statistical disaggregation, and can be replicated going forward at the national and state levels.

Our estimate of the unauthorized immigrant population in the United States – 11.7 million as of January 2010 – does not differ markedly from other recent estimates using similar data and methods (*e.g.,* Hoefer, Rytina, and Baker, 2011; Passel and Cohn, 2011). However, our estimates allow unique assessments of trends over time in the size of that population and of the component processes generating those trends. For example, we demonstrate below that the declining size of the unauthorized immigrant population in recent years has occurred not just because of rapidly declining inflows (*i.e.,* immigrants entering without inspection or overstaying their visas) but also because the number departing from the population is large and increasing. What is more, we demonstrate important heterogeneity across states in these patterns. Finally, as we explain below, our estimates are subject to less sampling error than other recently published estimates.

REVIEW AND CRITIQUE OF EARLY ESTIMATES

Early estimates of the number of unauthorized immigrants *residing* in the U.S. were based on strong assumptions and the creative use of very limited data (Siegel, Passel, and Robinson, 1980; Espenshade, 1995; Donato and Armenta, 2011). For example, Robinson (1980) began with the

estimated number of foreign-born Latinos counted in the 1950 through 1970 decennial censuses and a 1975 intercensal enumeration; used age-specific mortality rates to compute the expected numbers of death that should have been observed in various geographic areas; compared those expected numbers of deaths to the actual numbers of death records in the vital statistics system; and assumed that the difference between those figures represented the number of unauthorized (Latino) immigrants. As the author noted this procedure relies on the now discredited assumption that few unauthorized immigrants are counted in federal censuses and the assumption that most of their deaths are reflected in the vital statistics system. Another example: Bean, King, and Passel (1983) based their estimates of the number of unauthorized Mexican immigrants on sex ratios observed in the 1980 Mexican Census and on assumptions about the gender composition of those immigrants, the sex ratio at birth of Mexican babies, and the undercount of men in the Mexican Census. See Bos (1984) and Hill (1985) for a discussion of the methodological challenges faced in many of these pioneering efforts.

Early estimates of the number of unauthorized immigrants *entering* the U.S. also relied on the use of limited data and on important assumptions (Frisbie, 1975; Heer, 1979; Espenshade, 1995). For example, a number of observers have estimated the probability that an undocumented migrant is apprehended along the U.S.-Mexico border and then combined that with data on the annual number of such apprehensions to produce an estimate of the annual gross flow of undocumented migrants from Mexico (*e.g.,* Espenshade, 1990; Massey and Singer, 1995). The quality of such estimates depends on the questionable accuracy of apprehension probabilities; in any case, these estimates have been produced only episodically and then only for Mexico.

REVIEW OF RECENT ESTIMATES

In recent years, virtually all systematic estimates have been based on some form of the residual method,[4] a variant of capture–recapture and dual system estimation procedures used in demography and elsewhere (*e.g.,* Sekar and Deming, 1949; Shryock, Siegel, and Associates, 1973). In general,

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[4]One exception is Warren (1994), whose national estimates were based on data from the Immigration Reform and Control Act (IRCA) legalization program, estimates of non-immigrant overstays, and estimates for Mexico based on the residual method.

this method involves comparing the *total* number of foreign-born people to the number of *authorized* immigrants. The difference between these figures (perhaps after some adjustments) is an estimate of the number of *unauthorized* immigrants. As reviewed by Bos (1984), Hill (1985), and Passel (1986), estimates based on the residual method are sensitive to how "authorized" and "unauthorized" immigrants are defined and counted. Some foreign-born people – such as students or tourists who overstay their visas – were authorized to enter the U.S. upon arrival, but should not necessarily be counted as authorized immigrants. Others – such as asylees and parolees who have work authorization but who have not adjusted to permanent resident status and aliens who are allowed to remain and work in the United States under various legislative provisions – may have entered the U.S. without authorization, but should not necessarily be classified as unauthorized immigrants.

Lancaster and Scheuren (1977) were among the first to use the residual method to estimate the number of unauthorized immigrants residing in the United States. They began with an estimate of the *total* civilian non-institutionalized adult population based on matched March 1973 Current Population Survey (CPS) and administrative record data (80.2 million), subtracted from that an estimate of the *legal* civilian non-institutionalized adult population based on adjusted 1970 Census data (76.3 million), and arrived at an estimate of the number of *illegal* immigrant adults in April 1973 (3.9 million). More recently, Passel and Woodrow (1984) and Warren and Passel (1987) estimated the number of unauthorized immigrants counted in the 1980 Census (2.06 million) by comparing the non-naturalized foreign-born population in the 1980 Census (7.44 million) to the non-naturalized legally resident immigrant population at the time of the 1980 Census (5.38 million). Using similar methods, Woodrow and Passel (1990) used 1986 and 1988 CPS data to show that the number of unauthorized immigrants in the U.S. declined precipitously (from 3.16 to 1.91 million) after IRCA. Likewise, Warren (2003) used residual methods to estimate that about 7 million unauthorized immigrants lived in the U.S. in January 2000.

The residual method has also been used to estimate the annual number of unauthorized immigrants *entering* (and remaining) in the U.S. and the annual *net change* in that population. These figures are based on (1) the estimated total number of unauthorized immigrants after disaggregating by year of entry; (2) information from administrative records on annual numbers of legal entrants and removals (*e.g.,* U.S. Department of

Homeland Security, 2010); and (3) estimated mortality and emigration rates (*e.g.,* Van Hook and Zhang, 2011). For example, Woodrow and Passel (1990) used this method to conclude that the average annual net increase in the number of unauthorized immigrants was almost unchanged in the two years after IRCA (246,000 per year) compared with the years immediately before it (218,000 per year).

Two ongoing sets of published reports provide estimates of the size and characteristics of the unauthorized immigrant population. Both are based on the residual method. However, despite their conceptual and technical similarities, each is limited in important ways. Both have methodological limitations, but more importantly, neither provides adequately disaggregated estimates. A central goal of the current article is to overcome these limitations and to provide estimates that are more useful for applied and academic purposes.

First, since 2005, Passel, Cohn and colleagues at the Pew Hispanic Center (hereafter, Pew) have issued reports on the size and characteristics of the unauthorized immigrant population (*e.g.,* Passel, 2005; Passel and Cohn, 2009, 2011). Their estimates begin with the total number of foreign-born people residing in the U.S. as reflected in the Annual Social and Economic Supplement to the March CPS. They subtract from that figure the estimated number of legal residents based on data collected by DHS and other government agencies; for their purposes, these include naturalized citizens, legal permanent residents, refugees, asylees and parolees; and legal temporary residents (*e.g.,* students and workers in some high-technology industries). Some of their reports include estimates of annual net change in the size of the unauthorized immigrant population (Passel and Cohn, 2008, 2010). The Pew estimates are typically disaggregated by state of residence, geographic regions of origin, and five-year periods of entry.

Second, in recent years the Department of Homeland Security's (DHS) Office of Immigration Statistics (OIS) has issued reports on the size and characteristics of the unauthorized immigrant population (*e.g.,* Hoefer, Rytina, and Campbell, 2006; Hoefer, Rytina, and Baker, 2011). Their estimates begin with the total number of foreign-born people residing in the U.S. as reflected in the annual American Community Survey (ACS). Like the Pew estimates, they subtract from that figure the estimated number of legal residents based on data collected by DHS and other government agencies; these include naturalized citizens, legal permanent residents, asylees, refugees, and non-immigrants (*e.g.,* students

and temporary workers). The OIS estimates are typically disaggregated by state of residence, region and country of origin, and period of entry. These reports have typically included a statement about the average annual net change in the unauthorized immigrant population over a period of several years.

The Pew and OIS estimates are similar at the national level and for larger states. For example, their estimates of the total unauthorized immigrant population in early 2010 were 11.2 and 10.8 million, respectively (Hoefer, Rytina, and Baker, 2011; Passel and Cohn, 2011). Both estimated that California was home to 2.6 million unauthorized immigrants.

CRITIQUE OF RECENT ESTIMATES

The Pew and OIS estimates are based on methods that, in significant aspects, are similar to our own, and they are useful for a number of academic and policy applications. However, in some important areas – estimates for states with relatively smaller populations, analysis of long-term trends for every state, and estimates derived separately for arrivals and departures – our estimates should prove to be more useful. Below we review four conceptual and technical differences between those estimates and ours.

First, neither the Pew nor the OIS reports routinely disaggregate annual net change in the unauthorized immigrant population into its component parts: inflows and outflows. Net change is a function of people *entering* that population (mainly via "entering without inspection" or overstaying temporary visas) and *leaving* that population (via removal by DHS, death, adjusting to authorized status, or voluntary emigration). Both Pew and OIS report annual net change, and in some reports, Pew describes total inflows for selected years (*e.g.*, Passel and Cohn, 2010: iii). However, there is a considerable amount of policy and research interest in the components of entry and exit from the population of authorized immigrants. How many unauthorized immigrants enter the U.S. each year, either by "entering without inspection" or by overstaying a student, tourist, or other temporary visa? How many unauthorized residents are removed by DHS? How many simply leave voluntarily? How many adjust to lawful status? Without access to disaggregated components of change of this sort, it becomes difficult to interpret net change in the unauthorized immigrant population. For example, Pew and OIS each reported that the size of that population declined between 2008 and 2009, by 500,000

(Passel and Cohn, 2011) and 800,000 (Hoefer, Rytina, and Baker, 2011), respectively. Did this decline happen mainly because fewer people entered the country without authorization, because fewer people who were admitted temporarily overstayed their visas, because of a growing numbers of removals by DHS, or because of increasing rates of emigration? Likewise, what are the relative contributions of these components of change to the increase in the overall size of the unauthorized immigrant population in earlier years? The Pew and OIS reports provide very limited evidence regarding these questions, despite their fundamental importance for policy and research purposes.

Second, like OIS, we use data from the American Community Survey; the Pew estimates are based on data from the CPS. The relatively small size of the CPS sample – even when expanded somewhat for the March supplement – yields substantially larger ranges of sampling error in the Pew estimates. For example, the 90 percent confidence interval for Pew's CPS-based estimate of the unauthorized immigrant population in 2010 was 11.2 million $\pm$ 500,000 (Passel and Cohn, 2011: Table 2). In contrast, the 90 percent confidence interval for the parallel OIS figure – based on the ACS, which includes 30 times as many observations as the CPS – was 10.8 million $\pm$ 149,000 (Hoefer, Rytina, and Baker, 2011: 2). This uncertainty in the CPS-based estimates leads the authors of the Pew reports to aggregate data in a way that obscures potentially important detail. For example, the authors sometimes aggregate across states (as described below) and combine countries of origin in their reports such that all unauthorized immigrants are classified as originating from (1) Mexico, (2) other Latin American countries, (3) Asia, (4) Europe or Canada, or (5) elsewhere. Statistical uncertainty with CPS-based estimates also leads to problems with statistical power when analyzing trends over time. For instance, the authors of the Pew reports describe the decline in the number of unauthorized immigrants between 2007 (12.0 million) and 2009 (11.1 million). This decline of nearly one million was not statistically significantly different from zero (Passel and Cohn, 2011: Table 2).

Third, neither the Pew nor the OIS figures are disaggregated fully and reliably by state. The OIS reports provide estimates of the size of unauthorized immigrant population only in the 10 states with the largest such populations (e.g., Hoefer, Rytina, and Baker, 2011: Table 4). Over time, the Pew reports have employed different methods to produce state estimates. In some years, they have used residual methods to directly generate estimates of the size of unauthorized immigrant population only in

the several states with the largest such populations. For the remaining states, they have employed some form of averaging across states and/or regression-based estimates. In all years and even after averaging across multiple years, the Pew estimates for states have wide margins of error; again, this is a function of the relatively small sample sizes in the March CPS. For example, even after averaging across multiple years of CPS data, their 90 percent confidence interval for the number of unauthorized immigrants in Alabama in 2010 ranged from 75,000 to 160,000 (Passel and Cohn, 2011: Table A3).

Fourth, both the Pew and OIS estimates go back in time only to 2000 (and OIS has not published estimates for 2001–2004). As we describe below, it is possible to use parallel methods to produce annual estimates back to 1990. This longer time horizon for estimates at the national and state levels is useful for policy analysts and researchers who are interested in understanding the correlates of change in the size of the unauthorized immigrant population.

Below we describe an extension of the residual method that produces separate estimates of arrivals and departures of unauthorized immigrants in addition to estimates of the size of the unauthorized immigrant population. Compared to Pew and OIS, our estimates are more statistically reliable, are available annually at both the state and national levels for 1990–2010, and include information at the national and state levels about both the size of the population and the components of annual inflows into and outflows from the population.

RESEARCH DESIGN

Our estimates are based on a comparison of the *total* foreign-born population to the *legally resident* foreign-born population; the difference between them is taken to represent the unauthorized foreign-born population. Detailed estimates were derived for each state, annually, from 1990 to 2010, and the results were summed to produce national estimates. In this section, we describe the data that we use to account for each element of both the total foreign-born and the legally resident foreign-born populations; in Table S1, we summarize these several data elements. We then describe our techniques for deriving annual national and state estimates of the unauthorized immigrant population and of the components of annual inflows into and outflows from that population.

Data

Estimates of the *total foreign-born population* – separately by state and by year of entry into the country – were obtained from the 2000 decennial census (for those moving to the U.S. between 1990 and 1999) and from the 2010 ACS (for those moving to the U.S. between 2000 and 2009). Estimates of the *legally resident foreign-born population* combine counts of (1) legal permanent residents for each state, by year of entry, and for both new arrivals and those who adjust their status (obtained from the DHS); (2) non-immigrant residents[5] for each state and by length of stay (based on arrival and departure statistics obtained from DHS); and (3) refugees for each state and by year of entry (obtained from the Office of Refugee Resettlement).

Our method also requires estimates and assumptions about (1) *emigration rates* (discussed below); (2) Census and ACS *undercount rates* (discussed below); (3) *removals* of unauthorized residents for each state and by year of entry among those living in the U.S. for six months or longer (which we base on data obtained from DHS); (4) *adjustments* from unauthorized to lawful status by state, year of entry, and year of adjustment (also based on data obtained from DHS); and (5) *mortality rates* (which we base on age-standardized crude death rates for relevant populations as discussed below). In the next few paragraphs, we explain and justify our estimates and assumptions for mortality rates, undercount rates, and emigration rates. Later, we explore the consequences of alternative assumptions about these three sets of rates for our estimates of the size of the unauthorized immigrant population.

Mortality Rates. To estimate the annual number of deaths, we computed age-adjusted crude death rates separately for unauthorized and legal immigrants. In both calculations, we used age-specific survival rates for Hispanic males in 1990 (Ahmed and Robinson, 1994: Table A2). To compute the rate for unauthorized immigrants, we used the age distribution of applicants under IRCA; for legal immigrants, we used the age distribution of legal immigrants in 1994. The crude death rate was

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[5]Non-immigrants are non-citizens admitted legally for specified temporary periods. Examples include foreign students, temporary workers, intra-company transferees, and others, including family members. These estimates include only those nonimmigrants that would be expected to be counted in censuses and surveys.

estimated to be 3.9 per 1,000 for unauthorized immigrants and 5.7 per 1,000 for legal immigrants. We assume that national rates apply to each state. Note that mortality is a very small component of change in our estimates. As described below, varying the rates by 25 percent would change the estimated total population by about ±85,000, or less than 1 percent. The effects of increasing or decreasing mortality rates for *both* authorized and unauthorized immigrants would be offsetting.

Emigration Rates. The emigration rates used to construct our estimates are derived from Ahmed and Robinson (1994). Their 10-year rate of 18.7 percent for the decade of the 1980s was extrapolated to single years of entry. Although annual emigration rates are assumed to decline after entry, the overall 10-year emigration rate is maintained. National rates are assumed to apply to each state. The emigration rates we used were 3.0 percent for legal residents in their first year in the U.S. and 3.2 percent for unauthorized residents in their first year of residence. The rates decrease gradually with length of residence, dropping to 1.9 percent for legal residents after 10 years in the U.S. and 2.0 percent for unauthorized residents after 10 years in the U.S.

To determine whether Ahmed and Robinson's (1994) estimates are still applicable for more recent years, we conducted supplementary analyses (the results of which are available upon request) using data for the foreign-born population collected in the 2005 through 2009 ACS. This analysis indicates that national emigration rates at the end of the estimation period were at about the same level as in the earlier period. Supplementary analysis of ACS data for the ten states with the largest foreign-born populations in 2010 indicates that emigration rates for those states were at about the same level as the national rate.

Undercount Rates. The undercount rates we used were developed within the following logical framework: (1) the foreign-born population was more completely counted in the 2000 Census than in the 2010 ACS; (2) those with close attachments to the U.S. (legal immigrants) were more completely counted than unauthorized immigrants; and, (3) undercount rates decrease with length of time in the U.S.

For *unauthorized* immigrants who entered the United States in the 1990s, we used an overall undercount rate of 10.0 percent based on work by Marcelli and Ong (2002).[6] The most recent unauthorized entrants were adjusted by 11.5 percent, and the undercount rate decreased by about 5 percent per year. The *legal* immigrant population is composed of legal permanent residents (LPRs), refugees, and non-immigrants. For LPRs and refugees that entered the U.S. in the 1990s, we used a rate of 2.5 percent, or one-quarter of the rate for unauthorized residents. For non-immigrant residents, we used an undercount rate of 5.0 percent, which is twice the rate used for LPRs and refugees.[7] This produced an undercount rate of 3.0 percent for total legal immigrants at the national level.

As noted above, we assumed that undercount rates were higher in the 2010 ACS than in the 2000 Census because the ACS does not have the resources – money, publicity, extensive follow-up, etc. – that decennial censuses have. We set the undercount rate at 20 percent for the most recently arrived cohort of *unauthorized* residents in the 2010 ACS and then reduced the rates by 10 percent per year. The *overall* undercount rate for unauthorized residents that entered in 2000–2009 was thus estimated to be 12.1 percent.[8] For *LPRs and refugees* that entered from 2000 to 2009, we doubled the 2000 rate of 2.5 to 5.0 percent. The rate of

[6]Our assumed undercount rate of 10.0 percent in the 2000 Census for unauthorized immigrants who entered in 1990–1999 is comparable to estimated undercount rates for two of the most difficult-to-measure populations in the 2000 Census: (1) Hispanic males age 16–29 (10 percent) and age 30–49 (15 percent; U.S. Census Bureau, 2010a: Table 4) and (2) Black males age 18–49 (8.3 percent; U.S. Census Bureau, 2001: Table S3). In addition, in constructing an estimate of the unauthorized immigrant population originating from Mexico for 1996, the Mexico-United States Binational Migration Study "set plausible underenumeration rates for the legal and unauthorized Mexican populations at 4 and 12 percent respectively" (Bean *et al.*, 1998: 79).

[7]A higher rate of undercount was used for nonimmigrant residents compared with LPRs and refugees because nonimmigrants are recent arrivals with relatively less experience and less attachment to the U.S., and thus, they would be more difficult to enumerate.

[8]Our overall undercount rate of 12.1 percent for unauthorized immigrants that entered from 2000 to 2009 is consistent with the rates used by Pew and OIS. Pew has developed a set of assumptions consistent with the available information from census-based studies and with historical demographic data from Mexico. The undercount rates are higher for countries where the population is largely Latino, for young adult males and for recent arrivals. Overall, in 2008, these assumptions resulted in an estimated undercount of 12.5 percent for unauthorized immigrants in the March CPS. In deriving their estimates, DHS assumes that 10 percent of unauthorized immigrants are omitted from the ACS.

15 percent used for non-immigrant residents brought the overall rate for legal immigrants for 2000–2009 up to 5.3 percent.

Methods

In Tables 1 through 3, we illustrate the methods we use to compute annual estimates of the unauthorized immigrant population and components of change in that population for 1990 through 2010. These tables present national estimates; figures in them are aggregated up from 51 parallel sets of state tables (which appear as Table S3).

Estimates for 2000–2010. Using 2010 ACS data, Column 1 in Table 1 reports estimates of the *total* foreign-born population, separately by year of entry between 2000 and 2009.[9] For example, the ACS included about 1,188,000 foreign-born people who entered the country in 2002, and about 12,775,000 foreign-born people who entered in any year between 2000 and 2009. For some states, an adjustment was made to correct the apparent overstatement of the 2000 entry cohort in the ACS.[10] Column 2 reports the size of the *legally resident* foreign-born population, separately by year of entry between 2000 and 2009, including immigrants admitted for permanent residence, refugees, and non-immigrant residents; as described above and in Table S1, these figures are based primarily on administrative data collected by DHS and other federal agencies. Column 3 presents the estimated number of unauthorized immigrants who were included in the ACS, separately by year of entry between 2000 and 2009. The estimates in Column 3 are residual estimates (Column 1 minus

[9]The estimates in column 1 of Table 1 are from the 2010 ACS, which is the first ACS to be controlled to the results of the 2010 Census. Comparisons of the results presented here with similar estimates for July 2009 – based on ACS data controlled to the 2000 Census – indicate that shifting the ACS controls from the 2000 Census to the 2010 census increased the estimated unauthorized immigrant population by between 750,000 and 1 million.

[10]Specifically, we adjust for "heaping" – the tendency for respondents in censuses and surveys to erroneously select years ending in zero or five when reporting their age or year of entry. It was apparent from examining the ACS data and from the pattern of annual estimates produced by the unadjusted ACS data that there was a considerable amount of heaping on the year 2000. For each state, the size of the 2000 entry cohort used in these estimates was limited to no more than 25 percent above the average of the 2001 and 2002 entry cohorts. The amount that the 2000 entry cohort exceeded the limit was judged to be due to heaping.

TABLE 1

ANNUAL ESTIMATES OF THE FOREIGN-BORN POPULATION RESIDING IN THE UNITED STATES, BY LEGAL STATUS AND YEAR OF ENTRY: 2000 TO 2009

| Year of Entry | Foreign-born Population in January 2010 | | | | Unauthorized Immigrant Population in January 2010 $(5) = 3 + 4^{a}$ | Left the Unauthorized Immigrant Population (via Emigration, Removal by DHS, Adjustment to Lawful Status, or Death) | | | | | | | | | | Entry cohorts $(16) = \Sigma(5 - 15)^{a}$ |
	Total (ACS) (1)	Legally Resident (2)	Unauthorized $(3) = (1) - (2)$ (4)	Undercount (4)	(5)	2009 (6)	2008 (7)	2007 (8)	2006 (9)	2005 (10)	2004 (11)	2003 (12)	2002 (13)	2001 (14)	2000 (15)	(16)
Total	12,775	7,441	5,334	733	11,725	558	549	531	482	476	474	493	473	508	369	8,600
2009	1,136	819	307	77	384	—										384
2008	1,162	885	317	70	387	53	—									439
2007	1,245	848	386	75	461	43	54	—								558
2006	1,238	762	516	88	604	42	47	56	—							749
2005	1,478	762	596	90	686	38	44	49	57	—						873
2004	1,212	737	537	72	609	32	36	40	44	52	—					813
2003	1,135	653	499	59	558	30	31	33	37	41	50	—				779
2002	1,188	631	577	61	638	34	32	33	35	39	45	51	—			906
2001	1,368	655	727	68	795	44	38	37	37	41	46	50	58	—		1,146
2000	1,615	690	872	73	945	50	48	43	40	43	47	53	57	65	—	1,389
Pre-2000	—	—	—	—	—	192	220	241	234	261	286	339	358	443	369	8,600

All numbers in thousands, and rounded independently.
ᵃExcept for the shaded area.

Column 2) that have been smoothed slightly to reduce the effects of sampling variation.[11] Column 3 indicates that about 5,334,000 more foreign-born individuals were counted in the ACS as arriving between 2000 and 2009 than were legally admitted during those years. Column 4 introduces an adjustment for undercount in the ACS; for reasons described above, assumed undercount rates vary across entry cohorts, ranging from 20.0 percent for 2009 to 7.7 percent for 2000 and averaging 12.1 percent. Finally, Column 5 reports the total unauthorized immigrant population living in the U.S. in January 2010, by year of entry between 2000 and 2009; the derivation of the estimate for "Pre-2000" is described below. The top line of Column 5 in Table 1 indicates that there were about 11,725,000 unauthorized immigrants living in the U.S. in January 2010.

    The next step in constructing Table 1 is to determine how many unauthorized immigrants *left* the population each year between 2000 and 2009 (as shown in Columns 6 through 15), separately by year of entry. Unauthorized immigrants can leave the population in four ways – emigration, removal by DHS, adjustment to lawful status, or death. Our sources of information for these components are described above and in Table S1. For example, among foreign-born individuals that entered the U.S. in 2005, Column 9 of Table 1 indicates that about 57,000 left the U.S. (one way or another) in 2006. The last step in constructing the non-shaded area of Table 1 was to estimate the size of each annual cohort in its *actual* year of entry. Each entry cohort in Column 16 was estimated by summing Columns 5–15. In essence, we started with the population in January 2010 (Column 5) and "added back" those who left the population between entry and January 2010.[12] For example, Column 5 of Table 1 shows that

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[11]For the nine states that have the smallest unauthorized immigrant populations, the size of each residual estimate shown in column 3 was set to be (1) at least zero and (2) no larger than twice the percent of unauthorized to total foreign-born estimated for the State in the 1995–1999 period. These limitations added logical consistency to the estimates and tended to smooth the annual entry cohorts.

[12]The description above is conceptually accurate, but the actual calculations were made differently. The size of each entry cohort shown in Column 16 is defined as, "the number that will produce the figure in Column 6 *after being reduced by the four components of change each year.*" Because estimated emigrants and deaths are based on rates, it was necessary to use an iterative process to derive the numbers shown in Column 16. This estimation procedure assures that unauthorized immigrants that entered the U.S. during each year of the decade, and then left the population before the end of the decade, are taken into account in the estimates.

in January 2010, there were about 461,000 unauthorized immigrants living in the U.S. who entered in 2007. Columns 6 and 7 show that a total of 97,000 unauthorized immigrants who entered the country in 2007 subsequently left that population (54,000 in 2008 and 43,000 in 2009). Consequently, we estimate that 461,000 + 43,000 + 54,000 = 558,000 unauthorized immigrants *entered* the country in 2007. The top line of column 8 shows that 531,000 unauthorized immigrants *left* that population in 2007; this implies a net change of 558,000 − 531,000 = +27,000 unauthorized immigrants in 2007.

The shaded area at the bottom of Table 1 pertains to unauthorized immigrants who entered the country prior to 2000. The beginning point is the estimated unauthorized immigrant population of 8.6 million in January 2000, shown at the bottom of Column 16; this figure is taken from Table 2, as described below. The number of unauthorized immigrants who arrived prior to 2000 and who left that population in each year between 2000 and 2009 (the shaded areas of Columns 6–15) was subtracted from 8.6 million. That yields an estimate of 5.7 million unauthorized immigrants who moved to the United States before 2000 *and still lived here* in January 2010 (the shaded area of Column 5 in Table 1). Adding 5.7 million to the other numbers in Column 5 produces our estimate of 11,725,000 unauthorized immigrants living in the United States in January 2010.

Estimates for 1990–1999. Estimates for 1990–1999 were computed using data from the 2000 Census and the same methodology described above. Details are presented in Table 2. Our estimate of 3,500,000 unauthorized immigrants in 1990 – the figure in Column 16 of the shaded area of Table 2 – is based on estimates produced by Warren (1997). Columns 6 through 15 of the shaded area in Table 2 show that of the 3.5 million unauthorized immigrants living in the U.S. in 1990, 1.25 million left by 2000, yielding 2.25 million who arrived in the U.S. prior to 1990 and who still lived in the U.S. in 2000. The un-shaded portion of Column 5 in Table 2 shows the number of unauthorized immigrants who entered the U.S. in each year between 1990 and 1999 and who still lived in the U.S. in 2000. After "adding back" individuals in each year-of-entry cohort who left the population of unauthorized immigrants (the un-shaded portions of Columns 6 through 15 in Table 2), Column 16 reports the total size of each annual entry cohort between 1990 and 1999.

TABLE 2
ANNUAL ESTIMATES OF THE FOREIGN-BORN POPULATION RESIDING IN THE UNITED STATES, BY LEGAL STATUS AND YEAR OF ENTRY: 1990 TO 1999

| Year of Entry | Foreign-born Population in January 2000 | | | | Unauthorized Immigrant Population in January 2000 (5) = 3 + 4[a] | Left the Unauthorized Immigrant Population (via Emigration, Removal by DHS, Adjustment to Lawful Status, or Death) | | | | | | | | | | Entry cohorts (16) = $\Sigma(5-15)$[a] |
	Total (2000 Census) (1)	Legally Resident (2)	Un-authorized (3) = (1) − (2)	Un-dercount (4)		1999 (6)	1998 (7)	1997 (8)	1996 (9)	1995 (10)	1994 (11)	1993 (12)	1992 (13)	1991 (14)	1990 (15)	
Total	12,590	6,851	5,741	609	8,600	358	338	311	284	251	233	229	220	197	181	3,500
1999	1,868	824	979	127	1,106	26	—	—	—	—	—	—	—	—	—	1,132
1998	1,463	680	793	97	889	44	20	—	—	—	—	—	—	—	—	954
1997	1,229	670	604	70	674	31	37	16	—	—	—	—	—	—	—	759
1996	1,171	655	582	63	646	27	31	36	15	—	—	—	—	—	—	756
1995	1,371	634	617	63	680	27	30	33	35	16	—	—	—	—	—	822
1994	1,155	678	505	49	554	23	25	27	27	30	14	—	—	—	—	700
1993	1,033	704	381	35	416	18	20	21	22	22	25	12	—	—	—	557
1992	1,094	705	368	32	400	17	19	21	21	21	22	25	12	—	—	559
1991	988	625	415	34	449	20	21	22	23	23	24	25	28	15	—	649
1990	1,219	677	498	39	536	31	30	27	27	27	27	29	31	33	18	816
Pre-1990	—	—	—	—	2,250	94	103	107	113	112	121	138	149	149	163	3,500

All numbers in thousands and rounded independently.
[a] Except for the shaded area.

Annual Estimates of Population Size and Components of Change, 1990–2010

The first four columns of Table 3 were constructed entirely from the estimates reported in Tables 1 and 2, but the numbers have been put into a more familiar form. Table 3 also includes detailed information about the method by which unauthorized immigrants left that population, by year of entry. The headings for Columns 2, 3 and 4 show the sources of the estimates. Column 1 in Table 2 begins with the estimate of 3.5 million unauthorized immigrants in January 1990 (Table 2, Column 16, shaded area), and annual estimates were then computed for subsequent years by comparing the size of annual entry cohorts (Column 3) to the annual number leaving the unauthorized immigrant population (Column 4) to produce annual estimates of net change in the unauthorized immigrant population. For example, we estimate that there were 11,899,000 unauthorized immigrants on January 1, 2009 (Column 1). During 2009, we estimate that 384,000 unauthorized immigrants entered the U.S. (Column 3) and 558,000 left that population (Column 4). Thus, there was a net change of $374,000 - 558,000 = -174,000$ unauthorized immigrants in 2009, and the population of unauthorized immigrants on January 1, 2010 equaled $11,899,000 - 174,000 = 11,725,000$.

Sampling Variability

Our estimates of the size and attributes of the foreign-born population are based on sample data from the 2000 Census and the ACS, and therefore, our annual estimates of the unauthorized immigrant population are subject to sampling variability. In Table S2, we report estimates of the number of foreign-born people living in the U.S. and in each state who came to the U.S. between 2000 and 2009 along with standard errors of those estimates; the standard errors are computed as per the guidance of the U.S. Census Bureau (2010b). In contrast, our counts of the legally resident foreign-born population and of the number of unauthorized immigrants removed each year are not subject to sampling variability because they are based on administrative record data; therefore, we are unable to estimate a possible range of non-sampling error in the estimates of the legally resident population. Finally, our estimates of mortality and emigration are based on sample data and statistical models, but uncertainty in these estimates is difficult to quantify. Because of this mixture of types of

data, we do not compute proper standard errors for our estimates. We suggest that relatively small year-to-year or state-to-state differences should be disregarded, and we caution that actual differences might be somewhat higher or lower than reported here. The standard errors reported in Table S2 may be useful for generating approximate confidence intervals and for describing uncertainty in our population estimates.

RESULTS

Figure I is based on the estimates in Table 3, and depicts the annual number of unauthorized immigrants entering the United States (the top bars), the annual number leaving the country (the bottom bars), and net change in the population size (the line). The annual number *moving to* the U.S. increased in the 1990s, growing from about 550,000 in 1993 to 1.1 million in 1999. More than 1 million arrived each year from 1999 to 2001; 1.4 million arrived in 2000. After 2000, the number moving to the U.S. declined sharply, dropping by 72 percent from its peak in 2000 to about 400,000 in 2009.

From 1990 to 2009, an estimated 15.7 million unauthorized immigrants moved to the United States. However, the population grew by

Figure I.   **Annual Net Change and Components of Change in the Number of Unauthorized Immigrants in the U.S. 1990–2009**
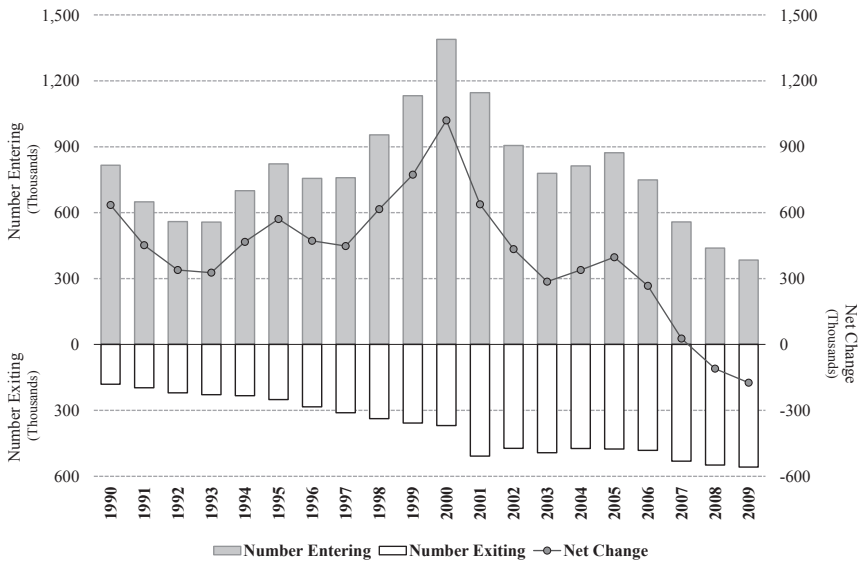
TABLE 3
Estimates of the Total Unauthorized Immigrant Population of the United States and Annual Components of Population Change: 1990–2010

Year	Unauthorized Immigrants, January 1 (1)	Annual Net Change (2) = (3) − (4)	Entered the Population[2] (3)	Left the Population[3] (4) = Σ(5 to 8)	Method of Leaving the Population			
					Emigrated (5)	Adjusted to Lawful Status[4] (6)	Removed by DHS[5] (7)	Died (8)
2010	11,725							
2009	11,899	(174)	384	558	243	104	165	46
2008	12,009	(110)	439	549	252	100	150	46
2007	11,981	27	558	531	258	94	133	46
2006	11,714	267	749	482	256	64	117	45
2005	11,317	397	873	476	250	79	103	44
2004	10,978	339	813	474	247	84	100	42
2003	10,692	286	779	493	244	120	88	41
2002	10,259	434	906	473	237	115	81	40
2001	9,620	638	1,146	508	223	176	71	37
2000	8,600	1,020	1,389	369	198	73	65	33
1999	7,827	773	1,132	358	198	60	65	35
1998	7,210	616	954	338	182	61	65	30
1997	6,763	448	759	311	170	54	59	28
1996	6,291	472	756	284	161	55	41	26
1995	5,720	571	822	251	150	42	36	24
1994	5,253	467	700	233	138	38	35	22
1993	4,925	327	557	229	130	45	34	20
1992	4,587	339	559	220	124	43	34	19
1991	4,135	452	649	197	116	35	29	17
1990	3,500[1]	635	816	181	103	38	25	15

All numbers in thousands and rounded independently.
[1] From the shaded area of Table 2, Column 16.
[2] From Column 16 of Tables 1 and 2.
[3] From the top row of Columns 6–15 in Tables 1 and 2.
[4] Includes unauthorized residents that left the U.S., returned with immigrant visas, and were tabulated as new arrivals.
[5] Resided in the United States for six months or more before being removed.

"only" 8.2 million. This reveals an important aspect of unauthorized immigration that has typically been overlooked: *Significant numbers of unauthorized immigrants leave the population each year.* Between 1990 and 2009, an estimated 7.5 million left the unauthorized immigrant population (*i.e.*, by removal, death, emigration, and adjustment of status).[13] Although the rates of departure have remained fairly constant over the past two decades, the growing population has generated increasing numbers of departures. The total number leaving the population increased steadily from about 180,000 in 1990 to about 560,000 per year in 2009; as shown in Columns 5–8 of Table 3, each category of departure increased considerably between 1990 and 2009.

Annual *net change* in the unauthorized immigrant population is determined by the number entering minus the number leaving. As shown in Table 3 and Figure I, population growth dropped from one million in 2000 to a net *decline* of 174,000 in 2009. A variety of factors might explain the sharp reduction in population growth in the past decade, including less favorable U.S. economic conditions after 2000, heightened security for air travel after September 11, 2001, and increased enforcement efforts by DHS. It is clear, however, that the substantial drop in arrivals after 2000 was the primary contributor to declining population growth and to reaching zero growth by the end of the decade.

The economic downturn in 2008 and 2009 apparently had little effect on emigration from the unauthorized immigrant population in those years. A set of estimates for January 2008, comparable to ours, estimated the unauthorized population that entered from 2000 to 2007 to be 5,187,000 (Hill and Johnson, 2011). Two years later, those entry cohorts would have been reduced by emigration, adjustments to legal status, removals by DHS, and deaths.[14] However, as shown in Table 1, Column 5, our estimate for January 2010 for those same cohorts is 5,296,000 or about 2 percent *higher* than the comparable figure in 2008. The unexpected increase for 2010 compared with 2008 probably occurred because

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[13]It is important to note that the phrase "leaving the unauthorized resident population," as used above, does *not* refer to internal migration within the United States. The term "emigration" above refers to movement out of the United States. Below we discuss the issue of internal migration in more detail.

[14]If emigration rates of unauthorized immigrants from 2008 to 2010 had been about the same as the rates we used, the cohort would have declined by about 11 percent.

of coverage improvement in the 2010 ACS, which is likely to be better enumerated because it was conducted in a census year. Still, these two estimates provide clear evidence that any increases in emigration rates in 2008 and 2009, if they did occur, were too small to have a discernible effect on the population estimates and patterns of growth described here. We will leave it to others to more fully analyze the determinants of the patterns observed in Figure I. However, it would be difficult to do those analyses without annual estimates of inflows into, outflows from, and net change in the unauthorized immigrant population.

These results at the national level have a number of implications for developing immigration policy and for U.S. data collection efforts. First, even though the number of unauthorized arrivals has dropped significantly since 2000, hundreds of thousands continue to move to the United States each year. Second, departures from the unauthorized immigrant population are an important aspect of population change for this group. Third, improvements in the data sources are needed to update and expand the empirical basis for future estimates. Fourth, the ACS has proven to be a vital resource for deriving detailed national and state estimates of the unauthorized immigrant population.

State Estimates

Table S3 shows estimates for each state that are comparable to the figures shown in Table 3 for the country as a whole: The size of the unauthorized immigrant population each year, the number entering that population each year, the number exiting that population each year (through emigration, death, removal, and adjustment of status), and annual net change in the size of that population.[15]

Figure II shows estimates for the 25 states with the largest unauthorized immigrant populations in January 2010. More than half of all unauthorized immigrants lived in California (2.9 million), Texas (1.6 million), Florida (1.0 million), and New York (705 thousand) in 2010. The temporal trends in inflows, outflows, and net change in the size of the unauthorized immigrant population observed in Table 3 and Figure I for the total U.S. population occurred in most, but not all, of the states.

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[15]We provide Table S3 here to facilitate the peer review process. We anticipate that this lengthy table will be made available online, not in print, once this article is accepted for publication.

Figure II.   Number of Unauthorized Immigrants, by State, January 2010
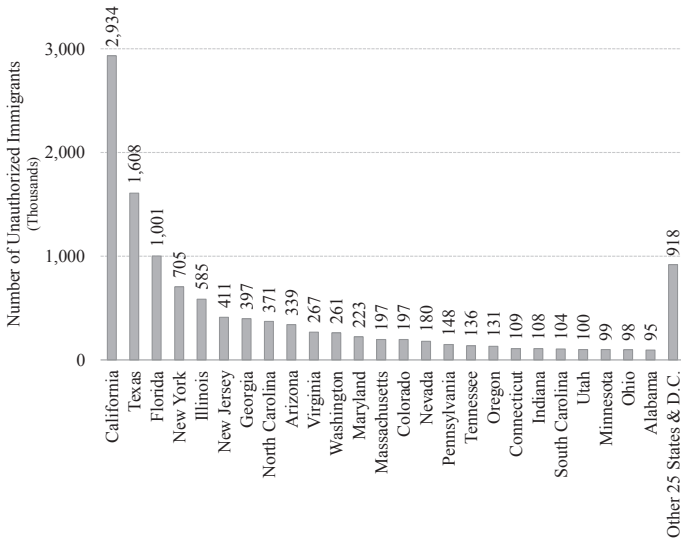
In Figure III, we depict temporal trends in inflows, outflows, and net change in population size for the six states with the largest unauthorized immigrant populations in 2010: California, Texas, Florida, New York, Illinois, and New Jersey. As in the country as a whole, in each of these states, the inflow of unauthorized immigrants rose in the 1990s, peaked in about 2000, and declined steadily thereafter.[16] Outflows from the unauthorized immigrant population increased gradually over time; and thus, net change after 2000 declined to a point near or below zero in 2010. Between 2000 and 2009, every state (except Mississippi)[17] and DC saw *declines in inflows* of unauthorized immigrants, and every state saw *increases in outflows* between 2000 and 2009. As a result, 29 states and DC experienced *net losses* in 2009 in their unauthorized immigrant populations. As shown in Figure IV, only four states had net gains of 4,000 or more unauthorized immigrants in 2009, while the combined

[16]In the large majority of states, the patterns of estimated arrivals and, consequently, net change in the unauthorized immigrant populations show peaks in 1990, 1995, 2000, and 2005. While this pattern could reflect actual peaks in inflows, especially in 2000, these peaks at five-year intervals probably also reflect an unknown amount of "heaping," which is the tendency for respondents to choose dates ending in 0 or 5.

[17]Estimated inflow to Mississippi increased from 1,418 in 2000 to 2,315 in 2009.

Figure III.   **Annual Net Change and Components of Change in the Number of Unauthorized Immigrants, Selected States, 1990–2009**
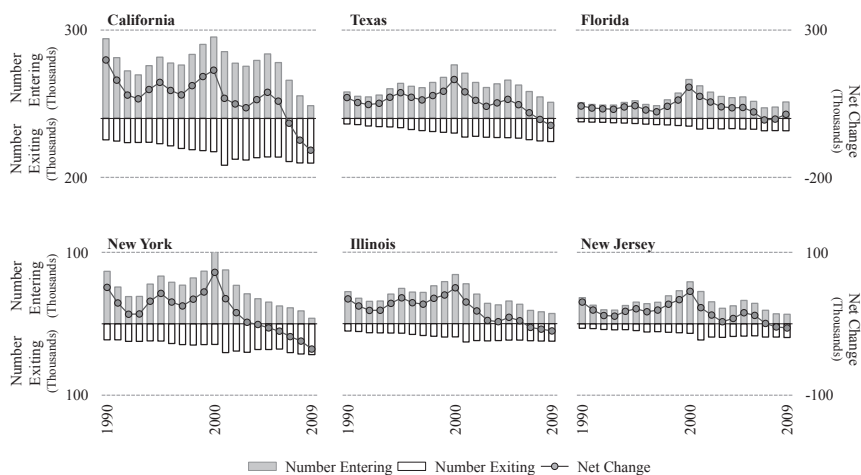
Note: The vertical scale of the figures for California, Texas, and Florida (in the top row) is different from the vertical scale for New York, Illinois, and New Jersey (in the bottom row). In all figures, the lines (representing net change in population size) are scaled according to the vertical axis on the right. The bars (representing entries and exits) are scaled according to the vertical axis on the left.

populations of California, New York, and Texas declined by more than 165,000.[18]

The seven states with the fastest growing populations of unauthorized immigrants over the past two decades, in declining order, were in the southeast: Alabama, South Carolina, North Carolina, Tennessee, Arkansas, Kentucky, and Georgia. In each of these states, the unauthorized immigrant population was more than 11 times larger in 2010 than it was in 1990; by contrast, the total U.S. unauthorized immigrant population tripled in the 1990–2010 period. In 1990, these seven states were home to just 2.5 percent (about 90,000) of the total unauthorized immigrant population; by 2010, the seven states had 10.4 percent (1.2 million) of the U.S. total. Yet, despite the very rapid growth in these states from 1990 to 2010, the percent of unauthorized to total residents in the seven-state area in 2010 was still well below the same percent for

[18]There are certainly exceptions to the patterns described above. For example, in Alabama, Louisiana, Mississippi, and Oklahoma, inflows continued at high levels from 2002 through 2009. The annual inflow to Tennessee was about 13,000 from 1999 to 2007 and then declined in 2008 and 2009. We will leave it to others to explore the reasons for various regional and state-specific exceptions to the general patterns described above.

Figure IV.   **States with the Largest Net Changes in Populations of Unauthorized Immigrants, 2009**
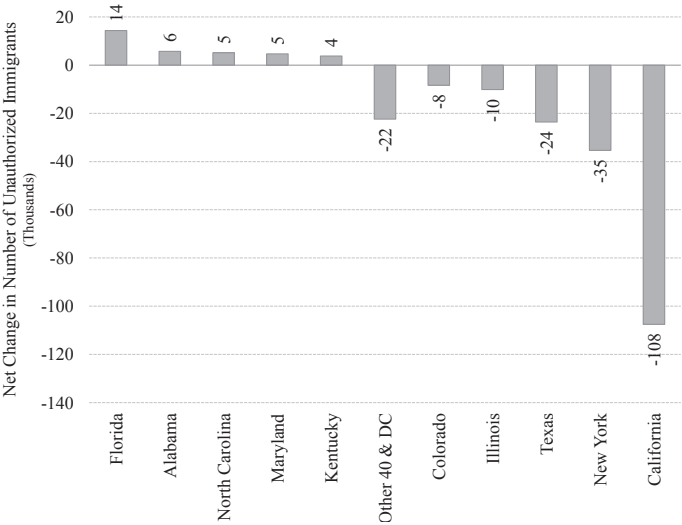
California. In these seven states, the 1.2 million unauthorized residents in 2010 made up 2.9 percent of the total resident population of 42.3 million. In California, the 2.9 million unauthorized residents in 2010 constituted 7.9 percent of the total resident population of 37.3 million.

QUALIFICATIONS AND SENSITIVITY ANALYSES

As described above, our estimates are more statistically reliable than those produced by Pew and OIS and they include detailed information about inflows, outflows, and net change in each year and by state. However, three potential methodological issues regarding our estimates are worth exploring.

First, the basic logic of the residual method identifies the number of unauthorized immigrants by subtracting the number of authorized immigrants from the total foreign-born population. Precise counts of the legally resident population should – but in our estimates do not – include: (1) asylees and parolees who have work authorization but who have not adjusted to permanent resident status; (2) aliens who have filed Form I-485 (Application to Register Permanent Residence or Adjust Status) and who have been given work authorization pending final approval of legal permanent resident status; and (3) aliens who are allowed to remain and

work in the United States under various legislative provisions, such as
Temporary Protected Status. Unfortunately, current estimates are not
available for these groups; estimates for 2000 totaled 577,000 people
(Warren, 2003). Because we are likely modestly *under*stating the number
of authorized immigrants, we are also likely modestly *over*stating the num-
ber of unauthorized immigrants.

Second, we are not able to quantify the migration of authorized
immigrants between U.S. states. For our purposes, the state of residence
of authorized immigrants is generally the state in which they lived when
they entered DHS's databases. Subsequent changes of residence to other
states typically are not recorded. Net internal migration of both autho-
rized and unauthorized immigrants within the U.S. after admission could
affect the accuracy of our estimates of unauthorized immigration for indi-
vidual states. We discuss the issue of internal migration in more detail at
the end of this section.

Third, as described above, the methodology used to generate our
estimates is based on assumptions about (1) mortality rates among the
foreign-born; (2) rates of emigration from the United States; and (3)
undercount rates in the Census and ACS. Although we cannot know any
of these rates with precision, in this section we quantify the sensitivity of
our estimates to alternative assumptions about each of these rates. How
much would our national estimate of 11.7 million unauthorized immi-
grants in January of 2010 change under alternate assumptions about the
three sets of rates?

Mortality

Because of their relatively youthful age distributions, authorized and
unauthorized immigrants have crude death rates that are lower than the
rate for the entire U.S. population. Consequently, alternative assump-
tions about death rates have very little impact on our estimates.
Increasing the crude death rate for the *unauthorized* immigrant popula-
tion by 25 percent would reduce our estimate of the unauthorized
immigrant population by only 81,000, or 0.7 percent. Increasing the
crude death rate for the *authorized* immigrant population by 25 percent
would increase the total unauthorized population by 90,000, or
0.8 percent. As noted above, the effects of increasing or decreasing
mortality rates for both authorized and unauthorized immigrants would
be offsetting.

Emigration and Undercount

Assumptions about emigration and undercount have greater potential for biasing our estimates. Table 4 shows the amount and percent that our estimate of total number of the unauthorized immigrants would change if alternative assumptions about emigration and undercount – plus or minus 25 percent in both cases – were used to construct that estimate. In general, even these extreme alternative assumptions about emigration and undercount would change our estimate of 11.7 million by only plus or minus 400,000 or about 3.5 percent.

Note that all of these sensitivity analyses pertain to our *point estimate* of the total size of the unauthorized immigrant population. The discussion above provides considerable support for our assumptions about mortality, emigration, and undercount rates. Reasonable variations in these assumptions would not matter a great deal for the sorts of temporal *trends* shown in Figure I or in parallel figures for states.

Net internal migration

To take account of internal migration would require detailed data on net internal migration for each state, by year of entry, compiled separately for legal and unauthorized immigrants; unfortunately, the necessary information is not available. DHS takes account of internal migration of *part* of the legal resident population using data on the residence of the naturalized population; PEW takes account of internal migration of legal residents using state-to-state migration rates for six states (CA, TX, NY, FL, IL, and NJ) and "all other" from the CPS and assuming that the rates for *all* foreign-born apply to the estimates of legal residents by state.[19]

There are three reasons why the effects of net internal migration of legal residents on our estimates could be relatively small. First, the majority of LPRs are admitted on the basis of close kinship with U.S. relatives,

[19]The DHS or Pew procedures would not be applicable to our estimates. The naturalization data would not cover the majority of our legal resident population because, on average, our legal immigrant population resided in the U.S. for only five years, which is about the length of time that would be needed to naturalize. The PEW assumption that the rates for *all* foreign-born apply to legal residents has not been tested empirically. In fact, there are plausible reasons, described in the text, to believe that legal immigrants, especially the recently arrived immigrants in our estimates, have relatively lower rates of internal migration than the rest of the foreign-born population.

TABLE 4
Sensitivity of Estimates of the Size of the Unauthorized Immigrant Population in 2010 to Different Assumptions about Emigration and Undercount Rates

	Increase rates by 25%		Reduce rates by 25%	
	Number	Percent	Number	Percent
Effects of changing <u>emigration</u> rates by ±25%				
Unauthorized Immigrants	−403	−3.40	431	3.70
Authorized Immigrants	375	3.20	−383	−3.30
Effects of changing <u>undercount</u> rates by ±25%				
Unauthorized Immigrants	356	3.00	−332	−2.80
Authorized Immigrants	172	1.50	−159	−1.40

All numbers in thousands and rounded independently.

possibly reducing their odds of subsequent out-of-state moves. Second, a substantial proportion of the legally resident population already had a residence in the U.S. at the time they entered the DHS data systems, for example by adjusting from temporary to permanent lawful residence. Third, the legal immigrants and refugees in our estimates have, on average, only five years of residence in the U.S., reducing the time they have to migrate compared with those who have been here for longer periods.

DISCUSSION

We estimate that about 11.7 million unauthorized immigrants lived in the United States in January of 2010.[20] This figure is likely a modest overestimate (by perhaps a few hundred thousand) because data are not available for some (relatively smaller) portions of the authorized immigrant population (who are thus counted as unauthorized). More than half of all unauthorized immigrants lived in California, Texas, Florida, and New York. The number of unauthorized immigrants coming to the U.S. grew steadily in the 1990s, declined between 2000 and 2003, and then continued to decline rapidly after 2005. From 2000 to 2009, arrivals of unauthorized immigrants to the U.S. dropped from about 1.4 million to 400,000, a decline of 72 percent. While there is a great deal of publicity about the number of unauthorized immigrants who *enter* the U.S. each year, it is important to reiterate that many unauthorized immigrants also

[20]As noted above, these estimates were derived using 2010 ACS data that are consistent with the 2010 Census count. As a result, they are approximately 750,000 to one million higher than other recent estimates that were based on 2000 Census counts. Explanation of the differences in the foreign-born population caused by changing from 2000- to 2010-based ACS population controls is beyond the scope of this article.

leave that population each year – well over half a million in 2009. Because of declining inflows after 2000 and steadily increasing outflows since 1990, annual *net change* in the size of the unauthorized immigrant population has also declined – indeed, it was negative in 2008 and 2009. That is, since 2007, the United States has *lost* more unauthorized immigrants than it has gained. It should be noted, however, that even though the unauthorized immigrant population in the U.S. has essentially reached zero growth, unauthorized immigration to the United States continues at a high level – nearly 400,000 arrived in 2009.

The annual time series for every state can be used in conjunction with other data collected by the Census Bureau to analyze trends in immigration since 1990. The estimates will complement any analysis of immigration trends carried out at the state level.[21] For example, in her discussion of immigration to gateway states, Singer (1994) shows state-by-state estimates of the percent change in the foreign-born population from 1990 to 2000. Using our estimates, Table 2 in that report could be revised to show comparable estimates for legal and unauthorized residents in each state. Then, those tables could be updated to show change from 2000 to 2010.

Although additional analyses are beyond the scope of this article, we can illustrate some of the implications of these estimates by focusing on the seven rapidly growing states in the southeast.[22] On the broadest scale, the size of the unauthorized population in these seven states in 2010 might not appear to be remarkable – even after growing very rapidly for 20 years, unauthorized immigrants make up just 2.9 percent of all residents, well below the U.S. average of 3.9 percent. When we expand the analysis to include Census data for the foreign-born population, we begin to see additional effects of unauthorized immigration to the seven states. In 1990, the percent of foreign-born that were unauthorized was the same in the seven states as it was nationally, about 18 percent. From 1990 to 2010, the percent of the foreign-born that were unauthorized jumped from 18 to 47 percent in the seven states. In other words, in 1990, the foreign-born population in the seven states was small, about 500,000, and

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[21]Studies of trends in immigration, by category of migrants, would be improved considerably if methods were devised to estimate unauthorized immigration below the state level.

[22]Of all the states and DC, the seven with the highest ratios of unauthorized immigrants in 2010 compared to 1990 are as follows: Alabama, Arkansas, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. The ratios range from 12:1 for Georgia to 19:1 for Alabama.

fewer than one in five were unauthorized residents. By 2010, the foreign-born population had quadrupled to 2.6 million, and nearly *half* of them were unauthorized.

As described above, our estimates (as are those from OIS and Pew) are based on assumptions about mortality rates, emigration rates, and rates of undercount in the Census and ACS. As demonstrated above, our point estimates – at least at the national level – change only modestly if we make fairly extreme alternative assumptions about those rates. Our inferences about trends over time are likely unaffected by these assumptions. Nonetheless, our estimates could be improved by refinements in techniques for measuring emigration and undercount rates. Indeed many important policy and academic questions could be much more readily addressed if the Census Bureau would implement the pending U.S. General Accounting Office (1998) recommendation that the Census Bureau and the Immigration and Naturalization Service (now DHS) devise a plan of joint research to evaluate the quality and completeness of Census and survey data on the foreign-born population in the United States. In addition, DHS should improve its collection of data on the arrival and departure of all non-immigrants.

The quality of our estimates is certainly limited by the accuracy and completeness of the data on which they are based; besides the assumptions about mortality, undercount, and emigration that are built into our estimates, they are still also subject to random sampling error. Note, however, that amid all of the speculation and attempts to estimate the size of the unauthorized immigrant population over the years, the methodology used here is the *only* one that has been tested empirically. When IRCA was enacted in 1986, the U.S. Government needed to know how many might come forward for legalization so that it could set up legalization offices across the country. The Statistics Division of what was then called the Immigration and Naturalization Service, using methods similar to the ones used here, projected that the number of pre-1982 applicants for legalization would range from 1.3 to 2.7 million. A total of 1.6 million in this group came forward. In the large majority of cases, the projected high and low ranges for individual states bracketed the numbers that actually applied for legalization. A difference between the data and methods used here and those that performed so well at the time of IRCA is that both the methods and data sources have been improved significantly since 1987.

Our estimates of the total number of unauthorized immigrants in the U.S. and in larger states are comparable to those produced over the

past few years by Pew and DHS. The similarities in these estimates are remarkable given the differences in data sources and methods used to derive them. Overall, however, our data and methods produce estimates with smaller ranges of sampling error compared with those produced by Pew, and we show estimates for all of the states and DC instead of just the top ten states produced by DHS. We also provide a longer time series, covering every year between 1990 and 2010. Finally, an important and unique strength of our estimates is that we quantify inflows into and outflows from the unauthorized immigrant population at both the state and national levels. This makes possible any number of policy and academic analyses of the factors that influence inflows, outflows, and net change and of the economic, social, political, demographic, and other consequences of those trends.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article.

Table S1. Sources and Descriptions of Data Used to Construct Estimates.

Table S2. Standard Errors for ACS Estimates of the Number of Foreign-born People Entering Between 2000 and 2009, by State.

Table S3. Estimates of the Unauthorized Immigrant Population and Annual Components of Population Change, by State: 1990 to 2010.