How Well Does the American Community Survey Count Naturalized Citizens?

Jennifer Van Hook[a] and **James D. Bachmeier**[b]
[a]Population Research Institute, The Pennsylvania State University

[b]Temple University

Abstract

Background—Citizenship status among the foreign born is a crucial indicator of social and political incorporation, yet there are good reasons to suspect that citizenship status is inaccurately reported on U.S. surveys.

Objective—This paper updates research carried out in the mid-1990s by Passel and Clark (1997) on the extent to which foreign-born non-citizen respondents in U.S. government-sponsored surveys misreport as naturalized citizens.

Methods—We compare demographic estimates of the resident naturalized foreign-born population in 2010, based on administrative data, to estimates from the 2010 American Community Survey (ACS).

Results—Similar to previous research, we find that misreporting in the ACS is especially high among immigrants from all countries/regions who report fewer than five years in the U.S. We also find that among longer-term foreign-born residents, misreporting is concentrated only among those originating in Mexico, especially men, a finding that diverges from Passel and Clark in that we find no evidence of over-reporting among immigrants from Central America and the Caribbean. Finally, the estimated magnitude of misreporting, especially among longer-term Mexican-born men, is sensitive to assumptions about the rate of emigration in our administrative-based demographic estimates, and assumptions about coverage error in the ACS, though altering these assumptions does not change the conclusions drawn from the general patterns of the results.

Conclusions—For applications that use citizenship as an indicator of legal status, we recommend that self-reported data on citizenship be accepted at face value for all groups except those with less than five years of U.S. residence and Mexican men.

Introduction

Immigration and immigrant integration continue to be topics of enormous social significance, particularly for countries like the United States where immigrants make up 13% of its population. In the context of anti-immigrant policies and attitudes that treat societal outsiders differently, citizenship status among the foreign born is a crucial indicator of social and political incorporation in the United States (Van Hook, Brown, and Bean 2006) and other immigrant-receiving societies (Bloemraad 2006), and is strongly associated with political participation, access to public assistance, health care, and jobs (Passel, Clark and Fix 1997; DeSipio 2001; Fix and Zimmermann 2001; Van Hook and Balistreri 2006). Citizenship is also a key variable for the production of estimates of the characteristics of the unauthorized foreign-born population (Passel, Van Hook, and Bean 2006). Social scientists and policy analysts therefore rely heavily on survey items on citizenship to answer questions

about immigrants, their well-being, and their impact on host societies (Bloemraad, Korteweg and Yardakul 2008).

Given the importance of citizenship for research on immigrants, it is important to assess the accuracy of citizenship reporting in surveys. In the United States, data on naturalization and citizenship largely come from Census Bureau surveys, such as the Current Population Survey (CPS), the long form of the decennial Census (2000 and earlier), and the American Community Survey (ACS). Prior research, carried out in the mid-1990s by Passel and Clark (1997), suggests that the number of naturalized citizens is over-estimated in Census data, possibly because some non-citizens misreport as citizens. We update and extend this work by comparing demographic estimates of the resident naturalized foreign-born population in 2010, based on administrative data, to estimates from the 2010 American Community Survey (ACS).

Prior Research and Study Contributions

In the United States, immigrants may naturalize after five years of legal permanent residency if they meet the criteria for citizenship (e.g., they must demonstrate English proficiency and pass a civics test), or after three years if they are married to a U.S. citizen or have served in the U.S. military (U.S. Citizenship and Naturalization Services 2012). Because citizenship grants immigrants eligibility for a wide variety of public assistance programs and civic activities (Passel, Clark and Fix 1997; DeSipio 2001; Fix and Zimmermann 2001), and because it serves as an indicator of social inclusion and integration (Van Hook, Brown, and Bean 2006; Bloemraad 2006), researchers interested in immigrant integration and the well-being of immigrants and their children often incorporate citizenship into their analyses. For example, using Canadian and U.S. Census data Bloemraad (2006) finds that rates of naturalization among immigrants in Canada, which has a multiculturalist policy regime, are relatively higher than those for immigrants in the United States, where federal policy with respect to the civic incorporation of immigrants is, by comparison, more laissez-faire. In another example, Van Hook and Balistreri (2006) found that children living in households with noncitizens experienced steeper declines in food support and increases in food insecurity following the enactment of legislation that cut public assistance programs to noncitizens.

Data on citizenship has also been used in research on the characteristics of the unauthorized immigration. Few surveys ask questions about immigrants' legal status. Information on citizenship, which is a common survey question, along with other indicators of legal status, has been used to impute who among the foreign born are legally resident (Passel and Cohn 2009). Citizenship is strongly associated with legal status because naturalized citizens are composed entirely of legally-resident persons, while noncitizens are composed of a mixture of legal statuses, including unauthorized migrants, legal permanent residents, and other legal non-immigrants (Passel, Van Hook, and Bean 2006).

There are good reasons to suspect that citizenship is inaccurately estimated in Census data. During the late 1990s, Passel and Clark (1997) compared the number of persons that are reported as naturalized in the 1990 Census and the 1996 Current Population Survey (CPS) with the number of naturalized citizens based on administrative data from the Immigration and Naturalization Service (INS). They found the Census/CPS estimates to be much higher than the INS-based estimates for two groups. Among new arrivals (those in the U.S. fewer than five years) from all national origins, about 75% of those who were reported as naturalized were probably not. Among longer-resident Mexican and Central American immigrants, about one-third of those who were reported as naturalized were probably not.

Although other possible explanations exist, the discrepancy between administrative records and the Census/CPS has been attributed to false reporting of citizenship among Mexican and Central American immigrants, possibly because many of them are unauthorized and have an incentive to hide their status from interviewers or Census takers, or because they are confused about their citizenship status. This assessment has limited the value of the citizenship variable for research on immigrant naturalization and legal status. For example, skepticism about the accuracy of citizenship reporting has led the Pew Hispanic Center to refrain from using citizenship as an indicator of legal status among most recently-arrived immigrants and all Mexicans and Central Americans (Passel et al. 2006).

For several reasons, we seek to update and extend the research conducted by Passel and Clark (1997). First, Passel and Clark's research was presented at a conference but the details of their methodology were never published in a peer-reviewed outlet. For this reason, it has been difficult to evaluate and replicate their work. Here, we provide a detailed description of the data and methods used to evaluate Census-based estimates of the number of naturalized citizens. While our method is not identical to Passel and Clark's method, it adheres to the same basic logic. Like Passel and Clark, we use administrative data on naturalization to evaluate the number of citizens enumerated in Census data, working under the premise that administrative records of naturalization are less sensitive to error than Census data.

Second, we seek to update the Passel and Clark estimates because no evaluations of citizenship reporting have been done since their study. Reporting error may have increased due to increased DHS enforcement activities both at the U.S.-Mexico border and in the U.S. interior (Haddal 2010). The increased risk of deportation and heightened costs of re-entering the United States if deported may have made migrants less willing to provide accurate responses to questions about citizenship. Thus, at the same time that Federal and state/local policy vis-à-vis immigrants has shifted toward the increasing exclusion of non-citizens (Portes and Rumbaut 2006) – and especially unauthorized migrants – from certain rights, benefits and access to labor markets, the changing policy context may have also encouraged increased misreporting of naturalization among non-citizen immigrants, especially in government-sponsored surveys. Passel and Clark examined citizenship in the 1996 March Current Population Survey and the 1990 Census, data collected over 15 years ago. We evaluate the number of naturalized citizens in the 2010 American Community Survey (ACS). Discussed further below, the ACS was designed as a replacement of the decennial Census long form, and now serves as the major source of information about the size and composition of the foreign born population in the United States.

Third, we go beyond the Passel and Clark estimates by exploring the sensitivity of the results to three sources of uncertainty in the calculations: sampling error, emigration of naturalized citizens, and coverage error of naturalized citizens in Census data. We explain how these factors influence estimates of the number of citizens and identify plausible ranges of emigration and coverage error based on past research. We then use these ranges to produce a range of estimates of the discrepancy between administrative and census estimates of the number of citizens. These ranges help us eliminate some of the most important alternative explanations for discrepancies between administrative and census-based estimates. If a discrepancy is consistently evident across all plausible ranges of sampling error, emigration, and coverage error, this lends support to idea that the discrepancy is due to an actual difference between the number of naturalized citizens represented in Census data and the number of naturalized citizens in the population, rather than the assumptions we make in the process of evaluating census data.

Finally, we stress that our aim is to evaluate the ACS citizenship data *as it is produced for public use* by the Census Bureau. Therefore, we do not attempt to "correct" the citizenship

status or place of birth data reported in the public-use files of the ACS, such as by recoding what appear to be implausible responses to the citizenship question (e.g., foreign born with fewer than five years of U.S. residence), by adjusting the survey weights to account for insider knowledge of coverage error or other problems with the sampling weights, or by using restricted-use census data. We instead treat the ACS data as a competent non-Census Bureau analyst would.

Data and Methodology

To assess the current level of citizenship reporting error, we estimated the number of naturalized citizens in mid-year 2010 by age group, sex, region of origin, and duration of residence based on the number of Office of Immigration Statistics (OIS) naturalization records. We then compared the OIS-based estimates with the corresponding numbers in the 2010 American Community Survey (ACS) (also a mid-year estimate). The difference between the two provides an indication of over- or under-representation of naturalized citizenship in the ACS.

As mentioned above, the discrepancy can arise from errors other than reporting error. Most importantly, the ACS estimates are also subject to sampling error and coverage error, and the OIS-based estimates may not be accurate because of erroneous assumptions about the extent to which immigrants remain in the United States after naturalizing. We provide ranges of estimates based on plausible ranges of sampling error and coverage error (in the ACS), and emigration among naturalized citizens (for the OIS-based estimates). We are therefore able to assess not only the ACS-OIS difference, but also whether the difference could possibly be explained by sampling error or alternative assumptions about emigration or coverage error.

In what follows, we describe the data, samples, methods, and errors associated with the production of the ACS- and OIS-based estimates. This is then followed by a description of how we compare the two sets of estimates. We conducted all data analyses in Stata 12.1[i]. All Stata programs and data files used to produce the ACS and OIS estimates are provided at [link here].

Estimates Based on the American Community Survey

Data—The 2010 ACS interviewed approximately 1.9 million U.S. housing units, or 2.4 percent of all occupied U.S. housing units, and 145 thousand persons in group quarters[ii]. We used the one-year public use 2010 ACS, which contains a 1-in-100 sample of the U.S. population (N = 3,061,692 persons), obtained from the *Integrated Public-Use Microdata Series* (IPUMS) (Ruggles et al. 2010)[iii]. We used the ACS, rather than the decennial Census or the Current Population Survey (as done by Passel and Clark), for several reasons. First, the decennial census no longer asks questions about citizenship. By design, the ACS replaced the decennial long form in the early 2000s and is now the only large U.S. sample with questions about naturalization and citizenship. The CPS would have been a good alternative, but the ACS is better because it includes a question about the year of naturalization, an item that is important for our estimates. Additionally, the ACS has a much larger sample than the CPS, which reduces sampling error. Finally, the ACS is representative of the U.S. resident population while the CPS is representative of a sub-set— the civilian noninstitutionalized population. While we do not expect this to make much

difference, the more inclusive ACS population is a closer match to the OIS-based estimates, which capture the entire U.S. resident population of naturalized citizens.

As described in the next section, the OIS estimates are limited to those who arrived in the United States in 1990 or later and naturalized age 18 or older. To match the universe for the OIS estimates, the ACS sample is limited to the same population: foreign-born naturalized citizens who came to the U.S. to stay in 1990 or later and who naturalized age 18 or older (N = 47,842).

The key variables used to produce the ACS estimates include country or region of birth (categorized as Mexico, Central American/Caribbean, Asia, and all other regions), sex, age (18-29, 30-39, and 40+), duration of U.S. residence (categorized <5 and 5+ years; recoded from the year the respondent reported he/she came to live in the U.S.), citizenship status, and age naturalized (18+; recoded from year of naturalization). Citizenship is based on the question: "Is this person a citizen of the United States?" to which respondents would have to answer "Yes, U.S. citizen by naturalization" in order to be counted as a naturalized citizen[iv]. Persons marking this response are then asked to indicate the specific year of naturalization. Year of entry is ascertained by the question: "When did this person come to live in the United States?" Respondents are further asked to indicate the specific year of immigration.

Errors and Omissions in ACS Data—As discussed above, citizenship status could be mis-reported. This is the type of error we are most interested in evaluating. However, there are several other possible sources of error in the ACS estimates that we wish to account for. While it is impossible to identify and enumerate *every* source of error, we attempt to account for the errors that seem most likely to affect our evaluation.

First, ACS estimates are subject to sampling error. To assess the size of sampling error, standard errors and confidence intervals were calculated using the Successive Differences Replication (SDR) method described in the ACS design and methodology documentation (U.S. Census Bureau 2009). To do so, we employed the ACS replicate weights provided by the Census Bureau. For more details, interested readers should refer to the accompanying stata program for the ACS analyses (available on-line), as well as to the useful description of the method provided at the IPUMS website (https://usa.ipums.org/usa/repwt.shtml#q70).

Second, ACS estimates are subject to imputation error. Item nonresponse on the immigration questions is 4.5% on country of birth, 9.0% on year of entry, 5.2% on citizenship, and 15.1% on year of naturalization[v]. The U.S. Census Bureau uses a "hot-deck" method for imputing missing data on these items, but the details of their methodology are unclear. While missingness varies in magnitude[vi], it is worth noting that some sub-populations such as young adult and elderly Mexicans have relatively high rates of missing data on key variables. To the extent that the Census Bureau's hot deck method does not accurately assign missing values, the naturalized population totals in the ACS will be prone to error.

Third, there may be some reporting error or inconsistencies associated with some of the immigration-related items in the ACS other than citizenship, particularly year of entry and

---

[iv]The 1990 Census asked the identical question as the 2010 ACS, and the CPS asks a similar question: "Did you become a citizen of the United States through Naturalization?"

[v]Naturalized citizens, of course, are the only persons who answer the question about year of naturalization. Thus, 15.1 percent of the citizens had missing data on this question, while the other percentages reported are for the entire foreign-born sample.

[vi]The average allocation rate for person variables in the 2010 ACS was 5.8 percent. For context, rates for other commonly used ACS variables are: year last married (11.4%), employer-provided health insurance (6.2%), hours worked per week (7.7%), occupation (8.1%), and income (22.4%).

year of naturalization. Ellis and Wright (1998) showed that there were inconsistencies in responses to questions about year of entry and place of residence one year earlier in the Current Population Survey. Recently-arrived immigrants who are engaged in circular migration may find the year of entry question particularly confusing and could plausibly report the year of their first trip, last trip, or a year in between (Redstone and Massey 2004). This suggests that, at least for temporary migrants, year of entry may understate duration of U.S. residence. In a related vein, and as we discuss in more detail below in relation to the OIS data, differences in the questions used to determine year of immigration between the two data sources also lend uncertainty to the comparative estimates of the naturalized population.[vii]

A fourth source of error in the ACS data is coverage error. By coverage error, we refer to discrepancies between the number in a given population represented in the ACS and the actual population that are not due to sampling error or reporting error. Coverage error among the foreign born can arise from inadequate representation of housing units containing foreign born persons in the ACS sample or sampling frame, omissions of individuals from household rosters, or from errors in the sampling weights. If the number of naturalized citizens in the ACS were too low because of coverage error, then this would influence the comparison with OIS based estimates of the number of naturalized citizens independently of reporting error in the ACS.

Many observers suspect that coverage error is higher for the foreign born than the native born population, particularly among the U.S. Mexican-born population. The reason is simply that groups characterized by residential mobility and complex living arrangements, illicit activity, fear of detection, and socio-political marginality are less likely to be picked up in censuses or surveys (Swanson, Siegel and Shryock 2004). A comprehensive review of this work was provided by Van Hook and Bean (1998). During the 2000s, the two leading producers of estimates of the unauthorized foreign-born population, the Office of Immigration Statistics (OIS) and the Pew Hispanic Center (Pew), assumed that coverage error was, respectively, 10 (Hoefer, Rytina and Baker 2011) and 13 percent (Passel and Cohn 2009) for the unauthorized foreign born, and about 2.5% for other foreign born. OIS rested its assumption about coverage error on a survey conducted in Los Angeles that was then compared to Census counts (Marcelli and Ong 2002). Pew based its assumption on the levels of enumeration error estimated for the 2000 Census, which were calculated by incorporating data from the Accuracy and Coverage Evaluation (ACE) post-enumeration survey[viii]. Recent evidence based on a triangulation of three different methods that examine trends in births, deaths, and net migration, however, suggests slightly higher coverage error among all Mexican born in 2000 than estimated by OIS and Pew (about 15-20% coverage error), but declining rates throughout the 2000 decade (Van Hook et al. 2012)[ix].

[vii]Additionally, responses to the year of entry and year of naturalization questions may suffer from year heaping, in which respondents are more likely to report years ending in 5 or 0. Examination of the data did suggest some digit preference among respondents for these years, but also showed considerable heaping in years ending with digits 8 and 9, reflecting, we believe, actual spikes in both immigration and naturalization during the late 1990s. Because this type of heaping reflects actual trends in immigration and naturalization, we do not smooth the data. We did produce a supplementary set of results (available upon request) based on smoothed year of entry and year of naturalization data (Myers 1940). The results were very similar to those presented here. This makes sense. Year heaping resulting from digit preference would present the greatest concern if year variables were used as continuous measures, but we designed our analyses to minimize our reliance of these variables. We only use year of entry to drop pre-1990 arrivals from the sample, and for some analyses to discern between those arriving in the last five years versus five or more years. Similarly, we only used year of naturalization to classify respondents as naturalizing at age 18 or older. We discuss the limitations of these indicators and possible implications for the results in the conclusions.

[viii]Like previous post-enumeration surveys, the 2000 ACE re-interviewed a stratified sample of households shortly following the decennial census. Respondents in the post-enumeration survey were matched to Census respondents in order to assess rates of omission, duplication, and net coverage error. Although the ACE did not produce separate estimates for the foreign born, the Pew Hispanic Center used the ACE to arrive at a 13 percent figure by assuming unauthorized rates of coverage error two to three times those for others within the same race/Hispanic origin, age and sex grouping.

This evidence places coverage error in the range of 2.5% (for legal foreign born), to 10% to 13% (for unauthorized foreign born), to 15-20% (for Mexican foreign-born). Considering that coverage error is likely to be even lower among naturalized citizens than all foreign born or the Mexican born (because they are not unauthorized), we assumed a narrow range of coverage error of 0% to 5%. We adjusted for coverage error in selected analyses by dividing the ACS estimate by one minus the assumed coverage error rate (e.g., in the case of 5% coverage error, the adjusted ACS estimate = ACS estimate/.95).

Estimates Based on Office of Immigration Statistics (OIS) Naturalization Records

OIS-based estimates of the naturalized citizens in 2010 were derived from the numbers of naturalizations in OIS administrative records. OIS data on naturalizations are historical records of events ("flows") occurring over time, so they need to be converted to a "stock" estimate of the number of naturalized citizens for a given point in time (i.e., July 2010) to be comparable with ACS estimates. Once a person becomes a naturalized citizen, they may remain living in the United States and be represented in the 2010 ACS. Alternatively, they may have died or emigrated from the United States, and therefore could not be represented in the 2010 ACS.

To account for deaths and emigration, we used the cohort-component projection method (Rowland 2003). More specifically, for each naturalization cohort, we estimated the number remaining by the time of the 2010 ACS (July 1, 2010 on average) by subtracting an estimate of deaths (D) and emigrants (E) that likely occurred during the follow-up period, that is, between the year of naturalization and July 1, 2010. For example, for a cohort age 20 that naturalized in 1995 ($N_{20, 1995}$), the number of naturalized citizens age 35 in 2010 ($C_{35, 2010}$) is:

$$C_{35, 2010} = N_{20, 1995} - D_{1995\text{-}2010} - E_{1995\text{-}2010}$$

More generally, for a given cohort that naturalized at age a in year t,

$$C_{a+(2010\text{-}t, 2010} = N_{a, t} - D_{t\text{-}2010} - E_{t\text{-}2010}$$

We describe below how we estimated each component of this equation.

Naturalizations ($N_{a, t}$)

Data: The OIS routinely compiles data obtained from the administrative records of legal immigrant admissions and naturalizations kept by the U.S. Department of Homeland Security. These files are not available as public use data. The naturalization files include a record for each naturalization event occurring in the United States since the mid 1970s. Attached to each record is the demographic and immigration-related information (e.g., age, sex, country of birth, year of admission to the U.S., year of arrival to the U.S.) for the people who became citizens. Unlike the ACS, missing data do not pose significant problems for the OIS data. Out of the 5.4 million naturalization records used to produce our estimates, only 0.05% were missing on age, 0.03% on sex, 0.11% on country of birth, and 0.40% on year of arrival[x].

[ix]The three methods involve (1) comparisons of U.S. births to Mexican born mothers with U.S. born children counted in the ACS; (2) comparisons of estimates of net migration from Mexico to the United States based on Mexican census data and U.S. Census data; and (3) comparisons of deaths to the Mexican born in the United States, and the underlying population that "produced" those deaths, with the number enumerated in the Census and ACS.

Because no public use data are available, the Office of Immigration Statistics generously provided a file to us containing detailed cross-tabulations of the number of naturalizations by year of naturalization, age at naturalization[xi], sex, year of arrival, and region of birth (Mexico, Central American/Caribbean, Asia, Other). Combined, the cross-tabulations described the size and characteristics of 122,660 different naturalization cohorts. Together, these cohorts experienced 5.4 million naturalizations between January 1, 1990 and July 1, 2010[xii]. Of course, we later combined these groups for presentation purposes, but the underlying detail granted us considerable flexibility.

Errors and Omissions in OIS Naturalization Data: Like the ACS data, the OIS data are subject to errors and omissions. First, the OIS data include only those who naturalized as adults age 18 and older. Children ages 0-17 may obtain "derivative" citizenship from their parents when they naturalize, but the U.S. government does not produce easily accessible or interpretable statistics on derivative citizenship among children. We therefore limited our analyses (for both the OIS and ACS estimates) to those who naturalized as adults age 18+.

Second, to be included in the OIS naturalization file, a person must have a matching record in the computerized OIS admission file and these files do not extend back before 1972. Thus pre-1972 arrivals (who contributed about 10% of all naturalizations between 1990 and 2010) are not in the computerized OIS naturalization file. To minimize this error, we limited our naturalization estimates (for both OIS and ACS) to those who arrived in the United States in 1990 or later.

Third, naturalization data were not available for the approximately 100,000 LPR records out of 1.7 million that were not originally included in DHS flow data between 2001 and 2010 due to delayed data entry. For naturalizations occurring between 2001 and 2010, we therefore proportionately adjusted the number of naturalizations upward by a small percentage in order to add back in the 100,000 missing records. Specifically, we weighted the 1,661,815 cases that naturalized after 2000 by the ratio: (1,761,816 / 1,661,816).

Fourth, information in the OIS data on year of arrival may be unreliable because it is based on a variety of sources (i.e., sometimes determined from other documents, sometimes self-reported, etc.). Additionally, self-reported year of arrival is based on a question about the year of the respondents' last trip to the United States, which is different from the census question (year the respondent came to the U.S. to live). In our analyses, we therefore use year of arrival in a limited manner, namely to identify those who arrived in 1990 or later, and to discern recently-arrived immigrants (with less than 5 years of U.S. residence) from longer-resident immigrants.

Deaths (D_{t-2010})—We estimated the likely number of deaths to each naturalization cohort by multiplying the appropriate age-, sex-, and year-specific annual probability of dying (q_x) by the number remaining in the cohort for each year of the follow-up period. No life table for naturalized citizens exists, so we used the life tables produced by the Social Security

---

[x]Even though missingness in the OIS data is not high enough to bias estimates of the characteristics of naturalized citizens, we did not want to discard the records with missing data or our estimates of naturalized citizens would be too low. Since the OIS data was given to us in the form of cross tabulations rather than individual records, we could not use standard methods to handle missing data. Instead, we simply distributed the records with missing data proportionately across the categories of each variable (i.e., matching the observed distributions).

[xi]OIS provided data for five-year age groups. We subdivided the data into single-year age groups for the purpose of performing the projections (which are considerably easier computationally for single years of age), with the numbers of naturalizations equally allocated across single-year age groups. After the projection was done, the age groups were collapsed into very broad age categories (18-29, 30-39, 40+) for the purpose of comparison with the ACS.

[xii]OIS did not report month of naturalization, so we estimated the number of naturalizations from January 1, 2010 through July 1, 2010 as half the total number occurring in the 2010 calendar year.

Administration (Bell and Miller 2005), which estimate mortality risks for the United States based on NCHS vital statistics for ages 0-64 and Medicare files for ages 65 and older across all years of the projection period. Thus they yield more accurate estimates of old-age mortality (with less age misreporting) and reflect the mortality experiences of those eligible for Medicare, including naturalized immigrants. The Social Security Life Tables are available from the Max Plank Institute's Human Life-Table Database (http://www.lifetable.de/). Mortality is a small component of the OIS-based estimates, and the estimates do not vary much when alternative U.S. life tables are used except for the oldest age groups (not a major concern because over 90% of the naturalized citizens in our sample are younger than 65).

Emigrants (E_{t-2010})—We estimated the number of emigrants for each naturalization cohort by applying a set of race-, age- and duration-specific emigration rates each year of the projection period. Because no official statistics on emigration from the United State have been collected since 1956 (Kraly 1998), emigration among the foreign born has been estimated with a variety of indirect demographic methods, which have yielded a range of estimates. Because of uncertainty about emigration, we apply four different sets of estimates. The first assumes *no* emigration at all, and the other three come from published estimates, which roughly correspond with "low", "moderate", and "high" levels of emigration. For the latter three, we used rates that vary by 5-year age group, sex, race or country of birth (Mexico vs. other), and duration of U.S. residence (0-4, 5-9, and 10+ years).

The "low" estimates are those produced by Ahmed and Robinson (1994). These are based on comparisons of cohorts followed over time between 1980 and 1990 censuses. The Ahmed and Robinson rates are broken down by race/ethnicity: Hispanic, white, black, and Asian. We used the Hispanic rates for Mexicans and Central/South Americas, the white rates for Europeans and Canadians, the Asian rates for all Asians, and the black rates for all other immigrants (mostly Caribbeans and Africans).

The "moderate" estimates are those based on Social Security work history files (Schwabish 2009). These use a three-year discontinuation in U.S.-reported earnings as an indicator of emigration. Because unauthorized immigrants do not qualify for Social Security, the Social Security-based rates may most closely describe the emigration patterns of legal immigrants and (by extension) naturalized citizens. Our rates came from a prediction model provided to us by Schwabish, which permitted us to produce annual emigration rates by age, sex, duration of residence, and Mexican origin[xiii]. We used the Mexican rates for Mexicans and Central Americans, and the non-Mexican rates for all other immigrants.

Finally, the "high" estimates are those based on the CPS-matching method (Van Hook, Zhang, Bean, and Passel 2006). These use attrition from the Current Population Survey to estimate emigration. We used this method together with data from the 1996-2009 CPS to produce annual probabilities of emigration for naturalized foreign-born individuals in the CPS. We then estimated a prediction model of the probability of emigration, and used the estimated coefficients to construct predicted emigration rates by age, sex, duration of

---

[xiii]We gratefully acknowledge the assistance of Jonathon Schwabish for providing the prediction model. The model was discrete-time event history model (logistic regression) predicting the odds of emigrating in a given year. The model was estimated on a person-year file that contains a record for every foreign-born Social Security recipient from the time of entry into the Social Security system until emigration or censorship. We used the coefficients to calculate the log-odds of annual emigration for each demographic group, which we then converted to predicted probabilities (i.e., annual emigration rates).

residence, and Mexican origin[xiv]. We used the Mexican rates for Mexicans and Central Americans, and the non-Mexican rates for all other immigrants.

Figure 1 illustrates the three sets of emigration rates for male Mexican immigrants with 0-4 years of U.S. residence. Readers will notice that the "low", "moderate", and "high" labels are broadly descriptive but are only partially accurate. Their rank order changes around age 55. At younger ages, the Ahmed/Robinson "low" rates are lowest, the Van Hook "high" rates are highest, and the Schwabish "moderate" rates fall in the middle. However, at older ages (55+), the Van Hook "high" rates fall below the Schwabish "moderate" rates.

Projection Details—We projected forward each naturalization cohort from the year of its naturalization to July 1, 2010 (the ACS estimate date), subtracting deaths and emigrants and adding one year of age to the remaining members of the cohort, for each year of the follow-up period[xv]. The first and last years of the follow-up period consisted of only six months. In the first year, we assumed naturalizations occurred evenly throughout the year, so the duration of the first year averaged six months. In the last year (2010), the projection period was only six months (from January 1 through July 1). The projections were conducted using Stata for all 122,660 naturalization cohorts. To compare the projected numbers of naturalized citizens for July 1, 2010 with 2010 ACS estimates, we collapsed the surviving cohorts into manageable groupings: by country/region; by country/region, sex, and duration of residence (>5 and 5+ years); and by Mexican origin, age grouping (18-29, 30-39, and 40+), and sex.

Comparing OIS with ACS estimates

We compare each of the OIS- and ACS-based estimates of naturalizations. We report the difference as a raw number (ACS – OIS) and a percentage difference [(ACS – OIS)/OIS × 100]. We take into consideration three criteria for determining the presence of reporting error. First, the difference between the OIS-based estimates of naturalizations for a given sub-population (e.g., Mexican immigrant women) and the corresponding ACS estimate must be significantly different. That is, the OIS estimate must fall outside the bounds of the ACS 95 percent confidence interval. Second, the ACS estimate must fall outside the bounds of OIS-based estimates given a plausible range of assumptions about emigration. Third, the OIS estimate must fall outside the bounds of ACS estimates given a plausible range of assumptions about coverage error. In reporting results, we first focus in Tables 1-3 on the size of the OIS-ACS differences and whether they may be explained by sampling error or by alternative assumptions about emigration. Later, in Tables 4-5, we add in the complexity of making alternative assumptions about coverage error.

Results

In Table 1 we report the number of naturalizations from the OIS tables, components of change, and the resulting estimate of naturalized citizens, as well as the corresponding estimate from the ACS. These figures are reported for the entire foreign-born population and separately for Mexicans, Central Americans/Caribbeans, Asians, and "Other" immigrants, with varying levels of emigration assumed.

[xiv]We adjusted the estimates for return migration to reduce the influence of circular migration on the emigration rates. Additionally, we use the model to produce estimates rather than simply producing rates for each demographic group separately because of sample size constraints.

[xv]We estimated the number of deaths and emigrants simultaneously for each year of the follow-up period. That is, we used mathematical equations developed for multiple decrement life tables, which take into account the size of the cohort at all instances in time that it is at risk for death and emigration (Preston, Heuveline, and Guillot 2001).

The ACS estimates about 5,260,000 foreign-born residents arriving in the U.S. after 1989 and naturalizing as adults. This is nearly identical to the OIS estimate (5,316,000 naturalizations) when we assume zero emigration, an implausible assumption. However, if we account for emigration, we estimate significantly more naturalized citizens in the ACS than the OIS-based estimates. Expressed as a percentage of the OIS estimate, the magnitude of the discrepancy increases from 4, 7, to 10 percent and becomes statistically significant when we apply the "low", "moderate" and "high" emigration rates, respectively.

Table 1 indicates that the OIS-ACS difference is concentrated largely among Mexican immigrants, among whom the discrepancy is significant and ranges from 25 percent (assuming no emigration) to 38 percent (assuming high emigration). Unlike the previous work of Passel and Clark (1997), comparison of ACS and OIS estimates do not suggest significant levels of misreporting among Central Americans/Caribbeans, for whom the ACS estimate is significantly higher than the OIS-based estimate only when assuming "moderate" or "high" levels of emigration. Also, when we assume no emigration among Asians, the ACS estimates significantly *fewer* naturalizations than are estimated in the OIS data. This is probably because emigration is almost certainly <u>not</u> nonexistent for this group. When we assume low or moderate emigration, the OIS-ACS differences are insignificant, and at high levels of emigration, the ACS-based estimate is only 3 percent higher than the OIS estimate. Finally, naturalizations among immigrants born elsewhere in the world are not significantly higher in the ACS when we assume no emigration. But the OIS-ACS gap increases as the assumed rate of emigration increases, from 5 to 8 to 10 percent, respectively, at "low", "moderate", and "high" levels of emigration.

Table 2 reports the naturalization estimates by sex, region of birth, and duration of U.S. residence. For both men and women from all origin regions, the estimated number of naturalized citizens in the ACS is substantially and significantly higher than the OIS-based estimates among immigrants with fewer than five years in the U.S. For example, the number of naturalized Mexican men with fewer than five years of U.S. residence is nearly 27 times higher (2587%) in the ACS than the OIS estimates. Another way to express this is that among the 16 thousand reporting as citizens in the ACS, only about 600 (or about 4 percent) are likely to actually be naturalized citizens. Among those in the U.S. for five or more years, the OIS-ACS gap is much lower in relative terms, and concentrated among Mexican men. The 2010 ACS estimates about 250,000 naturalizations among Mexican-born men with 5 or more years of U.S. residence (i.e., arrived in 1995 or later), and naturalizing as adults. Even when assuming no emigration among Mexican men with OIS naturalization records, the ACS estimate is significantly higher by 37 percent, and this increases to 41, 43 and 54 percent when "low", "moderate", and "high" rates of emigration, respectively, are assumed. Though ACS estimates are significantly higher among Mexican women as well, the magnitude of estimated over-reporting is substantially lower than among Mexican men, ranging from 7 percent at low levels of emigration to 17 percent at high rates of emigration.

In Table 3, OIS and ACS estimates are presented for Mexican and non-Mexican men and women by age group by varying rates of emigration. We note that the OIS estimates do not always decline as emigration increases from the "low" to the "moderate" to the "high" series because of age crossovers in various emigration estimates. Regardless of assumptions about emigration, ACS estimates are especially high relative to the OIS-based estimates among Mexican men of all age groups and Mexican women aged 40 and older. The same pattern does not hold among non-Mexicans, among whom the discrepancy remains relatively low across all age groups.

Up to this point, our ACS estimates of naturalization have not been adjusted for possible under-coverage of the foreign-born in the ACS. To illustrate the impact of coverage error,

we report in Table 4 percentage differences between the ACS and OIS estimates at three levels of assumed coverage error. For all groups, the OIS-ACS discrepancies increase as rates of assumed emigration and coverage error increase. For example, among Mexican-born men aged 18-29, the gap is about 26 percent if no coverage error is assumed (assuming no emigration). This increases to 29 percent when we assume 2.5 percent coverage error, and to 32 percent when we assume 5 percent coverage error. The same pattern holds for Mexican women 18-29, though the magnitude of over-reporting is substantially lower, ranging from −1 percent to 4 percent (assuming no emigration), and is not significant in any instance. This shows that the naturalization reporting error estimates shown in Tables 1-3 are low-end estimates. They will be higher for groups that are underrepresented in the ACS.

Finally, we summarized the OIS-ACS differences and assessed whether these can be explained by sources other than reporting error in Table 5. In the first column, we present the percentage OIS-ACS difference while assuming moderate emigration and no coverage error. In the next three columns, we designate with a "Y" the differences that are greater than can be explained by (1) sampling error (assuming moderate emigration and no coverage error), (2) alternative plausible assumptions about emigration (assuming no coverage error), and (3) alternative plausible assumptions about coverage error (assuming moderate emigration). Finally, the last column indicates with a "Y" whether the ACS-OIS difference is so large that it cannot be explained by *any* of these three sources of error and are therefore is very likely to reflect reporting error. For example, the OIS-ACS gap for Mexicans is 31 percent if we assume "moderate" levels of emigration and no coverage error (2nd row). The "Y" in the second column indicates that this gap is statistically significant. The "Y" in the third column indicates that the gap remains no matter what we assume about emigration (with no coverage error). The "Y" in the fourth column indicates that the gap remains no matter what we assume about coverage error (with moderate emigration). Finally, "Y" in the fifth column indicates that the gap remains significant under all combinations of plausible assumptions about sampling error, emigration, and coverage error.

Overall, the results confirm that the OIS-ACS discrepancies for three groups are large enough to suggest reporting error among: (1) all immigrants with less than five years of U.S. residence, (2) Mexican men of all ages and durations of residence, and (3) Mexican women ages 40 and older. Of course, there may be alternative explanations for the discrepancies other than reporting error, but our analyses eliminate three of the major alternative explanations.

Conclusion

Naturalization is an important, though under-examined, indicator of immigrants' social and political integration, and numerous government-sponsored population surveys include questions about citizenship status (Costanzo, Davis and Malone 2002). It is therefore important to gauge the degree to which immigrants may misreport their citizenship status in response to such questions. To the best of our knowledge, estimates of the misreporting of naturalization have not been generated since the mid-1990s (Passel and Clark 1997). Our objective in this paper has been to update this research and provide the first set of estimates of reporting error among immigrants in the American Community Survey (ACS).

Naturalization reporting error was estimated by comparing a demographic estimate based on administrative data from the Department of Homeland Security's (DHS) Office of Immigration Statistics (OIS), with the number of naturalizations reported in the 2010 ACS. Similar to the earlier work of Passel and Clark (1997), we find that the ACS estimates of naturalized citizens are much higher than OIS-based estimates among immigrants from all regions of the world who have lived in the U.S. fewer than five years. Among immigrants

residing in the U.S. for five or more years, the OIS-ACS discrepancy is concentrated among those born in Mexico, especially men of all ages and women age 40 or older. In fact, the discrepancy is particularly large for both men and women age 40+, which is a little surprising given that the unauthorized population is concentrated among young and working-aged adults, and we expected the unauthorized to be most likely to misreport. Nevertheless, these patterns cannot be explained by sampling error, alternative assumptions about emigration, or coverage error.

We can only speculate as to the reasons behind the apparently high rates of over-reporting among Mexican immigrants. There remains the remote possibility that the discrepancies derive from inaccurate assessments of mortality[xvi], or by differences in how duration of residence is measured between the OIS and ACS[xvii]. However, the results seem more likely to reflect the fact that large portions of Mexicans, particularly young Mexican men, are unauthorized migrants. When compared with the total foreign born population, the 2010 estimates of the unauthorized population (Hoefer, Rytina, and Baker 2011) suggest that 55% of Mexican foreign born are unauthorized compared with 28% of Central Americans/ Caribbeans, 8.5% of Asians, and 10% of all other national origins. Estimates of the Mexican unauthorized population by age and sex are difficult to locate, but one report based on the 2000 Census (Passel, Van Hook, and Bean 2004) suggests that Mexican-born men and women younger than 30 were the most likely to be unauthorized among all age, sex, and national origin groups. For example, 89.4% were estimated to be unauthorized compared with 34.6% of same-aged non-Mexican foreign-born men. Such high prevalence of unauthorized status may help explain the large OIS-ACS discrepancy among young Mexican-born men.

In the case of Mexican immigrants age 40+, the results are more difficult to explain since the proportion unauthorized for this age group is lower than younger Mexican immigrants. Perhaps one clue is that most of these migrants arrived in the United States as older adults (due to the fact that we restricted the sample to immigrants arriving in the U.S. in 1990 or later to be consistent with the population reflected in the OIS data). Among *all* naturalized Mexican immigrants counted in the 2010 ACS, just 14 percent of those aged 40-64 and 8 percent of those aged 65+ arrived in the U.S. in 1990 or later. We suspect that the distinctive group of older-arriving immigrants in our sample knows little to no English, may well be unauthorized migrants reuniting with adult children who have settled in the U.S., and as such, may live in complex multi-generational households. To the extent that these attributes characterize older-arriving Mexican migrations, these factors may combine to lend difficulty in collecting complete and accurate survey data about them, and thus be in part responsible for their high rates of over-reporting of naturalization. Supplementary analyses further reveal high levels of missing data on immigration items for this group, so missing data and inaccurate missing data allocations may also help explain their high OIS-ACS gap in the number of naturalized citizens.

[xvi]However, we think this is unlikely. Fewer than 10% of the naturalized citizens in our analyses were age 65 or older. Additionally, supplementary analyses show that the OIS-ACS discrepancy is equally high among the older age groups with lower mortality rates (age 40-64) and higher mortality rates (age 65+).

[xvii]We think this is unlikely. To explain, the ACS question, "When did this person come to live in the United States?" lacks specificity and it is possible that respondents who have made multiple trips to the U.S. would report their first, last, or any trip in between (Redstone and Massey 2004). However, the primary source of year of entry information in the OIS data is more specific, asking respondents to indicate their "Date of Last Arrival *(mm/dd/yyyy)*". Thus, circular migrants would be more likely to answer the ACS question with the year of their first or second trip, while indicating their most recent year of arrival (a later year) on their LPR application form. As an example, imagine a Mexican immigrant who first entered the country as an unauthorized immigrant in 1985 and made annual trips back and forth before legalizing in 1995 and naturalizing by 2000. He/she may plausibly indicate on his/her LPR application 1995 as the year of last arrival, but an earlier year (say 1985) as the year he/she first came to live on the ACS. In our analysis, this person would be excluded from the ACS sample of post-1989 arrivals but included in the OIS data. To the extent that this is the common scenario among circular migrants (and we have no way of confirming that it is), this would lead to *fewer* naturalized immigrants being counted in the ACS than indicated in the OIS data, not more as we observe.

One difference between our results and those of Passel and Clark is that they find over-reporting of naturalization among longer-term immigrants for both Mexicans *and* Central Americans. Our results do not suggest substantively significant levels of naturalization over-reporting among immigrants born in countries other than Mexico. We do not have a strong explanation for this difference from Passel and Clark. It may arise from a real change in reporting among Central Americans, or it may arise from methodological differences, such as in how emigration is treated. The OIS-ACS gap for Central Americans could not be explained by sampling error or coverage error, but was significant when we assumed moderate or high levels of emigration. Still another divergence from the Passel and Clark study is that we found little evidence of over-reporting among Mexican women, particularly those younger than 40. This does not necessarily conflict with Passel and Clark's finding concerning Mexicans, but instead builds on it since they did not break down their results by Mexican-origin, age and sex.

Finally, our analyses suggest that our conclusions are robust to alternative assumptions about emigration and coverage error. Even if there were no emigration and no coverage error at all, the ACS estimates would be higher than the OIS estimates for many groups. And, when we assumed higher (non-zero) emigration, this reduced the OIS-based estimates, which then further increased the OIS-ACS discrepancy. Similarly, when we accounted for coverage error of the foreign born in the ACS, this again increased the gap between OIS and ACS estimates. Moreover, it is clear that if coverage error for some groups (such as Mexican male immigrants) were even higher than 5% (which we assumed to be on the "high end"), this would serve to further increase the OIS-ACS gap. Passel and Clark's (1997) evaluation of naturalization reporting error appears to have assumed no coverage error and low emigration rates. Thus their estimates probably represented lower-bound estimates of reporting error.

In conclusion, it is reassuring that the results do not indicate significant naturalization reporting error among non-Mexicans with five or more years of U.S. residence and young Mexican women. On the other hand, the results continue to provide evidence for naturalization over-reporting for all groups of Mexican men, older Mexican women, and all recent arrivals, regardless of assumptions about emigration or coverage error. We therefore recommend that ACS data on citizenship be accepted at face value for all groups except those with less than five years of U.S. residence, Mexican men, and older Mexican women.

Acknowledgments

References

Ahmed, B.; Robinson, JG. Estimates of Emigration of the Foreign-born Population: 1980-1990. Population Division, U.S. Census Bureau; Washington, DC: 1994.

Bell, FC.; Miller, ML. Life Tables for the United States Social Security Area 1900-2100 Actuarial Study No. 116. 2005.

Bloemraad, I. Becoming a Citizen: Incorporating Immigrants and Refugees in the United States and Canada. University of California Press; 2006.

Bloemraad I, Korteweg A, Yurdakul G. Citizenship and Immigration: Multiculturalism, Assimilation, and Challenges to the Nation-State. Annual Review of Sociology. 2008; 34(1):153–79.

Costanzo, JM.; Davis, CJ.; Malone, N. Guide to International Migration Statistics: The Sources, Collection, and Processing of Foreign-Born Population Data at the U.S. Census Bureau. U.S. Census Bureau; Washington, DC: 2002. Population Division Working Paper #68

DeSipio, L. Building America, One Person at a Time: Naturalization and Political Behavior of the Naturalized in Contemporary U.S. Politics.. In: Mollenkopf, John; Gerstle, Gary, editors. E Pluribus Unum? Immigrant, Civic Life and Political Incorporation. Russell Sage Foundation; New York: 2001. p. 67-106.

Ellis M, Wright R. When Immigrants are Not Migrants: Counting Arrivals of the Foreign-Born Using the U.S. Census. International Migration Review. 1998; 32(1):127–44. [PubMed: 12321468]

Fix M, Zimmermann W. All under One Roof: Mixed-Status Families in an Era of Reform. International Migration Review. 2001; 35(134):397–419.

Haddal, CC. Border Security: The Role of the U.S. Border Patrol. Congressional Research Service; Washington, DC: 2010.

Hoefer, M.; Rytina, N.; Baker, BC. Estimates of the Unauthorized Immigrant Population Residing in the United States: January 2010. Department of Homeland Security; Washington, DC: 2011.

Kraly, EP. Migration Between Mexico and the United States: Binational Study, Vol. 2 Research Reports and Background Materials. Mexican Ministry of Foreign Affairs and the U.S. Commission on Immigration Reform; Mexico City and Washington, DC: 1998. Emigration: Implications for U.S. Immigration Policy Research.; p. 587-618.

Marcelli, EA.; Ong, PM. 2000 Census Coverage of Foreign-Born Mexicans in Los Angeles County: Implications for Demographic Analysis.. Paper presented at the 2002 Annual Meeting of the Population Association of America; Atlanta, GA. 2002.

Minnesota Population Center. Replicate Weights in the American Community Survey / Puerto Rican Community Survey. University of Minnesota; Minneapolis, MN: 2012. on-line at: http://usa.ipums.org/usa/repwt.shtml [3/13/2012]

Myers RJ. Errors and Bias in the Reporting of Ages in Census Data. Transactions of the Actuarial Society of America. 1940; 41(2):395–415.

Passel, JS.; Clark, RL. How Many Naturalized Citizens Are Thee? An Assessment of Data Quality in the Decennial Census and CPS.. Paper presented at the Annual Meeting of the Population Association of America; Washington, DC. March 1997; 1997.

Passel, JS.; Cohn, D. A Portrait of Unauthorized Immigrants in the United States. Pew Hispanic Center; Washington, DC: 2009.

Passel, JS.; Clark, RL.; Fix, M. Proceedings of the Social Statistics Section of the American Statistical Association: 1997. American Statistical Association; Alexandria, VA: 1997. Naturalization and Other Current Issues in U.S. Immigration: Intersections of Data and Policy..

Passel, JS.; Van Hook, J.; Bean, FD. Immigration Studies Whitepapers No. 3. Sabre Systems; Washington, D.C.: 2006. Narrative Profile with Adjoining Tables of Unauthorized Migrants and Other Immigrants, Based on Census 2000: Characteristics and Methods.. (http://sabresystems.com/sd_whitepapers_immigration.asp)

Portes, A.; Rumbaut, RG. Immigrant America: A Portrait. University of California Press; Berkeley, CA: 2006.

Preston, SH.; Heuveline, P.; Guillot, M. Demography: Measuring and Modeling Population Processes. Blackwell; Oxford: 2001.

Redstone I, Massey DS. Coming to Stay: An Analysis of the U.S. Census Question on Immigrants' Year of Arrival. Demography. 2004; 41(4):721–38. [PubMed: 15622951]

Rowland, DT. Demographic Methods and Concepts. Oxford University Press; 2003.

Ruggles, S.; Alexander, JT.; Genadek, K.; Goeken, R.; Schroeder, MB.; Sobek, M. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. University of Minnesota; Minneapolis, MN: 2010.

Schwabish, JA. Identifying Rates of Emigration in the United States Using Administrative Earnings Records. Congressional Budget Office; Washington, DC: 2009.

Swanson, D.; Siegel, JS.; Shyrock, HS. The Methods and Materials of Demography. Emerald Group Publishing; San Diego, CA and London: 2004.

U.S. Census Bureau. American Community Survey Design and Methodology. U.S. Census Bureau; Washington, DC: 2009.

U.S. Citizenship and Naturalization Services. Citizenship Through Naturalization. 2012. (www.uscis.gov)

Van Hook J, Balistreri KS. Ineligible Parents, Eligible Children: Food Stamps Receipt, Allotments and Food Insecurity among Children of Immigrants. Social Science Research. 2006; 35(1):228–251.

Van Hook, J.; Bean, FD. Migration Between Mexico & the United States: Binational Study, Thematic Chapters. Vol. 1. Mexican Ministry of Foreign Affairs and U.S. Commission on Immigration Reform; Mexico City and Washington, DC: 1998. Estimating Underenumeration among Unauthorized Mexican Migrants to the United States: Applications of Mortality Analyses.; p. 551-70.

Van Hook, J.; Bean, FD.; Bachmeier, JD.; Tucker, C. The Hidden Dimension: Coverage Error and the Estimation of the U.S. Unauthorized Mexican Population. 2012. In progress

Van Hook J, Brown SK, Bean FD. For Love or Money? Welfare Reform and Immigrant Naturalization. Social Forces. 2006; 85(2):643–666.

Van Hook J, Zhang W, Bean FD, Passel JS. Foreign-born Emigration: A New Approach and Estimates Based on Matches CPS Files. Demography. 2006; 43:361–382. [PubMed: 16889133]
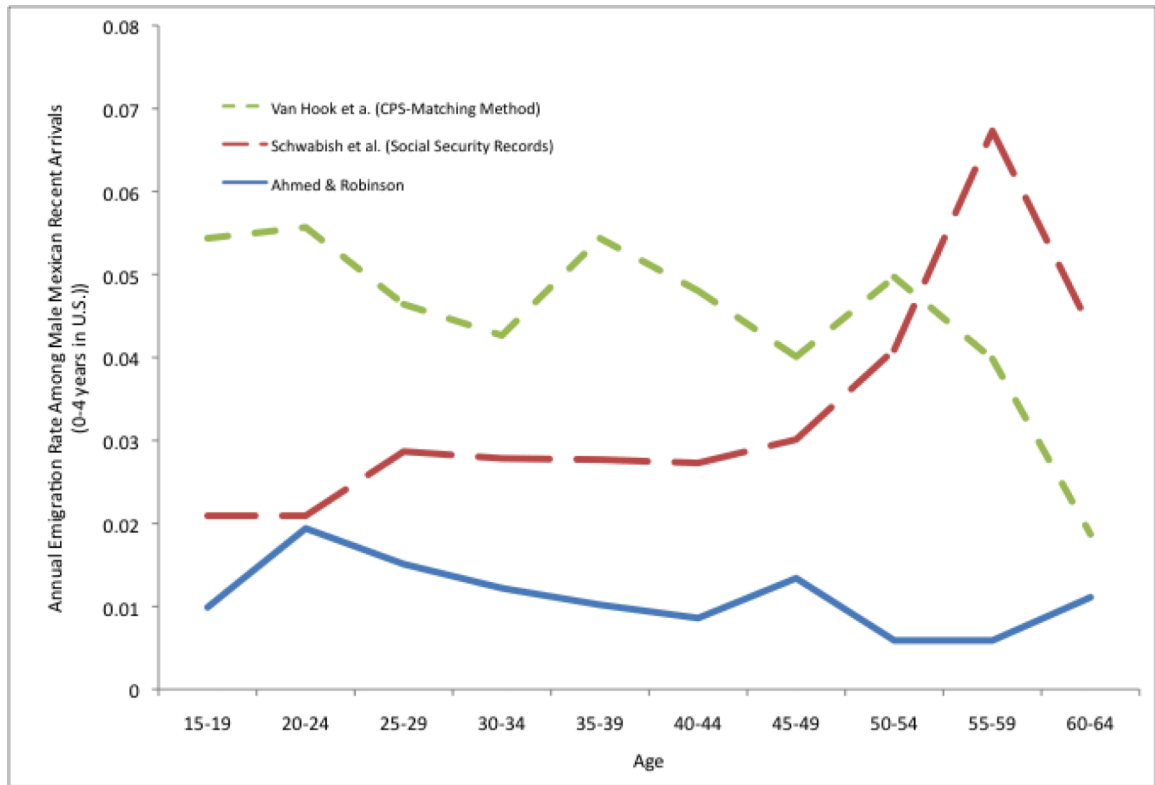
Figure 1.
Estimates of Foreign-born Emigration

Table 1

Estimated Naturalized Citizens (thousands) based on OIS naturalization records and ACS, by Region of Birth, July 2010 (see notes below)

	OIS-based estimates (components of change between Jan 1, 1990 and July 1, 2010)				Comparison with 2010 American Community Survey (ACS)		
	Naturalizations[1]	Deaths[2]	Emigrants[3]	Remaining Naturalized Citizens	Nat'ed Citizens, ACS[1]	Diff[4]	% Diff[5]
All Countries/Regions							
No Emigration[3]	5,496	180	0	5,316		−56	−1
A/R "low" Emigration	5,496	173	243	5,079		181	4[*]
SSA "Moderate" Emigration	5,496	166	398	4,932	5,260	328	7[*]
VH "high" Emigration	5,496	167	531	4,798		462	10[*]
Mexico							
No Emigration[3]	470	5	0	465		116	25[*]
A/R "low" Emigration	470	5	11	455		127	28[*]
SSA "Moderate" Emigration	470	5	21	444	581	137	31[*]
VH "high" Emigration	470	5	43	422		159	38[*]
Central American/Caribbean							
No Emigration[3]	792	19	0	773		2	0
A/R "low" Emigration	792	19	19	754		21	3
SSA "Moderate" Emigration	792	18	45	730	775	46	6[*]
VH "high" Emigration	792	18	83	691		84	12[*]
Asia							
No Emigration[3]	2,466	91	0	2,376		−174	−7[*]
A/R "low" Emigration	2,466	87	136	2,243		−41	−2
SSA "Moderate" Emigration	2,466	83	197	2,186	2,202	16	1
VH "high" Emigration	2,466	84	244	2,138		64	3[*]
Other Regions							
No Emigration[3]	1,767	65	0	1,702		−1	0
A/R "low" Emigration	1,767	63	77	1,627		74	5[*]
SSA "Moderate" Emigration	1,767	60	135	1,573	1,701	128	8[*]
VH "high" Emigration	1,767	61	160	1,546		155	10[*]

Note: Estimates are for naturalized citizens who naturalized between 1/1/1990 and 7/1/2010

[1] Excludes naturalizations of immigrants who arrived before 1990 or who naturalized as children aged 0-17.

[2] Based on Social Security administration lifetable (Bell and Miller 2005)

[3] A/R = Ahmed & Robinson 1994 ("low"), SSA = Social Security (Schwabish 2009) ("moderate"), VH = Van Hook et al. 2006 ("high")

[4] Diff = (ACS - OIS)

[5]%Diff = (ACS - OIS)/OIS * 100

[*] Absolute difference between OIS and ACS estimate is greater than twice the standard error of the ACS estimate.

Table 2

Estimated Naturalized Citizens (thousands), by Sex, Duration of Residence, and Region of Birth, July 2010 (see notes below)

	<5 years U.S. Residence			5+ Years of U.S. Residence		
	OIS[1]	ACS[1]	% Diff[2]	OIS[1]	ACS[1]	% Diff[2]
Men						
Mexico						
No Emigration[3]	.6		2587[*]	183		37[*]
A/R "low" Emigration	.6		2588[*]	178		41[*]
SSA "Moderate" Emigration	.6	16.0	2589[*]	175	250	43[*]
VH "high" Emigration	.6		2590[*]	162		54[*]
Central American/Caribbean						
No Emigration[3]	1.2		1366[*]	322		−1
A/R "low" Emigration	1.2		1382[*]	313		2
SSA "Moderate" Emigration	1.1	17.3	1404[*]	305	320	5[*]
VH "high" Emigration	1.1		1431[*]	282		13[*]
Asia						
No Emigration[3]	5.0		395[*]	1,029		−9[*]
A/R "low" Emigration	4.9		403[*]	960		−3
SSA "Moderate" Emigration	4.9	24.7	403[*]	956	935	−2
VH "high" Emigration	4.9		404[*]	949		−1
Other Regions						
No Emigration[3]	4.5		360[*]	767		−4[*]
A/R "low" Emigration	4.4		369[*]	732		0
SSA "Moderate" Emigration	4.4	20.8	369[*]	715	734	3
VH "high" Emigration	4.4		370[*]	711		3
Women						
Mexico						
No Emigration[3]	.8		1689[*]	281		7[*]
A/R "low" Emigration	.8		1700[*]	276		9[*]
SSA "Moderate" Emigration	.8	13.8	1727[*]	268	302	13[*]
VH "high" Emigration	.8		1726[*]	259		17[*]
Central American/Caribbean						
No Emigration[3]	1.2		1097[*]	449		−6[*]
A/R "low" Emigration	1.2	14.2	1105[*]	439	424	−3

	<5 years U.S. Residence			5+ Years of U.S. Residence		
	OIS[1]	ACS[1]	% Diff[2]	OIS[1]	ACS[1]	% Diff[2]
SSA "Moderate" Emigration	1.2		1128[*]	423		0
VH "high" Emigration	1.2		1127[*]	407		4[*]
Asia						
No Emigration[3]	11.3		208[*]	1,331		−9[*]
A/R "low" Emigration	11.2	35.0	212[*]	1,266	1,207	−5[*]
SSA "Moderate" Emigration	11.1		214[*]	1,213		0
VH "high" Emigration	11.1		216[*]	1,174		3[*]
Other Regions						
No Emigration[3]	6.3		361[*]	925		−1
A/R "low" Emigration	6.2	28.9	369[*]	885	918	4[*]
SSA "Moderate" Emigration	6.1		371[*]	847		8[*]
VH "high" Emigration	6.1		373[*]	824		11[*]

Note: Estimates are for naturalized citizens who naturalized between 1/1/1990 and 7/1/2010

[1] Excludes naturalized immigrants who arrived before 1990 or who naturalized as children aged 0-17.

[2] %Diff = (ACS - OIS)/OIS * 100

[3] A/R = Ahmed & Robinson 1994 ("low"), SSA = Social Security (Schwabish 2009) ("moderate"), VH = Van Hook et al. 2006 ("high")

[*] Absolute difference between OIS and ACS estimate is greater than twice the standard error of the ACS estimate.

Table 3

Estimated Naturalized Citizens of all Years of U.S. Residence (thousands), by Age, Sex, and Mexican Origin, July 2010 (see notes below)

	Men				Women			
	OIS[1]	ACS[1]	Diff[2]	% Diff[3]	OIS[1]	ACS[1]	Diff[2]	% Diff[3]
Mexicans								
Age 18-29								
No Emigration[4]	46		12	26*	68		−1	−1
A/R "low" Emigration	45	58	13	29*	66		1	1
SSA "Moderate" Emigration	45		13	29*	66	67	1	2
VH "high" Emigration	42		16	37*	63		4	6
Age 30-39								
No Emigration[4]	82		19	23*	108		5	5
A/R "low" Emigration	79	101	21	27*	105		8	7
SSA "Moderate" Emigration	78		23	29*	102	113	10	10*
VH "high" Emigration	72		28	39*	99		14	14*
Age 40+								
No Emigration[4]	55		52	94*	107		29	27*
A/R "low" Emigration	54	107	53	99*	105		31	29*
SSA "Moderate" Emigration	52		55	105*	101	136	35	35*
VH "high" Emigration	48		59	122*	97		38	39*
Non-Mexicans								
Age 18-29								
No Emigration[4]	282		5	2	345		−13	−4*
A/R "low" Emigration	267		20	8*	329		2	1
SSA "Moderate" Emigration	277	287	11	4	336	332	−5	−1
VH "high" Emigration	266		21	8*	321		10	3
Age 30-39								
No Emigration[4]	587		−25	−4*	795		−16	−2
A/R "low" Emigration	548		14	3	754		25	3*
SSA "Moderate" Emigration	564	562	−1	0	755	779	23	3*
VH "high" Emigration	542		20	4*	717		62	9*
Age 40+								
No Emigration[4]	1258		−56	−4*	1583		−67	−4*
A/R "low" Emigration	1201		1	0	1525		−9	−1
SSA "Moderate" Emigration	1147	1202	55	5*	1410	1517	107	8*

	Men				Women			
	OIS[1]	ACS[1]	Diff[2]	% Diff[3]	OIS[1]	ACS[1]	Diff[2]	% Diff[3]
VH "high" Emigration	1144		58	5 *	1385		131	9 *

Note: Estimates are for naturalized citizens who naturalized between 1/1/1990 and 7/1/2010

[1] Excludes naturalized immigrants who arrived before 1990 or who naturalized as children aged 0-17.

[2] Diff = (ACS - OIS)

[3] %Diff = (ACS - OIS)/OIS * 100

[4] A/R = Ahmed & Robinson 1994 ("low"), SSA = Social Security (Schwabish 2009) ("moderate"), VH = Van Hook et al. 2006 ("high")

* Absolute difference between OIS and ACS estimate is greater than twice the standard error of the ACS estimate.

Table 4

Percentage Difference between OIS and ACS estimates[1] While Varying ACS Coverage Error Assumptions, by Mexican Origin, Age, and Sex (see notes below)

	Men			Women		
	0% Coverage Error	2.5% Coverage Error	5% Coverage Error	0% Coverage Error	2.5% Coverage Error	5% Coverage Error
Mexicans						
Age 18-29						
No Emigration[2]	26 *	29 *	32 *	−1	1	4
A/R "low" Emigration	29 *	32 *	35 *	1	4	7
SSA "Moderate" Emigration	29 *	32 *	36 *	2	5	7
VH "high" Emigration	37 *	41 *	44 *	6	8	11 *
Age 30-39						
No Emigration[2]	23 *	27 *	30 *	5	8 *	11 *
A/R "low" Emigration	27 *	30 *	34 *	8	10 *	13 *
SSA "Moderate" Emigration	29 *	32 *	36 *	11 *	14 *	17 *
VH "high" Emigration	39 *	43 *	47 *	15 *	18 *	21 *
Age 40+						
No Emigration[2]	94 *	99 *	104 *	26 *	29 *	33 *
A/R "low" Emigration	99 *	104 *	109 *	29 *	32 *	35 *
SSA "Moderate" Emigration	105 *	110 *	116 *	34 *	38 *	41 *
VH "high" Emigration	122 *	127 *	133 *	39 *	42 *	46 *
Non-Mexicans						
Age 18-29						
No Emigration[2]	2	4	7 *	−4 *	−1	1
A/R "low" Emigration	8 *	10 *	13 *	1	3	6 *
SSA "Moderate" Emigration	4	6 *	9 *	−1	1	4

	Men			Women		
	0% Coverage Error	2.5% Coverage Error	5% Coverage Error	0% Coverage Error	2.5% Coverage Error	5% Coverage Error
VH "high" Emigration	8*	11*	14*	3	6*	9*
Age 30-39						
No Emigration[2]	-4*	-2	1	-2	0	3*
A/R "low" Emigration	2	5*	8*	3*	6*	8*
SSA "Moderate" Emigration	0	2	5*	3*	5*	8*
VH "high" Emigration	4*	6*	9*	8*	11*	14*
Age 40+						
No Emigration[2]	-4*	-2*	1	-4*	-2*	1
A/R "low" Emigration	0	3*	5*	0	2*	5*
SSA "Moderate" Emigration	5*	8*	10*	8*	10*	13*
VH "high" Emigration	5*	8*	11*	10*	12*	15*

[1] (ACS - OIS)/OIS * 100

[2] A/R = Ahmed & Robinson 1994 ("low"), SSA = Social Security (Schwabish 2009) ("moderate"), VH = Van

* Absolute difference between OIS and ACS estimate is greater than twice the standard error of the ACS estimate.

Table 5

Sensitivity of OIS-ACS difference to sampling error, assumptions about emigration, and assumptions about coverage error (see notes below)

		Difference is greater than can be explained by plausible assumptions about:			
	% Difference[a]	Sampling Error[a]	Emigration[b]	Coverage Error[c]	Any of the 3
All Countries/Regions	7	Y	.	Y	.
Mexico	31	Y	Y	Y	Y
Central American/Caribbean	6	Y	.	Y	.
Asia	1	.	.	.	.
Other Regions	8	Y	.	Y	.
Men, <5 years of U.S. Residence					
Mexico	2589	Y	Y	Y	Y
Central American/Caribbean	1404	Y	Y	Y	Y
Asia	403	Y	Y	Y	Y
Other Regions	369	Y	Y	Y	Y
Women, <5 years of U.S. Residence					
Mexico	1727	Y	Y	Y	Y
Central American/Caribbean	1128	Y	Y	Y	Y
Asia	214	Y	Y	Y	Y
Other Regions	371	Y	Y	Y	Y
Men, 5+ years of U.S. Residence					
Mexico	43	Y	Y	Y	Y
Central American/Caribbean	5	Y	.	Y	.
Asia	−2	.	.	.	.
Other Regions	3	.	.	.	.
Women, 5+ years of U.S. Residence					
Mexico	13	Y	Y	Y	Y
Central American/Caribbean	0	.	.	.	.
Asia	−1	.	.	.	.
Other Regions	8	Y	.	Y	.
Mexican Men					
18-29	29	Y	Y	Y	Y
30-39	29	Y	Y	Y	Y
40+	105	Y	Y	Y	Y
Mexican Women					
18-29	2	.	.	.	.
30-39	11	Y	.	Y	.
40+	34	Y	Y	Y	Y
Non-Mexican Men					
18-29	4	.	.	.	.
30-39	0	.	.	.	.
40+	5	Y	.	Y	.

		Difference is greater than can be explained by plausible assumptions about:			
	% Difference[a]	Sampling Error[a]	Emigration[b]	Coverage Error[c]	Any of the 3
Non-Mexican Women					
18-29	−1	.	.	.	.
30-39	3	Y	.	Y	.
40+	8	Y	.	Y	.

Y = yes

[a] assuming moderate emigration (SSA series) and no coverage error (these estimates come from Table 1, last column for the top panel; Table 2, 3rd and 6th columns for the middle panel; and Table 3, 4th and 8th columns for the bottom panel)

[b] ACS estimate (assuming no coverage error) falls significantly outside range of OIS estimates while varying emigration assumptions

[c] OIS estimate (assuming moderate emigration) falls outside range of ACS estimates while varying coverage error assumptions