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Two Sources of Error in Data on Migration From Mexico to the United States in Mexican Household-Based Surveys

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Abstract We examine the nature and degree of two sources of error in data on migration from Mexico to the United States in Mexican household-based surveys: (1) sampling error that results when whole households migrate and no one is left behind to report their migration; and (2) reporting errors that result when migrants are not identified by survey respondents. Using data from the first two waves of the Mexican Family Life Survey, which tracked Mexican migrants to the United States from 2002 to 2005, we find that one-half of migrants from Mexico to the United States are not counted as a result of these two sources of error. Misreporting is the larger source of error, accounting for more than one-third of all migrants. Those who are not counted, especially whole-household migrants, are a unique group. Their omission results in an underestimate of female migrants, child migrants, and migrants from the Mexican border region, and an overestimate of migrants from the periphery region.

Keywords Mexico-U.S. migration · Migration estimates · Sampling error · Reporting error · Survey data

Introduction

In the past three decades, key demographic data sources in Mexico have incorporated household-based reports of migration to and from the United States, including the survey component of the decennial census, the National Survey of Demographic Dynamics (ENADID), and the National Survey of Employment and Occupations (ENE/ENOE). In these surveys, migration information is collected via household

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members left behind; survey respondents report the recent migration of household members, including those who have returned and those who are still abroad. These data have been used to estimate and describe migration between Mexico and the United States (Bean et al. 1998; Durand et al. 2001; Hill and Wong 2005; Marcelli and Cornelius 2001; Mendoza-Cota 2012; Passel and Cohn 2009; Passel et al. 2012; Rendall et al. 2011; Riosmena and Massey 2012; Villarreal 2014), to assess the educational selectivity of Mexican migrants (Fernández-Huertas Moraga 2011; Ibarraran and Lubotsky 2007), and to analyze the causes (Hamilton and Villarreal 2011; Lindstrom and Lauster 2001; Nawrotzki et al. 2013; Villarreal and Blanchard 2013) and consequences (Frank and Hummer 2002; Hildebrandt and McKenzie 2005; McKenzie and Rapoport 2007; Nobles 2013) of migration between Mexico and the United States.

In this research note, we focus on two sources of error in data on out-migration from Mexico to the United States collected in Mexican household-based surveys. The first is a form of sampling error that arises when whole households migrate and no one is left behind to report their departure. The second is reporting error in which migrants are not accurately reported by the household respondent. It is unclear how large these errors are and what sort of bias they present to estimates of out-migration from Mexico to the United States.

Previous studies comparing the numbers and characteristics of migrants in Mexican household-based survey data to other sources suggest that Mexican household-based survey data undercount migrants and overrepresent male migrants and migrants who are less well educated. Hill and Wong (2005) compared several Mexican household-based surveys with residual estimates of net migration during the 1990s and found that estimates in the surveys were 30 % smaller than the residual estimates. Other studies have also reported an undercount of 20 % to 30 % of migrants in Mexican household-based survey data, based on comparisons with other sources (Corona and Tuirán 2008; López Vega and Gaspar Olvera 2010). Durand et al. (2001) and Ibarraran and Lubotsky (2007) found that female migrants are underrepresented in the Mexican ENADID and census compared with immigrants in the U.S. census. Ibarraran and Lubotsky (2007) additionally found that migrants in the Mexican census are less well educated than immigrants in the U.S. census, suggesting that the U.S. census overrepresents better-educated immigrants and/or that better-educated migrants are underrepresented in the Mexican census. None of these studies were able to differentiate between errors that arise from the Mexican household-based survey data versus the comparison data source.

We bring new data to bear on this issue. We analyze error presented by whole-household migration and migrant misreporting in a single source of data, the Mexican Family Life Survey (MxFLS), a national sample of Mexican households interviewed in 2002 and 2005. Crucial for our purposes, the MxFLS tracked individuals who migrated to the United States between the two waves, allowing for the identification of households that migrate as units. Additionally, the MxFLS tracking method allows us to identify U.S. migrants who were not initially reported by the origin-household respondent. By analyzing a single source of data, we are able to provide direct estimates of the size and nature of error presented by whole-household migration and migrant misreporting in household-based survey data from Mexico.

Research Design

Data

The MxFLS is an ongoing, longitudinal survey of 35,677 individuals in 8,440 households in Mexico who were originally surveyed in 2002 and reinterviewed in 2005 (Rubalcava and Teruel 2007).[1] The MxFLS reinterviewed 90 % of the original sample in Wave 2, including 91 % of U.S. migrants. The vast majority of those lost to follow-up were domestic migrants, who were not tracked if they moved outside the original MxFLS localities (Velasquez et al. 2010).

Migrants are individuals from the 2002 sample who immigrated to the United States between 2002 and 2005, were in the United States at the time of the 2005 survey, and were considered "permanent" migrants—that is, were in the United States for one year or intended to remain in the United States for at least one year (Teruel et al. 2012). Return migrants were not analyzed because they would not be subject to the two sources of error analyzed here.

In Wave 2, preprinted lists of sociodemographic information of all members of the Wave 1 household were used to identify the original participants. When entire households were no longer at the original address, fieldworkers inquired with neighbors and/or used a recontact directory developed in Wave 1 to determine the household's new location. For individuals who were absent from original households, remaining household members were asked to identify their new location. When respondents in origin households did not provide information about the migrant's location, the recontact directory was used; in some cases, fieldworkers made follow-up visits to the origin household, offering in-kind and monetary incentives. Through this process, the MxFLS identified 854 individuals (2.4 % of the original sample) who were U.S. migrants in 2005.

To assess the nature and degree of error presented by whole-household migration and misreporting, we counted the number and compared the characteristics of individuals who migrated to the United States with their whole households ("whole-household" migrants) to two categories of "split-household" migrants: (1) those who were not reported or were inaccurately reported by remaining household members ("misreported" migrants), and (2) those who were accurately reported ("reported" migrants). Whole-household migrants are those belonging to households in which all Wave 1 household members were identified as U.S. migrants in Wave 2. Misreported migrants are U.S. migrants whose location was missing, unknown, or incorrectly reported as in Mexico in the Wave 2 household roster and whose status as U.S. migrants was determined through the tracking procedure.[2] The logic is that misreported migrants would be uncounted in a household-based survey that relies exclusively on the household respondent's information and willingness to report that information. Insofar

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[1] The main data files for the third wave of the MxFLS, collected between 2009 and 2011, were recently released, but data on U.S. migrants in the third wave had not yet been released at the time of this writing. The data are publically available online (http://www.ennvih-mxfls.org/).

[2] All Wave 1 household members were listed in the Wave 2 household roster. Household members who were no longer living in the origin household at Wave 2 were reported as absent, and their current location was recorded. This information reflects the result of the initial attempt by fieldworkers to identify the location of U.S. migrants in Wave 2. In the case of absent household members whose location was not reported in the initial visit, fieldworkers used the recontact directory or made follow-up visits to the household to determine their location, but the Wave 2 roster was not updated with this information.

as the MxFLS Wave 2 respondents' information and willingness to report are similar to respondents in other surveys, misreporting in the MxFLS should give some sense of this error in other data sources.

We compared the three groups of migrants by the following characteristics measured at Wave 1: (1) sex, age, and relationship to household head; (2) among adults (those older than 15 years), marital status, employment status, and U.S. networks (whether a spouse, an immediate family member, or an extended family member lives in the United States); and (3) among households, household size; whether female-headed; whether any household member owns the home, has financial savings, owns a business, or owns land other than the home; size of locality (<2,500, 2,500–14,999, 15,000–99,999, ≥100,000); and region in Mexico, following Durand et al. (2001) and differentiating between the Historic region (including Durango, Guanajuato, Jalisco, and Michoacán), the Border region (including Baja California Sur, Coahuila, Nuevo León, Sinaloa, and Sonora), the Center region (including the Federal District, México, Morelos, Oaxaca, and Puebla), and the Periphery region (including Veracruz and Yucatán).

Analytical Methods

We followed the approach used by other scholars examining the quality of migration data (e.g., Massey and Capoferro 2004; Massey and Zenteno 2000). Specifically, we compared the social and demographic characteristics of individuals and households across groups. To assess the bias introduced by whole-household migration and misreports, we then estimated four logistic regressions of migration among adults in the sample: (1) including only reported migrants, (2) including reported and misreported migrants but excluding whole-household migrants, (3) including reported and whole-household migrants but excluding misreported migrants, and (4) including all migrants.

The MxFLS sampling design was implemented by the National Institute of Geography, Statistics and Information (INEGI). We used sample weights provided by the MxFLS.

Results

Of 854 U.S. migrants, 153 (17.9 %) were whole-household migrants, and 305 (35.7 %) were misreported (Table 1). When weighted, these sources of error account for 1,070,647 migrants, one-half of all migrants who were in Mexico in 2002 and in the United States in 2005. Among misreported migrants, 38 % were missing location information; for 44 %, the location was unknown; and for 18 %, the location was incorrect (not shown).

Whole-household migrants have a unique sociodemographic profile (Table 2). More than one-half are female, compared with one-third of all migrants; and one-half are children under age 15, compared with one-quarter of all migrants. Adult whole-household migrants are more likely to be married or previously married and far more likely than other migrants to have a spouse or immediate family member in the United States. The three groups of adult migrants do not differ significantly in terms of education.

Households that migrate as a unit are smaller than other migrant households, and one-half are headed by women, compared with one-quarter of all migrant households. Households that migrate as a unit are less likely to own property in Mexico and are more likely to migrate from the Historic and Border regions.

Table 1 Estimates of whole-household migration and reporting error in the MxFLS

	Count	% of Migrants/ Migrant Households	Weighted Count	Weighted % of Migrants/ Migrant Households
Individuals				
All migrants	854	100.0	2,114,613	100.0
Reported migrants	395	46.3	1,043,432	49.3
Misreported migrants	305	35.7	764,575	36.2
Whole-household migrants	153	17.9	306,072	14.5
Households				
All migrant households	510	100.0	1,287,372	100.0
Households with reported migrants	258	50.6	656,867	51.0
Households with misreported migrants	210	41.2	542,069	42.1
Whole-household migrant households	42	8.2	88,436	6.9

Source: Mexican Family Life Survey.

Table 3 compares four logistic regression models, each using different definitions of migration. In Model 1, only reported migrants are included; migrants who are incorrectly coded as in Mexico are coded 0, and whole-household migrants and migrants whose status is unknown or missing are coded as missing. We compare Model 1 with a model including reported and misreported migrants (Model 2), a model including reported and whole-household migrants (Model 3), and a model including all migrants (Model 4). The results show that the coefficients for sex, household role, homeownership, and Border region are significantly biased by the omission of misreported and whole-household migrants, and that the omission of whole-household migrants introduces more error than misreports. The coefficient for female sex is significantly more negative in Model 1 than in Models 3 and 4 as a result of women being underrepresented among split-household migrants. The coefficients for children of and other relations to the household head are significantly more positive in Model 1 than in Models 3 and 4 as a result of these household members being overrepresented among split-household migrants. The coefficient for Border region is significantly more negative in Model 1 as a result of Border migrants being underrepresented among reported migrants, and the coefficient for homeownership is significantly more positive in Model 1 than in Models 2 and 4 as a result of homeownership being overrepresented among reported migrants.

Discussion

In this research note, we estimated the degree and nature of two sources of error in household-based reports of out-migration from Mexico to the United States: (1) whole-household migration, which leaves behind no one to report the migration; and (2) misreporting that occurs when survey respondents are unwilling or lack the information to accurately report U.S. migrants. These errors affect key Mexican demographic data sources that have incorporated household-based reports of U.S. migration in the past

Table 2 Characteristics of individuals and households by migration status[a]

	Reported Migrants	Misreported Migrants	Whole-Household Migrants	All Migrants
Migrants All Ages				
Sex				
Female	30.8	37	56.2***	36.7
Male	69.2	63	43.8	63.3
Age				
0–14	19.6	25.8	50.2***	26.3
15–24	56.5	48.2	9.4***	46.7
25–34	13.7	14.1	17.2	14.3
35–44	5.7	9.3	8.9	7.5
45+	4.4	2.7	14.4*	5.2
Household role				
Head/spouse	14.5	19.9	41.6***	20.4
Child of head	63.2	63	52	61.5
Other	22.3	17.2	6.4***	18.2
Sample	396	305	153	854
Migrants Age 15 and Older				
Marital status				
Never married	66.7	61.8	20.5***	60.4
Currently married	31.4	36.5	72.6***	37.3
Previously married	1.8	1.7	6.9	2.3
Education				
None	3.9	2.0	7.0	3.5
Primary	35.8	32.7	40.6	35.2
Secondary	40.1	43.6	28.6	40.2
High school	14.8	17.2	14.3	15.7
College+	5.2	3.8	9.5	5.1
Missing	0.1	0.8	0	0.3
Employed	59.5	63.9	46.3	59.8
U.S. networks				
Spouse in United States	3.9	2.2	21.6**	5.0
Immediate family in United States	31.3	31.6	50.3*	33.3
Extended family in United States	19.5	22.0	11.7	19.7
Sample	313	225	80	618
Households				
Size (mean)	5.8	5.9	3.6***	5.6
Female headed	26.0	18.3	50.1*	24.4
Household resources				
Owns home	85.6	72.4**	64.0*	78.6
Has savings	13.8	16.4	27.5	15.8
Owns business	16.4	18.6	7.7	16.8

Table 2 (continued)

	Reported Migrants	Misreported Migrants	Whole-Household Migrants	All Migrants
Owns land	31.3	32.1	9.5***	30.1
Size of locality				
<2,500	43.7	39.6	45.4	42.1
2,500–14,999	25.3	26.4	17.6	25.2
15,000–99,999	9.6	5.5	12.7	8.1
≥100,000	21.4	28.5	24.3	24.6
Region				
Historic	41.0	41.9	58.6	42.6
Border	3.4	10.6**	14.4	7.2
Center	41.4	37.8	27.0	38.9
Periphery	14.2	9.7	0.0***	11.3
Sample	258	210	42	510

Source: Mexican Family Life Survey.

[a] All distributions are weighted. All characteristics were measured in 2002, up to three years prior to the migration.

*p < .05; **p < .01; ***p < .001 (based on *t* tests of equal means, comparing whole-household migrants and misreported migrants each with reported migrants)

three decades. Our analysis of migration in the MxFLS suggests that the number of U.S. migrants not counted as a result of whole-household migration and migrant misreporting is large, totaling one-half of all migrants who were in Mexico in 2002 and in the United States in 2005.

The MxFLS undercount rate of 50 % is significantly larger than previous estimates, which placed the undercount rate at 20 % to 30 % (Corona and Tuirán 2008; Hill and Wong 2005; López Vega and Gaspar Olvera 2010). These previous estimates are close to our estimate of whole-household migration (17.9% of migrants) but do not account for the large degree of misreporting. These previous estimates rely on comparisons between Mexican household-based survey data and data sources that are subject to their own unique sources of error.

Migrants who are not counted, particularly whole-household migrants, are not a random sample of migrants. Their sociodemographic profile suggests a unique pathway to migration: these are mostly small families headed by women who are following a spouse or other immediate family member to the United States. Their migration is facilitated by few economic ties to Mexico, such as landownership or homeownership, but greater savings. As a result of the omission or miscoding of whole-household and misreported migrants, regression analysis of U.S. migration is biased, particularly the estimates for sex, household role, homeownership, and region of origin.

These results are mostly consistent with studies comparing Mexican household-based surveys to U.S. data sources, which have suggested that Mexican data sources undercount migrants, particularly women and highly educated migrants. Our results confirm the undercount of women in Mexican household-based surveys; indeed, the MxFLS estimate

Table 3 Logistic regression coefficients of migration among MxFLS adults, comparing migration measured with all migrants to reported migrants

	Model 1: Reported Migrants	Model 2: Reported and Nonreported Migrants	Model 3: Reported and Whole-Household Migrants	Model 4: All Migrants
Sex (male)				
Female	−1.09***	−0.91***	−0.90***[a]	−0.81***[a]
Age (15–24)				
25–34	−0.77**	−0.76***	−0.68***	−0.70***
35–44	−1.26***	−1.04***	−1.22***	−1.05***
45+	−2.07***	−2.17***	−1.71***	−1.85***
Marital Status (never married)				
Currently married	0.36	0.38	0.27	0.30
Previously married	0.39	0.43	0.11	0.23
Household Role (head/spouse)				
Child of head	1.12***	1.00***	0.52*[a]	0.64**[a]
Other	1.42***	1.13***	0.83**[a]	0.79**[a]
Education (none)				
Primary	0.37	0.19	0.07	0.03
Secondary	0.62	0.66*	0.45	0.54
High school	0.54	0.68*	0.44	0.59*
College+	0.21	0.40	0.15	0.34
Employed	0.25	0.29*	0.18	0.24*
Household Resources				
Owns home	0.56*	0.14[a]	0.49*[a]	0.15[a]
Has savings	−0.22	−0.27	−0.05	−0.16
Owns agricultural land	−0.10	0.08	−0.15	0.03
Owns nonagricultural business	−0.25	−0.05	−0.34	−0.13
U.S. Networks				
Spouse in United States	1.86***	1.62***	2.29***	2.04***
Immediate family in United States	1.07***	1.15***	1.15***	1.19***
Extended family in United States	0.52*	0.63***	0.51**	0.62***
Missing	0.25	0.49**	0.34	0.52**
Region (Historic)				
Border	−1.94***	−1.29***[a]	−1.50***[a]	−1.16***[a]
Center	−0.35	−0.47***	−0.36*	−0.46**
Periphery	−0.59	−0.97***	−0.72**[a]	−0.79**
Size of Locality (<2,500)				
2,500–14,999	−0.01	0.00	−0.12	−0.07
15,000–99,999	−0.25	−0.50*	−0.28	−0.49*
≥100,000	−1.06***	−0.97***	−1.13***	−1.03***
Constant	−4.88***	−4.22***	−3.99***	−3.68***
Sample	23,543	23,717	23,617	23,803

Source: Mexican Family Life Survey.

[a] Indicates the coefficient is significantly different from the coefficient for reported migrants at $p < .05$, based on a cross-model Wald test of equal coefficients.

*$p < .05$; **$p < .01$; ***$p < .001$

that 36.7 % of migrants are female is more similar to the sex distribution of Mexican immigrants in the U.S. census (40 %) than in the Mexican census (24 %; Ibarraran and Lubotsky 2007: table 5.1). Future studies should be especially careful in making conclusions about the gender selectivity of migration using Mexican household-based survey data. Researchers should also be attuned to the underrepresentation of children among migrants in household-based survey data. We do not find significant differences in the educational distribution across groups; patterns suggest that whole-household migrants are less well educated than reported migrants, but misreported migrants are better educated. These results suggest that differences in the educational profiles of Mexican immigrants in U.S. and Mexican data sources may arise primarily from the underrepresentation of less-educated migrants in U.S. sources.

These findings have important implications for scholarship that employs Mexican household-based survey data. For example, in assessing how sampling error might affect their analysis of the educational selectivity of Mexico-U.S. migrants in the Mexican census, Ibarraran and Lubotsky (2007: table 5.7) estimated the impact of a range of possible undercount rates and educational attainments of nonsampled migrants. With an undercount rate of 50 %, between 50 % and 70 % of nonsampled migrants would have to attain years of education above the median for nonmigrants to change the authors' conclusion of negative educational selectivity of Mexico-U.S. migrants, and they argued that the true undercount rate and the degree of educational selectivity among nonsampled migrants are unlikely to be large enough to bias their conclusion. Our analysis of the MxFLS offers a direct answer for Ibarraran and Lubotsky's puzzle: the undercount rate is large (50 %), but only 44 % of nonsampled migrants in the MxFLS completed more years of education than the nonmigrant median in Ibarraran and Lubotsky's analysis. In other words, their conclusions remain not because the undercount is small but rather because the education of unsampled migrants is not widely different from that of sampled migrants.

The two errors that we investigate here would not affect residual estimates of migration that use population data from the Mexican census and vital statistics to calculate net migration as the difference among intercensus population change, births, and deaths. Therefore, we might expect our estimates of out-migration to be similar to residual estimates of net migration adjusted by in-migration. Using population counts from the 2000 Mexican Census and the 2005 Mid-Census Population Count, and births and deaths from vital statistics from 2000 to 2005, we estimated annual net migration between 2000–2005 to be –549,606. The Mexican Population Council population projections estimate annual immigration (international in-migration) to Mexico as ranging between 132,000 and 160,000 for the years 2002–2005, meaning that annual out-migration in this period ranged between 681,000 and 709,606 (CONAPO 2015). Our estimate from the MxFLS of 704,871 annual U.S. migrants between 2002–2005 falls in this range. By comparison, the average annual estimate of out-migration from the closest period covered by household-based survey data, in the 2002 National Employment Survey (ENE), was 350,000 (López Vega and Gaspar Olvera 2010).[3]

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[3] There are no published reports of out-migration from Mexican household-based surveys covering the period between 2003 and 2005. The 2005 Mid-Census Population Count did not include household-based questions of migration, and the 2006 ENADID was not included by CONAPO in its review of estimates of out-migration from household-based survey data from 1990 to 2010 (López Vega and Gaspar Olvera 2010).

The difference between the MxFLS estimate and the 2002 ENE is nearly equal to our estimate of a 50 % undercount of migrants as a result of whole-household and misreported migrants. Our estimate is also more similar to, although still higher than, estimates of annual Mexican immigration to the United States using Current Population Survey (CPS) data, which range from 550,000 to 670,000 for 2003 to 2005 (Passel et al. 2012).

Two differences between the MxFLS and other Mexican household-based surveys deserve comment. First, because the MxFLS follows a panel of households, migrant misreporting is of specific people who were listed in the household roster in Wave 1 and absent from the origin household in Wave 2. Wave 2 respondents' willingness to report the migrant status of their household members may depend on their sense of the risk involved, which may be greater when surveyors are asking about a specific person. Moreover, the MxFLS intent to track these individuals in the United States may have increased respondents' sense of risk. These issues would result in an overestimate of misreporting in the MxFLS, compared with other surveys, most of which do not ask about the current location of specific people. On the other hand, it might be easier for a respondent to avoid reporting migrants when not asked about specific individuals.

Second, the time frame over which migration is measured in the MxFLS is three years, whereas in most household-based surveys, migration is measured over five years. Over a longer period, some respondents might be less certain about the whereabouts of migrants, whereas others might be more certain. Over the longer period, whole-household migrants may represent a greater proportion of all migrants if whole-household migrants are less likely to return to Mexico than split-household migrants. Our results are also not strictly comparable with retrospective reports, which are additionally affected by unobserved geographic mobility and household reconfiguration in the preceding period.

In past analyses using Mexican household-based survey data, the size and nature of error resulting from whole-household migration and misreporting have been obscured from researchers. This article shows that these errors are substantially larger than previously thought, that migrant misreporting is the greater of the two errors, and that whole-household migration in particular presents bias to estimates of migration. This article also suggests the analytical potential gained from tracking migrants across time and space for the study of migration, which is after all a truly longitudinal and spatial process.

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