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**IDENTIFYING RATES OF EMIGRATION IN THE UNITED
STATES USING ADMINISTRATIVE EARNINGS RECORDS**

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Abstract

Sound assessment of the impact of immigration on the economy and public policies requires accurate measurement of both inflows and outflows of migrants. This paper undertakes a new strategy to estimate emigration rates among U.S. immigrants by inferring the probability of emigration using longitudinal administrative earnings data from 1978 through 2003. Two groups of emigrants are evaluated separately: those who emigrate from the United States and those who leave both the United States and the Social Security system. The method used here finds that between 1.0 percent and 1.5 percent of the foreign-born working population emigrates every year, consistent with previous estimates. These estimates suggest that the number of foreign-born workers who emigrate each year doubled between the late 1970s and late 1990s, rising from about 200,000 to 400,000. A smaller portion—between about 0.8 and 1.2 percent of foreign-born workers—emigrates from the United States *and* exits the Social Security system annually. This suggests that the number of foreign-born workers who emigrated each year from Social Security grew from about 150,000 to 330,000 over the same period. Logit regressions using data at the individual level provide evidence of differences between various demographic groups. The regression analysis suggests that immigrants with lower earnings are more likely to emigrate and that the likelihood of ever emigrating decreases with age at an increasing rate.

I. Introduction

The substantial growth in the U.S. immigrant population over the last 30 years has spurred an ongoing debate about the impact that immigrants have on the economy. Some analysts have found that immigrants quickly develop labor market and other skills that help them climb the economic ladder. Thus, although immigrants may enter the United States with low earnings and less labor market experience than native-born workers, they quickly assimilate into the labor force. Other analysts have suggested that immigrants—especially those arriving more recently—have a lower earnings trajectory and fail to assimilate appreciably.¹ Fewer analysts, primarily because of data constraints, have examined the characteristics of immigrants who later emigrate from the United States. Understanding the flows of migrants both in and out of the United States can help shed light on the path of immigrant labor market assimilation as well as the effects of a variety of public policies, ranging from local provision of health care and welfare to the impact of the immigrant population on large federal social insurance programs such as Social Security and Medicare.

This paper uses longitudinal administrative earnings data to infer rates of emigration among U.S. immigrants with earnings. Three separate administrative data files, provided by the Social Security Administration, are merged to provide information on individual earnings histories, Social Security beneficiary status, year of birth and death, and place of birth. When merged, these three files—the Detailed Earnings Records, the Numerical Identification System (Numident), and the Master Beneficiary Record—contain

¹ These opposing views can be seen, for example, in LaLonde and Topel (1992) and Borjas (1985). A survey of the economic literature on immigration can be found in Borjas (1994).

information on over 300,000 immigrants between 1978 and 2003. The basic strategy is to first identify immigrants by using the birthplace and foreign-born variables from the Numident data file. Emigration among these foreign-born workers is then inferred from longitudinal earnings patterns using the Detailed Earnings Records; immigrants who have a stream of positive earnings followed by zero earnings are assumed to have left the country. Because individuals may leave the labor force for reasons, either voluntary or involuntary, other than emigration (for example, to care for a child or because of disability or retirement) this methodology might misclassify some workers as emigrants.

In addition to these estimates of overall emigration among foreign-born workers, a second categorization calculates the fraction of immigrants who “emigrate” from the Social Security system. Workers who leave the United States and do not qualify for Social Security benefits (i.e., are not current beneficiaries or have fewer than 40 quarters of covered earnings) are considered to have emigrated from the Social Security system. Workers who leave the United States and qualify for Social Security benefits, but move to a country that does not have an agreement with the United States such that the worker can receive Social Security benefits, are also considered to have emigrated from the Social Security system. Thus, the group of individuals who emigrate from the Social Security system is a subset of the group who emigrate from the United States.

This paper is believed to be the first to make such an explicit calculation of foreign-born emigration rates and tie those results to the Social Security system. Such direct connections may be important to more accurately estimate Social Security’s finances and to better understand the distribution of revenues and outlays in the current system. Hence

the analysis focuses on the migration flows of workers and not on the more general question of how migration can shape the demographic distribution of the entire population. The differences between the two groups of foreign-born emigrants—those who leave the United States (hereafter called “U.S. emigrants”) and those who leave the United States *and* the Social Security system (“Social Security emigrants”)—are nontrivial. In general, the probability of ever emigrating during the sample period declines more steeply by age for Social Security participants than for the entire foreign-born working population.

In contrast to the methodology introduced here, the existing literature almost exclusively uses what is known as the “residual” methodology, in which the foreign-born population is projected from one year to some year in the future by accounting for incoming immigrants and deaths in the intervening years. By calculating the difference between this expected foreign-born population in some year and the actual population in that year, the residual method yields an estimate of the number of emigrants in the intervening period. The residual method has a number of drawbacks, however, including lack of information on individual characteristics and changes in survey methodology and survey coverage, both of which could introduce bias in the estimated rates of emigration.

Because the estimation used here relies on the earnings records of those workers whose earnings are tracked by the Social Security Administration (SSA), emigration flows for many illegal immigrants are not captured. Hence, the estimates of total emigration presented here most likely lie somewhere between existing estimates of total emigration of legal foreign-born residents and total emigration of both legal and illegal foreign-born

residents. Overall, this paper estimates that between 1.0 percent and 1.5 percent of foreign-born workers emigrate from the United States every year, a range consistent with previous estimates that use the residual method. These estimates suggest that the number of foreign-born workers who emigrate from the United States in a given year doubled between the late 1970s and the late 1990s, from about 200,000 to about 400,000. A smaller portion—between about 0.8 percent and 1.2 percent of the foreign-born population—emigrates from the country *and* from the Social Security system annually. These estimates suggest that the number of Social Security emigrants grew from about 150,000 to about 330,000 over the same period. The differences between the two groups arise both from whether the worker emigrates to a country that has an agreement with the United States such that the worker can receive Social Security benefits, and from requirements regarding quarters of covered earnings.

II. Previous Literature

Previous estimates of foreign-born emigration rates have relied almost entirely on the “residual method,” first introduced by Warren and Peck (1980). Estimating rates of emigration by this method involves projecting the foreign-born population by adding estimates of new immigrants and subtracting estimated deaths to construct an expected population. The difference between that projection and the actual foreign-born population observed on the future date yields an estimate of the number of emigrants during that period. Thus, for example, Warren and Peck (1980) estimate that the net emigration between 1960 and 1970 of foreign-born women ages 30 to 34 is

$$\begin{aligned}
E &= P_{1960} - D + I - P_{1970} \\
E &= P_{1960} - P_{1960} \times (1 - s) + I - P_{1970} \\
E &= P_{1960} \times s + I - P_{1970} \\
E &= (170,000 \times 0.9912) + 277,000 - 357,000 \\
E &= 88,504.
\end{aligned}$$

Here E equals the number of foreign-born emigrants; P_{1960} and P_{1970} represent the foreign-born population in this age cohort in 1960 and 1970; D is the number of foreign-born deaths; s is the survival probability of the foreign-born; and I is the number of immigrants between 1960 and 1970. This approach is used to generate net emigration numbers and rates by demographic characteristics and, in some cases, length of time in the United States.²

The residual method has served as the main approach for estimating emigration rates used by the U.S. Census Bureau in estimating population stocks and flows (Hollmann and others, 2000). Warren and Peck's (1980) original estimates suggested that annual emigration among the foreign-born was 114,000 for the decade of the 1960s. This figure was then increased to 133,000 based on Warren and Passel's (1987) analysis of the 1965-1980 period. Ahmed and Robinson (1994) used the residual method for the 1980s, which resulted in an increase in the number of foreign-born emigrants the Census Bureau assumes in their calculations to 195,000. Mulder (2003) and Mulder and others (2002) indicated an emigration estimate of 225,000 for the 1990s, but it is unclear whether this number is currently used by the Census Bureau in official estimates (see the discussion in Van Hook and others, 2006). Overall, these studies suggest annual foreign-born emigration rates of about 0.9 percent to 1.2 percent of the total immigrant population.

² See also Ahmed and Robinson (1994), Borjas and Bratsberg (1996), Mulder (2003), Mulder and others (2002), and Warren and Passel (1987).

Although used throughout the literature, the residual method has a number of disadvantages. First, the estimates are sensitive to differences in survey coverage between the two years of data used in the calculations. For example, certain groups were undercounted at higher rates in the 1970 census than in the 1980 and 1990 census files (Robinson and others, 1993), which would bias emigration estimates downward and could even create negative emigration rates, as found for certain countries in Ahmed and Robinson (1994). A second problem with the residual method is that the estimates are sensitive to misreporting by survey respondents. For example, Ellis and Wright (1998) find evidence of significant reporting error in the year-of-arrival question in the census and that such misreporting increased between the 1980 and 1990 census files. Ellis and Wright argue that these errors are mainly caused by immigrants who migrate back and forth between the United States and their home country. They find that 22 percent of immigrants in the 1980 census who reported that they had arrived between 1975 and 1980 also reported that they had lived in the United States in 1975. This rate was found to be higher in the 1990 census, where about 30 percent of immigrants who said they had lived in the United States in 1985 also reported that they had arrived sometime between 1985 and 1990. Such reporting error could bias estimates of overall emigration. A final shortcoming of the residual method is that it does not allow researchers to examine changes in individual-level characteristics of the population, including those that correlate with the probability of emigrating.

One exception to the residual approach is the analysis by Reagan and Olsen (2000), who use longitudinal data from the 1979 youth cohort of the National Longitudinal Survey (NLSY79). The NLSY79 attempts to interview those respondents who leave the United

States. This unique design allows the authors to track individual migration patterns of U.S. immigrants back to their home countries; the sample, however, is limited to 571 observations, nearly half of whom are of Mexican origin. Reagan and Olsen's regression analysis suggests that older immigrants are more likely to emigrate than younger immigrants, that men and women migrate at about the same rates, and that individuals with higher earnings potential are less likely to emigrate than those with lower earnings potential.³ In general, Reagan and Olsen (2000) reach similar conclusions to those found in the regression analysis described below.

More recently, Van Hook and others (2006) used data from the Current Population Survey (CPS) matched from one year to the next to estimate emigration rates among the foreign-born for the 1996-2003 period. In that analysis, the authors used the rotation group feature of the CPS survey structure (where households appear in the survey for four months, are excluded for eight months, and then reappear in the subsequent four months) to estimate the probability that a nonmatched individual emigrated from the United States between the two years. For those individuals who were not interviewed in the second year, the authors constructed probabilities of death, migration within the United States, emigration, and the probability that they were not re-interviewed for other reasons. There are obvious complications with this methodology: the match rate in the different CPS files varies over time, assumptions about mortality rates are uncertain, and the qualifications for being classified as a matched or nonmatched observation are subject

³ Reagan and Olsen (2000) use a measure of the "real potential wage," which is a predicted wage from a regression of log wages on actual experience and its square, years of education, dummy variables for gender and a present spouse, and skill (measured by the Armed Forces Qualifying Test).

to debate.⁴ Regardless, the Van Hook and others (2006) study is noteworthy in that it is one of the few (along with Reagan and Olsen, 2000) to try to estimate emigration rates using longitudinal data as opposed to differencing two populations from repeated cross-sectional data and inferring the level (or rate) of emigration.

Van Hook and others (2006) estimate that approximately 1.1 million foreign-born persons emigrated from the United States during the late 1990s and early 2000s, yielding an annual emigration rate of 2.9 percent.⁵ Their estimate of the number of emigrants is about three to four times as high as others in the literature (in particular, those of Ahmed and Robinson, 1994, and Mulder, 2003), and their estimated annual emigration rate is more than twice that estimated elsewhere (see table 3 in Van Hook and others, 2006). In its population projections, the Census Bureau assumes that emigration of legal permanent residents (LPRs) rises from about 311,000 in 2005 to 466,000 by 2050 (Hollmann and others, 2000, table 2). By comparison, the U.S. Social Security Trustees currently assume separate annual emigration rates for LPRs and “others,” a category that includes some legal immigrants, such as students, those with temporary visas, and illegal immigrants. Over the course of their 75-year projection of Social Security revenues and outlays, the Trustees assume that 250,000 LPRs emigrate annually and that about 600,000 “other” foreign-born persons emigrate each year in the near term, rising to about 725,000 by 2080 (SSA, 2008).

⁴ The authors require consistency in sex and age (a person’s age cannot differ by more than two years) but not on other characteristics such as race, education, or marital status. For more details on matching in the March-to-March CPS files, see Madrian and Lefgren (1999).

⁵ Note that these authors do not list emigration rates separately by year but instead report estimates from pooled matched CPS files.

The rate at which the foreign-born emigrate, and the characteristics of those emigrants, can yield information about labor market and earnings assimilation of immigrants who choose not to emigrate. The average characteristics of immigrants who remain in the United States for long periods are directly affected by the fact that immigrants who fail to assimilate often return to their native countries. For instance, some of the earliest research on immigrant labor market assimilation found that the average immigrant's earnings surpassed that of the average native-born around 10 to 15 years after immigration (see, for example, Chiswick, 1978). That research relied on cross-sectional data, which Borjas (1985) later suggested confounded the true impact of assimilation with changes in immigrant quality over time.⁶ In recent research, Lubotsky (2007) and Hu (2000) note that estimates using cross-sectional data fail to account for the emigration of immigrants with low earnings, which would tend to bias the cross-sectional findings upward. Lubotsky (2007), who uses administrative earnings data similar to those used here, shows that the earnings gap between immigrants and native-born closes by 10 to 15 percent during immigrants' first 20 years in the United States, which is about half as fast as the increase found when Lubotsky uses cross-sectional census data. Hu (2000), using longitudinal data from the Health and Retirement Survey, finds slower earnings growth for Hispanic immigrants relative to cross-sectional data. Hu also finds earnings *declines* for non-Hispanic white immigrants, as opposed to earnings increases in the cross-sectional data.⁷

⁶ Also see the summary of these issues in Borjas (1994) and Duleep and Dowhan (2008a). For additional examples of slower rates of assimilation, see LaLonde and Topel (1992) and the discussion in Lubotsky (2007).

⁷ See also Baker and Benjamin (1997), who find that the labor force participation of married immigrant women in Canada falls below that of their native-born counterparts after an initial period of work dedicated

III. Identifying Immigrants and Emigrants in the Administrative Data

For the most part, the existing literature on foreign-born emigration uses publicly available repeated cross-sectional data. Aside from Van Hook and others (2006) and Reagan and Olsen (2000), few researchers have used panel data to help identify rates of emigration. In this paper, identifying immigrants and emigrants involves merging three administrative datasets provided by SSA.⁸ The files represent a 1 percent random sample of issued Social Security numbers, but because the files include only those immigrants whose earnings are tracked by SSA, many illegal immigrants are presumably excluded.

The first data file, the Detailed Earnings Record (DER), contains longitudinal earnings information from 1978 to 2003. The total earnings variable used here is derived from the worker's W-2 tax form and includes wage and salary earnings, tips, self-employment income and some deferred compensation, such as an employee's 401(k) contributions. For the years 1978-1980, there appear to be some errors in the data recording (in particular, in some records the decimal point appears to be in the wrong position), and thus some sample statistics appear to be incorrect. Following Kopczuk and others (2008), total earnings are compared with FICA earnings, which do not appear to have the same recording errors.⁹ In cases where FICA earnings are exactly 1/100th of total earnings, total earnings are divided by 100. Overall, for the three years under consideration (1978, 1979, and 1980), this procedure affects fewer than 0.2 percent of all workers and reduces

to financing their husbands' human capital investment. Blau and others (2008) find rapid rates of assimilation in annual hours worked among married immigrants.

⁸ Kraly (1998) suggested using administrative data to estimate rates of emigration, but to my knowledge, this paper is the first to do so. For other research that uses administrative earnings data to examine immigrant earnings growth, see Lubotsky (2007) and Duleep and Dowhan (2002).

⁹ Kopczuk and others (2008) had access to other administrative data, which allowed them to use several additional procedures to adjust the earnings for people whose records were inaccurate.

average earnings by less than \$1,000.¹⁰ In any case, the strategy for identification used below requires only the existence of positive earnings; the actual measurement of earnings is a second-order concern.

The primary difficulty in using the DER earnings data is that there is no distinction between earnings recorded as zero and earnings recorded as missing; all such records appear as zeros. Thus, for example, a person who retires at age 50 and has zero earnings will look the same as a 50-year-old who emigrated.

The second data file is the Numerical Identification System (Numident), which, for purposes of this study, contains information on the worker's date of death, place of birth, and a variable indicating whether the person was born in the United States. For the U.S.-born, the state and city of birth are recorded; country and city of birth are recorded for the foreign-born.

The third file is the Master Beneficiary Record (MBR), which contains a variety of information on an individual's Social Security beneficiary status, including time of beneficiary claim, beneficiary type, and whether a claim was denied. The beneficiary variable denotes whether the person is receiving worker or auxiliary benefits and the year in which those benefits began.

Using administrative data introduces both advantages and disadvantages over publicly available survey data. The major advantage of administrative data is that earnings records are presumably more accurate than those found in survey data, because they are not

¹⁰ Average earnings are reduced by 8 percent in 1978, 6 percent in 1979, and 1 percent in 1980.

subject to nonresponse bias, recall error, rounding, or any other sort of respondent error (see Abowd and Stinson, 2005). Furthermore, the earnings data are not imputed or topcoded in any way, thereby preserving information within the upper range of the distribution. For purposes of this study, more precise earnings values are important for the regression analysis, but less important for identifying emigrants. Finally, the data include a large number of observations and longitudinal earnings histories typically unavailable in survey data.

The data also have several disadvantages, however. First, information on only a limited list of demographic variables is available. For example, educational attainment, marital status, and number of children are presumably important predictors of the probability of emigrating from the United States, but are absent from the administrative records.

Second, the administrative files capture earnings only from workers in the covered sector—that is, workers who are actively contributing to Social Security. About 4 percent of current paid civilian workers are not in the covered sector, down from about 10 percent in 1980; for the most part, these are employees of state or local governments (House Committee on Ways and Means, 2004). Finally, the administrative data do not include earnings from cash-based employment (such as under-the-table earnings) or earnings from workers who do not have, or do not report, a valid Social Security number. Both categories may be especially important for estimating emigration rates among immigrants, who are more likely than the native-born not to have—or to have invalid—Social Security numbers. This is perhaps especially true for illegal immigrants, and thus the estimates below likely fall between previous existing estimates of the legal immigrant population and the total (legal plus illegal) immigrant population.

Identifying Immigrants

The merged administrative dataset contains over 2 million total observations for individuals ages 16 to 62, representing a 1 percent sample of the U.S. population. About 7 percent of the total population ages 16 to 62 are classified as immigrants in 1978, and that fraction rises steadily over the next two decades to about 10 percent in 1990 and over 13 percent by 2003. These shares are roughly in line with those reported elsewhere and reflect the swift increase in the share of the U.S. foreign-born population (Congressional Budget Office, 2004).

The sample used in this analysis is restricted to those individuals who are identified in the administrative files as born outside the United States; estimates of native-born emigration rates are not considered here (see Fernandez, 1995). SSA provides a codebook of over 200 country codes to identify individual places of birth.¹¹ A number of countries are not assigned codes, but in most cases the city names permit identification of the country of birth. Of the foreign-born, only about 10 percent come from countries not listed in the SSA codebook. Those countries were identified by visual inspection and added to the existing identified list. The identified countries were then grouped into 11 separate entities, either countries or regions: Mexico, Central America, South America, Asia, the Middle East, Africa, Australia region¹², Europe, the Caribbean, Canada, and “Other/unidentified.” The last category comprises about 2 percent of the sample, and fewer than 1,000 individuals in that category have birthplaces that are missing or unknown.

¹¹ See Social Security Administration Publication No. 42-007, MMREF-1 Tax Year 2005 (V.2) Appendix G-Country Codes.

¹² The Australia region includes Australia, New Zealand, and several neighboring island groups.

Table 1 presents the share of immigrants from each of the 11 countries and regions in the merged administrative data (regardless of emigration status) with positive earnings in 1998. Large percentages originate from Asia (27 percent), Europe (18 percent), and Mexico (21 percent). For most, these shares mirror those found in a person-weighted tabulation of the 1999 March Current Population Survey (CPS); however, the CPS data indicate that nearly 30 percent of immigrants originate from Mexico and only 13 percent from Europe. The significantly larger share of immigrants from Mexico in the CPS data may reflect the presence of illegal immigrants in the survey data but not in the administrative earnings data, or mislabeling in either dataset.

Identifying Emigrants

The process of identifying foreign-born workers who subsequently emigrate relies on following the sequence of earnings over time. Two groups are identified in the analysis that follows. The first is based on the standard definition of emigrants and includes those immigrant workers who leave the United States to live abroad. The second group includes those workers who “emigrate” from the Social Security system. Workers who leave the United States and do not qualify for Social Security benefits (that is, are not current beneficiaries or have fewer than 40 quarters of covered earnings) are considered to have emigrated from the Social Security system.¹³ Workers who leave the United States and qualify for Social Security benefits, but move to a country that does not have an agreement with the United States such that the worker can receive Social Security

¹³ Because the administrative earnings data are recorded on an annual basis, the quarter of coverage dollar amounts are converted to annual amounts. As a point of reference, the quarters of coverage amount in 2003 was \$890.

benefits, are also considered to have emigrated from the Social Security system.¹⁴ Thus, the group of individuals who emigrate from the Social Security system (“Social Security emigrants”) is a subset of the group that emigrates from the United States (“U.S. emigrants”).

Both sets of emigrants are identified as those who have at least one year of positive earnings followed by at least two years of zero earnings. Conditioning on at least two years of zero earnings (as opposed to one) is intended to avoid one-year transitory earnings variability or unemployment. Since the administrative earnings records are based on the calendar year, having two years of zero earnings requires that the person be out of the labor force for *at least 24* months and thus potentially attenuates the problem of year-to-year changes in earnings and employment (see, for example, Congressional Budget Office, 2008).

Certain workers may be misclassified as emigrants. Individuals who leave the workforce for voluntary or involuntary reasons for more than two years (e.g., to care for a child, become disabled, retired, are unemployed for longer than two years, or move from covered to uncovered work) would be classified as emigrants.¹⁵ Alternatively, a worker’s Social Security number may become lost, which would generate erroneous occurrences of years with zero earnings, or the worker may not report his or her earnings to SSA for

¹⁴ Countries where U.S. workers can receive their Social Security benefits are known as “exception countries.” A full description of these countries can be found in the appendix.

¹⁵ Workers who become disabled toward the end of the sample period, but do not start receiving Social Security disability benefits until after the sample period ends, might also appear to have zero-earnings years, and hence be considered emigrants, when in fact these workers are out of the labor force because of the disability.

reasons relating to work or immigration status.¹⁶ The methodology also does not identify those immigrants who move back and forth between the United States and another country. Depending on the timing of such migration patterns and the length of time spent outside the United States, these workers may or may not be considered to have emigrated from the United States. In sum, because the administrative earnings records do not allow the researcher to distinguish between zero earnings (out of the workforce) and missing years of earnings (out of the country), estimates of emigration rates may be slightly overstated. However, such bias may be attenuated because the administrative earnings records most likely underrepresent the numbers of illegal immigrants and immigrants who never had covered work.¹⁷

To avoid some of the problems associated with retirement, the sample is restricted to persons ages 16 to 62. Thus, workers who retire at age 62 and have years of zero earnings thereafter are not considered to have emigrated under this definition. Workers who retire before age 62, however, may appear to have a sequence of zero-earnings years and would be considered to have emigrated.

Conditioning on at least two consecutive zero-earnings years introduces a censoring problem for workers who have positive earnings starting in 2001. For these workers there are not enough observations after 2001 to distinguish their emigration status. Further, for workers who have positive earnings in the years leading up to 2001, emigration rates may

¹⁶ The worker's Social Security number could also be stolen by another worker, which could introduce error in the earnings variable.

¹⁷ The administrative data also do not allow the researcher to identify foreign persons living in the United States under temporary visa status. Emigration rates for these individuals are most likely higher than those for other immigrants, since these temporary visas have specific expiration dates. Temporary workers who overstay their visa, however, may continue to have recorded earnings in the administrative data if they continue to use their Social Security number.

be overstated. This may occur because there are not enough years following a sequence of “positive-zero-zero” earnings years to observe additional years of positive earnings. Thus, many of the statistics presented below are truncated at 1998, but all workers are included in the regressions.

By identifying the first year of positive earnings, the length of time spent in the United States before emigration can be approximated. This has obvious shortcomings, however. For those who immigrate to the United States as children (recall that the age range is restricted to 16 to 62 years), positive earnings will not initially appear until the individual begins covered work. For example, suppose a person immigrates to the United States at age 5, attends school through college, begins work at age 22, and then emigrates to her country of birth at age 30. Although she has lived in the United States for 25 years, the procedure used here would generate a length of stay of 8 years. Because the methodology probably incorrectly measures the length of time children or students have lived in the United States, the overall average length of time spent in the United States is most likely biased downward.¹⁸

IV. Identifying Rates of Emigration

The final dataset contains over 300,000 immigrants whose earnings were tracked by SSA for at least one year during the sample period. Table 2 lists summary statistics for the main variables in 1998 for both definitions of emigration (U.S emigration and Social

¹⁸ Lubotsky (2007) uses survey data matched to longitudinal administrative earnings data to measure immigrant earnings growth. He uses three definitions of arrival in the United States: the reported year of arrival in the survey, the first year of covered earnings, and the earlier of the two. He notes that the second method “provides perhaps the most easily interpretable picture of immigrant earnings growth because it measures wage growth from the year of entry into the formal, or covered, U.S. labor market” (p. 842).

Security emigration). Immigrants who later left the country at some point earned, on average, about \$11,600 in 1998; average earnings among those who stayed were about \$27,700.¹⁹ Average earnings of Social Security emigrants are about the same as U.S. emigrants, at about \$11,200. Social Security emigrants are, on average, the youngest of the four groups, with an average age of 36 years. Both emigrant groups include a smaller proportion of men than do the nonemigrant groups. Because the administrative records do not contain family identifiers, however, there may be interactions between men and women that are not captured in these estimates.

For most years in the sample period, between 1.0 percent and 1.5 percent of immigrants with earnings tracked by SSA emigrate from the United States each year (figure 1).²⁰ A slightly smaller fraction of immigrants leave the Social Security system each year, between 0.8 percent and 1.2 percent. For comparison, the figure also plots the share of immigrants with two years of consecutive zero earnings. That line is about 1.5 percentage points higher than the U.S. emigration rate line and follows a slightly different pattern. Thus, the emigration methodology does not appear to be simply picking up earnings variability. Further, the trends appear to have a modest link to the business cycle: all three metrics decline during the economic slowdowns of 1981-1982 and 1990-1991, but rise during the shorter slowdown of the first half of 1980. The link between the business cycle

¹⁹ These means are conditional on having positive earnings. Note that in these calculations, workers emigrate in 1998 or later. Earnings are measured in 2007 CPI-U-RS dollars.

²⁰ One policy change that could have shifted the pattern of emigration rates is the Immigration Reform and Control Act of 1986 (IRCA), which extended legal status to immigrants who had been unlawfully living in the country continuously since before January 1, 1982, and to illegal immigrants employed in agriculture for a minimum of 90 days in the year preceding May 1986. IRCA may have led to a greater number of immigrants with earnings in the administrative data, but it is not possible to separate new immigrants from those who converted from illegal to legal status under IRCA. The introduction of large numbers of legal immigrants could bias estimates of emigration rates downward. For a description of IRCA, see Fix and Passel (1994).

and the rate of emigration might be made stronger if the administrative earnings sample used here contained a larger portion of illegal immigrants. Papademetriou and Terrazas (2009) argue that excess demand for visas forces many migrants into illegal channels; it should then follow, they argue, that illegal immigrants are more responsive to changes in the economy than legal immigrants (see also Hanson, 2007).

Comparisons with the Existing Literature

Estimated emigration rates from a number of previous studies and those estimated here are presented in figures 2 through 4.²¹ In figure 2, emigration rates for all foreign-born persons estimated in the earlier literature are compared with average emigration rates found in the present study over the 1978-1998 period; the error bar for the present study depicts the minimum and maximum estimates during the period. In general, these emigration rates lie between about 0.9 percent and 1.5 percent, with a higher estimate from Van Hook and others (2006) at 2.9 percent.²² In their “middle” migration series, the Census Bureau uses an emigration rate of 1.2 percent (Hollmann and others, 2000, following Ahmed and Robinson, 1994); the error bar for the estimate by Hollmann and others represents the average of the “lowest” and “highest” emigration rates used by the Census Bureau over their projection period.

Even the slight differences in emigration rates shown in figure 2 can lead to large differences in the *number* of estimated emigrants. Warren and Peck (1980) estimated a

²¹ Kraly (1998) and Mulder (2003) review the literature in detail.

²² The estimates in figures 2 through 4 from Van Hook and others, Mulder, Warren and Peck, and Ahmed and Robinson are reported in Van Hook and others (2006), tables 2 and 3. The estimates for Passel (2006) and Hollmann and others (2000) are taken directly from those studies.

total of 114,000 emigrants per year during the 1960s, which translates to a 1.18 percent average annual emigration rate. Over the course of the 1980s, Ahmed and Robinson (1994) estimated that 195,000 people emigrate per year, for an emigration rate of 1.15 percent. The emigration assumptions used by the Census Bureau (Hollmann and others, 2000) yield LPR emigration rates (using their middle series) of about 311,000 in 2003, up from about 250,000 in 1991.²³ The Social Security Trustees estimate that 250,000 LPRs emigrate per year, while, on average, about 680,000 “Other” immigrants emigrate per year.²⁴ The 1:100 sampling framework used in this study yields emigration estimates of approximately 200,000 in 1978, rising to about 400,000 by 1998. Averages suggest that about 275,000 workers emigrated each year during the 1980s, an estimate that rises to about 380,000 during the 1990s. When even a slightly lower rate is applied to the sample (say, 1.2 percent instead of 1.4 percent in 1998), the number of emigrants falls from about 400,000 to about 336,000.

Of course, since information on immigration status (LPR, “Other”) is not available in the administrative data and it is unclear how many “Other” immigrants are included in the earnings data, the emigration rates estimated here are some combination of the two. Further, because illegal immigrants (included in the “Other” category) are presumably underrepresented in the administrative earnings data, it is perhaps not surprising that the total estimated number of emigrants lies between the number of LPRs and that of total emigrants estimated by the Social Security Trustees.

²³ In 2005, the Census Bureau’s estimates of emigration for LPRs ranged from 229,000 to 430,000.

²⁴ The Trustees’ estimates rise from about 520,000 in 2006 to over 725,000 in 2082.

In figure 3, emigration rates estimated in this study for immigrants who remain in the United States less than 10 years are compared with rates reported in the literature.²⁵ Nearly all studies find the annual emigration rate for this group to be higher than the overall rate. The sole exception is Mulder (2003), who finds an annual emigration rate in the first 10 years of 0.3 percent, about a third of the 0.9 percent that Mulder found for all foreign-born. The emigration rates in figure 3 are a bit more variable than those in figure 2, ranging from 0.3 percent to 4.4 percent. The average annual emigration rate generated for this study from the longitudinal earnings data (2.3 percent) is at about the midpoint of these estimates.

Finally, figure 4 presents annual emigration rates by country or region from this study and four of the earlier studies. Except for Europe and Canada, Van Hook and others (2006) report the highest annual emigration rates, with rates for Mexico (4.3 percent) more than double that of the next highest study (Passel, 2006, at 1.8 percent). In general, the emigration rates estimated from the longitudinal data are in line with most of these studies, but the differences across the eight regions are smaller than in most of the other studies. For example, estimates from the administrative files range from 1.0 percent (Central America and Africa) to 1.8 percent (Canada), whereas the estimates from Van Hook and others (2006) range from 1.8 percent (Europe and the Caribbean) to 4.3 percent (Mexico and Africa). Overall, the variance of annual estimated emigration rates from each of the five studies across the eight countries and regions ranges from 0.09 (this study) to 1.06 (Van Hook and others, 2006).

²⁵ Recall that length of time spent in the United States is measured as the number of years between the last year of positive earnings and the first year of positive earnings, similar to the third method used by Lubotsky (2007).

The fact that the annual emigration rate for Mexicans is not the highest of the eight countries and regions is perhaps surprising. The large number of Mexican immigrants currently living in the United States, coupled with Mexico's close proximity, might suggest a higher emigration rate. Mexico's close proximity might also suggest lower migration costs than those faced by immigrants from more distant countries (see Chiquiar and Hanson, 2005). Yet, as noted previously, the administrative earnings data used here presumably fail to capture many illegal immigrants who do not have a valid Social Security number or do not report their earnings to SSA. Duleep and Dowhan (2008b) show that more than half of all illegal immigrants are from Mexico, another 10 percent come from the Caribbean, and roughly 16 percent immigrate from Central and South America (see also Passel, 1999, and Johnson, 2006). The share of the illegal immigrant population from the Caribbean and Central and South America is about equal to the share of legal immigrants from those countries, suggesting that the estimated emigration rates for these countries especially are most likely smaller than the actual emigration rate.

Comparing U.S. Emigrants with Social Security Emigrants

The existing literature on emigration is concerned with emigration from the United States, but a separate policy question is: At what rate do immigrants leave the Social Security system? Revenues from Social Security taxes paid by workers who then leave the Social Security system before claiming benefits are, from the perspective of the system's finances, a pure gain. On the other hand, immigrants who enter the U.S. workforce and qualify for benefits may, depending on their earnings, family composition, and mortality risk, impose a net cost on the system. This section compares rates of

emigration from the United States with emigration rates from the Social Security system.²⁶

Average annual emigration rates for both concepts by age, sex, time in the United States, and country of origin are shown in table 3. These rates rise relatively linearly across the four age groups, from 0.69 percent for the youngest workers (16 to 24 years old) to 2.31 percent for those ages 45 to 62. Social Security emigration rates also rise by age, but at a slower rate, from 0.66 percent for the youngest workers to 1.21 percent for the oldest. The large difference in rates for the two concepts among the oldest workers may be a signal that as workers near retirement—and hence eligibility to claim Social Security benefits—they are less likely to leave the Social Security system than to emigrate from the United States. The increase in emigration rates across age groups may also reflect the lack of illegal immigrants in the administrative files. As Duleep and Dowhan (2008b) show, the age distribution of illegal immigrants is more heavily skewed toward younger ages than that of legal immigrants; the emigration rate among the youngest workers shown in table 3 may therefore be underestimated.²⁷

Women are slightly more likely than men to emigrate from the United States in any year (1.39 percent versus 1.25 percent), but the two groups emigrate from the Social Security system at essentially the same rate (1.02 percent for women and 0.98 percent for men).

This result differs from those of both Van Hook and others (2006) and Passel (2006),

²⁶ Duleep (1994) is one of the only papers to explore the relationship between the level and timing of immigrant emigration and projections of the financial status of the Social Security system.

²⁷ Duleep and Dowhan (2008b) compare stocks of legal and illegal immigrants using data from the Immigration and Naturalization Service and from Passel (1999). Nearly all of the illegal immigrant population is estimated to be under age 35, whereas about 65 percent of legal immigrants are estimated to be in the same age range.

who find that emigration rates for men are more than twice those for women. The method used here may bias estimates of women's emigration rates upward, because women are more likely than men to exit the labor force for reasons related to childbirth and thus may appear to have emigrated rather than left the labor force temporarily.

Much as the rest of the literature has found, annual emigration rates for both concepts decline as individuals live in the United States longer. In any particular year, nearly 3 percent of immigrants who have lived in the United States less than 5 years emigrate from the country. This annual rate declines to 0.2 percent for those who have lived in the United States more than 21 years. A similar pattern can be found in Van Hook and others (2006), but, again, emigration rates in that study are higher than those found here.²⁸

Determining emigration rates by country of origin may also be important for social policy, because immigrants and emigrants from different countries have different labor market and social behaviors. Rates differ between the two emigration concepts considered here with no apparent pattern across countries and regions. Immigrants from the Australia region have the highest emigration rates (2.2 percent for both emigration concepts), whereas emigrants from Mexico emigrate at slower rates (1.3 percent for U.S. emigrants, 0.9 percent for Social Security emigrants). Over all countries and regions, the difference between U.S. emigrants and Social Security emigrants varies from 0.03 (Africa) to 0.65 (Canada) percentage points. Again, the lack of illegal immigrants in the administrative files may generate lower emigration rates than those for all immigrants.

²⁸ Emigration rates in Van Hook and others (2006) by length of time in the United States are 5.0 percent (0 to 4 years), 3.6 percent (5 to 9 years), and 2.0 percent (10 or more years).

V. Estimating Correlations with Emigration

Using the population of emigrants defined above, the analysis in this section identifies some of the basic correlations between emigration and individual characteristics. As noted, because the administrative data contain few additional variables, the regressions include a small set of regressors: age, age-squared, sex, average earnings, and country or region of origin. Additional covariates—such as the difference in growth rates of GDP per capita between the United States and the emigrant’s country or region of birth, dummy variables for each age group or year, and time spent in the United States—appear to have little impact on the main results.

Probability of Ever Emigrating

The regression model used in this section is a logit regression where the dependent variable indicates whether the foreign-born worker *ever* emigrated. Despite a significant censoring problem at the end of the sample period, the estimation results can be used to determine the probability of emigrating from the United States within the 26-year sample period.

Tables 4 and 5 present the logit regression results (in odds ratios) for the two emigration samples. In both sets of regressions, when age, earnings, and country or region of origin are held constant, men are more likely to emigrate than women.²⁹ The gender effect is larger in the Social Security sample than in the U.S. sample. The largest point estimate suggests that the odds of a man with covered earnings ever emigrating from the United

²⁹ Age is measured in the last year the person is observed in the sample.

States are about 7 percent higher than the odds of a woman with covered earnings doing so. The analogous estimate in table 5 suggests that the odds of a man ever emigrating from the Social Security system are about 15 percent higher than those of a woman. Age appears to be negatively correlated with emigration, but when age-squared is also included as a covariate, age is positively correlated with emigration but at a declining rate.³⁰ The higher an emigrant's average earnings, the less likely he or she is to emigrate, either from the United States or from the Social Security system.³¹ This negative correlation supports the hypothesis put forth by Lubotsky (2007) that immigrants with low earnings are more likely to emigrate than those with high earnings.

The odds ratios on the individual country and region dummy variables are generally statistically significant and larger than one. Given that the reference country is Mexico, these results suggest that immigrants from other countries and regions are more likely than Mexicans to emigrate at some point to their home country or region. For example, the odds ratio on the European dummy variable suggests that Europeans are almost twice as likely as Mexicans to emigrate from the United States. The highest rates of emigration, reflecting the raw statistics presented in table 3, are for those from the Australia region, who are about three to four times as likely as Mexicans to emigrate. These results might again reflect the large number of illegal immigrants who originate from Mexico and are not captured in the administrative earnings records.

³⁰ Similar findings are reported by Chiquiar and Hanson (2005) and McKenzie and Rapoport (2007).

³¹ Average earnings are defined as the average across real (2007 CPI-U-RS adjusted) earnings between the first and the last year in the United States.

Two additional covariates—the difference in growth rates of GDP per capita between the United States and the origin country, and the length of time spent in the United States—are all statistically significant and large in magnitude.³² The odds ratio on the GDP per capita difference variable is greater than one in each regression, suggesting that for an increase in the difference in rates of 1 percentage point in favor of the United States, the odds of emigration increase by between 18 percent and 22 percent. Though this finding is perhaps counterintuitive, it may be partially explained by the fact that other support for retirees in the home country—for example, health care or pension benefits—are not included in the regressions.³³ Thus, the difference in growth rates of GDP per capita does not capture the entire difference between the U.S. and the worker's home country. Odds ratios on the dummy variables for length of time spent in the United States (5 to 9 years, 10 to 15 years, 16 to 20 years, and 21 to 26 years) reflect the declining likelihood of emigrating the longer an immigrant remains in the United States. Thus, for example, the odds of emigrating after living in the United States for over 21 years are nearly negligible, whereas the odds of emigrating after living in the United States for 5 to 9 years are about 60 percent lower than those workers who emigrate after living in the United States for less than 5 years (holding sex, age, and average earnings constant).

These correlations can be summarized graphically by calculating the probability of emigrating by age for each sex at a fixed level of average earnings; this is done in figure

³² The GDP per capita difference variable is measured at the year in which the worker emigrates from the United States (that is, the year after the last year of positive earnings are observed). GDP per capita growth rates are calculated by region and not for each country separately and are available from the U.S. Department of Agriculture's Economic Research Service (www.ers.usda.gov/Data/Macroeconomics/).

³³ Reagan and Olsen (2000), for example, find that welfare generosity in the state of residence does not serve to deter migration to the immigrant's home country. Dumont and Spielvogel (2008) summarize the empirical literature that finds support for the idea that return migration is more highly correlated with the economic and political situation of the country of origin than with that of the country of destination (see also Papademetriou and Terrazas, 2009).

5 using the regression results in column 3 of tables 4 and 5 at average annual earnings levels of \$10,000 and \$30,000. When the results are viewed in this way, it becomes clear that the odds ratio on the sex variable generates a larger difference between men and women with respect to Social Security emigration than with respect to U.S. emigration. In fact, patterns for the two sexes are essentially identical for U.S. emigration, whereas there is a difference of about 0.02 between prime-age men and women for Social Security emigration. Similarly, the combination of the age and age-squared terms generates different shapes in the two profiles: the probability of leaving the Social Security system falls much faster with age than that of emigrating from the country.

Probability of Emigrating in a Single Year

An alternative estimation technique is to calculate the probability of emigrating in *any year* of observed data. The presence of censoring on the right (later) end of the time series, combined with the annual earnings data, suggests a discrete hazard model as the appropriate choice. Following Jenkins (1995) and Allison (1984), the discrete hazard model with a binary dependent variable reduces to a logit model. Thus, instead of having a single observation for each person (as in the logit regressions in tables 4 and 5), the “logit-hazard” regressions require a person-year data format where, for each person, there are as many observations as years in the sample up to the year in which the person emigrates or his or her earnings stream ends (that is, at age 62 or in 2003).

For the most part, the statistical significance of the covariates in the logit-hazard model is approximately the same as in the standard logit model, but the magnitudes are smaller

(tables 6 and 7).³⁴ The odds ratio on sex still suggests (controlling for age and earnings) that men are more likely to emigrate than women. In the U.S. emigration regressions, the direction of the effect of age and age-squared is the reverse of the effect in the standard logit model, suggesting that the odds of emigration rises with age at an increasing rate. Average earnings continue to be negatively correlated with emigration, so that immigrants with lower earnings are more likely to emigrate.

The odds ratios on the country and region dummy variables are also similar to those in the standard logit case. Most of these are statistically significant and greater than one, suggesting that Mexicans—or at least those with earnings tracked by SSA—are among the least likely to emigrate. In these regressions, Europeans are about 1.5 to 1.8 times as likely as Mexicans to emigrate, and Australians are about three to five times as likely. African immigrants appear to be more likely to emigrate in these regressions, whereas they were less likely in the standard logit case. Adding the GDP per capita difference variable (here measured in each year the worker appears in the sample) generates statistically significant results but has a smaller effect than in the standard logit case.

The discrete hazard model has the advantage of allowing for complete flexibility in both duration and age by including dummy variables for both. When these controls are included (see columns 6 and 7 of table 6), the odds ratio on the GDP per capita difference

³⁴ The calculation of average earnings differs from the logit case: instead of being calculated as the average across all years, earnings are averaged over the previous three years. This formulation serves to add variation in earnings to the model and helps control for short-run changes in earnings. In the first year of each person's earnings stream, average earnings are set equal to the first year's earnings. In the second and third years, average earnings are calculated as the average of earnings in years 1 and 2. Starting in year 4, average earnings are calculated as the average over the previous three years.

variable changes direction but remains small in magnitude.³⁵ When the duration-specific dummy variables are included (columns 6 through 8), the other covariates are little changed. In the U.S. emigration regressions, the direction of the age and age-squared variables is closer to expectations (and to the results found in the Social Security emigration regressions and to the standard logit case), with a positive effect of age on emigration. The effect of age-squared on emigration also remains positive. Odds ratios on separate age dummy variables (not reported) also suggest a linear rise in the probability of emigrating (columns 7 and 8).³⁶

These correlations are summarized graphically in figure 6, which, using the regression results in column 3 of tables 6 and 7, plots by age the probability of emigrating for men and women with earnings of \$10,000 and \$30,000. The trends in the top panel illustrate how the combination of the negative age coefficient and the positive age-squared coefficient result in a curvilinear upward trend in emigration rates. For those emigrating from the Social Security system at some point during the period, the computed probabilities generate a flat age-emigration profile, with differences between men and women that are slightly larger than in the top panel. Note also that the U.S. emigration probabilities grow from about one-fourth as large as the Social Security emigration probabilities at age 40 to about two-and-a-half times as large by age 62.

³⁵ Note that because there are no emigrants in 2001, 2002, or 2003, these year dummy variables are perfectly collinear and drop out of the regression, which reduces the number of observations by about 104,000 between columns 5 and 6. Because of the two consecutive zero-earnings years restriction, the dummy variables for 61- and 62-year-olds are also perfectly collinear (all zero) and thus drop out from the regression in column 7, reducing the number of observations by almost another 56,000.

³⁶ In unreported results, logit-hazard regressions that included separate year dummy variables lowered the point estimate on the age coefficient by about 1 percentage point but had no significant effect on the other main variables of interest.

VI. Conclusion

Estimating rates of emigration of the foreign-born, and thus accurately tracking migrant flows, is hampered by the lack of data that follow people from one country to another. Researchers have therefore made use of the residual method, which measures the difference between the foreign-born population in one year and that in another year. Although this methodology is widely used, recent research (for example, see Van Hook and others, 2006) has begun to explore the advantages of longitudinal data. The methodology presented in this paper uses longitudinal administrative earnings data to estimate rates of emigration among immigrants with earnings that are tracked by the Social Security Administration by observing the earnings patterns of U.S. immigrants between 1978 and 2003.

The results are close to those found elsewhere in the literature and suggest an annual emigration rate of workers of about 1.3 percent, or about 315,000 people, over the 1978-1998 period. Averages suggest that about 280,000 workers emigrated each year during the 1980s, a figure that rises to about 380,000 during the 1990s. Analysis of the group of workers who emigrate from the U.S. Social Security system generates a smaller annual emigration rate of about 0.9 percent. Logit and logit-hazard regression models further support the differences between these groups, and when age-squared is included as a covariate, the probability of emigrating rises over the first part of an individual's lifetime before declining after about age 30. However, because the data do not distinguish between zero and missing earnings values, the methodology may slightly overstate the number of emigrants. On the other hand, because the administrative files do not capture

those workers whose earnings are not tracked by the Social Security Administration—particularly illegal immigrants—these estimates are most likely smaller than actual total emigration.

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Appendix. Exception Countries

About 80 countries have agreements with the United States whereby qualified U.S. workers may continue to receive Social Security benefits. Such countries are known as “exception countries” and fall into three separate categories. This appendix lists the exceptions under which U.S. workers living abroad can still receive Social Security benefits, and the set of countries that have existing agreements with the United States. The information below is quoted directly from table 1 and appendix A of Congressional Research Service, “Social Security Benefits for Noncitizens: Current Policy and Legislation,” February 1, 2008.

Table 1. Exceptions to the Alien Nonpayment Provision for Workers and Dependents/Survivors

An alien’s benefits are suspended if he/she is outside the United States for more than six consecutive months, unless one of the following exceptions is met:

- the individual is a citizen of a country that has a social insurance or pension system under which benefits are paid to eligible U.S. citizens who reside outside that country (for example, Brazil, Finland, Mexico, Philippines and Turkey; see **Appendix A** [below] for a complete list of countries)
- the individual is entitled to benefits on the earnings record of a worker who lived in the United States for at least 10 years or earned at least 40 quarters of coverage under the U.S. Social Security system (exception does not apply if the individual is a citizen of a country that does not provide social insurance or pension system payments to eligible U.S. citizens who reside outside that country)
- the individual is entitled to benefits on the earnings record of a worker who had railroad employment covered by Social Security
- the individual is outside the United States while in the active military or naval service of the United States
- the individual is entitled to benefits on the earnings record of a worker who died while in the U.S. military service or as a result of a service-connected disease or injury
- the nonpayment of benefits would be contrary to a treaty obligation of the United States in effect as of August 1, 1956 (i.e., the individual is a citizen of a treaty obligation country; see **Appendix A** for a list of countries)
- the individual is a citizen or resident of a country with which the United States has a totalization agreement (see **Appendix A** for a list of countries)
- the individual was eligible for Social Security benefits as of December 1956.

Because the administrative data used in this analysis do not identify spouses or railroad workers or military service, only the first, sixth, and seventh exceptions listed above are relevant. This requires using the administrative earnings data to identify the list of “exception countries” where eligible individuals (current recipients of Social Security worker or auxiliary benefits and current workers with 40 or more quarters of coverage) can move and still receive Social Security benefits.

Appendix A. Exception Countries

The following country lists, which are subject to change periodically, are taken from the *Code of Federal Regulations* (C.F.R., revised through April 1, 2002) and the Social Security Administration's International Program web page.

Social Insurance or Pension System Countries

The following countries meet the "social insurance or pension system" exception in Section 202(t)(2) of the Social Security Act:

Antigua and Barbuda, Argentina, Austria, Bahamas, Barbados, Belgium, Belize, Bolivia, Brazil, Burkina Faso (formerly Upper Volta), Canada, Chile, Colombia, Costa Rica, Cyprus, Czechoslovakia, Denmark, Dominica, Dominican Republic, Ecuador, El Salvador, Finland, France, Gabon, Grenada, Guatemala, Guyana, Iceland, Ivory Coast, Jamaica, Liechtenstein, Luxembourg, Malta, Mexico, Monaco, Netherlands, Nicaragua, Norway, Panama, Peru, Philippines, Poland, Portugal, San Marino, Spain, St. Christopher and Nevis, St. Lucia, Sweden, Switzerland, Trinidad and Tobago, Trust Territory of the Pacific Islands (Micronesia), Turkey, United Kingdom, Western Samoa, Yugoslavia, Zaire (20 C.F.R. § 404.463).

Treaty Obligation Countries

The following countries meet the "treaty obligation" exception in Section 202(t)(3) of the Social Security Act:

Germany, Greece, Ireland, Israel, Italy, Japan, Netherlands*

*Treaties between the United States and the Netherlands preclude the application of residency requirements for noncitizens with respect to monthly survivor benefits only.

Totalization Agreement Countries

The following countries meet the "totalization agreement" exception in Section 202(t)(11)(E) of the Social Security Act. The effective date is shown for each agreement.

Australia	October 1, 2002
Austria	November 1, 1991
Belgium	July 1, 1984
Canada	August 1, 1984
Chile	December 1, 2001
Finland	November 1, 1992
France	July 1, 1988
Germany	December 1, 1979
Greece	September 1, 1994
Ireland	September 1, 1993
Italy	November 1, 1978
Japan	October 1, 2005
South Korea	April 1, 2001
Luxembourg	November 1, 1993
Netherlands	November 1, 1990
Norway	July 1, 1984
Portugal	August 1, 1989

Spain	April 1, 1988
Sweden	January 1, 1987
Switzerland	November 1, 1980
United Kingdom	1985/1988*

* Provisions that eliminate double taxation became effective January 1, 1985; provisions that allow persons to use work in both countries to qualify for benefits became effective January 1, 1988.

Note: Agreements with Austria, Belgium, Germany, Sweden and Switzerland permit the individual to receive benefits as a dependent or survivor while a *resident* in those countries only if the worker is a U.S. citizen or a citizen of the country of residence.

Because in this paper the individual's year of emigration is calculated from the administrative earnings data, only those workers who emigrate after the year the totalization agreement was approved are considered as emigrants from the Social Security system. No restriction on the year of emigration is applied to the first two groups of countries (social insurance or treaty obligation countries).

Table 1.**Immigration by Country of Origin, 1998**

(Percent)	Source	
	Administrative Data	Current Population Survey
Asia	26.7	24.4
Europe	17.6	13.2
Mexico	21.3	28.5
Caribbean	10.3	10.4
Central America	6.5	7.8
South America	5.7	6.4
Middle East	3.8	3.0
Africa	3.0	2.2
Canada	2.8	2.2
Other	2.0	1.2
Australia region	0.3	0.6
Total	100.0	100.0
No. of Observations	172,480	8,008
No. of Weighted Observations	n.a.	14,889,800

Source: Author's calculations from merged Detailed Earnings Records, Numident, and Master Beneficiary Records data from the Social Security Administration, and the 1999 March Current Population Survey.

Note: Percentages for the administrative data are derived from the universe of immigrants ages 16 to 62 with positive earnings in 1998 from the merged DER-Numident-MBR data. Percentages from the March Current Population Survey are derived from person-weighted tabulations of immigrants ages 16 to 62 with positive earnings from the 1999 CPS. The Australia region includes Australia, New Zealand, and several neighboring island groups.

Table 2.**Summary Statistics of Emigrants and Nonemigrants, 1998**

	Emigration from the United States		Emigration from the U.S. Social Security system	
	Nonemigrants	Emigrants	Nonemigrants	Emigrants
Average Age (years)	37.9	38.0	37.9	35.9
Average Earnings (dollars)	\$27,713	\$11,617	\$27,646	\$11,248
Percent Men	56%	51%	56%	51%
Number of Obs.	168,422	4,058	169,198	3,282

Source: Author's calculations from merged Detailed Earnings Records, Numident, and Master Beneficiary Record data from the Social Security Administration.

Note: Universe limited to immigrants with positive earnings in 1998.

Table 3. Emigration Estimates of the Foreign-Born Population by Characteristic, 1978-1998

(Percent)	Emigration Rate	
	From the United States	From the Social Security system
<i>All Foreign Born</i>	1.31	1.00
<i>Sex</i>		
Men	1.25	0.98
Women	1.39	1.02
<i>Age Group</i>		
16-24	0.69	0.66
25-34	1.25	1.13
35-44	1.49	1.16
45-62	2.31	1.21
<i>Years in the United States</i>		
0-4 years	2.72	2.35
5-9 years	1.78	1.39
10-15 years	1.27	0.83
16-20 years	0.98	0.55
21+ years	0.22	0.12
<i>Country/Region of Origin</i>		
Australia region	2.21	2.17
Canada	1.67	1.02
Europe	1.64	1.12
Middle East	1.43	1.28
Mexico	1.33	0.91
Caribbean	1.27	0.95
South America	1.21	0.90
Asia	1.05	0.92
Africa	1.04	1.01
Central America	0.94	0.73
Other	2.03	1.78

Source: Author's calculations from merged Detailed Earnings Records, Numident, and Master Beneficiary Record data from the Social Security Administration.

Note: Data are annual averages over 1978-1998. The Australia region includes Australia, New Zealand, and several neighboring island groups.

Table 4.

Logit Regressions Investigating the Determinants of Emigration from the United States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sex (dummy, 1=men)	1.028 (0.009)**	1.030 (0.009)**	1.020 (0.009)**	1.075 (0.010)**	1.069 (0.010)**	1.023 (0.010)*	1.056 (0.010)**	1.051 (0.010)**
Age	0.991 (0.000)**	1.054 (0.003)**	1.060 (0.003)**	1.079 (0.003)**	1.086 (0.003)**	1.188 (0.003)**	1.218 (0.003)**	1.227 (0.003)**
Age-squared	---	0.999 (0.000)**	0.999 (0.000)**	0.999 (0.000)**	0.999 (0.000)**	0.998 (0.000)**	0.998 (0.000)**	0.998 (0.000)**
Average earnings ^a	0.986 (0.000)**	0.985 (0.000)**	0.986 (0.000)**	0.982 (0.000)**	0.984 (0.000)**	0.991 (0.000)**	0.990 (0.000)**	0.990 (0.000)**
Difference in growth rates of GDP per capita ^b	---	---	1.185 (0.003)**	---	1.223 (0.003)**	---	---	1.203 (0.003)**
<i>Country and regional dummy variables^c</i>								
Central America	---	---	---	0.757 (0.017)**	0.691 (0.016)**	---	0.644 (0.015)**	.585 (0.014)**
South America	---	---	---	1.083 (0.023)**	1.471 (0.033)**	---	0.878 (0.020)**	1.141 (0.027)**
Europe	---	---	---	1.895 (0.027)**	1.879 (0.027)**	---	1.676 (0.025)**	1.674 (0.025)**
Africa	---	---	---	0.883 (0.026)**	0.829 (0.024)**	---	0.655 (0.020)**	0.612 (0.019)**
Middle East	---	---	---	1.451 (0.035)**	2.016 (0.051)**	---	1.277 (0.032)**	1.675 (0.055)**
Asia	---	---	---	1.108 (0.016)**	1.357 (0.020)**	---	0.939 (0.014)**	1.124 (0.017)**
Caribbean	---	---	---	1.060 (0.019)**	1.004 (0.018)**	---	1.017 (0.019)	0.978 (0.019)**
Australia region ^d	---	---	---	3.018 (0.169)**	2.953 (0.166)**	---	2.187 (0.128)**	2.134 (0.125)**
Canada	---	---	---	2.072 (0.053)**	2.027 (0.052)**	---	1.751 (0.048)**	1.723 (0.047)**
Other	---	---	---	2.134 (0.063)**	3.027 (0.091)**	---	2.632 (0.083)**	3.463 (0.113)**
<i>Dummy variables for length of time in U.S.^e</i>								
5-9 years	---	---	---	---	---	0.431 (0.005)**	0.436 (0.005)**	0.398 (0.005)**
10-15 years	---	---	---	---	---	0.274 (0.004)**	0.280 (0.004)**	0.277 (0.004)**
16-20 years	---	---	---	---	---	0.190 (0.003)**	0.192 (0.003)**	0.189 (0.003)**
21+ years	---	---	---	---	---	0.059 (0.001)**	0.055 (0.001)**	0.056 (0.001)**
No. of observations	323,896	323,896	323,896	323,896	323,896	323,896	323,896	323,896

Source: Author's calculations.

Note: The dependent variable is the odds of the immigrant ever emigrating from the United States.

Standard errors are in parentheses. * Significant at 5 percent; ** Significant at 1 percent.

a. Defined as the average across real (2007 CPI-U-RS adjusted) earnings between the immigrant's first and last years in the United States.

b. Annual percentage change in U.S. GDP per capita minus annual percentage change in GDP per capita in the country or region of origin.

c. Immigrants from Mexico are the excluded category.

d. Includes Australia, New Zealand, and several neighboring island groups.

e. Immigrants living in the United States for 0 to 4 years are the excluded category.

Table 5.

Logit Regressions Investigating the Determinants of Emigration from the Social Security System

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sex (dummy, 1=men)	1.100 (0.011)**	1.102 (0.011)**	1.092 (0.011)**	1.154 (0.012)**	1.148 (0.012)**	1.110 (0.012)**	1.145 (0.012)**	1.139 (0.012)**
Age	0.972 (0.000)**	1.059 (0.003)**	1.063 (0.003)**	1.082 (0.003)**	1.089 (0.003)**	1.207 (0.004)**	1.232 (0.004)**	1.240 (0.004)**
Age-squared	---	0.999 (0.000)**	0.999 (0.000)**	0.999 (0.000)**	0.999 (0.000)**	0.998 (0.000)**	0.997 (0.000)**	0.997 (0.000)**
Average earnings ^a	0.984 (0.000)**	0.982 (0.000)**	0.983 (0.000)**	0.980 (0.000)**	0.981 (0.000)**	0.990 (0.000)**	0.988 (0.000)**	0.989 (0.000)**
Difference in growth rates of GDP per capita ^b	---	---	1.181 (0.003)**	---	1.248 (0.004)**	---	---	1.217 (0.004)**
<i>Country and regional dummy variables^c</i>								
Central America	---	---	---	0.872 (0.022)**	0.795 (0.020)**	---	0.731 (0.019)**	0.668 (0.018)**
South America	---	---	---	1.230 (0.030)**	1.713 (0.044)**	---	0.958 (0.025)	1.258 (0.034)**
Europe	---	---	---	2.023 (0.033)**	2.011 (0.034)**	---	1.707 (0.030)**	1.719 (0.030)**
Africa	---	---	---	1.263 (0.038)**	1.187 (0.036)**	---	0.903 (0.028)**	0.849 (0.027)**
Middle East	---	---	---	2.020 (0.052)**	2.922 (0.079)**	---	1.741 (0.048)**	2.332 (0.067)**
Asia	---	---	---	1.531 (0.024)**	1.933 (0.032)**	---	1.283 (0.021)**	1.571 (0.027)**
Caribbean	---	---	---	1.246 (0.026)**	1.176 (0.025)**	---	1.186 (0.026)**	1.144 (0.025)**
Australia region ^d	---	---	---	4.456 (0.257)**	4.396 (0.255)**	---	3.097 (0.188)**	3.060 (0.186)**
Canada	---	---	---	1.974 (0.060)**	1.935 (0.059)**	---	1.575 (0.050)**	1.570 (0.051)**
Other	---	---	---	3.318 (0.106)**	4.983 (0.164)**	---	4.353 (0.152)**	5.885 (0.211)**
<i>Dummy variables for length of time in U.S.^e</i>								
5-9 years	---	---	---	---	---	0.415 (0.005)**	0.421 (0.006)**	0.389 (0.005)**
10-15 years	---	---	---	---	---	0.198 (0.003)**	0.203 (0.003)**	0.203 (0.003)**
16-20 years	---	---	---	---	---	0.121 (0.003)**	0.124 (0.003)**	0.123 (0.003)**
21+ years	---	---	---	---	---	0.041 (0.001)**	0.038 (0.001)**	0.039 (0.001)**
No. of observations	323,896	323,896	323,896	323,896	323,896	323,896	323,896	323,896

Source: Author's calculations.

Note: The dependent variable is the odds of the immigrant ever emigrating from the United States.

Standard errors are in parentheses. * Significant at 5 percent; ** Significant at 1 percent.

a. Defined as the average across real (2007 CPI-U-RS adjusted) earnings between the immigrant's first and last years in the United States.

b. Annual percentage change in U.S. GDP per capita minus annual percentage change in GDP per capita in the country or region of origin.

c. Immigrants from Mexico are the excluded category.

d. Includes Australia, New Zealand, and several neighboring island groups.

e. Immigrants living in the United States for 0 to 4 years are the excluded category.

Table 6.

Logit-Hazard Model Regressions Investigating the Determinants of Emigration from the United States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sex (dummy, 1=men)	1.036 (0.010)**	1.074 (0.011)**	1.031 (0.010)**	1.067 (0.011)**	1.067 (0.011)**	1.049 (0.011)**	1.044 (0.011)**	1.044 (0.011)**
Age	1.022 (0.000)**	1.021 (0.000)**	0.974 (0.002)**	0.982 (0.002)**	0.982 (0.002)**	1.039 (0.002)**	---	---
Age-squared	---	---	1.001 (0.000)**	1.000 (0.000)**	1.000 (0.000)**	1.000 (0.000)	---	1.001 (0.000)**
Average earnings ^a	0.984 (0.001)**	0.983 (0.001)**	0.985 (0.001)**	0.983 (0.001)**	0.983 (0.001)**	0.987 (0.001)**	0.987 (0.001)**	0.987 (0.001)**
Difference in growth rates of GDP per capita ^b	---	---	---	---	0.997 (0.002) ⁺	1.005 (0.002)**	1.006 (0.002)**	1.006 (0.002)**
<i>Country and regional dummy variables^c</i>								
Central America	---	0.980 (0.021)	---	0.978 (0.021)	0.979 (0.021)	0.914 (0.019)**	0.911 (0.019)**	0.911 (0.019)**
South America	---	1.202 (0.024)**	---	1.195 (0.024)**	1.199 (0.024)**	1.096 (0.022)**	1.106 (0.022)**	1.106 (0.022)**
Europe	---	1.646 (0.023)**	---	1.613 (0.023)**	1.609 (0.023)**	1.477 (0.021)**	1.493 (0.021)**	1.493 (0.021)**
Africa	---	1.324 (0.037)**	---	1.325 (0.037)**	1.327 (0.037)**	1.176 (0.032)**	1.166 (0.031)**	1.166 (0.031)**
Middle East	---	1.453 (0.032)**	---	1.448 (0.032)**	1.451 (0.032)**	1.368 (0.029)**	1.368 (0.029)**	1.368 (0.029)**
Asia	---	1.202 (0.016)**	---	1.191 (0.016)**	1.187 (0.016)**	1.104 (0.015)**	1.112 (0.015)**	1.112 (0.015)**
Caribbean	---	0.969 (0.016) ⁺	---	0.960 (0.016) [*]	0.957 (0.016)**	0.914 (0.015)**	0.924 (0.015)**	0.924 (0.015)**
Australia region ^d	---	3.710 (0.199)**	---	3.651 (0.196)**	3.645 (0.196)**	3.174 (0.158)**	3.161 (0.156)**	3.161 (0.156)**
Canada	---	1.691 (0.041)**	---	1.651 (0.040)**	1.649 (0.040)**	1.504 (0.036)**	1.514 (0.036)**	1.514 (0.036)**
Other	---	1.243 (0.031)**	---	1.229 (0.031)**	1.225 (0.031)**	1.216 (0.030)**	1.225 (0.030)**	1.225 (0.030)**
Year dummy variables ^e	No	No	No	No	No	Yes	Yes	Yes
Age dummy variables	No	No	No	No	No	No	Yes	Yes
No. of observations	3,767,846	3,767,846	3,767,846	3,767,846	3,767,846	3,663,954	3,607,995	3,607,995

Source: Author's calculations.

Note: The dependent variable is the odds of the immigrant emigrating from the United States in any year.

Heteroskedasticity-consistent standard errors are in parentheses. * Significant at 5 percent; ** Significant at 1 percent.

a. Defined as average earnings over the past three years, in 2007 CPI-U-RS adjusted dollars.

b. Annual percentage change in U.S. GDP per capita minus annual percentage change in GDP per capita in the country or region of origin.

c. Immigrants from Mexico are the excluded category.

d. Includes Australia, New Zealand, and several neighboring island groups.

e. Duration-interval-specific dummy variables for each observation.

Table 7.

Logit-Hazard Model Regressions Investigating the Determinants of Emigration from the Social Security System

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sex (dummy, 1=men)	1.080 (0.012)**	1.127 (0.013)**	1.080 (0.012)**	1.129 (0.013)**	1.129 (0.013)**	1.104 (0.013)**	1.097 (0.013)**	1.097 (0.013)**
Age	1.001 (0.001)*	1.001 (0.001)*	1.004 (0.003)	1.015 (0.003)**	1.015 (0.003)**	1.089 (0.003)**	---	---
Age-squared	---	---	1.000 (0.000)	1.000 (0.000)**	1.000 (0.000)**	0.999 (0.000)**	---	1.001 (0.000)**
Average earnings ^a	0.983 (0.001)**	0.982 (0.001)**	0.983 (0.001)**	0.982 (0.001)**	0.982 (0.001)**	0.987 (0.001)**	0.987 (0.001)**	0.987 (0.001)**
Difference in growth rates of GDP per capita ^b	---	---	---	---	0.998 (0.002)**	1.006 (0.002)**	1.007 (0.002)**	1.007 (0.002)**
<i>Country and regional dummy variables^c</i>								
Central America	---	1.121 (0.027)**	---	1.122 (0.027)**	1.122 (0.027)**	1.022 (0.024)	1.019 (0.024)	1.019 (0.024)
South America	---	1.378 (0.033)**	---	1.381 (0.033)**	1.383 (0.033)**	1.232 (0.028)**	1.247 (0.029)**	1.247 (0.029)**
Europe	---	1.837 (0.030)**	---	1.850 (0.031)**	1.848 (0.031)**	1.665 (0.028)**	1.686 (0.029)**	1.686 (0.029)**
Africa	---	1.831 (0.052)**	---	1.830 (0.052)**	1.832 (0.052)**	1.567 (0.043)**	1.554 (0.043)**	1.554 (0.043)**
Middle East	---	1.943 (0.046)**	---	1.945 (0.046)**	1.947 (0.046)**	1.812 (0.042)**	1.810 (0.042)**	1.810 (0.042)**
Asia	---	1.593 (0.025)**	---	1.599 (0.025)**	1.596 (0.025)**	1.454 (0.022)**	1.467 (0.022)**	1.467 (0.022)**
Caribbean	---	1.121 (0.022)**	---	1.124 (0.022)**	1.123 (0.022)**	1.062 (0.020)**	1.076 (0.021)**	1.076 (0.021)**
Australia region ^d	---	5.375 (0.286)**	---	5.403 (0.288)**	5.399 (0.288)**	4.536 (0.219)**	4.517 (0.217)**	4.517 (0.217)**
Canada	---	1.687 (0.050)**	---	1.701 (0.051)**	1.700 (0.051)**	1.530 (0.045)**	1.539 (0.046)**	1.539 (0.046)**
Other	---	1.750 (0.048)**	---	1.756 (0.048)**	1.754 (0.048)**	1.750 (0.046)**	1.768 (0.047)**	1.768 (0.047)**
Year dummy variables ^e	No	No	No	No	No	Yes	Yes	Yes
Age dummy variables	No	No	No	No	No	No	Yes	Yes
No. of observations	3,767,846	3,767,846	3,767,846	3,767,846	3,767,846	3,663,954	3,607,995	3,607,995

Source: Author's calculations.

Note: The dependent variable is the odds of the immigrant emigrating from the United States in any year.

Heteroskedasticity-consistent standard errors are in parentheses. * Significant at 5 percent; ** Significant at 1 percent.

a. Defined as average earnings over the past three years, in 2007 CPI-U-RS adjusted dollars.

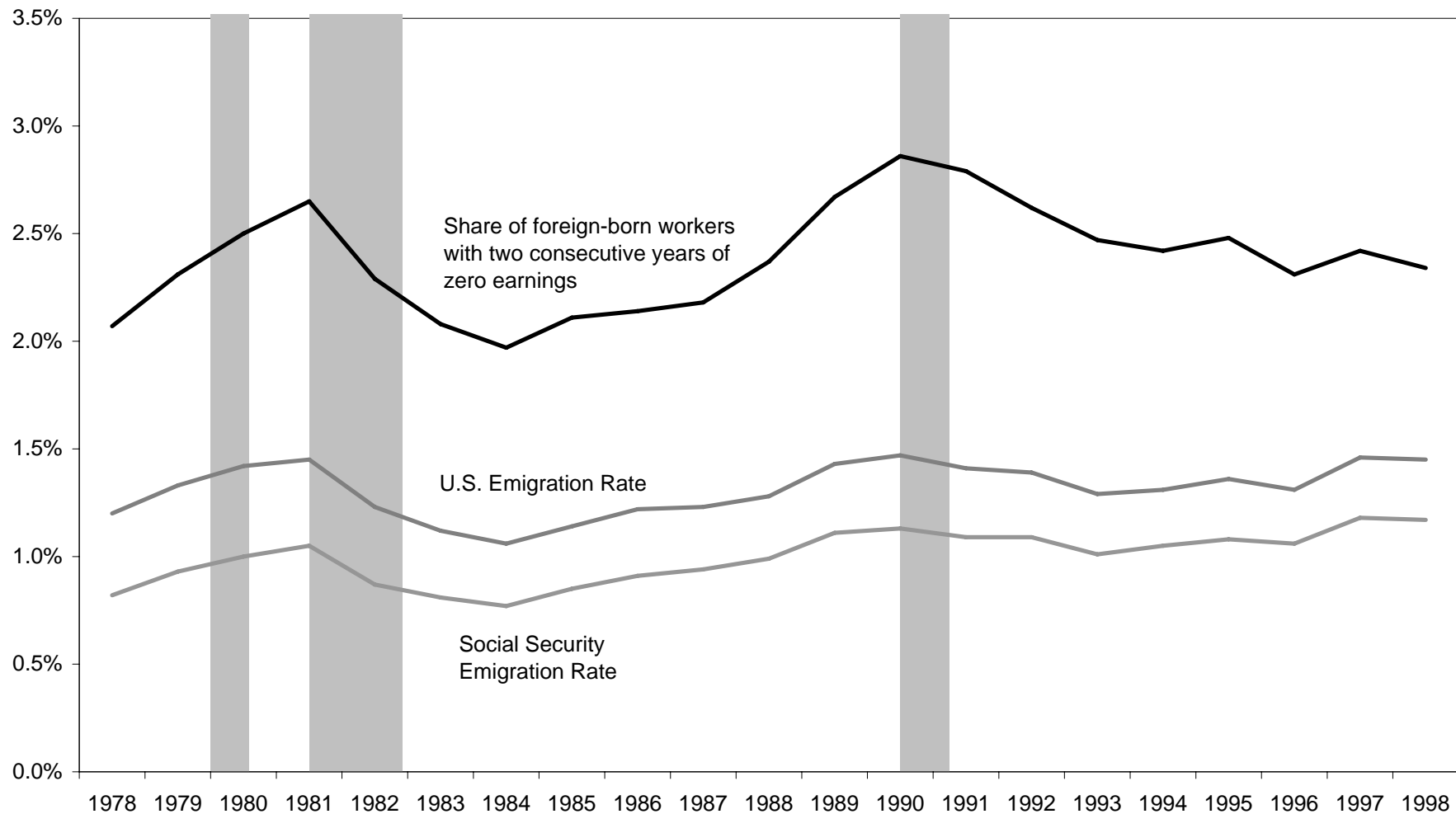
b. Annual percentage change in U.S. GDP per capita minus annual percentage change in GDP per capita in the country or region of origin.

c. Immigrants from Mexico are the excluded category.

d. Includes Australia, New Zealand, and several neighboring island groups.

e. Duration-interval-specific dummy variables for each observation.

Figure 1. Foreign-Born Emigration Rates and Share of Workers with Two Consecutive Years of Zero Earnings, 1978-1998

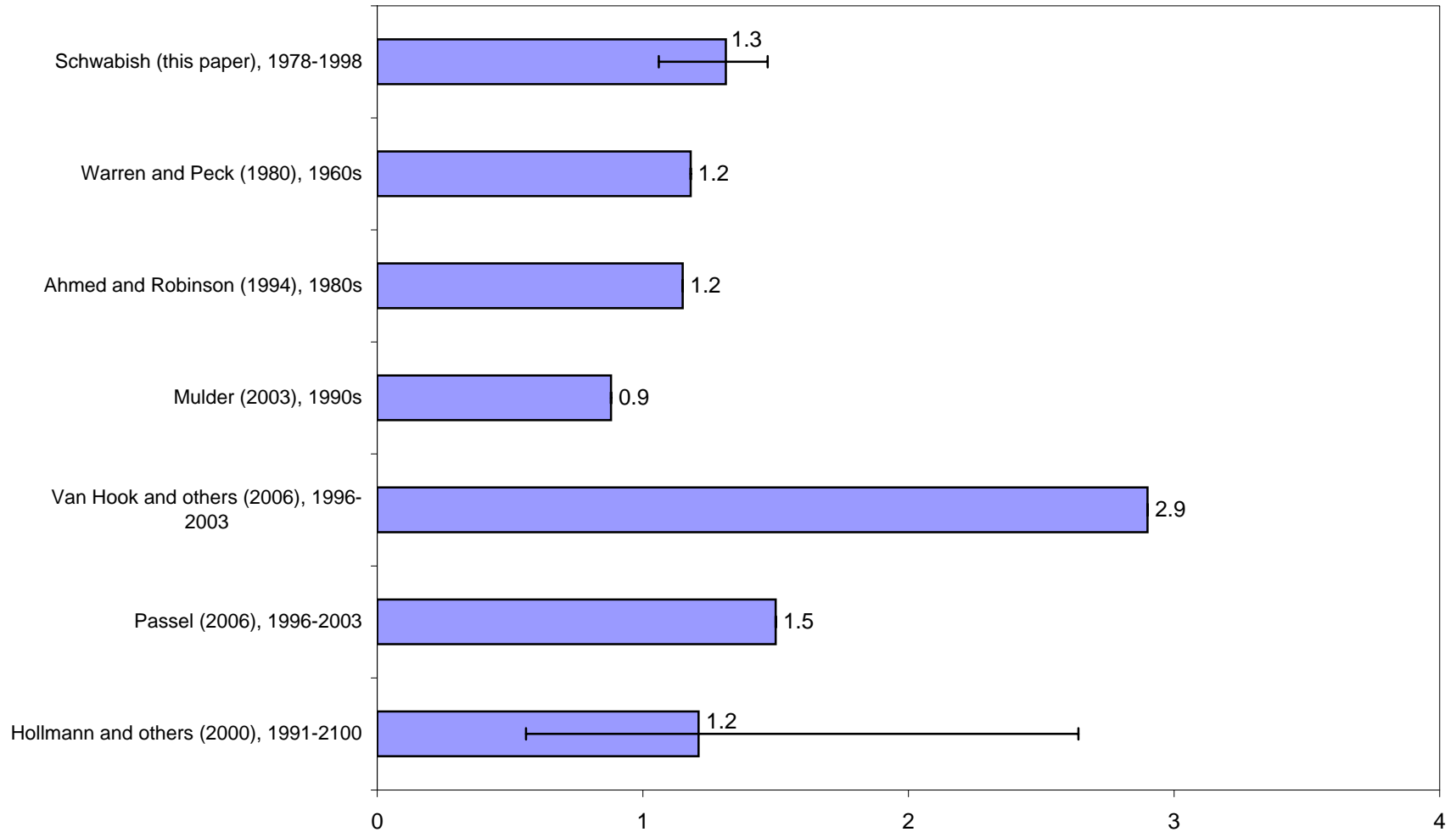


Source: Author's calculations using merged Detailed Earnings Records, Numident, and Master Beneficiary Record data files from the Social Security Administration.

Note: U.S. and Social Security emigration rates are defined in the text. Shaded bands indicate recessions.

Figure 2. Estimates of Emigration Rates in the Literature, All Foreign-Born Persons

(Per 100 Foreign Born)

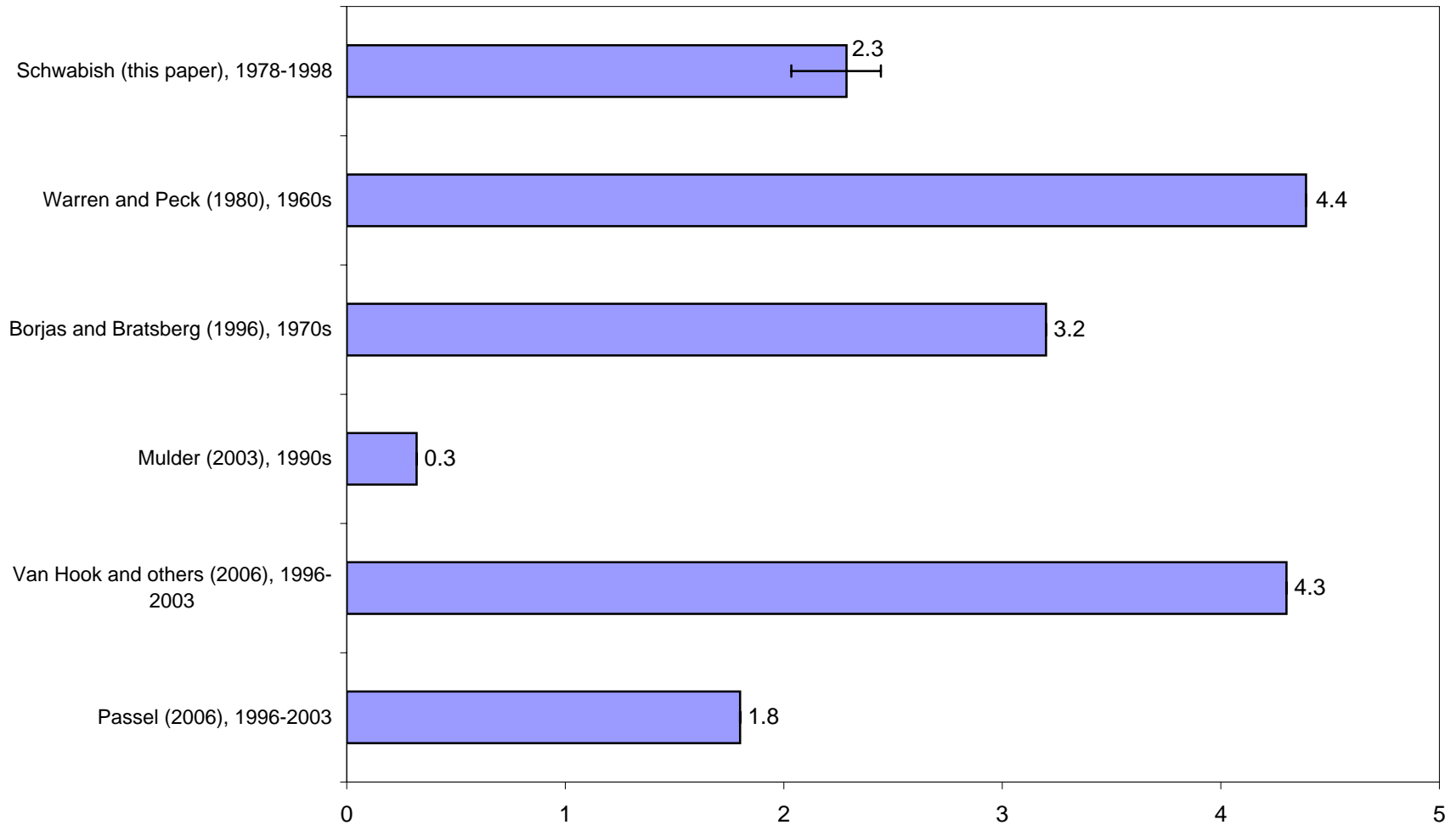


Sources: Author's calculations and literature cited.

Note: Error bar indicates either the minimum and maximum rates observed over the data period (Schwabish) or the highest and lowest assumed rates of emigration (Hollmann and others).

Figure 3. Estimates of Emigration Rates in the Literature, Foreign-Born Persons in the United States Less Than 10 Years

(Per 100 Foreign Born)

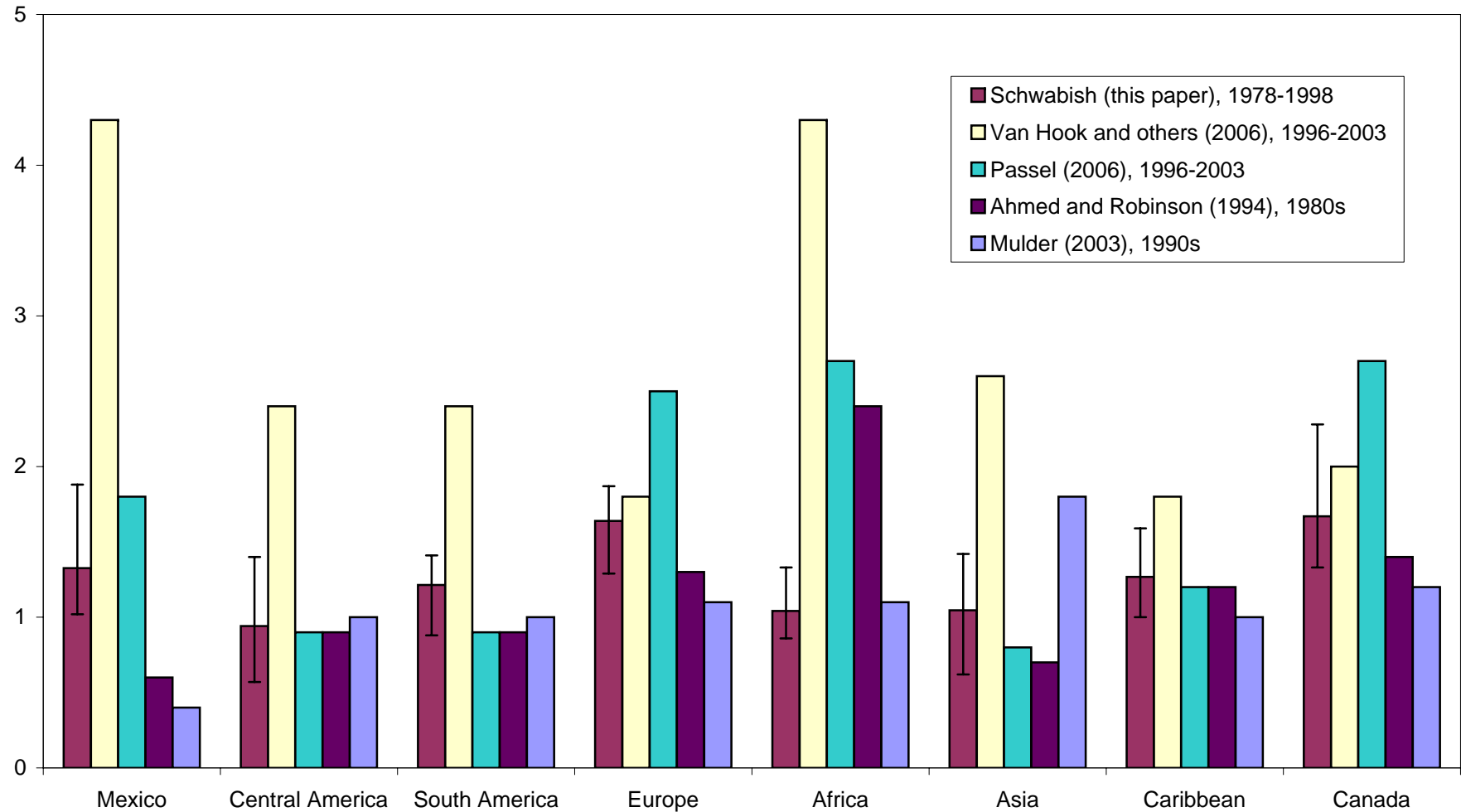


Sources: Author's calculations and literature cited.

Note: Error bar indicates the minimum and maximum rates observed over the data period.

**Figure 4. Estimates of Emigration Rates in the Literature,
All Foreign-Born Persons in the United States, by Region**

(Per 100 Foreign Born)

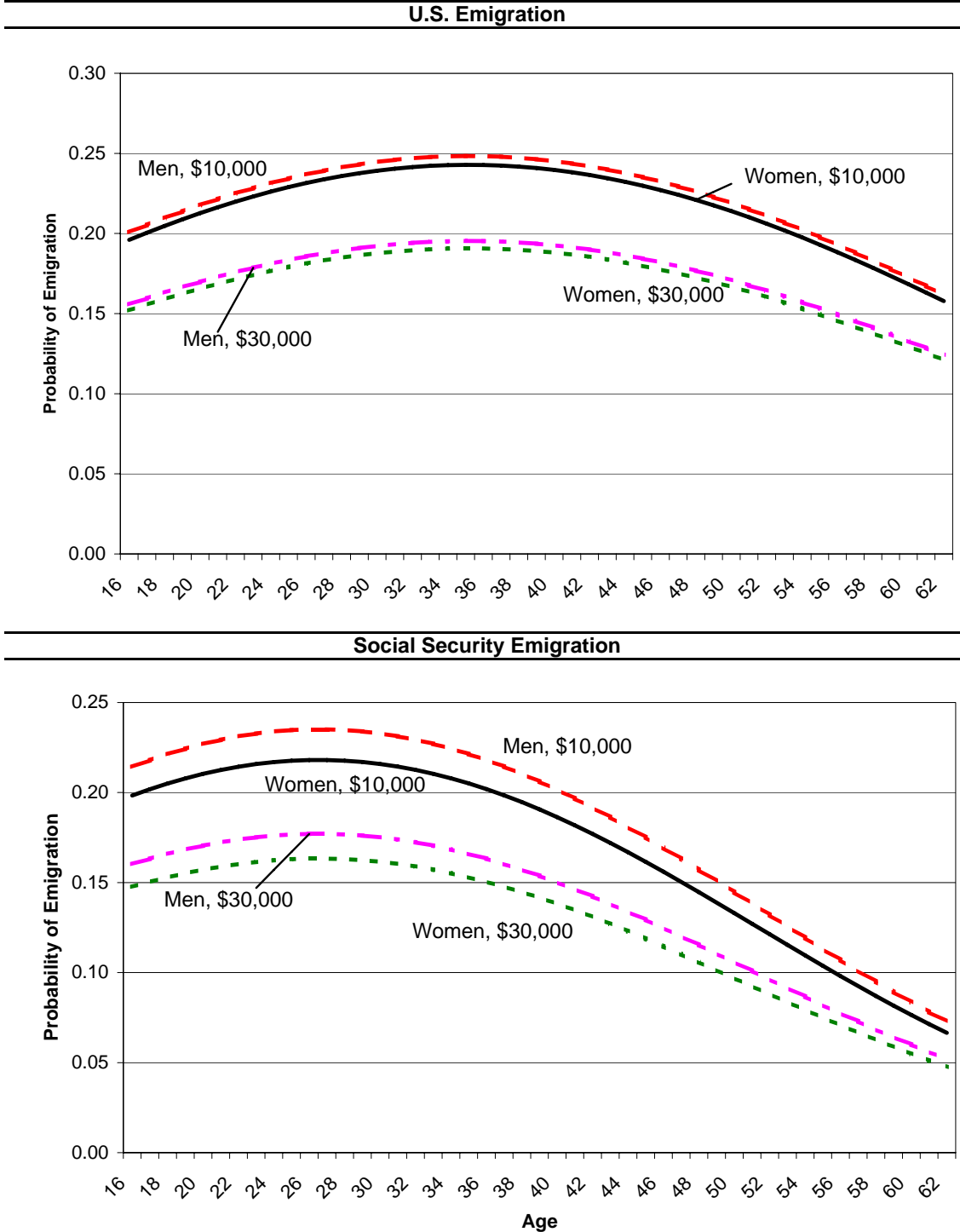


Sources: Author's calculations and literature cited.

Note: Error bars indicate the minimum and maximum rates observed over the data period.

Figure 5.

Logit-Hazard Model Estimates of the Probability of Emigrating in Any Year, by Age, Sex, and Annual Earnings



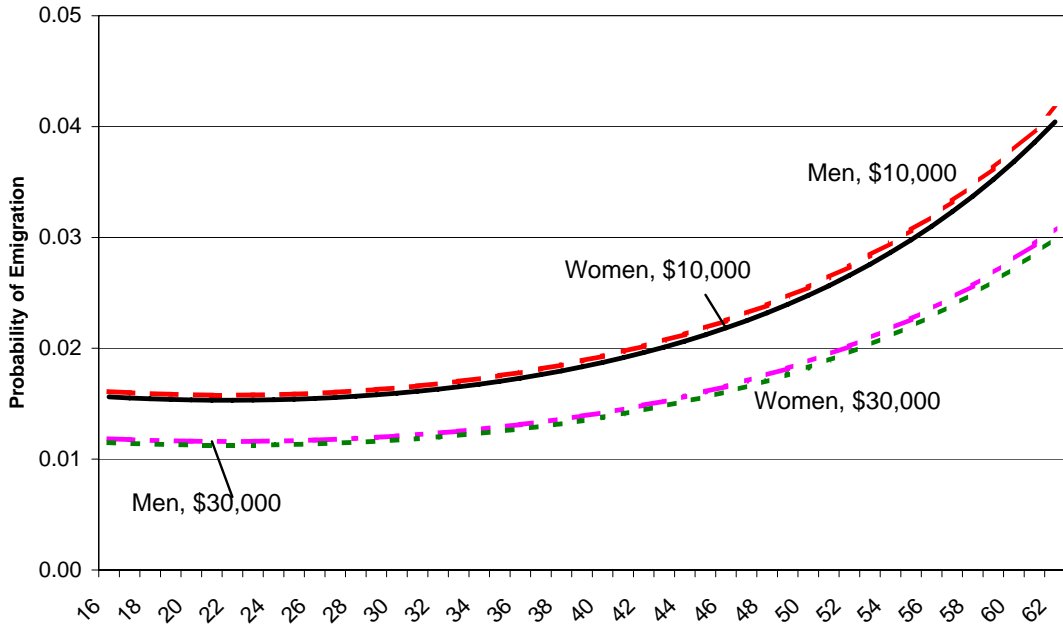
Source: Author's calculations using merged Detailed Earnings Records, Numident, and Master Beneficiary Record data files from the Social Security Administration.

Note: Probabilities are derived from a logit model in which the probability of a foreign-born person ever emigrating is a function of the person's sex, age, age-squared, and average earnings. See the text for details of the model. Coefficients used to derive the results in the top and bottom panels are those reported in column 2 of table 4 and table 5, respectively.

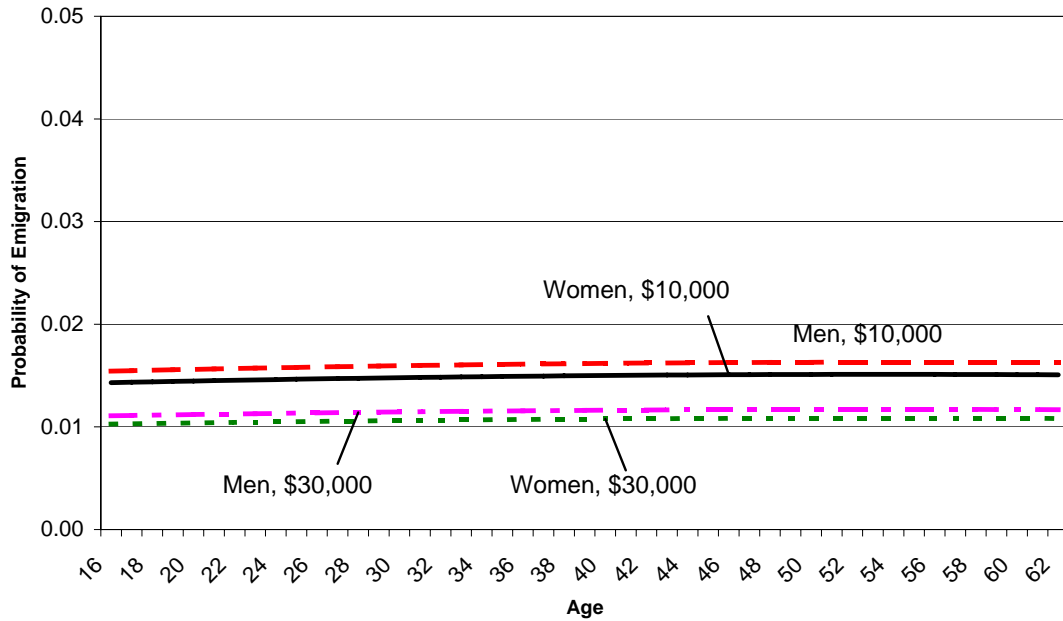
Figure 6.

Logit-Hazard Model Estimates of the Probability of Emigrating in Any Year, by Age, Sex, and Annual Earnings

U.S. Emigration



Social Security Emigration



Source: Author's calculations using merged Detailed Earnings Records, Numident, and Master Beneficiary Record data files from the Social Security Administration.

Note: Probabilities are derived from a logit-hazard model in which the probability of a foreign-born person emigrating in any year is a function of the person's sex, age, age-squared, and average earnings. See the text for details of the model. Coefficients used to derive the results in the top and bottom panels are those reported in column 3 of table 6 and table 7, respectively.