IMMIGRATION AND LABOR MARKET OUTCOMES IN THE NATIVE ELDERLY POPULATION

George J. Borjas
Harvard University

September 2008

This research was supported by the U.S. Social Security Administration through grant #10-P-98363-1-05 to the National Bureau of Economic Research as part of the SSA Retirement Research Consortium. The findings and conclusions expressed are solely those of the author(s) and do not represent the views of SSA, any agency of the Federal Government, or the NBER.

IMMIGRATION AND LABOR MARKET OUTCOMES IN THE NATIVE ELDERLY POPULATION

George J. Borjas

ABSTRACT

A rapidly increasing fraction of the elderly workforce is foreign-born. This paper uses data drawn from the 1960-2000 censuses and the post-1994 Current Population Surveys to examine the impact of immigration on various economic outcomes in the native elderly population. The analysis suggests that immigration had a depressing effect on the wage of competing native workers, and induced substantial reductions in labor supply and increases in retirement propensities in the native elderly population. The data also suggest that conditions in the labor market for elderly workers exhibit "excess sensitivity" to immigration-induced supply shifts. The wage elasticity typically found in national-level studies of the impact of immigration on the overall labor market lies around -0.3 or -0.4 (in other words, a 10-percent immigration-induced supply shift in the size of a particular skill group lowers the wage of that group by 3 or 4 percent). In contrast, the wage elasticity in the elderly workforce seems to be twice as high. As a result, immigration had correspondingly large effects on the time allocation of elderly persons. A 10-percent immigration-induced increase in the size of the workforce lowers the employment rate of elderly men by 7 percentage points and increases the probability of receiving Social Security benefits by 6 percentage points.

IMMIGRATION AND LABOR MARKET OUTCOMES IN THE NATIVE ELDERLY POPULATION

George J. Borjas

The textbook model of a competitive labor market has clear and unambiguous implications about how wages should adjust to an immigration-induced labor supply shift, at least in the short run. In particular, higher levels of immigration should lower the wage of competing workers.

Despite the common-sense intuition behind these predictions, the economics literature has—at least until recently—found it difficult to document the inverse relation between wages and immigration-induced supply shifts. Much of the literature attempts to estimate the labor market impact of immigration in a receiving country by comparing economic conditions across local labor markets in that country. Although there is a great deal of dispersion in the measured impact across studies, there is some consensus that the estimates cluster around zero. This finding has been interpreted as indicating that immigration has little impact on the receiving country's wage structure.[1]

One problem with this interpretation is that the spatial correlation—the correlation between labor market outcomes and immigration across local labor markets—may not truly capture the wage impact of immigration if native workers (or capital) respond by moving their inputs to localities seemingly less affected by the immigrant supply shock.[2] Because these flows

[1] Representative studies include Altonji and Card (1991), Borjas, Freeman, and Katz (1997), Card (1991, 2001), and LaLonde and Topel (1991). Friedberg and Hunt (1995) survey the literature.

[2] The literature has not reached a consensus on whether native workers respond to immigration by voting with their feet and moving to other areas; see, for example, Borjas (2006) and Card (2001). Alternative modes of market adjustment are studied by Lewis (2005), who examines the link between immigration and the input mix used by firms, and Saiz (2003), who examines how rental prices adjusted to the Mariel immigrant influx. It is worth noting that the spatial correlation will also be positively biased if income-maximizing immigrants choose to locate in high-wage areas, creating a spurious correlation between immigrant supply shocks and wages.

arbitrage regional wage differences, the wage impact of immigration may only be observable at the national level. Borjas (2003) used this insight to examine if the evolution of wages in particular skill groups—defined in terms of both educational attainment and years of work experience—were related to the immigrant supply shocks affecting those groups. In contrast to the local labor market studies, the national labor market evidence indicated that wage growth was strongly and inversely related to immigrant-induced supply increases.

A number of recent studies have begun to pursue and expand this line of research by examining how immigration affects the economic status of specific demographic groups in the native-born population, such as African-Americans (Borjas, Grogger, and Hanson, 2008), or young workers (Smith, 2007). These studies are motivated by the fact that the entry of large numbers of low-skill migration may be particularly harmful to minorities or to new labor market entrants. It turn out, however, that immigration is also likely to influence the economic status of workers at the other end of the age distribution. A sizable (and rapidly rising) fraction of the elderly workforce is foreign-born. For example, in 1980 only 7.1 percent of male workers aged 50-74 were foreign-born. By 2007, the immigrant share in the elderly workforce had risen to 12.0 percent. The sample of native elderly workers represents a particularly interesting case for examining the impact of immigration because many elderly workers—unlike their prime-age counterparts—have a relatively low-cost option that can be used to mitigate any adverse effects induced by immigration: cut labor supply and/or retire.[3]

This paper uses data drawn from the 1960-2000 U.S. decennial censuses and the post-1994 Current Population Surveys to examine the impact of immigration on various economic outcomes in the elderly population (specifically, men aged 50-74). The study examines not only the link between immigration and the wage structure of elderly workers, but also the link between immigration and the labor supply and retirement propensities of native elderly workers

The data reveal that the large influx of elderly immigrants has adversely affected the wage of elderly workers, and that these wage effects have led to substantial labor supply adjustments in the native elderly population. In fact, an important finding of the study is that the earnings of elderly workers show "excess sensitivity" to immigration-induced supply shifts—relative to the impact of immigration on other demographic groups. The national level studies of the labor market impact of immigration suggest that the wage elasticity is around -0.3 or -0.4 (in other words, a 10-percent immigration-induced supply shift in the size of a particular skill group lowers the wage of that group by 3 or 4 percent). In contrast, the wage elasticity found in the elderly workforce seems to be twice as high. As a result, immigration has correspondingly high effects on the probability that an elderly person is employed as well as on the probability that the elderly person receives Social Security benefits. A 10-percent immigration-induced increase in the size of the workforce lowers the employment rate of elderly men by 7 percentage points and increases the probability of receiving Social Security benefits by 6 percentage points.

II. Data

The empirical analysis uses data from both the decennial censuses and the Current Population Surveys (CPS). The analysis of census data uses extracts drawn from the 1960-2000 Integrated Public Use Microdata Series (IPUMS) of the U.S. Census. The 1960 and 1970 data files provide a 1 percent random sample of the population, while the post-1970 files provide a 5

---

[3] Borjas (2007) examines the labor supply behavior of elderly immigrants and shows that Social Security eligibility rules play an important role in determining immigrant labor supply in the years prior to retirement.

percent sample. The analysis of the CPS data uses extracts drawn from the 1994-2007 IPUMS March CPS. In both data sets, persons who are not citizens or who are naturalized citizens are classified as immigrants; all other persons are classified as natives. The sample consists of men aged 50-74 who do not reside in group quarters. The analysis of the decennial census data provides a historical context for the link between immigration-induced supply shifts and labor markets adjustments, while the analysis of the CPS data helps to document if these long-run trends are present in the more recent period when the influx of elderly immigrants into the workforce accelerated.

It is well known that the skill composition of immigrants differs drastically from that of native-born workers in the population of prime-age workers. I will show below that there is also a dramatic difference in the skill composition of elderly immigrants and natives. In order to differentiate workers into skill groups, I use the now common disaggregation of persons into groups defined by educational attainment and age (or years of work experience). In particular, I use four education categories to classify the skill groups: (1) high school dropouts (i.e., workers who have less than 12 years of schooling); (2) high school graduates (workers who have exactly 12 years of schooling); (3) workers who have some college (13 to 15 years of schooling); and (5) college graduates (workers who have at least 16 years of schooling).

The elderly population is also disaggregated into one of five potential age cohorts: persons aged 50-54, 55-59, 60-64, 65-69, and 70-74. The classification into five-year age cohorts is designed to capture the notion that male workers who are roughly in the same age group (and hence have roughly similar years of experience) are more likely to affect each other's labor market opportunities than workers who differ significantly in their work experience.

The cells corresponding to educational attainment (e), age (x), and calendar year (t) define a specific skill group at a point in time. Let N_{ext} give the number of native-born persons in the (e, x, t) cell; and M_{ext} be the corresponding number of immigrants in that cell. Throughout the paper, the measure of the immigrant supply shock is given by the immigrant share:

(1) $$p_{ext} = \frac{M_{ext}}{(M_{ext} + N_{ext})}.$$

The immigrant share in (1) simply gives the fraction of the persons in a particular skill group that is foreign-born.

Figure 1 illustrates the trend in the immigrant share of the *working* elderly population—that is, the fraction of immigrants in the population of men aged 50-74 who worked at least one week in the calendar year prior to the census or CPS survey. The steep decline in the immigrant share among elderly workers between 1960 and 1980 is not surprising—as it reflects the fact that the volume of immigration declined steadily until the policy shift initiated by the 1965 Amendments to the Immigration and Nationality Act. As a consequence of this policy shift, the immigrant share in the elderly workforce began to rise after 1980, increasing from 7.1 percent in 1980 to 10.7 percent in 2000. The extension of the decennial census time series using the March CPS data indicates that the immigrant share among elderly workers has continued to rise at a rapid pace since 2000. By 2007, 12.0 percent of elderly working men were foreign-born.

Of course, these aggregate trends hide a lot of variation in the impact of immigration on different skill groups. Figure 2 illustrates the education-specific trends in the immigrant share using the decennial census, while Figure 3 shows the analogous trends in the March CPS. Between 1980 and 2000, the immigrant share rose fastest for elderly workers who are high school dropouts.[4] In 1980, only 7.8 percent of such workers were foreign-born, but this proportion had risen to 18.9 percent by 2000. As Figure 3 shows, the immigrant share in this low-skill elderly group continued to rise rapidly after 2000. By 2007, almost 30 percent of these elderly workers were foreign-born.

Figures 2 and 3 also show that the group with the second fastest rise in the immigrant share was the group of elderly workers who are high school graduates (this group comprised 32.2 percent of the elderly population in 1990). The immigrant share in this group rose from 5.6 to 8.2 percent between 1980 and 2000, and continued rising rapidly after 2000. By 2007, the immigrant share in this group stood at almost 10 percent.

To avoid cluttering the presentation, Figures 2 and 3 focus on the trends in the immigrant share at the level of a particular education group. It is well known that there also exists a great deal of dispersion in the volume of immigration even *within* education groups (Borjas, 2003). In some years, it is the youngest groups in the elderly population that receive the most immigrants while in other years it is the oldest groups. In short, there is a great deal of dispersion in immigration-induced supply shifts across the skill groups and during the time period under analysis. The empirical analysis presented below exploits the variation in immigrant supply shocks across skill groups and over time to identify the labor market impact of immigration on the elderly workforce.

It is also easy to show that there exists substantial dispersion in the variables measuring various types of labor market outcomes that will be analyzed in the next section. In particular, I will focus on measuring the impact of immigration on five separate outcomes: the log of weekly earned income, the log of annual earned income, the probability that a person works at some

[4] In 1990, elderly high school dropouts comprised 30.3 percent of the elderly workforce.

point during the year, the fraction of the year that the person has worked (defined as the ratio of annual hours worked to 2000, including persons with zero hours worked), and the probability that the person receives Social Security benefits.[5] It is important to emphasize that these labor market outcomes are calculated in the sample of *native* elderly workers.

Table 1 reports some of the trends in these variables for the four education groups in the analysis. Perhaps most striking is the very rapid decline in labor supply exhibited by low-skill elderly workers during the period, particularly after 1980. The probability that an elderly high school dropout worked at some point during the year dropped from 56.3 percent to 41.2 percent between 1980 and 2007, a 15.1 percentage point drop. It is worth noting that the work probability of high school graduates also dropped significantly, from 72.8 percent to 60.4 percent during the same period, or a 12.4 percentage point drop. These precipitous declines contrast dramatically with the minor declines observed in the employment rates of high-skill elderly workers. For instance, the work probability dropped by only 3.2 percentage points for elderly college graduate (from 81.8 to 78.6 percent).

Not surprisingly, these changes in work attachment are exactly mirrored in the trends exhibited by the probability that a person receives Social Security benefits. Among elderly high school dropouts, for instance, the probability of receiving such benefits rose from 42.9 to 52.0 percent between 1980 and 2007, nearly a 10 percentage point increase. Among elderly college graduates, however, the probability of receiving such benefits rose only from 19.5 to 22.2 percent, less than a 3-percentage point increase.

[5] The variable indicating whether a person received Social Security benefits is only available beginning with the 1970 Census.

The crucial question, of course, is whether these changes in work attachment and retirement behavior can be linked to the sizable immigration-induced supply shifts that buffeted the elderly population during the period. We now turn to an analysis of this link.

III. Evidence

Because immigrants tend to cluster in a small number of cities in most receiving countries, most studies estimate the labor market impact of immigration by comparing economic conditions across localities in the receiving country. These studies calculate the correlation between measures of immigrant penetration in local labor markets and measures of economic outcomes, such as wages (Altonji and Card, 1991; Card, 2001; and LaLonde and Topel, 1991). The sign of this spatial correlation is interpreted as indicating the direction in which supply shifts affect wages; a negative correlation would suggest that immigrant-induced increases in labor supply lower wages. Although there is a lot of dispersion across studies, the estimated spatial correlations cluster around zero. This weak correlation has been interpreted as indicating that immigration has little impact on the receiving country's wage structure.

The potential problems associated with using regional wage differences to measure the labor market impact of immigration are now well understood. Natives (and pre-existing immigrants) may respond to the adverse wage impact of immigration by moving their labor or capital to other cities. These regional flows diffuse the impact of immigration across all regions, suggesting that the labor market impact of immigration may be measurable only at the national level. Borjas (2003) used this insight to examine how the aggregate wage trends of U.S. workers were related to the immigrant supply shocks affecting those groups. The national-level evidence indicated that the wage growth experienced by narrowly defined skill groups was strongly and inversely related to immigrant-induced supply increases. This approach has now been applied to such diverse contexts as Canada (Aydemir and Borjas, 2007) and Mexico (Mishra, 2007) with similar conclusions: supply shifts induced by international migration lead to an opposite-signed change in the wage of competing workers.

In this section, I use this methodological approach to investigate if the wage structure of elderly native workers responded to the immigration-induced supply shifts documented in the previous section. Moreover, I examine if these wage shifts encouraged changes in labor supply and retirement behavior in the elderly population. As in my earlier work, I analyze the relation between the evolution of the wage structure and labor flows by using the education-age skill groups defined above. The construction of the various groups, of course, implicitly assumes that workers with the same level of schooling but in a different age cohort are imperfect substitutes in production (Welch, 1979; Card and Lemieux, 2001).

Within a particular age-education group, however, I assume that immigrants and natives are perfect substitutes. It is easy to show that this assumption is consistent with the underlying data. Consider a generic CES production function (as in Card and Lemieux, 2001), where output depends on the number of immigrant (*M*) and native (*N*) workers. By equating the wage to the marginal product of labor for each worker type, it is easy to derive the relative demand function:

$$\ln\left(w_{mext} / w_{next}\right) = -\frac{1}{\sigma}\ln\left(M_{ext} / N_{ext}\right) + \frac{1-\sigma}{\sigma}\ln\left(\tau_{mext} / \tau_{next}\right), \tag{2}$$

where w_{mext} is the wage of immigrant workers in education group *e*, age group *x*, at time *t*; w_{nest} is the corresponding wage of native workers in that group; σ is the elasticity of substitution between immigrant and native workers; and τ_{iext} is a parameter measuring productive efficiency.

It is typical in the estimation of this type of model to proxy for the relative efficiency term in equation (2) by using vectors of fixed effects indicating education, experience, and time effects, their interactions, and a random error term. The null hypothesis of perfect substitution between immigrant and native workers states that the coefficient $-1/\sigma$ equals zero.

Equation (2) can be easily estimated using the cell-level data set created in the previous section that contains information on wages and the size of the immigrant and native workforce for each age-education combination in each survey year. The first row of the top panel of Table 2 reports the OLS coefficient that examines the extent of substitutability between immigrant and native labor. It is evident that the estimated regression coefficients do not provide *any* support for the hypothesis that immigrant and native workers are imperfect substitutes in production (within these narrowly defined skill groups). In fact, even though the coefficient of the relative quantity variable in this type of regression model should be negative, it is often positive (though statistically insignificant).[6]

The second row of the top panel uses an alternative relative quantity variable to assess the robustness of this finding. In particular, the quantity variables M and N in equation (2) have been defined as the number of immigrant and native workers in the labor market, respectively. The theory of factor demand, however, suggests that the relative quantity variable in the relative demand function given by (2) should reflect the manpower provided by all immigrants and natives in the particular skill cell, and not simply be a body count of how many immigrant and native workers are in each cell. It is common in the wage structure literature, therefore, to define the relative quantity variable in equation (2) in terms of the total number of hours worked

[6] Note that the finding of perfect substitution contradicts the evidence reported in Ottaviano and Peri (2007). As Borjas, Grogger, and Hanson (2008) note, however, the Ottaviano-Peri evidence is seriously flawed

annually by a particular skill group (see, for example, Murphy and Welch, 1992; Katz and Murphy, 1992; and Card and Lemieux 2001). In other words, the immigrant and native counts in each cell are weighted by annual hours worked. As shown in row 2 of Table 2, the regression of relative wages on the relative number of man-hours worked yields a regression coefficient that is numerically and statistically equal to zero. In short, the hypothesis of perfect substitution between comparably skilled immigrants and natives cannot be rejected.

One potential problem with the least squares estimates of the parameter $-1/\sigma$ in equation (2) is that the relative size of the immigrant workforce in the right-hand-side of the regression model may be endogenous, regardless of whether it defined in terms of body counts or total man-hours. The estimated elasticity of substitution between immigrant and native workers, therefore, may be contaminated by labor supply decisions at both the intensive and extensive margins. I use instrumental variables to correct for the possible endogeneity bias. In particular, I instrument the relative number of workers (or the relative number of man-hours supplied) with the relative number of immigrants in the *population* of that skill group.[7] The regression coefficients reported in the bottom panel of Table 2 show that the IV estimates of the elasticity of substitution also provide no evidence that would lead to rejecting the null hypothesis that immigrants and natives in these narrowly defined skill groups are perfect substitutes.

The robust finding of perfect substitution between "observationally equivalent" immigrants and natives allows the specification of a simple regression model to directly estimate the reduced-form impact of immigration on elderly workers. Let y_{ext} denote the mean value of a particular outcome for *native-born* men who have education e, age x, and are observed at time t.

---

because their sample of "high school dropouts" includes millions of students who are currently enrolled as high school junior and high school seniors.

The empirical analysis reported in this section stacks these national-level data across skill groups and calendar years and estimates the following regression model:

$$(3) \qquad y_{ext} = \theta\, p_{ext} + E + X + T + (E \times T) + (X \times T) + (E \times X) + \varphi_{ext},$$

where E is a vector of fixed effects indicating the group's educational attainment; X is a vector of fixed effects indicating the group's work experience; and T is a vector of fixed effects indicating the time period. The linear fixed effects in equation (3) control for differences in labor market outcomes across schooling groups, experience groups, and over time. The interactions $(E \times T)$ and $(X \times T)$ control for the possibility that the impact of education and experience changed over time, and the interaction $(E \times X)$ controls for the fact that the experience profile for a particular labor market outcome may differ across education groups. The regression specification in (3) implies that the labor market impact of immigration-induced supply shifts is identified using time-variation within education-experience cells. All regressions are weighted by the number of observations used to calculate the dependent variable y_{ext}.[8] The standard errors are clustered by education-experience cells to adjust for possible serial correlation in the cell-level data. Finally, the regression models are estimated separately in the decennial census and March-CPS data.

As noted above, I use the regression model in (3) to estimate the impact of immigration on five distinct economic outcomes in the elderly population. The alternative dependent variables are: the log of weekly earnings, the log of annual earnings, the employment rate, the

---

[7] More precisely, the instrument is the ratio of the number of immigrants in a skill group to the number of natives in that skill group. The counts of persons in the instrument include both workers and non-workers.

[8] Since the dependent variable is an average estimated from a sample, the cells are weighted by sample size to adjust for differences in precision.

fraction of the year worked, and the fraction of workers who receive Social Security benefits.[9] The data appendix describes the construction of these variables in detail.

Table 2 reports the estimates of the adjustment coefficient θ in equation (3) using the decennial census data. As with the regressions that tested for imperfect substitution between immigrants and natives, there are four different specifications for each labor market outcome, using the two alternative measures of the immigrant share and using either ordinary least squares or instrumental variables. To simplify the discussion, I will emphasize the estimates resulting from the IV regression that uses the immigrant share defined in terms of the total number of man-hours supplied to the labor market.

The first column of the table reports the results using the average log weekly earnings of the skill group as the dependent variable. The adjustment coefficient θ is -1.162 (with a standard error of 0.212). This coefficient is easier to interpret by converting it into an elasticity that gives the percent change in wages associated with a percent change in labor supply. Let m_{ext} = M_{ext}/N_{ext}, or the percentage increase in the labor supply of group (e, x, t) attributable to immigration. The reduced-form wage elasticity is then given by:

(4) $$\frac{\partial \log w_{ext}}{\partial m_{ext}} = \theta (1 - p_{ext})^2.$$

By 2007, immigration had increased the immigrant share in the total number of hours supplied by the elderly workforce to 12.9 percent. Equation (4) implies that the reduced-form wage

[9] Recall that the employment rate is defined by the proportion of the skill group that has worked at least one week in the preceding calendar year, and that the fraction of the year worked is defined as the mean ratio of annual hours worked (including non-workers) to 2000.

elasticity—evaluated at the mean value of the immigrant supply shift—can be obtained by multiplying θ by approximately 0.76. The reduced-form wage elasticity for weekly earnings is then -0.88 (or -1.162 × 0.76). Put differently, a 10 percent immigrant-induced increase in the number of elderly workers in a particular skill group reduces the wage of that group by 8 to 9 percent.[10] This wage elasticity is about twice the size of the wage elasticity that has been estimated in the sample of all workers aged 18-64 (see Borjas, 2003). The finding of "excess sensitivity" among elderly workers to immigration-induced supply shifts is potentially important as it indicates that the economic status of elderly workers is particularly sensitive to immigration. The excess sensitivity may partly reflect the relative ease with which elderly workers can adjust their behavior along various labor supply margins.[11] The reasons underlying the excess sensitivity of the elderly labor market to immigration remain a fertile area for future research.

The remaining columns of Table 2 document the impact of immigration on the other labor market outcomes under analysis. Of particular interest is the impact of immigration on the labor supply of elderly workers. The third column of the table shows the impact of immigration on the employment rate (i.e., on the fraction of elderly workers who worked at least one week in the calendar year preceding the survey). The adjustment coefficient θ is -0.935 (with a standard error of 0.127). In other words, immigration has a sizable adverse impact on the employment of elderly native workers. A 10 percent immigration-induced increase in supply is predicted to

[10] The regression model in (3) uses the immigrant share, p, rather than the (more natural) relative number of immigrants, m, as the regressor. The main reason for using p as the regressor is that the outcomes examined in this paper tend to be nonlinearly related to m, and p is approximately a linear function of log m. Rather than introducing significant nonlinearity in the regression, I opted for the simpler approach of a generic regression of the outcome on the immigrant share.

[11] Note, however, that it is likely that the exit of large numbers of native workers from the workforce due to the wage depression effect of immigration would attenuate the impact on wages. Put differently, in the absence of such attenuation the wage impact of immigration on elderly workers would be even larger than that documented in Table 3.

reduce the employment rate of elderly men by 7.1 percentage points (-0.935 × 0.76). It seems, therefore, that the impact of immigration at the extensive margin of labor supply is quite large.

Finally, the last column of Table 2 documents the impact of immigration on the probability of receiving Social Security benefits.[12] Not surprisingly, the immigration-induced wage depression encourages a substantial number of native elderly workers to withdraw from the labor force, retire, and join the Social Security system. The adjustment coefficient is 0.743 (with a standard error of 0.20). A 10 percent immigration-induced increase in supply increase the probability of receiving retirement benefits by 5.6 percentage points (+0.743 × 0.76).

One concern with the interpretation of the regression coefficients in Table 3 as measuring the labor market impact of immigration is that the estimated adjustment coefficient may be contaminated by factors that are driving wages and employment for elderly workers within education-experience groups. These factors will not be absorbed by the fixed effects included in the regression and may be correlated with the immigrant supply shifts. Ideally, one would want to control for such factors by introducing an age-education-year fixed effect three-way interaction. Such a regression, however, would be impossible to estimate because it would introduce a fixed effect for each observation. One potential way of addressing the issue is to estimate the same regression model using an alternative data set (such as the March CPS) that relates labor market outcomes in the elderly population and immigration in a different time period. Clearly the factors that are driving wages and employment over the four-decade span between 1960 and 2000 are likely not the same factors that are driving wages and employment over the much narrower period between 1994 and 2007.

---

[12] The regressions that use the fraction of the group that receives Social Security benefits as the dependent arable are not entirely comparable to the other regressions reported in Table 3 because the census data on the receipt of Social Security benefits is only available for the period 1970-2000.

Table 4 reports the adjustment coefficients estimated in the CPS data. It is worth emphasizing that the regression methodology used to estimate the coefficients in Table 4 is identical to that used in the analysis of the decennial census data. The comparison of Tables 3 and 4 yield two key findings. First, the *qualitative* nature of the evidence is very similar: in both data sets, immigration reduces earnings, reduces employment, and increases participation in the Social Security system. Second, the *quantitative* nature of the evidence is quite different. Even though the adjustment coefficients estimated in the CPS data are statistically significantly different from zero, they are also numerically smaller than those estimated in the decennial census data. As an example, consider the impact of immigration on the log weekly earnings of elderly workers. In the Census data, the adjustment coefficient was -1.162 (0.212); in the March-CPS data, the adjustment coefficient is -0.668 (0.289). Similarly, the adjustment coefficients in the regressions on the employment rate were -0.935 (0.127) in the census data and -0.322 (0.086) in the March-CPS data. Finally, the adjustment coefficients in the regressions on the probability of receiving Social Security benefits were 0.743 (0.200) in the census data and 0.155 (0.080) in the March-CPS data. In general, the estimated impacts observed in the CPS data tend to be 2 to 3 times larger than the estimated impacts in the decennial census data.

There are two obvious factors that could generate substantial differences in the estimated effects between the two data sets. The first concerns the frequency of the data. In the decennial census data, the data on labor market outcomes and immigration-induced supply shifts are ten years apart. In the CPS, the data are annual. However, it would seem reasonable to argue that a higher-frequency data set would lead to larger impacts of immigration—after all, the economy has less time to adjust when the data are observed year-to-year than when the data are observed only once a decade. In fact, the CPS data reveals smaller impacts than the Census data.

More likely, the quantitative differences in results between the two data sets reflect a much greater amount of measurement error in the CPS data. In particular, the immigrant share that is measuring the size of the immigration-induced supply shift is probably measured with greater error in the smaller samples available in the CPS.

As noted by Aydemir and Borjas (2008), measurement error can play a central role in the type of analysis exemplified by equation (3) because of the longitudinal nature of the empirical exercise that is being conducted. As is typical in the literature, I measured immigration by the "immigrant share," the fraction of the workforce in a particular labor market that is foreign-born. The regression model in (3) then relates a particular labor market outcome and the immigrant share across labor markets. To net out market-specific wage effects, however, the regression included various vectors of fixed effects (e.g., skill-level fixed effects) that absorb these permanent factors. The inclusion of these fixed effects, in effect, differences the data and implies that there is very little identifying variation left in the variable that captures the immigrant supply shift, permitting the sampling error in the immigrant share to play a disproportionately large role. As a result, even very small amounts of sampling error get magnified and can easily dominate the remaining variation in the immigrant share.

Because the immigrant share variable is a proportion, its sampling error can be easily derived from the properties of the binomial distribution. The statistical properties of this random variable can be used to measure the extent of attenuation bias attributable to measurement error. More importantly, the binomial distribution of the immigrant share implies that it is relatively simple to construct a relatively simple correction for measurement error. In fact, Aydemir and Borjas (2008) show that the probability limit of the adjustment coefficient estimated in the typical regression model in equation (3) is given by:

(5) $$\operatorname{plim}\hat{\theta}=\theta\left(1-\frac{\bar{p}(1-\bar{p})/\bar{n}}{(1-R^2)\sigma_p^2}\right),$$

where $\bar{p}$ is the mean immigrant share; $\bar{n}$ is the mean sample size used to calculate the immigrant share in a particular labor market; σ_p^2 is the variance of the observed immigrant share across the various labor markets; and R^2 is the multiple correlation of the auxiliary regression that relates the observed immigrant share to all the other right-hand-side variables in equation (3). The term $(1-R^2)\sigma_p^2$, therefore, gives the variance of the observed immigrant share that remains unexplained after controlling for all other variables in the regression model.

In the CPS data, the immigrant share defined in terms of total number of man-hours provided to the labor market has a mean of 0.114 across the 280 education-age-year cells that can be defined.[13] The typical cell in the CPS data had 721.3 observations that were used to calculate the immigrant share. The observed variance of the immigrant share across the 280 cells was 0.0045. Finally, the auxiliary regression of the immigrant share on all the other explanatory variables in the regression model in (3) yielded an R^2 equal to 0.9235.

A simple application of the formula in (5) then indicates that the probability limit of the estimated coefficient equals the true coefficient times a correction factor (represented by the bracketed term in the formula) of 0.590. In other words, we can cleanse the regression coefficients reported in Table 4 of the bias generated by sampling error in the immigrant share by multiplying the coefficients by approximately 1.7 (or 1/0.590). The adjustment for measurement

[13] The mean immigrant share and the variance of the immigrant share are calculated by weighting the cell-level data by the sample size used in calculating the immigrant share.

error, therefore, roughly doubles the size of the effects estimated in the CPS data and substantially narrows the variation in the results between the decennial census and the CPS analyses.

IV. Summary

One of the central questions in the economics of immigration concerns the impact of immigrants on the labor markets of receiving areas. Economic theory suggests that, at least in the short run, immigration-induced shifts in labor supply should lead to opposite-signed changes in the wage of competing workers. This wage response is a crucial parameter not only in the study of the efficiency and distributional impact of migration, but also in the policy debate over how to best regulate the population flows.

This paper uses data drawn from the 1960-2000 U.S. decennial censuses and the post-1994 Current Population Surveys to examine the impact of immigration on an array of economic outcomes in the elderly population (specifically, men aged 50-74). The study examines not only the link between immigration and the wage structure of elderly workers, but also the link between immigration and various labor market outcomes in this population, including the labor supply of native workers and the propensity to retire. The empirical analysis suggests that immigration has a depressing effect on the wage of competing elderly native workers, and induced substantial reductions in labor supply and increases in retirement in this population.

An important finding of the study is that the wage structure of elderly workers shows "excess sensitivity" to immigration-induced supply shifts. The national level studies of the labor market impact of immigration on workers aged 18-64 suggest that the wage elasticity is between -0.3 and -0.4 (in other words, a 10-percent immigration-induced supply shift in the size of a particular skill group lowers the wage of that group by 3 or 4 percent). In contrast, the wage elasticity found in the labor market for elderly workers seems to be twice as high. As a result, immigration had correspondingly large effects on the probability that elderly persons participate in the labor market as well as on the probability that elderly persons receives Social Security benefits. A 10-percent immigration-induced increase in the size of the workforce lowers the employment rate of elderly men by 7 percentage points and increases the probability of receiving Social Security benefits by 6 percentage points.

DATA APPENDIX

The census data are drawn from the 1960, 1970, 1980, 1990, and 2000 Integrated Public Use Microdata Samples (IPUMS) of the U.S. Census. In the 1960 and 1970 Censuses, the data extract forms a 1 percent sample of the population. Beginning in 1980, the extracts form a 5 percent sample. The March CPS data are drawn from the IPUMS extracts for the 1994-2007 period. The analysis is restricted to men aged 50-74. A person is classified as an immigrant if he was born abroad and is either a non-citizen or a naturalized citizen; all other persons are classified as natives. Sampling weights are used in all calculations.

Definition of education and experience: I use the IPUMS variable *educrec* to first classify workers into four education groups: high school dropouts (*educrec* <= 6), high school graduates (*educrec* = 7), persons with some college (*educrec* = 8), college graduates (*educrec* = 9). In each education group, workers are then classified into one of 5 age groups: 50-54 years old, 55-59, 60-64, 65-69, and 70-74.

Counts of persons in education-experience groups: The counts are calculated in the sample of men who worked at least one week in the previous calendar year. The counts adjusted for annual hours worked simply reweigh these data by the ratio of annual hours worked to 2000.

Annual and weekly earnings: I use the sample of men who reported positive weeks worked and report positive earnings. The measure of earnings is the sum of the IPUMS variables *incwage* and *incbusfm* in the 1960 Census, the sum of *incwage*, *incbus*, and *incfarm* in the 1970 and 1980 Censuses as well as in the CPS, and the variable *incearn* in the 1990 and 2000 Censuses. In the 1960-1980 Censuses, the top coded annual salary is multiplied by 1.5. In the 1960 and 1970 Censuses, weeks worked in the calendar year prior to the survey are reported as a categorical variable. I imputed weeks worked for each worker as follows: 6.5 weeks for 13 weeks or less, 20 for 14-26 weeks, 33 for 27-39 weeks, 43.5 for 40-47 weeks, 48.5 for 48-49 weeks, and 51 for 50-52 weeks. The average log earnings for a skill cell is defined as the mean of log annual earnings or log weekly earnings over all workers in the relevant population.

Probability of working during the year: This variable gives the fraction of persons in the relevant population who worked at least one week in the calendar year preceding the census or the CPS survey.

Fraction of year worked: This variable gives the mean of the ratio of annual hours worked (including the zero values for non-workers) divided by 2000 in the relevant population.

Fraction receiving Social Security benefits: This variable gives the fraction of persons in the relevant population who report positive Social Security earnings in the previous calendar year. This variable is available for all CPS surveys, but only for the 1970-2000 decennial censuses.

References

Altonji, Joseph G. and Card, David. "The Effects of Immigration on the Labor Market Outcomes of Less-Skilled Natives," in John M. Abowd and Richard B. Freeman, eds., *Immigration, Trade, and the Labor Market*. Chicago: University of Chicago Press, 1991, pp. 201-234.

Aydemir, Abdurrahman and George J. Borjas. "A Comparative Analysis of the Labor Market Impact of International Migration: Canada, Mexico, and the United States," *Journal of the European Economic Association* 5 (June 2007): 663-708.

Aydemir, Abdurrahman and George J. Borjas, "Attenuation Bias in Measuring the Wage Impact of Immigration," Harvard University Working Paper, September 2008.

Borjas, George J. "The Labor Demand Curve *Is* Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *Quarterly Journal of Economics* 118 (November 2003): 1335-1374.

Borjas, George J. "Native Internal Migration and the Labor Market Impact of Immigration," *Journal of Human Resources* 41 (Spring 2006): 221-258.

Borjas, George J. "Social Security Eligibility and the Labor Supply of Elderly Immigrants," Harvard University Working Paper, December 2007.

Borjas, George J., Richard B. Freeman, and Lawrence F. Katz. "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity* (1997): 1-67.

Borjas, George J., Jeffrey Grogger, and Gordon H. Hanson, "Immigration and the Economic Status of African-American Men," NBER Working Paper No. 12518, September 2006.

Borjas, George J., Jeffrey Grogger, and Gordon H. Hanson, "Imperfect Substitution between Immigrants and Natives: A Reappraisal," NBER Working Paper No. 13887, March 2008.

Card, David. "The Impact of the Mariel Boatlift on the Miami Labor Market," *Industrial and Labor Relations Review* 43 (January 1991): 245-257.

Card, David. "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration," *Journal of Labor Economics* (January 2001): 22-64.

Card, David, and Thomas Lemieux, "Can Falling Supply Explain the Rising Return to College for Younger Men? A Cohort-Based Analysis," *Quarterly Journal of Economics* (May 2001): 705-746.

Friedberg, Rachel M. and Jennifer Hunt. "The Impact of Immigration on Host Country Wages, Employment and Growth," *Journal of Economic Perspectives* 9 (Spring 1995): 23-44.

Katz, Lawrence F., and Kevin M. Murphy. 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics*, 107(1):. 35-78.

LaLonde, Robert J. and Robert H. Topel. "Labor Market Adjustments to Increased Immigration," in John M. Abowd and Richard B. Freeman, editors, *Immigration, Trade, and the Labor Market*. Chicago: University of Chicago Press, 1991, pp. 167-199.

Lewis, Ethan G. "Immigration, Skill Mix, and the Choice of Technique." "Immigration, Skill Mix, and the Choice of Technique." Federal Reserve Bank of Philadelphia Working Paper #05-08, May 2005.

Mishra, Prachi. "Emigration and Wages in Source Countries: Evidence from Mexico," *Journal of Development Economics* 82 (January 2007): 180-199.

Murphy, Kevin M. and Finis Welch. 1992. "The Structure of Wages," *Quarterly Journal of Economics*, 107(1): 285-326.

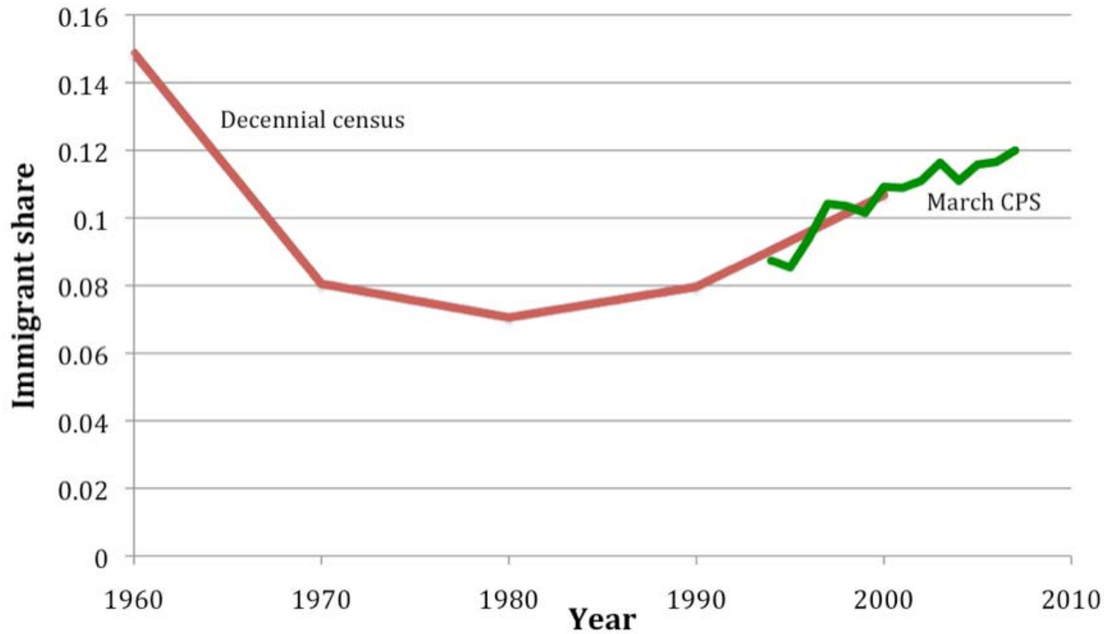
Ottaviano, Gianmarco, and Giovanni Peri. 2007a. "Rethinking the Effects of Immigration on Wages." Mimeo, UC Davis.

Saiz, Albert. "Room in the Kitchen for the Melting Pot: Immigration and Rental Prices." *Review of Economics and Statistics* 85 (August 2003): 502-21.

Smith, Christopher L. "'Dude, Where's My Job?' The Impact of Immigration on the Youth Labor Market," MIT Working Paper, 2008.

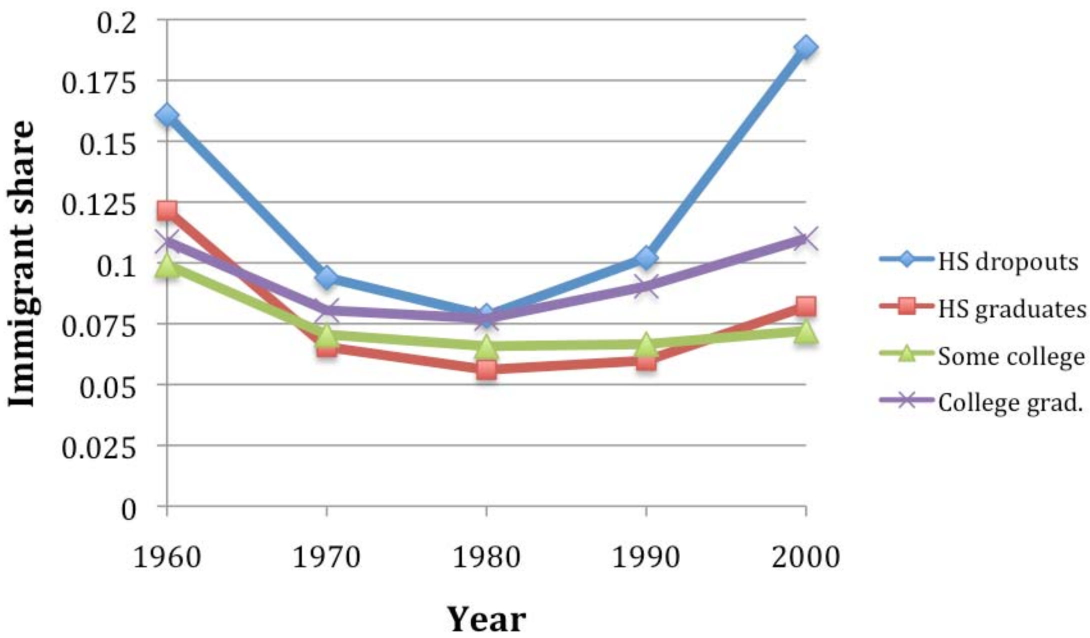
Welch, Finis. "Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust," *Journal of Political Economy* 87 (October 1979, Part 2): S65-S97.

Figure 1. Trends in the immigrant share in the elderly workforce



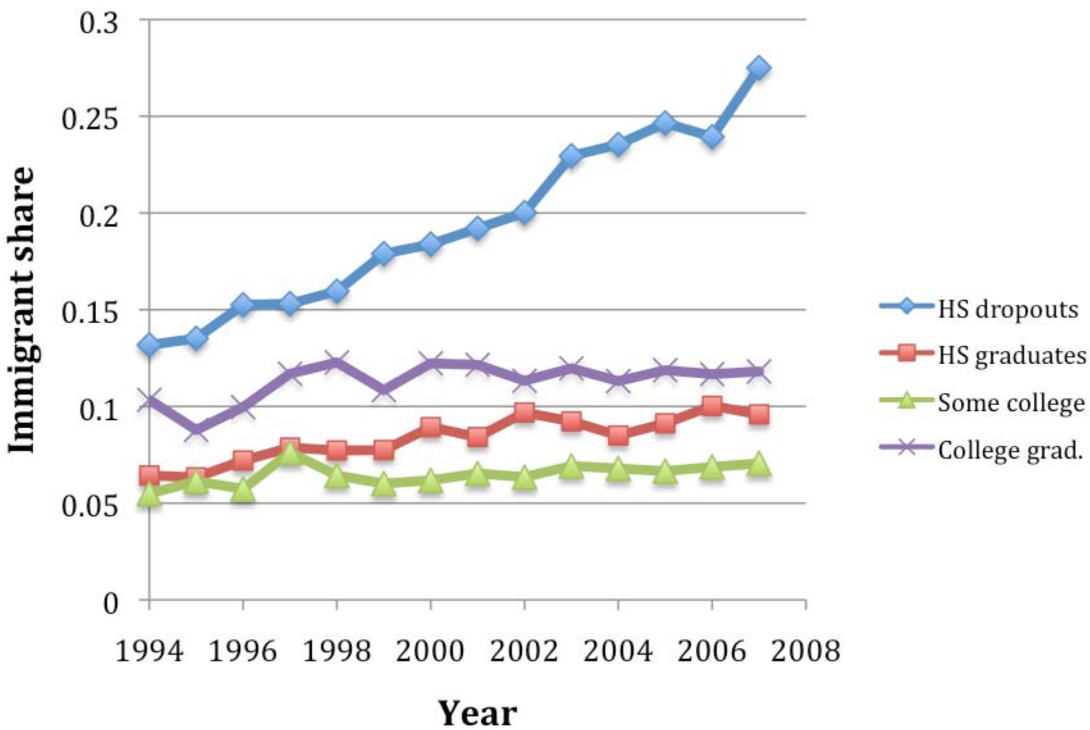
Notes: The immigrant share is defined as the fraction of foreign-born persons in the sample of male persons who worked at least one week in the calendar year preceding the Census or the CPS survey.

Figure 2. Trends in the immigrant share in the decennial census, by educational attainment



Notes: The immigrant share is defined as the fraction of foreign-born persons in the sample of male persons who worked at least one week in the calendar year preceding the Census.

Figure 3. Trends in the immigrant share in the March CPS, by educational attainment



Notes: The immigrant share is defined as the fraction of foreign-born persons in the sample of male persons who worked at least one week in the calendar year preceding the CPS survey.

Table 1. Summary characteristics of labor market outcomes in the population of native elderly persons

	HS dropouts	HS graduates	Some college	College graduates
Log of weekly earnings				
1960	5.763	6.169	6.302	6.656
1980	5.911	6.262	6.385	6.731
2000	5.981	6.251	6.468	6.893
2007	6.299	6.613	6.768	7.234
Log of annual earnings				
1960	9.404	9.953	10.077	10.479
1980	9.528	10.001	10.132	10.511
2000	9.577	9.942	10.188	10.622
2007	10.000	10.414	10.545	11.055
Probability of working during year				
1960	0.766	0.872	0.862	0.902
1980	0.563	0.728	0.751	0.818
2000	0.417	0.611	0.713	0.786
2007	0.412	0.604	0.705	0.786
Fraction of year worked				
1960	0.640	0.851	0.834	0.938
1980	0.516	0.726	0.749	0.839
2000	0.372	0.596	0.718	0.813
2007	0.388	0.616	0.725	0.845
Probability of receiving Social Security benefits				
1970	0.317	0.152	0.181	0.148
1980	0.429	0.270	0.252	0.195
2000	0.511	0.373	0.284	0.244
2007	0.520	0.362	0.261	0.222

Notes: The 1970-2000 statistics are calculated using the decennial censuses; the 2007 statistics are calculated using the 2007 March CPS. All statistics are calculated in the sample of elderly men aged 50-74.

Table 2. Tests for perfect substitution between immigrants and natives

	Decennial Census	March CPS
A. Relative quantity defined in terms of the number of workers		
OLS estimate of $-1/\sigma$	0.053	0.031
	(0.064)	(0.059)
IV estimate of $-1/\sigma$	-0.030	-0.066
	(0.079)	(0.051)
B. Relative quantity defined in terms of the number of man-hours		
OLS estimate of $-1/\sigma$	0.070	0.103
	(0.062)	(0.055)
IV estimate of $-1/\sigma$	0.056	-0.062
	(0.064)	(0.049)

Notes: Standard errors are reported in parentheses and are adjusted for clustering within age-education cells. The regressions estimated in the decennial census have 100 observations, while the regressions estimated in the March CPS have 280 observations. The dependent variable in all the regressions is the difference between the mean log weekly wage of immigrant and native workers. The independent variable in Panel A is the difference between the log of the number of immigrant workers and the log of the number of native workers; the independent variable in Panel B is the difference between the log in the number of annual man-hours supplied by immigrant workers and the log of the number of annual man-hour supplied by native workers. The instrument in the IV regressions is the log of the ratio of the total number of immigrant persons in the population to the total number of native persons in the population. All regressions include education-experience, education-time, and experience-time fixed effects.

Table 3. Impact of immigration on economic status of native elderly workers In decennial Census data, 1960-2000

Model Specification:	Log of weekly earnings	Log of annual earnings	Fraction of persons working	Fraction of year worked	Fraction receiving Social Security
OLS regressions					
1. Immigrant share defined as fraction of number of workers	-1.112	-1.923	-0.871	-1.175	0.671
	(0.172)	(0.240)	(0.095)	(0.123)	(0.155)
2. Immigrant share defined as fraction of total man-hours	-1.108	-1.944	-0.893	-1.233	0.656
	(0.191)	(0.274)	(0.107)	(0.128)	(0.149)
IV regressions					
1. Immigrant share defined as fraction of number of workers	-1.102	-1.927	-0.868	-1.195	0.687
	(0.174)	(0.243)	(0.095)	(0.128)	(0.165)
2. Immigrant share defined as fraction of total man-hours	-1.162	-2.031	-0.935	-1.287	0.743
	(0.212)	(0.307)	(0.127)	(0.155)	(0.200)

Notes: Standard errors are reported in parentheses and are adjusted for clustering within age-education cells. The regressions have 100 observations. The independent variable in Panel A is the immigrant share defined as the fraction of the total number of workers that is foreign-born; the independent variable in Panel B is the immigrant share defined as the fraction of the total number of man-hours supplied by foreign-born persons. The instrument in the IV regressions is the immigrant share in the population. All regressions include education-experience, education-time, and experience-time fixed effects.

Table 4. Impact of immigration on economic status of native elderly workers In CPS data, 1994-2007

Model Specification:	Log of weekly earnings	Log of annual earnings	Fraction of persons working	Fraction of year worked	Fraction receiving Social Security
OLS regressions					
1. Immigrant share defined as fraction of number of workers	-0.577	-0.752	-0.512	-0.460	0.117
	(0.436)	(0.442)	(0.098)	(0.094)	(0.068)
2. Immigrant share defined as fraction of total man-hours	-0.584	-0.898	-0.441	-0.451	0.129
	(0.333)	(0.343)	(0.080)	(0.067)	(0.061)
IV regressions					
1. Immigrant share defined as fraction of number of workers	-0.715	-0.975	-0.345	-0.360	0.166
	(0.311)	(0.341)	(0.094)	(0.094)	(0.085)
2. Immigrant share defined as fraction of total man-hours	-0.668	-0.910	-0.322	-0.337	0.155
	(0.289)	(0.310)	(0.086)	(0.085)	(0.080)

Notes: Standard errors are reported in parentheses and are adjusted for clustering within age-education cells. The regressions have 280 observations. The independent variable in Panel A is the immigrant share defined as the fraction of the total number of workers that is foreign-born; the independent variable in Panel B is the immigrant share defined as the fraction of the total number of man-hours supplied by foreign-born persons. The instrument in the IV regressions is the immigrant share in the population. All regressions include education-experience, education-time, and experience-time fixed effects.