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ABSTRACT

This paper uses data drawn from the 1970-2010 decennial Censuses to examine the evolution of immigrant earnings in the U.S. labor market. The analysis reveals that there are cohort effects not only in the level of earnings, with more recent cohorts generally having relatively lower entry wages, but also in the rate of growth of earnings, with more recent cohorts having a smaller rate of economic assimilation. Immigrants who entered the country before the 1980s typically found that their initial wage disadvantage (relative to natives) narrowed by around 15 percentage points during their first two decades in the United States. In contrast, the immigrants who entered the country after the 1980s have a negligible rate of wage convergence. Part of the slowdown in wage convergence reflects a measurable reduction in the actual rate of human capital accumulation. In particular, there has been a concurrent decline in the rate at which the newer immigrant cohorts are "picking up" English language skills. The study identifies one factor that explains part of these trends: the rapid growth in the size of specific national origin groups in the United States reduces incentives for acquiring English language skills. The growth in the size of these groups accounts for about a quarter of the decline in the rates of human capital acquisition and economic assimilation.

The Slowdown in the Economic Assimilation of Immigrants: Aging and Cohort Effects Revisited Again

George J. Borjas[*]

I. Introduction

The economic impact of immigration ultimately depends on the skill composition of the immigrant population. Not surprisingly, much of the research in the economics of immigration over the past three decades has focused on examining the evolution of skills in the foreign-born workforce, both in terms of their pre-existing human capital (which depends on the decision rule that selects the immigrants from the population of the source countries) and in terms of their assimilation (which depends on the rate at which immigrants acquire additional skills in their newly chosen homes).

Beginning with Chiswick (1978), there has been a great deal of empirical research that attempts to measure the rate of wage convergence between immigrants and natives. The findings in these studies are often interpreted through the lens of the Becker-Mincer human capital framework. Immigrants have pre-existing skills that may not be transferable across countries. Because the immigrant must now compete in a labor market where he may lack even basic tools (such as fluency in the host country's language), an immigrant faces renewed incentives to acquire types of human capital that may be more marketable in the new environment. Economic assimilation, in the sense of wage convergence between immigrants and natives, then ensues.

The initial studies in this literature used cross-section data sets to compare the age-earnings profiles of immigrants and natives, and typically found a very rapid rate of wage

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convergence. Borjas (1985, 1995) emphasized that the cross-section comparison may not properly measure the true rate of assimilation because there may be substantial differences in earnings potential across immigrant cohorts. In fact, the Borjas studies documented the presence of sizable "cohort effects." In the United States, more recently arrived immigrant cohorts tend to have lower earnings potential than earlier cohorts. Not surprisingly, accounting for these cohort effects in *wage levels* substantially reduces the rate of economic assimilation implied by the cross-section comparison.

This paper uses data drawn from the 1970-2010 decennial Censuses to examine the evolution of immigrant earnings in the United States over the past few decades. The long-term trends in the data immediately reveal a potentially important new finding. There are cohort effects not only in the level of earnings, with more recent cohorts having relatively lower entry wages, but there also exist cohort effects in the rate of growth of earnings, with more recent cohorts having a much smaller rate of economic assimilation than earlier cohorts. Immigrants who entered the country before the 1980s typically found that their initial wage disadvantage (relative to natives) narrowed by around 15 percentage points during their first two decades in the United States. In contrast, the immigrants who entered the country after the 1980s have a much lower rate of wage convergence. In fact, the evidence suggests that there has not been *any* economic assimilation for the cohorts that entered the country in the 1990s.

The paper examines a number of alternative hypotheses that may explain the onset of these cohort effects in the rate of wage convergence. These hypotheses include the possibility that changes in macroeconomic conditions are affecting the immigrant and native wage structures differentially, precluding the possibility of much earnings growth for immigrant workers; the hypothesis that the changing national origin composition of the immigrant population may lead, on average, to lower assimilation rates; and the hypothesis that the geographic settlement of newer immigrant cohorts in different regions of the United States may have affected assimilation trends. The data convincingly show that none of these factors can account for the severe decline in the rate of assimilation.

The analysis instead suggests that at least part of the decline in assimilation reflects a detectable reduction in the actual rate of human capital accumulation. Although the Census data provides only limited information on the acquisition of human capital in the post-migration period, the data reveal a concurrent decline in the rate at which the newer immigrant cohorts are “picking up” English language skills. The cohorts that entered the country prior to the 1980s typically experienced a 15-percentage point increase in their fluency rate during their first two decades, while the cohorts that entered the country after the 1980s show only a 2 or 3 percentage point increase.

Finally, the study identifies one factor that seems to explain part of the decline in the rate of economic assimilation: the rapid growth in the size of specific national origin groups in the United States. The rate of increase in English language skills is significantly slower for larger national origin groups. As a result, the growth in the size of the groups accounts for about a quarter of the concurrent declines in the rate of economic assimilation and the rate of human capital acquisition.

Given the potential significance of these findings, it is wise to interpret the results cautiously. Although the evidence from the decennial Census data is unambiguous, much further analysis is required before we can affirm that the economic assimilation of immigrants in the United States slowed down dramatically in the past few decades. Perhaps most important, it is crucial to replicate the findings in the context of longitudinal samples rather than the repeated cross-sections available in Census data. Nevertheless, if the evidence presented in this paper can be confirmed in other data sets, the results suggest a hypothesis that is sure to attract interest in the next decade: the more recent immigrant cohorts have fewer incentives to invest in U.S.-specific human capital because the growth of the immigrant population makes those investments less profitable than they once were, and those reduced incentives have slowed the rate of economic assimilation.

II. Background

The empirical analysis of the relative economic performance of immigrants in a host country was initially based on the cross-section regression model proposed by Chiswick (1978):[1]

$$\log w_\ell = X_\ell \beta_0 + \beta_1 F_\ell + \beta_2 y_\ell + \varepsilon_\ell, \quad (1)$$

where w_ℓ is the wage of person ℓ in the host country; X_ℓ is a vector of socioeconomic characteristics, which often includes education and age (or experience); F_ℓ is an indicator variable set to one if person ℓ is foreign-born; and y_ℓ gives the number of years that the immigrant has resided in the host country and is set to zero if ℓ is a native. Because the vector X controls for age, the coefficient β_2 measures the differential value that the host country's labor market attaches to time spent in the host country versus time spent in the source country.

[1] The regression models actually used in empirical studies typically include higher-order polynomials in age and years-since-migration. The voluminous literature includes Antecol, Kuhn, and Trejo (2006), Aydemir and Skuterud (2005) Baker and Benjamin (1994), Borjas and Friedberg (2006), Chiswick (1986), Duleep and Regets (1997), Edin, LaLonde, and Åslund (2000), Funkhouser and Trejo (1995), Green (1999), LaLonde and Topel (1992), and Schoeni (1997).

It is instructive to begin the discussion by illustrating the sensitivity of the estimated coefficients in equation (1) across U.S. Census cross-sections. Specifically, I use all available decennial Census data between 1970 and 2000, as well as the pooled 2009-2011 American Community Surveys.[2] For expositional convenience, I refer to the pooled ACS surveys as the "2010 Census." In each cross-section, the sample consists of men aged 25-64 as of the time of the survey, who are not enrolled in school and worked at some point in the calendar year prior to the census. In addition, the immigrant sample is restricted to persons who migrated after age 18.[3] The dependent variable is the log weekly earnings of the worker, where weekly earnings are defined by the ratio of total earned income to weeks worked. The regression specification used in the empirical analysis expands equation (1) by introducing both age and years-since-migration as a second-order polynomial, and includes the number of completed years of schooling.

The various columns of Table 1 report estimates of the regression model in each Census cross-section and Figure 1 illustrates the implied path in the relative earnings of immigrants as they acquire labor market experience in the United States. As is well known, the coefficient β_1 is negative, so that for given levels of education, immigrants earn less than comparably aged natives at the time of arrival. In fact, the regression suggests that immigrants earn about 21 percent less than comparable natives at the time of entry in the 1970 Census.

Define the rate of *economic assimilation* as the rate at which the wage gap between immigrants and natives narrows over time. In the cross-section model given by equation (1), the

[2] The 1970 Census cross-section represents a 3 percent random sample of the population obtained by pooling the State, Metropolitan Area, and Neighborhood files. The 1980-2000 cross-sections represent a 5 percent random sample, and the pooled 2009-2011 ACS represents a 3 percent random sample. The data were downloaded from the Integrated Public Use Microdata Series (IPUMS) website in March 2013. All calculations reported in this paper use the Census-provided sampling weight.

[3] A person is classified as an "immigrant" if he is not a citizen or is a naturalized citizen; all other persons are classified as natives.

rate of economic assimilation would be given by the parameter β_2. As in Chiswick's (1978) original study, the 1970 cross-section suggests that the implied rate of economic assimilation is large, with the wage gap between immigrants and natives closing rapidly, and immigrant earnings reaching parity with native earnings after only 8 years in the United States.

Certainly the main lesson implied by the various columns in Table 1 is that the regression coefficients are inherently unstable from cross-section to cross-section. Both the intercept of the relative age-earnings profile (i.e., the coefficient β_1) and its slope change dramatically from year to year. By 1980, for example, the coefficient β_1 had fallen from -.21 to -.24, increasing the overtaking age from 8 to about 15 years. By 2010, the estimated relative age-earnings profile was much flatter, with less than half the slope of the profile estimated in the original 1970 census cross-section, and the overtaking age had increased to over 25 years. In fact, Figure 1 illustrates what is surely a most peculiar finding in the human capital literature: the cross-section relative earnings profile of immigrants has changed from being quite concave to being slightly convex.[4]

As noted earlier, the initial interpretation of the cross-section evidence relied on a variant of the Becker-Mincer model of human capital accumulation. Immigrants arrived in the United States lacking the types of specific capital valued by American employers, leading to a large initial wage gap. Over time, as immigrants acquired those skills and the process of "economic assimilation" took hold, the wage gap between immigrants and natives narrowed.

The instability in the cross-section estimates of the parameters in equation (1) led Borjas (1985, 1995) to suggest an alternative interpretation of the evidence. Specifically, he argued that instead of interpreting the slope of the relative age-earnings profile as a measure of the rate of economic assimilation, the cross-section data could instead be revealing a decline in the relative

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[4] The changing concavity, in fact, presages the key empirical results reported in this paper.

"quality" of successive immigrant cohorts.[5] In the United States, for example, the postwar era witnessed major changes in immigration policy and in the size and national origin mix of the immigrant flow. If these changes generated a less-skilled flow, a positively sloped relative age-earnings profile may say little about the process of wage convergence, but may instead reflect the fact that more recent immigrant cohorts are inherently less able or less skilled.[6] More precisely, the cross-section correlation between earnings and years-since-migration captures both an aging effect (i.e., the presumed rate of economic assimilation), as well as a cohort effect (the change in the relative quality of successive immigrant cohorts). It is important to emphasize that the cohort effects isolated in the Borjas (1985) study captured variation in the *level* of earnings potential across different groups of immigrants.

It is well known that the separate identification of aging and *level* cohort effects raises difficult methodological problems in many demographic contexts (Glenn, 1976). Obviously, identification requires the availability of longitudinal data where a particular worker is observed over time, or, equivalently, the availability of a number of randomly drawn cross-sections so that specific cohorts can be "tracked" across survey years. To simplify the exposition, suppose that two cross-section surveys are available, with cross-section τ ($\tau = 1, 2$) being observed in calendar year T_τ. Stack the data for immigrants and natives across the cross-sections, and consider the two-equation regression model:

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[5] Douglas (1919) presented a related discussion of cohort effects in the context of early 20th Century immigration to the United States. Abramitzky, Boustan, and Eriksson (2012) revisit the issue of measuring aging and cohort effects in the early 1900s.

[6] The self-selection of return migrants can also generate skill differences among immigrant cohorts. Suppose, for example, that the return migrants are those who fare poorly in a host country, Earlier cohorts will then have higher average wages than the more recent cohorts since, in any given cross-section, the earlier cohorts have been "filtered out."

(2*a*) Immigrant earnings function: $\log w_{\ell\tau} = X_{\ell\tau}\varphi_i + \alpha y_{\ell\tau} + \beta C_\ell + \gamma_i \pi_{\ell 2} + \varepsilon_{\ell\tau}$,

(2*b*) Native earnings function: $\log w_{\ell\tau} = X_{\ell\tau}\varphi_n + \gamma_n \pi_{\ell 2} + \varepsilon_{\ell\tau}$,

where $C_{\ell\tau}$ gives the calendar year in which the immigrant arrived in the host country; $y_{\ell\tau}$ again gives the number of years that the immigrant has resided in the host country ($y_{\ell\tau} = T_\tau - C_{\ell\tau}$); and $\pi_{\ell 2}$ is an indicator variable indicating if person ℓ was drawn from cross-section 2.

Since the vector X includes the worker's age (or experience), the parameter α in the immigrant earnings function measures the "excess" value of acquiring a year of experience in the host country's labor market, and represents an aging effect; the coefficient β indicates how the earnings of immigrants are changing across cohorts, and measures the cohort effect on the *level* of earnings potential; and the coefficients γ_i and γ_n give the impact of changes in aggregate economic conditions on immigrant and native wages, respectively, and measure period effects. For simplicity, equations (2*a*) and (2*b*) build in a simple (i.e., linear) parameterization of the aging and cohort effects; it is trivial to incorporate a more general specification of these effects in empirical work.

The parameters measuring the aging, cohort, and period effects in equation (2*a*) are not separately identified. The identification problem arises from the identity:

(3) $$y_{\ell\tau} \equiv T_1 + \pi_{\ell 2}(T_2 - T_1) - C_\ell .$$

Equation (3) introduces perfect collinearity among the variables $y_{\ell\tau}$, C_ℓ, and $\pi_{\ell 2}$ in the immigrant earnings function. To identify the parameters of interest, therefore, not only is it necessary to have a panel of data where immigrant cohorts or specific workers can be tracked over time, but also impose some additional restriction that breaks the perfect collinearity in equation (3). Borjas (1985) proposed the restriction that the period effects were the same for immigrants and natives:

(4) $$\gamma_i = \gamma_n .$$

Put differently, trends in aggregate economic conditions change immigrant and native wages by the same percentage amount. A useful way of thinking about this restriction is that the period effect for immigrants, γ_i, is determined *outside* the immigrant-specific labor market.[7]

As I emphasized in the discussion, the generic model of aging, cohort, and period effects summarized by equations (2*a*) and (2*b*) generalized the cross-section framework by allowing for differences in the *level* of earnings potential across successive immigrant cohorts. As will be seen shortly, it is easy to show that the disparity in the cross-sectional relative earnings paths illustrated in Figure 1 can no longer be "explained" solely by the presence of level cohort effects. Specifically, there has been a new development in the process that determines the evolution of immigrant earnings in the United States: *there now exist cohort effects in the rate of assimilation*, with the more recent cohorts experiencing a much lower rate of wage convergence than earlier cohorts. In other words, an understanding of the evolution of immigrant earnings will now require a generalization of the cross-section model that allows for cohort differences in both the level of earnings potential as well as in its growth rate.

[7] For example, the value of the period effect γ_n can be obtained by estimating the earnings function in the native sample. The estimated coefficient can then be used to "solve out" the period effect from the immigrant earnings function.

III. Empirical Evidence on Aging and Cohort Effects

It is instructive to begin by describing the basic patterns revealed in the data. In particular, I estimate the following regression model in *each* of the available Census cross-sections:

$$\log w_{\ell\tau} = \phi_{c\tau} + X_{\ell\tau}\,\beta_\tau + \varepsilon_{\ell\tau}, \tag{5}$$

where $w_{\ell\tau}$ represents the weekly earnings of person ℓ in cross-section τ ; X is a vector of socioeconomic characteristics; and $\phi_{c\tau}$ is a vector of fixed effects indicating a specific immigrant cohort in the particular cross-section (with the native fixed effect being excluded from the regression). By construction, the estimated value of the fixed effects give the adjusted wage gap between each immigrant cohort and the native-born workforce. As before, the immigrant sample only includes persons who migrated to the United States on or after they were 18 years old. This sample restriction ensures that the tracking of specific cohorts across Censuses is not contaminated by the "late entry" in later censuses of persons who migrated as children.

Table 2 reports the estimated cohort fixed effects when the vector X includes only the worker's age (introduced as a cubic polynomial). The age variable is defined to have zero mean, so that the estimated cohort effects give the age-adjusted relative wages evaluated at the mean age in each census. Assuming that changes in aggregate economic conditions do not affect the relative wage of immigrants across cross-sections so that the restriction in equation (4) holds, the trends in these fixed effects across censuses can be used to describe the nature of the aging and cohort effects in the (age-adjusted) data.[8]

An examination of the fixed effects reported in Table 2 reveals two interesting findings. The first, which has received a great deal of attention in the literature, is the existence of numerically sizable *level* cohort effects, with the more recent cohorts having a relatively lower earnings potential than earlier cohorts. Consider, for example, the trend in the wage gap between the most recent cohort of immigrants and natives in each census cross-section. In 1970, the most recent immigrant wave earned 23.5 percent less than comparable natives. By 1990, the immigrant disadvantage had grown to 33.1 percent, before contracting slightly to 27.3 percent in 2000.[9] By 2010, however, the long-run trend in level cohort effects seems to have returned, and the latest wave of immigrants earned almost 33 percent less than comparable natives.

In addition to the trend in the level of earnings potential for successive immigrant cohorts, the adjusted wage gaps reported in Table 2 suggest another interesting (and potentially important) finding, one that has not yet been noted in the literature: there seems to have been a "break" around 1990 in the rate of economic assimilation experienced by immigrants. Specifically, the immigrants who arrived on or after 1985 experience much less economic assimilation than earlier arrivals. Put differently, the 40-year history of wage trends in the

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[8] The U.S. wage structure changed markedly in the 1980s (Katz and Murphy, 1992), with a substantial decline in the relative wage of low-skill workers. A generalization of the framework that accounts for this shift is discussed below.

[9] Borjas and Friedberg (2009) analyze the uptick in the relative entry wage of the 1995-2000 cohort and conjecture that it may be partly due to the temporary expansion of the high-tech H1-B visa program in the late 1990s.

immigrant population summarized in Table 2 suggests the presence of cohort differences not only in the *level* of immigrant earnings, but in the *rate of growth* of immigrant earnings as well.[10]

The cohort effects in the rate of economic assimilation can be detected by "tracking" a specific cohort across Censuses, allowing us to observe the change in the relative wage of the group as it assimilates into the labor market. Consider, for example, the cohort that entered the country between 1975 and 1979. The relative wage of this group improved from a disadvantage of 31.4 percent at the time of entry in 1980, to 18.5 percent in 1990, and to 17.8 percent by 2000—a growth of about 14 percentage points over their first two decades in the United States (with much of it occurring in the first 10 years). In contrast, consider the cohort that entered the country between 1985 and 1989. At the time of entry, they earned 33.1 percent less than comparably aged natives. This wage disadvantage improved by only 6 percent points between 1990 and 2000, and by another percentage point between 2000 and 2010. In other words, the relative wage of the 1985-89 cohort improved by only 7 percentage points during their first 20 years in the country. Finally, consider the cohort that entered the country between 1995 and 1999. Their wage disadvantage stood at about 27 percent both in 2000 and 2010, so that this cohort experienced *no* relative wage growth whatsoever during their first 10 years in the United States.

Before proceeding to generalize the regression model to allow for both level *and* growth cohort effects, it is instructive to first estimate the regression model summarized in equations (2*a*) and (2*b*). In carrying out the regression analysis, I again expand the specification to allow for third-order polynomials in the age and years-since-migration variables. In addition, the cohort

[10] Interestingly, Aydemir and Skuterud's (2005) study of assimilation trends in Canada also finds a break after 1990, but in the opposite direction. The post-1990 immigrants in Canada have much lower entry earnings than earlier waves, but a faster rate of wage convergence.

variable C is defined as a vector of fixed effects indicating the year of arrival of immigrants in a number of different "windows" (i.e., all of the cohorts used in the regression reported in Table 2). Because of the difficulty of interpreting the coefficients of the cubic terms in age and years-since-migration in the native and immigrant equations, the table instead reports the amount of wage convergence predicted to occur over the first 10 or first 20 years in the United States.[11]

The first column of Table 3 summarizes the regression results when the model is estimated using the data over the entire 1970-2010 period. To simplify the exposition, the table reports only a selected (but representative) set of the fixed effects that capture the level cohort effects. The regression framework generally confirms the level differences in the relative entry wage of cohorts that are evident in the raw data, and the direction of these level cohort effects is consistent with the well-known finding that there was a significant decline in the average "quality" of immigrant cohorts from about 1965 through 1990. The initial entry earnings of immigrants who arrived in 1965 are predicted to be 13.9 percent below those of natives, while the initial entry earnings of immigrants who arrived between 1984 and 1990 are predicted to be 32.9 percent below those of natives. It is important to emphasize, however, that the size of the level cohort effect seems to be "off" for some of the cohorts. For example, the "raw" data in Table 2 shows that the relative entry wage of the 1965-1969 cohort was -.235, but the regression in the first column of Table 3 predicts it to be -.139. This difference between the raw data and the regression prediction for the level cohort effects, suggests that the regression may be mis-specified.

This suspicion is confirmed by examining the predicted rates of wage convergence between immigrants and natives. Surprisingly, the regression model estimated over the four-

[11] The x-year growth in the relative wage of immigrants is calculated by predicting immigrant and native log earnings both at the time of entry, assumed to occur at age 25, and x years later.

decade period suggests that the rate of economic assimilation is small. During the first decade in the United States, the relative wage of immigrants is predicted to increase by only 5.6 percentage points, and the increase over the first 20 years is only 7.5 percentage points. However, the raw data makes it evident that this "average" rate of economic assimilation does not truly portray the evolution of immigrant earnings over the 40-year period. After all, the cohorts that arrived in the 1960s and 1970s experienced substantial wage growth in the first two decades.

It is easy, in fact, to illustrate that the choice of sampling period strongly influences the predicted *level* cohort differences and the predicted rate of economic assimilation. In particular, the last two columns of Table 3 report the estimated coefficients when the regression is estimated separately in the 1970-1990 and 1990-2010 periods. The choice of sampling period leads to a striking difference in the estimated rate of economic assimilation. The relative wage of immigrants is predicted to increase by around 13 percentage points in the first decade when the regression is estimated in the 1970-1990 period, but is predicted to decline very slightly when the regression is estimated using the 1990-2010 cross-sections.

The inherent instability in the estimated rate of economic assimilation (combined with the obvious "break" in economic assimilation revealed by the raw data) suggests that the regression model needs to be generalized to allow for cohort differences in *both* the level and the growth rate of immigrant earnings. In terms of the framework illustrated in equation (2*a*), the presence of cohort differences in the rate of assimilation can be characterized by a simple parameterization of the model: the coefficient α varies across immigrant cohorts. One obvious (and simple) solution would be to interact the variables measuring the calendar year of arrival with the variable measuring the number of years since migration. The immigrant earnings function can then be written as:

(6) $$\log w_{\ell\tau} = X_{\ell\tau}\varphi_i + \alpha y_{\ell\tau} + \beta C_\ell + \theta(y_{\ell\tau} C_\ell) + \gamma_i \pi_{\ell 2} + \varepsilon_{\ell\tau}.$$

The coefficient β would still measure the trend in the relative entry wage of immigrants, while the coefficient θ would be positive or negative depending on whether more recent cohorts have a larger or smaller rate of economic assimilation.[12] It is worth emphasizing that no additional identification restrictions are required to estimate θ. In other words, the inclusion of some form of interaction between the cohort variable and the years-since-migration variable does not introduce any additional perfect collinearities into the regression model. The assumption that the period effects are the same for immigrant and natives, therefore, remains the only restriction that needs to be imposed to estimate both the level and growth cohort effects in immigrant earnings.

In conducting the empirical analysis, I expand the interactive framework suggested by equation (6). In particular, I estimate a regression model that interacts the linear term of the years-since-migration variable with each variable in the vector of cohort fixed effects. Put differently, each entry cohort is allowed to have its own growth path.[13]

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[12] The presence of cohort effects in the growth rate, with more recent cohorts having relatively smaller wage growth rates, helps to explain the peculiar finding in Figure 1 where the relative earnings profile of immigrants shifted from being concave to being (slightly) convex between 1970 and 2010. Let *Z* be the vector of variables (*X*, *A*) and suppose that all of these variables have the same impact on immigrants and natives. Further, suppose that the "true" assimilation effect is described by a quadratic function, so that the pooled regression of immigrants and natives can be written as:

$$\log w = Z\varphi + \lambda F + \alpha_1 y + \alpha_2 y^2 + \beta C + \theta(Cy),$$

where the variables *y* and *C* should be interpreted as being interactions with the foreign-born fixed effect, *F*. Since $C = T - y$, a cross-section model collapses to:

$$\log w = Z\varphi + (\lambda + \beta T)F + (\alpha_1 - \beta + \theta T)y + (\alpha_2 - \theta)y^2.$$

The quadratic term in years-since-migration turns positive if the growth cohort effects are sufficiently negative.

[13] For simplicity, the cohorts who entered the country prior to 1965 are pooled into a single cohort. It is also possible to interact the higher-order years-since-migration variables with the vector of cohort fixed effects, but these higher-order interactions add little to the empirical analysis.

The first column of Table 4 presents selected coefficients from the generalized regression model that allows for both level and growth cohort differences. The regression is estimated using data from the entire 1970-2010 period. As before, even though the regression model contains the full set of cohort fixed effects listed in Table 2 (and the interactions of these cohort fixed effects with the years-since-migration variable), I only report selected coefficients to easily illustrate the direction and magnitude of the level and growth cohort differences.

The generalization of the regression model leads to estimates of the level cohort differences that are much more aligned with the raw data reported in Table 2. For example, Table 4 predicts that an entry wage disadvantage of 21.4 percent for the cohort that entered the country in the late 1960s, while the raw data in Table 2 suggested a 23.5 percent wage disadvantage. It seems, therefore, that allowing for cohort differences in growth rates solves the misspecification problem noted earlier that led to poor predictions of the entry wage for the various immigrant cohorts.

The generalized regression model also reveals that the rate of economic assimilation began to decline with the immigrant cohorts that arrived in the 1970s and 1980s. Prior to that time, immigrants could expect an increase in their relative earnings of about 12 to 13 percentage points during their first decade in the United States. However, the assimilation rate of the immigrants who entered in the late 1980s was about a third smaller, and the assimilation rate of the immigrants who entered in the late 1990s was essentially zero.

There are two potential explanations for this slowdown in the rate of wage convergence. The first is that it represents a failure of the regression model to properly account for various factors that may be leading to lower relative wages for immigrants in recent years and that have nothing to do with the underlying process of *actual* human capital accumulation. The second is that it reflects a tangible decline in the rate at which more recent immigrant waves accumulate marketable skills after their entry in the United States. Before proceeding to discuss the plausibility of the second hypothesis, it is important to devote some effort to determining if the result "goes away" when the model is confronted with various sensitivity tests that attempt to more properly account for the evolution of wages in the native and immigrant populations.

Perhaps the most obvious explanation for the declining rate of earnings growth in the immigrant population is that the assumption that macroeconomic shifts in economic conditions change the earnings of immigrants and natives by the same relative amount is incorrect—i.e., the identification restriction in equation (4) is false. This conjecture seems particularly relevant because the 2010 Census data (where much of the decline in immigrant wage growth is observed) is composed of the 2009-2011 pooled American Community Surveys. The wage data in these surveys, of course, inevitably reflects the impact of the Great Recession on the wage structure, and the severe economic downturn could have had a differential impact on the wages of immigrant and native workers.

It is easy to document, however, that the Great Recession cannot possibly explain the post-1985 slowdown in the rate of economic assimilation. The simplest way of showing this is to redefine what is meant by the "2010 Census." In particular, the availability of annual ACS surveys each comprising 1 percent of the population suggests that I can re-estimate the model by defining the pooled 2005-2007 ACS surveys as the "2010 Census" cross-section, so that the most recent data used in the analysis was collected *before* the economic slowdown.

Before proceeding to the regression analysis, the last column of Table 2 reports the estimated age-adjusted relative wage gaps using this alternative definition of the 2010 cross-section. It is evident that the rate of wage growth experienced by the various entry cohorts is essentially the same regardless of whether I use the 2005-2007 or the 2009-2011 pooled ACS. For example, the relative wage of the 1995-1999 cohort in 2010 was around -.28, regardless of which pooled ACS data set is used. Similarly, the relative wage of the 1985-1989 cohort in 2010 was -.26, again regardless of which data set is used.[14] Given the similar findings in the raw data, it is not surprising that estimating the generalized regression model using this alternative definition of the 2010 Census yields essentially the same estimates of the rate of economic (see column 2 of Table 4). In short, the economic upheaval accompanying the Great Recession has nothing to do with the observed decline in the rate of economic assimilation experienced by the most recent immigrant cohorts.

Nevertheless, it is still possible that the period effects restriction imposed by equation (4) does not adequately represent the evolution of the wage structures for immigrants and natives over the past few decades. After all, it is well known (Katz and Murphy, 1992; Lemieux, 2006) that the returns to skills dramatically increased during this period. Because the immigrant and native populations have a different skill mix, the assumption that the period effects are the same "on average" may not capture the impact of macroeconomic conditions on the evolution of the two wage structures, and would bias the other parameters of the model.

One straightforward way of controlling for this problem is to assume that the period effects restriction in equation (4) should operate at the level of a particular skill group at a particular point in time, rather than for the average immigrant and native at a point in time. In other words, the period effect restriction should be skill-specific: changes in macroeconomic

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[14] The only noticeable change that occurs when using the 2005-2007 pooled ACS is that the relative entry wage of the most recent cohort is substantially lower. This is not surprising since, by construction, the latest cohort can only include persons who migrated between 2005 and 2007 and their earnings are essentially captured *immediately* after arrival, rather than with the short lag that would occur if the data continued to accumulate new immigrants through 2010.

activity have the same proportionate impact on the wages of immigrants and natives in a particular skill. The "deflator," therefore, should be skill-specific.

To examine the sensitivity of the results to the use of a skill-specific wage deflator, I classify all workers into one of 40 narrowly defined skill groups (h) based on a worker's educational attainment and age.[15] I then use the 1970-2010 cross-sections to calculate the nominal rate of wage growth experienced by *native* workers in each of these groups over the four-decade period. Let $\phi_{h\tau}$ be the implied "price index" that can be used to deflate the wages of a worker in skill group h and in cross section τ calculated from the various Censuses.[16] I then estimated the regression model using the skill-specific deflator $\phi_{h\tau}$ to "solve out" the period effects from the model. The operational assumption, of course, is that period effects are the same for natives and immigrants *within* a narrowly defined skill group.

The third column of Table 4 shows that controlling for skill-specific period effects reduces the rate of decline in the entry wage of immigrant cohorts. For example, the entry wage of the 1985-1989 cohort is about 14 percentage points lower than that of the 1965-1969 cohort in the simpler specification, but only 9 percentage points lower when the model adjusts for skill-specific period effects. This finding is similar to that reported in Lubotsky (2011), who uses a more structural framework to estimate the changing price of skills over the period and concludes

[15] Specifically, workers are classified into one of 5 education groups and into one of 8 age groups, for a total of 40 skill groups. The five education groups are: high school dropouts, high school graduates, workers with some college, college graduates, and workers with more than a college education. The eight age brackets are given by: 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, and 60-64. Since it does not matter whether I use the 2005-2007 or the 2009-2011 pooled ACS to define the 2010 cross-section, the empirical analysis exclusively uses the more recent data from this point on.

[16] Suppose that a particular cross-section is used as the baseline, then the implied price deflator for a specific skill group in cross-section τ would be given by $\phi_{h\tau} = \overline{w}_{h\tau} / \overline{w}_{h0}$, where $\overline{w}_{h\tau}$ gives the mean earnings of native workers in group h in cross section τ.

that changes in the wage structure can account for about a third of the observed decline in entry earnings typically associated with *level* cohort effects.[17]

However, Table 4 also shows that the estimated rate of decline in the rate of economic assimilation is impervious to the use of skill-specific price deflators. In particular, the growth rate in the relative wage during the first decade is still about 6.0 percentage points lower for the 1985-1989 cohort (relative to the immigrants who entered in the late 1960s) and is essentially zero for the cohort that entered the country in the late 1990s.

Finally, an even more general way of relaxing the period effects restriction in equation (4) would be to introduce a vector of fixed effects defined at the year-education-age level. As the last column of Table 4 shows, however, this general approach, which effectively lets the data decide the factors that are "common" between immigrants and natives in a particular skill group at a particular point in time, does not change the nature of the evidence. The 10-year rate of wage convergence declines from about 11 percent for the pre-1980 cohorts, to 8 percent for the late 1980s cohort, and to 1 percent for the late 1990s cohort.[18]

It is evident, therefore, that a careful accounting of the nature of period effects cannot explain why the rate of economic assimilation declined so dramatically for the immigrant cohorts that began to arrive after the mid-1980s. There are, however, two other obvious "compositional" changes that could potentially account for the declining assimilation rate. Specifically, the growth cohort effects may be attributable to the changing national origin mix of immigrants or to changes in the geographic sorting of immigrants across regions of the United States.

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[17] See also Barth, Bratsberg and Raaum (2004).

[18] There is an important conceptual difference in the estimated rates of wage convergence reported in columns 1 and 4 of the table. Column 1 reports the rate of wage convergence relative to the "average" native, while column 4 reports the rate of wage convergence relative to comparably skilled natives.

It is well known that a substantial part of the decline in the entry wage of successive immigrant cohorts can be explained by the changing national origin mix of the immigrant population in the 1970s and 1980s (Borjas, 1992). The national origin mix of the immigrant workforce, of course, is highly correlated with the skill composition of immigrant workers, and the changing national origin mix (i.e., away from developed countries in Western Europe to less-developed countries in Latin America and Asia) inevitably led to an immigrant population that was, on average, relatively less skilled. It seems plausible to conjecture that the changing national origin mix of the immigrant population influences not only the wage level of the average immigrant, but the average rate of growth in earnings as well.

Table 5 examines if the changing national origin mix of immigrants can account for the decline in assimilation rates. In particular, the second column of the table re-estimates the basic regression model after including a vector of national origin fixed effects (using the three-digit birthplace classification in the IPUMS that can be consistently defined between 1970 and 2010).[19] Controlling for the changing national origin mix of immigrant by including a vector of around 100 national origin fixed effects does, in fact, greatly attenuates the decline in relative wages observed across successive immigrant cohorts.[20] However, the inclusion of these national origin fixed effects barely affects the magnitude of the estimated rates of assimilation. Even within national origin groups, the 10-year growth in relative wages is around 9 to 10 percent for the pre-1980 cohorts, around 7 percent for the 1985-1999 cohort, and slightly negative for the

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[19] The IPUMS also provides a five-digit birthplace classification. I do not use the more detailed classification to conduct the exercise because the national origin information provided by the 1970 Census data is less detailed than that provided by the later censuses.

[20] The absolute size of the relative entry wage predicted after including over 100 national origin fixed effects depends on the choice of the base group. To make the results comparable across columns, I chose a relatively large national origin group (South America) where the average wage was very close to that of the entire immigrant population.

1995-1999 cohort.[21] In other words, changes in the national origin mix of immigrants cannot explain why the more recent cohorts have a much lower rate of economic assimilation.

The changing rate of economic assimilation could also be due to the changing geography of immigrant settlement in the United States. Fewer immigrants are now settling in the traditional immigrant-receiving states, and parts of the country where immigration was relatively rare historically (e.g., Arkansas and Georgia) now receive large numbers of foreign-born workers. The geographic diffusion of immigration could, in theory, alter the rate of economic progress of immigrants since there are dramatic geographic differences in the industrial and occupational mix of jobs, and these differences may stimulate or dampen the economic assimilation of newcomers. Column 3 of Table 5 adds a vector of state-of-residence fixed effects to the regression model to determine if the results are sensitive to controlling for geographic location. It is evident that the inclusion of the state fixed effects barely changes the estimates of the various parameters.

The last two columns of the table conclude the series of sensitivity tests by: (a) using the skill-specific price deflators $\phi_{h\tau}$ defined earlier; and (b) including the worker's educational attainment in the regression model. Regardless of the specification, the data clearly document a steep decline in the rate of economic assimilation beginning with the cohort that entered the United States in the late 1980s. In other words, there does not seem to be a "mechanical" reason that can easily explain the cohort differences in the rate of assimilation that are so evident in the raw data. The evidence, therefore, points to the hypothesis that there may have been a tangible

[21] I also estimated the regressions separately for the three largest national origin groups. Even within these groups, there is clearly a decline in the rate of economic assimilation. The 10-year relative wage growth for the 1975-79 cohorts were -.039 (.035) for Mexican immigrants; .422 (.074) for Indian immigrants; and .044 (.049) for Salvadoran immigrants. The respective statistics for the 1995-1999 cohort are: -.166 (.019), .227 (.052), and -.091 (.024).

slowdown in the rate at which immigrants accumulate human capital after they migrate to the United States.[22]

In fact, the Census data itself suggests that such a slowdown may have occurred. In particular, the various surveys contain one variable that partially measures the changing human capital stock of immigrants during the assimilation period—the acquisition of English language skills. Beginning with the 1980 Census, the data provides self-reported information on each immigrant's level of English proficiency. I use these data to define an English proficiency indicator variable set to one if the immigrant speaks only English or speaks English very well. I re-estimated the descriptive regression model in equation (5) using this human capital variable as the dependent variable. Table 6 reports the trends in the (age-adjusted) fraction of immigrants who are English-proficient, both across cohorts and for a single cohort over time.[23]

The top panel of the table uses the entire sample of immigrants in the various censuses. It is evident that there was a clear break in the extent to which a particular cohort "picks up" English language skills beginning with the cohort that entered the United States around 1990. In particular, 39.6 percent of the immigrants who arrived in the country between 1975 and 1980 were English proficient at the time of arrival, and this fraction increased to 47.8 percent (or an

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[22] It is important to emphasize that the rate of economic assimilation that can be estimated from repeated cross sections suffers from a potentially important flaw. In particular, a fraction of the immigrants in a particular cohort are likely to return to their source countries (or migrate elsewhere), and the rate of economic assimilation is necessarily calculated from a sample that contains all immigrants at the beginning of the period and only the survivors at the end. Some studies in the literature use longitudinal samples to examine how non-random return migration affects the rate of economic assimilation implied by the repeated cross-section method. Hu (2000) and Lubotsky (2007), for example, employ datasets that match, at the individual level, demographic information from (relatively small) Census-type datasets with the complete earnings histories of workers maintained by the Social Security Administration. These studies typically find that, at least in the pre-1990 period, the method of repeated cross-sections *overestimates* the rate of economic assimilation. See also Beenstock, Chiswick, and Paltiel (2010) and Duleep and Dowhan (2002).

[23] The regression includes the worker's age, introduced as a third-order polynomial. The age variable is again defined to have zero mean, so that the estimated cohort effects give age-adjusted proficiency rates evaluated at the mean age in each census.

8.2 percentage point increase) by 1990. The proportion of English-proficient immigrants in this cohort increased further to 49.5 (another 1.7 percentage points) between 1990 and 2000.

In contrast, even though the immigrants who entered the country between 1985 and 1989 had similar initial conditions in terms of English proficiency (40.4 percent were English proficient at the time of arrival), the proficiency rate of this cohort increased by only another 2.6 percentage points during the first 20 years, far less than the 10 percentage increase experienced by the 1975-1979 cohort. Finally, note that the English proficiency rate of the cohort that arrived in 1995-2000 was essentially the same at the starting line (at 40.2 percent), but essentially did not change during their first decade in the United States.

Panel B of the table replicates the analysis after excluding from the sample those immigrants who originated in one of the countries in the British "sphere of influence" where English is widely used by the foreign-born population.[24] These immigrants had a 98.3 percent English proficiency rate at the time of arrival, and hence it would be impossible to observe much of an increase in their English language proficiency rate as the assimilation process took hold. These immigrants would target their investments on different aspects of their human capital portfolio.

The results reported in Panel B again confirm the slowdown in language human capital investments across successive immigrant cohorts. Consider, for example, the cohort that entered the country in the late 1970s; their English proficiency rate increased by 12 percentage points during the first decade (from 30.9 to 42.8 percent). In contrast, the rate of increase in the

[24] The countries are Canada, Bermuda, Belize-British Honduras, Jamaica, Antigua-Barbuda, Bahamas, Barbados, Dominica, Grenada, St. Kitts-Nevis, St. Vincent, Trinidad and Tobago, Guyana/British Guiana, the United Kingdom, Ireland, Northern Ireland, Liberia, South Africa, Australia, and New Zealand. These countries were selected because English was the modal language spoken at home by immigrants from these countries even at the time of arrival. These countries account for 7.7 percent of all immigration and the fraction of newly arrived immigrants originating in these countries who speak English very well is 97.0 percent.

proficiency rate was only 2.8 percentage points for the immigrants who arrived in the late 1980s, and 2.0 percentage points for those who arrived in the late 1990s.[25] In short, there seems to be a potentially important link between the slowdown in the rate of economic assimilation and the slowdown in the rate at which immigrants acquire human capital in the post-migration period.

IV. A Model of Human Capital Accumulation and Economic Assimilation

The available evidence suggests that the observed decline in the rate of economic assimilation is not a spurious finding resulting from changes in the wage structure or from changes in the demographic composition of the immigrant population. Instead, it seems to reflect a significant slowdown in the rate at which immigrants accumulate human capital after arriving in the United States. In order to identify the cause of the slowdown, therefore, it is useful to derive the implications of a model of optimal human capital accumulation for the rate of human capital investment and the rate of economic assimilation of immigrants.

A two-period model of the life cycle provides a simple framework for thinking about these questions.[26] Let K be the number of efficiency units an immigrant acquired in the source country. A fraction δ of these efficiency units are specific to the source country's labor market, so that the worker's marketable human capital in the post-migration period is $E = (1 - \delta) K$. Note that the value of the depreciation parameter δ provides a simple way for contrasting the investment incentives faced by comparable immigrants and natives in the United States. The

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[25] The implicit assumption being made in comparing the trends in the English language proficiency rate across cross-sections is that there are no period effects. Since there is no native baseline, it is difficult to imagine which deflator could be used to adjust the data. I also predicted the trends in the proficiency rate after controlling for the worker's educational attainment, and the trends are remarkably similar to those illustrated in Table 6.

[26] The model presented below adapts the framework introduced in Borjas (2000). A more general theory would jointly consider the human capital investment decision, the decision to emigrate, and the possibility that the worker may reconsider the migration decision after "testing" the host country's labor market.

typical native can sell all of his K efficiency units in the labor market, so that $\delta = 0$ for natives and $0 < \delta < 1$ for immigrants.

An immigrant lives for two periods after migrating. During the investment period, the immigrant devotes a fraction π of his human capital to the production of additional human capital, and this investment increases the number of marketable efficiency units in the payoff period by $g \times 100$ percent. If the market-determined rental rate for an efficiency unit in the host country is one dollar, the present value of the post-migration income stream is:

$$PV = (1 - \delta)\, K\, (1 - \pi) + \rho\, [(1 - \delta)\, K\, (1 + g)], \tag{7}$$

where ρ is the discounting factor.

The human capital production function that generates the increase in the number of marketable efficiency units is:

$$gE = (\pi K)^{\alpha} K^{\beta}, \tag{8}$$

with $\alpha < 1$. The production function in (8) is a simple adaptation of the one in the classic Ben-Porath (1967) model of human capital accumulation. In that framework, a worker produces human capital by using part of his current human capital stock for the production of additional efficiency units. In equation (8), the worker uses a fraction of his *entire* human capital stock (or πK) as an input in production. Therefore, even though part of the pre-existing human capital may not be marketable in the United States, it is still useful in the production of additional human capital.[27] As an extreme example, an immigrant with highly specialized medical training may not be able to market his skills in the U.S. labor market due to licensing restrictions. Nevertheless, those skills do not entirely disappear; that knowledge is imbedded in the worker and would certainly be useful in the production of additional human capital.

As in the Ben-Porath model, the production function in equation (8) allows for the possibility that the worker's pre-existing human capital stock K is an independent input in the production process. It may be the case, for instance, that immigrants with higher levels of pre-existing human capital may be more efficient at acquiring additional human capital. It is analytically convenient to rewrite the human capital production function as:

$$(9) \qquad g = (1-\delta)^{-1} \pi^{\alpha} K^{\alpha+\beta-1}.$$

Equation (9) directly relates the rate of human capital accumulation of marketable skills (g) to the fraction of efficiency units used for investment purposes (π). Define "relative neutrality" as the case where the rate of human capital accumulation of marketable skills is independent of the initial level of human capital, so $\alpha + \beta = 1$. If $\alpha + \beta > 1$, the rate of human capital accumulation is positively related to initial skills, or "relative complementarity." If $\alpha + \beta < 1$, there is a negative relationship, or "relative substitutability."[28]

[27] This formulation implies that πK units of human capital are "used up" in the production of additional human capital. The marketable human capital available to sell in the U.S. labor market during the investment period then equals $(1 - \delta)(K - \pi K) = (1 - \delta)K(1 - \pi)$, as specified in equation (7).

[28] The special case of "relative neutrality" is, of course, analogous to the neutrality assumption in the Ben-Porath model, where the marginal cost curve of producing human capital is independent of the worker's initial stock. The relative neutrality assumption implies that it is the fraction of *time* allocated to human capital investments that is independent of the initial human capital stock.

Workers choose the value of π that maximizes the present value of post-migration earnings. The implied optimal rate of accumulation of marketable efficiency units in the post-migration period is then given by:

(10) $$g = (\alpha\rho)^{\frac{\alpha}{1-\alpha}} \left(\frac{1}{1-\delta}\right)^{\frac{1}{1-\alpha}} K^{\frac{\alpha+\beta-1}{1-\alpha}}.$$

If there is relative complementarity, highly skilled immigrants acquire more human capital; if there is relative substitutability, the more skilled acquire less. Equation (10) also implies a positive relation between the rate of human capital accumulation g and the depreciation parameter δ. In fact, because $\delta = 0$ for native workers, the model implies that immigrants are accumulating human capital at a faster rate than comparable natives. The intuition is obvious: For comparable levels of "true" skills, immigrants face lower forgone earnings (a fraction δ of the pre-existing human capital is not marketable in the United States), and hence have a greater incentive to acquire more skills. In short, the income-maximization hypothesis implies that immigrants devote a larger fraction of their resources to investment activities than comparable natives. Finally, equation (10) implies a positive relation between the rate of human capital accumulation and the discounting factor ρ. As a result, immigrants who discount their future U.S. earnings less heavily (i.e., a higher ρ) would invest more.

Let $\dot{w}$ be the rate of wage growth experienced by an immigrant in the United States. This rate of wage growth is given by:[29]

[29] The rate of economic assimilation is given by the difference between $\dot{w}$ and the rate of wage growth experienced by comparable native workers (or $\dot{w}$ evaluated at $\delta = 0$).

(11) $$\dot{w}=\frac{(1-\delta)K(1+g)-(1-\delta)K(1-\pi)}{E}=g+\pi.$$

It is easy to show that:

(12*a*) $$\frac{\partial\dot{w}}{\partial\delta}>0,$$

(12*b*) $$sign\frac{\partial\dot{w}}{\partial K}=sign(\alpha+\beta-1),$$

(12*c*) $$sign\left(\left.\frac{\partial\dot{w}}{\partial K}\right|_{\delta>0}-\left.\frac{\partial\dot{w}}{\partial K}\right|_{\delta=0}\right)=sign(\alpha+\beta-1).$$

(12*d*) $$\frac{\partial\dot{w}}{\partial\rho}>0,$$

Equation (12*a*) shows that the predicted rate of wage growth in the United States is larger for workers who have a larger δ. This result immediately implies that immigrants will experience faster wage growth than comparable natives, so that optimal human capital investment behavior predicts a positive rate of economic assimilation. Interestingly, the model generates a positive rate of economic assimilation because, on average, immigrants are "different" from natives: immigrants start their working life in the host country at a disadvantage (some of their skills have depreciated because $\delta > 0$) and have an incentive to catch up. Equation (12a) also implies that *within* the immigrant population, those immigrants originating in countries where the pre-existing skills are least transferable to the host country will experience a *faster* rate of post-migration wage growth.

Equation (12*b*) implies that the sign of the correlation between the rate of wage growth and the pre-existing human capital stock depends on whether there is relative substitution between pre- and post-migration human capital ($\alpha + \beta - 1 < 0$), or relative complementarity ($\alpha + \beta - 1 > 0$). Equation (12*c*) reports the analogous result in terms of the rate of economic assimilation: high-skill immigrants "assimilate faster" only if there is relative complementarity in the production of human capital.

Finally, equation (12*d*) implies that immigrants who are less likely to discount their future earnings in the U.S. labor market (i.e., have a higher ρ) will experience a higher rate of wage growth. This result suggests, for example, that immigrants who face higher costs for return migration will assimilate more quickly.

V. Empirical Determinants of the Slowdown in Economic Assimilation

The analysis uses the 1980-2010 decennial Census data extracts described earlier.[30] By definition, an immigrant cohort now comprises a group of foreign-born persons who migrated to the United States at age *i*, from country *k*, at a particular calendar time *t*.[31] For each (*i*, *k*, *t*) cell, I used the Census data to calculate the mean log weekly wage in each cross-section as well as the fraction of persons in the group who are English proficient. The calculation uses the education-age deflator introduced earlier to allow for differential period effects across skill groups. The wage growth experienced by this cohort across censuses—relative to the wage growth experienced by a comparably aged group of native workers over the same period—measures the

[30] The 1970 Census data is not used in this section because it lacks information on English language proficiency and offers a much less detailed classification of country of origin than the subsequent censuses.

[31] More precisely, the age-at-migration is given by the age of the immigrant at the time that he is first enumerated in a U.S. Census.

rate of economic assimilation for each cohort. The change in the rate of English proficiency across Censuses is one measure of the volume of human capital investments undertaken in the post-migration period.

The empirical analysis uses the sample of immigrant men originating in the largest 80 sending countries. These countries accounted for 93.5 percent of the foreign-born workforce in 2000. The analysis uses three age-at-migration "windows" to construct the cohorts: persons who were 25-34, 35-44, and 45-54 as of the time of arrival. The analysis also uses six year-of-arrival groups: immigrants who arrived in 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, and 1995-1999. The construction of the aggregate data ensures that the assimilation process is being observed among immigrants who arrived in the United States as adults. Each of these (*i*, *k*, *t*) cohorts is then tracked over the first ten years after arrival by "jumping" to the next Census and observing the now-older group at that point.

It is well known that there are sizable wage differences across immigrants belonging to different national origin groups. Not surprisingly, there are equally large differences in the rates of economic assimilation and human capital accumulation. The first three columns of Table 7 report the first-decade wage growth experienced by immigrants in the 10 largest national origin groups (relative to that experienced by comparably aged natives). The statistics reported in the top panel of the table refer to immigrants who entered the country when they were 25-34 years old, while the bottom panel reports the trends for those who entered when they were 35-44 years old.

The top panel shows that Chinese immigrants who arrived in the United States between 1995 and 1999 experienced a relative wage increase of 23.2 percentage points during their first 10 years in the country. In contrast, the growth rate was -4.3 percent for Cuban immigrants, -5.5

percent for Mexican immigrants, +10.1 percent for Filipino immigrants, and +11.5 percent for Indian immigrants. Interestingly, *all* of these large national origin groups exhibit a decline in the rate of assimilation between the cohorts that entered in the late 1980s and the late 1990s. Among Indians, for example, the rate of assimilation for those who entered in the late 1980s is 13 percentage points greater than for those who entered in the late 1990s.

The last three columns of Table 7 also reveal sizable differences in the rate of human capital accumulation, as measured by the change in the English proficiency rate. For example, the fraction of immigrants who speak English very well increased by 8.3 percentage points for persons who migrated from Guatemala in the late 1980s. The respective growth rate is 2.2 percent for Mexican immigrants, 10.0 percent for Indian immigrants, and 21.4 percent for Chinese immigrants. In addition, most of the groups (8 out of 10) exhibit a decline in the growth rate of English language proficiency between the cohorts that entered in the late 1980s and the late 1990s. The 10-year growth rate of English language proficiency fell from 21.4 percent to 10.0 percent for Chinese immigrants, and from 8.4 percent to 0.9 percent for Vietnamese immigrants.

The human capital model presented in the previous section provides a useful framework for thinking about (and interpreting) the cross-country variation in the rate of human capital accumulation and economic assimilation, and for examining the extent to which changes in the underlying determinants can account for the slowdown in economic assimilation. The model isolates three variables that play a central role in the investment decision: the initial human capital stock of the cohort (K); the degree to which the skills of the cohort can be transferred to the U.S. labor market (δ); and the cohort's discounting factor (ρ). The empirical analysis presented below attempts to determine if empirical proxies for these variables can explain the disparity and decline in assimilation rates documented in Table 7.

Consider initially the determinants of the rate of economic assimilation. The regression model is given by:

$$(13) \qquad \Delta \log w_{ik}(t) = \phi_i + \phi_t + Z_k(t)\, \beta + \varepsilon,$$

where $\Delta \log w_{ik}(t)$ gives the 10-year change in the log weekly wage of a cohort of immigrants who arrived in the United States at age i, from country k, at time t *relative* to the wage growth experienced by comparably aged natives during the same decade; Z is a vector of country specific characteristics that may determine the rate of economic assimilation; and ϕ_i and ϕ_t are vectors of fixed effects that absorb any age- and year-of-arrival-specific factors.[32] The excluded year-of-arrival fixed effect indicates if the immigrant cohort arrived in the United States between 1975 and 1979, so that the cohort fixed effects measure the rate of assimilation relative to this cohort.

I first estimate a regression model that only includes the two vectors of fixed effects as regressors. Not surprisingly, the first column of Table 8 reports sizable cohort differences (i.e., the values of ϕ_t) in the rate of economic assimilation. Specifically, the assimilation rate of the cohort that arrived in the late 1990s is 9.1 percentage points lower than that of the cohort that arrived in the late 1970s. Although the table only reports the estimated cohort fixed effects for two of the cohorts, it is worth emphasizing that the regression includes the entire vector of ϕ_t.

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[32] I use the education-age deflator to define the rate of wage convergence in equation (13). I replicated the regression analysis using a standard CPI-based deflator that is not skill specific, and the results were quite similar to those reported below.

The empirical analysis uses the cohort's average years of educational attainment (measured at the time of arrival) to approximate for the pre-existing human capital stock *K*. The second column of Table 8 shows that this variable has a strong positive impact on the rate of economic assimilation. Each additional year of education increases the (relative) rate of wage growth by 0.6 percentage points. The evidence, therefore, supports the conjecture of relative complementarity in the production of human capital: more skilled immigrants invest more in U.S.-specific human capital and experience a higher rate of economic assimilation subsequently.

The regression in column 2 also includes a variable measuring the log per-capita GDP in the country of origin at the time of migration.[33] It is well known that there exists a strong positive correlation between immigrant earnings and per-capita GDP in the source country. This correlation is typically explained by arguing that the skills of immigrants from high-income countries are more easily transferable to the U.S. labor market, so that per-capita GDP may be an inverse proxy for the rate of depreciation δ. Table 8 shows that the per-capita GDP variable has a *negative* impact on relative wage growth. The negative effect is consistent with the theoretical prediction. Holding initial skills constant, the immigrants who can most easily transfer their skills from one industrialized economy to another are also the immigrants who find it most expensive to invest in the post-migration period.

Note, however, that controlling for the cohort's educational attainment and per-capita GDP of the country of origin does not "explain" the decline in assimilation rates observed across cohorts. The cohort that entered the country in the late 1990s is still predicted to have a rate of assimilation that is 8.9 percentage points lower than that of the cohort that entered in the late 1970s.

[33] The per-capita GDP variable is drawn from the Penn World Table (Heston et al. 2012) and gives the (PPP-adjusted) real per-capita GDP at the start of the five-year period that defines a year-of-entry cohort.

The third column of Table 8 adds variables that proxy for the discounting factor ρ. First, immigrants originating in countries that are at least 3,000 miles away from the United States have a faster rate of assimilation. One potential explanation is that these immigrants face a higher cost of return migration, so that they are less likely to discount their future earnings in the United States. Similarly, the regression includes a civil liberties index constructed by Freedom House (2011).[34] Immigrants from countries with repressive regimes have a larger rate of economic assimilation, presumably again because they are less likely to engage in return migration and do not heavily discount their future earnings in the United States. Note, however, that the inclusion of these additional variables in the regression model does not explain the lower assimilation rate of the cohort that arrived in the United States in the late 1990s. The relative decline experienced by this cohort stands stubbornly at 9.0 percentage points.

The payoff for immigrants to learning the English language (and perhaps engaging in other forms of U.S.-specific human capital investments) likely depends on the frequency with which they will use those skills in their everyday interactions (Lazear, 1999). Immigrants who find relatively few of their compatriots living in the United States typically have a stronger incentive to make the U.S.-specific investments that will allow a wider range of social and economic exchanges. In contrast, immigrants who enter the country and find a large welcoming ethnic enclave have much less incentive to engage in these types of investments since they will find a large market for their pre-existing skills.

The human capital model presented in the previous section defines the human capital stock that an immigrant can market in the United States as $(1 - \delta)K$. It is easy to imagine that the

[34] Freedom House (2011) constructs an index of civil liberties annually for each country in the world. The index ranges from 1 to 7, with seven being assigned to the countries with the most oppressive regimes. The variable used in the regression classifies a country as "repressive" if the index is 4 or greater, and is evaluated during the decade when the immigrant cohort arrived.

fraction of the human capital stock that survives in the post-migration period depends on the size of the "audience" that will value the cohort's skills in the United States. An increase in the pre-existing size of the national origin group likely implies that a larger fraction of the skills of new immigrant arrivals will survive the move.

I use two variables to test the hypothesis that "group size" influences the cohort's rate of assimilation. The first is the "effective" number of immigrants from that country who reside in the United States, where the effective size of national origin group k gives the expected number of immigrants that a randomly chosen newcomer from that country can potentially interact with in the marketplace. Obviously, the effective size of a national origin group depends not only on the actual size of the *pre-existing* group of immigrants, but on their geographic distribution as well. After all, for any given stock, economic and social exchanges are far more likely to occur if type k immigrants reside in a small number of localities. Let $s_{kr}(t)$ be the share of pre-existing immigrants from group k who reside in state r at time t, and $N_{kr}(t)$ be the number of such immigrants. The expected number of type k immigrants that "surround" a randomly chosen newcomer can then be defined by:[35]

$$(14) \qquad \bar{N}_k(t) = \sum_r s_{kr}(t) N_{kr}(t).$$

The second variable gives the "effective" number of *other* immigrants (i.e., outside national origin group k) who are in the same linguistic group, where a linguistic group is defined

[35] It is easy to show that $\bar{N}_k(t) = N_k(t) H_k(t)$, where $N_k(t)$ is the total size of the national origin group and H is the Herfindahl index measuring the geographic clustering of type k immigrants.

by the set of immigrants who share the same mother tongue.[36] Suppose immigrants from country k are in linguistic group g, and that there are $A_{gr}(t)$ additional (pre-existing) immigrants from that linguistic group residing in state r. The effective number of other linguistically compatible immigrants is then given by:

$$(15) \qquad \bar{A}_k(t) = \sum_r s_{kr}(t) A_{gr}(t).$$

To an important extent, the variable measuring the (excess) size of the linguistic group takes on a positive value only for Hispanic immigrants. The size of the national origin group within the Hispanic population may be small in some cases (e.g., immigrants from Ecuador), but the size of the linguistic group is much larger because there exists a numerically sizable audience with whom Hispanic immigrants can use their pre-existing language skills to frequently and cheaply carry out social and economic exchanges.[37]

Column 4 of Table 8 introduces the vector $(\bar{N}_k, \bar{A}_k)$ into the cross-country regression and shows that the effective size of the national origin group has a strong negative effect on the rate of economic assimilation, but the impact of the (excess) size of the linguistic group, although negative, is numerically weaker and insignificant.[38] The magnitude of the impact of "own" group size on economic assimilation is sizable: If the size of the effective group increases by 1 million

[36] A country's "mother tongue" is defined as the language that most newly arrived immigrants from that country speak at home.

[37] The calculation of the variables $N_{kr}(t)$ and $A_{gr}(t)$ only use immigrants who arrived *prior* to the cohort that entered the country in year t. The geographic sorting of type k immigrants is obtained from the census cross-section in which the immigrant cohort is first enumerated. All of these calculations use the entire population of native- and foreign-born persons, regardless of age,

[38] I also estimated regression specifications that separated the two components of the effective size of a national origin group. Both the actual size of the group and the group's Herfindahl index tend to have strong negative effects on the rate of economic assimilation and the rate of human capital accumulation.

persons, the rate of economic assimilation falls by 3.7 percentage points.[39] Equally important, the introduction of these variables "nudges" the size of the cohort effects. It seems, therefore, that the increasing size of immigrant groups is correlated with the decline in the rate of economic assimilation observed across successive entry cohorts.[40] After controlling for group size, the relative decline in the rate of economic assimilation experienced by the cohort that entered in the late 1990s falls from 9.0 to 7.3 percentage points. In other words, the increasing size of the immigrant national origin group accounts for about 20 percent of the decline in the rate of economic assimilation.

To demonstrate the link between the determinants of the rate of economic assimilation and the rate of human capital acquisition, I estimated a similar set of cross-country regressions, except that the dependent variable is now the growth rate for cohort (i, k, t) in the fraction of the group that is English proficient. More precisely, I estimate the regression model in equation (13) using the dependent variable $\Delta\, p_{ik}(t)$, which gives the 10-year change in the probability that immigrants who arrived in the United States at age i, from country k, at time t speak only English or speak English very well.[41]

To ensure that the growth rate in English proficiency is a sensible measure of human capital accumulation for the immigrant cohort, I limit the regression to cohorts originating in countries outside the British "sphere of influence," so that, at least in principle, there could have

[39] For the cohort that arrived between 1995 and 2000, there were 113,000 "effective" immigrants from Jamaica; 301,000 from the Philippines; 389,000 from Cuba; and 1.8 million from Mexico.

[40] It could be argued that the size of the national origin group may be reflecting a labor demand effect: the wage falls as the group's size increases. Note, however, that the neoclassical labor demand model would imply that it is the *change* in the size of the group that leads to a *change* in the wage. The regressions reported in Table 8 conduct a very different conceptual experiment, correlating the future change in the wage with the pre-existing size of the group.

[41] I make one adjustment in the selection of the sample used to calculate the English proficiency rates. In particular, I do not exclude persons enrolled in school because some of the language investments may be occurring while the immigrants are enrolled in an educational institution.

been an increase in the English language proficiency of the immigrant cohort. This restriction reduces the number of countries in the data from 80 to 69.[42]

Table 9 summarizes the regression results. The first column again reports the coefficients of the cohort fixed effects ϕ_t. It is evident that the immigrants who immigrated in the late 1980s or 1990s have around a 6-percentage point lower rate of increase in the English proficiency rate than the immigrants who immigrated in the late 1970s. As the second column of Table 9 shows, the group's initial human capital (as measured by educational attainment) has a strong positive impact on the rate of English language acquisition. Each additional year of pre-acquired education increases the growth in the English proficiency rate by nearly 1 percentage point. The evidence, therefore, again supports the conjecture of relative complementarity in the production of human capital.

Finally, as the regression in the last column shows, the inclusion of the group size variables attenuates the magnitude of the cohort effects in the rate of human capital accumulation. Note that the (national origin) group size variable has a strong negative effect: a one million-person increase in the size of the effective national origin group reduces the growth rate in English proficiency by 4.4 percentage points. As with the economic rate of assimilation, the size of the (excess) linguistic group has a negative, but numerically weaker, effect. Finally, the coefficient of the relative cohort effect for the immigrants who entered in the late 1990s declines from -6.4 percent to -3.8 percent, so that the increasing size of the effective national origin group, and the corresponding reduction in the incentives to invest in human capital,

[42] In 2000, the 69 countries outside the British sphere of influence accounted for 93.2 percent of all immigrants.

explains about 40 percent of the decline in the rate of (language) human capital investments across the cohorts.[43]

It is easy to document that the results are not driven by the remarkable growth of Hispanic immigration in the United States. Table 10 reports selected coefficients when the regressions exclude either Mexican immigrants (in Panel A) or all Hispanic immigrants (in Panel B). Since Mexicans account for nearly a third of all immigrants in the United States and the regressions are (approximately) weighted by the sample size of a cohort, the massive size of the Mexican cohorts may be distorting the results. As the coefficients reported in Panel A show, however, the evidence is generally robust to the exclusion of Mexican immigrants from the analysis.

Panel B of the table goes a step further and simply excludes all Hispanic immigrants. The sample of 80 countries of origin now becomes a sample of 62 countries in the regressions on the rate of economic assimilation, and of 51 countries in the regressions on the rate of language acquisition (since these regressions also exclude countries in the British sphere of influence). The results are generally robust to this substantial change in specification. In view of the evidence reported in previous sections, it is not surprising that there is a slowdown in both the rate of assimilation and the rate of language acquisition even among non-Hispanic immigrants. Moreover, there is still a negative correlation between national origin group size and the dependent variables in the economic assimilation regressions (although these coefficients now

---

[43] The regression results reported in Tables 8 and 9 can be interpreted as reduced-form coefficients from a structural model that relates the rate of economic assimilation to the rate of human capital accumulation. The key coefficient in the structural model would measure the rate of return to English proficiency. Unfortunately, none of the country-specific variables used in the reduced-form regressions provide valid instruments to estimate the structural parameter. The rate of wage growth in the model of human capital accumulation presented earlier is given by $\dot{w} = g + \pi$, where g is the rate of human capital accumulation and π measures the fraction of human capital freed up for labor market uses as the individual ages. Both g and π depend on all the key parameters of the model (i.e., the initial human capital stock, K; the depreciation rate, δ; and the discounting factor, ρ). Hence none of the country-specific variables that proxy for these underlying parameters can be a valid instrument in a regression of $\dot{w}$ on g.

have much larger standard errors). The exclusion of many of the national origin groups that form a core part of U.S. immigration greatly reduces the variance in the variable measuring the size of the effective groups.[44]

In sum, the results present a remarkably consistent picture of the underlying reason for part of the observed decline in the rate of economic assimilation. In fact, the evidence suggests a potentially important hypothesis that is certain to become the focus of much research: the more recent immigrant cohorts have fewer incentives to invest in U.S.-specific human capital because the growth of the immigrant population makes those investments less profitable than they once were, and the reduced incentives have slowed the rate of economic assimilation.[45]

VI. Summary

This paper uses data drawn from the 1970-2010 decennial U.S. Censuses to document and examine the long-run trends in immigrant earnings over the past few decades. Perhaps the

[44] For example, the unweighted mean (standard deviation) of the effective size of the national origin group across all cohorts is .048 (.170). The respective statistics in the subsample of non-Hispanic cohorts are .026 (.042). Although the coefficients of the group size variables in the English proficiency regressions for the non-Hispanic sample are essentially zero, this is due to the sizable collinearity between the two size variables (since national origin and linguistic group are almost perfectly collinear in the non-Hispanic sample that also excludes the countries in the British sphere of influence). The coefficient of the national origin group size would be negative and significant if the linguistic size variable were excluded from the regression.

[45] It would be interesting to examine the trends in other types of human capital investments undertaken by the immigrant workforce. After all, English language proficiency only plays a limited (though important) role in determining the value of the stock of marketable human capital. The decennial censuses contain only one other variable (i.e., educational attainment) that could be used to examine such trends. Unfortunately, the coding of the education variable changes capriciously from one census to the next. As a result, it cannot be used to construct a consistently defined measure of "average years of education" that could be differenced within a cohort to measure the volume of educational investments. One alternative would be to focus on a particular achievement—such as obtaining a college degree. This approach, however, is also problematic because obtaining a college diploma at older ages is a relatively infrequent event *and* the coding that defines a "college graduate" changes over time. As an example, the fraction of immigrants who entered the country in the late 1990s and have a college degree rose by only 0.9 percent in the first 10 years (from 37.0 to 37.9 percent), so that much of the variation in the change in college completion rates may be dominated by (non-classical) sampling error. In fact, 40.5 percent of the cohorts examined in this section report a negative value for the 10-year change in college enrollment rates. In contrast, 23.3 percent report a negative value for the 10-year change in the English proficiency rate.

main finding of the paper is that there are cohort effects not only in the entry wage of immigrants, with more recent cohorts having relatively lower entry wages, but there are also cohort effects in the rate of growth of earnings, with more recent cohorts having a much smaller rate of economic assimilation.

The crucial question, of course, is whether the decline in the rate of wage convergence represents a "true" decline in the rate of human capital accumulation or a spurious correlation caused by other factors. The analysis reported in this paper conducted a number of sensitivity tests to establish that the decline in the rate of economic assimilation was *not* due to the possibility that: (1) period effects change the wage structures of immigrants and natives differentially; (2) the changing national origin composition of immigrants may lead to an immigrant population where the "average" immigrant is now less likely to assimilate; (3) the changing geographic settlement of immigrants in the United States has reduced, on average, the assimilation rate of the typical immigrant.

Instead, the data seem to suggest that at least part of the decline in assimilation reflects a measurable reduction in the actual rate of human capital accumulation. In particular, the more recent immigrant cohorts are improving their English language skills at a far slower rate than earlier cohorts. In fact, the study identifies one factor that seems to explain part of the decline in both the rate of economic assimilation and the rate of human capital acquisition: the rapid growth in the size of specific national origin groups in the United States. Immigrants are less likely to assimilate and to invest in human capital the larger the size of the national origin group in the United States. The growth in the size of national origin groups accounts for about a quarter of the decline in the rates of human capital acquisition and economic assimilation.

Because of the potential significance of the evidence, it is prudent to conclude by stressing the need for caution in the interpretation of the findings and the need for replication of the results before we can unequivocally assert that the trends revealed by the Census data describe an important part of the immigrant experience in the U.S. labor market. Moreover, although the analysis conducted a large number of sensitivity tests to determine if the decline in economic assimilation could arise “spuriously,” I suspect that many other such tests can be (and should be) designed and carried out. It is obviously important to determine precisely the extent to which the earnings trends reported in this paper can be attributed to concurrent changes in the rate of human capital acquisition.

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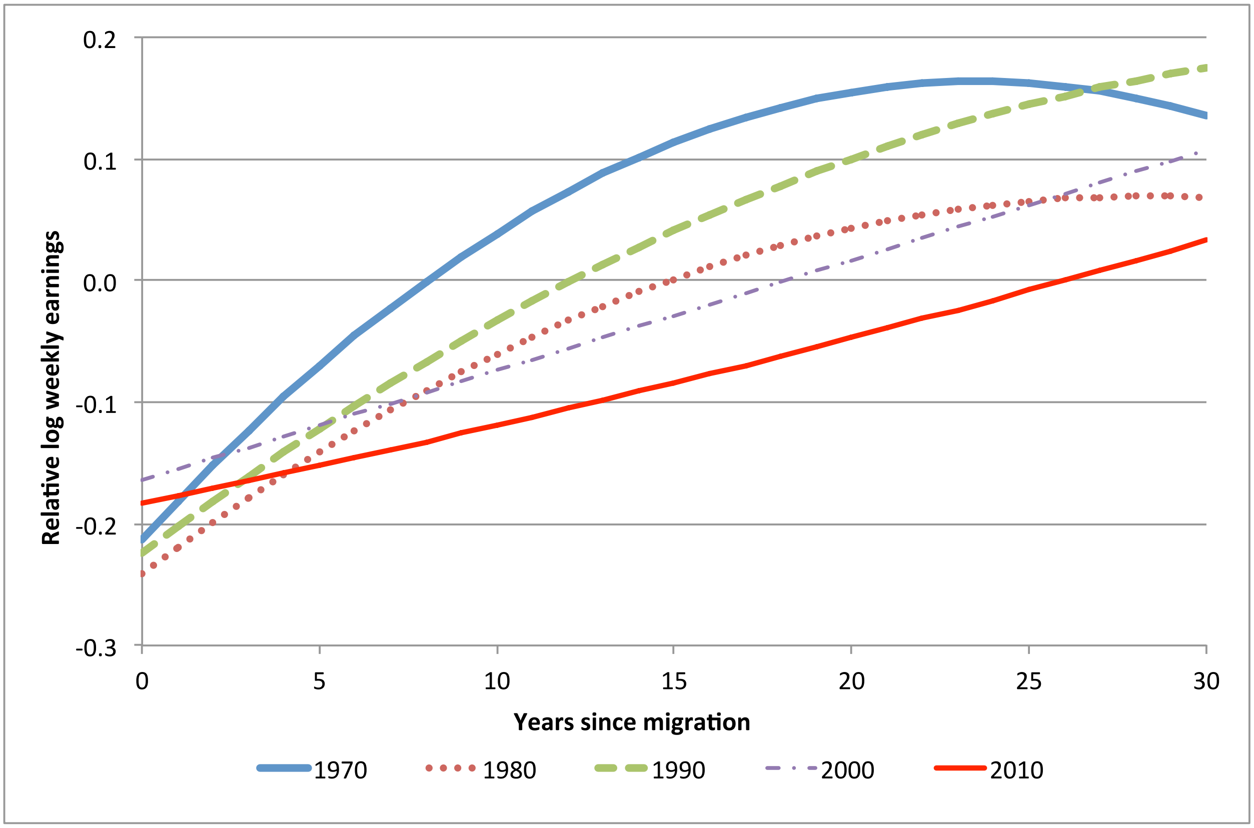
Figure 1. Cross-section relative earnings profiles, 1970-2010



Notes: The cross-section relative earnings profiles are constructed using the regression coefficients reported in Table 1, assuming that education and age have the same value for immigrants and natives.

Table 1. Cross-section earnings functions, 1970-2010

	Census				
Variable:	1970	1980	1990	2000	2010
Years of education	.072	.066	.090	.097	.116
	(.0002)	(.0001)	(.0002)	(.0002)	(.0002)
Immigrant indicator	-.213	-.241	-.224	-.164	-.183
	(.007)	(.005)	(.004)	(.003)	(.005)
Years in U.S.	.032	.022	.022	.009	.006
	(.001)	(.001)	(.001)	(.0005)	(.001)
Years in U.S. squared (÷100)	-.068	-.039	-.029	.0002	.004
	(.004)	(.003)	(.002)	(.001)	(.002)

Notes: Standard errors are reported in parentheses. The dependent variable gives the log weekly earnings of a worker. All regressions also include the worker's age (introduced as a second-order polynomial). The number of observations in the regressions are: 1970, 945,579; 1980, 2,002,074; 1990, 2,373,285; 2000, 2,708,438; 2010, 1,653,425.

Table 2. Age-adjusted relative weekly earnings of immigrant cohorts, by census

Cohort:	1970	1980	1990	2000	2010	Alternative 2010 data
2005-2009 arrivals	---	---	---	---	-.326	-.421
					(.004)	(.005)
2000-2004 arrivals	---	---	---	---	-.349	-.380
					(.003)	(.004)
1995-1999 arrivals	---	---	---	-.273	-.278	-.277
				(.004)	(.001)	(.003)
1990-1994 arrivals	---	---	---	-.269	-.271	-.259
				(.003)	(.003)	(.001)
1985-1989 arrivals	---	---	-.331	-.269	-.259	-.257
			(.001)	(.002)	(.005)	(.003)
1980-1984 arrivals	---	---	-.285	-.236	-.206	-.223
			(.001)	(.002)	(.006)	(.005)
1975-1979 arrivals	---	-.314	-.185	-.176	-.134	-.160
		(.001)	(.001)	(.005)	(.004)	(.005)
1970-1974 arrivals	---	-.223	-.124	-.128	-.053	-.094
		(.001)	(.002)	(.006)	(.004)	(.004)
1965-1969 arrivals	-.235	-.122	-.020	-.014	.205	.039
	(.001)	(.001)	(.003)	(.005)	(.010)	(.005)
1960-1964 arrivals	-.058	-.041	.046	.074	---	---
	(.001)	(.001)	(.004)	(.004)		
1950-1959 arrivals	.037	.032	.100	.147	---	---
	(.001)	(.001)	(.003)	(.010)		

Notes: Standard errors are reported in parentheses and are clustered at the cohort level. The age-adjusted wage differentials between each immigrant cohort and natives are calculated from a regression estimated separately in each cross-section where the dependent variable gives the log weekly earnings of a worker and the regressors include the worker's age (introduced as a third-order polynomial). The age-adjusted relative wages are calculated at the mean level of age in each census. The regressions also include a fixed effect for the residual immigrant cohort that arrived before 1950. The "2010" data is composed of the pooled 2009-2011 American Community Surveys. The "alternative 2010 data" is composed of the pooled 2005-2007 ACS. The number of observations in the regressions are: 1970, 945,579; 1980, 2,002,074; 1990, 2,373,285; 2000, 2,708,438; 2010, 1,653,425; and alternative 2010, 1,711,466.

Table 3. Estimated aging and cohort effects in repeated Census cross-sections (Specification allowing for level cohort effects)

Variable:	1970-2010	1970-1990	1990-2010
A. Excludes educational attainment			
Relative entry wage:			
1965-1969 arrivals	-.139	-.211	.008
	(.033)	(.031)	(.039)
1975-1979 arrivals	-.255	-.316	-.146
	(.033)	(.032)	(.038)
1985-1989 arrivals	-.329	-.369	-.246
	(.033)	(.027)	(.033)
1995-1999 arrivals	-.297	---	-.219
	(.030)		(.031)
2005-2009 arrivals	-.344	---	-.275
	(.024)		(.025)
Relative wage growth in first 10 years	.056	.127	-.008
	(.041)	(.038)	(.036)
Relative wage growth in first 20 years	.075	.196	-.044
	(.037)	(.034)	(.033)

Notes: Standard errors are reported in parentheses and are clustered at the cohort level. The 1970-2010 regression has 9,682,801 observations; the 1970-1990 regression has 5,320,938 observations; and the 1990-2010 regression has 6,735,148 observations. All regressions include the worker's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign- or native-born. The calculation of the relative wage growth in the first 10 or 20 years assumes that the immigrant arrives in the United States at age 25.

Table 4. Generalized regression model allowing for cohort effects in both wage levels and wage growth rates

Cohort:	1. Basic specification	2. Using 2005-2007 pooled ACS	3. Using education-age deflator	4. Including period-education-age fixed effects
Relative entry wage:				
1965-1969 arrivals	-.214	-.207	-.214	-.154
	(.020)	(.020)	(.028)	(.018)
1975-1979 arrivals	-.302	-.298	-.265	-.191
	(.020)	(.020)	(.029)	(.018)
1985-1989 arrivals	-.350	-.350	-.300	-.199
	(.019)	(.017)	(.027)	(.018)
1995-1999 arrivals	-.271	-.269	-.245	-.134
	(.016)	(.013)	(.021)	(.018)
2005-2009 arrivals	-.301	-.444	-.226	-.163
	(.037)	(.013)	(.033)	(.018)
Relative wage growth in first 10 years:				
1965-1969 arrivals	.133	.126	.126	.123
	(.025)	(.025)	(.037)	(.019)
1975-1979 arrivals	.111	.106	.097	.105
	(.025)	(.026)	(.038)	(.019)
1985-1989 arrivals	.090	.090	.066	.076
	(.024)	(.022)	(.036)	(.019)
1995-1999 arrivals	.026	.006	.032	.007
	(.020)	(.015)	(.025)	(.018)

Notes: Standard errors are reported in parentheses and are clustered at the cohort level. The regressions in columns 1, 3, and 4 have 9,682,801 observations; the regression in column 2 has 9,740,842 observations. All regressions include the worker's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign- or native-born. The calculation of the relative wage growth in the first 10 years assumes that the immigrant arrives in the United States at age 25.

Table 5. Sensitivity of estimated cohort effects to compositional changes

Cohort:	(1)	(2)	(3)	(4)	(5)
Relative entry wage:					
1965-1969 arrivals	-.214	-.213	-.291	-.297	-.214
	(.020)	(.023)	(.025)	(.020)	(.023)
1975-1979 arrivals	-.302	-.241	-.303	-.284	-.232
	(.020)	(.020)	(.021)	(.020)	(.023)
1985-1989 arrivals	-.350	-.258	-.322	-.291	-.254
	(.019)	(.017)	(.018)	(.019)	(.022)
1995-1999 arrivals	-.271	-.149	-.183	-.172	-.188
	(.016)	(.015)	(.016)	(.017)	(.022)
2005-2009 arrivals	-.301	-.198	-.228	-.168	-.195
	(.037)	(.016)	(.017)	(.019)	(.023)
Relative wage growth in first 10 years:					
1965-1969 arrivals	.133	.098	.101	.092	.112
	(.025)	(.020)	(.020)	(.022)	(.023)
1975-1979 arrivals	.111	.086	.083	.071	.103
	(.025)	(.020)	(.020)	(.022)	(.023)
1985-1989 arrivals	.090	.072	.071	.051	.074
	(.024)	(.020)	(.020)	(.022)	(.022)
1995-1999 arrivals	.026	-.024	-.031	-.021	.016
	(.020)	(.018)	(.019)	(.018)	(.018)
Controls for:					
Country of origin	No	Yes	Yes	Yes	Yes
State of residence	No	No	Yes	Yes	Yes
Education-age deflator	No	No	No	Yes	Yes
Educational attainment	No	No	No	No	Yes

Notes: Standard errors are reported in parentheses and are clustered at the cohort level. The regressions in columns 1 and 2 have 9,682,801 observations; the regressions in columns 3 through 5 have 9,367,529 observations. All regressions include the worker's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign- or native-born. The regression in column 5 includes the worker's years of educational attainment interacted with a variable indicating if the person is foreign- or native-born. The calculation of the relative wage growth in the first 10 years assumes that the immigrant arrives in the United States at age 25.

Table 6. Age-adjusted probabilities of speaking English very well, by year

Cohort:	1980	1990	2000	2010
A. All immigrants				
2005-2009 arrivals	---	---	---	.372
2000-2004 arrivals	---	---	---	.360
1995-1999 arrivals	---	---	.402	.395
1990-1994 arrivals	---	---	.406	.417
1985-1989 arrivals	---	.404	.406	.430
1980-1984 arrivals	---	.426	.451	.476
1975-1979 arrivals	.396	.478	.495	.510
1970-1974 arrivals	.423	.520	.543	.584
B. Originating in countries outside British sphere				
2005-2009 arrivals	---	---	---	.315
2000-2004 arrivals	---	---	---	.310
1995-1999 arrivals	---	---	.332	.352
1990-1994 arrivals	---	---	.346	.375
1985-1989 arrivals	---	.327	.355	.395
1980-1984 arrivals	---	.369	.408	.445
1975-1979 arrivals	.309	.428	.462	.493
1970-1974 arrivals	.364	.480	.517	.571

Notes: The age-adjusted probability of speaking English very well is calculated from a linear probability model estimated separately in each cross-section. The dependent variable is a dummy variable set to unity if the immigrant speaks only English or speaks English very well and zero otherwise, and the regressors include the worker's age (introduced as a third-order polynomial). The age-adjusted probabilities are calculated at the mean level of age in each census. Although the standard errors are not reported, they typically lie between .01 and .02, even after clustering at the cohort level. The number of observations in the regressions in the top panel are: 1980, 103,947; 1990, 162,484; 2000, 289,061; 2010, 197,371. The number of observations in the regressions in the bottom panel are: 1980, 91,126; 1990, 146,578; 2000, 264,918; 2010, 181,718.

Table 7. Summary statistics for 10 largest national origin groups (by country of origin, age-at-arrival, and year-of-arrival)

	Rate of economic assimilation			Increase in rate of English language proficiency		
Group:	1975-79	1985-89	1995-99	1975-79	1985-89	1995-99
Arrived at age 25-34:						
Mexico	0.027	0.054	-0.055	0.093	0.022	0.013
El Salvador	0.129	0.105	0.044	0.052	0.060	0.046
Guatemala	0.121	0.067	-0.010	0.207	0.083	0.036
Cuba	0.150	0.176	-0.043	-0.042	0.154	0.113
Dominican Republic	0.094	-0.091	-0.156	0.109	-0.025	0.008
China	0.102	0.426	0.232	0.081	0.214	0.100
Korea	0.266	0.122	-0.078	0.125	0.034	0.019
Philippines	0.203	0.180	0.101	0.147	0.095	0.120
Vietnam	0.182	0.153	-0.096	0.103	0.084	0.009
India	0.334	0.243	0.115	0.132	0.100	0.055
Arrived at age 35-44:						
Mexico	0.101	0.178	0.074	0.064	-0.014	-0.006
El Salvador	0.213	0.219	0.204	0.147	0.024	-0.033
Guatemala	0.036	0.137	0.037	0.103	-0.021	0.034
Cuba	0.278	0.230	0.020	0.061	0.072	0.028
Dominican Republic	0.382	-0.010	0.016	0.022	-0.080	0.059
China	0.064	0.153	0.024	0.030	0.110	0.029
Korea	0.150	-0.020	-0.226	0.036	-0.022	0.044
Philippines	0.081	0.245	0.096	0.094	-0.012	0.049
Vietnam	0.168	0.247	-0.062	-0.025	-0.015	0.030
India	0.242	0.216	0.087	0.074	0.025	-0.016

Notes: The rate of economic assimilation gives the rate of wage growth experienced by the immigrant cohort during the first decade in the United States relative to that experienced by comparably aged native workers, using the education-age specific deflator. The rate of English language acquisition gives the increase in the fraction of the cohort that speaks only English or speaks English very well over the first decade in the United States.

Table 8. Determinants of economic assimilation in first 10 years

Variable:	(1)	(2)	(3)	(4)
Arrived in 1985-1989	-.028	-.023	-.028	-.025
	(.022)	(.021)	(.020)	(.020)
Arrived in 1995-1999	-.091	-.089	-.090	-.073
	(.016)	(.016)	(.016)	(.021)
Educational attainment of cohort at time of entry	---	.006	.004	.001
		(.002)	(.003)	(.004)
Log per-capita GDP of source country	---	-.024	-.019	-.015
		(.007)	(.009)	(.011)
Repressive government in source country	---	---	.023	.038
			(.015)	(.023)
Geographic distance from U.S. (=1 if > 3000 miles)			.024	.011
			(.019)	(.021)
Effective number of immigrants from source country (in millions)	---	---	---	-.037
				(.016)
Effective number of other linguistic compatriots (in millions)	---	---	---	-.005
				(.013)

Notes: Standard errors are reported in parentheses and are clustered at the source country level. The unit of observation in the regression is an immigrant cohort defined by age at arrival, source country, and year of arrival. The regressions are weighted by $n_0 n_1/(n_0 + n_1)$, where n_0 is the sample size used to calculate the cohort's mean log wage at the beginning of the decade and n_1 is the respective sample size at the end of the decade. The regressions have 1,430 observations and include fixed effects indicating the age at arrival and the calendar year of entry. The excluded cohort fixed effect indicates if the immigrants arrived between 1975 and 1979. The rate of economic assimilation gives the rate of wage growth experienced by the immigrant cohort during the first decade in the United States relative to that experienced by comparably aged native workers, using a deflator that is education-age specific.

Table 9. Determinants of increase in English language proficiency in first 10 years

Variable:	(1)	(2)	(3)	(4)
Arrived in 1985-1989	-.060	-.063	-.061	-.053
	(.009)	(.008)	(.008)	(.008)
Arrived in 1995-1999	-.059	-.067	-.064	-.038
	(.010)	(.011)	(.009)	(.009)
Educational attainment of cohort at time of entry	---	.007	.005	.001
		(.001)	(.002)	(.001)
Log per-capita GDP of source country	---	.012	.012	.019
		(.004)	(.004)	(.003)
Repressive government in source country	---	---	.001	.020
			(.009)	(.005)
Geographic distance from U.S. (=1 if > 3000 miles)	---	---	.016	-.010
			(.013)	(.011)
Effective number of immigrants from source country (in millions)	---	---	---	-.044
				(.006)
Effective number of other linguistic compatriots (in millions)	---	---	---	-.013
				(.007)

Notes: Standard errors are reported in parentheses and are clustered at the source country level. The unit of observation in the regression is an immigrant cohort defined by age at arrival, source country, and year of arrival. The regression excludes source countries in the British "sphere of influence." The regressions are weighted by $n_0 n_1/(n_0 + n_1)$, where n_0 is the sample size used to calculate the cohort's English proficiency rate at the beginning of the decade and n_1 is the respective sample size at the end of the decade. The regressions have 1,233 observations and include fixed effects indicating the age at arrival and the calendar year of entry. The omitted cohort fixed effect indicates if the immigrants arrived between 1975 and 1979.

Table 10. Sensitivity of results to the growth of Hispanic immigration

	Rate of economic assimilation			English language proficiency		
Variable:	(1)	(2)	(3)	(1)	(2)	(3)
A. Excluding Mexicans						
Arrived in 1985-1989	-.050	-.045	-.037	-.056	-.059	-.053
	(.020)	(.019)	(.020)	(.011)	(.010)	(.010)
Arrived in 1995-1999	-.089	-.086	-.065	-.046	-.053	-.039
	(.021)	(.022)	(.022)	(.010)	(.009)	(.009)
Size of national origin group	---	---	-.213	---	---	-.101
(in millions)			(.166)			(.148)
Size of other linguistic	---	---	-.012	---	---	-.013
compatriots (in millions)			(.014)			(.008)
B. Excluding Hispanics						
Arrived in 1985-1989	-.041	-.037	-.034	-.054	-.057	-.052
	(.023)	(.022)	(.022)	(.013)	(.012)	(.013)
Arrived in 1995-1999	-.075	-.071	-.062	-.039	-.045	-.035
	(.025)	(.027)	(.024)	(.012)	(.010)	(.012)
Size of national origin group	---	---	-.318	---	---	-.012
(in millions)			(.166)			(.148)
Number of other linguistic	---	---	.112	---	---	-.073
compatriots (in millions)			(.107)			(.118)
Includes country characteristics	No	Yes	Yes	No	Yes	Yes

Notes: Standard errors are reported in parentheses and are clustered at the source country level. The unit of observation in the regression is an immigrant cohort defined by age at arrival, source country, and year of arrival. The regression excludes source countries in the British "sphere of influence." The regressions are weighted by $n_0n_1/(n_0 + n_1)$, where n_0 is the sample size used to calculate the cohort's log wage or English proficiency rate at the beginning of the decade and n_1 is the respective sample size at the end of the decade. The regressions that exclude the Mexican national origin group have 1,412 observations when the dependent variable is the rate of economic assimilation and 1,215 observations when the dependent variable is the rate of English language acquisition. The sample sizes in the non-Hispanic sample are 1,107 and 910 observations, respectively. The omitted cohort fixed effect indicates if the immigrants arrived between 1975 and 1979. The vector of "country characteristics" includes all the other variables in the regressions reported in columns 3 of Tables 8 and 9.