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The Elusive Concept of Immigrant Quality: Evidence from 1970-1990

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Abstract

The labor market "quality" of immigrants is a subject of debate among immigration researchers, and a major public policy concern. However, traditional methods of measuring human capital are particularly difficult to apply to recently arrived immigrants. Many factors that have a negative effect on entry earnings also increase either the incentive or the opportunity for faster human capital investment and earning growth. In addition, many country-of-origin acquired skills that are not immediately valued in the U.S. labor market are useful to the acquisition of U.S. skills. Thus entry earnings are not a good measure of the stock of immigrant human capital.

This article presents a model of immigrant human capital investment and, using 1970-1990 census data, presents strong evidence of a systematic and important inverse relationship between initial immigrant earnings and subsequent earnings growth. This result—which persists even after accounting for differences in the immigration flows from different countries, sampling error, and the effects of emigration—is fundamentally different from both earlier cross-sectional estimates and more recent pooled models that constrain cohort growth rates to be equal. Although our model provides theoretical support for an inverse relationship only when source country human capital is held constant, faster earnings growth for low-entry-earnings immigrants is found empirically even when age and education are not controlled for.

The immigrant human capital investment model presented here explores general principles that may apply to other labor market transitions that involve skill transferability—including occupational change and labor market reentry.

JEL Codes: J61, J24, F22, J1

Keywords: immigration, migration, human capital investment, skill transferability, assimilation

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The Elusive Concept of Immigrant Quality:
Evidence from 1970-1990

The “quality” of immigrants to the United States has historically been of great popular and political concern. A current concern, prompted by a large unexplained decline in the initial earnings of immigrants, is that recent immigrants may be of lower labor market quality than their predecessors (Borjas, 1985, 1987, 1992, 1994). Yet, if entry earnings are correlated with any factor that increases the return to human capital investments, then immigrant entry earnings are not a good measure of either human capital or unmeasured immigrant quality: home-country skills and attributes that do not yield an immediate labor market return may still represent human capital in a meaningful way if they aid the acquisition of U.S. skills.

Skills transferability provides a plausible explanation for much of the across-group and over-time variation in the education-adjusted entry earnings of immigrants (Chiswick, 1978, 1979; Duleep and Regets, 1997c).[1] However, initial skill transferability affects more than just entry earnings. If skills transferability is the dominant source of variation in education-adjusted entry earnings (as opposed to differences in intrinsic ability) then we would expect an inverse relationship between the education-adjusted entry earnings and earnings growth of immigrants. This occurs because of higher rates of human capital investment by immigrants that are directly related to their untransferred human capital. Although formal education is just one form of human capital investment (and for adults probably much less important than on-the-job and occupational investments), at every age above 21, recent immigrants report higher school attendance than their native counterparts (Figure 1).

[1]The lower entry earnings of recent immigrants may reflect lower skill transferability either because skills acquired in less-developed countries are less useful to American employers, than those acquired in advanced economies (Chiswick, 1979, 1980), or because limited opportunities in less-developed countries make migration worthwhile even with substantial post-migration investment (Duleep and Regets, 1997c). A supplemental explanation is the increase in the U.S. earnings differential between high- and low-skill workers that has occurred.

This paper explores both theoretical and observed patterns of immigrant earnings and investment. Despite extensive research in this area, three errors are commonly made: a conceptual error of equating earnings with level of human capital, a statistical design error of assuming in pooled or cross-sectional models that earnings growth rates are constant across entry cohorts, and an analytical and policy error of assuming that differences in entry earnings measure differences in immigrant quality. The next section presents a theoretical model that explains why we would expect an inverse relationship between entry earnings and earnings growth rates. Following this, we examine the association between the entry earnings of country-of-origin/age/education immigrant cohorts and earnings growth, first across countries of origin using 1980 and 1990 census data, and then over time for the same source countries using 1970-1990 census data. We find a strong inverse relationship between entry earnings and earnings growth that persists when we estimate it with a straightforward new methodology that circumvents regression-to-the-mean bias caused by sampling error. Our result suggests that the current concept of unmeasured immigrant quality is cloaked in the emperor's new clothes, diverting attention away from important behavioral issues such as differential investments. Methodological, conceptual and policy implications of the inverse relationship are discussed in the conclusion.

I. Why We Would Expect an Inverse Relationship between Immigrant Entry Earnings and Earnings Growth: Theoretical Development[2]

A simple two-period model of human capital investment can be used to describe the human capital investments of natives as follows:

$$\max_{\theta} \; w H_1 (1-\theta) + w (H_1 + \gamma f(H_1,\theta)) \qquad 1.1$$

where w is the market rate of return on a unit of human capital, H_1 is the initial stock of human capital,

[2]The components of this model have been present in earlier versions (e.g. Duleep and Regets, 1992a and 1994a).

and θ is the proportion of available time devoted to investment in the first period.[3] The optimal investment decision, θ^*, maximizes total earnings over the two periods. The production function of human capital is denoted $\gamma f(H_1,\theta)$ where f is a positive function of θ and H_1. The human capital production function is a function of γ, a human capital productivity coefficient that may vary across individuals. We assume that the production function is concave in θ and H_1 and that the cross derivative between initial human capital and investment is positive: $f_{\theta\theta}(H_1, \theta) < 0$, $f_{H_1 H_1}(H_1, \theta) < 0$, and $f_{\theta H}(H_1, \theta)>0$.

Even in this simple framework, the human capital investment decision of immigrants is more complicated and requires the introduction of two skill transferability parameters.

An immigrant's initial stock of human capital, H_1, was produced in their source country and may not be fully valued in their destination country. It is necessary to introduce a factor, τ_M, the proportion of source-country human capital that is initially valued in the labor market of the destination country. We shall refer to this skill transferability parameter as "skill transferability to the labor market." Introducing this parameter formalizes the discussion of international transferability of skills put forth by Chiswick (1978a, 1979).

An immigrant's initial stock of human capital may also not fully transfer to the production of new, destination-country, human capital. To capture this feature, we introduce a factor, τ_P, the proportion of source-country human capital that transfers to the production of new, destination-country human capital. We shall refer to this second skill transferability parameter as "skill transferability to human capital production."

Thus, for immigrants, the two-period model of human capital investment becomes:

[3]While the proportion of time devoted to investment is a convenient concept of θ for exposition of the model, it could also be usefully thought of as the proportion of the U.S. market value of initial human capital that is foregone as a result of investment. This broader concept would include traditional forms of human capital investment such as apprenticeships or simply taking a job with lower initial pay, but greater opportunity for

$$\max_{\theta} w\, \tau_M H_1 (1\text{-}\theta) + w\, (\tau_M H_1 + \gamma\, \tau_P\, f(H_1, \theta)) \qquad 1.2$$

When $\tau_M < 1$, the opportunity cost of investment for immigrants is lower than for natives with the same level of human capital in period 1. Among immigrants with the same level of human capital, the opportunity cost differential between those with high skill transferability to the labor market (τ_M^{HT}) versus low skill transferability to the labor market (τ_M^{LT}) is $w\, H_1\, (\tau_M^{HT} - \tau_M^{LT})$. Yet, despite lower opportunity costs, there would not necessarily be a greater incentive for immigrants to invest in destination-country human capital than natives, or for immigrants with low labor market skill transferability to invest more than immigrants with high labor market skill transferability. Offsetting the lower opportunity costs associated with low labor market transferability are lower returns to investment because of less human capital transferring to the production of new human capital. If $\tau_M = \tau_P$, the lower opportunity cost of investment resulting from low skill transferability to the labor market will be completely offset by higher respective production costs. We would argue, however, that when $\tau_M < 1$, τ_M is always less than τ_P and that as skill transferability to the labor market, τ_M, falls, the transference of source-country human capital to the production of new skills, τ_P, falls less. In other words, when $\tau_M < 1$ source-country human capital is more valuable in learning than in earning, and this difference increases as skill transferability to the labor market falls. Our reasoning follows.

A sound assumption is that whatever portion of source-country human capital transfers to the labor market is also useful in the production of destination-country human capital. Thus τ_P is always at least as large as τ_M. When $\tau_M = 1$, $\tau_P = 1$ and the investment decisions of immigrants and natives are indistinguishable. As τ_M decreases, τ_P never decreases by more than τ_M decreases.

Furthermore, source-country human capital that is not valued in the destination country's labor market is still useful in producing new human capital. There are several reasons for this.

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advancement.

• Part of the difficulty in transferring human capital between the labor markets of countries is not its innate productivity in the production of good and services, but a matter of information costs and risks. It can be much harder for potential employers to evaluate foreign educational credentials and work experience. However, real abilities are useful in gaining new skills. In addition, individuals' superior knowledge of their own abilities will be used in making their human capital investment decisions.

• Learning skills—the set of abilities and experiences that aid in learning new knowledge and skills—should transfer more readily than skills more specifically related to the business and production practices in the origin and destination countries. Those with home-country skills have learned how to learn; previously learned work and study habits may greatly facilitate the learning of destination-country skills.

• Similarity and common elements between old and new skills aid learning. Although the technologies in producing goods and services differ across countries—particularly between developed and less-developed countries—the processes, materials, and ultimate aims are analogous. Thus, skills acquired in a less-developed source country are useful for learning skills in a more-developed destination country: a Cambodian carpenter's experience with a hand saw is useful in learning to use an electric saw. More generally, persons who have learned one set of skills—even if those skills are not valued in the destination-country labor market—have advantages in learning a new set. Cognitive psychologists refer to this phenomenon as "transfer" (Mayer and Wittrock, 1996).

These ideas suggest that as skill transferability to the labor market (τ_M) falls, skill transferability to human capital production, τ_P, falls less, since some of the source-country human capital that is not valued in the labor market will still be useful in producing new human capital. Even when $\tau_M = 0$, that is when source-country skills have zero destination-country market value, τ_P will still be positive. Since when $\tau_M=1$, $\tau_P=1$, and when $\tau_M=0$, τ_P is positive, then (in the absence of any discontinuity) the difference between τ_P and τ_M must grow as labor market skill transferability falls.

Since τ_M falls more than τ_P, the opportunity cost of source-country human capital applied to human capital investment falls more than the value of that human capital in producing new, destination-country human capital. This implies that as skill transferability to the labor market falls, the incentive to invest in destination-country human capital grows: θ^*, the optimal level of investment will be greater for immigrants with low skill transferability to the destination-country labor market than for immigrants with high skill transferability to the labor market. Given the concavity of the production function in θ, θ^* will increase the smaller τ_M is relative to τ_P. This is evident from the first order condition:

$$\gamma f_\theta (H_1, \theta) = \tau_M / \tau_P H_1$$

More explicitly, applying the implicit function theorem to the first order condition:

$$\partial \theta^* / \partial \tau_M = H_1 / \gamma \tau_P f_{\theta\theta} (H_1, \theta) < 0$$

The greater investment means that the initial earnings differential between immigrants will be even greater than reflected by the difference in their skill transferability to the destination-country labor market.[4] In comparing immigrants with the same level of source-country human capital, but different degrees of transferability of this human capital to the destination-country labor market, this model implies faster earnings growth for the immigrants with lower skill transferability to the labor market. The same faster earnings growth is implied for any immigrants with imperfect skill transferability to the labor market relative to natives, with natives represented as a special case where $\tau_M=\tau_P=1$.

[4]Another model with a similar principal prediction of greater immigrant human capital investment is in

In addition to faster earnings growth for migrants with low skill transferability to the labor market, several other empirical predictions flow from this model of immigrant human capital investment:

1. *Holding source-country human capital constant, there will be an inverse relationship between initial earnings and earnings growth.*

If we roughly control for the level of source-country human capital through age and education variables, this model yields an empirical prediction of an inverse relationship between initial immigrant earnings and earnings growth. Where earnings differences result from the degree of skill transferability of source-country human capital to the labor market, lower initial earnings are associated with greater human capital investment.

2. *The lower the degree of skill transferability to the destination country's labor market, the more likely it is that immigrants with high levels of source-country human capital will invest more than immigrants with low levels of source-country human capital.*

Generally speaking, an increase in prior education or experience could increase or decrease human capital investment since an increase in prior human capital increases both the opportunity cost and the productivity of time spent investing. In our model, as τ_M decreases, τ_P decreases less: as skill transferability to the labor market decreases, the productivity of source-country human capital increases relative to its opportunity cost, and the incentive to invest increases. In terms of the model, the effect of H_1 on optimal human capital investment, θ^*, moves in a positive direction as τ_M decreases: if an increase in source-country human capital increased human capital investment, then a decrease in labor market skill transferability increases this increase; if an increase in source-country human capital decreased human capital investment, then a decrease in labor market skill transferability decreases this decrease. More formally,

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Eckstein-Weiss(1998).

$$\partial (\partial \theta^* / \partial H_1)/\partial \tau_M = 1/\tau_P f_{\theta\theta} (H_1, \theta) < 0$$

Whether an increase in source-country human capital will actually increase human capital investment depends upon the relationship between labor market skill transferability and the cross derivative in human capital production between investment θ and the initial level of human capital H_1.

$$\partial \theta^* / \partial H_1 = (- f_{\theta H} (H_1, \theta) + \tau_M/\tau_P) / f_{\theta\theta} (H_1, \theta)$$

Since $f_{\theta\theta} (H_1, \theta) < 0$, optimal investment will increase with an increase in H_1 if and only if $\tau_M/\tau_P < f_{\theta H} (H_1, \theta)$. The smaller the skill transferability to the labor market (τ_M) is relative to the skill transferability to human capital production (τ_P), the more likely it is that an increase in source-country human capital will increase human capital investment.[5]

The above considerations suggest that we are more likely to observe greater relative earnings growth for highly educated immigrants versus poorly educated immigrants if they come from a country with less similarity to the United States, and thus lower skill transferability to the U.S. labor market. To the extent that lower skill transferability leads to greater investment by more highly educated immigrants, the inverse relationship between entry earnings and earning growth will be greater for that group.[6]

3. *Holding education constant, there will be a stronger inverse relationship between entry earnings and earnings growth for younger workers.*

This can be seen if the two-period model given above is simply extended to a third period in which only workers that are young in period 1 may have earnings.

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[5]An alternative way to interpret this condition is to focus on the magnitude of the cross derivative. The more that an increase in H_1 increases the productivity of investment in new human capital, the more likely it is that an increase in H_1 will increase investment as the productivity of H_1 is increased relative to its opportunity cost.

[6]If natives are the special case of perfect skill transferability, we would expect education to have a more positive effect on further human capital investment for immigrants than for natives.

It is a common result from human capital models and empirical estimates that the young engage in more human capital investment since they have a longer period over which to receive a return from new human capital. In this model, youth makes investment more likely, and increases the sensitivity of investment to the rate of initial skill transferability. In addition, longer time horizons increase the likelihood that the more highly educated will have greater rates of investment.

II. The Relationship between Entry Earnings and Earnings Growth

The relationship between initial earnings and earnings growth can be directly examined by following various immigrant entry cohorts across decennial censuses.[7] We used the 1980 Census 5% Public Use Micro Sample and a 1990 Census 6% microdata sample to examine the entry earnings and earnings growth of adult immigrants who migrated between 1975 and 1980.[8] Given the sensitivity of immigrant earnings growth estimates to slightly different model assumptions (Lalonde and Topel, 1992), we pursued a simple non-parametric approach that avoids assumptions about the earning profile's functional form or the appropriate reference group against which earnings differentials are measured and avoids confounding effects of age and assimilation (Kossoudji, 1989; Friedberg, 1993).

Median earnings were measured within education and age subsets for 24 countries or regions of origin.[9] Entry earnings were measured by the earnings reported in 1980 by the 1975-1980 entry

[7]Due to data limitations in the 1970 census and the only indirect identification of wage rates in 1980 and 1990, we focus on annual earnings.

[8]The 1990 census sample used in our analyses is a 6 percent microdata sample created by combining and reweighting the 1990 Public Use 5% and 1% samples. The 1980 census sample is the 5 percent "A" Public Use Sample. The 1970 census sample, is the 1% State Public Use Sample (5% questionnaire).

[9]Median rather than mean earnings were used since the median is a much less volatile measure of central tendency in small samples. The source areas are: Africa, Canada, Jamaica, Britain, Germany, Greece, Italy, Portugal, Other Non-Communist Europe, Poland, Yugoslavia, Other Communist Europe, China/Taiwan, Japan, Korea, India, Islamic Southwest Asia, Philippines, Other Asia, Oceania, Cuba, Mexico, Other Central

cohort.[10] The earnings growth rate of each of the country/age/education groups was then measured by the difference between their 1980 earnings and their respective earnings ten years later, as measured by the 1990 census, dividing the difference by their 1980 earnings. An alternative approach would be to first estimate a parametric model and then, using the predicted values, estimate the correlation between the predicted entry earnings and predicted earnings growth. Although our approach ignores information beyond the median within each age/education/country cell, we can be very certain that our results are not the product of a particular set of model assumptions.

Consistent with standard professional practice in estimating Mincer earnings functions, immigrant regression models that pool entry cohorts from two or more censuses typically limit the sample to employed individuals, and exclude the self-employed.[11] These sample limitations may create severe problems when following a "synthetic" cohort over time: individuals eligible for the sample in the first census through normal employment may be ineligible for the sample in the second census due to self-employment; individuals without earnings during the first census, because of low employability or time spent in school, might be fully employed during the second, biasing the estimated earnings growth of immigrants downwards. This issue applies to any cohort followed between censuses. But it is particularly important here as immigrants have high occupational mobility, high in-school rates, and high rates of movement into self-employment. To avoid these difficulties we place no labor force status

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America, and South America.

[10]There are concerns about how well the census year-of-immigration variable captures actual U.S. date of entry and thus measures U.S. experience (Massey and Malone, 1998). For purposes of correctly identifying a cohort between censuses, all that is needed is that the Census question be interpreted by the respondents the same way in each census. To the extent a Census-based measure underestimates time in the U.S., estimates of initial earnings growth will be biased downwards (Duleep and Dowhan, 1999a).

[11]Self-employment earnings usually include some return on financial or physical capital that would bias regression coefficients of rates of return. For many policy purposes, it is desirable to include these income flows in an assessment of immigrant economic contributions. However, our use of the median rather than the mean of earnings reduces the effect of non-labor income flows from the self employed, and we do interpret changes in earning over time as primarily resulting from human capital investment.

restrictions on our census cohorts.

Sample size concerns led us to group several countries, and to group age and education each into two categories: the education categories are 1-12 years and 13 or more years; the age categories are 25-39 and 40-54 on the 1980 sample, and 35-49 and 50-64 on the 1990 sample. All told there were 96 country/age/education cells in our data set for the 1980-1990 comparison.[12] The correlation between the entry earnings of the country/age/education cohorts and their 1980-1990 earnings growth rates is -.4889 and highly statistically significant. A negative correlation of -.4593 is found when each country/age/education observation is weighted to reflect its relative importance using the entry cohort sample size[13] The negative correlation suggests that lower initial earnings within education and age groupings are associated with faster growth. This finding, based on numerous country/age/education cohorts, agrees with the Lalonde and Topel (1991) comparison of 1970 earnings and 1970-1980 earnings growth for five ethnic groups, and with the Schoeni et al. (1996) finding of low initial wages but fast wage growth for East Asian immigrants and high initial wages but slow wage growth for European immigrants.[14]

A potential caveat is that sampling error could produce the measured inverse relationship. Any sample estimate will contain some error. In this case, any error in the estimated first-period earnings creates an opposite error when calculating the growth rate using the earnings estimates of the first and

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[12]Our conclusions are robust over numerous alternative approaches used in forming subgroups.

[13]The argument for weighting is that the larger the sample size underlying a country/age/education group, the more accurate the estimated median for the group. In addition, weighting by the size of a country's contribution to U.S. immigration ensures the policy relevance of a result. The argument against weighting is that the resulting estimated relationship may reflect the dominance of a few country/age/education groups, as opposed to a more general phenomenon.

[14]We also confirm the Schoeni et al. finding of low initial earnings and slow earnings growth for Mexican immigrants during the 1980's. This finding does not hold, however, for all of Latin America or for Mexican immigrants of earlier periods. The 3 million legalizations in the 1980's under the 1986 Immigration Reform and Control Act might have made this a uniquely difficult period in the labor market for Mexican immigrants due to increased competition. Equally plausible is a sample selection bias (Ahmed and Robinson (1994): Mexican immigrants illegal at the time of the 1980 census might have been more likely to be counted in 1990, after legalization.

second periods: if the estimated entry earnings for a cohort in 1980 are underestimated, then the estimated earnings growth between 1980 and 1990, calculated using an erroneously low base, will tend to be too high. Thus even if there is a random relationship between initial earnings and growth rates for different cohorts in the full population, a correlation between estimates of these two values would be negative. Although the 1990 earnings estimate has its own error term, this does not affect the false correlation between initial earnings and earnings growth unless it is correlated with the 1980 error term.[15]

To solve the bias problem, let $y_{j,k}$ be our entry earnings for a cohort who entered in period k as measured in year j and $y_{j+10,k} - y_{j,k}$ be the estimated earnings growth for cohort k. The bias problem is then completely circumvented by splitting the random sample from which $y_{j,k}$ is estimated and using one half to estimate entry earnings and the other half to estimate the entry earnings used in the earnings growth computation.[16] In other words, relate $y_{j,k,1/2a}$ to $y_{j+10,k} - y_{j,k,1/2b}$, or $y_{j,k,1/2b}$ to $y_{j+10,k} - y_{j,k,1/2a}$, where 1/2a and 1/2b are the two halves of the random sample for year j. Using the "split random sample method," the estimated correlations between entry earnings and earnings growth are -.4017 and -.4662, instead of -.4889 for the unweighted sample, and -.3917 and -.4870, instead of -.4593 for the weighted sample.

[15]The measurement error concern is equally valid whether county-of-origin-specific entry earnings and growth rates are estimated from dummy variables and interaction terms in a regression or more directly using the observations within each sample cell. Estimating directly from sample cells allows us to estimate median rather than mean earnings, thereby reducing the effect of measurement error (the median is a much less volatile measure of central tendency in small samples), and permits eliminating the measurement error bias problem with the split random sample method introduced below.

[16]In a previous analysis, we tested the sensitivity of our estimates to sampling error bias by re-estimating our earnings estimates and correlations 100 times using separate random 75% samples and 100 times using random 50% samples of the original census data. Although similar to resampling techniques such as bootstrapping (Simon and Burstein, 1985 and Efron, 1982), our motivation was to increase the expected variance, and hence the mean absolute value, of the error terms of the estimates of median earnings. Increasing the magnitude of the sampling errors provides an indication of the effect of measurement error on the correlation between entry earnings and earnings growth. Taking multiple subsamples of the original census data reduces the probability that the change in coefficients we observe is due to chance.

To determine whether the inverse relationship is large enough to be of practical significance, we regressed the 10-year earnings growth rate on entry earnings (Table 1). According to the unweighted estimates, shown in the first data column, a 10-year growth rate changes -5.8 percentage points for every $1,000 change in entry earnings. For the weighted estimate, a $1000 change in earnings is associated with an opposite 9.7 percentage point change in the 10-year growth rate (column 4).[17] Our model predicts an inverse relationship conditional on human capital. When we control for the age and education strata used to form our cells (column 7), the negative estimated effect of entry earnings on earnings growth increases to 13.0 percentage points.

To ensure that the estimated negative effect of entry earnings on earnings growth is not the result of sampling error bias, we re-estimated the simple unweighted regression with the split random sample method; the results (Table 1, second and third columns) are close to the full-sample estimates. The weighted data estimates (fourth through sixth columns) reveal an even greater inverse relationship—perhaps because weighting places greater emphasis on countries where larger sample sizes allow more accurate estimates of first- and second-period earnings.

Dividing by education and age (Table 2), we find that the weakest inverse relationship is for older, more educated immigrants for whom a $1,000 decrease in entry earnings (a decrease of 4.9% of median earnings) is associated with a 2 percentage point increase in 10-year earnings growth. The strongest inverse relationship is for the young and more highly educated, for whom a $1,000 entry-earnings decrease (a decrease of 7.2% of median earnings) is associated with a 20.8 percentage point increase in 10-year earnings growth. Consistent with our model of immigrant human capital investment, the inverse relationship is greater for the young than for the old at each education level.[18]

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[17]Using the weighted estimates, this suggests that for immigrants who entered the U.S. between 1975-79, an immigrant cohort with entry earnings that were a $1,000 less than the overall median of $12,130 would catch up to a cohort with median entry earnings in 10 years.

[18]Also consistent with our model of immigrant human capital investment is the finding that the ratio of the inverse

The inverse relationship also emerges in separate regressions for each immigrant origin region (Table 3). But with notable differences: a $1,000 change in entry earnings produces a 3.1 percentage point opposite change in the 10-year earnings growth rate for European immigrants, a 19.9 percentage point change for immigrants from Central and South America (including Mexico), and an 18.9 percentage point change for Asian immigrants. (Similar results are obtained using the split random sample method.) This is exactly what would be expected if skill transferability is the principle mechanism for the inverse relationship between entry earnings and growth: Europeans, with a more similar economy to the United States, likely have fewer problems transferring their country-of-origin human capital to the United States.[19] If skill transferability is greatest between the United States and other developed countries, we should find the weakest inverse relationship for immigrants from these countries. Separately regressing the 10-year earnings growth rates on entry earnings across a "developed-country" group (Europe, Japan, Canada, and Oceania) and a less developed country group reveals a smaller inverse relationship for the former—a $1,000 decrease in entry earnings produces a 2.9 percentage point increase in earnings after ten years for immigrants from developed countries compared to a 28.9 percentage point increase for immigrants from less developed countries (Table 4).

According to our model of immigrant human capital investment, the lower the degree of skill transferability, the greater the likelihood that high-skill immigrants will invest more than low-skill immigrants: the ratio of the inverse relationship for the more educated to the inverse relationship for the less educated should be larger among immigrants from economically-underdeveloped versus

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relationship for the high educated to the inverse relationship for the low educated is larger among the younger immigrants than among the older immigrants. Intuitively, this is because education increases the opportunity cost of investment for both young and old, but the return to investment is less for the old.

[19]Asian and Hispanic immigrants may have less transferable skills due to differences between the economic and educational systems of those countries and the U.S. or because the employment opportunities in these countries make it worthwhile for persons to migrate even when it involves substantial investment in new human capital. Rivera-Batiz (1996) shows that the skills acquired at given schooling levels in several developing countries are superior to those acquired in U.S. schools.

economically-developed countries. Dividing the more developed/less developed samples by education level (Table 4), we find the inverse relationship among immigrants from the less developed countries is much greater among the more educated immigrants than among the less educated; for immigrants from the economically developed countries, the inverse relationship is slightly greater among the less educated than among the more educated.

To learn whether entry earnings are inversely related to earnings growth over longer time horizons, we used the 1970-1990 censuses to follow the 1965-69 cohort for ten- and twenty-year periods (Table 5).[20] There is a significant negative relationship between entry earnings and earnings growth for the 1965-1969 entry cohort: a $1,000 decrease in entry earnings is associated with a 4.7% additional increase in earnings over ten years. The earnings growth increase associated with lower initial earnings also continues beyond the initial 10-year period—a 6.0 percentage point increase in earnings over 20 years for each $1,000 decrease in entry earnings, or about one-third more than the 10-year effect. Consistent with the model, the incentive for human capital investment decreases with age and as source-country human capital becomes more transferable.

To isolate the inverse relationship from coincidental country-of-origin effects, we used the 1970, 1980, and 1990 censuses to relate *changes* in entry earnings to *changes* in earnings growth *for the same country*. The change in initial earnings was measured by $y_{1980,75} - y_{1970,65}$, where $y_{1980,75}$ refers to the 1980 earnings of immigrants who entered the U.S. between 1975 and 1980 and $y_{1970,65}$ refers to the 1970 earnings of immigrants who entered the U.S. between 1965 and 1970. The change in the 10-year growth rates was measured by $[(y_{1990,75} - y_{1980,75}) / y_{1980,75}] - [(y_{1980,65} - y_{1970,65}) / y_{1970,65}]$ where $y_{1990,75}$ refers to the 1990 earnings of immigrants who entered the United States between 1975 and 1980 and $y_{1980,65}$ refers to the 1980 earnings of immigrants who entered the United States between 1965 and 1970.

Correlations were computed between these two measures across country/age/education cohorts using various indexes to deflate earnings over the three periods. Although it makes little difference to our results, we prefer on theoretical grounds to deflate using average weekly earnings.[21] Since we are using earnings as an indicator of changes in the unmeasured aspects of human capital of different immigrant cohorts, the deflator used should ideally reflect not only inflation, but also changes in how the market values human capital. Average weekly earnings more closely approximate this concept than an index based on price changes alone—an earnings index helps to control for period effects in labor market demand conditions between censuses.[22]

Changes in entry earnings between entry cohorts are negatively associated with changes in earnings growth rates (Table 6). Since errors in the entry-earnings estimates may produce a negative bias in the estimated relationship, we repeated the analysis with the split random sample method. Doing so reduces the estimated negative relationship (Table 6, second and third columns).[23] Nevertheless, we still find decreases in entry earnings to be associated with increases in earnings growth within education/age cohorts, holding country of origin constant. To gauge the magnitude of

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[20]The twenty-year comparison also represents an independent observation with a different sampling error.
[21]The weekly earnings index was derived from the Bureau of Labor Statistics' series on average weekly earnings in private nonagricultural industries. The correlation shown in Table 6 is negative and of similar size regardless of whether the deflator is the Consumer Price Index, the Personal Consumption Expenditure Deflator, or an index based upon average weekly earnings.
[22]Period effects upon earnings and earnings distributions have been raised as a potential concern for studies that follow cohorts. Differences in demand conditions between census years that affected the entire income distribution would have similar effects upon the earnings of immigrants from each source country, and thus have relatively little effect on our analysis even if we had not deflated by a wage measure. There is a greater potential for changes in the distribution of earnings across skill levels to affect our result. Chiswick (1991) and Lalonde and Topel (1992) argue that the 1970-1980 decline in immigrant entry earnings (adjusted for measured characteristics), interpreted by Borjas as a decline in immigrant quality, is partially due to a general decline in the relative wages of low-skilled workers.
[23]The greater reduction with the split random sample method in the estimated coefficient for the 1970-1990 analysis than for the 1980-1990 analyses may reflect a greater negative bias in the full-sample estimated relationship due to the smaller sample sizes underlying the 1970 entry-earnings estimates or a greater relative increase in measurement error when the 1970 country/age/education cells are split in half compared with when the 1980 cells are divided; measurement error will tend to diminish the estimated relationship quite apart from the sampling error bias discussed above.

the estimated association, we regressed the change in the 10-year earnings growth rate on the change in entry earnings (Table 7). Estimated with the split random sample method, the effect of entry-earnings changes on changes in the 10-year earnings growth rate becomes smaller. Nevertheless, the smallest estimated effect (using growth rates based on sample b entry earnings of each initial census year) translates into 12.7 extra percentage points of growth after ten years for a $1,000 change in entry earnings–a larger effect than in single cohort estimates.

To explore the effect of emigration on our estimates, we calculated an emigration rate for each cohort, using it to categorize the country/age/education cohorts as having high or low emigration rates. The correlation between changes in entry earnings and changes in earnings growth is similar for high and low emigration groups. This suggests that any bias of the earnings growth estimates caused by emigration does not seriously affect our analysis.

III. Conclusion

Even after accounting for differences in the immigration flows from different countries of origin, sampling error, and emigration effects, we find a strong systematic inverse relationship between immigrant entry earnings and earnings growth. The inverse relationship has implications for the interpretation of immigration research, empirical techniques to measure immigrant earnings growth, and philosophical and policy issues related to immigration.

Absent the inverse relationship, previous empirical studies of immigrant earnings growth present a puzzling array of seemingly contradictory results.[24] Chiswick's (1978a, 1979) path-breaking analysis, which used cross-sectional census data to estimate immigrant earnings growth, found that immigrant men experience high earnings growth, exceeding that of the native born. Borjas (1985, 1987, 1992, 1994) found that (controlling for observable characteristics) immigrant entry earnings have fallen over time. He further showed that the cross-sectionally measured high earnings growth was the spurious consequence of pairing the progressively lower entry earnings of recent immigrants with the earnings of earlier immigrants. Immigrant earnings growth, he concluded, was in fact quite slow. Yet, several estimates of immigrant earnings growth based on following individuals or cohorts resemble the cross-sectional estimates![25]

These apparent contradictions are resolved if immigrant entry earnings and earnings growth are inversely related. With a systematic inverse relationship, when immigrant entry earnings have been declining, cross-sectional estimates will over-estimate the earnings growth of *earlier* cohorts. Yet Borjas' (1985) decomposition of cross-sectional estimates, which assumes stationarity in immigrant earnings growth, will underestimate the earnings growth of *newer* cohorts.[26] Because the change in growth rates between entry cohorts moves in the same direction as the bias in the cross-sectional estimates of the growth rate for the earlier cohort, cross-sectional regressions may appear to do deceptively well in predicting the growth rate of the most recent cohort.[27]

Since cohorts that vary in their entry-level earnings will also systematically vary in their earnings growth, the popular approach of controlling for cohort effects by including a dummy variable for each

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[24]The review of Lalonde and Topel (1997) offers a somewhat different perspective.

[25]See, for instance, Chiswick 1980, Bloom and Gunderson 1991, Duleep and Regets 1992a, 1997a, Lalonde and Topel 1992, Duleep and Dowhan, 2002.

[26]Earnings convergence among immigrants with U.S. time, such as convergence by immigrants separated by admission criteria (e.g. Duleep and Regets 1992b, 1996a, b and DeSilva 1996) and earnings convergence by source country (Duleep and Regets 1994b), is further evidence of the inverse relation. The inverse relationship is also consistent with findings of faster earnings growth for immigrants than for natives (Chiswick, 1977; Duleep and Regets, 1997b; Eckstein and Weiss, 1998; Duleep and Dowhan, 2002). Other corroborating evidence includes Garvey (1996), who finds that the education-adjusted earnings growth of the most recent cohort of immigrants in New Jersey exceeds that of U.S.-born New Jersey residents and also exceeds the earnings growth of the earlier immigrant cohort, and Myers and Park (1997), who find that immigrant groups in Southern California start at much higher levels of poverty than natives, but experience much larger declines in poverty.

[27]The similarity between cohort- and cross-section-based estimates does not justify the cross-sectional method as its underlying assumption of no unexplained cohort effects is wrong: controlling for commonly included variables, immigrant entry earnings, not separating by source country, have declined over time; separating by source country, adjusted entry earnings have increased in some cases while falling in others.

cohort in analyses that pool more than one cross-section is invalid: earnings growth will be overestimated for cohorts starting at relatively high levels and underestimated for cohorts starting at relatively low levels. Predictions of immigrant earnings growth must either take into account directly the inverse relationship between entry earnings and earnings growth or include variables such as immigrant admission criteria, that may capture the effect of cohort characteristics on entry earnings *and* earnings growth, and allow the interaction between the added variables and the entry earnings *and* earnings growth (Duleep and Regets 1992b, 1996a, 1996b).

The strong inverse relationship between entry earnings and earnings growth when controlling for source-country human capital suggests that the unexplained decline in immigrant entry earnings reflects changes in skills transferability[28] as opposed to a decline in immigrant innate ability: the latter seems incompatible with an increase in earnings growth. Although our model predicts an inverse relationship *conditional* on level of human capital, the persistence of a somewhat weaker inverse relationship, even when there are no controls for age and education, further suggests that skill transferability is a more important reason for the total decline in entry earnings than is any decline in measured or unmeasured skills.

The inverse relationship should affect how we think about immigrant labor market "quality." Several studies emphasize adjusted differences in entry earnings among country-of-origin groups or between entry cohorts as signifying differences in immigrant quality. Measures of earnings growth are often ignored or emphasized separately. The presence of a strong inverse relationship suggests that we need to think about entry earnings and earnings growth as jointly affected by more than a single dimension of immigrant quality. Such a perspective illuminates other findings in the immigration

[28]Regets (2000) found lower initial earnings, but faster earnings growth in a special case where differences in skill transferability are nearly certain—holders of foreign university degrees compared to other migrants with U.S. degrees in the same field of study.

literature such as the relative decline in the propensity of recent immigrants to engage in criminal activity (Butcher and Piehl, 1999) and the decrease in initial immigrant labor force participation (Fry, 1997). The distribution of life-cycle returns to human capital is shaped differently for immigrants than for natives. Our model suggests that this is due to a previously ignored and potentially important attribute of initially unvalued country-of-origin skills—their value in gaining U.S. human capital relative to their value in the U.S. labor market.

Although present value calculations have relevance for the evaluation of the net economic contributions of different immigrant groups, there are important social and economic externalities resulting from the growth path. Expectations of upward mobility can affect social behavior and the prevalence of pathologies otherwise associated with low-income individuals. High rates of human capital investment and occupational change may give immigrants greater ability to adapt to changing skills needs in the economy, adding significant flexibility to the economy (Green, 1995). There are immigration policy concerns about human-capital investment and the long-run skill level of the work force, whether more recent immigrants will form a permanent underclass, and the rate of inter-generational economic assimilation. Even if some groups do not catch up to the representative native, do they acquire additional human capital after entering the U.S. work force? The inverse relationship between immigrant entry earnings and earnings growth also informs other topics such as immigrant welfare use and the labor market impact of immigrants on natives (i.e. Gang and Rivera-Batiz, 1994; Jaeger, 1996). Even if immigrants and natives were perfect substitutes within broad skill levels, the inverse relationship suggests that over their life cycle many immigrants will go from being substitutes for low-skill labor to complements (Lalonde and Topel, 1992).

A decline in entry (and probably life-cycle) earnings is real. Yet much greater rates of human capital investment and earnings growth greatly ameliorate the importance of this decline. More generally, an important implication of the strong inverse relationship for across-group and over-time immigrant comparisons is that the entry earnings of immigrants are a seriously flawed predictor of immigrant economic success.

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Figure 1: 1990 Census In-School Rates By Nativity, Age, and Sex

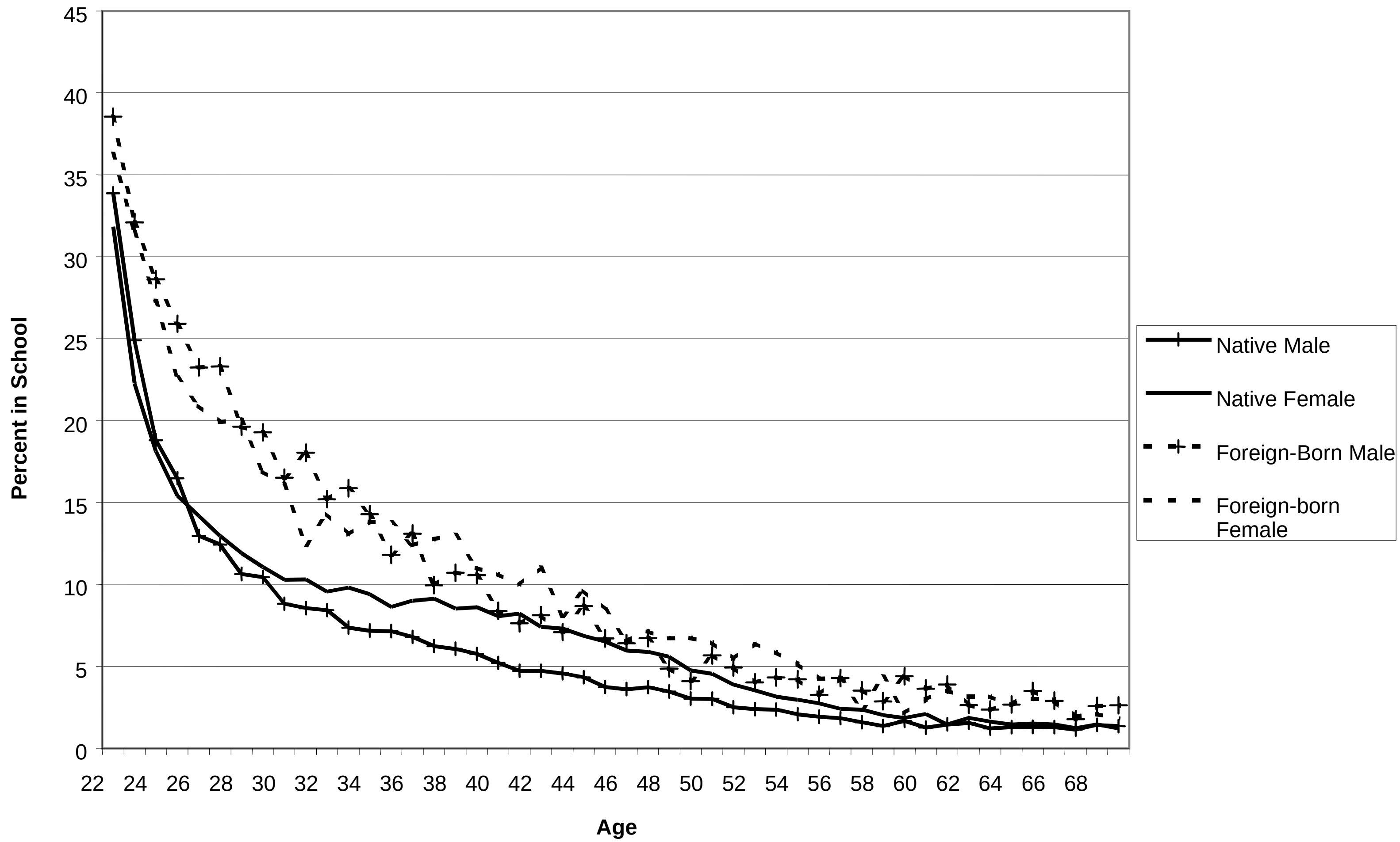

Table 1: Estimated Relationship of 1979-1989 Real Earnings Growth Rate to Entry Earnings
(t-statistics in parentheses)

	Full sample, unweighted	Split random sample method, unweighted		Full sample weighted	Split random sample method, weighted		Controls for age and education, weighted
		Growth from sample a, Initial Earnings from sample b	Growth from sample b, Initial Earnings from sample a		Growth rate from sample a, initial earnings from sample b	Growth from sample b, initial earnings from sample a	
Intercept	1.8562 (8.52)	1.7025 (7.32)	1.8895 (8.03)	2.5878 (8.64)	2.6097 (7.42)	2.4948 (9.39)	2.1999 (8.75)
$Earnings_{1979}$/ 1000	-.0583 (-5.44)	-.0474 (-4.25)	-.0601 (-5.11)	-.0967 (-5.01)	-.0928 (-4.13)	-.0932 (-5.41)	-.1296 (-7.66)
Older than 40							-.3089 (-.99)
13 or more years of schooling							1.8788 (6.92)
Adjusted R^2	.23	.15	.21	.20	.14	.23	.48
Sample size	96	96	96	96	96	96	96

Note that using the split random sample method reduces the sample sizes underlying the estimates of the entry-earnings medians for the country/age/education groups by half.
Estimates based on the 1980 Census of Population, 5 percent "A" Public Use Sample and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 2: Estimated Relationship of 1979-1989 Real Earnings Growth Rate to Entry Earnings
By Age and Education Groups
(t-statistics in parentheses)

	Age 25-39 1-12 Years of Education	Age 25-39 13 or more Years of Education	Age 40-64 1-12 Years of Education	Age 40-64 13 or more Years of Education
Intercept	2.0652 (4.44)	5.2420 (8.41)	1.7673 (4.84)	0.9038 (7.15)
$Earnings_{1979}$/1000	-0.1228 (-2.96)	-.2083 (-5.38)	-.1028 (4.84)	-.0203 (-4.421)
Adjusted R^2	.25	.55	.34	.45
Sample size	24	24	24	24

Estimates based on the 1980 Census of Population, 5 percent “A” Public Use Sample and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 3: Estimated Effect of Immigrant Entry Earnings on 1979 to 1989 Real Earnings Growth Rate: By Region
(t-statistics in parentheses)

	Full Sample							
	Unweighted				Weighted			
	Asia	Central and South America	Europe	Other Areas	Asia	Central and South America	Europe	Other Areas
Intercept	2.3146 (4.53)	4.0736 (6.23)	1.1668 (5.37)	2.0237 (3.02)	4.2883 (6.53)	2.6483 (3.10)	1.3462 (7.271)	4.1704 (6.98)
$Earnings_{1979}/1000$	-.0864 (-2.84)	-.2630 (-4.78)	-.0305 (-3.42)	-.0556 (-2.08)	-.1899 (-4.03)	-.1992 (-2.42)	-.0311 (-3.93)	-.1240 (-4.23)
Adjusted R^2	.2068	.5352	.2340	.2319	.3602	.2032	.2920	.6051
Sample size	28	20	36	12	28	20	36	12
	Split Random Sample Method with Growth Rate Based on Sample A and Initial Earnings Based on Sample B							
Intercept	2.2030 (5.06)	4.0538 (4.78)	1.2304 (3.57)	1.8811 (3.20)	3.9778 (7.68)	2.8544 (2.86)	1.3125 (4.79)	3.7013 (6.78)
$Earnings_{1979}/1000$	-.0827 (-3.16)	-.2559 (-3.55)	-.0326 (-2.23)	-.0507 (-2.21)	-.1755 (4.67)	-.2098 (-2.22)	-.0301 (-2.52)	-.1090 (-4.05)
Adjusted R^2	.2503	.3797	.1016	.2608	.4348	.1714	.1331	.5833
Sample size	28	20	36	12	28	20	36	12

Estimates based on the 1980 Census of Population, 5 percent “A” Public Use Sample and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 4: Estimated Relationship of 1979-1989 Real Earnings Growth Rate to Entry Earnings
For Immigrants From Economically Developed and Less Developed Countries by Education Groups
(t-statistics in parentheses)

	Developed Countries and Regions			Less Developed Countries and Regions		
	All Education Groups	1-12 Years of Education	13 or more Years of Education	All Education Groups	1-12 Years of Education	13 or more Years of Education
Intercept	1.2639 (8.33)	1.3937 (7.67)	1.8272 (10.48)	4.5034 (7.50)	3.7061 (7.27)	6.9314 (11.59)
$Earnings_{1979}$/ 1000	-.0292 (-4.84)	-.1228 (-2.96)	-.0416 (-6.93)	-.2894 (-5.32)	-.3129 (-5.90)	-.3886 (-8.19)
Adjusted R^2	.32	.57	.67	.37	.60	.74
Sample size	48	24	24	48	24	24

Developed countries included all country grouping in Europe, Canada, Japan, and Oceania. All other country groupings are included under lesser developed.

Estimates based on the 1980 Census of Population, 5 percent “A” Public Use Sample and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 5: Estimated Effect of Immigrant Entry Earnings on Real Earnings Growth Rate:
10 and 20 Year Growth Rates
(weighted)
(t-statistics in parentheses)

	1965-1969 Entry Cohort Dependent: 10 year growth rate	1965-1969 Entry Cohort Dependent: 20 year growth rate
Intercept	1.0463 (7.927)	1.3479 (7.277)
Entry Earnings/1000	-.0467 (-6.717)	-.0604 (-6.186)
Older than 40	-.2455 (2.294)	-.4897 (-3.261)
13 years or more of schooling	.8463 (8.068)	1.2392 (8.418)
Adjusted R-squared	.5487	.5765
n	81	81

Estimates based on the 1970 Census of Population 1 percent State Public Use Sample based on the 5% questionnaire, the 1980 Census of Population 5 percent “A” Public Use Sample, and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 6: The Correlations Between Change in Initial Earnings and Change in Earnings Growth: 1965-1970 & 1975-1980 Entry Cohorts
(weighted)
(p values in parentheses)

Full sample	Split Random Sample Method	
	Growth from sample a, Initial Earnings from sample b	Growth from sample b, Initial Earnings from sample a
-.70735 (.0001)	-.49716 (.0001)	-.40599 (.0005)

The sample size for all analyses shown in this table is 81 observations.

Estimates based on the 1970 Census of Population 1 percent State Public Use Sample based on the 5% questionnaire, the 1980 Census of Population 5 percent “A” Public Use Sample, and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 7: OLS Estimates of the Effect of Changes in Entry Earnings on Changes in Earnings Growth Rates
(weighted)
(t-statistics in parentheses)

		Split random sample method	
	Full sample	Growth from sample a, Initial Earnings from sample b	Growth from sample b, Initial Earnings from sample a
Intercept	-.1099 (-6.38)	.0482 (0.18)	.3055 (1.27)
Change in Entry Earnings/100	-.0236 (-8.89)	-.0183 (-4.73)	-.0127 (-3.66)
Adjusted R^2	.4940	.2361	.1525
Sample size	81	70	70

Estimates based on the 1970 Census of Population 1 percent State Public Use Sample based on the 5% questionnaire, the 1980 Census of Population 5 percent "A" Public Use Sample, and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 8: Entry Earnings and 10-Year Real Earnings Growth Rates of Age-Education Cohorts by Region of Origin (1989 Dollars, deflated by index of weekly wages)

	All Immigrants					*Immigrants from Central/South America*				
Year of Entry	1965-1969		1975-1979		1985-1989	1965-1969		1975-1979		1985-1989
	Entry Earnings	Earnings Growth	Entry Earnings	Earnings Growth	Entry Earnings	Entry Earnings	Earnings Growth	Entry Earnings	Earnings Growth	Entry Earnings
Ages 25-54, All Education Levels	17,634	24.5	12,130	64.9	10,062	14,933	15.6	10,107	47.2	9,000
Age<40, Ed<13 years	16,045	17.3	10,671	40.6	9,000	13,821	18.5	9,684	41.7	8,600
Age<40, Ed>=13 years	20,176	71.0	13,907	121.3	13,000	17,793	41.1	11,299	112.4	12,000
Age>=40, Ed<13 years	16,045	-2.2	10,985	18.3	8,000	14,933	-0.4	9,417	27.4	8,000
Age>=40, Ed>=13 years	26,531	6.4	20,268	28.3	18,000	19,223	14.3	15,964	31.5	14,604
	Immigrants from Asia					*Immigrants from Europe*				
Year of Entry	1965-1969		1975-79		1985-89	1965-1969		1975-79		1985-89
	Entry Earnings	Earnings Growth	Entry Earnings	Earnings Growth	Entry Earnings	Entry Earnings	Earnings Growth	Entry Earnings	Earnings Growth	Entry Earnings
Ages 25-54 All Education Levels	16,045	95.5	12,240	105.0	10,954	22,400	12.0	18,826	59.4	18,500
Age<40, Ed<13 years	12,868	34.1	9,887	92.2	10,000	21,129	11.4	15,690	58.5	15,000
Age<40, Ed>=13 years	16,045	134.6	12,553	154.9	11,633	27,167	44.3	23,531	70.0	20,000
Age>=40, Ed<13 years	11,756	20.1	9,417	32.3	6,728	19,223	-2.1	15,690	21.1	12,000
Age>=40, Ed>=13 years	30,662	-2.8	17,258	42.7	16,000	31,933	8.6	29,019	12.0	30,000

Estimates based on the 1970 Census of Population 1 percent State Public Use Sample based on the 5% questionnaire, the 1980 Census of Population 5 percent “A” Public Use Sample, and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.

Table 9: Median Earnings of Immigrants Relative to Natives During Their First Five Years in the United States and Ten Years Later: 1965-1970 and 1975-1980 Immigrant Entry Cohorts

Year of Entry	1965-1970 Cohort		1975-1980 Cohort	
	1969 Ratio to Natives	1979 Ratio to Natives	1979 Ratio to Natives	1989 Ratio to Natives
25-39 years old, 1-12 years of school	.631	.706	.486	.750
25-39 years old, more than 12 years of school	.577	.864	.463	.886
40-54 years old; 1-12 years of school	.594	.769	.417	.867
40-54 years old; more than 12 years of school	.522	.720	.479	.788

Estimates based on the 1970 Census of Population 1 percent State Public Use Sample based on the 5% questionnaire, the 1980 Census of Population 5 percent "A" Public Use Sample, and a 6 percent microdata sample created by combining and reweighting the 1990 Census of Population Public Use 5% and 1% Public Use samples.