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Immigration and Poverty in the United States

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Abstract

In this paper, we assess the likely contribution of immigration over the past three and a half decades to poverty in the U.S. We first document trends in poverty rates among the native-born by race and ethnicity and poverty trends among all immigrants, recent immigrants, and immigrants by their region and (in some instances) country of origin. Next, we assess how poverty rates among immigrants change with time in the United States. Finally, we simulate the effects of competition with immigrant labor on native wages and the likely consequent effects on native poverty rates. We find that international immigration to the U.S. between 1970 and 2005 has increased the overall poverty rate due to the facts that immigrants are more likely to be poor and that an increasing proportion of the U.S. resident population that is foreign born. This effect, however, is modest (it increases U.S. poverty rates by half a percentage point) and transitory, as immigrant poverty rates decline quickly with time in the U.S. Our wage simulations indicate that competition with immigrants does adversely impact those natives, and only those natives, with the least education. However, the impact of wage competition with immigrants on native poverty rates is negligible.

1. Introduction

Between 1970 and 2003, the proportion of U.S. residents born in another country increased from 4.8 to 12.4 percent. This relative increase corresponded to a sizable absolute increase with net international migration accounting for over one quarter of net population growth during this period. Moreover, recent international migrants are heavily concentrated among groups with either extremely low or relatively high levels of formal educational attainment, with the group at the low end being particularly large. Many have conjectured that this large flow of immigrants has had adverse effects on the economic well being of the least-skilled native born.

The potential contribution of international migration to the official poverty rate in the United States is likely to operate through two avenues. First, migrants may have a direct effect on the poverty rate. Since the poverty rates observed among the foreign born are high, an increase in the proportion foreign-born will as a matter of arithmetic increase the national poverty rate. This direct compositional effect can either be exacerbated or mitigated over time depending on the extent to which immigrants acquire experience in U.S. labor markets and progress through the earnings distribution.

Second, international immigration alters the relative supplies of labor of different skill levels, a factor that may influence the wages and employment of natives. In particular, recent immigration has increased the relative supply of low-skilled labor. The indirect impact of this change on poverty depends on the sensitivity of native labor market outcomes to these immigration induced labor supply shifts. Moreover, the effects on poverty rates are unlikely to be neutral across racial and ethnic groups. In particular, African-Americans, native-born Hispanics, and the native-born children of prior immigrants tend to be less educated on average

and thus are likely to suffer disproportionately from any adverse labor market effects stemming from international immigration.

In this paper, we assess the likely contribution of immigration over the past three and a half decades to poverty in the U.S. We first document trends in poverty rates among the native-born by race and ethnicity and poverty trends among all immigrants, recent immigrants, and immigrants by their region and (in some instances) country of origin. Next, we assess how poverty rates among immigrants change with time in the United States. By measuring poverty rates over time among immigrant cohorts formed by when they arrives, we are able to track how the poverty rates of immigrants change through time. We present estimates for all immigrants, immigrants by region of origin, and comparable estimates for natives.

Having documented these basic facts, we turn to a discussion of the likely impact of immigration on poverty rates operating through (1) a shift in the composition of the population, and (2) an impact of immigration on the labor market outcomes of natives and prior immigrants. We first do a shift share analysis to assess what the nation's poverty rate would have been under the assumption of no increase in the proportion immigrant between 1970 and 2006 and assuming no labor market effects of immigration. Next, we provide a simple theoretical discussion of labor market competition between immigrants. Finally, we simulate what native poverty rates would be under alternative estimates of the effects of immigrants on native earnings and employment.

To summarize our findings, poverty in the U.S. declined modestly between 1970 and 2005. Declines are notable for the native born, while poverty among immigrants increases absolutely. Within country of origin groupings, poverty also declines for most groups. However, the

distribution of the U.S. immigrant population by region of origin has shifted decisively towards source countries that generate immigrants who are more likely to be poor.

We find that poverty rates among immigrants groups decline quite quickly with time in the U.S. Moreover, while the level of poverty among recent arrivals has increased in recent decades, the declines in poverty observed in subsequent censuses suggests that even the poorer immigrants of the most recent wave either exit poverty at a fairly rapid rate, or emigrate out of the country. Interestingly, the immigrant-native disparity in the incidence of poverty declines with time in the U.S. when immigrants are compared to native birth cohorts of similar age at similar points in time. This pattern is consistent with either real income growth among immigrant households that propel immigrants out of poverty or the selective return migration of those immigrants most likely to be poor.

Our shift share analysis reveals several modest patterns. Overall poverty declines by a modest amount between 1970 and 2005 (by two-tenths of a percentage point). Decomposing this change into a component attributable to changing population shares across groups by nativity and country of origin indicates that had the composition of the U.S. population not changed between 1970 and 2005, the poverty rate would have fallen by an additional five tenths of a percentage point. Thus, while immigration certainly has contributed to overall poverty rates, the contribution through this direct channel is modest.

Finally, we simulate the effects of immigration between 1970 and 2005 on native wages and poverty using a model of wage determination that allows for imperfect substitutability of workers with different skill levels and allows for the accumulation of capital in response to changes in the supply of labor. Our simulation results suggest modest effects of immigration over this time period on the least education natives (those with less than a high school diploma)

and no or slightly positive effects on the earnings of most other skill groups. With regards to the overall native poverty rate and native poverty rates for specific racial and ethnic groups, the simulation results suggest that labor market competition with immigrants has had no effect on native poverty levels.

2. Data Description and Basic Poverty Trends

We analyze data from the Integrated Public Use Microdata Samples (IPUMS) collected and maintained by the University of Minnesota. We use the one percent samples from the 1970, 1980, 1990, and 2000 U.S. Censuses of Population and Housing and the 2005 American Community Survey (ACS). Poverty is imputed from total household income (not inclusive of transfer payments) with the federal poverty line adjusted for family size in each census year (and in 2005 for the ACS sample). We restrict the sample to all non-institutionalized residents of the United States in each census year.

We begin by documenting poverty trends. Figure 1 displays the poverty rates measured for each census year and 2005 for all U.S. residents, the native-born, and immigrants. Since the native born constitute the majority of the U.S population in each year (from a high of 95 percent in 1970 to a low of 87 percent 2005), the overall poverty rate closely mirrors the poverty rate among the native-born. However, there is a notable increase in poverty among immigrants, from roughly 0.15 to 0.18 over the time period depicted.

Table 1 displays the proportion of natives in poverty for five mutually-exclusive race/ethnicity groupings in all decennial census years since 1970 and in 2005. There are several notable changes. First, with the exception of native-born Asians, poverty declines for all groups, with particularly large declines for non-Hispanic blacks and non-Hispanic others. More modest

declines are observed for whites and Hispanics. For African-Americans and Hispanics, poverty rates decline monotonically between 1970 and 2000, and then increase slightly in 2005

Table 2 presents similar tabulations for immigrants by region of origin. For one group, Mexican immigrants, we provide separate country-of-origin estimates given the disproportionate importance of immigrants from Mexico. Immigrants from Mexico, Central and South America, and Asia have relatively high poverty rates, with the highest poverty rates observed for Mexican immigrants. On the other hand, Western European immigrants and immigrants from other North American countries have low poverty rates, with proportions in poverty that are fairly stable across census years. Interestingly, there are very few notable increases in poverty within country/region-of-origin groups, and many instances where poverty rates decline.

Table 3 present comparable calculations where immigrants within each group and year are further sub-divided into immigrants who have arrived within five years prior to the census (recent immigrants) and immigrants who arrived earlier (non-recent immigrants). Notable differences emerge when we stratify immigrants in this manner: poverty rates are much higher among recent immigrants. This pattern is consistent with either a strong negative effect of time in the U.S. on poverty or increasing poverty rates among more recent arrival cohorts. We investigate this issue in more detail in the next section.

The poverty rate trends in Figure 1 reveal increases in poverty among immigrants while the tabulations in Tables 2 and 3 suggest that within group poverty rates have been relatively stable. Taken together, these two trends suggest that the distribution of immigrants across country-of-origin groupings must have shifted towards higher poverty immigrant groups. Indeed, this is the case. Table 4 displays the distribution of the U.S. resident population by nativity, by race/ethnicity among natives, and by region of origin among immigrants. The

tabulations for immigrants reveal several stark changes in the regions of origin distribution for immigrants. Western Europeans constituted 41 percent of the immigrant population in 1970 but only 10 percent of immigrants in 2005. By contrast, Mexican immigrants constituted 8 percent of immigrants in 1970 and 27 percent of immigrants in 2005. In addition, sizable increases are observed in the proportion of immigrants from other Latin American countries and Asian countries. Thus, we observe a notable shift towards immigrant groups with higher U.S. poverty rates.

3. How Immigrant Poverty Rates Change With Time in the U.S.

We have seen that poverty rates among recent immigrants are considerably higher than poverty rates among immigrants from the same regions who arrive in the more distant past. This cross sectional pattern suggests that with time in the U.S., immigrant poverty may decline, and perhaps, converge to the lower levels experienced by the native born.

However, the composition of time-of-arrival cohorts appears to have shifted across regions in a manner that is generating increasingly poorer immigrants. Moreover, if there have been comparable shifts in the composition of immigrants from the same nation (from lower poverty to higher poverty co-nationals), the implication of this cross sectional relationship for convergence may be more illusionary than real. That is to say, more recent immigrants may be fundamentally different from previous immigrants, with higher propensities to experience poverty in the U.S. Thus, higher poverty among recent immigrants is also consistent with a decline in the average earnings potential of more recent immigrants relative to immigrants from times past.

This difficulty in interpreting the difference in socioeconomic status between recent immigrants and non-recent immigrants is a central point of contention in the research regarding the degree to which immigrant wages assimilate upwards towards the higher earnings of the native born. In a series of papers, Chiswick (1978, 1980) argues that the strong cross-sectional relationship between time in the U.S. and earnings is indicative of the speed with which immigrants assimilate into the U.S. labor market. In many instances, comparing the cross sectional earnings profiles of immigrants and natives even suggests that immigrant earnings eventually overtake those of natives. Since poverty is defined by household income relative to a pre-determined threshold, relatively high earnings growth among immigrants imply that native-immigrant poverty differentials should narrow with time in the U.S.

This interpretation of the cross sectional earnings data was contested in a series of articles by Borjas (1985, 1995). Borjas argues that to the extent that more recent immigrants have discretely lower earnings potential than immigrants from previous years, the cross sectional age-earning profile provides a distorted picture of the future earnings paths of recent immigrants. Borjas constructs "synthetic cohorts" across census years to investigate this possibility. A synthetic cohort compares the earnings of a specific arrival cohort at different points in time with the change in earnings across census years thereby providing an alternative characterization of the age earnings profile. For example, one compares the average earnings of immigrants who arrive between 1965 and 1970 as measured in the 1970 census, the 1980 census, and so on. In this comparison changes between years would pertain to the same cohort and may be attributable to time in the U.S. When estimated in this fashion, the age-earnings profiles of immigrants look considerably less steep than those implied by the cross sectional patterns. That is to say, earnings growth appears to be no faster than that of comparable natives, immigrant earnings do

not overtake native earnings, and native-immigrant income convergence occurs at a slower rate than is implied by an analysis of cross-sectional earnings profiles for a given point in time (such as a census year).

In Table 5 we apply the synthetic cohort analysis of Borjas to the measurement of poverty. Specifically, using census data from 1970 through 2005, we define immigrant cohorts by their year of arrival and measure their poverty rates in successive census years. Assuming that the composition of the cohort does not change over time through selective emigration or measurement error (a big assumption that we will discuss further), changes in poverty rates across census years for fixed arrival cohorts provide estimates of how immigrant poverty changes with time in the U.S.

Table 5 presents basic patterns for all immigrants, for immigrants who are between 18 and 34 years of age in the census immediately following their arrival, and for comparable fixed age cohorts of natives. For the immigrant population, we define fixed year-of-arrival cohorts for the five year period before each of the decennial census years.

The results in Panel A reveal several patterns. First, the poverty rates of recent immigrants (read along the diagonal) increase notably between 1970 and 1990. In 1970, 18 percent of recent immigrants (defined as those arriving within the past five years) had incomes below the federal poverty line. This increased to 28 percent in 1980, to 30 percent in 1990, but then declines to 28 percent in 2000. Panel A also reveals that poverty rates decline quite quickly with time in the U.S. Moreover, these declines are more pronounced for more recent cohorts relative to past cohorts. For example, between 1970 and 1980, the poverty rate of immigrants arriving between 1965 and 1970 declined by 5.7 percentage points. The comparable ten-year change for recent immigrants in the 1980 census is 11.3 percentage points, while the comparable

change for recent immigrants in the 1990 census is 12.4 percentage points. Even for the five year period following the 2000 census, the poverty rate among recent immigrants declines by a full 10 percentage points.

Panel B reproduces these figures for immigrants who are between 18 and 34 years of age in the census year following their arrival. The patterns are quite similar to those in Panel A, with poverty declining during the first ten years in the U.S. by ten percentage points or more in most instances. To address whether these poverty rates converge towards or diverge from those of the native born, Panel C presents comparable cross-census comparisons of poverty rates among the native born who are 18 to 34 years of age in each of the decennial census years. For example, the figures in the first row present poverty rates for those natives who are 18 to 34 in 1970, 28 to 44 in 1980, 38 to 44 in 1990, and so on, and are thus directly comparable to the tabulated poverty rates in Panel B for the 1965 to 1970 arrival cohort of immigrants. The corresponding immigrant-native differences in poverty (using the figures in Panels B and C) and how they change over time provides an assessment of the degree to which immigrant poverty rates converge towards those of the native born.

Figure 3 graphs the corresponding differences between immigrant and native poverty rates in Panels B and C of Table 5 for each arrival cohort. The figure reveals the rapid convergence of native and immigrant poverty rates. For example, over the 35 year period between 1970 and 2005, the immigrant-native poverty rate differential between the 1965-1970 arrival cohort and the comparably-aged natives declines from roughly 7 percentage points to half a percentage points. Between 1980 and 2005, the relative poverty rate differential for the 1975 to 1980 cohort declines from 15.6 percentage point to 1.2 percentage points. Among the most recent arrivals in the 2000 census (the 1995 to 2000 arrival cohort) the immigrant-native poverty

differential declines from 14.7 percentage points to 4.6 percentage points over a relatively short five year period. Thus, in contrast to the wage results discussed above, the poverty rates of immigrants do indeed assimilate for the better towards native outcomes.[1]

Table 6 presents comparable synthetic cohort analyses of the relationship between time in the U.S. and poverty rates among immigrants for select region-of-origin groups. While there are large differences in starting levels for recent immigrants, poverty declines with time in the U.S. for all groups. For example, between 1980 and 2005 the proportion in poverty among the 1975 to 1980 arrival cohort declines by 14.5 percentage points among Mexican immigrants, 19.8 percentage points among Central American immigrants, 19.4 percentage points among South American immigrants, 16.1 percentage points among East Asian immigrants, and 22.6 percentage points among Southeast Asian immigrants.

Table 7 presents specific age-cohort estimates for natives by race and ethnicity similar to those presented in Table 5. For most of the native groups, poverty rates are either high at age 18 to 34 and decline slowly with age, or are very low for ages 18 to 34 and similarly decline slowly with age –i.e., that much of the variation displayed in this table occurs between groups rather than within groups over time.

For the purpose of providing an alternative set of metrics of poverty assimilation among immigrants, we compare the poverty rates for Mexican, Central American, and South American immigrants to those of native-born Hispanics in Panel E. Similarly, we compare the poverty rates for East Asian and Southeast Asian immigrants to those of native-born Asians in Panel C. Figure 4 through 8 present these poverty rate differentials for each immigrant group and within group for each cohort. The figures generally portray substantial narrowing of the immigrant-

[1] Similar positive assimilation is observed for homeownership rates (see Borjas (2002) and Greulich, Quigley, and Raphael (2004). Rumbaut (1999) documents the downward assimilation of immigrants in health and behavioral outcomes for which recent immigrants perform better than the native born.

native poverty rate disparity with time in the United States. The slowest narrowing is observed for Mexican immigrants, while for Central American and South American immigrants, poverty rates fall below native-born Hispanic poverty rates in several instances. For East Asian and South East Asian immigrants, nearly all of the immigrant-native poverty disparity is eliminated within 10 years, while the remaining disparity disappears within 20 years in most instances.

The results from this section strongly suggest that with time in the U.S. the poverty rates of specific immigrant cohorts defined by year of arrival decline sharply and, for the most part, converge to the lower poverty rates of the native born. Since these results are based on synthetic cohorts rather than on analysis of actual longitudinal data on actual cohorts, they are open to several alternative interpretations. One clear possibility is that as immigrants acquire experience in the U.S. labor market earnings increase sufficiently to propel many out of poverty. An alternative interpretation is that those immigrants who are the most likely to remain poor selectively migrate out of the U.S. and back to their home countries. In other words, the arrival cohort observed near the time of arrival differs in composition from the same arrival cohort observed a decade or two later.

We cannot distinguish between these two possibilities with census data, but recent research by Lubotsky (2007) speaks directly to this issue. Lubotsky hypothesizes two sources of upward bias to synthetic cohort estimates of earnings growth among immigrants. First, selective emigration of the least successful leaves a positively-selected, higher earning group of immigrants remaining in the U.S. Second, since the census basically asks immigrant respondents when did they arrive in the U.S. “to stay,” many who appear to be recent immigrants in the data are likely to be immigrants who have previous short-spell experience in the U.S. and who are perhaps more likely to be low earners. The first source of bias increases estimates of immigrant

earnings growth through estimating later earnings with a select sample of immigrants. The second source of bias leads to an over-estimate of immigrant earnings growth due to an under-estimate of the true initial earnings of recent immigrants (as many low-earnings immigrants are misclassified as recent). By comparing longitudinal earnings records from U.S. Social Security Administration records with synthetic cohort estimates from the census and other sources, Lubotsky shows that both sources of bias tend to exaggerate the degree to which immigrant earnings increase with time in the U.S.

What are the implications of these findings for the analysis here? Clearly, any upward bias in synthetic cohort estimates of immigrant earnings assimilation is likely to lead us to overstate the degree to which an immigrant who enter the U.S. today will climb out of poverty in future years. However, the extent of this bias in the current application is perhaps less severe than in studies of income growth. Since progressing out of poverty simply requires that household income cross the poverty line, income growth beyond this threshold (even if exaggerated) does not impact the incidence of poverty. The second source of bias resulting form misclassification suggests that our estimates of poverty among recent immigrants are likely to be too high while the estimates of the poverty rates for non-recent immigrants is likely to be low. Again, this bias is perhaps less important when the poverty count is at issue. What is clear, however, is that with time in the U.S. income growth and selective migration results in sharply declining poverty rates among specific time-of-arrival cohorts of immigrants.

4. Contribution of Immigration to the National Poverty Rate: Country of Origin Compositional Effects

The descriptive statistics indicate that (1) poverty among the U.S. immigrant population has increased, and (2) this increase has been driven largely by shifts in the composition of the immigrant population towards higher poverty source countries. Moreover, the figures in Table 4 indicate that a larger proportion of the nation's population is foreign born (increasing from 4.8 to 12.4 percent over the period studied). Increasing poverty among immigrants coupled with a higher proportion of the population immigrant must add to the national poverty rate. In this section, we assess by how much.

To be sure, the basic patterns documented in Figure 1 suggest that this composition effect cannot be large. Immigrants still comprise a small minority of the U.S. population and thus, their contribution to the poverty rate is dwarfed by poverty among the native born. To be sure, native poverty may be higher as a result of labor market competition with immigrants (an issue that we analyze in detail in the next section). Nonetheless, the pure compositional effect is limited in size by the size of the overall foreign-born population.

To analyze this question more formally, here we calculate a simple decomposition of the change in the national poverty rate between 1970 and 2005. Specifically, let w_{it} be the proportion of the U.S. population at time t accounted for by group i, where the index i encompasses the native born and each of the country-of-origin groups listed in Table 2. In addition, define $poverty_{it}$ as the corresponding poverty rate for group i in year t. The national poverty rate for 1970 and 2005 can be expressed as a weighted sum of the group-specific poverty rates:

(1)
$$poverty_{1970} = \sum_{i=1}^{I} w_{i1970}\, poverty_{i1970}$$
$$poverty_{2005} = \sum_{i=1}^{I} w_{i2005}\, poverty_{i2005}.$$

The change in poverty rates can be expressed by

(2) $$\Delta Poverty = \sum_{i=1}^{I} w_{i2005}\, poverty_{i2005} - \sum_{i=1}^{I} w_{i1970}\, poverty_{i1970}.$$

Adding and subtracting the term $\sum_{i=1}^{I} w_{i1970}\, poverty_{i2005}$ to equation (2) and factoring give the decomposition

(3) $$\Delta Poverty = \sum_{i=1}^{I} (w_{i2005} - w_{i1970})\, poverty_{i2005} + \sum_{i=1}^{I} w_{i1970}\, (poverty_{i2005} - poverty_{i1970}).$$

The first component on the right hand side of equation (3) shows the contribution to the poverty change associated with the shift in population shares between 1970 and 2005. The second component represents the contribution of changes in group-specific poverty rates between 1970 and 2005 holding the population shares constant at 1970 levels.

Figure 9 presents the results from this decomposition using the poverty rates in Table 2 and the population shares in Table 4. Overall poverty declines by a mere two-tenths of a percentage point. Shifts in population shares contribute half a percentage point to the national poverty rate, while the change in poverty within groups reduces the national poverty rate by seven tenths of a percentage points. One way of interpreting these figures is that had the immigrant population not grew proportionally between 1970 and 2005 and had the country or origin composition not changed, the national poverty rate would have decline by an additional half of a percentage point over the time period studied.

5. Poverty among natives due to labor market competition with immigrants

The contribution of immigration to poverty analyzed in the previous section is purely arithmetic. To the extent that immigrants have higher poverty rates and immigrants are an

increasing proportion of the resident population, the national poverty rate will increase. Beyond this compositional effect, immigrants may also impact national poverty via labor market competition with natives. To the extent that immigrants drive down the wages of natives with similar skills, increased immigration will contribute to native poverty. Moreover, this effect may be exacerbated by labor supply responses among natives to lower wage offers.

In this section, we begin with a theoretical discussion of the potential impact of immigrants on the earnings and employment of natives. We then present upper and lower bound estimates of the effects of immigration on native poverty operating through an impact on immigrant competition on the national wage distribution.

A. Basic Economic Models of Immigration and Labor Market Competition with Natives[2]

Plainly stated, an influx of immigrants will lower the wages of those native-born workers with whom immigrants are in direct labor market competition. To the extent that wage suppression is sufficient to push these natives below the poverty line, immigration will contribute to native poverty. The economic forces behind this proposition are best illustrated with a simple model of wage determination in the overall economy. Suppose for the moment that all workers in the economy are exactly the same in that employers can perfectly substitute one employee for another. Assume further that this perfect substitutability extends to substituting an immigrant worker for a native worker. Also assume that the stock of productive capital (machinery, plant, and equipment used in the production of goods and services) is fixed. Under these conditions, an increase in immigration increases national output, lowers the wages and employment of native workers as well as aggregate native wage and salary income, and increases total income accruing to the owners of capital.

[2] The discussion in this section draws heavily upon the discussion in Raphael and Ronconi (2008).

Figure 10 illustrates these conclusions in a simple supply-demand framework. The downward-sloping curve, D_0, depicts the economy-wide demand for labor, with the height of the curve giving the maximum amount that employers would be willing to pay for one more worker at the corresponding level of employment. This amount equals the value of the output added by the last worker hired, a value that declines as the level of employment increases.[3] Thus, to induce employers to hire more workers relative to some given employment level, wages must decline. Since the height of the demand curve at any employment level provides the value added by the last worker, it follows that the area under the demand curve up until the actual employment level corresponds to the value of national output (or gross domestic product).

The upward-sloping line, S_0, represents the supply of native workers to the labor market, or the number of workers willing to work at a given wage. The upward slope indicates that as wages increase, more people will want to work. In the absence of foreign migration, the market will settle where supply equals demand, at the wage W_o and the employment level E_0. Total wage and salary income is simply wages times employment (the area in the rectangle below the line at the wage level W_o and to the left of the employment level E_0).

In this simple framework, international immigration impacts the economy by augmenting the number of people wishing to work at any given level of wages. For example, at the equilibrium wage W_o, the quantity of natives who wish to work is E_0, and absent international immigration this is where the economy will settle. Immigration however, increases the number of people willing to work at this wage, effectively shifting the entire labor supply curve outwards to S_1. At the old wage level, there are now more workers seeking employment than employers are willing to hire. Competition for jobs will drive down wages, inducing employers to expand

[3] The downward slope of the demand curve follows from assuming that the stock of productive capital is fixed, and thus the marginal output of each additional hire will decline as we stretch available capital more thinly across the pool of employed residents.

employment and some job seekers to leave the labor market. This continues until wages decline to W_1 in Figure 1, where labor demand and supply are once again equal to one another.

Note the impact of this "labor supply shock" on the labor market outcomes of native workers and on the economy as a whole. To begin, wages have declined for all workers, immigrant as well as native, and thus natives who are still working are clearly worse off relative to the outcome pre-immigration. Moreover, despite the fact that total employment has increased native employment has declined, since the decreases in wages causes some natives to withdraw from the labor market. This can be seen by looking at the number of native job seekers along the old natives-only supply curve S_0 at the new lower wage W_1. At the lower post-immigrant wave wage, only E_2 natives would be seeking work, a decline in employment equal to the distance between E_0 and E_2. Thus, in this simple model, it must be the case that native born workers are harmed by the influx of foreign-born labor.

In contrast, employers (or more specifically, the owners of capital) clearly benefit from the influx of immigrants. Since overall employment has increased and the value of national output is given by the area under the demand curve up through the actual employment level, the nation's gross domestic product must have also increased. Moreover, employers are now paying lower wages than they were previously. With higher national output and a lower wage level, the total income accruing to capital has clearly increased.

This is a relatively straightforward story. Immigration increases national output, harms native labor, but enriches the owners of capital. Stated in an alternate manner using terminology that we will more clearly define momentarily, immigration harms those "factors of production" with which it directly competes while benefiting those factors that it complements.

Given the large increases in immigration in recent decades and the clear predictions of these simple theoretical arguments, one may wonder what there is to debate.

Of course, the actual economy and the likely impacts of immigration operate within a far more complex model. Perhaps the best way to proceed is to relax some of the simplifying assumptions that permitted us to reduce the entire economy to Figure 1, and discuss how this impacts the story.

Most conspicuously, we assumed that employers can perfectly substitute the average immigrant worker for the average native worker (and visa versa). This is clearly unrealistic. Immigrants and natives differ along a number of dimensions that are likely of value to employers. Immigrants tend to have less formal education on average, with levels of educational attainment particularly low among Hispanic immigrants and many Southeast Asian immigrants. Immigrant and native-born workers are also likely to differ in their ability to converse in English. Immigrants also tend to be younger than natives, a fact suggesting that the average immigrant worker may have less labor market experience than the average native-born worker.[4]

Given such differences in skills, it is more likely the case that immigrants and natives are imperfect substitutes in production – i.e., substituting immigrant for native workers is possible, but limited by differences in skills. Moreover, the substitution possibilities are likely to vary across jobs according to the skill content of various occupations. In some instances, certain sub-groups of natives are likely to complement immigrant labor in production. That is to say, certain native workers are likely to be hired in conjunction with the hiring of immigrant workers. For example, Spanish speaking laborers on a construction site may increase the demand for native-born bilingual Hispanics with enough education to serve in supervisory positions. As another

[4] Of course, if immigrants enter the labor market earlier in life due to leaving school at a younger age, the relative youth of immigrant workers may not translate into lower average years of work experience relative to natives.

example, an increase in the supply of low-skilled construction labor may increase the demand for architects, structural and civil engineers, skilled craftsmen, and workers in other such occupations whose labor constitutes important inputs in the construction industry.

The imperfect substitutability between immigrant and native workers in the U.S. is most readily demonstrated by comparing their distributions of educational attainment. Table 8 presents the distributions of immigrants and native men and women, ages 18 to 64, across formal educational attainment levels for the year 2000 using data from the one percent PUMS for that year. The share of immigrant workers with extremely low levels of educational attainment is quite high relative to all native groups. For example, roughly 22% of immigrant men left school before the ninth grade, compared with 2% of native-born White men, 4% of native-born Black men, 2% of native-born Asian men, and 8% of native-born Hispanic men. Similar patterns are observed when comparing immigrant and native-born women. Immigrants are also more likely to hold advance degrees relative to most of the native-born groups.

We can further characterize the degree of overlap between the skill distributions of immigrants and natives by incorporating the effects of age as well as education on skills and earnings. We do so in the following manner. We first defined 54 groups based on age and educational attainment.[5] We then use the 2000 PUMS data to rank these groups from lowest to highest average earnings among those employed within each group. This ranking serves as an indication of skill endowments as they are valued by the market.[6] Next, we identified those age-education groups that account for the bottom 25%, or first quartile, of the skill distribution for

[5] We use the six educational attainment groups defined in Table 1 and the nine age groups, 18 to 25, 26 to 30, 31 to 35, 36 to 40, 41 to 45, 46 to 50, 51 to 55, 56 to 60, and 61 to 64. The interaction of these six educational groups and nine age grouping define 54 age-education cells.

[6] We use average earnings among native-born, non-Hispanic White men to do these rankings. We use this group to rank age-education groupings into apparent skills groups since White men are the largest sub-groups in the labor market. We exclude other groups and women to abstract from the effects of race, ethnicity, and gender on wages. In other words, we wish to identify a ranking that is more likely to purely reflect average difference in skills.

natives, the next 25% of natives (the second quartile), the middle-upper 25% of natives (the third quartile), and the top 25% of the native skill distribution (quartile four). With this breakdown, we then calculated the percent of each immigrant and native groups that falls within each skill quartile. To the extent that the percent for a given group and quartile exceed 25%, the group is over-represented in this portion of the skill distribution. Conversely, to the extend that the percent falls below 25%, the group is under-represented.

Figure 11 presents these skill distributions for immigrant and native men. In addition to all immigrants, we also present the distribution for Hispanic immigrants. As can be seen, immigrants are heavily over-represented in the least-skilled quartile and under-represented in the remainder of the skill distribution. Fully 42% of all immigrant men and 62% of Hispanic immigrant men lie in the bottom quartile of the overall native skill distribution. For the native-born, by contrast, 23% of White men, 35% of Black men, 41% of Asian men, and 48% of Hispanic men fall in this low-skilled group. Furthermore, immigrants are under-represented in the middle of the skill distribution, with 37% of all immigrants and 31% of Hispanic immigrants in the second and third quartiles. For the native born, the comparable figures are 50% for White men, 53% for black men, 34% for Asian men, and 43% for Hispanic men. Figure 12 presents comparable distribution for women. Figure 12 also reveals fairly large differences between the skill distributions of immigrant and native women.

These figures suggest that immigrants and natives differ considerably in terms of their skills, a fact that complicates our analysis. Allowing for imperfect substitution between immigrant and native labor driven by differences in skills alters our theoretical predictions regarding the economic effects of immigrants on native labor market outcomes. Those natives whose skills are most like those of immigrants are most likely to be harmed. On the other hand,

those natives groups with sufficiently different skill sets are likely to be least harmed or may even benefit in the form of higher wages and greater employment as a result of an increase in immigrant labor. The educational attainment figures presented in Table 8 and the skill distributions depicted in Figures 11 and 12 indicate that there are substantial differences in skills between immigrants and natives. Perhaps the greatest degree of similarity occurs between immigrants and native-born Hispanics. Nonetheless, one cannot predict a priori how immigration will impact each of these groups on average, as immigrant skills distributions clearly differ in each case. The ultimate effect of immigrants on natives (both in terms of the sign of the effect as well as the magnitude) is an empirical rather than a theoretical question.

In the simple model in Figure 10, we also assumed that the stock of productive capital used in the production of goods and services was fixed. To understand the importance of this assumption, we briefly discuss the process by which capital accumulates in modern market economies. Changes in the capital stock from year to year reflect the difference between capital investment (which increases the capital stock) and capital depreciation (which diminishes the capital stock). Investment involves the deliberate allocation of resources towards activities that augment the future productive capacity of the economy –e.g., the addition of a machine or factory. Capital depreciation occurs through the wear and tear of the existing capital stock. For the capital stock to increase, capital investments must exceed capital depreciation.

Whether the economy makes sufficient investments to, on net, increase the stock of productive capital will depend on the return to capital, with increasing returns over time to capital spurring net capital accumulation. If, for whatever reason, one can earn more with a lathe today than yesterday, the demand for investment capital for the purpose of producing lathes will increase. This will increase interest rates (the price of capital) which will induce people to save

more domestically (supply their purchasing power to the capital market) and perhaps induce inflows of investment capital from abroad.

Immigration may increase the returns to capital by raising the amount of labor employing a unit of capital. To appreciate this point, it is helpful to think about how the mix of a country's endowment of productive inputs – its factor proportions -- impacts the marginal productivity of each input. The larger the amount of capital per worker, the more capital each employed person has to work with, which translates into higher labor productivity. Conversely, with a higher ratio of labor to capital, each unit of capital has more labor to work with, increasing the average productivity of capital. By increasing the ratio of labor to capital (or equivalently reducing the capital-labor ratio), immigration makes the existing capital stock more productive per unit. This in turn increases the returns to capital in the receiving nation and should spur net capital formation.

To see how allowing capital to respond to an immigrant inflow alters our conclusion from the model in Figure 10, Figure 13 charts the effect of a net augmentation of capital in response to an increase in immigration. As before, we begin with our original labor demand curve, D_0, our native labor supply curve, S_0, and the labor supply curve incorporating a new wave of immigrants, S_1. Holding capital fixed, immigration leads to a decrease in wages, an increase in overall employment, and a reduction in native employment. An increase in the capital stock in response to the immigrant wave will add one additional adjustment to our original story. An increase in capital now makes labor more productive, increasing the value of the output of the marginal worker at each point. Since the height of the demand curve is indicative of this value, the increase in the capital stock shifts the labor demand curve upwards to D_1. This increase in labor demand will result in an excess demand for labor at the wage W_1 (in other words, more

employers will be seeking workers than workers seeking jobs at that wage level). Wages will increase, and as they do, more workers, native as well as immigrant, will be coaxed into the labor market. Thus, capital accumulation will partially offset the negative effects of immigration on native wages and employment. The degree of this offset will depend on the responsiveness of capital supply to changes in return as well as underlying technological relationships governing production in the economy.

Thus, we began with a simple story in which immigration unambiguously lowers the wages and reduces the employment of native workers, and then finished with a more nuanced description where the theoretical predictions are more ambiguous and varied. In our more complex yet more realistic theoretical discussion, the potential adverse labor market effects of immigration should be greatest for those native-born workers who are most similar in their skills to immigrants. Workers who are sufficiently different may even benefit from immigration insofar as immigrants complement such natives in producing goods and services. In addition, capital accumulation in response to an immigrant inflow will, in isolation, benefit all workers by making them more productive. This will partially offset the wage declines for workers that are most similar to immigrants and accentuate the wage increases of complementary natives.

As the theoretical predictions regarding the magnitude and size of the effects of immigrants on native wages and employment are ambiguous (as is, therefore, the theoretical prediction regarding poverty), whether immigration increases or decreases poverty is ultimately an empirical issue. Thus, we now turn to our empirical estimates of the contribution of immigration to poverty via labor market competition with natives.

B. Empirical Estimates

We simulate the effects of competition with immigrants on native poverty rates in the following manner. First, we estimate the parameters of a theoretical model that ties the wages of workers of various skill groupings to their own supply and the supply of all other workers. We then use the calibrated theoretical model to simulate the hypothetical wages that workers of various skill groups would earn if the supply of immigrant labor were held to 1970 levels. Using these alternative wage estimates we simulate hypothetical personal income and total family income with restricted immigrant labor supply. Finally, we use these simulated family income levels to simulate what native poverty rates would have been had the immigrant population been held at 1970 levels.

The theoretical model of wage determination posits that the wages of workers in a given skill level depends inversely on own supply. In addition, a given group's wages also depend on the supply of other workers. The supply of other types of workers can either suppress (when these workers are close substitutes) or increase (when these workers are complementary) the wages for a given skill group, depending primarily on the ease with which employers can substitute workers of different skill levels in producing goods and services. The appendix presents the formal model, a description of the data that we use to estimate the parameters of the model, and our alternative estimates of the impact of immigration between 1970 and 2005 on the wages of natives of different skills groups defined by their level of educational attainment and potential years of work experience.

Table 9 presents a set of lower bound and upper bound estimates of the effects of immigration on native wages. The lower bound estimates assume a fairly high degree of substitutability (but not perfect substitutability) between immigrant and native labor, a modest degree of substitutability between workers of different experience levels but similar educational

attainment levels, and a modest degree of substitutability between workers of different educational attainment. The upper bound estimates assume much less substitutability between workers of different educational attainment groups, effectively concentrating the adverse impacts of an immigrant supply shock on natives with similar levels of educational attainment. In both simulations, we assume that the capital stock accumulates at the rate necessary to maintain a constant return to capital. In the appendix, we present a number of alternative wage simulations.

In both sets of estimates, the proportional effects on wages are negative for the least educated natives. Our lower bound estimates suggest that the wages of native high school dropouts are one to two percentage points lower as a result of immigration between 1970 and 2005. Our upper bound estimates suggest that wages for these workers are five to seven percentage points lower. Wages are not adversely affected for any of the other skill groups. Thus, the simulations indicate that immigration has had a modest adverse impact on the earnings of the least educated native workers.

To simulate the impacts of these wage effects on poverty, we performed the following calculations. Using data from the 2005 ACS, we first tabulated what each individual's weekly wages would have been under the counterfactual that immigrant labor supply in each skill category is held at 1970 levels. For both our lower bound and upper bound estimates, this effectively raises the earnings of those with less than a high school diploma and slightly decreases earnings for everyone else. Next, for both the upper and lower bound wage estimates we tabulated counterfactual annual wage and salary incomes first assuming that weekly labor supply is not affected by the wage change and then assuming a labor supply elasticity of one for all skill groups.[7] With these hypothetical wage and salary income levels, we then tabulate

[7] Note, an increase in wages can either increase or decrease the quantity of time that a worker supplies to the market, depending on the relative size of the negative income effect of the wage increase and the positive substitution effect

hypothetical family income levels for all families where the head of household is native born. Finally, we tabulate income relative to the poverty line using these hypothetical family income levels and calculated hypothetical poverty rates.

Table 10 presents actual poverty rates for the members of households headed by a U.S. native and the four hypothetical poverty rates using the upper and lower bound estimates of the immigrant wage effects and the two alternative assumptions regarding the sensitivity of labor supply to wage changes. The hypothetical poverty rates are essentially identical to actual poverty rates. Given the modest wage effects listed in Table 9, this is not too surprising. Thus, while our simulations suggest that immigration between 1970 and 2005 may have had a modest impact on the wages of the least educated native workers, the impact of these wage effects on native poverty rates is negligible.

6. Conclusion

In this chapter, we explored three possible connections between international immigration to the United States between 1970 and 2005 and the nation's poverty rate. First, we documented the increased poverty incidence among immigrants and the connections between the changing national origin mix of the immigrant population and immigrant poverty. Second, we estimated how poverty rates change within immigrant arrival cohorts as time in the U.S. increases. Finally, we discussed in detail the avenues through which immigration may impact the wages of the native born; we simulated the likely wage effects of immigration between 1970 and 2005, and we simulated the consequent effects on native poverty rates.

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of the wage increase. Our alternative scenarios with regards to labor supply amounts to first assuming that the income and substitution effects offset one another and then assuming that the substitution effect dominates. Note, for workers who usually work 52 weeks, we do not cap hypothetical -weeks supply at 52. While clearly a person cannot work more than 52 weeks, she can expand hours per week in response to a wage increase. Our simulation results are not sensitive to this specification choice.

In the end, it appears that the only substantive contribution of immigration to the national poverty rate occurs through the compositional effects of recent immigrants on the national poverty rate. Recent immigrants from Latin America and Asia tend to experience high initial poverty rates which certainly increased the overall poverty rate relative to what it would otherwise be. However, this effect is small (no more than half a percentage point). Moreover, through wage growth and selective out-migration, immigrant poverty declines quickly with time in the U.S.

We find much less evidence of an impact of immigration on native poverty through immigrant-native labor market competition. Despite adverse wage effects on high school dropouts, the effects on native poverty rates are negligible. This latter result is largely driven by the fact that even among native-born poor households most have at least one working adult with at least a high school education.

Appendix: Simulating the Effect of Immigration Between 1970 and 2005 on the National Wage Structure

We estimate the impact of immigration on native poverty rates in two steps. First, we calibrate a model of the U.S. wage structure using census data for the period 1970 to 2005 and use this model to simulate what native wages would have been in 2005 if immigrant penetration in the labor market were at 1970 levels. Next, we use this hypothetical set of wage effects in conjunction with household survey data for 2005 to estimate what the consequences for native poverty rates would have been. In this appendix, we describe how we estimate the underlying wage model and the simulation methods used to quantify the impact of immigration on wages.

Describing the model of wage determination

Following Card and Lemieux (2001), Borjas (2003), and Ottaviano and Peri (2007), we assume that overall production in the economy is described by the multi-layer constant elasticity of substitution (CES) production function

(1) $$Q_t = [a_{0t}K_t^{\nu} + a_{1t}L_t^{\nu}]^{\frac{1}{\nu}}, \quad where \quad \nu = 1 - \frac{1}{\sigma_{KL}}$$

(2) $$L_t = \left(\sum_{k=1}^{4} e_{tk}L_{tk}^{\eta}\right)^{\frac{1}{\eta}}, \quad where \quad \eta = 1 - \frac{1}{\sigma_{educ}}$$

(3) $$L_{tk} = \left(\sum_{j=1}^{8} x_{tkj}L_{tkj}^{\delta}\right)^{\frac{1}{\delta}}, \quad where \quad \delta = 1 - \frac{1}{\sigma_{\exp}}$$

(4) $$L_{tkj} = \left(\sum_{i=1}^{2} m_{tkji}L_{tkji}^{\varepsilon}\right)^{\frac{1}{\varepsilon}}, \quad where \quad \varepsilon = 1 - \frac{1}{\sigma_{immig}}$$

where t indexes times, k indexes four labor groups defined by educational attainment (less than high school, high school, some college, college graduates), j indexes eight potential years of experience groups (0 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 40), and i indexes nativity (1=native, 2=immigrant).

Equation (1) combines capital and total labor in year t to produce national output Q_t, where a_{ot} and a_{1t} are productivity coefficients for capital and labor, respectively, and σ_{KL} is the elasticity of substitution between capital and labor. In turn, the total labor supply aggregate, L_t, is a CES aggregation of sub-categories of labor defined by the four educational groups, L_{tk}, given by equation (2) where the e_{tk} provide the corresponding productivity coefficients and σ_{educ} is the elasticity of substitution between education groups. The labor supply of each educational group, L_{tk}, is further assumed in equation (3) to be a CES aggregation of labor supply for each of the

eight experience groups, L_{tkj}, with corresponding productivity coefficients x_{tkj} and an elasticity of substitution between experience groups within an education branch given by σ_{exp}. Finally, labor supplied within a given education-experience cell is assumed to be a CES aggregation of native labor, L_{tkj1}, and immigrant labor, L_{tkj2}, with a corresponding elasticity of substitution between immigrants and natives given by σ_{immig} and productivity coefficients given by m_{tkji}.

The wages of workers in group *tkji* are determined by their marginal product, which in turn will depend on the supply of capital, the overall supply of labor, the supply of labor in education group *tk*, the supply of labor in education-experience group *tkj*, and their own-supply of labor L_{tkji}. Assuming a product price of one, the wage is determined by the equation

$$w_{tkji} = Q_t^{1-\nu} a_{1t} L_t^{\nu-\eta} e_{tk} L_{tk}^{\eta-\delta} x_{tkj} L_{tkj}^{\delta-\varepsilon} m_{tkji} L_{tkji}^{\varepsilon-1}. \tag{5}$$

Taking logs and rewriting (5) as a function of the four elasticities of substitution gives

$$\ln w_{tkji} = \ln Q_t^{1-\nu} a_{1t} + \left[\frac{1}{\sigma_{educ}} - \frac{1}{\sigma_{KL}}\right] \ln L_t + \ln e_{tk} + \left[\frac{1}{\sigma_{exp}} - \frac{1}{\sigma_{educ}}\right] \ln L_{tk} + \ln x_{tkj} + \left[\frac{1}{\sigma_{immig}} - \frac{1}{\sigma_{exp}}\right] \ln L_{tkj} + \ln m_{tkji} - \frac{1}{\sigma_{immig}} \ln L_{tkji}. \tag{6}$$

Assuming that the supply of labor is perfectly inelastic within the year-education-experience-nativity cell of equation (6), various specifications of equation (6) can be used to estimate the substitution elasticities underlying the wage determination process. The equation highlights how an increase in own factor supply suppresses wages as well as the relationship between wages and factor supply of other nativity groups (operating through L_{tkj}), the factor supply of other experience groups within one's education group (operating through L_{tk}), and the factor supply of other education groups (operating through the effect of L_t).

How immigration impacts the wages of specific native skill groups

Immigration over a given time period impacts the wages of a native in a specific skill group through four avenues: (1) its impact on the supply of workers within her year-education-experience cell, (2) its impact on the supply of workers in her year-education cell, (3) its effect on the overall aggregate supply of labor, and (4) its impact on capital accumulation. An increase in immigrants within one's own year-education-experience group impacts wages through all avenues, immigration within one's education group but outside one's experience group affects one's wages through avenues (2) through (4) only, while immigration from outside one's educational group impacts own wages through avenues (3) and (4) only.

Since we are estimating the effects of immigration over a 35 year period, we assume that the economy is on its long-run balanced growth path (following Ottaviano and Peri (2007) and Borjas (2005)), implying that capital accumulates at the rate needed to ensure a constant return to

capital. Under this assumption regarding the growth path of the capital stock, equation (6) becomes

$$(7)\qquad \ln w_{tkji} = \ln B_t + \frac{1}{\sigma_{educ}}\ln L_t + \ln e_{tk} + \left[\frac{1}{\sigma_{\exp}} - \frac{1}{\sigma_{educ}}\right]\ln L_{tk} + \ln x_{tkj} + \left[\frac{1}{\sigma_{immig}} - \frac{1}{\sigma_{\exp}}\right]\ln L_{tkj} + \ln m_{tkji} - \frac{1}{\sigma_{immig}}\ln L_{tkji}.$$

where the term B_t will be a function of the constant return to capital but varies over time due to technological progress.[8] Thus an increase in the supply of any labor skill group will induce a positive effect on wages through capital accumulation, partially offsetting any decrease in wages due to the greater labor supply.

To derive the full effects of a specific immigration-induced supply shock on the wages of a given native skill group, we must differentiate the log wage for native group *tkj1* (as given in equation (7)) with respect to a change in immigrant supply within the same education-experience cell, with respect to immigrant supply within one's education group but outside one's education-experience cell, and with respect to immigrant supply outside one's education group. These three wage elasticities are given by the expressions

$$(8)\qquad \varepsilon_{own} = \frac{\partial \ln w_{tkj1}}{\partial \ln L_{tkj2}} = \frac{1}{\sigma_{educ}}\frac{s_{tkj2}}{s_t} + \left[\frac{1}{\sigma_{\exp}} - \frac{1}{\sigma_{educ}}\right]\frac{s_{tkj2}}{s_{tk}} + \left[\frac{1}{\sigma_{immig}} - \frac{1}{\sigma_{\exp}}\right]\frac{s_{tkj2}}{s_{tkj}}$$

$$(9)\qquad \varepsilon_{cross-\exp} = \frac{\partial \ln w_{tkj1}}{\partial \ln L_{tkj'2}} = \frac{1}{\sigma_{educ}}\frac{s_{tkj'2}}{s_t} + \left[\frac{1}{\sigma_{\exp}} - \frac{1}{\sigma_{educ}}\right]\frac{s_{tkj'2}}{s_{tk}}, \quad where \quad j \neq j'$$

$$(10)\qquad \varepsilon_{cross-educ} = \frac{\partial \ln w_{tkj1}}{\partial \ln L_{tk'j2}} = \frac{1}{\sigma_{educ}}\frac{s_{tkj'2}}{s_t}, \quad where \quad k \neq k'$$

where s_t is labor's share of income in year *t*, s_{tk} is the share of income accruing to labor in education group *k* in year *t*, s_{tkj} is the share of income accruing to labor in group *tkj*, and s_{tkj2} is the share of income accruing to immigrant labor in group *tkj*.

Define the variable M_{kj} as the percentage increase in immigrant supply between 1970 and 2005 and the column vector m as the complete set of shocks for the 32 education-experience groups. Using the elasticites in equations (8) through (10), we can construct a square elasticity matrix Π where the rows are defined by the education experience group of natives for whom we wish to

[8] Specifically, assume that the first level of the CES production function is defined by the Cobb-Douglas production function $Q_t = A_t K_t^{\alpha} L_t^{1-\alpha}$. If capital accumulates to maintain a constant return to capital of r, the production function reduces to $Q_t = B_t L_t$ where $B_t = \left[\frac{r}{A_t \alpha}\right]^{\frac{\alpha}{\alpha-1}}$.

analyze wage effects, the columns are defined by the education-experience group experiencing an immigrant labor supply shock. Elements of the matrix where $i_{row} = i_{column}$ and $j_{row} = j_{column}$ are given by the own-elasticity in equation (8), elements of the matrix where $i_{row} = i_{column}$ and $j_{row} \neq j_{column}$ are given by the cross experience group elasticity in equation (9), while elements of the matrix where $i_{row} \neq i_{column}$ and $j_{row} \neq j_{column}$ are given by the cross education group elasticity in equation (10). With this matrix and the supply shock vector, the vector of simulated effects of immigrations between 1970 and 2005 are given by the equation

$$Wage\ Effect = \Pi m, \tag{11}$$

where the individual elements of this vector are given by the expression

$$Wage\ effect_{kj} = \frac{1}{\sigma_{educ}} \sum_{k=1}^{4} \sum_{j=1}^{8} \frac{s_{tkj2}}{s_t} M_{kj} + \left[\frac{1}{\sigma_{\exp}} - \frac{1}{\sigma_{educ}} \right] \sum_{j=1}^{8} \frac{s_{tkj2}}{s_{tk}} M_{kj} + \left[\frac{1}{\sigma_{immig}} - \frac{1}{\sigma_{\exp}} \right] \frac{s_{tkj2}}{s_{tkj}} M_{kj} \tag{12}$$

As is evident in equation (12), immigrant supply shocks to one's one education-experience group impacts ones wages through all three terms, shocks within one's education group but outside one's experience group only affect the first two terms, while shocks outside of one's education-experience cell only impact wages through the first term.

To implement the wage simulations described by equations (11) and (12), we need three pieces of information. First, we need to estimate the proportion of income accruing to various aggregations of labor input. We assume that labor's share of national income is 0.7 and estimate the additional shares using data from the 2005 American Community Survey.

Second, we need to characterize the magnitude of the immigration shock for each education-experience cell. We define the immigrant shocks M_{kj} as the difference between the immigrant supply level (the measurement of which is discussed below) in 2005 less the immigrant supply level in 1970 all divided by the immigrant supply level in 2005. Thus, we are simulating the effect of reducing immigration to 1970 levels relative to 2005 labor supplies.

Finally, performing these wage simulations requires estimates of the three substitution elasticities σ_{immig}, σ_{exp}, and σ_{educ}. We turn now to a discussion of how we estimate these elasticities.

Estimating the elasticity of substitution between different labor aggregates

To estimate the needed substitution elasticities, we analyze data from the 1960 and 1970 one percent PUMS files, the 1980 through 2000 five percent PUMS files, and data from the 2005 American Community Survey. While our principal analysis pertains to the period from 1970 to 2005, we occasionally include 1960 to facilitate comparisons with previous research. In each year, we restrict the analysis to individuals ages 17 to 65 who do not reside in institutional group quarters, who have positive weeks worked, who work positive hours during the interview week (for 1960 through 1990) or who indicate that they usually work a positive number of hours per week (2000 and 2005), and who have positive values for annual wage and salary income. We define education groups, work experience groups, and nativity status as in Ottaviano and Peri

(2005) (as described in Borjas, Grogger and Hansen (2008)). To measure wages, we calculate average weekly wages for men who usually work 35 hours or more (using either hours prior to the survey week or usual hours depending on the survey year). To measure labor supply, we aggregate total hours supplied to the market within various labor sub-aggregates using the entire sample of workers 17 to 65. To calculate total hours, we calculate annual hours worked for each person, multiply by the survey weight, and then sum within labor aggregate categories.

Equation (7) above gives an expression for log wages for those in group *tkji*. The equation implies that the difference in log wages between natives and immigrants in the same year-education-experience cell can be expressed as

$$\ln \frac{w_{tkj1}}{w_{tlk2}} = \ln \frac{m_{tkj1}}{m_{tkj2}} - \frac{1}{\sigma_{immig}} \ln \frac{L_{tkj1}}{L_{tkj2}} \tag{13}$$

indicating that the relative log wages of natives and immigrants should vary inversely with relative log factor supplies. Specifically, a regression of the log of the native-immigrant wage ratio on the log of native-immigrant factor supplies provides an estimate of -1 over the elasticity of substitution between these two groups. Appendix Figures 1A and 2A provide scatter plots that summarize the relationship between these two ratios. Figures 1A plots the log wage ratio against the log supply ratio using all experience-education groups from 1960 through 2005. Figure 2A presents a scatter plot of the residual variation in these ratios after purging the data of year fixed effects. The line fit to the scatter in Figure 1A has a slope of -0.034 and is statistically significant at the one percent level. The comparable slope through figures 2A is -0.027, also significant at the one percent level.

Appendix Table 1A provides various estimate of $-1/\sigma_{immig}$ where alternative combinations of fixed effects are used to proxy for variation in the intercept term $ln(m_{tkj1}/m_{tkj2})$. Panel A presents estimates using 1960 through 2005 while panel B presents estimates restricting the data to 1970 through 2005. Standard errors in all models are calculated assuming clustering by experience-education cells. The negative significant effect of approximately -0.03 survives controlling for education group, experience group, and year fixed effects as well as education-year interaction effects alone. Including effects beyond the latter specifications generally leads to insignificant estimates, although the standard error are sufficiently high that we cannot rule out fairly low value of σ_{immig}. The estimates are fairly insensitive to dropping 1960 (if anything the point estimates suggest stronger effects). Previous research by Ottaviano and Peri (2007) finds estimates of this elasticity on the order of 6, using a different more inclusive sample of workers to measure the elements of the wage ratio in (13). Manacorda, Manning, and Wadsworth (2006) find similar estimates using data for Great Britain. Borjas, Grogger and Hanson (2008) find no relationship using full-time full-year workers not enrolled in school to estimate the relative wage ratio in (13). Finally, Card (2008) finds an estimate of $-1/\sigma_{immig}$ on the order -0.03 using a cross section of metropolitan areas from the U.S. census.

In our simulation results below, the implied impacts of immigrants on native wages increase in the assumed value of σ_{immig} (since lower elasticity of substitution estimates suggest that the wage effects of an immigrant supply shock are concentrated on immigrants themselves). Since the implied wage effects in our simulations are fairly low and concentrated among the least

educated, we choose a fairly high estimate of σ_{immig} as our preferred figure. In particular, we assume a value of 33 (the value implied by several of the regressions in Table 1A), much larger than the estimates in the two papers discussed above, yet within the sampling distribution of many of the estimates presented in Borjas, Grogger, and Hansen (2008).

Estimating the elasticity of substitution between experience groups requires aggregating immigrant and native labor into the higher aggregate labor supply units. The average wage paid to immigrants and natives will equal the marginal effect of an increase in this labor aggregate on total output (calculated by differentiating Q with respect to L_{tkj}). Taking this derivative[9] and taking logs yields the wage expression

$$\ln w_{tkj} = \ln B_t + \frac{1}{\sigma_{educ}} \ln L_t + \ln e_{tk} + \left[\frac{1}{\sigma_{\exp}} - \frac{1}{\sigma_{educ}} \right] \ln L_{tk} + \ln x_{tkj} - \frac{1}{\sigma_{\exp}} \ln L_{tkj}. \quad (14)$$

Thus, a regression of log wages for group *tkj* on a series of appropriate fixed effects and own-factor supply yields an estimate of $-1/\sigma_{exp}$. To identify the elasticity of substitution across education groups, note that (14) can be rewritten as

$$\ln w_{tkj} = \ln B_t + \frac{1}{\sigma_{educ}} \ln L_t + \ln e_{tk} - \frac{1}{\sigma_{educ}} \ln L_{tk} + \ln x_{tkj} - \frac{1}{\sigma_{\exp}} [\ln L_{tkj} - \ln L_{tk}]. \quad (15)$$

where the coefficient on aggregate labor supplied in each education group provides an estimate of $-1/\sigma_{educ.}$

Estimating equation (14) requires the inclusion of several sets of fixed effects to account for the first five terms on the right hand side of the equation. The first two terms vary with time only and thus can be captured by a series of time effects. The third and fourth terms vary with time and education group and thus can be captured by time-education fixed effects. The term lnx_{tkj} varies across all observations, and thus an identifying restriction is needed. Following Borjas (2003) and Ottaviano and Peri (2007) we assume that these effects vary by education and experience groups but do not vary over time. Thus, we estimate the key coefficient in equation (14) with the regression model

$$\ln w_{tkj} = \beta_t + \pi_{tk} + \theta_{kj} - \frac{1}{\sigma_{\exp}} \ln L_{tkj} \quad (16)$$

We estimating equation (16) using instrumental variables where the log immigrant supply is used as an instrument for lnL_{kjt}.

The first two models in Appendix Table 2A present our estimates of the coefficient corresponding to $-1/\sigma_{exp}$. The first estimate uses all of the data from 1960 to 2005, while the second specification drops 1960 (to conform with our analysis period). Standard errors are clustered on education-experience cells in all models. Wages are inversely related to factor supplies in both models, with both coefficients statistically significant at the one percent level.

[9] The derivative assumes that capital accumulates endogenously to hold the return to capital constant.

However, dropping 1960 yields an estimate of σ_{exp} which is somewhat larger than the corresponding estimate from the model that includes 1960. Specifically, the model including 1960 gives an estimate of σ_{exp} approximately equal to 4.5. Dropping 1960 gives an estimate of 9.17. Since we are studying the period 1970 to 2005, and since this elasticity estimate is fairly well-measured, our preferred parameter value that we use below is 9.17.

To estimate the cross-education group elasticity using equation (15) we must again impose some identifying restrictions on the first few terms of the equation. First, we need to calculate the aggregate supply values, L_{tk}. With an estimate of the elasticity of substitution between experience groups, one could construct this aggregate from the third level of the CES production function given by equation (3) above. However, previous research has found that estimates that simply sum up the supply measures from the next level of dis-aggregation tend to yield nearly identical results. Here we measure L_{tk} by simply summing across experience groups within year-education cells.

Since the key variable in this model varies by year and education group only, we cannot include a full set of year-education fixed effects. Instead we parameterize the relationship between education groups, time and wages by proxying the first three terms in equation (15) with education group specific time trends. Again we impose the restriction that lnx_{tk} varies across education and experience groups but not by time. Thus, we estimate the model

$$\ln w_{tkj} = \pi_k t + \theta_{kj} - \frac{1}{\sigma_{educ}} \ln L_{tk} - \frac{1}{\sigma_{\exp}} [\ln L_{tkj} - \ln Ltk]. \tag{17}$$

where t is a time trend and π_k is a education group-specific trend coefficient. Note, the coefficient on the deviation in the third term provides an alternative estimate of $-1/\sigma_{exp}$. We estimate equation (17) using instrumental variables where the two supply variables are instrumented with the corresponding values for immigrants.

The second two models in Appendix Table 2A present these estimation results. The estimate of $-1/\sigma_{educ}$ in the model including 1960 yields a fairly low estimate of the degree of substitutability between workers of different levels of educational attainment (implied σ_{educ} =1.58). Note, the alternative estimate of the experience group elasticity is quite close to the estimate using equation (16) above.

When we drop 1960, the implied degree of substitutability among education groups is much greater (implied σ_{educ} =8). Since this is the estimate deriving from the time period that we are studying, we use implied σ_{educ} = 8 as a key parameter choice in our simulations below.

As we will soon see, the estimated effects of immigration on the native wage structure are very sensitive to the chosen value for implied σ_{educ}. Generally speaking, the larger this parameter the smaller will be the effect of immigration on those parts of the skill distribution where immigrant penetration is the greatest. This follows from the fact that the greater substitution possibilities facilitate transmitting the shock throughout the wage distribution rather than concentrating it in specific areas. To account for this sensitivity, we also present simulations using alternative

values of implied σ_{educ}. In particular, we make use of the value 2.5 that seems to be central finding in Card and Lemieux (2001).

Simulated effect on the native wage distribution

Appendix Tables 3A and 4A provide various estimates under alternative parameter values of the effects of immigration between 1970 and 2005 on native wages. The figures should be interpreted as the proportional wage penalty on the given group created by immigrant flow over this period, accounting for the entire distribution of the immigrant shocks as specified in equations (11) and (12).

The first column in Table 3A makes use of the parameter estimate implied by the analysis of census data during this time period. The simulations indicate relatively small effects of immigration on the wages of those with less than high school (on the order of one to two percent), and small, scattered positive or zero effects on all other groups. The results in the second through fourth column explore the sensitivity of this finding to alternative values of the parameter estimates. The second column assumes that immigrants and natives are perfect substituted within education-experience cells. The results still imply no impact of immigration for native with a high school degree or greater, but larger impacts on the order of 2 to 4 percentage points (roughly double those presented in the first column) for high school dropouts. The third column simulates wage effects with an education elasticity of 2.5. This change yields larger adverse wage effects for native high school dropouts, varying between 7 and 9 percentage points. Finally, the final column assumes immigrants and natives are perfects substitutes within education-experience groups, an experience elasticity of 5 and a cross-education group elasticity of 2.5. These simulations yield the largest estimates ranging from 6 to 10 percentage point wage penalties for high school dropouts, slight positive effects for high school graduates and those with some college, and slight negative effects for relatively inexperienced college graduates.

To explore further the sensitivity of these simulations to the degree of substitutability between immigrants and natives, Table 4A presents a series of simulations where σ_{edu} is held at 2.5, σ_{exp} is held at 9.14, but σ_{immig} varies between infinity at one extreme and the very low value of 5 at the other. The first column simply reproduces the results from the third column of Table 3A. The next column allows for the fairly high (yet finite) elasticity of substitution between immigrants and native implied by the census data (σ_{immig}=33). The next few columns sequentially lower the estimate of σ_{immig}.

Comparing the first and second columns, even a moderate degree of imperfection in the substitution possibilities between immigrants and natives attenuates the effects of immigration on native wages for the least educated natives. Specifically, the adverse wage effects are roughly twenty to thirty percent smaller using an elasticity estimate of 33. Subsequently lowering the elasticity used in the simulations yields even smaller wage effects, with the implied difficulty substituting immigrants for natives concentrating the wage effects of new immigration on the wages earned by immigrants themselves.

In our analysis of poverty trends, we use the wage results in the first column of Table 3A to calculate the lower bound poverty effects and the results in the second column in Table 4A to

calculate the upper bound effects. The first set of simulation results are justifiable on the grounds that these are the parameter estimates (and by extension, wage simulations) implied by the data. Regarding the second set of parameter estimates, the data do imply that immigrants and natives are not perfect substitutes for one another, although substitution possibilities may be greater than those implied by recent research. Moreover, the elasticity of substitution between experience groups is fairly well measured (and the wage simulations are relatively insensitive to this parameter). Since the simulation results are sensitive to the education parameter, and since extant research suggests lower values for the education elasticity than that provided by the estimates in Table 3A, presenting alternative calculation using a higher σ_{edu} is merited.

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Figure 1

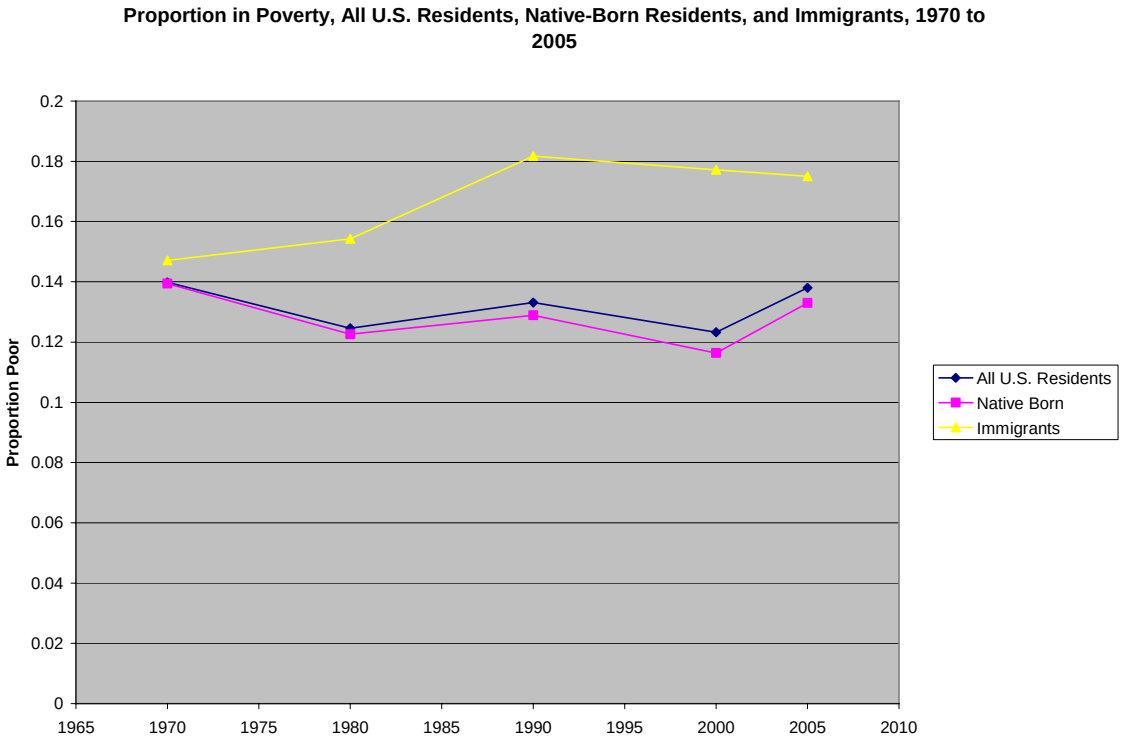


Figure 2

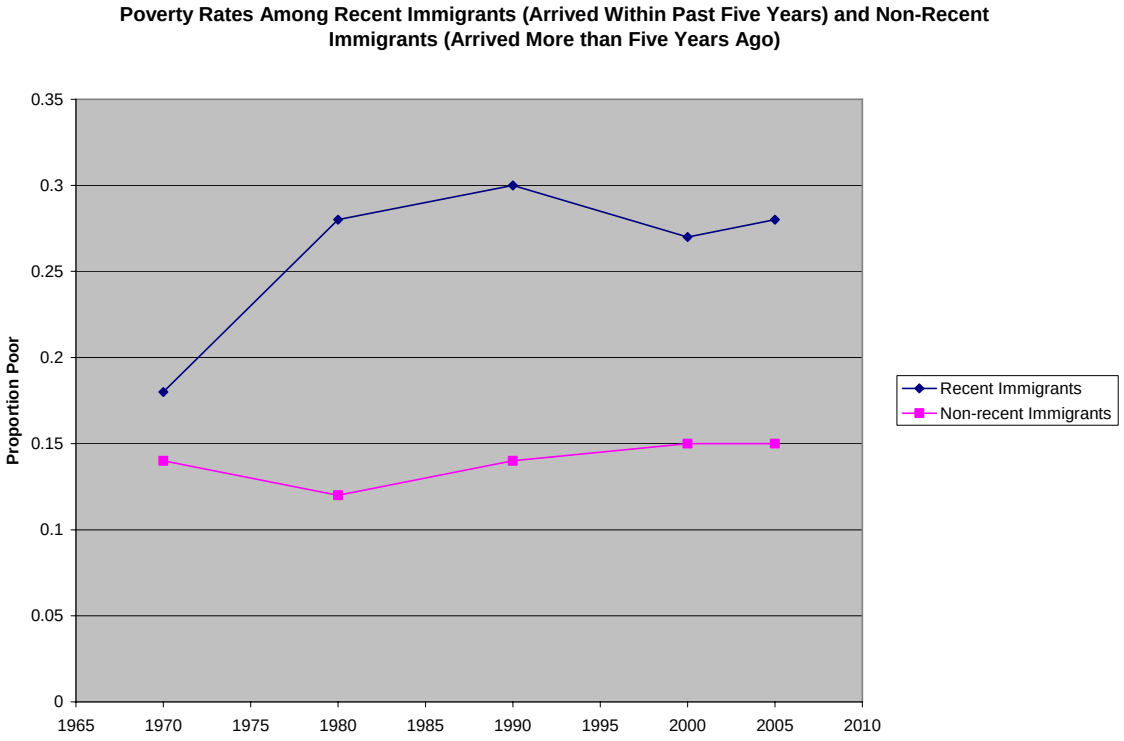


Figure 3

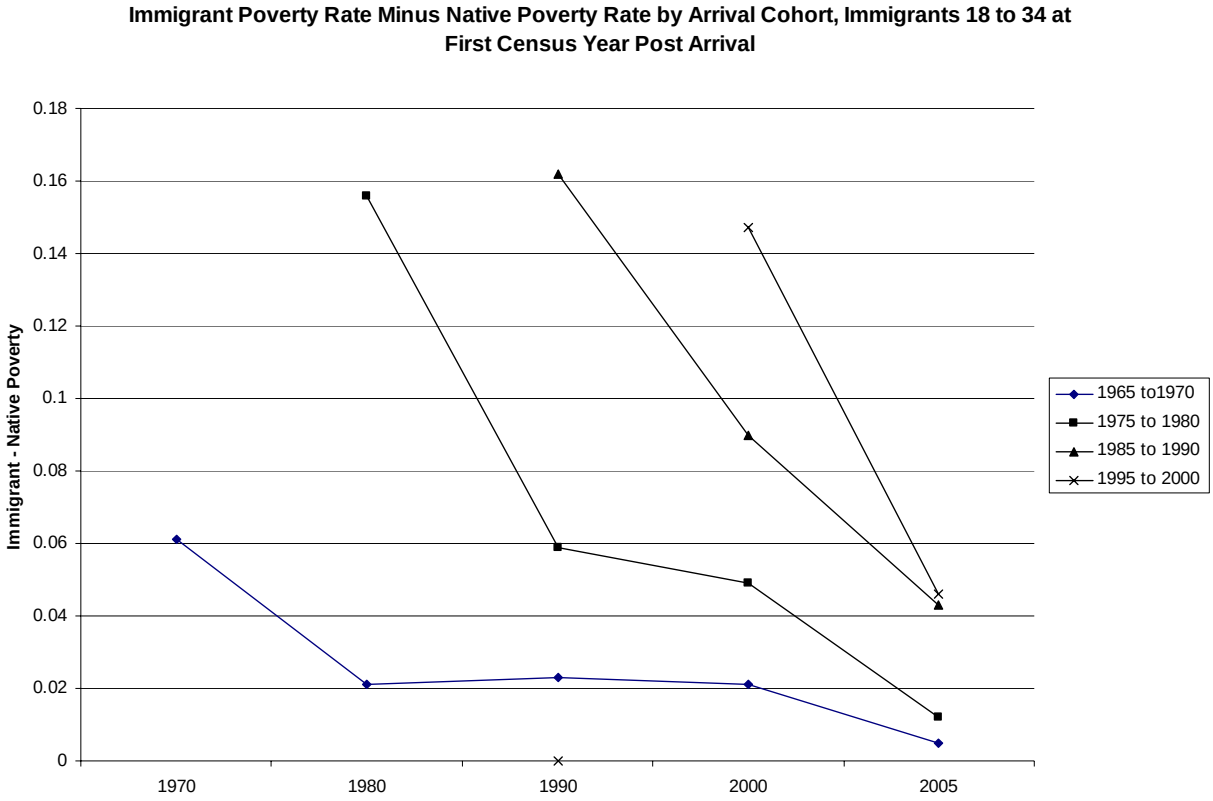
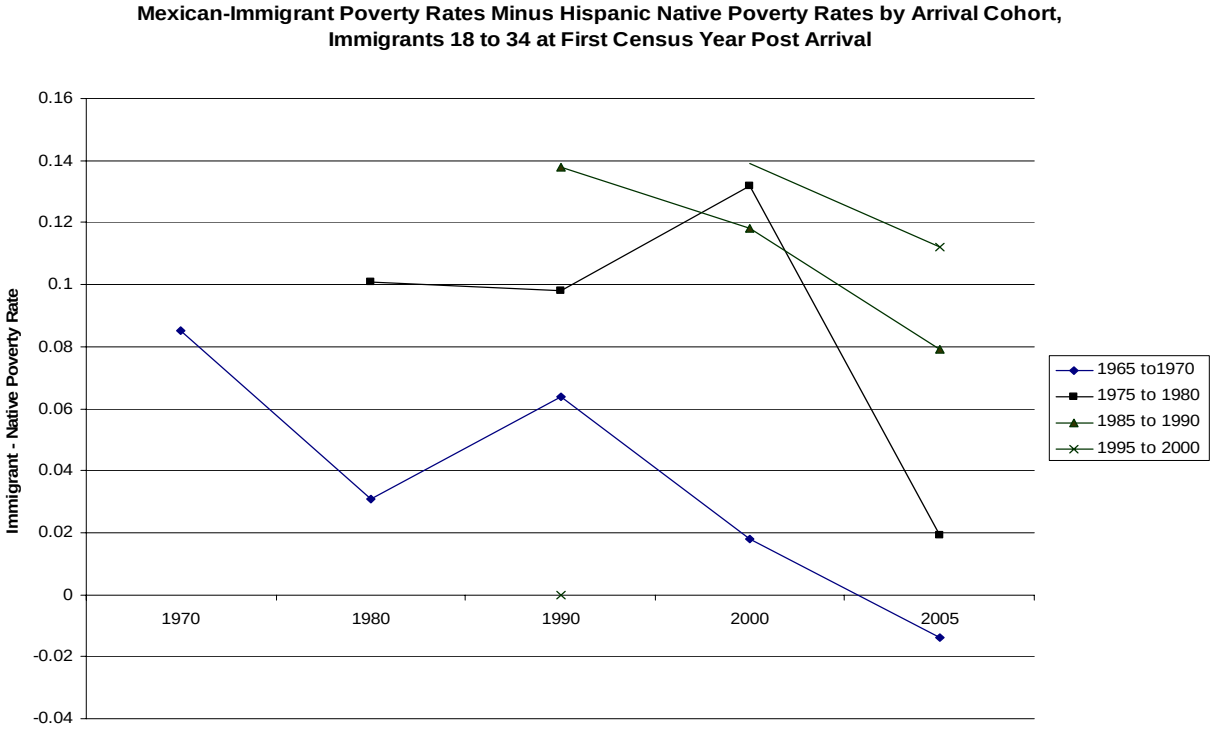


Figure 4



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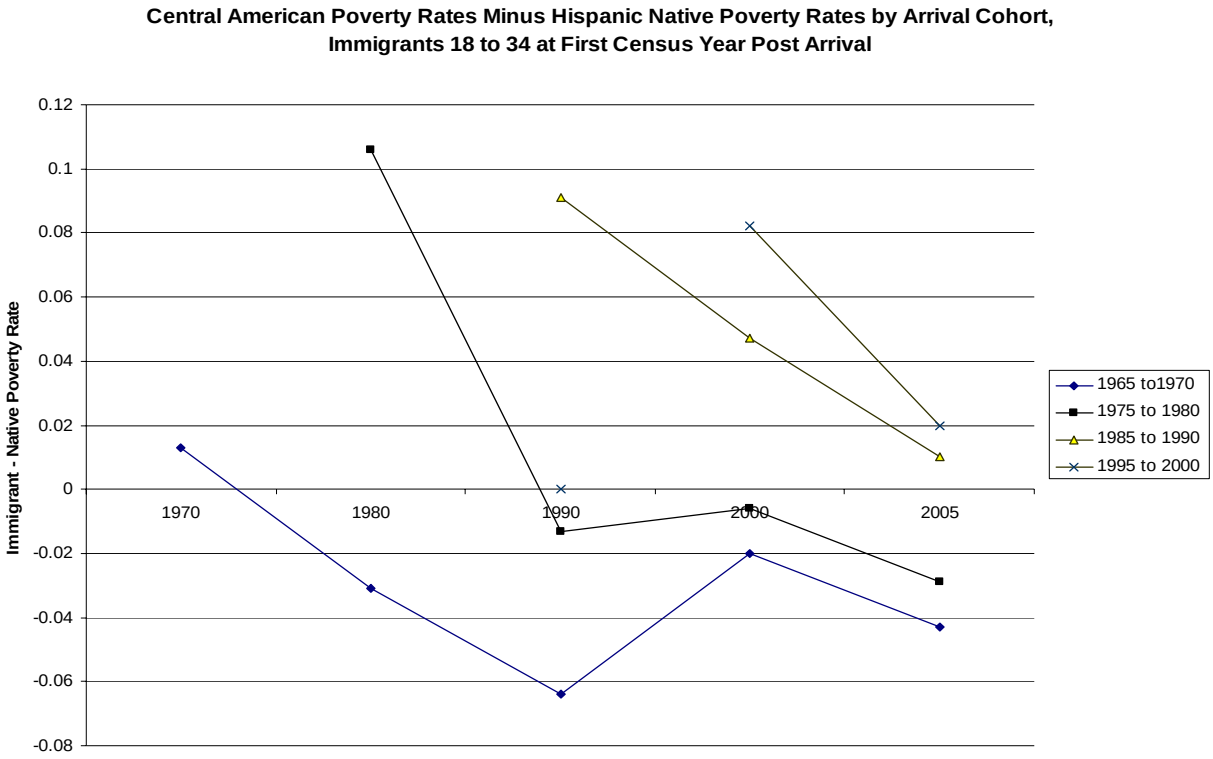

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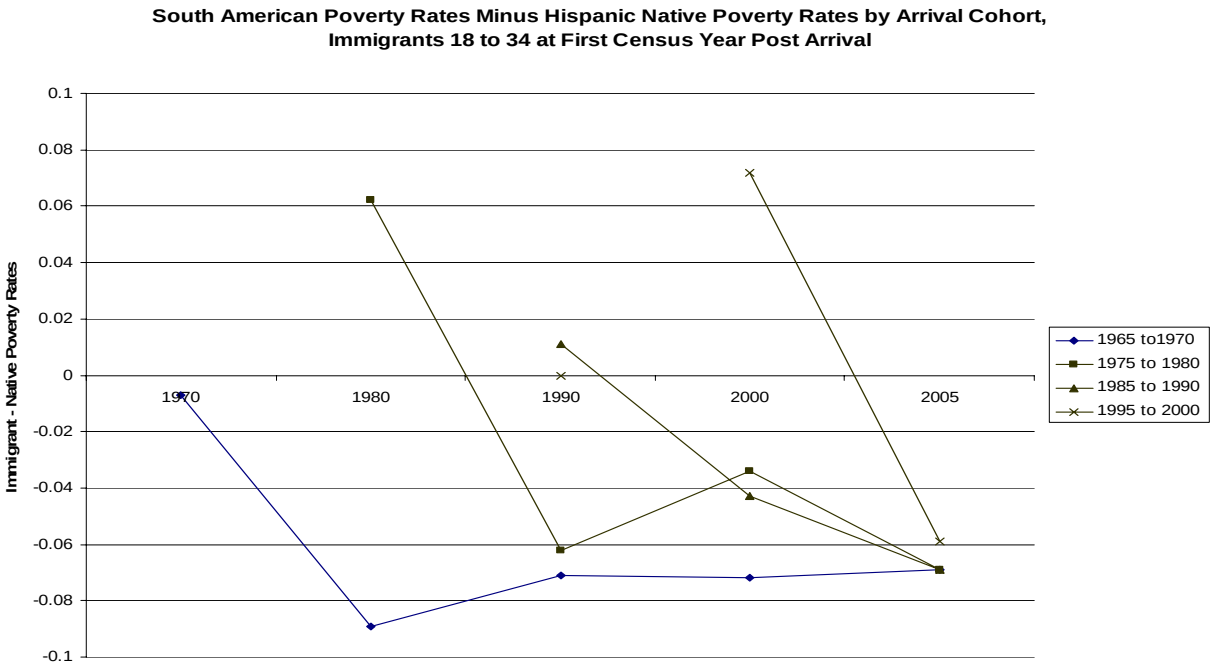

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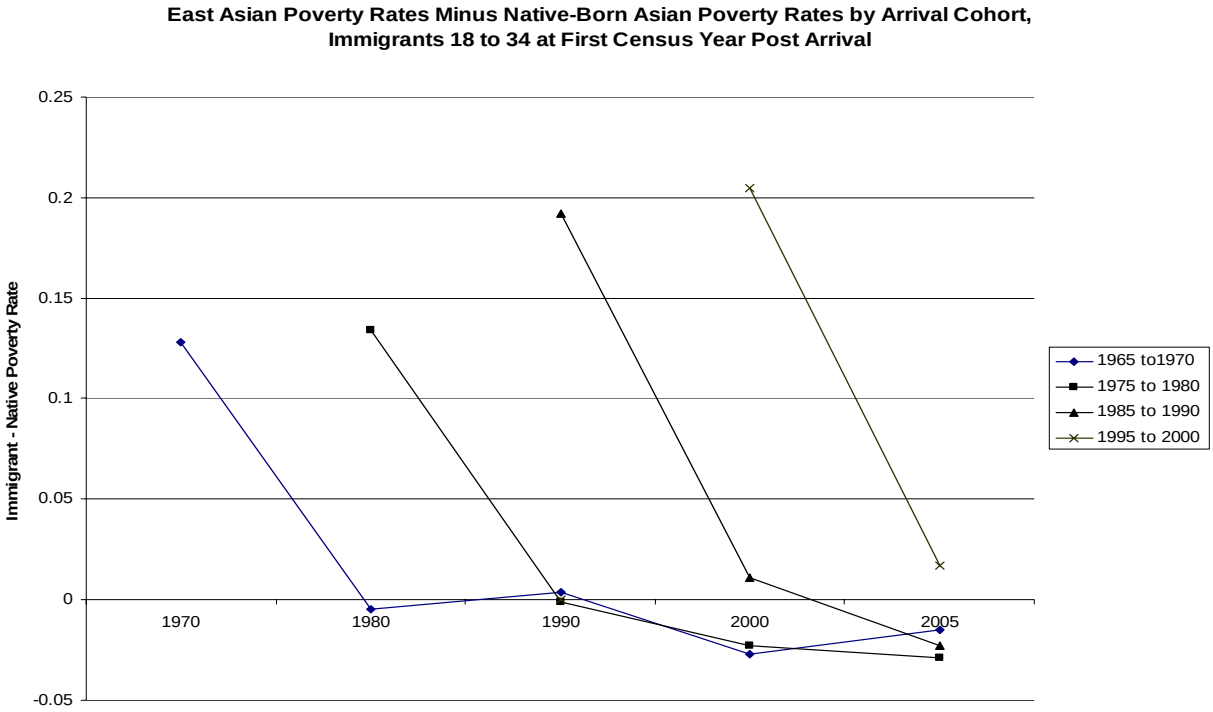

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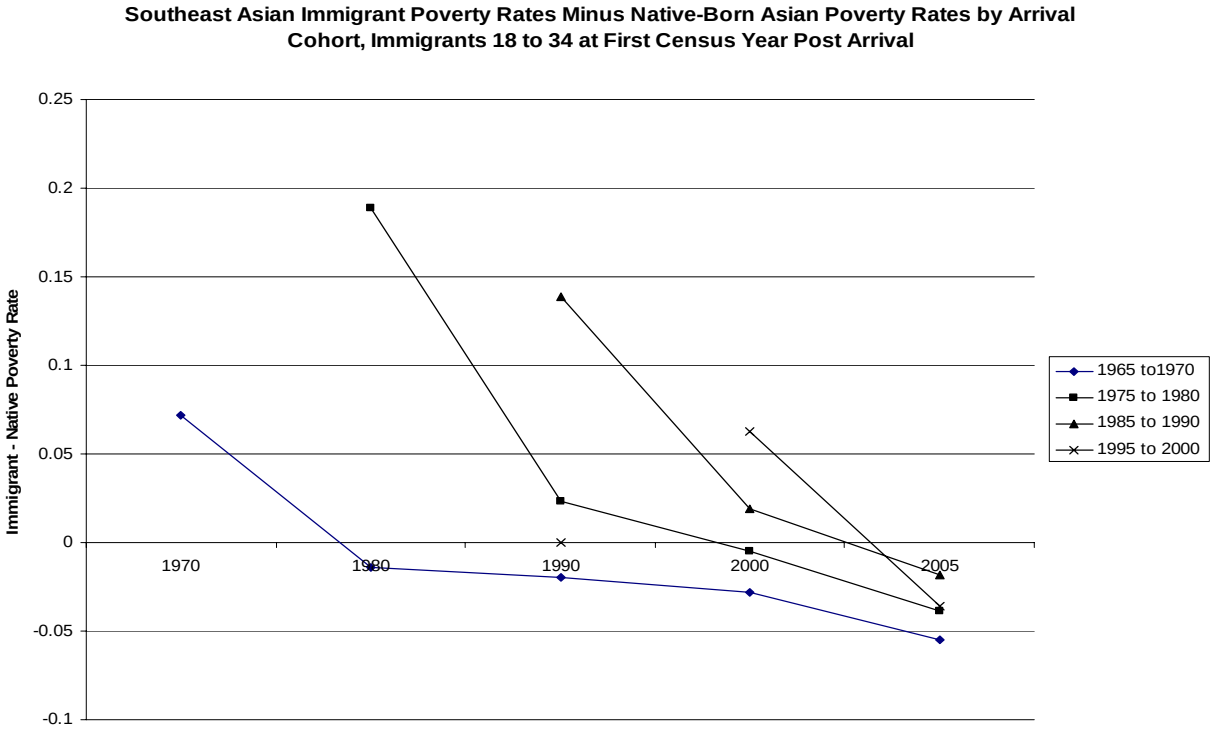

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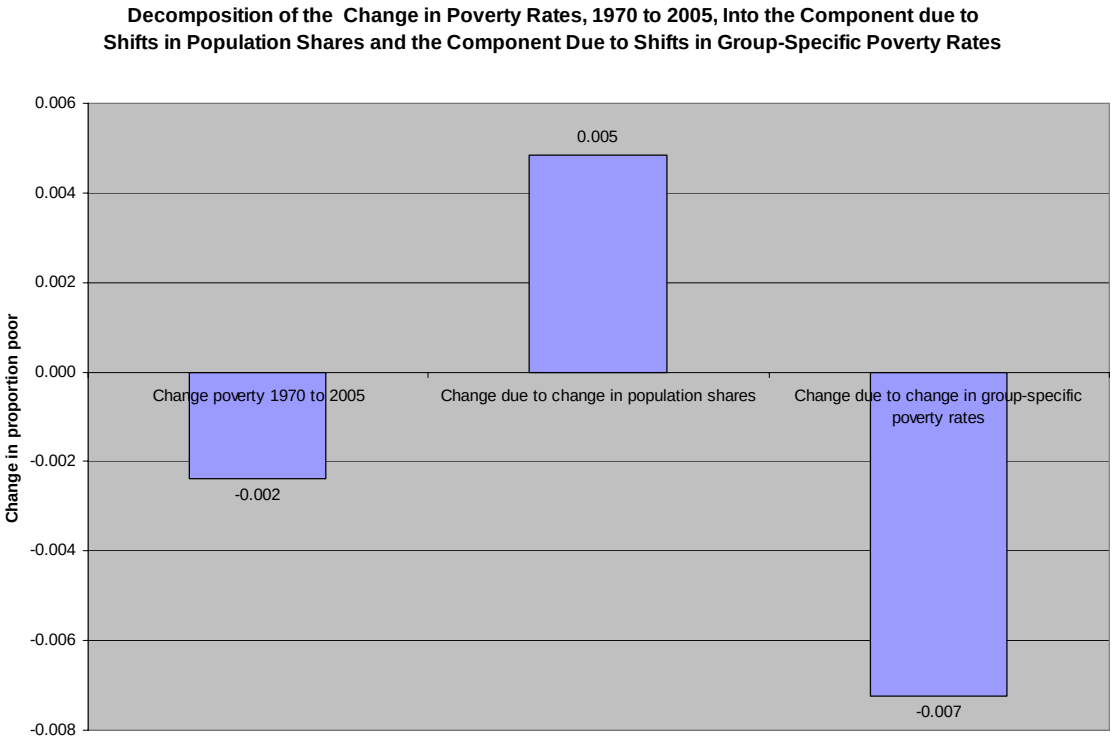

Figure 10: The Effect of Immigration on Labor Supply and Native Wages and Employment

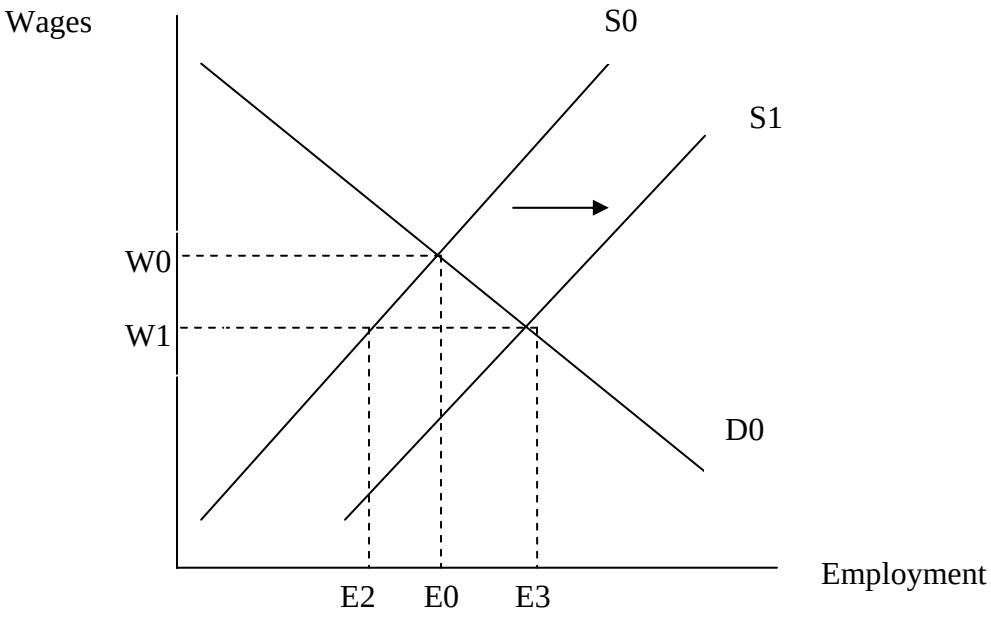

Figure 11

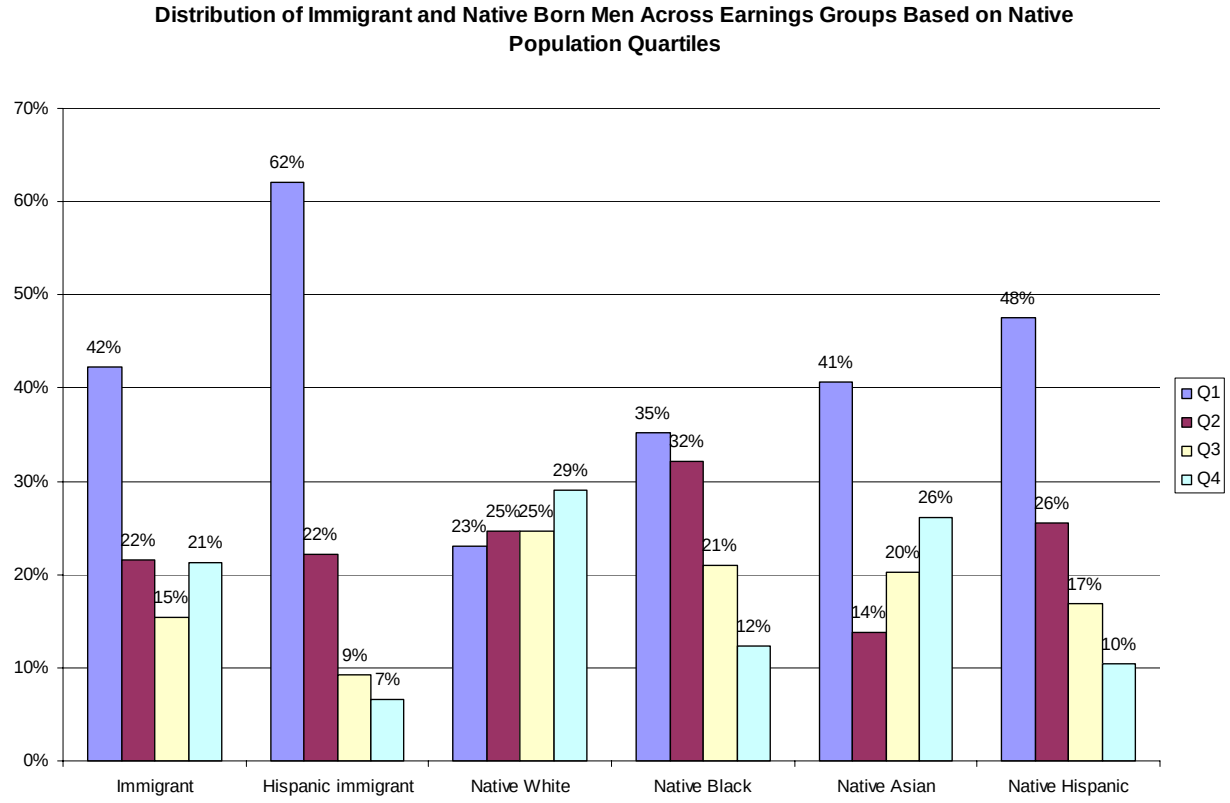

Figure 12

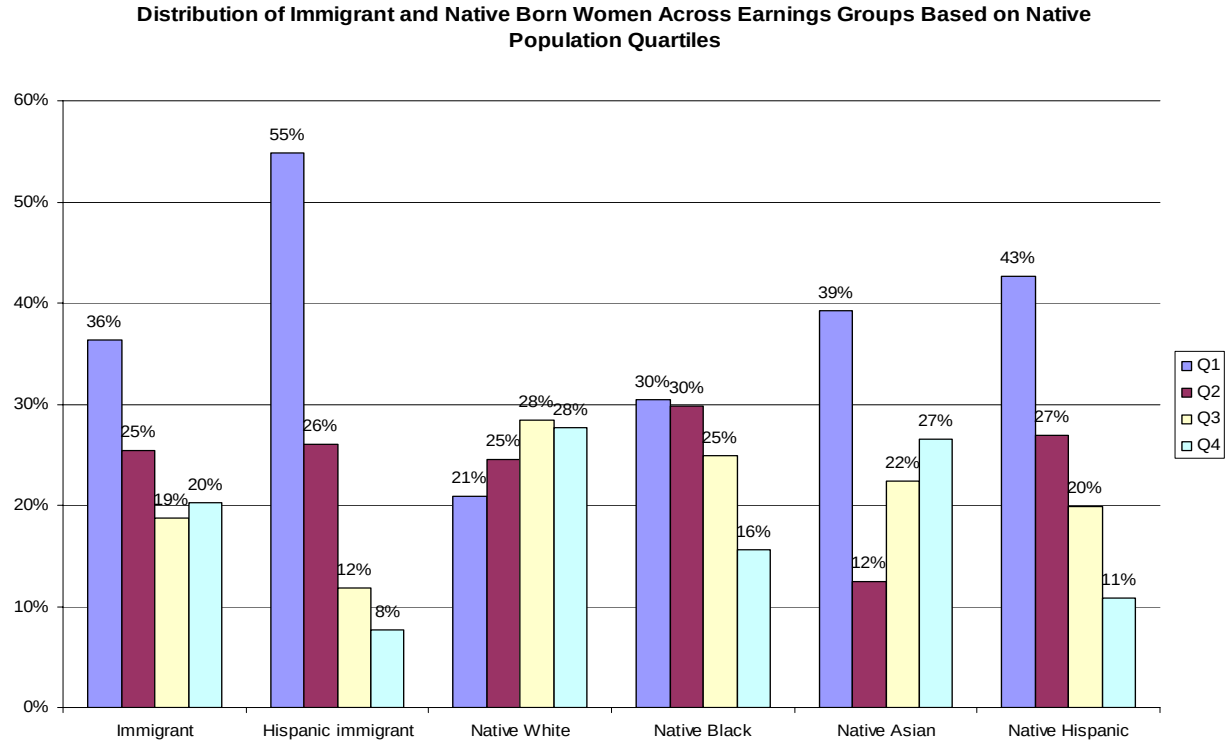

Figure 13: Allowing Capital to Accumulate in Response to Immigration Inflow

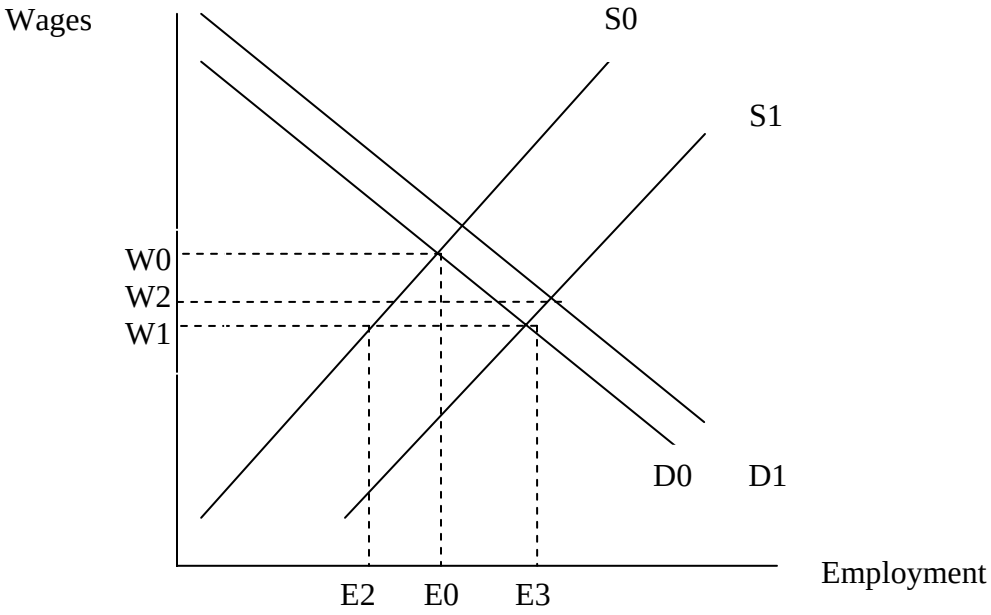

Figure 1A: Scatter Plot of the Native-Immigrant Log Wage Differential Measured by Year (1960 through 2005), Education, and Skill Groups Against the Corresponding Log Supply Differentials

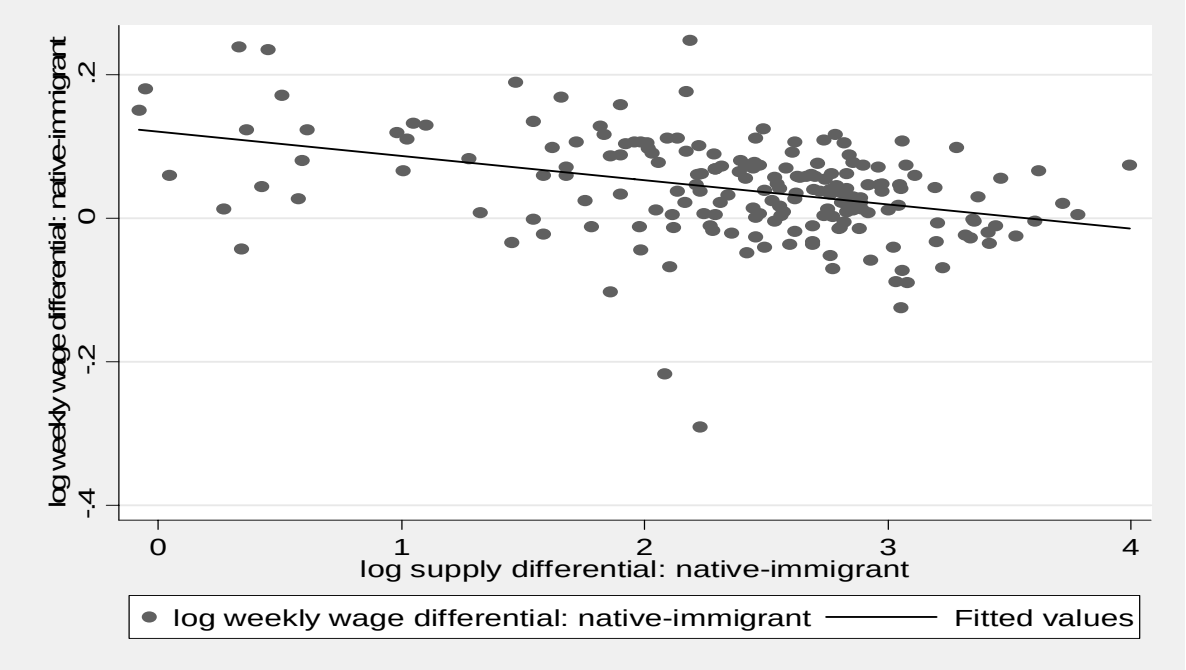

Figure 2A: Scatter Plot of the Residual Native-Immigrant Log Wage Differential Measured by Year (1960 through 2005), Education, and Skill Groups Against the Residual Corresponding Log Supply Differentials From Regressions of Each Variable on Year Fixed Effects

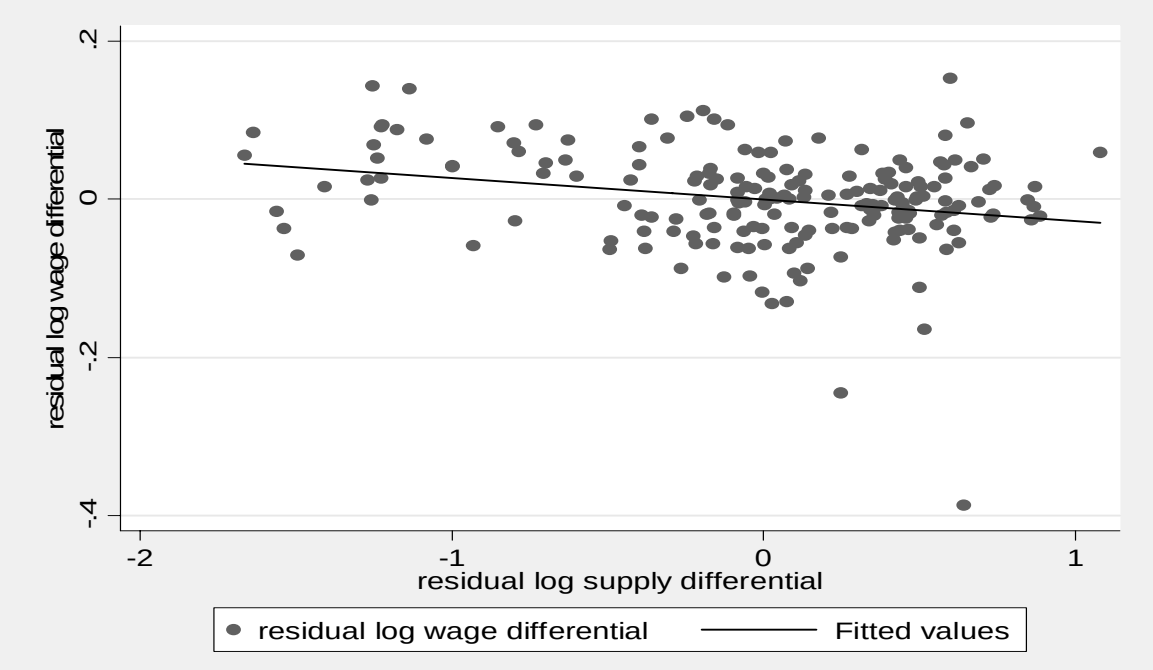

Table 1
Poverty Rates Among the Native Born by Race/Ethnicity, 1970 to 2006

	1970	1980	1990	2000	2005
Non-Hispanics					
White	0.103	0.088	0.091	0.079	0.093
Black	0.362	0.301	0.306	0.252	0.267
Asian	0.094	0.084	0.112	0.123	0.125
Other	0.371	0.270	0.308	0.221	0.243
Hispanic	0.270	0.239	0.254	0.221	0.235

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

Table 2
Poverty Rates Among Immigrants by Region of Origin, 1970 to 2005

	1970	1980	1990	2000	2005
North America	0.090	0.080	0.081	0.076	0.080
Latin America					
Mexico	0.292	0.264	0.294	0.265	0.261
Central America	0.159	0.206	0.224	0.199	0.179
Caribbean	0.147	0.164	0.186	0.175	0.179
South America	0.145	0.153	0.146	0.155	0.122
Europe					
Western[a]	0.126	0.085	0.081	0.078	0.082
Eastern[b]	0.143	0.089	0.092	0.117	0.109
Russian Empire	0.161	0.149	0.197	0.196	0.169
Asia					
East	0.134	0.127	0.156	0.151	0.150
Southeast	0.162	0.198	0.184	0.122	0.114
India/SW	0.146	0.172	0.124	0.110	0.098
Middle East	0.143	0.201	0.195	0.183	0.193
Africa	0.125	0.204	0.149	0.176	0.204
Oceania	0.119	0.159	0.161	0.121	0.105
Other	0.208	0.231	0.247	-	0.174

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.
a. Excludes Warsaw Pact Countries plus the components of the former Yugoslavia.
b. Includes former Warsaw Pact countries plus the components of the former Yugoslavia.

Table 3
Poverty Rates Among Immigrants by Region of Origin and By Whether they have been in the U.S. for Five Years or Less (Recent Immigrants) or More Than Five Years (Non-Recent Immigrants)

	1970		1980		1990		2000		2005	
	Recent	Non-Recent	Recent	Non-Recent	Recent	Non-Recent	Recent	Non-Recent	Recent	Non-Recent
North America	0.072	0.093	0.132	0.074	0.174	0.070	0.112	0.068	0.174	0.067
Latin America										
Mexico	0.325	0.282	0.349	0.221	0.381	0.258	0.340	0.234	0.366	0.235
Central America	0.230	0.117	0.303	0.148	0.329	0.164	0.280	0.177	0.267	0.160
Caribbean	0.213	0.096	0.289	0.136	0.291	0.161	0.242	0.161	0.285	0.165
South America	0.215	0.087	0.250	0.105	0.219	0.114	0.257	0.111	0.183	0.105
Europe										
Western[a]	0.112	0.128	0.143	0.079	0.169	0.071	0.176	0.064	0.162	0.074
Eastern[b]	0.118	0.144	0.180	0.083	0.193	0.074	0.223	0.079	0.209	0.091
Russian Empire	0.117	0.162	0.374	0.098	0.515	0.087	0.300	0.141	0.283	0.143
Asia										
East	0.198	0.101	0.201	0.080	0.267	0.099	0.272	0.108	0.294	0.117
Southeast	0.178	0.149	0.318	0.053	0.297	0.141	0.192	0.110	0.189	0.103
India/SW	0.176	0.111	0.270	0.059	0.226	0.071	0.178	0.079	0.166	0.080
Middle East	0.165	0.134	0.323	0.115	0.339	0.136	0.351	0.126	0.336	0.159
Africa	0.164	0.094	0.327	0.109	0.236	0.108	0.264	0.119	0.350	0.146
Oceania	0.157	0.096	0.264	0.096	0.276	0.116	0.179	0.094	0.178	0.081
Other	0.239	0.203	0.306	0.210	0.327	0.213	0.000	0.000	0.183	0.171

Tabulates from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

a. Excludes Warsaw Pact Countries plus Yugoslavia.

b. Includes former Warsaw Pact countries plus Yugoslavia.

Table 4
Distribution of the U.S. Resident Population by Nativity, by Race/Ethnicity Among the Native Born, By Time in the U.S. Among Immigrants, and By Region of Origin Among Immigrants

	1970	1980	1990	2000	2005
All U.S. Residents	100.00%	100.00%	100.00%	100.00%	100.00%
Native Born	95.18	93.82	92.03	88.82	87.60
Immigrant	4.82	6.18	7.97	11.18	12.40
All Natives	100.00%	100.00%	100.00%	100.00%	100.00%
Non-Hisp White	84.50	81.61	81.52	76.67	78.25
Non-Hisp. Black	11.43	11.94	10.50	11.71	10.00
Non-Hisp Asian	0.50	0.69	1.07	2.11	2.47
Non-Hisp Other	0.42	0.74	0.99	1.39	1.10
Hispanic	3.15	5.02	5.91	8.10	8.19
All Immigrants	100.00%	100.00%	100.00%	100.00%	100.00%
Recent	82.46	76.15	75.15	75.63	82.54
Non-Recent	17.54	23.85	24.85	24.37	17.46
All Immigrants	100.00%	100.00%	100.00%	100.00%	100.00%
North America	9.60	6.13	4.12	2.90	3.03
Latin America					
Mexico	8.22	15.82	22.77	30.74	27.45
Central America	1.21	2.54	5.52	6.46	6.10
Caribbean	7.05	9.12	9.08	9.09	8.25
South America	2.71	4.08	5.18	5.93	6.56
Europe					
Western[a]	40.94	26.27	16.37	9.99	9.77
Eastern[b]	11.36	6.58	4.22	3.48	3.46
Russian Empire	6.09	3.51	1.99	2.79	3.14
Asia					
East	4.31	6.84	8.90	8.63	9.78
Southeast	1.74	6.60	10.13	9.89	10.43
India/SW	0.92	2.79	4.13	5.45	6.57
Middle East	1.33	2.02	1.95	1.71	1.76
Africa	0.63	1.35	1.54	2.50	3.16
Oceania	0.43	0.58	0.53	0.53	0.48
Other	3.45	5.77	3.57	0.00	0.06

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

Table 5
Synthetic Cohort Analysis of Immigrant Poverty Rates by Census Year and by Year of Arrival

	Census Year				
Year of First Arrival	1970	1980	1990	2000	2005
Panel A: All Immigrants					
1965-1970	0.180	0.123	0.108	0.103	0.095
1975-1980	-	0.279	0.163	0.131	0.107
1985-1990	-	-	0.303	0.179	0.145
1995-2000	-	-	-	0.278	0.178
Panel B: Immigrants 18 to 34 in Census Year Immediately Following Arrival					
1965-1970	0.168	0.104	0.095	0.095	0.086
1975-1980	-	0.270	0.148	0.120	0.093
1985-1990	-	-	0.296	0.175	0.136
1995-2000	-	-	-	0.285	0.168
Panel C: Natives					
Age 18 to 34 in	1970	1980	1990	2000	2005
1970	0.107	0.083	0.072	0.074	0.081
1980	-	0.114	0.089	0.071	0.081
1990	-	-	0.134	0.085	0.093
2000	-	-	-	0.138	0.122

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

Table 6
Synthetic Cohort Analysis of Immigrant Poverty Rates by Region of Origin

Year of First Arrival	Census Year 1970	1980	1990	2000	2005
Panel A: Mexico					
1965-1970	0.292	0.209	0.222	0.163	0.142
1975-1980	-	0.298	0.272	0.264	0.153
1985-1990	-	-	0.350	0.264	0.222
1995-2000	-	-	-	0.325	0.273
Panel B: Central America					
1965-1970	0.220	0.147	0.094	0.125	0.113
1975-1980	-	0.303	0.161	0.126	0.105
1985-1990	-	-	0.303	0.193	0.153
1995-2000	-	-	-	0.267	0.181
Panel C: South America					
1970	0.200	0.089	0.087	0.073	0.087
1980	-	0.259	0.112	0.098	0.065
1990	-	-	0.223	0.103	0.074
2000	-	-	-	0.257	0.102
Panel D: East Asia					
1970	0.213	0.046	0.048	0.057	0.079
1980	-	0.229	0.054	0.057	0.068
1990	-	-	0.317	0.098	0.071
2000	-	-	-	0.357	0.132
Panel E: Southeast Asia					
1970	0.157	0.037	0.024	0.056	0.039
1980	-	0.284	0.078	0.075	0.058
1990	-	-	0.264	0.106	0.076
2000	-	-	-	0.215	0.079

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

Table 7
Native Poverty Rates Across Census Years for Fixed Age Cohorts

	Census Year				
Age 18 to 34 in	1970	1980	1990	2000	2005
Panel A: Non-Hispanic Whites					
1970	0.081	0.061	0.053	0.057	0.063
1980	-	0.088	0.065	0.053	0.063
1990	-	-	0.104	0.062	0.070
2000	-	-	-	0.109	0.095
Panel B: Non-Hispanic Black					
1970	0.268	0.209	0.186	0.179	0.181
1980	-	0.253	0.222	0.173	0.178
1990	-	-	0.279	0.187	0.194
2000	-	-	-	0.243	0.232
Panel C: Non-Hispanic Asian					
1970	0.085	0.051	0.044	0.084	0.094
1980	-	0.095	0.055	0.080	0.097
1990	-	-	0.125	0.087	0.094
2000	-	-	-	0.152	0.115
Panel D: Non-Hispanic Other					
1970	0.304	0.196	0.212	0.170	0.197
1980	-	0.237	0.239	0.169	0.195
1990	-	-	0.299	0.189	0.200
2000	-	-	-	0.228	0.229
Panel E: Hispanic					
1970	0.207	0.178	0.158	0.145	0.156
1980	-	0.197	0.174	0.132	0.134
1990	-	-	0.212	0.146	0.143
2000	-	-	-	0.185	0.161

Tabulated from the Integrated Public Use Microdata Files of the U.S. Census, 1970 through 2000 and the 2005 American Community Survey.

Table 8
Distribution of Educational Attainment by Immigration States and by Race/Ethnicity for Adults, 18 to 64 Years of Age, 2000

	Foreign-Born		Native-Born American Citizens							
			Non-Hispanic White		Non-Hispanic Black		Non-Hispanic Asian		Hispanic	
Educational Attainment	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
< 9 year	21.61%	19.57%	2.315	1.63%	4.18%	2.93%	2.09%	1.63%	8.15%	7.22%
9 to 12, no diploma	17.48	15.70	10.02	8.47	23.14	18.73	7.72	6.00	23.29	19.56
High school grad	19.02	20.76	29.04	28.99	33.90	30.18	18.67	17.43	29.80	28.70
Some college	18.43	22.05	31.37	34.66	28.16	33.81	36.60	36.94	28.10	32.37
Bachelors degree	12.62	14.09	17.80	17.81	7.60	9.89	24.18	27.04	7.45	8.78
Masters or higher	10.84	7.83	9.45	8.43	3.02	4.47	10.74	10.96	3.21	3.37

Figures are tabulated from the one percent 2000 Public Use Microdata samples from the US Census of Housing and Population.

Table 9
Simulated Proportional Effects of Immigration Between 1970 and 2005 on Native Weekly Wages by Level of Educational Attainment and Potential Years of Work Experience

Native Skill Group	Lower Bound Estimates	Upper Bound Estimates
Less than high school		
0 – 4	-0.00	-0.05
5 – 9	-0.02	-0.07
10 – 14	-0.02	-0.07
15 – 19	-0.02	-0.07
20 – 24	-0.02	-0.07
25 – 29	-0.01	-0.06
30 – 34	-0.01	-0.06
35 – 40	-0.00	-0.06
High school graduates		
0 – 4	0.01	0.01
5 – 9	0.00	0.01
10 – 14	0.00	0.01
15 – 19	0.00	0.01
20 – 24	0.01	0.01
25 – 29	0.01	0.02
30 – 34	0.01	0.02
35 – 40	0.01	0.02
Some college		
0 – 4	0.01	0.02
5 – 9	0.01	0.02
10 – 14	0.01	0.02
15 – 19	0.01	0.02
20 – 24	0.01	0.02
25 – 29	0.01	0.02
30 – 34	0.01	0.02
35 – 40	0.01	0.02
College graduates		
0 – 4	0.01	0.00
5 – 9	0.00	0.00
10 – 14	0.00	0.00
15 – 19	0.00	0.00
20 – 24	0.00	0.00
25 – 29	0.00	0.00
30 – 34	0.01	0.00
35 – 40	0.01	0.00

Figures in the table are the results of simulating the effect of reducing immigrant employment in 2005 to 1970 levels on the 2005 weekly wages of natives defined by the education and experience groups in the Table. A complete description of the model and the parameter choices for the lower and upper bound estimates are presented in the appendix.

Table 10
Actual Poverty Rates and Simulated Poverty Rates for 2005 Among Persons in Households Headed by Natives

		Using Lower Bound Wage Effects		Using Upper Bound Wage Effects	
	Actual Poverty Rates	Elastic Labor Supply	Inelastic Labor Supply	Elastic Labor Supply	Inelastic Labor Supply
Non-Hispanics					
White	0.079	0.079	0.078	0.078	0.079
Black	0.260	0.258	0.258	0.258	0.257
Asian	0.080	0.080	0.079	0.079	0.079
Other	0.196	0.195	0.195	0.195	0.195
Hispanic	0.193	0.190	0.191	0.187	0.190

Actual and simulated poverty rates pertain to persons in households where the household head is native-born. Simulations with elastic labor supply assume a weeks-worked labor supply elasticity of one. Simulations with inelastic labor supply assume a weeks-worked labor supply elasticity of zero. See the text for a complete discussion of the calculations of the simulated poverty rates.

Appendix Table 1A
Estimated Results from Regressions of the Natural Log of the Native Immigrant Weekly Wage Ratio on the Native Immigrant Supply Ratio (Estimate of -1/σ_{immig})

Panel A: Using 1960 through 2005, Dependent Variable = log(Native Weekly Wage/Immigrant Weekly Wage)							
$\ln(L_{tkj1}/L_{tkj2})$	-0.027	-0.043	-0.025	-0.031	0.017	-0.019	-0.004
	(0.009)	(0.016)	(0.012)	(0.029)	(0.027)	(0.021)	(0.052)
Remaining Specification							
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educ	No	Yes	Yes	Yes	Yes	Yes	Yes
Exp	No	No	Yes	No	Yes	Yes	Yes
Year*Educ	No	No	No	Yes	Yes	Yes	Yes
Year*Exp	No	No	No	No	No	Yes	Yes
Educ*Exp	No	No	No	No	No	No	Yes
Panel B: Using 1970 through 2005, Dependent Variable = log(Native Weekly Wage/Immigrant Weekly Wage)							
$\ln(L_{tkj1}/L_{tkj2})$	-0.030	-0.055	-0.034	-0.056	0.005	-0.040	-0.017
	(0.010)	(0.020)	(0.015)	(0.035)	(0.040)	(0.030)	(0.069)
Remaining Specification							
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educ	No	Yes	Yes	Yes	Yes	Yes	Yes
Exp	No	No	Yes	No	Yes	Yes	Yes
Year*Educ	No	No	No	Yes	Yes	Yes	Yes
Year*Exp	No	No	No	No	No	Yes	Yes
Educ*Exp	No	No	No	No	No	No	Yes

Standard errors are in parentheses and allow for clustering of the error variance-covariance matrix within education-experience cells. The weekly wage differential is measured for full time male workers as described in the appendix text. Log supply differential is measures by the annual supply of hours for all workers in the education-experience-year-nativity cell, again as defined in the text. The models using 1960 through 2005 are based 192 education-experience group observations. The models based on 1970 through 2005 are base don 160 education-experience group observations.

Appendix Table 2A
Estimated Results from IV Regressions of the Natural Log of Weekly Wages Among Full-Time-Male Workers on Log Annual Hours Supplied Using Log Annual Hours Supplied by Immigrants as an Instrument

	Estimates of $-1/\sigma_x$		Estimates of $-1/\sigma_E$ and $-1/\sigma_x$	
	Using 1960 through 2005	Using 1970 through 2005	Using 1960 through 2005	Using 1970 through 2005
$\text{Log}(L_{tkj})$	-0.218	-0.109	-0.227	-0.095
	(0.072)	(0.043)	(0.117)	(0.046)
$\text{Log}(L_{tkj}) - \text{Log}(L_{tk})$	-	-	-0.631	-0.125
			(0.095)	(0.057)
N	192	160	192	160

Standard errors are in parentheses and allow for clustering of the error variance-covariance matrix within education-experience cells. The first two models include a full set of education-year fixed effects and education-experience fixed effects. The second set of regressions include a full set of education-experience fixed effects and education group specific linear time trends.

Appendix Table 3A
Simulated Proportional Effects of Immigration-Induced Labor Supply Shocks Between 1970 and 2005 on Native-Born Weekly Earnings by Education and Experience Level

Native Education-Experience group	$\sigma_{immig} = 33$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 8$	$\sigma_{immig} = \infty$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 8$	$\sigma_{immig} = \infty$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$	$\sigma_{immig} = \infty$ $\sigma_{\exp} = 5$ $\sigma_{educ} = 2.5$
Less than high school				
0 – 4	-0.00	-0.01	-0.07	-0.05
5 – 9	-0.02	-0.03	-0.09	-0.09
10 – 14	-0.02	-0.04	-0.09	-0.10
15 – 19	-0.02	-0.04	-0.09	-0.10
20 – 24	-0.02	-0.03	-0.09	-0.09
25 – 29	-0.01	-0.02	-0.08	-0.08
30 – 34	-0.01	-0.02	-0.08	-0.07
35 – 40	-0.00	-0.01	-0.07	-0.06
High school graduates				
0 – 4	0.01	0.00	0.01	0.01
5 – 9	0.00	0.00	0.00	0.00
10 – 14	0.00	0.00	0.00	0.00
15 – 19	0.00	0.00	0.00	0.00
20 – 24	0.01	0.00	0.01	0.01
25 – 29	0.01	0.01	0.01	0.01
30 – 34	0.01	0.01	0.01	0.01
35 – 40	0.01	0.01	0.01	0.02
Some college				
0 – 4	0.01	0.01	0.02	0.02
5 – 9	0.01	0.00	0.02	0.02
10 – 14	0.01	0.00	0.01	0.01
15 – 19	0.01	0.00	0.01	0.01
20 – 24	0.01	0.00	0.01	0.01
25 – 29	0.01	0.01	0.02	0.02
30 – 34	0.01	0.01	0.02	0.02
35 – 40	0.01	0.01	0.02	0.02
College graduates				
0 – 4	0.01	0.00	0.00	0.00
5 – 9	0.00	0.00	-0.01	-0.01
10 – 14	0.00	0.00	-0.01	-0.01
15 – 19	0.00	0.00	-0.01	-0.01
20 – 24	0.00	0.00	0.00	0.00
25 – 29	0.00	0.00	0.00	0.00
30 – 34	0.01	0.00	0.00	0.00
35 – 40	0.01	0.00	0.00	0.00

Appendix Table 4A
Simulated Proportional Effects of Immigration-Induced Labor Supply Shocks Between 1970 and 2005 on Native-Born Weekly Earnings by Education and Experience Level, Assuming Fixed Education and Experience Group Elasticities and Alternative Values of the Elasticity of Substitution Between Immigrants and Natives

Native Education-Experience group	$\sigma_{immig} = \infty$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$	$\sigma_{immig} = 33$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$	$\sigma_{immig} = 20$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$	$\sigma_{immig} = 10$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$	$\sigma_{immig} = 5$ $\sigma_{\exp} = 9.14$ $\sigma_{educ} = 2.5$
Less than high school					
0 – 4	-0.07	-0.05	-0.05	-0.04	-0.02
5 – 9	-0.09	-0.07	-0.06	-0.04	-0.01
10 – 14	-0.09	-0.07	-0.06	-0.04	0.00
15 – 19	-0.09	-0.07	-0.06	-0.04	0.00
20 – 24	-0.09	-0.07	-0.06	-0.04	-0.01
25 – 29	-0.08	-0.06	-0.06	-0.04	-0.01
30 – 34	-0.08	-0.06	-0.05	-0.04	-0.02
35 - 40	-0.07	-0.06	-0.05	-0.04	-0.02
High school graduates					
0 – 4	0.01	0.01	0.02	0.02	0.03
5 – 9	0.00	0.01	0.01	0.02	0.03
10 – 14	0.00	0.01	0.01	0.02	0.03
15 – 19	0.00	0.01	0.01	0.02	0.03
20 – 24	0.01	0.01	0.01	0.02	0.03
25 – 29	0.01	0.02	0.02	0.02	0.03
30 – 34	0.01	0.02	0.02	0.02	0.03
35 – 40	0.01	0.02	0.02	0.02	0.03
Some college					
0 – 4	0.02	0.02	0.02	0.02	0.03
5 – 9	0.02	0.02	0.02	0.02	0.03
10 – 14	0.01	0.02	0.02	0.02	0.03
15 – 19	0.01	0.02	0.02	0.02	0.03
20 – 24	0.01	0.02	0.02	0.02	0.03
25 – 29	0.02	0.02	0.02	0.02	0.03
30 – 34	0.02	0.02	0.02	0.02	0.03
35 – 40	0.02	0.02	0.02	0.02	0.03
College graduates					
0 – 4	0.00	0.00	0.00	0.01	0.02
5 – 9	-0.01	0.00	0.00	0.01	0.02
10 – 14	-0.01	0.00	0.00	0.01	0.03
15 – 19	-0.01	0.00	0.00	0.01	0.02
20 – 24	0.00	0.00	0.00	0.01	0.02
25 – 29	0.00	0.00	0.00	0.01	0.02
30 – 34	0.00	0.00	0.00	0.01	0.02
35 – 40	0.00	0.00	0.00	0.01	0.02