California Counts
POPULATION TRENDS AND PROFILES

How Immigrants Affect California Employment and Wages

By Giovanni Peri

Summary

One of the most contentious issues about immigration is how it affects the wages and employment opportunities of U.S. natives. If immigrants hurt the labor market options of native workers, Californians should feel the most pain. California has a higher share of immigrants in its population and labor force than any other state. The large inflow of documented and undocumented immigrants during recent decades increased the presence of foreign-born individuals in California so much that by 2004, immigrants constituted one-third of the state's labor force and population.

This edition of *California Counts* analyzes the effect of the immigration inflow on the employment, population, and wages of U.S. natives in California, using the decennial Censuses and American Community Survey data spanning the period 1960–2004. It presents the size, trends, and composition of immigration in California, compares these with national averages, and estimates how native workers' behavior and wages respond to the inflow of immigrant workers across age and education groups over that period. The major findings could have important implications for the national debate as well as for California:

- First, there is no evidence that the inflow of immigrants over the period 1960–2004 worsened the employment opportunities of natives with similar education and experience. The study finds no association between the inflow of immigrants and the out-migration of natives within the same education and age group.

In 2004, California was home to almost 30 percent of all foreign-born individuals working in the United States.

- Second, according to our calculations, during 1990–2004, immigration induced a 4 percent real wage increase for the average native worker. This effect ranged from near zero (+0.2%) for wages of native high school dropouts and between 3 and 7 percent for native workers with at least a high school diploma.
- Third, the results indicate that recent immigrants did lower the wages of previous immigrants. Wages of immigrants who entered California before 1990 were 17 to 20 percent lower in 2004 than they would have been absent any immmigration between 1990 and 2004.

These findings derive from empirical analyses showing that immigrant workers often serve as complements to native workers rather than as their direct competitors for jobs, thereby increasing total economic output. Native workers benefit because they are able to specialize in more productive work. The results are consistent with other national-level research showing that immigrants have little if any effect on the wages of low-skilled natives and benefit high-skilled natives.

Introduction

The supposedly dire labor market effect of immigration is one reason why some politicians called for tougher measures against illegal immigrants during the last Congress (2004–2006). Moreover, the new Congress (2006–2008) is likely to revisit the immigration issue, considering potential reforms, such as introducing a guest-worker program, and revisiting the H1B visa program. Hence, careful evaluation of the labor market effect of immigrants with different skill levels should be an important consideration in the process.

This issue of *California Counts* analyzes the effect of immigrants on the employment and wages of native-born individuals in California's labor market during the period 1960–2004. California is the state likely to bear the largest costs and/or enjoy the largest benefits of proposed reforms, given the number of foreign-born workers in the state.[1] Thus, evaluating its experience should provide valuable inputs for formulating federal policies.

In 2004, California was home to almost 30 percent of all foreign-born individuals working in the United States. Moreover, one-third of the state's 15 million workers and two-thirds of those without a high school diploma were foreign-born, making California the state with the largest share of foreign-born individuals in its population and labor force. During 1990–2004 alone, new immigrants increased the size of the foreign-born population in California by over 40 percent. A very large number of those individuals were poorly educated Mexican laborers. Certainly, if the recent waves of immigration affected the labor market opportunities of U.S. natives (particularly the low-skilled ones) in the form of fewer jobs and lower wages, such effects should have been extreme in California.

On first thought, it might seem that the simple economics of supply and demand would answer the question: What is the effect of immigrants on wages? Immigrants increase the supply of labor. Hence, they should decrease the wages of native workers, reduce their employment opportunities, or push them to other states. The question, however, is more subtle than this, because all workers are not the same: They differ by education, skills, and occupation and perform jobs and productive tasks different from and complementary to (or interdependent on) each other.

Immigrants usually do not compete directly with the majority of natives for the same jobs. Rather, immigrants often complement native workers in terms of education, skills, and occupations. This complementarity has the potential to increase the productivity of most groups of native workers, with potentially beneficial effects on their job opportunities and wages. In nontechnical terms, the wages of native workers could increase because the increased supply of migrants is likely to put native workers in jobs where they perform supervisory, managerial, training, and in general interactive and coordinating tasks, which makes them more productive. Moreover, the presence of new workers also implies higher demand for consumption, so that immigration might simply increase total production and demand without depressing wages.

A key element in assessing the effect of immigrants on the labor-market opportunities of natives is careful analysis of those interdependencies and interactions. That is the approach taken here. The following section presents some descriptive statistics on the size and skills of California's immigrant workers. The data used are from the U.S. decennial Censuses

> **During 1990–2004 alone, new immigrants increased the size of the foreign-born population in California by over 40 percent.**

1960–2000 and from the 2004 American Community Survey.[2] Next, we present the framework used to analyze the effect of immigration on productivity of native workers, emphasizing the importance of complementarities between workers of different education and skills. Following that, the study checks whether native workers in California were displaced by immigration, moving out of California and thereby diffusing part of the effect of immigrants to other states. We then look at displacement again, isolating migration associated with "push" factors from the countries of origin and unrelated to increased labor demand in California. Estimates of the strength of complementarities between U.S. and foreign-born workers and calculations of the effects of immigrants on wages and employment of Californians for the period 1990–2004 are then presented. A final section offers some comments and conclusions.

Immigrant Workers: Numbers, Skills, and Age Composition

Two of the most fundamental aspects of the supply of immigrants and their skills are their number and their education. In this section, we describe the size of the immigrant population in

California and its distribution over schooling groups and compare them with the size and distribution nationally. We also briefly describe the age composition of recent immigrants.

Figure 1 shows the percentage of workers in California and in the United States that were foreign-born, 1960–2004.[3] That percentage began to grow in the 1960s in California and in the 1970s in the United States overall. The share of foreign-born workers in California increased steadily by about 7 percentage points each decade from 1970 to 2000 and by similar rates during the 2000s. By 2004, one-third of all California's workers (5.4 million individuals) were foreign-born. In the United States as a whole, the share of

foreign-born in employment grew by about 3 to 4 percentage points in each decade between 1970 and 2000 and reached 14.4 percent by 2004 (equal to 20 million individuals). That percentage was still smaller than the percentage in California as of 1980. California leads the nation in its immigration trends, and this study, besides being important for California, may provide a glimpse of future developments of the labor-market effects of immigration at the national level.[4]

Table 1 considers the presence of immigrants by educational attainment. The table shows the percentage of each group of workers that was foreign-born in California between 1960 and 2004. The groups correspond to workers

Figure 1. Percentage of Foreign-Born in Total Employment, 1960–2004
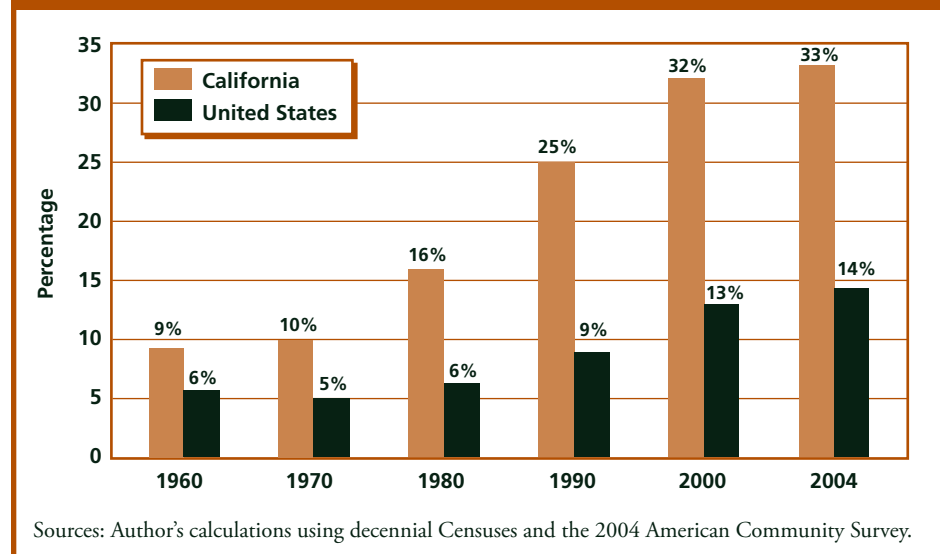

Sources: Author's calculations using decennial Censuses and the 2004 American Community Survey.

Table 1. Percentage of Foreign-Born Workers in Each Education Group, California 1960–2004

Years of Education	1960 Census	1970 Census	1980 Census	1990 Census	2000 Census	2004 American Community Survey
0 to 11	13.0	15.7	33.68	52.17	63.44	66.78
12 (high school graduate)	6.4	7.4	11.31	19.11	27.55	31.19
13 to 15	7.4	7.8	11.02	15.37	20.59	20.73
16 (college graduate)	7.7	8.3	13.87	18.70	24.87	27.85
Master's/professional degree	n.a.	n.a.	n.a.	19.88	26.68	28.93
Doctoral degree	n.a.	n.a.	n.a.	28.46	37.23	42.06
Average in California	**9.4**	**10.0**	**16.06**	**24.59**	**31.98**	**33.17**

Sources: Author's calculations using decennial Censuses and the 2004 American Community Survey.
Note: Workers included are individuals ages 17–65, not residing in group quarters, who worked at least one week during the previous year.

with different educational attainments (no high school diploma, high school diploma, some college, college degree, master's or professional degree, and Ph.D.). Figure 2 depicts and compares those percentages for California and the United States overall for 2004. In 2004 and every year since 1960, foreign-born workers accounted for much larger percentages among the less-educated (less than high school diploma) and higher-educated (college degree or more) workers than among those with intermediate education levels (high school diploma or some college but no bachelor's degree). In 2004, two-thirds of high school dropout workers and 42 percent of workers with a Ph.D. in California were immigrants, compared to only 21 percent of workers with some college education. National data for 2004 show that about 32 percent of U.S. workers without a high school diploma and

Figure 2. Percentage of Workers Who Are Foreign-Born, by Education, 2004

Source: Author's calculations using the 2004 American Community Survey.
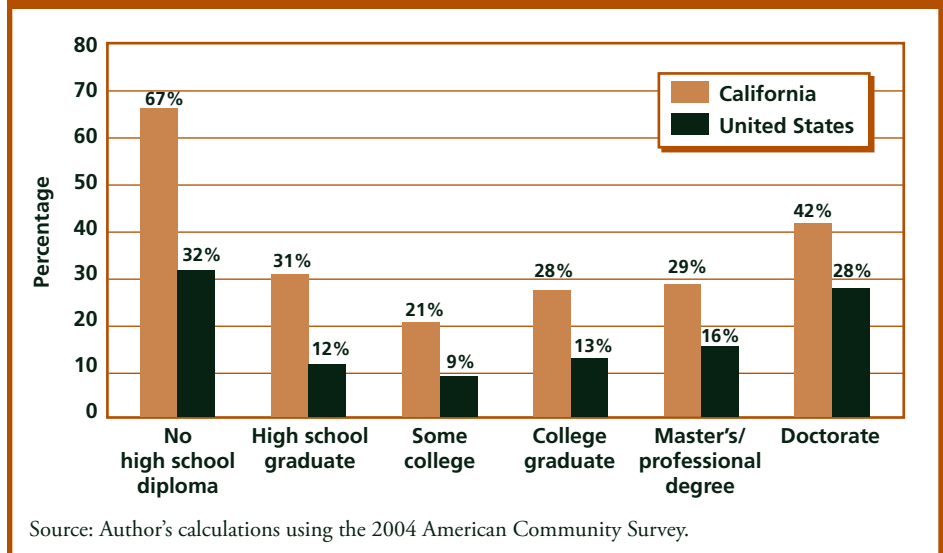
28 percent of those with a Ph.D. were foreign-born, compared to only 9.3 percent of workers with some college education.[5]

The numbers presented cover the *stock* of foreign-born workers living and working in California (or the nation) in 2004 and in previous years. However, the recent *flow* of immigrants has the same general skill composition. Figure 3 shows net immigration in 1990–2004 as a percentage of 1990 employment, by education groups, for California and for the United States as a whole. Net immigration of workers in 1990–2004 accounted for a much higher percentage of initial employment among workers *with* a college degree and among those *without* a high school diploma than in the group of workers with a high school diploma or some college but no degree. Since workers with different levels of education tend to fill different types of occupations and jobs, this distribution of skills already suggests that fewer native workers are in "direct" competition with foreign-born workers than in "complementary" skill groups.

Overall, aggregating across groups, the net inflow of immigrant workers in the 1990–2004 period (2.4 million individuals) equaled 20 percent of California's employment in 1990 (nationally, the net inflow was only 11 percent of initial employment). The flow supplied many more workers at the low and

Figure 3. Net Immigration 1990–2004 As a Percentage of 1990 Employment, by Education

Sources: Author's calculations using the 1990 Census and the 2004 American Community Survey.
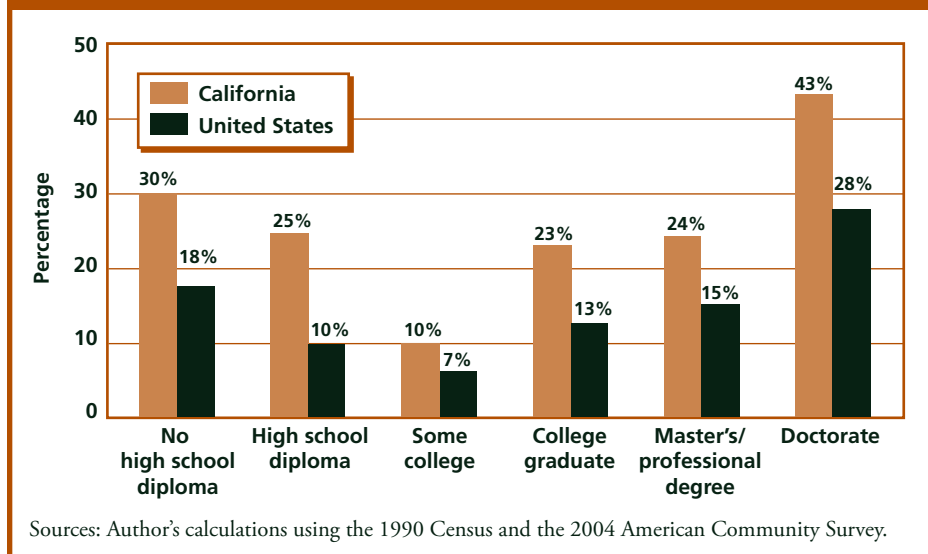
high ends of the skill (education) spectrum than in the middle.

In considering employment effects, age is also an important characteristic of immigrants. Table 2 reports net immigration in 1990–2004 as a percentage of employment in 1990 for 20 age-education groups: five age groups of ten-year intervals between ages 17 and 66 within four education groups. (The same age-education cell structure is used in the next section, assuming that workers in each cell have somewhat different skills from workers in other cells.) Immigration disproportionately affected the young groups (workers between ages 17 and 36), with the group of very young college-educated (ages 17 to 26) more than doubling in size in 1990–2004 as a result of immigration (over

100% increase). The oldest group considered (ages 57 to 66) actually declined in size for most education groups because of a decline in the number of foreign-born (implying an outflow larger than the inflow in the labor market).

A Framework for Analyzing Effects of Immigrants on the Labor Market

This section describes a framework to analyze the effect of immigration on wages that is more complicated in structure than a simple labor-demand/labor-supply model. The framework is necessarily more complicated because

Table 2. Net Immigration As a Percentage of 1990 Employment, by Age and Education, 1990–2004					
	Age Group				
Education	**17–26**	**27–36**	**37–46**	**47–56**	**57–66**
High school dropout	86	40	20	25	−5
High school graduate	45	25	25	22	2
Some college	26	10	6	9	−3
College graduate	118	18	11	6	−16

Sources: Author's calculations using the 1990 Census and the 2004 American Community Survey.

Workers with different education and experience tend to fill different jobs. Rather than competing with each other in the labor market, they complement each other.

workers have different skills, and the productivity and wage of each worker depend on direct and indirect productive interactions with workers performing different and similar tasks. Measuring the degree of similarity or complementarity across workers is crucial for evaluating how the increased supply of one type of worker affects the productivity of and demand for another. It is also important to keep in mind that new workers of any kind produce an increase in consumption as well. They generate higher demand for goods and services so that overall production has to increase and more jobs need to be created, some of them filled by the new workers themselves.

Although we limit our attention to the labor market effect of immigration,[6] we are careful not to incur some of the limits associated with the "area approach" to immigration effects.[7] Namely, we establish that the labor market effect

of immigrants in California is not "diffused" to other states through displaced natives who move out of California (discussed below). We also show that California-specific demand for labor does not drive the correlation between immigration and wages of natives (also discussed below).

Typically, two very important dimensions of workers' skills are their education and their labor market experience. Workers with different education and experience tend to fill different jobs. Rather than competing with each other in the labor market, they complement each other. We say that two types of workers are "substitutes" (competitors) if the increased supply of a group decreases the wages of the other (other things equal). They are complements if the increased supply of a group increases the wage of the other. As an example, think of the construction sector. Workers with a college degree in that sector are likely

employed as structural engineers, whereas workers with some college education would be employed in accounting and secretarial jobs, and workers with a high school diploma or less (but with applied skills) might be masons, plumbers, or electricians. The increased supply of masons, plumbers, and electricians would allow more construction companies to start up (or existing ones to expand). In the long run, it would increase the demand for and wages of (complementary) secretaries and engineers. At the same time, the availability of young, inexperienced masons may increase the need for older, more experienced masons in the role of supervisors, coordinators, and team leaders. Hence, across education and experience groups, the increased supply of one group increases the demand (and productivity) of other groups through these linkages.

Figure 4 represents a simplified framework with which to

Figure 4. Framework to Study the Impact of Immigration on Native Workers
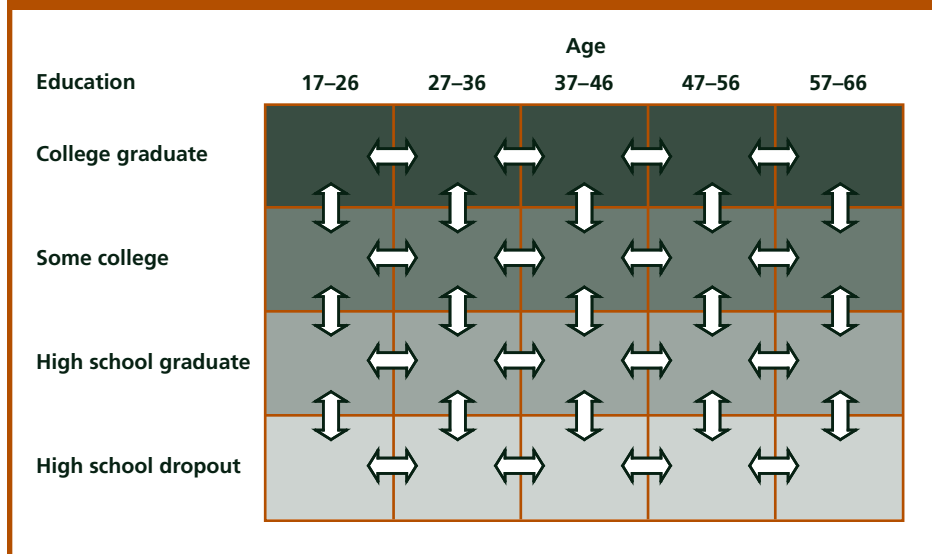
describe the labor market. The grid represents the classification of workers into cells according to four education groups (high school dropouts, high school graduates, those with some college, and college graduates) and five age groups (between ages 17 and 66, by ten-year intervals). Previous analyses[8] have shown that workers in different education groups complement each other: That is, the increased supply of one group increases the demand for and wages of the other groups, as they fill different jobs and perform different but interdependent tasks. Similarly, within an education group, workers with different experience levels are complementary in the sense that an increase in the supply of older workers increases the demand for and wage of younger workers.[9] This age effect, however, is weaker than the education effect, implying fewer complementarities and more competition between age groups than between education groups.

Even workers with the same education and experience but in different occupations are usually not purely competing with each other. In our previous example, a mason and a plumber, both with a high school diploma and between ages 27 and 36, complement each other to a significant degree: An increased supply of masons allows construction of more homes, increasing the demand for plumbers. However, if the supply of plumbers becomes small enough (or the supply of masons large

enough), some masons may adapt themselves to do plumbing work, implying some degree of competition (substitutability) between the two groups.

Complementarities between different workers are particularly important in evaluating the labor market effect of foreign-born immigrants. Because of their skills, informational constraints, preferences, and history, recent immigrants are usually employed in jobs, occupations, and sectors where previous immigrants were already predominantly employed. Hence, the jobs they compete for are *most closely substitutes for those held by other immigrants*, whereas they tend to be *more complementary to jobs held by natives*. For instance, many past and new immigrants are employed as plaster and stucco masons or as agricultural laborers. In contrast, occupations such as plumbers or farm managers require similar degrees of formal education and experience but employ mainly native workers. Therefore, recent immigrants affect the productivity and wages of previous immigrants and natives differently and are potentially beneficial to natives.

The degree of complementarity between different groups of workers is summarized in a number called "elasticity of substitution."[10] It is estimated by measuring how the relative wage of two groups of workers responds to changes in their relative supply. The inflow of

immigrant workers in a particular cell of the labor market affects the demand for native workers in that cell directly by providing closely (but not perfectly) substitutable workers. However, it also affects demand in all the other cells indirectly, through the complementarity linkages discussed above. These linkages are represented by the white double arrows between cells in Figure 4. The intensities of these indirect effects are regulated by the degree of complementarity (technically, the "elasticity of substitution") between each couple of cells. Because immigration entails inflows of workers in each cell, an analysis of the effect on native workers must account for all direct and indirect effects of each inflow. To relate our model to a labor-demand/labor-supply frame, it is as if there were as many demands and supplies as there are cells (types) in Figure 4. Our method accounts for their shifts and their linkages as the supply of one skill affects the demand for the other.

Immigrants and the Response of Native Workers: Interstate Migration

When analyzing the effect of immigrants on a state economy such as California's, we

need to consider a further adjustment of the local labor market: As immigrants of the same type move in, natives may move out of the state or lose their jobs as a result of increased competition. These responses of natives would "diffuse" the effects of immigration from a simple wage effect for Californians to potential employment and wage effects in other states where displaced California workers go. However, if immigrants in the same cell are complements rather than competitors (substitutes) for natives, the result may be to attract more natives from other states. Therefore, we also need to evaluate the employment/migration response of natives to immigration in each cell. The net migratory response of natives to immigrants is another indicator of how much they compete with (displace) or complement (creating opportunities for) native workers. Because of the costs of moving, the migratory reaction of natives may be imperfect and, if the effects of immigrants on wages are small, natives may not move at all.

Figure 5 shows the correlation between the net inflow of immigrants and of native workers into the labor market (employment). Each observation corresponds to one of the 20 age-education groups (described above) and one decade between 1960 and 2000. The reported inflow of U.S. native workers on the vertical axis of Figure 5 is calculated as the resid-

Because of their skills, informational constraints, preferences, and history, recent immigrants are usually employed in jobs, occupations, and sectors where previous immigrants were already predominantly employed.

ual change in native employment after we have accounted for the demographics and the education dynamics of each age-education group in the state.[11] Hence, the values reported on the vertical axis would be equal to 0 when migration of natives into the state equals migration of natives out of the state. Positive values on the vertical axis are due to net in-migration of natives from other states, and negative values are due to the net out-migration of natives to other states.[12] The horizontal axis of Figure 5 reports the net inflow of foreign-born workers as a percentage of the initial employment of the group. In most of the groups during this period, there was positive net in-migration of foreign-born individuals.

If the immigration of foreign-born workers induced natives in the same skill and age group to leave the state, Figure 5 would

Figure 5. Net Employment Inflows of Immigrants and U.S. Natives to California, by Age-Education Group, Decades Between 1960 and 2000
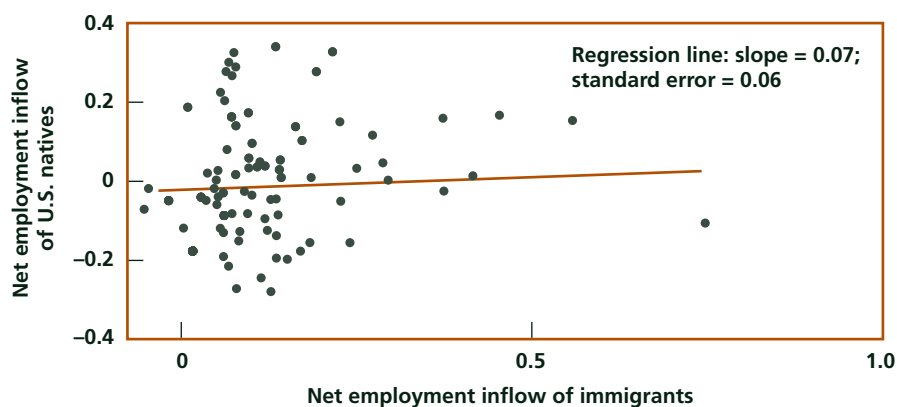
Source: Author's calculations using decennial Censuses.
Notes: Net inflows are measured as a share of base-year employment for each group. Each datapoint represents an age-education group.

show a significant negative correlation between the two variables, represented by a negative regression line. In particular, if each immigrant displaced one native worker, pushing that worker to move out of the state, the regression line would have a slope of –1. In fact, although natives and immigrants contributed to changes in employment in varying percentages across groups and decades, the figure *does not show any significant correlation between them*. The regression line reported on the graph has a small positive and statistically insignificant slope (0.07 with standard error close to 0.06).[13] More sophisticated regression analysis confirms that the correlation is never significantly different from 0.[14]

These results imply that immigrants do not displace native workers with similar education and age. Natives did not systematically move out as new immigrants moved into California. Instead, the net effect was an increase in the overall supply of California labor in each age-education group.

One may argue that native workers compete with all workers with similar schooling attainments no matter their age. To test that, we used aggregate education groups (not broken into age groups) as relevant units. Figure 6 shows the correlation between native and immigrant net changes in employment for the four schooling groups over each decade between 1960 and 2000.[15] Again, there is no systematic negative correlation

between changes in employment of natives and immigrants (the regression line has a slope 0.04 and standard error 0.17), which indicates that native employment does not respond to the immigration of similarly educated foreign-born workers.[16]

All in all, the correlations presented above, and the associated regression analyses, do not provide any evidence that the out-migration of natives is associated with the international immigration of workers with similar age-education (or education) characteristics. In other words, the results do not support the claim that immigrants displace native workers. Moreover, the high mobility of people across U.S. states (around one-third of them changed state of residence in the decade 1990–2000) implies moderate costs of moving. Thus, the insignificant migratory response seems to suggest that immigrants cannot have had large negative effects on native wages. Before analyzing the effects, however, we need to consider the issue of "push-driven" versus "pull-driven" immigration.

Isolating Push-Driven Immigration Changes

The zero correlation between immigration and employment changes for native workers could

Figure 6. Net Employment Inflows of Immigrants and U.S. Natives to California, by Education Group, Decades Between 1960 and 2000
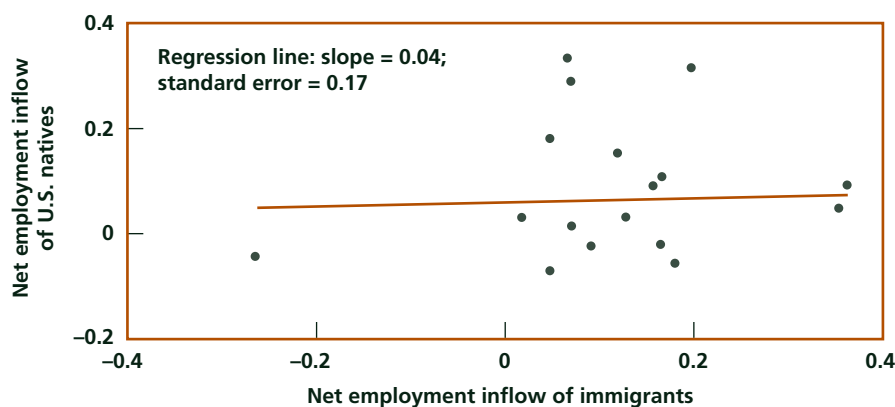
Source: Author's calculations using decennial Censuses.
Notes: Net inflows are measured as a share of base-year employment for each group. Each datapoint represents an education group.

be interpreted as evidence that immigration has no significant negative effect on natives' employment opportunities. This is correct, however, only if the increased inflow of immigrants is driven mainly by "push" factors. This is a very important point, and several researchers believe that the "area approach" (analyzing the effects of immigration on local economies) has failed to show a negative effect of immigration because it has not properly accounted for the unobservable regional "pull" factors.[17]

What is meant by push and pull factors, and why are they so important? Consider the following scenario. Suppose that immigrants with a college degree were "pulled" to California in the 1990s by the boom in the high technology sec-

tor, which increased the demand for workers with their qualifications. This would be a pull factor specific to California. The same boom probably would also have attracted (or reduced the potential outflow of) natives in the same skill group. It could thus create a positive correlation between foreign immigration and natives' migration—even if foreign migrants compete with natives for the same jobs. In fact, if there were no international migration, the demand boom might have attracted more natives (thus, immigrants would, in effect, have crowded out native workers).

Push factors are different in kind and effect. Take the cases of the increased international mobility of the college-educated Chinese

middle class or the worsened job outlook for young uneducated workers in Mexico during the 1990s. Both are push factors that could increase the immigration of some age-education groups to California (a large receiver of Chinese and Mexican migrants). Push factors generate more migrants to California (increase the supply of labor) and are not related to changes in California's local demand for labor. Thus, how native employment responded to those immigration changes would correctly estimate how immigrants affect natives' employment opportunities—for a given local demand.

We use a statistical method that can isolate push-driven immigration and lets us evaluate how natives' employment responds. The method uses the fact that, whereas push factors in countries of origin affect the migration of people to California as well as to other states, the pull factors are specific to California. Therefore, to isolate push-driven immigration over decades, we use the part of foreign immigration flows to California (by education-experience group) that correlates with the flows to other states. The technical details of the method (instrumental variable estimation) are described and developed in Peri (2007).

Figure 7 shows the correlation between push-driven immigration to California and net inflows of native workers for 20 age-education groups over the

Figure 7. Push-Driven Employment Inflows of Immigrants and Net Inflow of U.S. Natives to California, by Age-Education Group, Decades Between 1960 and 2000

Source: Author's calculations using decennial Censuses.
Notes: Net inflows are measured as a share of base-year employment for each group. Each datapoint represents an age-education group.

decades between 1960 and 2000.[18] The regression line in Figure 7 has a small slope and is insignificantly different from 0 (the point estimate is −0.13 and standard error is 0.18).[19] Thus, even isolating push-driven immigration shocks, we do not find any evidence of a "displacement" effect on native workers in California.

Complementarities

The recent increase in international migration to California had no significant effect on the migration of native workers. However, it did have two major effects on the state's labor markets: It increased the total supply of workers and it affected their distribution across education-experience cells.[20] As explained above, to calculate how these changes affect natives' wages, for each group and on average, we need to evaluate the strength of the complementarities between immigrants and natives, within and across the age-education groups.

We can measure the degree of complementarity by the percentage change in workers' relative wages in response to a 1 percent change in their relative supply.[21] For instance, the complementarity between workers with a high school diploma and those with no diploma has been estimated to be around 0.5.[22] This means that doubling the supply of workers with no diploma (a 100% increase) and keeping the supply of high school graduates fixed would increase the relative wage of high school graduates by 50 percent: High school dropouts would perform complementary production tasks that increase the productivity of high school graduates. (Similarly, the complementarity between experienced and young workers with the same educational attainment has been estimated at 0.25.)[23]

In this study, we use estimates of complementarities for workers in different age-education cells provided by the existing literature, but we use California data to estimate, within the same cell, how complementary native and foreign-born workers are in the state.[24] Although there are previous estimates of this parameter (Ottaviano and Peri, 2006), most previous literature on the effect of immigrants on native wages assumes perfect substitutability (zero complementarity) between native and foreign-born workers in the same age-education group. Thus, it is very important to check whether the California data support that assumption or support the recent evidence of imperfect substitution between native and foreign-born workers. This is done by analyzing how the relative wage of the two groups varies when their relative supply changes.

Figure 8 shows the complementarities between native and foreign-born workers in the same age-education group.[25] The vertical axis plots the percentage (logarithmic) changes in wages of

U.S. workers relative to foreign-born workers' wages in the same age-education group, over each decade between 1960 and 2000. The horizontal axis reports the percentage (logarithmic) change in the number of foreign-born workers relative to native workers for the corresponding group and decade.[26] A look at the scatter plot indicates that there is a positive correlation between variables: Groups with *larger relative increases in the number of foreign-born workers* also have *larger increases in the relative wages of native workers.* This confirms the complementarity role of native and foreign-born workers. The slope of the regression line measuring the complementarity between the two groups equals 0.26 (and its standard error equals 0.05). More sophisticated estimates of the same complementarity coefficient are reported in Peri (2007) and range between 0.10 and 0.33.[27] Those estimates are always significantly different from 0, and they suggest a fair degree of complementarity, rather than pure competition, between native and foreign workers.

These results imply that even when they are similar in education and age, foreign-born workers are likely to take different jobs, fill different occupations, and perform different productive tasks. Hence, they provide only limited competition to natives and, instead, stimulate demand for complementary productive tasks.

Immigration and Wages of Natives, 1990–2004

Keep in mind that the complementarities estimated above capture "relative" effects. To evaluate the total effect of an increased supply of immigrants on natives' wages, we must account for all the direct and indirect effects from workers in the same and in different age-education groups.[28]

The results above suggest that native workers did not respond to immigration by leaving the state, because foreign-born workers, even with similar characteristics, had significant complementary effects. Using estimates of the elasticities of substitution at hand and assuming the structure of labor market interactions described in Figure 4 (age groups nested into education tiers), we can calculate those effects. We consider the change in supply resulting from the influx of immigrants in the 1990–2004 period, and we assume that investments (i.e., business creation) adjusted to immigration to hold constant the real rate of return to capital.[29] The details of the model are presented in Peri (2007).

Table 3 reports the net inflow of foreign-born workers during that time as a percentage of initial employment. The average reported value means that new immigrants accounted for a 20.1 percent increase in total employment in

Figure 8. Complementarities Between U.S. Native and Foreign-Born Workers in California, by Age-Education Group, Decades Between 1960 and 2000
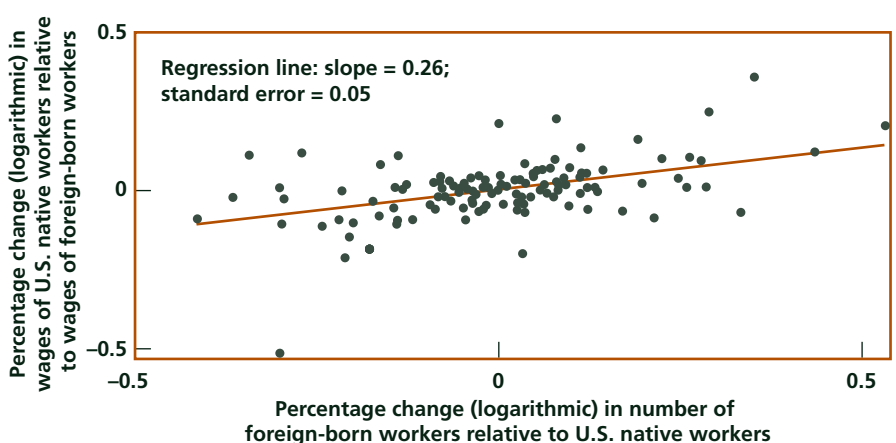
Source: Author's calculations using decennial Censuses.
Notes: Net inflows are measured as a share of base-year employment for each group. Each datapoint represents an age-education group.

Table 3. Net Inflow of Foreign-Born Workers 1990–2004 As a Share of 1990 Employment, by Skill Group

Skill Group	Share, %
High school dropout	29.5
High school graduate	24.2
Some college	10.5
College graduate	26.0
Average	**20.1**

Sources: Author's calculations using the 1990 Census and the 2004 American Community Survey.

California in 2004 over that in 1990. Similarly, immigrants increased employment among the group of high school dropouts by 29.5 percent but by only 10.5 percent for the group with some college.

Table 4 summarizes the main results. It shows how immigration affected the real wages of native workers over the period 1990–2004 by education group. These wage effects are calculated under alternative estimates of the complementarity between native and foreign-born workers within age-education groups. For native workers, we report the effect of immigration on wages for each educational group, as well as on average. The last row reports the effect of new immigrants on the average wages of previous immigrants (those who arrived before 1990).

The percentages reported in Table 4 represent the results of the following experiment. Consider the U.S. labor market as it was in 1990, with the labor market structure and interactions between workers as described in

Table 2 and characterized by the degree of complementarities estimated above. The values reported in Table 4 are the percentage changes in real wages resulting from immigration over the period 1990–2004, relative to a baseline scenario with no immigration (and keeping other things constant). A positive sign implies that workers experienced faster real wage growth because of immigration; a negative sign implies a slower real wage growth. Several features of the results presented in Table 4 are particularly important:

• The average wages of native workers received a positive boost from immigrants, estimated to be between 3 and 5 percent. This boost results from the complementarities of tasks performed by immigrants and natives in the labor market. The effect is higher the greater the amount of estimated complementarity (ranging from 0.15 to 0.33 in the table).
• Because of the relative inflow of immigrants, and comple-

mentarities across schooling groups, the group of native high school dropouts gains the least and the group with some college education gains the most from immigration. However, even the change in real wages of high school dropouts is calculated to be positive under the most reasonable estimates (Table 4, column 2) and represents only a minor loss (–1.3%) under the most pessimistic (lowest complementarity) case (column 3).
• Except for workers with some college education, whose real wage gain is around 6 to 7 percent, no other group experiences real wage gains or losses larger than 4 percent. This implies that even with the moderate costs of moving, in the range of 5 to 10 percent of their yearly income, native workers would not move (out of or into California) in response to immigration. This is consistent with the results above.
• Foreign-born workers already here sustain the largest losses in real wages, losing between 17 and 20 percent of their real wage over 14 years.[30] These losses are actually forgone wage gain as large as 1.4 percent per year. Previous immigrants would have experienced such gains if the borders were sealed and their services had become steadily

Table 4. Percentage Change in the Real Wages of California Workers As a Result of Immigrant Inflows over the 1990–2004 Period According to Level of Complementarity			
Specifications	1 High Complementarity	2 Medium Complementarity	3 Low Complementarity
U.S. Native Workers			
High school dropout	+1.8	+0.2	−1.3
High school graduate	+3.9	+2.9	+1.8
Some college	+7.2	+6.7	+6.2
College graduate	+4.0	+3.0	+1.9
Average	**+5.0**	**+4.1**	**+3.2**
Foreign-Born Workers			
Average	**−20.3**	**−16.8**	**−13.2**

Notes: The results in columns 1 to 3 are obtained from Peri (2007, Table 9). The percentage change for the wage of each worker in an age-education group is calculated using formula (5) for native workers and formula (6) for foreign-born workers, from Peri (2007). Then, percentage wage changes are averaged across age groups using the wage-share of the group in 1990 to obtain the table entries. The averages for native and foreign-born are obtained averaging the wage change of each education group weighted by its share in wage. We assume that capital adjusts to keep the capital labor ratio unchanged. The complementarity of native to foreign-born workers is 0.3 in column 1, 0.25 in column 2, and 0.15 in column 3.

scarcer as native employment grew. Technological advances, booming demand in sectors where immigrants are heavily employed, and increases in the employment of natives all reduce these theoretical (ceteris paribus) losses of existing foreign-born workers.

• Column 3 of Table 4 shows the effects on California wages of using rather low estimates of complementarities, which are compatible with estimates relative to the U.S. aggregate economy and obtained in Ottaviano and Peri (2006). Relative to the effects on real wages nationwide (reported in Ottaviano and Peri, 2006, Table 9, column 2), the estimates for California show a larger positive effect (3.2% vs. 1.8% nationwide) on average wages. Although the losses for high school dropouts are similar to the national ones (−1.3% vs. −1.1% nationwide), the California estimates show gains for workers with at least a high school diploma that are substantially higher than the national estimates, especially for workers with some college education (+6.2% vs. +3.4% nationwide).

The results reported in column 2 of Table 4 are calculated for a value of complementarity compatible with estimates from California, as well as for the nation as a whole. They are our preferred estimate. The complementarity estimates for California (mostly between 0.25 and 0.33) are generally larger than those for the United States overall (between 0.25 and 0.10). This may imply that in California, where immigrants are more concentrated, they are specialized in jobs and tasks more complementary to those of natives. Alternatively, it may suggest that natives have upgraded, specialized, or adapted themselves to those jobs that are best shielded from immigrants' competition and mostly complementary to them. Native workers may adjust, as immigrants become more numerous, by redirecting and specializing in production tasks that benefit more from their complementarities.

Such complementarities (larger than the national average) and the inflow of immigrants (also larger than the national average) combine to produce the large positive effects for California natives reported in Table 4 (+4.1% on average and no negative effect on low-skilled workers), which may seem remarkable. Ultimately, it is simply a "relative-scarcity" effect redistributing income away from previous immigrants (who lose around 17% of their real wage) to U.S. natives.

> **Immigrants evidently do not increase the tendency of natives with similar skills (education and experience) to migrate out of state or to lose jobs.**

This positive effect on native wages is all the more remarkable because we have not allowed any "externality" from immigrants, i.e., no positive effect on technology or innovation from them. Certainly, the very large number of highly educated immigrants (scientists and engineers) in California is responsible for a good share of innovation and technological improvements. If we were to account for those and their effects on productivity, we would likely obtain an extra positive effect on all wages.

Conclusions: What Have We Learned?

If the nation's states were independent countries, California, with its 8.5 million foreign-born residents as of 2004, would be the second-largest receiver of international migrants in the world (after Russia). Moreover, its proximity to Mexico and a porous border generated large flows of less-educated Mexican workers (documented and undocumented) during the last three decades. As of now, one-third of California's total labor force consists of immigrants, two-thirds of its uneducated workers come from abroad, and a burgeoning foreign-born population has grown by over 40 percent in the last 14 years. As a result, one might think that native Californians (particularly the unskilled ones) must have suffered, to an extreme, the negative effects of this "immigration crisis" on their employment opportunities and wages.

The present study seems to say otherwise. Immigrants evidently do not increase the tendency of natives with similar skills (education and experience) to migrate out of state or to lose jobs. Moreover, between 1960 and 2004, immigration had a much more negative effect on the wages of previous immigrants than on those of native workers. This suggests that native and foreign-born workers perform complementary rather than competing tasks in production. In fact, an increase in the number of immigrants evidently increases the demand for tasks performed by native workers and raises their wages. Our median estimates indicate that these complementarities of immigrants spurred wage growth of natives by about 4 percent in 14 years.

These results should certainly be taken into account by policymakers as they consider immigration reform. The findings would seem to defuse one of the most inflammatory issues for those who advocate measures aimed at "protecting the livelihood of American citizens." Because California leads the nation in immigration trends, this study may provide glimpses into the future and the potential effects of immigration on wages and employment at the national level. ◆

Notes

[1] Throughout this study, "foreign-born" signifies those individuals born outside the United States and its territories and without U.S. citizenship at birth.

[2] More specifically, the data used are from the 1% sample of Census 1960; the 1% state sample, Form 1, of Census 1970; the 5% state sample of Census 1980 and Census 1990; the 5% Census sample for 2000; and the 1/239 sample of the 2004 American Community Survey.

[3] Total employment is defined as the sum of individuals between ages 17 and 65, not residing in group quarters, who worked at least one week during the previous year and received some salary.

[4] Throughout the period considered here, the share of foreign-born workers in employment was one to three percentage points higher than their share in the population, denoting a higher employment/population ratio for immigrants than for natives (in part because of their age distribution).

[5] The education groups at the extreme of the spectrum are small in absolute terms. Only 10 percent of all California workers did not have a high school diploma and only 10 percent had a master's degree or Ph.D. in 2004. On the other hand, the group of high school graduates made up 31 percent of California employment, and the group of workers with some college made up another 31 percent. Hence, most native Californians are in the intermediate education groups that received relatively fewer immigrants.

[6] Several studies analyze at least three other areas in which immigrants have a relevant economic effect on natives: housing prices (e.g., Saiz, 2006; Ottaviano and Peri, 2005), technological adoption (Lewis, 2003, 2005), and fiscal burdens at the state and federal levels (National Research Council, 1997).

[7] These limits are discussed in Borjas, Freeman, and Katz (1997). Some of the most interesting recent studies on the labor market effect of immigration using the area approach are Borjas (2006), Card (2001), and Lewis (2003).

[8] Angrist (1995), Ciccone and Peri (2005), and Katz and Murphy (1992) estimate the degree of complementarities between workers of different levels of education.

[9] Card and Lemieux (2001) estimate the degree of complementarities between workers with the same educational attainment but different experience levels.

[10] The elasticity of substitution between two workers ranges between 0 (perfect complements) and ∞ (perfect substitutes).

[11] The residual is obtained as the actual employment change of an age-education group over a decade minus the predicted change calculated projecting forward the cohort that was ten years younger in the previous Census. We accounted for their mortality and changes in education using national rates.

[12] Systematic changes of employment/population ratios associated with immigration would cloud the interpretation of changes in employment as measuring the interstate migration. Peri (2007) shows that no such systematic relation exists and, using population rather than employment, by age and education groups, almost identical results are obtained.

[13] The regression coefficient is obtained from a least squares regression, weighting each observation for initial employment in the group and correcting the standard error to be heteroskedasticity robust.

[14] The regression analysis of a native's response to immigrants in California is developed in detail in Peri (2007, Section 4).

[15] Consistent with our "grid," the education groups are high school dropouts, high school graduates, some college, and college graduates. As in Figure 6, the vertical variable is the residual change in native employment, once we accounted for the demographic and education of each cohort. Hence, it is different from 0 only if there is net in- or out-migration of native workers to other states.

[16] Peri (2007, Section 4) develops further the econometric analysis across education groups.

[17] See, for instance, the discussion in Borjas, Freeman, and Katz (1997) and Borjas (2006).

[18] The push-driven component of immigration is obtained as the predicted flow of immigrants from an ordinary least squares (OLS) (first-stage) regression of immigration to California (by education, age, and decade) on immigration to the rest of the United States (by education, age, and decade).

[19] Even taking −0.13 as the actual estimated response of natives, this would imply a minuscule displacement effect (one native moves per ten immigrants coming in) with an insignificant effect on the supply and wages of other states. Peri (2007) reports an array of robustness checks. Although the IV estimates are sometimes imprecise, they are never significantly different from 0, nor are they significantly different from the OLS estimates. We take this as evidence of no significant upward bias of the OLS estimates.

[20] The distribution of immigrants across cells, in fact, is different from the existing distribution of natives (as illustrated above).

[21] What we call "complementarity" here is what in economic jargon is known as the inverse of the elasticity of substitution or the elasticity of relative labor demand between two factors.

[22] See, among others, Katz and Murphy (1992), Angrist (1995), Borjas (2003), and Ciccone and Peri (2005).

[23] In general, two workers performing identical tasks would have zero complementarity as they perfectly substitute for each other. Conversely, two workers performing perfectly complementary tasks, meaning that they are completely unproductive unless they work with each other, would have infinite complementarity. See, among others, Card and Lemieux (2001), Borjas (2003), and Ottaviano and Peri (2006).

[24] In the present study, we group foreign-born workers with natives with the same education and total experience, assuming that they are most comparable to those in that group. There are concerns, however, that what matters for the skills and wages of foreigners is their working experience in the United States.

Ottaviano and Peri (2006) show that reclassifying foreign-born workers according to their experience in the United States or correcting for the U.S. equivalent of foreign experience hardly changes the results at all.

[25] We implicitly assume that foreign-born workers are perfect substitutes among themselves. We could distinguish between recent and previous immigrants and estimate different complementarities with natives. What we do amounts to estimating an average complementarity between natives and the foreign-born. In terms of results, although allowing imperfect substitution across groups of immigrants would allow us to differentiate the wage effects of immigration on recent and previous immigrants, it would not change the estimates of their effect on native wages. Since our focus is on natives, we maintain the assumption of homogeneity of foreign-born workers.

[26] The reported changes have been cleaned for the average education by time fixed effect and age group by time fixed effect using an OLS regression.

[27] In those specifications, we account for push-driven immigration only and we perform an array of robustness checks.

[28] From our complementarity estimates, we can also calculate the "partial" effect of immigrants on the wages of natives in the same education-experience group, keeping supplies of all other groups constant. That partial effect is the one usually reported in previous area studies, such as Card (2001). A 1 percent increase in foreign-born employment would increase by about 0.26 percent the relative wage of natives in the same experience group (because of complementarities). However, as it increases the supply of that particular experience group relative to the others, it also decreases by 0.25 percent the wage of that experience group relative to others (complementarity across experience groups). Hence, overall, the partial effect on the wages of natives combines the two effects of similar size and opposite sign and is therefore about 0. This is consistent with Card (2001) and Lewis (2003), who find virtually no partial effects of immigration on the wages of similarly skilled workers.

[29] This is a typical assumption for the long-run response of the economy to immigration. For reasonable speed of adjustment of investments to new labor supply, almost all of the "long-run" adjustment already occurs within the period 1990–2004. Ottaviano and Peri (2006) analyze in detail the differences between the short- and the long-run effect of immigration.

[30] Because the focus of this study is on the effect of immigrants on natives, we report only the effect on the average wage of foreign-born workers. The effect on individual wages, however, would also differ by education group for foreign-born workers as reported in Peri (2007).

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