The Effects of Immigration on California's Labor Market

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Abstract

As of 2004 California employed almost 30% of all foreign born workers in the U.S. and was the state with the largest percentage of immigrants in the labor force. It also received a very large number of Mexican and uneducated immigrants during the recent decades. If immigration harms the labor opportunities of natives, especially the least skilled ones, in the form of downward wage pressure, pressure to move out of the state or increased likelihood to loose their jobs, California was the place where these effects should have been stronger. By analyzing the behavior of population, employment and wages of U.S. natives in California in the period 1960-2004 we address this issue. We consider workers of different education and age as imperfectly substitutable in production and we exploit the differences in immigration across these groups to infer their impact on US natives. Our estimates use international migration to other U.S. states as instrument for international migration to California to isolate the "supply-driven" variation of immigrants across skills and identify the labor market responses of natives. We find that in the considered period immigration did not produce significant migratory response or loss of jobs of natives. Moreover we find that immigrants were imperfect substitutes for natives of similar education and age, hence they stimulated, rather than harmed the demand and wages of U.S. native workers.

Key Words: Immigration, Skill Complementarities, Employment, Inter-state migration, wage effects.

JEL Codes: F22, J61, J31, R13.

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1 Introduction

In year 2004 California was home to almost 30% of all foreign born individuals working in the U.S. At the same time, roughly one third of the almost 15 million workers employed in California were foreign-born. Already as of year 1980 the share of foreign-born in California's labor force (equal to 16%) was larger than its national level today (14%) and the state attracted very large numbers of immigrants in general and a large share of uneducated Mexican immigrants, in particular, since then. As of 2004 two thirds of workers without a high school degree in California were immigrants as well as almost half of the workers with a doctoral degree. Moreover U.S.-born Californians moved out of the state during the nineties and some people cited the job competition from immigrants as a key factor for this outflow. Certainly, if the inflow of immigrants has crowded out the labor market options of U.S. natives, particularly the low skilled ones, in the form of fewer employment opportunities and/or lower wages such effect should have been the strongest in California. Analyzing California's labor market during the period 1960-2004 we should be able, therefore, to identify the upper bound of the effects of immigration on employment, population and wages of native workers in a U.S. state. Our approach combines the analysis of wages in a general equilibrium framework, as proposed in recent national studies (Borjas 2003, Ottaviano and Peri, 2006) with the study of employment and inter-state migratory response of native workers to foreign immigration, typical of the regional approach (such as Borjas, 2006, Card 1990, 2001 and Lewis 2005) and needed when we analyze a state economy.

As in Borjas (2003) we consider labor as a differentiated input in production and we model the interactions between workers with different education and age using a CES production function. As in Ottaviano and Peri (2006) we allow for imperfect substitution between native and foreign-born worker within an education-age group (due to differences in skills, occupational choices and job opportunities) and we estimate their elasticity of substitution. Then, maintaining the structure of imperfect substitutability across skill groups we analyze the effects of immigration on employment of natives. In particular natives in the same education-experience group may respond to a disproportionately large immigration in that group by moving out of California in larger numbers (or, if immigrants complement their skills, natives from other states will move to California), moving out of employment (displacement theory) or into it (new business opportunities). These responses to immigration generate a reaction of the labor supply of native workers to immigrants across skill groups that we are able to account for. Once we have accounted for this response we can calculate the effect of immigration on wages, using the estimated sensitivity of wages to supply of workers in the same and other skill groups.

An important advantage of using California as the unit of analysis is that we have a reasonable and original instrument for the inflow of immigrants across skill groups in California. When one estimates the migratory and wage response of natives to immigrants with an OLS regression the maintained identifying assumption is that once we control for education-age, education-year and age-year fixed effects the remaining variation

of immigrants in each skill group over time is driven by supply (push) factors related to their countries of origin, rather than to skill-specific labor demand variations in the destination economy which would also affect productivity and migration of natives. In this paper we instrument the flow of international immigrants to California with the flow of international immigrants to the rest of the United States. While sharing the push-factors determinants of international migration the flow to other states are not affected by California's Pull (unobserved) factors. Hence we have an instrument for immigrant inflow, potentially not (or little) correlated with California specific shocks to labor demand while still correlated with shocks to the supply of immigrants.

The rest of the paper is organized as follows: Section 2 presents the data and shows some statistics on the skills of foreign-born and recent immigrants to California. Section 3 presents the production function used to calculate labor interactions and the effects of immigration on wages. The skill-structure defined in the production function is used in all the empirical estimations. Section 4 estimates the migration response, and employment response of California's native workers to immigration for the period 1960-2004. Section 5 estimates the substitutability between U.S. and foreign born workers in the same education-age group. Section 6 uses the estimated parameters to calculate the effects of immigrants on wages of natives (by education) for the 1990-2004 period. Section 7 concludes.

2 Immigration to California: A look at the Data

The data we use in our empirical analysis are from the Integrated Public use Microdata Samples of the Census 1960 to 2000 plus those from the American Community Survey of 2004, all available from Ruggles et al. (2006). Individual data are aggregated to produce the averages by cell used in this section and in the empirical analysis of section 4 and 5. More specifically the samples are the 1% sample of Census 1960, the 1% State sample, Form 1, of Census 1970, the 5% state sample of Census 1980 and 1990 and the 5% Census Sample for 2000, plus the 1/239 sample of the American Community Survey, 2004. Let us present some summary statistics on immigration and foreign-born in California for the 1960-2004 period. Table 1 illustrates the evolution of the percentage of foreign born in employment and population for the 1960-2004 period. Employment is defined as the sum of individuals less than 65 years old, not residing in group quarters, who worked at least one week in the previous year. Population is defined as the sum of individual below 65 not residing in group quarters. We report the figures for California as well as the corresponding figures for the whole USA, as terms of comparison. First, note that the percentage of foreign-born in the population and employment began growing already in the sixties in California, while in the US as a whole it only began to grow during the seventies. The seventies, eighties and nineties experienced large increase in the share of foreign-born in California, by about 7% each decade, similar rates continued during the 2000's. Throughout the considered period the share of foreign born workers in employment was larger than the share in population denoting higher employment rates of immigrants relative to natives (in

part due to their age distribution). Finally, notice that the percentage of immigrant in California's population and employment as of year 1980 was similar to the percentage of immigrants in population and employment for the nation in year 2004. This is interesting as, continuing the present trend, in terms of percentages the future of the nation may look like the last 25 years of California experience. Let us carry this similarity a bit further, as not only the percentage of foreign born but also their distribution across education levels in California in 1980 was similar to that for the whole nation in 2004. Table 2 shows the percentage of foreign-born workers in California by education group, between 1960 and 2004. Notice the higher concentration of foreign-born among the low (less than high school) and high (college or more) schooling level and the lower concentration in the intermediate education levels. Notice that, as of year 2004, two thirds of high school dropouts workers in California were immigrants and 42% of Ph.D.'s were immigrants, while only 20% of college dropouts were not U.S. born. Such distribution of immigrants at the two ends of the schooling spectrum will be dubbed "U-shaped" distribution of immigrants and is also a feature of the national data. Figure 1 shows the percentage of foreign-born workers by education level in 2004, for California and the whole USA. One clearly notice the same qualitative U-shaped distribution, but each bar is much higher for California, denoting an higher average percentage of foreign-born. We need to go back to the year 1980 (see table 2) to find percentages of foreign born across education groups in California similar to the ones for the US today: back then, in California, 32% of dropouts, 12% of high school graduates, 10% of college dropouts and 14% of college graduates were foreign-born.

The numbers presented above are relative to the "stock" of foreign-born living in California (or in the Nation). Similar in its distribution over skill has also been the more recent flow of immigrants to California and to the U.S. during the period 1990-2004. Figure 2 shows the net growth in employment due to immigrants as percentage of initial employment by education group for California (light shaded columns) and for the U.S. as a whole (dark shaded columns). The U-shaped distribution over schooling attainments is clear, with college graduate, master and Ph.D.'s flowing in much larger percentages (of their initial group) than college dropouts both in California and the US and high school dropouts flowing in larger percentages than high school graduates. Overall, aggregating across groups, immigrants in the 1990-2004 period increased employment in California by 20% while in the US as a whole only by 11%. These very different average provide a good sense of how large and pervasive immigration has been in California.

The focus of this paper is the effect of immigration on labor market outcomes of Californian workers. It is useful, therefore, to show the behavior of real wages of natives during the most recent fourteen years of data (1990-2004) corresponding to the period of largest immigration flows. Figure 3 shows the percentage change in real wage for native workers, by education group, in California (light shaded columns) and in the US as a whole (dark shaded columns) for the 1990-2004 period. We use real weekly wages calculated as yearly wage and salary income divided by weeks worked and converted in constant dollars by dividing for the Consumption

Price Index (CPI) deflator. First of all we notice that the overall pattern of real wage changes across groups, as well as the actual changes for each group, are very similar in California and in the whole nation. High School dropouts' wages decreased in real terms in this period by as much as 17%, real wages of high school graduates were rather stationary while real wages of college graduates had substantial increases, generally above 20%. The differences in growth rates between California and the rest of the nation were never larger than 4%. This denotes a substantial integration of the Californian labor market with the rest of the nation implying small costs of moving that would arbitrage away large differences in wages. California was close to the national average as far as wage dynamics in the last 15 years are concerned. Certainly the bad performance of real wages of uneducated workers, contributing to an increase in wage dispersion and income inequality, has been a thorny issue in California, as well as in the rest of the nation. The question is wether the immigration flows contributed and by how much (in California as well as in the rest of the nation) to such wage performances. Aggregating across groups, the average real wage grew by 10.7% in California and by 9.7% in the US as a whole, again denoting a similar performance (less than 0.1% growth difference per year) and no apparent wage "penalty" at all for the high-immigration state of California.

3 The Framework: Production function and imperfect substitutability

To evaluate the effects of immigrants on the wages and employment of native workers in California we use a framework similar to Ottaviano and Peri (2006). Workers differ by their education and age; different types of workers and physical capital are combined in a production function to produce output. The marginal productivity (wage) of each group depends on skill-specific technology and the supply of each group is affected by immigration. We extend that framework to allow changes in labor supply of natives (via migration to/from other states and in/out of employment) in response to immigration. We estimate such responses maintaining the same grouping by skill in the production function. Then, we use the estimated responses and the estimated wage elasticities to calculate the overall effect of immigration on wages of U.S. natives in California.

3.1 Production Function

Following previous work with my coauthor Gianmarco Ottaviano (Ottaviano and Peri, 2006) that, in turn, builds on Borjas (2003) we represent output in California as produced by physical capital and different types of labor. Labor types are grouped according to education and age and combined in a constant elasticity of substitution (CES) aggregate; age groups are nested within educational groups, that are in turn nested into the labor composite. U.S.-born and foreign-born workers are allowed a further degree of imperfect substitutability

even when they have the same education and age. More specifically, the aggregate production function is given by the following expression:

$$Y_t = A_t L_t^{\alpha} K_t^{1-\alpha} \tag{1}$$

where Y_t is aggregate output , A_t is total factor productivity (TFP), K_t is physical capital, L_t is a CES aggregate of different types of labor (described below), and $\alpha \in (0,1)$ is the income share of labor. All variables are relative to the state of California in year t. The labor aggregate L_t is defined as:

$$L_t = \left[\sum_{k=1}^{4} \theta_{kt} L_{kt}^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} \tag{2}$$

where L_{kt} is an aggregate measure of workers with educational level k in year t; θ_{kt} are education-specific productivity levels (standardized so that $\sum_k \theta_{kt} = 1$ and any common multiplying factor can be absorbed in the TFP term A_t). We group educational achievements into four categories: high school dropouts (denoted as HSD) , high school graduates (HSG), college dropouts (COD) and college graduates (COG), so that $k = \{HSD, HSG, COD, COG\}$. The parameter $\delta > 0$ measures the elasticity of substitution between workers with different educational achievements. Within each educational group we allow workers with different experience levels to be imperfect substitutes. In particular, following the specification used in Card and Lemieux (2001), we write:

$$L_{kt} = \left[\sum_{j=1}^{5} \theta_{kj} L_{kjt}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{3}$$

where j is an index spanning age intervals of ten years between 17 and 66, so that $j = 1$ captures workers 17-26 years old , $j = 2$ those 27-36 years, and so on. Within an education group age groups are identical to groups based on years of experience and sometimes we will use the terms "age" and "experience" interchangeably. The reason to choose a ten year interval is that, by so doing, we can track ten year cohorts across censuses and control for their demographic tendencies as well as for age-group fixed effects when evaluating the impact of immigration on employment, revealing the internal migratory response of natives to foreign immigrants. The parameter $\eta > 0$ measures the elasticity of substitution between workers in the same education group with different experience levels and θ_{kj} are experience-education specific productivity levels (standardized so that $\sum_j \theta_{kj} = 1$ for each k and assumed invariant over time, as in Borjas, 2003) . As we expect workers within an education group to be closer substitutes than workers across different education groups, our prior (consistent with the findings of the literature) is that $\eta > \delta$. Finally we define L_{kjt} as a CES aggregate of home-born and foreign-born workers. Denoting the number of workers with education k and experience j who are, respectively, home-born and foreign-born, with H_{kjt} and F_{kjt}, and the elasticity of substitution between them by $\sigma > 0$, our

assumption is that:

$$L_{kjt} = \left[\theta_{Hkjt} H_{kjt}^{\frac{\sigma-1}{\sigma}} + \theta_{Fkjt} F_{kjt}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{4}$$

Foreign-born workers are likely to have different abilities pertaining to language, quantitative skills, relational skills and so on. These characteristics, in turn, are likely to affect their comparative advantages and choices of occupation and their abilities in the labor force, therefore foreign-born workers should be differentiated enough to be treated as imperfect substitutes for U.S.-born workers, even within the same education and experience group. While in a more general specification the substitutability between U.S.- and foreign-born workers, σ, may vary across education groups (k) the findings in Ottaviano and Peri (2006) suggest that those differences are not very relevant so here we maintain a common elasticity. Finally, the terms θ_{Hkjt} and θ_{Fkjt} measure the specific productivity levels of foreign- and home-born workers and they may vary across groups and years (in the empirical identification we impose a systematic structure on their time variations) . They are also standardized so that $(\theta_{Hkjt} + \theta_{Fkjt}) = 1$.

3.2 Effects of Immigration on Employment and Wages in a State Economy

Using the production function (1) we can calculate the wage response of each group to total immigration once we know the parameters δ, η and σ, and provided we have the data on immigration flows, on wage shares and on employment. In particular, assuming a given supply of U.S. born workers in each skill group, H_{kjt}, and assuming that physical capital adjusts to immigration as to keep its real return constant, Ottaviano and Peri (2006) show that the effect of total immigrants on real wages of U.S. natives of education k and experience j (expressed in units of output Y_t which is taken as the numeraire) is given by the following expression

$$\begin{aligned}\left(\frac{\Delta w_{Hkjt}}{w_{Hkjt}}\right)^{Total} &= \frac{1}{\delta}\sum_m\sum_i\left(s_{Fmit}\frac{\Delta F_{mit}}{F_{mit}}\right) + \left(\frac{1}{\eta}-\frac{1}{\delta}\right)\left(\frac{1}{s_{kt}}\right)\sum_i\left(s_{Fkit}\frac{\Delta F_{kit}}{F_{kit}}\right) + \\ &+ \left(\frac{1}{\sigma}-\frac{1}{\eta}\right)\left(\frac{1}{s_{kjt}}\right)\left(s_{Fkjt}\frac{\Delta F_{kjt}}{F_{kjt}}\right)\end{aligned} \tag{5}$$

and the effect on wages of foreign-born (previous immigrants) of education k and experience j of immigration is given by:

$$\begin{aligned}\left(\frac{\Delta w_{Fkjt}}{w_{Fkjt}}\right)^{Total} &= \frac{1}{\delta}\sum_m\sum_i\left(s_{Fmit}\frac{\Delta F_{mit}}{F_{mit}}\right) + \left(\frac{1}{\eta}-\frac{1}{\delta}\right)\left(\frac{1}{s_{kt}}\right)\sum_i\left(s_{Fkit}\frac{\Delta F_{kit}}{F_{kit}}\right) + \\ &+ \left(\frac{1}{\sigma}-\frac{1}{\eta}\right)\left(\frac{1}{s_{kjt}}\right)\left(s_{Fkjt}\frac{\Delta F_{kjt}}{F_{kjt}}\right) - \frac{1}{\sigma}\frac{\Delta F_{kjt}}{F_{kjt}}\end{aligned} \tag{6}$$

where $\frac{\Delta F_{kjt}}{F_{kjt}}$ is the percentage change of foreign-born in skill group k, j due to immigration; the variable s_{Fkjt} is the wage share paid in year t to foreign workers in group k, j, namely $s_{Fkjt} = \frac{w_{Fkjt}F_{kjt}}{\sum_m \sum_i (w_{Fmit}F_{mit} + w_{Hmit}H_{mit})}$. Analogously, $s_{kjt} = \frac{w_{Fkjt}F_{kjt} + w_{Hkjt}H_{kjt}}{\sum_m \sum_i (w_{Fmit}F_{mit} + w_{Hmit}H_{mit})}$ is the wage share in year t paid to workers in skill group k, j. While appropriate when considering the overall US economy, the assumption of fixed labor supply of natives, H_{kjt} may not hold when we analyze the effect of immigrants on a state-economy. In this case one needs to account for the fact that native workers in each skill group H_{kjt} may respond to immigration by moving out of California. In the present analysis, while we do not model in detail the mechanisms of such response to immigration, we estimate the elasticity of H_{kjt} to F_{kjt} in each group by running the following regression:

$$\frac{\Delta H_{kjt}}{H_{kjt} + F_{kjt}} = D_{kj} + D_{kt} + \vartheta \frac{(\Delta H_{kjt})^{natural}}{H_{kjt} + F_{kjt}} + \gamma \frac{\Delta F_{kjt}}{H_{kjt} + F_{kjt}} + u_{kjt} \tag{7}$$

ΔH_{kjt} is the change in native employment in cell k, j during the decade t. The left hand side of (7) measures this change as a percentage of the overall initial employment in the skill group, $H_{kjt} + F_{kjt}$. The regression controls for education by age (D_{kj}) and education by year (D_{kt}) fixed effects as well as for the predicted change of employment in the cell $(\Delta H_{kjt})^{natural}$ that accounts for the demographic trends (cohort size and mortality rates) and national employment rates [1]. Any deviation of ΔH_{kjt} from the predicted change $(\Delta H_{kjt})^{natural}$ in employment is either due to net migration to/from other states or net flows into/out of employment[2]. The coefficient γ captures the elasticity of native employment changes, ΔH_{kjt}, to immigration flows, ΔF_{kjt}. u_{kjt} are zero-mean cell-specific shocks. In order to obtain an estimate of the coefficient γ that could be considered as the "response" of native labor supply to immigration in California we adopt the following estimation and identification strategy. First, as already noted, we control for education-specific labor demand shocks (D_{kt}), that would induce correlation between the residual and the immigrants' inflow. Second, we perform an Instrumental Variables estimation using the variable $\frac{\Delta F_{kjt}}{H_{kjt}+F_{kjt}}$ calculated *for the rest of the U.S.* as instrument *for immigration flows to California*. The flows of immigrants into a U.S. state in each education and experience group are determined by the interaction of "push" (supply) factors, relative to the countries of origin and "pull" (demand) factors specific to the U.S. states where they move to. By using immigration by skill in the rest of the U.S. as instrument for its counterpart in California we are able to isolate the supply-driven variation of immigration (common to flows to California and rest of the U.S.) from the demand-driven variation that is specific to California. For instance, scant job opportunities for young uneducated workers in Mexico during the nineties may be a supply factor inducing a large ΔF_{kjt} for some education-age groups both for California and the US as a whole. On the other hand, good employment opportunities for middle age highly educated engineers in Silicon

[1] The construction of $(\Delta H_{kjt})^{natural}$ is described in detail in Section 4 below.

[2] Faster/slower educational upgrading relative to the rest of the nation could be a cause of deviation as well. However, we also run the regressions using only age groups over 27 years, which reduces the extent of educational upgrading of a cohort over time (as most people have their final degree by age 27) obtaining very similar results.

Valley would certainly affect ΔF_{kjt} in some education-age groups in California, but would not affect ΔF_{kjt} for the same groups in the rest of the country. Moreover, these "pull" factors would also affect ΔH_{kjt} for California inducing correlation between ΔF_{kjt} and u_{kjt}. In short the goal of our instrument is to proxy "supply-driven" migration shocks to California steering clear of "demand-drive" ones.

Once we obtain its estimate, the interpretation of the coefficient γ is very simple. If it is equal to negative one it implies that for each immigrant flowing to California one native moves out of the state or out of of employment so that immigrants displace natives. If γ is equal to 0 it implies that native workers' employment is not affected at all by immigration. Finally, if γ is positive it implies that immigrants are complementary enough to native workers to create new business/productivity opportunities for them attracting new workers to the state and increasing their job opportunities. In order to identify the cross-state migration and the pure employment effect we run different specifications of (7) using alternatively employment, population and employment rate changes (by education and age) as dependent variable in regressions similar to (7).

Finally, recall that γ estimates a relative supply response to immigration. Specifically γ measures the percentage change in native employment of group k, j in response to immigration in that group relative to changes in other experience groups in the same education group k. Maintaining the "nested" structure described in section 1 we allow for the relative employment elasticity to immigration for education groups, γ_{EDU}, to be different from γ, and we estimated it with the following regression:

$$\frac{\Delta H_{kt}}{H_{kt}+F_{kt}} = D_k + Trend_k + \vartheta_1 \frac{(\Delta H_{kt})^{natural}}{H_{kt}+F_{kt}} + \gamma_{EDU} \frac{\Delta F_{kt}}{H_{kt}+F_{jt}} + u_{kt} \tag{8}$$

where the variables have been aggregated across experience within education groups as follows: $\Delta H_{kt} = \sum_j \Delta H_{kjt}$, $H_{kt} = \sum_j H_{kjt}$, $F_{kt} = \sum_j F_{kjt}$ and $(\Delta H_{kt})^{natural} = \sum_j (\Delta H_{kjt})^{natural}$ .We allow fixed time effects D_t and education-specific trends $Trend_k$ to account for aggregate factors and skill-specific technological progress. We estimate γ_{EDU} using the variable $\frac{\Delta F_{kt}}{H_{kt}+F_{jt}}$ relative to migration to the rest of the U.S. as instrument for the corresponding migration to California.

4 The response of Native Labor Supply: Cross-state migration and Employment effects

The data we use are from the integrated public use microdata samples (IPUMS) of the U.S. decennial Census and of the American Community survey (Ruggles et al, 2005). In particular we use the general (1%) sample for Census 1960, the 1% State Sample, Form 1, for Census 1970, the 5% State sample for the Censuses 1980 and 1990, the 5% Census Sample for year 2000 and the 1/239 American Community Survey (ACS) Sample for the year 2004. As those are all weighted samples we use the variable "personal weight" to construct all the average

and aggregate statistics relative to California. We consider people aged 17 to 66 not living in group quarters, and we included them among the workers if they worked at least one week in the previous year and earned a positive amount in salary income. When using wage data we converted the current wages to constant wages (in 2000 U.S. $) using the C.P.I.-based deflator across years. We define the four schooling groups using the variable that identifies the highest grade attended (called "HIGRADEG" in IPUMS) for census 1960 to 1980 while we use the categorical variable (called "edu99" in IPUMS) for censuses 1990 and 2000 and ACS 2004. Age groups are identified using the variable "AGE". Finally, yearly wages are based on the variable salary and income wage (called "INCWAGE" in IPUMS). Weekly wages are obtained dividing that value by the number of weeks worked[3]. The status of "foreign-born" is given to those workers whose place of birth (variable "BPL") is not within the USA (or its territories overseas) and did not have U.S. citizenship at birth (variable "CITIZEN")[4]

Table 3 shows the estimates of the coefficients γ (first row) and ϑ (second row) in regression (7). The change in native employment as percentage of the initial employment (by cell) is regressed on the change in foreign-born employment (also as percentage of initial employment), on the predicted change in native employment and on a set of dummies that control for education by age fixed effects and education by year fixed effects. The predicted inter-census change in employment of an education-age group is calculated using the population of that group ten years earlier and applying to it the mortality rate over a decade of that group nationwide and the national employment rate for that group in that census year. We also correct for a possible education upgrading, i.e. people moving to a higher education cell, using the national upgrading rate by cohort. After 27 years of age, however, these upgrades are very small and the results are very similar accounting for them or not. Hence, for instance, the population of U.S. natives in the cohort of high school educated individual, 37 to 46 years old in 1960 is used to predict the population of U.S. natives in the cohort of high school educated individuals, 47 to 56 years old in 1970. Then the national employment rate for U.S. natives in the 47-56 years old group in 1970 is applied to obtain the predicted employment for that cohort in 1970. Any differences between the actual and the predicted change in population are due to a reduction (increase) of native individuals in the cohort due to cross-state migration. Any differences between actual and predicted employment changes are due either to cross-state migrations or to a decrease (increase) of the employment rate relative to the national one. We use ten-year age groups (five of them, between 17 and 66 years of age) and four educational attainments over four decades 1960-2000, for a total of 80 observations. After having analyzed the overall effect of immigration on native employment (Table 3) we also analyze its components by looking at population, only affected by migration of natives in or out-of-state, (Table 4) and employment rates, only affected by higher or lower participation into the labor market (Table 5). Regressions in Table 3 also include education by age fixed effects to account

[3]For the Census 1960 and 1970 only a categorical variables that measures weeks worked exists and is called "WKSWRK2". Individuals are assigned the middle value of the variable in the interval.

[4]The variable CITIZEN is not available in census 1960. For that year we consider all people born outside the U.S. as foreign-born.

for systematic differences across groups and education by year fixed effects to account for education-specific shocks to labor demand in California. The basic specification 1 of Table 3 estimates the panel by weighted least squares, using the employment of the cells as weight, specification 2 performs simple least squares estimation while specification 3 omits the education by year effects and specification 4 uses only data from the two groups with lower education (high school graduates and high school dropouts). The elasticity of native employment to immigration (γ in equation 7) is consistently estimated around 0.10, not significantly different from 0 but usually significantly different from -0.1. This implies that the estimates rule out even a very modest (such as -0.10) out-migratory or out-of-employment reaction of natives to immigrants. Native workers' employment is unaffected by immigrants, or if anything, natives are moderately attracted to groups in which immigrants' inflow was higher. Such feature is robust across specifications, and in particular holds also for the least educated. In order to check whether omitted demand-shock-bias may be the cause of such estimates, specification 5 to 8 re-estimate regressions1 to 4 using migration data to the rest of the U.S. as an instrument. As argued in the introduction this variable is correlated with the supply determinants of immigration to California but not to the demand determinants as it only measures immigrants to other states. The first stage of the regression (reported in the lower portion of Table 3) reveals that the instrument has power but may not be very strong (F-test between 7.5 and 33) and the IV estimates of the elasticity γ are insignificantly different from their OLS counterparts, and not different from 0 at any standard significance level. Therefore, even isolating supply-driven shocks to immigration we do not detect any negative employment effects on native employment. The size of standard errors makes inference less precise with the IV estimates but in general even a modest negative effect (such as -0.30) can be ruled out at standard confidence levels. Notice, on the other hand, that the coefficient on the predicted employment change is always positive, close to one and very significant. This means that the local demographic tendencies (affecting supply) are very important to predict employment change in California. Table 4 and 5 reproduce the analysis and the specifications of Table 3, considering respectively population and employment rate as dependent variables. The fact that we do not find any significant effects of immigration on changes in native employment suggests that we should not find any significant effect on the individual components of this change: population change due to cross-state migration and changes in employment rates. In fact the elasticities of these two variables to immigration are also estimated to be insignificantly different from 0: around 0.14 (median estimate in Table 4) for native population and around 0.05 (median estimate in table 5) for native employment rates. The specification estimated in these Tables are identical to those in Table 3: the Basic Least Square specification in Column 1, the unweighted OLS in column 2, omitting education by year dummies in column 3 and including only the groups of high school graduates and dropouts in column 4. Again we are able most of the time to rule out modest negative effects in the order of -0.20 for the population change and in the order of -0.05 for the employment rate change. Native population change in a group seems

to be predicted particularly well by the local demographics (cohort size) as the coefficients on the predicted change in the second row of Table 4 are all close to one and very precisely estimated. Similarly the national employment rates are very good predictor of the California employment rates (second row of Table 5). Notice also that the reaction of the least educated native groups to immigrants is not any different from the reaction of the other groups, neither in its population nor in its employment rates and isolating the supply shocks using the IV method (specifications 4 and 8 in tables 4 and 5) produces somewhat more imprecise estimates but never significantly different from the OLS ones and never in the negative range.

The skill structure assumed in production, implying higher substitutability between workers with the same education and age allows us to use age by education groups to estimate the relative elasticity γ, controlling for education by year effects. Native workers, however, may be exposed to competition from other age groups in the same education attainment group, and such competition may also affect cross-state migration and employment of natives. Therefore we estimate specification (7) aggregating age groups in each education category to obtain the elasticity of native employment to the flow of immigrants in the same education group, γ_{EDU}. We control for the predicted change in employment of the group, and for education-specific trends and education fixed effects. Table 6 presents the estimates of four different specifications using, respectively, simple and weighted least squares (specifications 1 and 2) and simple and weighted 2SLS (specifications 3 and 4) with migration to other states as instrument. The drawback of this specifications is that, as we are aggregating over age groups, we only have 16 observations (education group by census) and hence we are not able to obtain precise estimates. Even in this case, however, employment of natives does not respond significantly to immigrant flows in the same education group. The estimates of γ_{EDU} are positive, between 0.08 and 0.15 with standard errors around 0.2 so that they are consistent with no response of natives. The large standard errors only allows to rule out negative effects of the order of -0.3 to -0.4. both for the least squares and IV estimations. We never find negative point estimates of γ_{EDU}, however, so it seems quite reasonable to assume 0 response (rather than a negative response) of native employment to immigration within the same schooling group.

Table 7, finally, estimates the reaction of native employment to immigration by age group. While the production function in section 3.1 suggests that age is"nested" into schooling as a worker's attribute, hence the correct groupings are those analyzed in Tables 3 to 6, one may think that workers of the same age even with different educational attainments, compete more directly with each other as they enter the labor market in the same period and may have parallel career paths[5]. Table 7 consider 5 age groups (17 to 66) over four census years 1960-2000, and the response of employment (column 1 and 3) and employment rates (column 2 and 4) of natives to immigrants, controlling for age group effects and age-group trends. The estimates in the first row, obtained via least squares (specifications 1 and 2) and 2SLS (specifications 3 and 4) show once more no

[5]A closer substitutability within age groups would stem from a different type of nesting in the CES production function with education groups nested within age groups.

significant effect and positive point estimates. This time the standard errors are quite large (up to 0.80) while the point estimates range between 0.08 and 0.70. While not very informative per se, due to the imprecision of the estimates, this further check, does not provide any reason to doubt the previous estimates. Table 7 confirms that there is very little or no reaction at all of employment of natives to immigration , either via cross-state migration or via change in employment rates, for workers in the same age group just as it was true for education by age and education groupings.

5 Substitutability between native and Foreign-born

Adding up the evidence from section 4 above we find an insignificant reaction of natives to immigration. This may either be due to large costs of moving or to small wage effects of immigrants on natives. Gross migration rates between U.S. states have always been very large. About one third of Americans moved between states in the decade 1990-2000. While there are certainly costs of moving it is hard to believe that native workers would not move in the face of large potential wage losses due to immigration. How can we calculate such wage effects of immigrants, then, in order to check wether their size is consistent with such a small migratory reaction? Following the frame described in section 3.1 we can use the production function and the parameters δ, η and σ, estimated from the national economy, to evaluate the effect of immigrants on wages of each skill group in California. We can also aggregate those changes across age groups to obtain the effects for each education group of native and foreign-born workers. As the native supply in each group H_{jkt} does not seem to be significantly affected by immigration we can literally use formulas (5) and (6) to obtain these effects . Previous estimates of δ and η at the national level are relatively standard and non-controversial, finding values of δ in the proximity of 2 (Katz and Murphy, 1992, Angrist 1995, Ciccone and Peri 2005, Borjas 2003) and values of η around 4 (Card and Lemieux 2001, Ottaviano and Peri 2006). Hence we use those values in this study without further due. The estimates of the parameter σ, however, are more controversial and crucial to evaluate the degree of substitutability between U.S.-and foreign-born workers with important implications for the effect of immigration on wages of natives. Ottaviano and Peri (2006) estimate this parameter to range between 5 and 10 (median value 6.6) using national data. Our specification and the previous results, however, allow us to re-estimate σ using Californian data. As native labor supply H_{kjt} does not respond systematically to immigration one can run the following regression, derived from the production function in section 3.1, assuming that wages equal the marginal productivity of workers:

$$\ln(w_{Hkjt}/w_{Fkjt}) = D_{kj} + D_{kt} + D_{jt} - \frac{1}{\sigma}\ln(H_{kjt}/F_{kjt}) + u_{kjt} \tag{9}$$

Equation (9) shows that the response of log relative weekly wages (U.S.- and foreign-born) to log relative

employment, once we account for education by age, education by time and age by time fixed effects identifies the inverse (with a negative sign) of the elasticity of substitution between U.S. and foreign-born workers in production. The advantage of estimating this regression with California data is that we can use the variable $\ln(H_{kjt}/F_{kjt})$ constructed for the rest of the nation as instrument for supply shocks in California. Such instrumental variable, correlated to the supply-side determinants of migration and not to the California-specific demand side, should improve on the simple fixed effect estimation in controlling for California skill-specific demand shocks that may enter the zero-mean error term u_{kjt}. Table 8 shows several estimates of $\frac{1}{\sigma}$ using data for 5 age by 4 education groups over the 1960, 1970, 1980, 1990, 2000 and 2004 years. Columns 1 and 2 present, respectively, the least squares weighted and unweighted estimates of $\frac{1}{\sigma}$(using employment of a cell as weight) and column 3 and 4 show the 2SLS weighted and unweighted estimates of $\frac{1}{\sigma}$. Moving between rows, on the other hand, we have specification 1 that includes all years, specification 2 excluding year 1960, as migration flows were very scant in the 60's, and specification 3 excluding year 2004, not a census year. Finally specification 4 includes only observations relative to the groups of workers with an high school degree or less. The estimates range between 0.1 and 0.33 with a median of 0.30 implying σ between 3 and 10, with a median value of 3.33. Such range of estimates includes the estimates obtained at the national level by Ottaviano and Peri (2006) that were mostly between 5 and 10. Most of the values of σ for California , however, cluster between 3 and 4 implying an even smaller substitutability between U.S. and foreign-born than estimated at the national level. Certainly, however, confirming the finding at the national level, all the estimates of $1/\sigma$ are significantly larger than 0 implying imperfect substitutability between U.S. and foreign-born.

6 Immigration and Wages, California 1990-2004

Equipped with the estimates of the parameters from the production function and of the elasticity of natives' supply to immigration we are able to calculate the impact of immigration (1990-2004) on wages of natives. Consistently with the insignificant estimates of section 4 we evaluate wage effects of immigrants assuming, first, zero response of native employment (section 6.1). Then, as most of the point estimates of γ and γ_{EDU} are in the range between 0 and 0.20 we also evaluate the wage effect when native employment responds with a (positive!) elasticity of 0.10 to immigration (consistent with most estimates of section 6.2) implying that some natives from out of state move in to enjoy the increased California wages, due to the presence of complementary skills brought by immigrants.

6.1 Effects of immigration with no response from native employment

Assuming no significant employment response of native population (through migration or change in employment rates) we can use the formulas (5) and (6) to evaluate the wage effects of immigrants on each age-education group. Table 9 shows the calculated percentage changes of real wages for U.S.- and foreign-born workers by education group and overall. The percentage change for each education group is calculated by averaging the wage change in the age-education sub-groups using wage shares as weights. Similarly, the percentage changes of real wages of U.S. and foreign-born workers are obtained by averaging the changes for each education group among U.S. or foreign-born, weighting each change by the wage share of that education group among U.S. or foreign-born. The first column of Table 9 reports the increase in foreign-born workers for each education group as a percentage of the total (U.S. and foreign-born) employment in that group as of 1990. As already shown in Figure 2, the group of high school dropouts received the largest immigration as percentage of initial employment (almost 30%) followed by college graduates, high school graduates and college dropouts. The second column (specification 1) reports the calculated real wage changes due to immigration using the median estimate of σ from the previous section 5 that equals 3.3. The other parameters' values are kept fixed in all calculations and are equal to the values usually adopted in the literature, namely $\alpha = 0.66$, $\delta = 2$, $\eta = 4$. As we move to the right (specifications 2, 3 and 4) we repeat those calculations using higher estimates of σ, corresponding to the range of values (between 5 and 10) estimated in section 5 on California data and consistent with the national estimates in Ottaviano and Peri (2006). All effects are long-run effects, i.e. accounting for full adjustment of physical capital. First of all let us notice that using the estimate $\sigma = 3.3$, the imperfect substitutability between foreign-born and natives is strong enough to imply that immigration has a *positive* effect on each single group of native workers (by education). On average natives gain 5% in their productivity as foreign-born provide skills and labor types, complementing, rather than substituting their own. Even the least educated native workers gain almost 2% and college dropouts gain up to 7.2% of their wages. Correspondingly, the increasing supply of immigrants harms the wage of previous immigrants by crowding similar jobs-occupations implying an average loss of their productivity around 20%. Using the value of $\sigma = 5$ which is consistent with the national, as well as the California estimates, one still obtains positive effects for wages of native workers of any schooling level. High school dropouts experience almost no wage change (+0.2%), college graduates and high school graduates experience an increase in real wages by around 3% and college dropouts by 6.7%. Native real wages are boosted by 4.1%, on average, by immigration. Even allowing the highest degree of substitutability between U.S. and foreign-born compatible with our estimates, namely $\sigma = 10$ reported in specification 4, immigrants turn out to benefit natives by 2.2% on average, with a distribution of this effect ranging from a positive wage effects equal to 5.7% for college dropouts to a negative effect equal to 3% for high school dropouts. Except for the group of college dropouts (that always gains significantly) no group experiences losses or gains from immigration larger

than 4% over the fourteen considered years of immigration (1990-2004) in any of our estimates. It seems very plausible, therefore, that moderate costs of moving would make it not worth for native people to react to these small changes. Moreover, local prices (housing in particular) may react in part to these local wage changes and absorb part of them (see the model in Ottaviano and Peri, 2005) , implying even smaller real wage changes. We find it very plausible that, as found in section 4 these very modest wage changes did not trigger any major out- (or in-) migration from (to) California. On the other hand the negative wage effects of new immigrants on other foreign-born (between -10 and -20%) may imply that some old immigrants moved out of California as a consequence of new immigration, contributing to the diffusion of immigrants (especially Latinos) across other U.S. states, a phenomenon that typically took place during the nineties (see for instance Card and Lewis, 2005). Recall, however, that part of the large negative effect on foreign-born wages is due to the nature of the experiment, in which we are keeping all variables constant as of 1990 except for immigration. The increased employment of natives between 1990 and 2004, and their complementarity to foreign-born, acted to reduce that negative effect.

6.2 Effects of immigration with positive response from native employment

In this section we make the following simple generalization from the results of section 4: the elasticity of employment of natives to immigration (for an education-experience group, as well as for an education group and overall) is equal to 0.10. This is consistent with our estimates of section 5. This implies that in each education-age group the inflow of 10 immigrants per 100 existing workers , induced the entry (either from out of state or out of employment) of one more native worker as well, so that the total increase in employment in the group was equal to 11 units. Such small induced change in natives' supply has an additional impact on wages of natives and foreign-born, however, given its small size, such effect is quite small. Appendix A shows the formulas to calculate the real wage change when accounting for immigration and the native's response. In particular, equation (10) shows how to calculate the wage change of home-born workers in education group k and age group j who were already in California, while equation (11) shows how to find the effect on wages of foreign born workers in group k, j who were already in California. Table 10 shows the results of those calculations. The first column reports the labor supply shocks due to immigration (last five rows) and the corresponding reaction of native employment as percentage of initial employment in the group (first five rows). Notice that in response to immigration equal to 20% of initial employment, native's employment only increases by 2%, and the highest percentage response was for high school dropouts at 2.9%. In specification 1 and 2 we use the plausible values of $\sigma = 3.3$ and $\sigma = 5$ to simulate the wage effect of immigration-cum-adjustment. Those values implied (see Table 9) that without employment adjustment all groups of native workers would gain. Hence it make sense that immigration is positive for each group, and accounting for immigration, the gains for each group of natives

are reduced, while the losses of foreign-born are also reduced. The amounts, however, are very small. Only the group of native high school dropouts, has a reduction of its wage gains into negligible wage losses, while the other groups experience decrease in wage gain of 0.2-0.3% only, relative to the case with no migratory response of natives. The overall gains of natives are slightly reduced, but we have to account for the fact that now the California economy employs 2% more native workers than it did before, so the smaller gains of the "insiders" are to be added to the job-creation effects, benefitting some "outsiders". Finally specification 3 uses $\sigma = 6.6$ as elasticity of substitution between U.S.- and foreign-born workers. From Table 9 we can see that under this parameter estimate the impact of immigration on native high school dropouts was a small loss (-1.3%). Our simple approach to migratory response in this case introduces the odd feature that also this group receives an increase in native workers, as result of immigration. The result is that its small wage loss is increased to -3% while the wage gains of all other groups of natives are, as above, marginally reduced, and the wage losses of foreign-born are also marginally reduced, relative to the case with zero response. All in all the small migratory response only affects somewhat the gains of native high school dropouts which are now turned into small losses even when foreign-born are complements. However, in this case, we should keep in mind that the inflow of foreign-born workers allows employment of native high school dropouts to grow an extra 2.9% in California by creating, once capital adjusts, complementary jobs.

7 Conclusions

If U.S. States were independent countries, California would be the second major receiving country for international migrants in the whole world (after Russia) with its 8.5 Million foreign born as of 2004. Moreover its proximity to Mexico and a porous border generated extremely large flows of uneducated Mexican workers (documented and undocumented), at growing rate, during the last three decades. With one third of its total labor force made up by immigrants, two thirds of its uneducated workers coming from abroad and a bludgeoning foreign-born population, that grew by 40% in the last 14 years, certainly native Californians (particularly the unskilled ones) must have suffered, to an extreme, the negative effects of this "immigration crisis"[6] on their employment opportunities and wages. The present study, that analyzes employment and wage data in California over the 1960-2004 period, seems to tell otherwise. On one hand immigrants do not seem to increase the tendency of natives with similar skills (education and experience) to migrate or their likelihood to loose jobs and drop out of employment. On the other hand the impact of immigration, in the 1960-2004 period has been negative on wages of previous immigrants and positive on wages of U.S. natives, revealing a good degree of complementarity between U.S. and foreign-born workers that contributes to benefit (rather then to harm)

[6]The expression is paraphrased from an interview with Lou Dobbs of CNN, aired on National Public Radio on May, 1st 2006, entitled "Lou Dobbs and the American Immigration Crisis".

native workers' productivity. Our median estimates reveal that these complementarities of immigrants spurred wage growth of natives, once physical capital adjusted, by about 4% in fourteen years. These average wage gains for natives were distributed as small wage changes (0.2 to 0.7%) for high school dropouts and significant wage gains up to 6.7% for workers with at least an high school degree.

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8 Appendix A: The effect of immigration on Wages, accounting for Native Employment reaction

We call $\left(\frac{\Delta H_{kjt}}{H_{kjt}}\right)_{response}$ the percentage change of native employment for workers of education k and age j in period t in response to total immigration during period t.The simple assumption adopted in section 6.2, namely that the elasticity of native employment to immigrants is equal to γ across age, experience groups as well as overall allow us to calculate $\left(\frac{\Delta H_{kjt}}{H_{kjt}}\right)_{response}$ as $\gamma\left(\frac{\Delta F_{kjt}}{F_{kjt}}\right)\left(\frac{F_{kjt}}{H_{kjt}}\right)$. We can then account for such supply shift when evaluating the wage impact of immigration. It is easy to show that, in this case, the long-run effect of immigration on wages of natives and foreign-born would be given by the following two expressions:

$$\begin{aligned}\left(\frac{\Delta w_{Hkjt}}{w_{Hkjt}}\right)^{Total} &= \frac{1}{\delta}\sum_m\sum_i\left(s_{Fmit}\frac{\Delta F_{mit}}{F_{mit}}+s_{Hmit}\left(\frac{\Delta H_{mit}}{H_{mit}}\right)_{response}\right)+ \\ &\left(\frac{1}{\eta}-\frac{1}{\delta}\right)\left(\frac{1}{s_{kt}}\right)\sum_i\left(s_{Fkit}\frac{\Delta F_{kit}}{F_{kit}}+s_{Hkit}\left(\frac{\Delta H_{kit}}{H_{kit}}\right)_{reponse}\right)+ \\ &+\left(\frac{1}{\sigma}-\frac{1}{\eta}\right)\left(\frac{1}{s_{kjt}}\right)\left(s_{Fkjt}\frac{\Delta F_{kjt}}{F_{kjt}}+s_{Hkjt}\left(\frac{\Delta H_{kjt}}{H_{kjt}}\right)_{response}\right) \\ &-\frac{1}{\sigma}\left(\frac{\Delta H_{kjt}}{H_{kjt}}\right)_{response}\end{aligned} \tag{10}$$

$$\begin{aligned}\left(\frac{\Delta w_{Fkjt}}{w_{Fkjt}}\right)^{Total} &= \frac{1}{\delta}\sum_m\sum_i\left(s_{Fmit}\frac{\Delta F_{mit}}{F_{mit}}+s_{Hmit}\left(\frac{\Delta H_{mit}}{H_{mit}}\right)_{response}\right)+ \\ &+\left(\frac{1}{\eta}-\frac{1}{\delta}\right)\left(\frac{1}{s_{kt}}\right)\sum_i\left(s_{Fkit}\frac{\Delta F_{kit}}{F_{kit}}+s_{Hkit}\left(\frac{\Delta H_{kit}}{H_{kit}}\right)_{reponse}\right) \\ &+\left(\frac{1}{\sigma}-\frac{1}{\eta}\right)\left(\frac{1}{s_{kjt}}\right)\left(s_{Fkjt}\frac{\Delta F_{kjt}}{F_{kjt}}+s_{Hkjt}\left(\frac{\Delta H_{kjt}}{H_{kjt}}\right)_{response}\right) \\ &-\frac{1}{\sigma}\frac{\Delta F_{kjt}}{F_{kjt}}\end{aligned} \tag{11}$$

The terms containing $\frac{\Delta F_{kjt}}{F_{kjt}}$ are identical to those in the formulas with no migratory reaction appearing as (11) and (10) in the main text. The terms containing the terms $\left(\frac{\Delta H_{kit}}{H_{kit}}\right)_{reponse}$ account for the wage shift due to the change in native supply of labor as response to immigration. One can see that the only difference between the two effects is due to the last term, as the change in supply of natives in the same education-age group has an incremental negative effect on wages of natives and the supply of foreign-born (in the same group) has the incremental negative effect on foreign-born.

Table 1:
Percentage of foreign Born in Employment and Population 1960-2004

Years of Schooling:	1960 Census	1970 Census	1980 Census	1990 Census	2000 Census	2004 American Community Survey
Total Employment, California	9.4%	10.0%	16.06%	24.59%	31.98%	33.17%
Total Employment, U.S.A.	5.9%	5.1%	6.4%	8.9%	13.0%	14.4%
Total Population, California	8.6%	8.7%	15.6%	24.6%	29.9%	29.9%
Total Population, U.S.A.	5.2%	4.3%	6.0%	8.7%	12.5%	13.4%

Note: Author's calculation using Census 1960-2000 and ACS 2004 IPUMS data. Employment is calculated as the sum of individuals aged between 17 and 66, not residing in group quarters who worked at least one week during the previous years. Population is calculated as the sum of all individuals aged 7 to 66 not residing in group quarters.

Table 2:
Percentage of foreign Born Workers by Schooling, California 1960-2004

Years of Schooling:	1960 Census	1970 Census	1980 Census	1990 Census	2000 Census	2004 American Community Survey
0 to 11 years	13.0%	15.7%	33.68%	52.17%	63.44%	66.78%
12 years (High School Grads)	6.4%	7.4%	11.31%	19.11%	27.55%	31.19%
13 to 15 years	7.4%	7.8%	11.02%	15.37%	20.59%	20.73%
16 years (College Graduates)	7.7%	8.3%	13.87%	18.70%	24.87%	27.85%
Master, 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 California	9.4%	10.0%	16.06%	24.59%	31.98%	33.17%

Note: Author's calculation using Census 1960-2000 and ACS 2004 IPUMS data. Workers included are individuals aged 17-66, not residing in group quarters who worked at least one week during the previous years.

Table 3:
Response of Native Employment to Immigration:
By education-age groups, California 1960-2004

Method of Estimation	**Least Squares**				**2 Stage Least Squares**			
Specification	**1 Basic Least Squares**	**2 Not weighted Least Squares**	**3 No Fixed Effects Least Squares**	**4 HS or less, Least Squares**	**5 Basic IV**	**6 not weighted IV**	**7 No fixed effects IV**	**8 HS or less IV**
Immigration flow $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$, workers	0.13 (0.09)	0.16 (0.11)	0.07 (0.06)	0.09 (0.10)	0.26 (0.25)	0.28 (0.28)	0.18 (0.18)	0.05 (0.15)
Predicted Employment Change	0.85** (0.03)	0.85** (0.03)	0.98** (0.02)	0.80** (0.05)	0.83** (0.03)	0.84** (0.03)	0.98** (0.03)	0.81** (0.05)
Education by Age Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education by year effects	Yes	Yes	No	Yes	Yes	Yes	No	No
R^2	0.94	0.96	0.89	0.95	0.95	0.95	0.88	0.94
First Stage								
Immigration flow to other US states	n.a.	n.a.	n.a.	n.a.	2.38** (0.59)	2.11** (0.38)	1.7** (0.57)	2.5** (0.9)
F-test of exclusion	n.a.	n.a.	n.a.	n.a.	16.4	33.6	9.24	7.52
Observations	80	80	80	40	80	80	80	40

Notes: The Dependent variable is the change in employment of U.S.-born workers as percentage of the initial total employment in the group: $\Delta H_{kjt}/(F_{kjt}+H_{kjt})$. Groups are 4 Education by 5 age groups (17 to 66 by ten years of age) over 4 inter-census periods (four decades between 1960 and 2000). Employment is measured as total number of individuals who worked for at least one week in the previous year. Foreign-born are those individuals who were born outside the United States and not U.S. citizen at birth. Standard errors are clustered by education-age group. Specifications 1 to 4 use OLS as method of estimation, weighting each observation by the total employment in the cell (except for the not weighted specification 2). Specifications 5 to 8 use 2SLS as method of estimation with $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ relative to the rest of the US as instrument for $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ relative to California. The variable "Predicted Employment" is the total employment constructed for each age-education group using the demographics in California (i.e. the size of each cohort measured a decade earlier), accounting for national rates of mortality and national rates of employment.

Table 4:
Response of Native Population to Immigration:
By education- age groups, California 1960-2004

Method of Estimation	**Least Squares**				**2 Stage Least Squares**			
Specification	**1 Basic Least Squares**	**2 Not weighted Least Squares**	**3 No Fixed Effects Least Squares**	**4 HS or less, Least Squares**	**5 Basic IV**	**6 not weighted IV**	**7 No fixed effects IV**	**8 HS or less IV**
Immigration flow $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$, population	0.13 (0.09)	0.14 (0.11)	0.01 (0.04)	0.08 (0.06)	0.29 (0.24)	0.27 (0.28)	0.15 (0.15)	0.05 (0.13)
Predicted Population Change	0.90** (0.04)	0.90** (0.04)	1.02** (0.03)	0.81** (0.07)	0.87** (0.04)	0.88** (0.04)	1.03** (0.04)	0.83** (0.07)
Education by Age Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education by year effects	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
R^2	0.95	0.94	0.88	0.93	0.94	0.95	0.87	0.93
Observations	80	80	80	40	80	80	80	40

Notes: The Dependent variable is the change in population of U.S.-born workers as percentage of the initial total population in the group: $\Delta H_{kjt}/(F_{kjt}+H_{kjt})$. Groups are 4 Education by 5 age groups (17 to 66 by ten years of age) over 4 inter-census periods (four decades between 1960 and 2000). Foreign-born are those individuals who were born outside the United States and not U.S. citizen at birth. Standard errors are clustered by education-age group. Specifications 1 to 4 use OLS as method of estimation, weighting each observation by the total employment in the cell (except for the not weighted specification 2). Specifications 5 to 8 use 2SLS as method of estimation with $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ relative to immigration in the rest of the US as instrument for $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ to California. The variable "Predicted population" is the total population constructed for each age-education group using the demographics in California (i.e. the size of each cohort measured a decade earlier), accounting for national rates of mortality.

Table 5:
Response of Native Employment Rates to Immigration:
By Education-age groups, California 1960-2004

Method of Estimation	**Least Squares**				**2 Stage Least Squares**			
Specification	**1 Basic Least Squares**	**2 Not weighted Least Squares**	**3 No Fixed Effects Least Squares**	**4 HS or less, Least Squares**	**5 Basic IV**	**6 not weighted IV**	**7 No fixed Effects IV**	**8 HS or less IV**
Immigration flow $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$, population	0.05 (0.05)	0.02 (0.05)	0.05 (0.03)	0.08 (0.06)	0.02 (0.05)	0.01 (0.05)	0.06* (0.03)	0.08 (0.05)
National Employment Rate Change	0.88** (0.06)	0.91** (0.06)	0.88** (0.07)	0.91** (0.10)	0.87** (0.08)	0.91** (0.07)	0.89** (0.08)	0.92** (0.10)
Education by Age Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education by year effects	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
R^2	0.88	0.88	0.78	0.88	0.88	0.88	0.78	0.87
Observations	80	80	80	40	80	80	80	40

Notes: The Dependent variable is the change of employment rates of U.S.-born workers during each inter-census period. Employment rates are defined as number of individuals working divided by total population in each age-education group. Groups are 4 Education by 5 age groups (17 to 66 by ten years of age) over 4 inter-census periods (four decades between 1960 and 2000). Foreign-born are those individuals who were born outside the United States and not U.S. citizen at birth. Standard errors are clustered by education-age group. Specifications 1 to 4 use OLS as method of estimation, weighting each observation by the total employment in the cell (except for the not weighted specification 2). Specifications 5 to 8 use 2SLS as method of estimation with $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ relative to immigration in the rest of the US as instrument for $\Delta F_{kjt}/(F_{kjt}+H_{kjt})$ to California. The variable "National Employment Rates" is the employment rate for the group in the U.S, it captures the employment tendencies at the national level.

Table 6:
Response of Native Employment to Immigration:
By Education groups, California 1960-2004

Method of Estimation	**Least Squares**		**2 Stage Least Squares**	
Specification	**1 Employment**	**2 Employment rate**	**3 Employment**	**4 Employment rate**
Immigration flow $\Delta F_{kt}/(F_{kt}+H_{kt})$, population	0.17 (0.19)	0.15 (0.19)	0.08 (0.24)	0.15 (0.22)
Predicted Employment (Employment rate) change	0.86** (0.19)	0.77** (0.28)	1.22** (0.19)	1.23** (0.34)
Age-specific time trend	Yes	Yes	Yes	Yes
Age-specific fixed effect	Yes	Yes	Yes	Yes
R^2	0.97	0.88	0.98	0.99
Observations	16	16	16	16

Note: The Dependent variable is the change in employment of U.S.-born workers as percentage of the initial total employment in the education group: $\Delta H_{kt}/(F_{kt}+H_{kt})$. Groups are 4 education groups (High School Dropouts, High School Graduates, College dropouts and College Graduates) over 4 inter-census periods (four decades between 1960 and 2000). We only include individuals 27 to 66 years old who are likely to have completed their studies. Standard errors are clustered by education group. The variable "Predicted Employment" is the total employment constructed for each education group using the demographics in California (i.e. the size of each cohort measured a decade earlier), accounting for national rates of mortality and national rates of employment. The IV strategy used in specification 3 and 4 uses migration to the rest of the U.S. by age group as instrument for California immigration.

Table 7:
Response of Native Employment to Immigration:
By Age groups, California 1960-2004

Method of Estimation	**Least Squares**		**2 Stage Least Squares**	
Dependent Variable:	**1 Employment**	**2 Employment rate**	**3 Employment**	**4 Employment rate**
Immigration flow $\Delta F_{jt}/(F_{jt}+H_{jt})$, population	0.08 (0.77)	0.14 (0.14)	0.70 (0.80)	0.18 (0.20)
Predicted Employment (Employment rate) change	0.82** (0.16)	0.85** (0.14)	0.91** (0.15)	0.76** (0.14)
Age-specific time trend	Yes	Yes	Yes	Yes
Age-specific fixed effect	Yes	Yes	Yes	Yes
R^2	0.84	0.82	0.90	0.45
Observations	20	20	20	20

Note: The Dependent variable in specification 1 and 3 is the change in employment of U.S.-born workers as percentage of the initial total employment in the age group: $\Delta H_{jt}/(F_{jt}+H_{jt})$. The dependent variable in specification 2 and 4 is the change in employment rate. Groups are 5 age groups (17 to 66 by ten years of age) over 4 inter-census periods (four decades between 1960 and 2000). Standard errors are clustered by age group. The variable "Predicted Employment" is the total employment constructed for each age group using the demographics in California (i.e. the size of each cohort measured a decade earlier), accounting for national rates of mortality and national rates of employment. The IV strategy used in specification 3 and 4 uses migration to the rest of the U.S. by age group as instrument for California immigration.

Table 8:
Estimates of Relative wage elasticity of U.S.- and Foreign-born workers, California, 1960-2004

Estimates of $1/\sigma$	Ordinary Least Squares		2 Stage Least Squares	
	Weighted	**Non Weighted**	**Weighted**	**Non Weighted**
1: Basic	0.33**	0.28**	0.33**	0.24**
	(0.10)	(0.10)	(0.12)	(0.12)
2: Omitting year 1960	0.33**	0.31**	0.33**	0.31**
	(0.09)	(0.09)	(0.11)	(0.11)
3: Omitting year 2004	0.14**	0.13**	0.10**	0.10**
	(0.04)	(0.03)	(0.04)	(0.04)
4: High School or less	0.28**	0.26**	0.38**	0.36**
	(0.07)	(0.08)	(0.08)	(0.09)

Note: Each cell corresponds to the estimate of the coefficient $1/\sigma$ from a separate regression as (9) in the main text. The dependent variable in each regression is the relative log weekly wage between U.S.-born and foreign-born workers in the group. The explanatory variable is the relative employment of U.S. and foreign-born workers in the group. The regressions control for age by education, age by year and education by year fixed effects. Groups are 5 age groups by 4 education groups over 5 census years (1960-2000) plus 2004. The method of estimation for the first and second column is Least squares. For the third and fourth column we use two stage least square using the supply of immigrants relative to natives in the rest of the country as instrument for their supply in California. The instrument has an F-test equal to 92 in the first stage of the IV regression. In the specifications of column 1 and 3 we weight each cell by total employment in it.

Table 9:
Calculated Percentage Changes in Real Wages of California due to Immigrants Inflows:
Long-run effects, 1990-2004.

Estimates of σ	**Immigration as percentage of 1990 Employment**	**1 Median estimate for California σ=3.3**	**2 Low National estimate σ=5**	**3 Median National estimate σ=6.6**	**4 Upper bound National and California σ =10**
		% Real Wage Change of US-Born Workers due to immigration			
HS dropouts US-born	--	+1.8%	+0.2%	-1.3%	-3.0%
HS graduates, US-born	--	+3.9%	+2.9%	+1.8%	+0.6%
CO dropouts, US-born	--	+7.2%	+6.7%	+6.2%	+5.7%
CO graduates, US-born	--	+4.0%	+3.0%	+1.9%	+0.7%
Average, US-born	**--**	**+5.0%**	**+4.1%**	**+3.2**	**+2.2%**
		% Real Wage Change of Foreign- Born Workers due to immigration			
HS dropouts Foreign-born	29.5%	-13.1%	-12.1%	-10.5%	-8.9%
HS graduates, Foreign-born	24.2%	-31.1%	-25.2%	-19.5%	-13.4%
CO dropouts, Foreign-born	10.5%	-10.7%	-7.1%	-4.6%	-1.1%
CO graduates, Foreign-born	26.0%	-29.4%	-24.2%	-18.1%	-12.3%
Average Foreign-born	**20.1%**	**-20.3%**	**-16.8%**	**-13.1%**	**-9.1%**
Overall Average: Native and US Born	**--**	**0%**	**0%**	**0%**	**0%**

Note: Values of the other parameters used in the calculations: δ=2, η=4, α=0.66. The percentage change for the wage of each worker in group k, j is calculated using the formula (5) for US born and (6) for foreign-born from the main text. 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 US and Foreign-born are obtained averaging the wage change of each education group weighted by its share in wage. The overall average wage change adds the change of US and foreign-born weighted for the relative wage shares in 1990. In the long run, as the capital labor ratio does not change, the last row is always 0.

Table 10:
Calculated Percentage Changes in Real Wages in California due to Immigrants Inflows 1990-2004:
Long-run effects accounting for native employment response.

Estimates of σ	**Immigration and Native response as % of initial employment**	**1 Median estimate for California σ=3.3**	**2 Low National estimate σ=5**	**3 Median National estimate σ=6.6**
		% Real Wage Change of US-Born Workers due to immigration,		
HS dropouts US-born	2.9%	-0.3%	-0.7%	-2.0%
HS graduates, US-born	2.4%	3.7%	+2.6%	+1.5%
CO dropouts, US-born	1.0%	7.1%	+7.2%	+6.4%
CO graduates, US-born	2.6%	+3.8%	+2.7%	+1.6%
Average, US-born	**2.0%**	**4.9%**	**+4.0%**	**+3.1**
		% Real Wage Change of US-Born Workers due to immigration,		
HS dropouts Foreign-born	29.5%	-12.1%	-11.1%	-9.8%
HS graduates, Foreign-born	24.2%	-30.1%	-24.6%	-19.3%
CO dropouts, Foreign-born	10.5%	-9.1%	-6.8%	-3.9%
CO graduates, Foreign-born	26.0%	-29.2%	-23.5%	-18.2%
Average Foreign-born	**20.1%**	**-20.0%**	**-16.1%**	**-12.8%**
Overall Average: Native and US Born	**--**	**0%**	**0%**	**0%**

Note: The values of the other parameters used in the calculations are: δ=2, η=4, α=0.66. The percentage change for the wage of each worker in group k, j is calculated using the formula (10) for US born and (11) for foreign-born from the Appendix A. 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 US and Foreign-born are obtained averaging the wage change of each education group weighted by its share in wage. The overall average wage change adds the change of US and foreign-born weighted for the relative wage shares in 1990. In the long run, as the capital labor ratio does not change, the last row is always 0.

Figure 1:
Percentage of foreign-born workers by education group, 2004

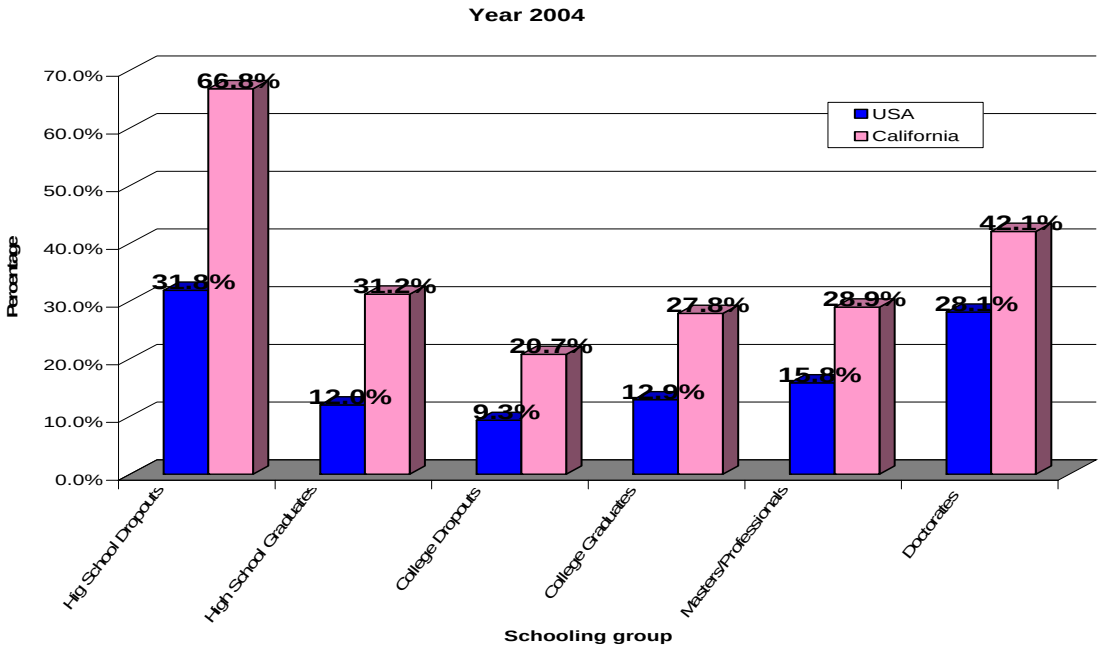

Figure 2:
Immigration flows by education group, 1990-2004

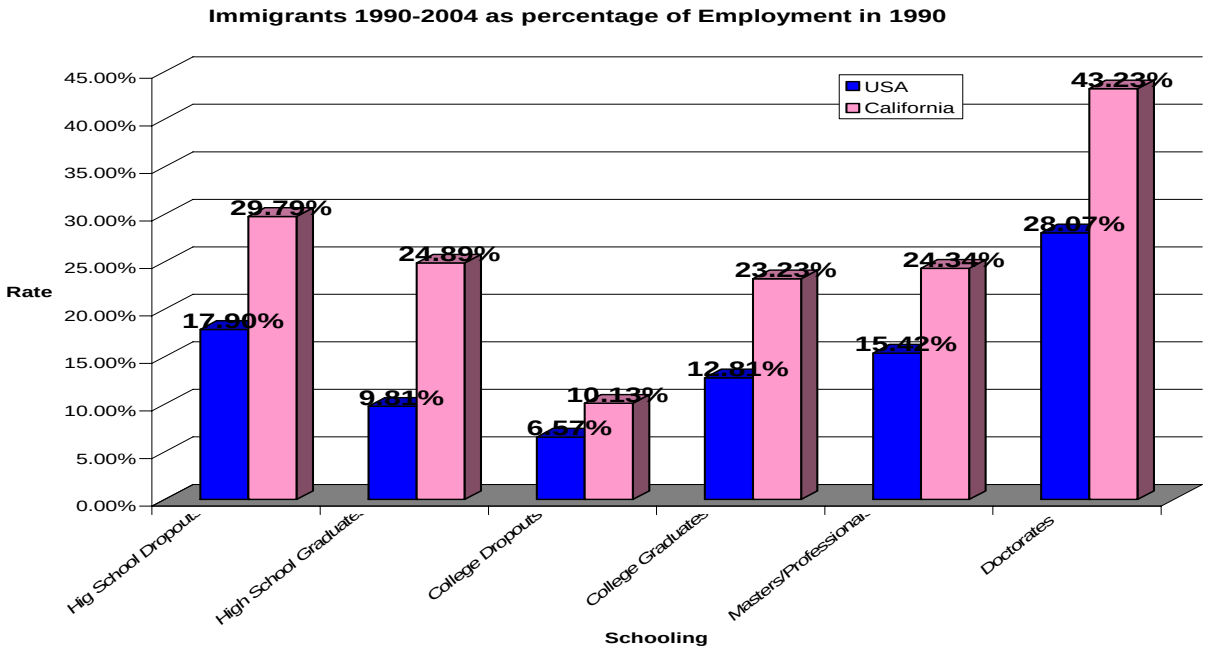

Figure 3:
Change in Real Wage of U.S. natives, by Education group 1990-2004.