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Can California Import Enough College Graduates to Meet Workforce Needs?

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Summary

California's labor market has changed dramatically over the past two decades because of rising demand for highly educated workers. Although economic projections for California indicate a continuation of this trend, projections of educational attainment for the future population strongly suggest a mismatch between the level of skills the population is likely to possess and the level of skills that will be needed to meet economic projections. PPIC's report, *California 2025: Taking on the Future*, highlighted this mismatch and in this issue of *California Counts*, we assess whether the state will be able to attract enough college graduates from other states and other countries to meet the projected economic demand.

Our analysis shows that the state can do so only if it attracts college graduates in unprecedented numbers. But judging by recent trends, it seems unlikely that a substantial number of college graduates will migrate to California. Estimates for the 1990s and the early 2000s suggest that, on net, California attracted relatively few college-educated migrants from other states, and most recently, the state has seen more college-educated residents leaving for other states than arriving. One reason for this is California's high cost of housing, which has made the state less accessible to residents of other states. Moreover, the baby boomers, who historically provided California with a large supply of college graduates from other parts of the country, are beyond the young adult ages when interstate migration is most common.

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To bridge the gap between supply and demand through migration, those with high skills would need to come from other countries. Hence, meeting the demand would require an intensification of current trends: Between 2000 and 2005, for the first time, immigrants to California with a college degree exceeded the number of immigrants who were not high school graduates. Large increases in the number of college graduates in other countries indicate that this trend could continue to intensify but the number of highly educated immigrants to California would still need to more than double to meet projected needs. U.S. immigration law would need to change fairly dramatically, and it seems unlikely that this will happen in the near future. Moreover, increasing global demand for highly skilled labor, including increasing demand in origin countries, makes it even less likely that California could successfully and sufficiently compete for large numbers of highly skilled labor from other countries.

We conclude that it is extremely unlikely that the projected need for highly skilled workers will be met mainly through the increased migration of college-educated workers. However, increases in college participation and graduation among California's residents could help meet these future demands. Such increases will be at least partly induced by the wage growth that will occur as highly skilled labor becomes relatively scarce. Public policy in California, a state where the vast majority of college students are in public institutions, has an important role to play in accommodating and even encouraging such increases.

Introduction

PPIC's report, *California 2025*, highlighted the potential mismatch between the skill levels that will be needed in California's increasingly highly skilled economy and the skill levels the future population is likely to possess (Hanak and Baldassare, 2005; Johnson, 2005; Neumark 2005a).[1] Only 33 percent of the state's working-age adults were projected to have a college degree in 2020, but 39 percent of jobs in the state's economy were projected to need a college graduate worker. That analysis assumed that past trends in population change would continue into the future. In particular, past trends in patterns of college graduates moving into and out of the state were used to gauge future patterns. In this issue of *California Counts*, we assess whether the state might be able to attract even more college graduates from other states and other countries to meet the projected economic demand.

We begin with a discussion of the context: California's relatively highly skilled economy and the role that domestic and international migration has played in fueling economic growth. We then examine the projected skills gap in the absence of the migration of college-educated workers to gauge how many such workers the state would need to attract by 2025. In the final sections, we consider the likelihood of bridging the skills gap through migration.

We focus on the skills gap in college graduate workers—an important focus of the *California 2025* study. However, we do not intend to imply that a policy focus on college graduates is the only way, or even the most important way, for California to prepare the future workforce. Certainly, other forms of workforce training, including vocational education, are important to consider in addressing the skills gap. Throughout the report, when we refer to skill needs or requirements, we mean the worker education levels that would be needed to meet economic projections. In 2025, as in any year, worker supply will equal worker demand in the sense that the education of Californians who work will be the same as the education of workers in California jobs. If the education levels of the population do not increase substantially more than projected in the *California 2025* study, then the California economy will be less highly skilled than projected.

Context

California's economy has long been characterized as relatively skilled, one that demands large numbers of college graduates. Moreover, California's economy has become more highly skilled over time, as has the economy in

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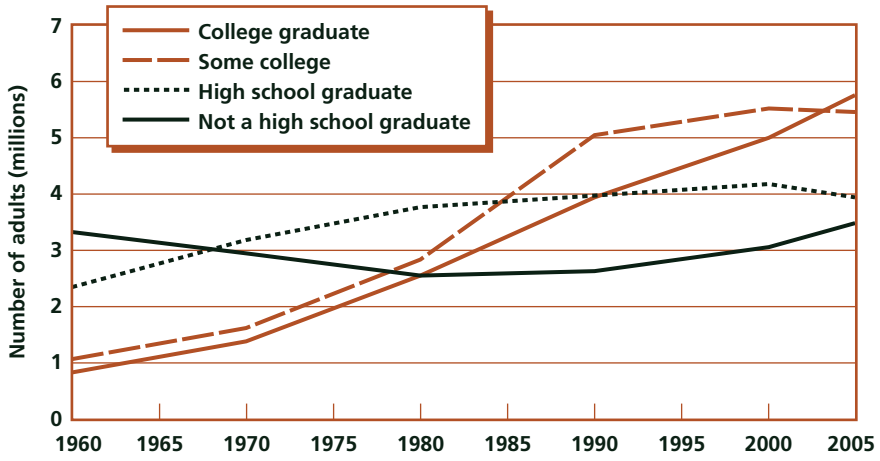
Immigration has long been an important source of college graduates in California.

Figure 1. California Adults, by Educational Attainment, 1960–2005



Sources: Authors' calculations using decennial Census data and the 2005 American Community Survey.
Note: Based on adults ages 25 to 64.

the rest of the nation. Growth in the number of college graduates in California has outpaced overall population growth for decades.[2] In 1960, when the state's Master Plan for Higher Education was developed, only 10 percent of adults were college graduates; by 2005, 31 percent were. Between 1960 and 2005, the number of working-age adults with at least a bachelor's degree increased more than sixfold, whereas the overall working-age population almost doubled.[3] By 2005, for the first time in the state's history, college graduates outnumbered any other education group (Figure 1). The state tends to be relatively well-educated compared to the rest of the nation; California ranks 12th among the 50 states in terms of the percentage of adults ages 25 and older who are college graduates (Figure 2).

Immigration has long been an important source of college graduates in California. A large majority of California's college graduates were born outside the state, a pattern that has persisted for many decades (Figure 3)—although within this group, the share born in other states has declined sharply and the share born in other countries has increased dramatically. Since 1980, these two trends have mostly offset each other.

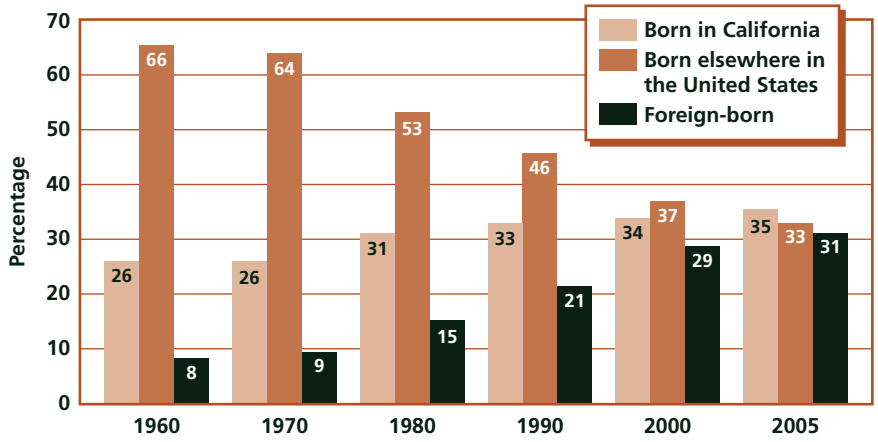
Recent Trends in the Domestic Migration of College Graduates

There is some dispute about the overall level of domestic migration into and out of California in this decade. The U.S. Census Bureau estimates that from 2000 to 2005, the state lost 644,000 people to other states and the California Department of Finance (DOF) estimates that the state gained 173,000 people via domestic migration during that period. Those two widely divergent estimates in turn imply very different recent levels of net flows of college-educated adults. The state estimate implies that California continues to gain college graduates from the rest of the United States, albeit fewer than in the past, whereas the federal estimates imply losses of college graduates.[4] Annual estimates of net domestic migration from four sources (Figure 4) show that the discrepancy persists across years and is consistently in the same direction. American Community Survey (ACS) figures are closer to

Figure 2. Percentage of College Graduates Among Adults Ages 25 and over, by State, 2005

Source: Authors' calculations using the 2005 American Community Survey.

Figure 3. Distribution of California College Graduates, by Place of Birth

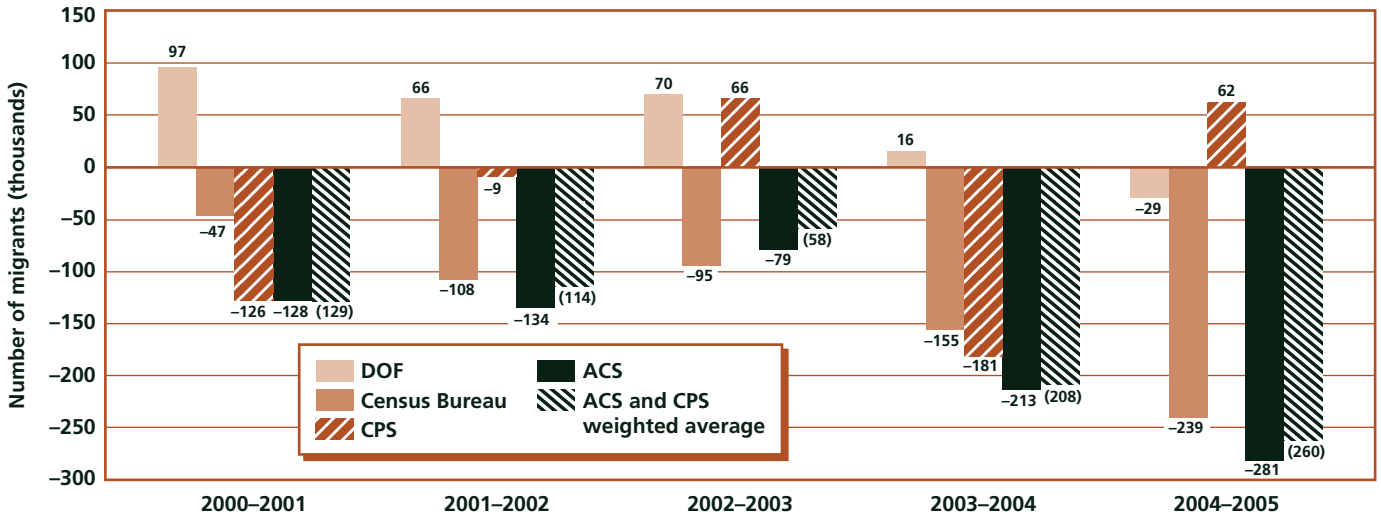


Sources: Authors' calculations using decennial Census data and the 2005 American Community Survey.
Note: Based on adults ages 25 to 64.

those of the Census Bureau, and estimates from the much smaller federal Current Population Survey (CPS) are more volatile.[5] The latest estimates from the state Department of Finance show net domestic migration losses continuing to 2005–2006 (not shown in Figure 4), so there is agreement that the state is now losing domestic migrants to other states, although the magnitude of that loss remains in dispute.

It is clear that since the 1970s, there has been a sharp decline in the share of California's college graduates who were born in other states. This is attributable to the overall decline in migration from other states across all education

Figure 4. Estimates of Annual Net Domestic Migration



Sources: Authors' calculations using Current Population Survey (CPS) and American Community Survey (ACS) data; California Department of Finance (DOF) E-6 report; and U.S. Census Bureau "Annual Estimates of the Components of Population Change," tables for the nation and the states.

groups. This domestic migration, once the leading source of population growth in California before the 1990s, now contributes little if anything to it. From at least the 1940s through the 1970s, migration from other states was a far more important source of growth than international migration, but now the reverse is true.

Although net domestic migration overall has declined, sizable numbers of people still flow into and out of California. For example, data from the 2005 American Community Survey suggest that in 2004 and 2005, almost 500,000 people moved into California from other states but more than 700,000 moved out. The educational attainment distributions of these two flows are quite different, and so domestic migration still has an important effect on the share of college-educated Californians.

Those arriving from other states tend to be better educated, with a large share having graduated from college (Table 1). Between 2000 and 2005, almost half of this group of immigrants from other states had completed college. Those leaving California for other states tend to be less educated, with almost a third having no more than a high school diploma during the same time period. However, the relative sizes of the two groups are very different: Many more people are leaving the state than are moving here (according to the ACS data). Domestic migrants to California are relatively few, so that in the early part of this decade, the state experienced no net increases in the number of college graduates moving to and from other states. Indeed, ACS data show that California lost some college graduates to other states, in addition to the hundreds of thousands of less-educated residents who also left. This outflow—of less-educated adults—leads to a higher percentage of college graduates among the population remaining here. In this decade, domestic migration has increased the percentage of Californians with a college degree primarily because less-educated residents are leaving. In contrast, in previous decades the state gained college graduates while losing less-educated adults (Table 2, bottom panel). Of course, if these estimates overstate outflows from the state, as suggested by California Department of Finance data, then domestic migration of college graduates to California is actually somewhat higher. Still, it is not dramatically so, and the general pattern of greater losses of less-educated residents is undoubtedly true.

In this decade, domestic migration has increased the percentage of Californians with a college degree primarily because less-educated residents are leaving.

It is also clear that the share of college graduates among migrants arriving from other states has increased across time. In 1960, only 10 percent of California residents ages 25 to 64 who were born in another state were college graduates; by 2005, 43 percent

Table 1. Educational Attainment of Domestic Migrants Moving into and out of California, 2000–2005

	Domestic In, %	Domestic Out, %
Not a high school graduate	9.0	11.1
High school graduate	15.1	20.5
Some college	27.6	30.2
Bachelor's degree	28.4	25.0
Graduate degree	20.0	13.2

Source: Authors' calculations using the 2001–2005 American Community Surveys.
Notes: Respondents were asked where they lived one year before the survey. Based on adults ages 25–64.

Table 2. Domestic Migration Flows of Adults, by Educational Attainment

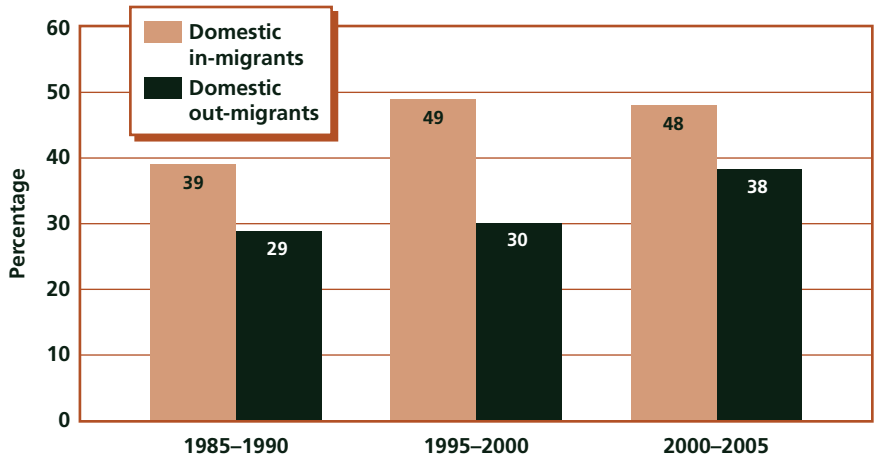
	Not a High School Graduate	High School Graduate	Some College	College Graduate	Total
Domestic In-Migrants					
1985–1990	120,000	220,000	377,000	461,000	1,178,000
1995–2000	79,000	139,000	276,000	475,000	969,000
2000–2005	118,000	194,000	350,000	612,000	1,274,000
Domestic Out-Migrants					
1985–1990	141,000	249,000	380,000	315,000	1,085,000
1995–2000	240,000	274,000	449,000	418,000	1,381,000
2000–2005	191,000	353,000	519,000	658,000	1,721,000
Net Domestic Migration Flow					
1985–1990	(21,000)	(29,000)	(3,000)	146,000	93,000
1995–2000	(161,000)	(135,000)	(173,000)	57,000	(412,000)
2000–2005	(73,000)	(159,000)	(169,000)	(46,000)	(447,000)

Sources: Authors' calculations using the 1990 and 2000 decennial Censuses and the 2001–2005 American Community Surveys.
Notes: Respondents were asked where they lived five years before the survey in the decennial Census. For 2000–2005, respondents were asked where they lived one year before the survey and we cumulated responses across five years. Based on adults ages 25–64.

were (see Figure 5). This increase was more pronounced than the overall increase in the share of college graduates in the state or nation; that is, the group coming to California from other states has become even more strongly skewed toward those with high levels of education.

All of this means that the net domestic flow of college graduates from other states has been quite small over the past 10 years—even turning negative in this decade for those ages 25 to 64 (but remaining positive if 20- to 24-year-olds are included). The state appears to be losing hundreds of thousands

Figure 5. Percentage of Domestic Migrants with a College Degree



Sources: Authors' calculations using decennial Census data and the 2005 American Community Survey.
Note: Based on adults ages 25 to 64.

of less-educated adults to other places in the country. From 1995 to 2005, the state lost more than *one million* adults ages 20 to 64 who did not have a college degree, whereas it gained just under 100,000 college graduates from other states.[6]

Recent Trends in International Migration

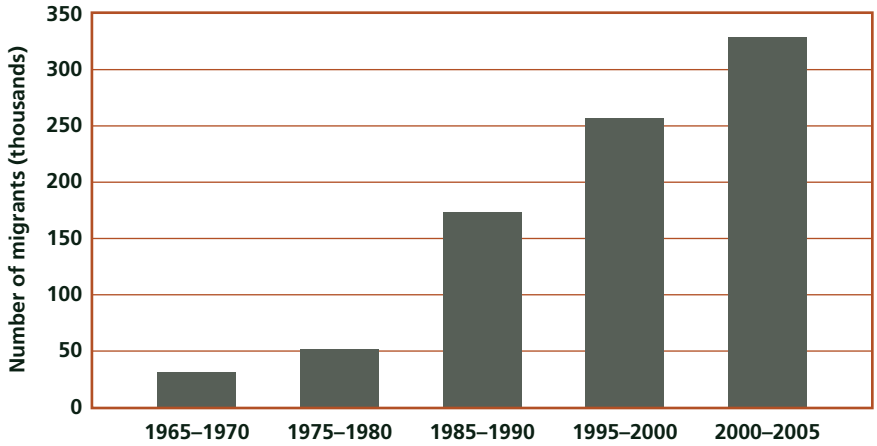
For many decades, California has been the most popular destination of immigrants to the United States. The most recent large wave of international migrants to California and the United States began in the 1970s. That wave strengthened considerably in the 1980s and continued into the 1990s and this decade. In 1970, only 9 percent of Californians were foreign-born; today, about 30 percent are.

Many foreign-born residents of California are highly educated, although many more have low levels of educational attainment. In 2005, more than one-third (36%) of foreign-born adults in California (ages 25 to 64) had not graduated from high school, but college graduates do make up a substantial share. Indeed, foreign-born residents are only slightly less likely than California-born residents to have graduated from college (25% versus 29%). The share of college graduates among the state's foreign-born population has risen steadily over time. In 1960, among 25- to 64-year-olds, only 8 percent of the foreign-born in California were college graduates. In absolute terms, the number of foreign-born college graduates living in California increased almost 30-fold, from 65,000 in 1960 to 1.8 million by 2005. The number of recently arrived highly skilled immigrants has also increased dramatically (Figure 6).

Some international immigrants come to California as young children or young adults and complete their education in the state; others come to California already having completed college.[7] As shown in Table 3, immigrants who have recently arrived from other countries have been the best-educated immigrants California has ever received, with one-third having graduated from college. For the first time ever among recent international immigrants, the number of college graduates exceeded the number who had not completed high school.

Although we have data for domestic migration flows both to and from California, we do not have good information on the gross flows of migrants out of California to other countries and so do not know the net increase in college graduates resulting from international migration; the figures in Table 3 show only gross flows into the country. Both the Census Bureau and the California

Figure 6. Number of Foreign College Graduates Migrating to California



Sources: Authors' calculations using decennial Census data and the 2005 American Community Survey.

Table 3. Educational Attainment of Recently Arrived Immigrants, 1985–1990, 1995–2000, and 2000–2005

	Not a High School Graduate	High School Graduate	Some College	College Graduate	Total
18- to 64-year-olds					
1985–1990	505,000 (45%)	193,000 (17%)	217,000 (19%)	201,000 (18%)	1,116,000 (100%)
1995–2000	424,000 (39%)	186,000 (17%)	190,000 (17%)	286,000 (26%)	1,086,000 (100%)
2000–2005	342,000 (31%)	201,000 (18%)	204,000 (18%)	363,000 (33%)	1,110,000 (100%)
25- to 64-year-olds					
1985–1990	295,000 (39%)	122,000 (16%)	149,000 (20%)	184,000 (25%)	750,000 (100%)
1995–2000	253,000 (33%)	118,000 (16%)	127,000 (17%)	262,000 (34%)	760,000 (100%)
2000–2005	218,000 (28%)	120,000 (15%)	132,000 (17%)	320,000 (41%)	790,000 (100%)

Sources: Authors' calculations using the 1990 and 2000 decennial Censuses and the 2001–2005 American Community Surveys.
Note: Recently arrived immigrants are those who arrived within the past five years.

Department of Finance estimate net international migration to the state when developing annual estimates of the state's population. Combining those estimates, which are not broken down by age or education, suggests that the percentage of people leaving the state for other countries is between 11 and 23 percent of those arriving.[8] Most emigration to other countries consists of return migrants—people returning to their original countries of departure after staying in the United States for some time. In a study of return migration to Mexico, Reyes (1997) found that less-educated, low-wage, and undocumented workers were more likely than other workers to return to Mexico.

Trouble Ahead? Economic and Demographic Projections

To assess whether domestic and international migration might resolve the projected shortfall in the number of college-educated workers, we updated and extended our population projections and economic analysis from 2005 using new data. The text box "Economic and Demographic Projections Methods" provides details of our approach.

The new economic projections are consistent with the previous series used in PPIC's *California 2025* report.[9] The projections categorized by industry, show that the state's economy will continue to demand more highly educated workers. This occurs as the state's economy continues to shift toward industries that need more highly skilled workers and as skill levels increase within industries. The health and education services industry is projected to be the most important growth industry in the state, increasing from 10.8 percent of all jobs in 2005 to

Economic and Demographic Projections Methods

Economic projections. Projections of the educational demands of the future workforce follow the methods developed in Neumark (2005b). We use economic projections by industry from the California Department of Transportation (2005). For each industry, we calculate the education of California workers in 2005 using the *Earner Study of the Current Population Survey* from the U.S. Census Bureau. We project the education needs of the industry in 2025 assuming that the worker education changes occurring from 1995 to 2005 will continue (using linear extrapolation). For example, for health and education services, we estimate that the share of workers with a college degree increased from 36.7 percent to 42.6 percent from 1995 to 2005. Continuing this growth for two additional decades leads to a projection of 54.4 percent for 2025. Our projections reflect a continued upgrading in worker education within industries consistent with California's experience since 1980. Our approach, a continuation of recent trends, is also consistent with the approach used for the demographic and industry employment projections. Neumark (2005b) considers a "static" alternative projection whereby education needs within each industry remain at current levels. When combined with static demographic projections (i.e., people within each demographic group maintain current education levels; see Johnson, 2005), the projections also lead to a shortage of college-educated workers, although a smaller shortage than is implied by the projections here.

Demographic projections. We use a cohort component model to develop population projections by educational attainment. In this model, age-specific mortality and migration rates are applied to a base year population broken down by age to project subsequent year populations. In our model, because we want to develop projections in the absence of migration, we set migration rates equal to zero. We disaggregate our populations and mortality rates by age (five-year age groups up to 90 and older); by six mutually exclusive ethnic groups (white, Latino, African American, American Indian, Asian and Pacific Islander—referred to as Asian—and multiracial); by two nativities (U.S.-born and foreign-born) and two genders; and by five educational attainment categories (not a high school graduate, high school graduate, some college, bachelor's degree, and graduate degree). Because we set migration to zero, the model is fairly straightforward. For example, the number of U.S.-born Latino males ages 55 to 59 with a bachelor's degree in 2025 equals the number of U.S.-born Latino males ages 35 to 39 with a bachelor's degree in 2005 times the probability of surviving (one minus the mortality rate for that group) over the 20-year period. We also make an adjustment for education completed after age 30 based on recent trends in educational improvements by cohort. Our base population is the 2005 American Community Survey population broken down by the categories listed above. Fertility does not affect our projections because we focus only on the age range 25 to 64 in 2025. Mortality rates are age-, ethnic-, nativity-, and gender-specific (but not education-specific). Thus, we do not allow mortality rates to differ by educational attainment. Our base rates for mortality are from 2000 values calculated by combining administrative vital statistics data with Census counts of the state's population. We allow mortality rates to decline by 1 percent for each five-year period. For younger cohorts (e.g., those ages 5 to 9 in 2005 and 25 to 29 in 2025), we project completed educational attainment based on parents' educational attainment. We use our own previous estimates of the relationship between parents' education and children's eventual levels of education by ethnicity and nativity. See Reed et al. (2005) for our method.

These economic projections suggest that by 2025, two of every five jobs (41%) will require a college graduate, an increase from less than one-third of all jobs in 2005.

13.2 percent of all jobs in 2025.[10] In this industry, 43 percent of workers in 2005 held a bachelor's degree and, if trends over the last decade continue, that share is expected to grow to 54 percent by 2025. The second most important growth industry is projected to be professional services, which includes legal, engineering, and computer services, among others. The share of workers in this industry is projected to grow from 14.7 percent to 16.4 percent. The composition of this industry has been changing rapidly and the share of workers with a college degree is projected to grow from 35 percent to 54 percent in 2025. The manufacturing industry, where only 30 percent of workers have a college education, is projected to be the one most in decline, falling from 10.8 percent to 8 percent of all jobs.

These economic projections suggest that by 2025, two of every five jobs (41%) will require a college graduate, an increase from less than one-third of all jobs in 2005 (Table 4). In absolute terms, the total number of jobs is projected to increase by 4.5 million. The vast majority of this net increase in jobs will be due to job growth at the high end, with 3.5 million additional jobs for people with either a bachelor's or graduate degree. Job growth is expected to be weakest for high school graduates and for those with some college but no degree. In those categories, the number of jobs is expected to grow less than 10 percent over the entire 20-year period. In contrast, there will be a 68 percent increase in jobs requiring a graduate degree and a 78 percent increase in jobs requiring a bachelor's degree.

How many college graduates would reside in California in 2025 if the state experienced no migration? Our projections show that if current trends continue without a major change in college-going and in college graduation, the proportion would remain essentially unchanged, with about three in 10 working-age adults having graduated from college, both in 2005 and in 2025 (Table 5). However, the ethnic makeup of these college graduates is expected to show some shifting, with some increases projected among Latinos and Asians. Among Latinos, the group least likely to graduate from college, younger cohorts will see especially strong increases. For example, among 30- to 34-year-olds, 18 percent are projected to be college graduates in 2025 compared to only 11 percent in 2005. This increase is due both to a greater share of U.S.-born Latinos in this cohort in 2025 than

Table 4. Skill Needs of Jobs in California (All Ages), by Educational Attainment

	Number of Jobs	
	2005	2025
Not a high school graduate	2,592,000 (17%)	3,079,000 (16%)
High school graduate	3,348,000 (22%)	3,671,000 (19%)
Some college	4,571,000 (30%)	4,849,000 (25%)
Bachelor's degree	3,167,000 (21%)	5,624,000 (29%)
Graduate degree	1,458,000 (10%)	2,452,000 (12%)
Total number of jobs	15,135,000	19,676,000

Sources: Authors' calculations using industry projections from the California Department of Transportation (2005) and worker education from the 1995 and 2005 *Earner Study of the Current Population Survey.*
Notes: See the textbox for our calculation methods. Percentages may not sum to 100 percent because of rounding.

Table 5. Percentage of Adults with a College Degree, 2005, and Zero-Migration Projections for 2025

	All Ethnic Groups		Whites		Latinos		Asians		African Americans	
Age Group	2005	2025	2005	2025	2005	2025	2005	2025	2005	2025
25–29	27	27	39	38	10	15	56	57	17	16
30–34	31	32	45	44	11	18	59	64	23	22
35–39	31	31	44	44	10	15	54	57	25	24
40–44	30	29	39	41	10	14	49	53	22	23
45–49	30	29	38	41	10	12	45	57	21	19
50–54	32	33	40	46	10	13	42	60	25	25
55–59	35	32	42	45	9	11	43	55	24	26
60–64	32	31	39	40	10	11	41	49	20	23
Total, 25–64	31	32	41	42	10	13	50	56	22	22

Sources: Authors' calculations for 2005 based on the American Community Survey; authors' projections for 2025.
Note: See the textbox for our calculation methods.

in 2005 (U.S.-born Latinos are much more likely than foreign-born Latinos to graduate from college), and to the increasing educational attainment of the parents of Latino children; parental educational attainment is a strong predictor of the educational attainment of children (Reed et al., 2005). Among Asians, already high levels of educational attainment will increase to even higher levels as very highly educated younger cohorts age and replace older cohorts who are not as well educated. For example, among 50- to 54-year-old Asians, the share with a college degree is projected to increase from 42 percent to 60 percent. Little change is expected in the proportion of whites with a college degree.

The lack of overall progress in educational attainment in the absence of migration can be attributed to two related factors: the aging of highly educated older Californians past their working ages, between 2005 and 2025, and the increase in the share of the working-age population comprising ethnic groups that tend to have fewer college graduates. Currently, California's most-educated cohorts are older white adults. The three age groups in 2005 with the highest percentages of college graduates were 55 to 59 (35%), 50 to 54 (32%), and 60 to 64 (32%). The high levels of college completion among those groups is partly due to the efforts of many in the 1960s and 1970s to avoid being drafted and sent to serve in the Vietnam War; college attendance allowed men to defer military service and sometimes avoid it altogether (Card and Lemieux, 2001). As those cohorts age out of working ages, they will be replaced by slightly less-educated younger cohorts. These replacement cohorts will have larger Latino populations, a group that historically has had relatively low levels of college graduation. In 2005, 32 percent of 25- to 29-year-olds in California were Latino; by 2025, that figure will increase to 47 percent in the zero-migration projections.

The difference (with some adjustments) between the population and economic projections helps us estimate of the size of the total college graduate migration, both domestic and international, that would be necessary to close the gap. The projections of jobs are based on our economic projections, and the projections of workers are based on our population projections. The adjustments take into account such factors as labor force participation rates, self-employment, and age group differ-

Recent trends show that college graduate migration from other states has been far too small to provide the number the state's economy will need.

Table 6. Jobs and Workers, by Educational Attainment, 2005 and 2025

	2005 Jobs and Workers	2025 Jobs	2025 Workers Under Zero-Migration Projections
Not a high school graduate	2,290,000	2,721,000	2,239,000
High school graduate	2,911,000	3,192,000	3,412,000
Some college	4,236,000	4,494,000	4,631,000
Bachelor's degree	3,046,000	5,409,000	3,458,000
Graduate degree	1,734,000	2,917,000	1,698,000
Total	14,217,000	18,733,000	15,438,000

Sources: Authors' calculations for 2005 based on the American Community Survey; authors' projections for 2025.
Notes: See the textbox for our calculation methods. The numbers have been adjusted from estimates of the population and industrial employment to estimates of workers and jobs (see the text for details).

ences between the two sets of projections. To estimate how many of the jobs shown in Table 4 will be filled by 25- to 64-year-olds, we use the ratio of 25- to 64-year-old workers to jobs in 2005, distinguished by education level, and then adjust the 2025 projections of jobs.[11] To estimate how many workers will be available in 2025, we apply 2005 labor force participation rates to our 2025 population projections.[12]

The results show that California would need to import large numbers of college-educated workers to meet the needs implicit in the economic projections (Table 6). The number would need to increase from 4.78 million in 2005 to 8.33 million in 2025—an increase of about 75 percent over two decades.[13] The final column of Table 6 shows that the increase in number of college-educated workers is not likely to be met without substantial migration. In the absence of migration, the number of workers with a college education is projected to be only about 5.16 million, or 3.17 million short of what will be needed.

Will College Graduates from Outside the State Close the Gap?

Recent trends show that college graduate migration from other states has been far too small to provide the number the state's economy will need (Table 7).[14] Indeed, between 2000 and 2005, the state experienced an annual net *loss* of college-educated domestic migrants ages 25 to 64; the state did experience small gains of less than 2,000 per year for 20- to 64-year-old college graduates. Even if the state were to return to the large positive flows of highly educated migrants from other states that was experienced in the late 1980s, those flows would fall far short of the projected need (left column of Table 7). Moreover, the general direction recently has been toward fewer, not more, college-educated domestic migrants.

As noted, international migration has been an increasingly important source of college graduates for California. Our estimates suggest that those flows have almost doubled from the late 1980s to the first half of this decade (Table 7). From 2000 to 2005, one-third of international immigrants arriving

in California had a college degree. However, the net flows of college graduates from abroad still fall short of the projected need; in fact, they would have to more than double immediately to meet the projected annual requirements for the economy. And although the share of immigrants arriving with a college degree has risen over the long run, it has fallen recently from 37 percent in 2000–2001 to 29 percent in 2004–2005. This may be a consequence of the decline in the granting of visas for highly skilled workers, discussed below.

These trends suggest that it is unlikely that migration of college-educated workers will bridge the gap. Even during the late 1980s, when the greatest net number of college-educated people came to California, net migration was about 60,000—less than 40 percent of the number required to meet the projected workforce needs.

Many factors could increase or decrease such migration. One is the overall attractiveness of California. An annual survey of U.S. adults has consistently found over the past several years that if respondents could live in any state outside their own, California would be their first choice (Harris Poll, 2006). The state's high home prices, often viewed as a barrier, may also reflect the increasing ability of more and more people with high incomes to choose where they want to live (Gyourko et al., 2006). However, those same housing prices have grown much faster than in other states, and high housing prices are still clearly a deterrent to moving here. In 1998, fewer than 10 percent of adults moving to other states cited housing as the primary reason they moved out of California in the previous year; by 2006, the percentage had jumped to 31.[15]

. . . the net flows of college graduates from abroad still fall short of the projected need.

Wages are a second factor that will affect migration flows. A shortage of highly skilled workers in California should drive up their

Table 7. Annual Average Projected Migration Required to Meet Economic Projections, and Historical Trends in Migration, by Educational Attainment

	Projections	Historical Trends					
	Total Net Migration Required to Meet Economic Projections	Net Domestic Migration			Net International Migration		
	2005–2025	2000–2005	1995–2000	1985–1990	2000–2005	1995–2000	1985–1990
Not a high school graduate	24,100	(14,600)	(32,200)	(4,200)	39,440	43,010	50,150
High school graduate	(11,000)	(31,800)	(27,000)	(5,800)	21,250	20,060	20,740
Some college	(6,900)	(33,800)	(34,600)	(600)	22,780	21,590	25,330
College graduate	158,400	(9,200)	11,400	29,200	55,760	44,540	31,280
Total	164,700	(89,400)	(82,400)	18,600	139,230	129,200	127,500

Sources: Authors' projections for 2005 to 2025; authors' calculations of historical migration using decennial Censuses and American Community Surveys.
Notes: Net international migration assumes out-migration equal to 15 percent of in-migration. Based on adults ages 25–64.

The growth in wages of college-educated workers in California was matched by strong growth in international migration.

Table 8. Real Hourly Wage in California and the Nation, by Educational Attainment (in dollars)

	1979	1989	1999	2005
California				
Not a high school graduate	22	19	19	21
High school graduate	24	21	20	21
Some college	27	24	25	26
Bachelor's degree	33	31	35	37
Graduate degree	34	36	39	44
United States				
Not a high school graduate	19	17	17	17
High school graduate	21	18	18	18
Some college	24	21	21	22
Bachelor's degree	30	28	30	32
Graduate degree	31	32	34	37

Sources: Authors' calculations using the 1980, 1990, and 2000 decennial Censuses and the 2005 American Community Survey.
Notes: The table shows the predicted hourly wages for working men with 15 years of experience holding constant demographic variables at the California average in 2000. Values are inflation-adjusted to 2005 dollars using the CPI-U-RS from the Bureau of Labor Statistics. Wages are not adjusted for cost-of-living differences between California and the rest of the nation.

wages and thus attract college-educated workers from other parts of the nation and world. At least two factors could work against this expectation, however. First, California is not the only state that needs these workers; the increase in demand is also expected in the rest of the nation (Neumark, 2005b). Second, the baby boomers, a large and important source of highly educated migrants to California in the past, have aged out of prime migration years. The youngest baby boomers in 2005 were 41 years old; and by 2025, many boomers will have reached retirement age (the oldest will be 79 years old).

Since 1989, both California and the nation have experienced rising wages for college-educated workers, but the wage growth has been greater in California (Table 8). In 1989, a typical male worker with a bachelor's degree earned $31 per hour in California and $28 per hour nationally—an 11 percent difference. By 2005, the average wage of such a worker had grown to $37 in California, 16 percent higher than the national level of $32 per hour. Despite this trend, the net migration of college-educated workers to California was much lower during recent years than in the 1980s or 1990s. So the better pay that California offers may still not be a strong enough draw to attract enough college graduates from other states.[16]

By comparison, international migrants appear to have been more responsive to wage adjustments in California and this could continue to be true. The growth in wages of college-educated workers in California was matched by strong growth in the international migration of college-educated workers (Tables 7 and 8). The international pool of potential college-educated migrants from key countries is expected to continue to grow rapidly and could lead to substantial increases in the numbers of college graduates coming here. In 1970,

71 percent of students enrolled in college worldwide were outside the United States; by 2000, this share had increased to 86 percent (Freeman, 2006a). California's college graduates are increasingly likely to come from India, with the Philippines and China remaining important sources as well. Along with Korea, those countries contributed more than half the state's immigrant college graduates between 1995 and 2005 (Table 9). Furthermore, the number of college graduates in India and China is growing rapidly. Between 1991 and 2004, for example, the total number of college graduates in India more than doubled, from 20.5 million to 48.7 million (Shukla, 2005). By 2010, Chinese universities are expected to produce more Ph.D.s in science and engineering than U.S. universities will (Freeman, 2006b).

Federal Immigration Policy May Impede College Graduate Immigration

Immigration policy in the United States is slow to change and gives higher priority to the goal of family reunification than to the importation of highly skilled workers. Caps on the number of international immigrants admitted to live permanently in the United States are much higher for those in family-based than for skills-based categories. In the federal fiscal year 2005, only 20 percent (226,000) of the 1.1 million immigrants given legal permanent residency in the United States were based on employment for highly skilled workers, and most of those, 123,000, were granted to the spouses and children of such workers.[17] Only Congress can change immigration caps (although some categories, such as the minor child of a legal permanent resident, are not subject to caps) and so the system is slow to respond to changing labor and economic conditions. The U.S. sys-

California's college graduates are increasingly likely to come from India, with the Philippines and China remaining important sources as well.

Table 9. College Graduates in California in 2005 and Arriving Between 1995 and 2005, by Country of Origin

	Number	Percentage of Total
India	107,331	18
Philippines	76,937	13
China	72,834	12
Korea	53,865	9
Mexico	42,519	7
Russia	23,790	4
Japan	20,427	3
Canada	15,103	3
United Kingdom	14,411	2
Iran	10,954	2
All other countries	153,780	26
Total	591,951	100

Source: Authors' calculations using the 2005 American Community Survey.
Notes: Total does not sum to 100 percent because of rounding. Based on adults ages 20 and over.

Population projections show that without dramatic change, the state will not have the number of college graduates required by tomorrow's economy.

tem is often compared unfavorably to the Canadian approach, which places greater emphasis on skills and allows levels to vary annually.

The recent history of giving temporary visas for highly skilled workers, called H-1B visas, illustrates some of these problems. H-1B visas allow skilled workers to live in the United States temporarily, initially for a period of three years. Employers must sponsor such workers and both must meet a number of criteria to be eligible. The Immigration Act of 1990 set the annual cap for H-1B workers at 65,000. Many of these visa-holders work in the high-tech sector, and in 1997, at the height of the dot-com boom, the number of applications for H-1B visas exceeded the cap for the first time. In response, Congress decided to raise the cap, an action that was controversial. Many argued that this action hurt U.S. workers. But by the time Congress responded by raising the cap (to 115,000 in 1999 and 2000, and 165,000 in 2001 through 2003), the dot-com boom had largely run its course and the number of applications was far below the caps. The quota returned to 65,000 in 2004. Since then, the demand for H-1B visas has risen dramatically with the number of applications exceeding the cap.[18]

Globalization Effects

Increasing global competition for skilled labor suggests that California must compete with more destinations, including other states, than in the past.[19] Some studies of the technology sector suggest that a global shortage for skilled labor is already being felt and will intensify (McKinsey and Company, 2005). California will also be competing with the immigrants' countries of origin for their labor. Some research suggests that the international brain drain (which benefits California) is increasingly becoming "brain circulation," as international migrants from Taiwan and India return to their countries of origin to establish new firms or additional locations for California firms (Saxenian, 2006).

Furthermore, college graduate migration may be reduced by the offshoring of highly skilled jobs to lower-wage countries. The Bureau of Labor Statistics (2006) has developed a list of 40 occupations susceptible to significant risk of offshoring in the future. Among the criteria for such work: It can be digitally transmitted, involves repetitive tasks, has clear requirements with few nuances, and has little face-to-face interaction. The list includes many engineering and computer-related occupations and others that have a relatively high share of workers with a bachelor's degree or more (48% for those on the list compared to 28% for other occupations).

Discussion

Economic projections indicate that California's employment will continue to shift toward college-educated workers, an intensification of trends over the last two decades. Population projections show that without dramatic change, the state will not have the number of college graduates required by tomorrow's economy. Meeting the skills gap by attracting more highly skilled migrants would require substantial increases in the number of college-educated migrants to the state, most likely from other countries. The net number of college-educated international migrants to California has grown rapidly, with annual averages about 11,000 higher in the early 2000s as compared to the late 1990s. But even if this number

were to continue growing by the same amount every five years, by 2025 the annual number would be just over 100,000—substantially less than 158,000, the estimated average number needed each year between 2005 and 2025 to close the gap. In the past, large increases in the number of highly educated international migrants have been partly offset by declines in the net flow of highly educated domestic migrants. California's high cost of housing has been at least one deterrent to attracting workers from other states. Future increases in the migration of college graduates to California will close some of the gap, but to close it completely would require an increase of unprecedented magnitude.

Faced with a shortage of highly skilled workers, wages are likely to rise for these workers, continuing the trend in the growing value of a college education in California. Wage adjustment should act as an incentive for more Californians to seek bachelor's degrees.

The state clearly has a role in encouraging and enabling Californians to attain bachelor's degrees. First, most Californians prepare for college in the public K–12 system and a majority who start college do so through the public community colleges. Improvements or expansions in these systems will better prepare Californians for bachelor's degree programs. Furthermore, most bachelor's degree students in California attend a public institution. In 2005, 76 percent of adults graduating from a California college with a bachelor's degree attended a public college or university, so changes in public policy are likely to have direct effects. Ultimately, even strong growth in the numbers graduating from California colleges is unlikely to fully close the workforce needs gap.[20] Nevertheless, of all the times to make an effort to increase educational attainment, doing so now may be particularly advantageous and can lead to better economic opportunities for Californians and possibly better outcomes for the state. ◆

Economic projections indicate that California's employment will continue to shift toward college-educated workers, an intensification of trends over the last two decades.

Notes

[1] The projected growth in demand for education in the California labor market continues a long-term trend over the last two decades in the state and in the nation (see Reed, 1999). Throughout this report, we use the term *highly skilled* to mean college educated.

[2] We define a college graduate as an adult with at least a bachelor's degree. For data before 1990, we define someone who has completed at least four years of college as a college graduate.

[3] Throughout this report, working-age refers to adults ages 25 through 64. All data presented are for that age group unless otherwise noted.

[4] Converting DOF net domestic migration estimates to gross flows and applying proportions of college graduates derived from CPS data to those gross flows yields an estimate of an annual net gain of 15,000 college graduates ages 25 to 64 between 2000 and 2005. However, even the DOF net domestic migration estimates imply a small net loss in the last two years.

[5] The CPS and ACS samples are weighted to agree with Census Bureau estimates of the state's total population. If we instead weight the CPS and ACS to DOF's estimates of the state population, the estimates of domestic migration from the CPS and ACS samples change only slightly. For example, the ACS estimate of a net domestic migration loss of 834,000 between 2000 and 2005 is reduced to a loss of 771,000 using weights that sum to DOF population totals.

[6] These figures are for all adults ages 20 to 64 and are based on the authors' calculations using 2000 Census data and the 2000–2005 American Community Surveys. From 2000 to 2005, California continued to gain young college graduates between the ages of 20 to 25 from other states even as it lost older college graduates to other states.

[7] The Censuses and the American Community Survey attempt to include all residents of the United States regardless of legal status. Undocumented immigrants, a group with low levels of educational attainment, are almost certainly undercounted at a higher rate than other groups, but the Census Bureau estimates that the 2000 Census had a lower undercount rate than the 1990 Census. Thus, the increases in educational attainment between 1990 and 2000 cannot be attributed to an increase in the undercount of undocumented immigrants. The extent to which undocumented immigrants are counted in the American Community Survey is unknown; however, the ACS population weights are based on independent estimates of the state's population that attempt to account for undocumented immigration.

[8] Between 2000 and 2005, international in-migration to California totaled 1,514,000 according to the American Community Survey (the Current Population Survey places the figure at 1,550,000). The Census Bureau estimates the state's net international immigration at 1,342,000 for this same period, and the comparable figure from the California Department of Finance is 1,166,000.

[9] Other projections show similar trends. We use CalTrans economic projections by industry, developed by Mark Schniepp of the California Economic Forecast, because they extend to 2025 and include farm workers. Neumark (2005b) shows that industry projections from the California Employment Development Department and the UCLA Anderson Forecast also imply a substantial demand shift toward college-educated workers. Projections of employment by occupation also show a demand shift but, when combined with occupational education needs produced by the Bureau of Labor Statistics (BLS), they suggest only a small increase in the share of jobs requiring at least a bachelor's degree. Nevertheless, Fountain (2006) concludes that California will face a shortage of college-educated workers using occupation projections from the California Employment Development Department combined with educational needs by occupation from the BLS. Because the educational needs estimates from the BLS account only for a single level of training for each occupation and do not consider the variation in educational needs within an occupation, we use the actual skill levels of workers for a more accurate picture of the range of skill requirements within an industry (see Neumark, 2005b, for further discussion of this issue). For example, within the group of occupations characterized by the BLS as requiring an associate's degree, almost half of U.S.-born workers nationally report having a bachelor's degree. Controlling for other factors and specific occupations, workers in these occupations who have bachelor's degree earn an average of 17 percent more than workers who have an associate's degree, suggesting that the labor market does value a bachelor's degree even within these occupations. However, the labor market appears to place a lower value on a foreign bachelor's degree with 64 percent of foreign-born workers in these occupations holding a bachelor's degree and those workers receiving only 12 percent higher wages than similar workers with an associate's degree.

[10] Health and education services does not include public school teachers who are classified in the "government" sector by the California Department of Transportation. This sector is projected to grow, albeit more slowly than the overall economy.

[11] This adjustment implicitly assumes that several factors will remain the same in 2025 as in 2005 within each education group: the share of jobs held by people ages 25–64, the share of people with more than one job, the share of people self-employed, and the share of people in the Armed Forces. There are several plausible alternatives to these assumptions, but the alternatives do not lead to changes in the estimates of sufficient magnitude to affect our conclusions drawn from Table 7.

[12] This adjustment implicitly assumes that labor force participation rates will remain the same in 2025 as in 2005 within each education group. In the event of a shortage of skilled workers, growth in the wages of such workers would likely induce an increase in labor force participation. However, even if labor force participation among college-educated workers increased from current levels of about 83 percent to 95 percent, the net migration need in the first column of Table 7 would remain substantial at about 131,000 college-educated workers annually.

[13] With no migration, the projected number of workers with a graduate degree in 2025 is lower than the number in 2005. This occurs because foreign-born workers are a particularly large share of California workers with a graduate degree.

[14] The net migration estimates in Table 7 are based on the migration of people ages 25 to 64. Some younger migrants will arrive before 2025 and will be of working age by 2025. We estimate the net number of such migrants to be about 23,000 migrants annually, judging by past trends in child and young adult migration. Even if half of these migrants were to obtain a bachelor's degree, the estimated number of college-educated workers needed annually would remain substantial at almost 147,000.

[15] Based on authors' calculations using annual Current Population Survey data. Figures for college graduates are similar, with only 7 percent citing a housing-related reason in 1998 and 27 percent doing so in 2006. Housing-related reasons include cheaper housing, new or better housing, owning rather than renting, wanting a better neighborhood, and establishing one's own household (but not a change in marital status). A plurality of domestic out-migrants (37% in 2006) cite job-related reasons.

[16] Table 8 also shows that since 1989, wages for college-educated workers have grown whereas wages for high-school-educated workers have been stagnant in California and in the nation. These trends suggest a rising demand for college-educated workers, consistent with our projections.

[17] Of course, some of the family-based immigrants are highly educated. Estimates are based on data compiled from the *Yearbook of Immigration Statistics* (U.S. Department of Homeland Security, 2006).

[18] For federal fiscal year 2008, the limit on H-1B visas was reached in the first day that such applications could be filed, with 150,000 applications filed on April 2, 2007.

[19] In 2005, 27 percent of the nation's immigrants resided in California, compared to 33 percent in 1980. California's share of highly educated immigrants has also declined slightly over this time period (24% of college graduates in 2005 lived in California, compared to 27% in 1990).

[20] Data from the California Postsecondary Education Commission show that roughly 140,000 people graduate with a bachelor's degree from California colleges each year. For studies of the value to California of college-educated workers and the returns to state investments in college education, see Fountain (2006) and Brady et al. (2005).

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