ASIAN-BORN SCIENTISTS AND ENGINEERS: THEIR IMMIGRATION FLOW AND LABOR MARKET ADJUSTMENT

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This paper examines the flow of Asian-born scientists and engineers and their labor market adjustment. First, main elements to affect their immigration flow are described: supply, demand, and institution. The supply has two sources: foreign students and direct immigrants. The scarcity of domestic workers is the most important factor affecting demand of immigration. Institution, such as immigration polices, is another element to influence the immigration flow. These three factors are also interrelated with one another. Second, by using the 1980 U.S. Census data set, their labor market adjustment is explored in terms of hourly wages. Compared to the native-born white, there is no evidence that Asian-born scientists and engineers receive lower wages or lower return on human capital. Also, the finding shows no effect of the placement in the labor market, associated with their handicaps of race or of the foreign-born, on wages.

INTRODUCTION

Since the 1960s there has been a noticeable change in the national origins of the U.S. scientific and engineering labor force. Between 1972 and 1982 alone, immigrant scientists and engineers increased their proportion of the work force from 9.6 percent to 16.9 percent while the percentage of immigrants in the total U.S. population increased from 4.7 percent to 6.2 percent. Further, by 1982 more than 84 percent of these immigrants had entered the country after the age of 18, making them part of a "brain flow" to this country, i.e., immigration of highly trained individuals who entered either by coming directly from abroad or by adjusting from temporary to permanent residency (Finn 1985; Terleckyj 1986; Jasso and Rosenzweig 1991).

This increasing flow of immigrants to the scientific and engineering labor force is related to evolving U.S. immigration policies. The 1952 Immigration Act gave first occupational preference and 50 percent of annual quotas to aliens whose services are urgently needed in the United States because of their high education, technical training, specialized and exceptional ability, and who would be substantially beneficial to the national economy, cultural interests or welfare of the United States. Included in this category were

scientists and engineers. Additional stimulation was added when Congress enabled a large backlog of scientists and engineers to enter in 1958 and 1963 as non-quota immigrants. By the mid-1960s, immigrant scientists and engineers accounted for 9 percent of the annual increase in scientists and 15 percent of the annual increase in engineers. The scientists and engineers who immigrated at this time were largely Europeans, especially British and Germans (Rhine and Creamer 1969; Keely 1971; Fortney 1972; Jasso and Rosenzweig 1991, pp.26-31).

Immigration statistics indicate that the flow of scientist and engineer immigrants accelerated in the years after implementation of the 1965 Immigration Act. The changes incorporated in this new law created two occupational categories for highly trained individuals. From 1967 to 1972, the number of immigrant scientists and engineers entering each year averaged over 12,000, more than twice the number entering during the previous period. Although the flow slowed during the mid-1970s to about 7,000 per year, the numbers have averaged around 10,000 annually since 1978 (Immigration and Naturalization Service 1963- 1980).

The 1965 immigration Act also ended the restrictive quotas for Asian countries and consequently opened the door to substantial immigration by Asian scientists and engineers. Between 1952 and 1965, Asians comprised only a small fraction of scientist and engineer immigration because each Asian country had an annual quota of only 100 individuals. For example, from 1954 to 1962, India--which would later become the major sending country of highly skilled people--had only 410 scientists and engineers who became permanent U.S. immigrants. During the early sixties, less than 10 percent of engineering immigrants were from the five major Asian sending countries: India, China, Japan, Korea, and Thailand (Immigration and Naturalization Service 1963-1980; Fortney 1972).

During the transitional years (1966 and 1967), individuals from the five major Asian sending countries made up over 22 percent of the engineer immigrants. After the full implementation of the 1965 Immigration Act, the proportion of all scientists and engineers immigrants that were Asian-born (Far and Middle East) steadily increased, from less than 30 percent in the late sixties to nearly 60 percent in the early eighties. Between 1982 and 1984, the Far East alone sent 45.5 percent of the scientists and engineers immigrants. The countries of origin for the largest number of scientists and engineers have been India, Taiwan, Korea, China, Japan, and the Philippines (National Science Foundation 1985).

This paper examines the flow of scientist and engineer immigrants from Asia and their labor market adjustment. In the first part, major elements to

influence their flow will be described: supply, demand, and institutional factors. The supply of Asian-born scientists and engineers has two sources: non-immigrants (primarily foreign students who adjust to immigrant status), and the immigrants (who come directly from abroad). The demand for Asian scientist and engineer immigrants is directly related to the scarcity of domestic workers.

The institutional factors also influence the flow of immigrant scientists and engineers: immigration policies, such as the labor certification process and family reunification. The second part will be devoted to the extent of their adjustment within the U.S. labor market, particularly in terms of wages.

FLOW OF SCIENTIST AND ENGINEER IMMIGRANTS

Supply Characteristics

1. Foreign Students

The two sources of Asian scientist and engineer immigration, adjusters and direct immigrants, have different patterns of entrance into the country and integration into the scientists and engineers work force. Foreign students constitute the single largest group of adjusters. Most of these enter the United States with F-1 visas, which are relatively easy to obtain and which normally grant them permission to remain only while they are students.

Over the last three decades, the foreign-student population (for all

TABLE 1. TOP 10 COUNTRIES OF ORIGIN FOR FOREIGN
STUDENTS IN THE U.S.

1954	1979	1985
Canada	Iran	Taiwan
Taiwan	Taiwan	Malaysia
India	Nigeria	Nigeria
Japan	Canada	Iran
Philippines	Japan	Korea
Colombia	Hong Kong	Canada
Mexico	Venezuela	India
Korea	Saudi Arabia	Japan
Iran	India	Venezuela
Venezuela	Thailand	Hong Kong

Source: Institution of International Education, 1954-85.

academic disciplines) from South and East Asia has increased dramatically, from about 10,000 in the mid-1950s, to 30,000 in the mid1960s , to 60,000 in the mid1970s , to over 142,000 in 1984-85 (Institute of International Education 1985). With the exception of the 1979-80 academic year when the number of foreign students from the Middle East was inflated by the newly acquired OPEC fortunes and by the political crisis in Iran, South and East Asia have sent the largest number of students to the U.S. Table 1 shows the top 10 countries of origin for all foreign students from the 1950s through the mid-1980s, Asian countries were 6 out of 10 when ranked by numbers of students sent.

Although foreign students have historically comprised only a small fraction of the total scientists and engineers enrollment, they comprise a significant percent of the graduate enrollment. An indicator of their importance at the graduate level is the large number of the doctorates going to foreign students. Non- citizens earned 12 percent of all the scientist and engineer PhDs awarded in 1960, and over 21 percent in 1985, and in engineering alone, 57 percent of the 1985 PhDs were awarded to non-citizens (National Science Foundation 1986).

Asians have consistently been a large proportion of these foreign students. As early as 1968, a majority of the foreign students in engineering masters' and doctoral programs were from Asia. Over half of the foreign-citizen science and engineering PhD recipients from 1970 to 1979 were from either East or West Asia. In 1980, three Asian countries alone (Taiwan, India, and Korea) accounted for over 50 percent of the enrollment in science and engineering graduate programs (National Science Foundation 1983).

Foreign students in science and engineers programs create a pool of potential scientist and engineer immigrants. Several studies have pointed out that many foreign students eventually become non-returnees (Oh 1969; North 1970). Estimates of the percent of foreign students who intend to remain in the U.S. var widely, but it appears that many wish to do so. During the mid1980s , a majority of foreign engineering doctoral students surveyed (54 percent) intended to stay in the United States (National Science Foundation 1986). While this figure is for all foreign-students in engineering only, the high proportion of Asians in this field implies that many of those wishing to remain in the U.S. are Asian. The decision to remain and adjust to immigrant status is based on many factors. Among the most commonly cited in the research are: 1) the lack of adequate job opportunities in the home country, 2) the higher wages in the U.S., and 3) the availability of jobs in the U.S. The amount of time spent in this country also affects the decision: those who have been in the United States the

longest have the highest probability of wanting to stay (Oh 1977; Vasegh-Daneshvary, Schlotmann, and Herzog 1987).

2. Direct immigrants

While student adjusters contribute to the immigrant scientist and engineer flow, direct immigration from abroad has become more important, The occupational preference introduced in the 1965 Immigration Act opened the door for highly trained individuals from outside the United States. This was particularly important during the early 1970s, when a number of occupations were given "blanket eligibility". Asian scientist and engineers took advantage of these preferences and immigrated. Although the criteria for occupational immigration tightened in the mid1970s, direct immigration of Asian scientists and engineers continued. The percentage of scientists and engineers from all professions who immigrate from China, India, Korea, Taiwan and the Philippines ranged from a low of 27 percent in 1976 to a high of 47 percent in 1985 (Immigration and Naturalization Service 1976-1986).

Demand Characteristics

Relatively less is known about the characteristics of the demand side than of the supply side, and much of what is known applies to a all scientist and engineer immigrants rather than just Asian scientist and engineer immigrants. Our focus is the demand for new immigrants and non-immigrants (temporary residents who potentially qualify for permanent status). The examination of the demand for these individuals is expected to provide insights into the openings or portal through which Asian scientist and engineer immigrants enter the U.S. economy.

Labor shortages in scientific and engineering fields are main factors to increase the demand of immigrant scientists and engineers. Some scholars have observed that, due to relatively high salaries which accrue to science and engineering bachelor degree recipients, relatively few U.S. citizens elect to attend graduate school. There has been a long-run decline in the number of U.S. natives enrolled in scientific and engineer graduate programs. This shortage pushes firms to be dependent on immigrant scientists and engineers (Fortney 1972).

The cyclical nature of the supply of scientists and engineers with advanced degrees is another side of the labor shortage. The demand for scientists and engineers is affected both by the business cycle and public spending, particularly defense spending. Industrial life cycles, the development and expansion of new industries result in rapid growth of the

demand side. The most obvious example is the expansion of the high-tech sector, particularly electronics. The labor demand associated with the hyper-expansion of Silicon Valley, Route 128, and other technology centers easily outstripped the domestic supply of scientists and engineers, particularly with advanced degrees.

Thurow (1975) suggests the "queue model," which provides insight into the employment opportunities for immigrant scientists and engineers. According to this theory, individual applicants do not compete on the basis of wages because wage levels are determined by institutional and market forces. In other words, an applicant can not increase the odds of being hired by lowering his or her asking wage. When there is an excess of applicants, there is a queue of candidates at the firm's door. Applicants are sorted according to what the firm perceives as hiring and on-the-job training costs associated with each individual, with the least costly put at the front of the line.

Other factors, however, such as racial prejudice, can also determine the order of the queue. Excess demand can be met by going around the queue, that is, by drawing experienced personnel from other industries. However, when there is still a gap, firms will turn to foreign and immigrant scientists and engineers.

There are important factors which reduce the demand for immigrant scientists and engineers. For example, most new immigrants do not meet the citizenship requirements of firms with defense contracts. There are additional costs and red tape to hiring foreigners. In the mid1970s , only half of the companies that recruited on college campuses for science and engineering graduates were willing to interview immigrants. Moreover, compared to U.S. citizens and western immigrants, non-western immigrants (primarily those from India, China, and Korea)'had fewer invitations to visit the company after an interview, and among those who were invited, fewer were given a job offer (Parlin 1976).

Institutional Factors

It is difficult to analyze the flow of Asian scientist and engineer immigrants in traditional economic terms because commonly accepted concepts, such as wage elasticity, are not always useful. International disparities in wage rates create a large potential pool of individuals wanting to immigrate or attain permanent status. However, the immigration law and policies are structured in order to regulate demand and supply of scientists and engineers.

1. Labor Certification

The labor certification process was designed to regulate the flow of immigrant labor according to the labor needs in this country. Labor scarcity (at the prevailing wage), then, affects not only the hiring practices of individual firms but also the institutional arrangements that govern much of the flow of scientists and engineers entering the U.S. via occupational preferences. The relative ease or difficulty of obtaining certification determines the number of scientist and engineer immigrants. Possibly even more important, the process also influences the characteristics of the immigrant population.

Two of the seven preference categories of the 1965 Immigration Act are related to occupational status. The third preference applies to those who are members of the professions or who can provide exceptional ability in the national economy, cultural interests, or welfare of the United States. The sixth preference applies to those who are capable of performing specified skilled or unskilled labor, not of a temporary or seasonal nature, for which a shortage of employable and willing persons exists in the United States. Each of these categories is allocated 10 percent of the annual quota (Jasso and Rosenzweig 1991).

At the time of the law's passage, immigrants in all of the major science and engineering occupations received blanket certification. This meant that anyone trained in these fields could apply for immigration. This policy was influenced, no doubt, by the robustness of the U.S. economy during the 1960s. Thus, the student adjusters were joined by direct immigrants, adding to the diversity of the Asian scientist and engineer flow.

In the mid-1970s, the use of blanket certification waned, partially due to the economic crises of the time: oil-price shocks, inflation, stagnant wages and labor productivity. With the disappearance of blanket certification, entry through the occupational preferences was then determined by labor demand at the firm level, rather than at the aggregate level.

Without blanket certification, a non-citizen scientist or engineer has to acquire a sponsoring firm in order to enter under an occupational preference. To obtain labor certification for such an employee, the sponsoring firm must show that there is no qualified citizen.

The shift to firm-based certification has two important implications. First, individuals already here on temporary visas have an advantage since they have a better chance of locating a sponsoring employer than Asian scientists and engineers living abroad. Second, the certification has maintained, and perhaps increased the number of very skilled individuals. Those with

advanced degrees are more likely to have highly specialized skills and fewer qualified competitors. The very nature of graduate training results in very specialized and scarce skills, making labor certification easier. In fact, the number of foreign graduate students adjusting to permanent status has not declined despite the changes in the labor certification process.

2. Student Restrictions

In 1982, there was a move to limit the flow of immigrant scientists and engineers. The United States Congress considered a change in the law that would require foreign students to leave the country after graduation (Institution of International Education 1983). These students would be eligible to return after staying abroad for two years. Passage of this requirement would seriously interrupt the flow of Asian scientists and engineers via student adjusters. However, universities and high-tech firms who were dependent on foreign nationals successfully lobbied against the proposal. This is a case of the demand side affecting institution in order to maintain the supply.

However, within the engineering profession, a group of vocal native citizens is complaining that the illegal recruitment of foreign engineers poses a significant threat to the employment of U.S. engineers. This group is pushing for tighter restrictions on foreign students wishing to study in the United States, which would make it more difficult for individuals to adjust their immigration status (Sulman 1987, p.15).

3. Family Reunification

As immigration of Asian scientists and engineers entering via occupational preferences has become tighter, a new migration pattern of Asian scientists and engineers has developed. From 1972 to 1973, the number of scientist and engineer immigrants in the labor certification category fell by nearly half. Starting in the mid-1970s , however, the number of Asian scientists and engineers entering via family reunification increased.

The earlier immigrants, both direct and adjusters have become citizens and are now qualified to sponsor relatives who are also scientists and engineers. The flow of Asian scientists and engineers through family reunification is also limited since these applicants must compete with other family reunification applicants under limited quotas.

In sum, immigration policies, including occupational preferences and labor certification, are the prime institutional determinants of the flow of Asian scientists and engineers. The changes in the certification process are related to conditions of the labor market, and have resulted in the process

being more closely linked to the firm-specific labor demand. While attempts at further restricting the flow have not been successful to date, they continue. At the same time, other avenues for Asian scientist and engineer immigration have developed, primarily through family reunification.

LABOR MARKET ADJUSTMENT

Despite the increasing flow of Asian-born scientists and engineers, their post-immigration status has received little attention. There may be several issues relating to their adjustment in the U.S. Their labor market adjustment is one of the most important aspects which indicates their well-being. In this section, the earning of Asian-born scientists and engineers is explored, especially in comparison with that of native-born scientists.

Individual Attributes

1. Education, Work Experiences, and Language Usage

In a perfect competitive labor market, workers' rewards correspond to their level of human capital (Rosen 1977; Taylor, Gwartney-Gibbs, and Farley 1989). Human capital theories assume that higher level of education and work experiences positively affect productivity and earnings. Formal education enhances one's ability to make better decisions and formulate career plans. People with higher education are expected to perform their tasks skillfully and efficiently, and contribute to higher productivity. Learning time is less, and errors in performing are fewer among better-educated people (Becker 1975).

In addition, individuals continue to invest in human capital after they complete their schooling. Many employees offer on-the-job training to develop new skills or improve old ones. Further job training and accumulated work experiences are believed to increase an individual's productivity, and consequently have a significant effect on earnings.

Especially in the case of immigrants, language usage is important because most work places use English for communication, and because accepted modes of daily personal conduct (as opposed to professional performance) are based on American norms and values. Also better English usage may provide more access to information on the labor market (McManus *et al.* 1983).

Considerable returns to past investments in education and occupational training of immigrants are well documented. Portes (1981) reports that the levels of education upon arrival have moderate effects on earnings among Cuban immigrants. Nee and Sanders (1985) show considerable effect of

education on earnings among Chinese and Filipino immigrants. Jasso and Rosenzweig (1991) find that lack of English- language skill reduces significantly wages of foreign-born men by analyzing the 1980 Census data.

2. Transferability of Human Capital

There are researchers who contend that, because scientific and engineering skills are not culture-bound, Asian scientists and engineers are readily incorporated in the labor market. For example, Kidd (1964) argues the following:

> The work of the scientists and engineers is the least culture-bound, and science is less so than engineering, While all people must live and adjust to some degree to alien cultures when they migrate, the strain is less on scientists and engineers because their work is little affected by national customs.

Scientific and engineering occupations require a high degree of school education, and a great deal of expert knowledge, they deal in human problems indirectly if at all, and require largely non-verbal skills. The primary reference group of the professional man is his or her professional society, which may be national and even international in scope, and not the community in which he or she lives. In such a setting, the handicaps of the foreign-born are of little consequence (Oh 1969).

However, there is research that found differences among foreign-born and native-born scientists and engineers in the labor market. Finn (1985) found that among engineers, both foreign nationals and naturalized citizens with no U.S. degree earned less than native-born whites, although the opposite was true for scientists: foreign nationals with no U.S. degree earned 8 percent more, other things being equal.

Chiswick (1982) argues that work experience and education are not necessarily transferable from country to country. Certain skills or training, while important in one's country of origin, may have lower value in the U.S. labor market. It is not self-evident that the overseas training of direct immigrants in scientific and engineering fields is of the same quality as training received in the U.S., or is readily transferable.

Positions in the Labor Market

1. Segmentation Approach

The employment circumstance of individuals is another important factor that influences outcomes in the labor market. In theories of dual economy, The U.S. economy is divided into two basic sectors. The core or monopoly

sector is composed of firms that are oligopolistic, capital intensive and profitable. In contrast, the periphery is composed of small firms requiring competition and little capital (Averitte 1968).

Some research has focused on distinctions between two segments of the labor market (Doeringer and Piore 1971). While the primary labor market consists of relatively high-paying, stable, secure jobs, and good working conditions, the secondary labor market consists of low-paying, unstable, unsecured jobs, and poor working conditions. Moreover, within a firm, careers and earnings may be influenced by different opportunities for promotion. Structural characteristics of, career ladders within a firm, internal labor markets affect how wages are determined, and the extent to which mobility is possible (Baron and Bielby 1978).

Another important dimension of the position in the labor market is authority. It is different from other task characteristics since it is a function of a particular job within a firm and not of an occupational task generally. There is evidence that an individual's class position (or authority) is important in understanding output in the labor market (Parcel and Mueller 1983).

The point is that career opportunities vary, depending on the economic sector, labor market segments, internal labor markets, or class positions. Since career opportunities affect outcome of the labor market (i.e., wages), it is important to consider the employment circumstances in any model dealing with individual earnings.

2. Segmentation and Immigrants

Some scholars argue that the segmentation of labor markets tends to occur along the race and ethnic boundaries in multi-ethnic societies. Workers from the dominant groups are generally employed in the primary labor market while workers from the subordinate groups find occupations in the secondary labor market. This race-ethnic division of labor helps perpetuate economic inequality between dominant and subordinate groups (Piore 1979).

Members of the dominant groups get the opportunities at the best occupations. These advantages are maintained through a race-ethnic labor principle in which subordinate groups' workers are excluded from high skill and high wage jobs. Immigrants are generally in weak positions as new entrants in the labor market and can be found in the secondary labor markets. The last jobs created in an employment expansion for immigrant workers are likely to be the least secure when the supply for labor outruns demand. They also lack familiarity with their new social as well as

economic conditions. They are separated from the other domestic workers by linguistic and cultural barriers. They are not homogeneous groups (Blauner 1969; Piore 1979).

Hypotheses

The analysis that follows is an empirical evaluation of labor market adjustment of Asian Immigrant scientists and engineers in term of wages, compared to the majority group, i.e., native-born white scientists and engineers. It will examine the following hypotheses:

1) There exists the wage difference among Asian immigrant and native-born white scientists and engineers after other individual attributes and positions in the labor market are controlled. It is expected that native-born white scientists and engineers earn more compared to other groups.

2) There are different returns to human capital between native-born white and Asian immigrant scientists and engineers. Native-born white scientists and engineers are expected to have more advantage in transferring their human capital to earnings than other groups.

3) Vulnerable positions of immigrants, resulting in placement of Asian immigrant scientists and engineers in less desirable positions in the labor market, have effects on wages. The interaction between positions in the labor market and the Asian group is expected to be significant. For comparison, native-born Asian scientists and engineers are included in the analysis.

DATA AND MEASUREMENT

Data

The data set comes from 1 percent of the 1980 U.S. Census public use sample (PUMS) of residents of the state of California. The usage of California state provides some benefits. First, in California, there are relatively large numbers of native-born and foreign-born Asians. In 1980, 40 percent of all Chinese, 37 percent of all Japanese, and 46 percent of all Philippines Americans reside in the state. Second, we can reduce the effects of region on wages at a state level by studying a single state.

The analysis is restricted to men's ages 25 through 64 who were employed in 1979. Given the small portion of women in the data set, we do not include women in the models. The self-employed are excluded because other factors, such as physical capital, may be more relevant in determining their earnings.

Measurement

1. Wages

   Log wages per week are used as a dependent variable. There are several reasons to choose the log form of wages. First, it has convenient interpretation: independent variables have proportional effects on the dependent variable. Sometimes relative difference of wages is more important than the absolute difference in studies of wages. Second, the effects of independent variables are invariant with respect to global price and productivity changes. Third, the log form has desirable properties relative to the linear form. The residuals are less skewed and less heteroskedastic (Heckman and Polachek 1974; Mincer 1974; Hauser 1980).

   The control for working time is also considered. Since wages are a function of wages per unit time and the amount of time, wages are heavily influenced by amount of time worked (Sørensen 1983). Mincer (1974) shows that the amount of weeks worked explains quite a bit of variance in earning equations.

2. Individual Attributes

   In order to measure human capital, education and work experiences are selected. Education is measured by years of schooling. Working experiences are measured in a manner identical to that found in Tolbert *et al.* (1980) and Chiswick (1982), where the proxy for work experiences is used: age minus number of schooling minus seven years.

   Wages tend to increase move swiftly in the early and middle career than in the later career. To capture this non-linearity, work experience squared is also included.

   English usage is measured by a five-point Likert-type measure of English speaking skills, assuming interval scaling. High values on this variable represent good English skills. Sex is measured by a single dummy variable. Male is a base category.

3. Positions in the Labor Market

   In order to measure positions in the labor market, labor market segmentation and occupational group are selected. Labor market segmentation is a tripartite measure, based on Hodson (1984), classification of industries into monopoly, regional, and local labor markets. The local labor market is our base category for labor market segments. The occupational group is distinguished into three groups by using the 3-digit occupation codes of the 1980 U.S. Census. The engineer group consists of

engineers (e.g., chemical, electrical, industrial, and mechanical engineers). The natural scientist group consists of life science (e.g., space, biological, and marine scientists), physical scientists (e.g., chemists, geological and physicists), and operations and system analysts. Social science group includes economists, psychologists, sociologists, urban planners, and so on. Social scientist group is used as a base category.

Statistical Model

To examine our first hypothesis, the following equation is estimated:

$$\ln(y) = Ha + Rb + Oc + Ld + e,$$

where ln (y) is a measure of log wages per week, H is a matrix of a constant, human capital and English usage; R is a matrix of race groups (i.e., native-born white, native-born Asian, and Asian; immigrant scientists and engineers); O is a matrix of occupational group; and L is a matrix of labor market segments. a, b, c, and, d are vectors of coefficients. e denotes a vector of random error with means zero and constant variances, and is assumed to be independent of the exogenous variables.

Interaction terms between race groups and human capital variables, and race groups and labor market segments will be introduced in order to test our second and third hypotheses, respectively.

RESULTS

Individual Attributes and Positions in the Labor Market

Table 2 presents the means and standard deviations of the variables used in our main analysis for each group. The mean wages per week of native-born white scientists and engineers are $524.79 (=$e^{6.263}$), whereas the means of wages per week of native-born and foreign-born Asian groups are $472.48 (=$e^{6.158}$) and $470.59 (=$e^{6.154}$), respectively.

As seen in the table, Asian-born scientists and engineers have the highest level of education of three groups, with an average educational attainment of 19.4 years, compared to the average of 17.9 years of native-born white scientists and engineers. The native-born Asian have average 18.4 years of schooling. However, in the case of experiences and English usage, the Asian-born group show the lowest levels. Their means of experiences and English usage are 9.78 years and 3.74 points, respectively.

More females (16.8 percent) are found in the native-born Asian than the native-born white (11.6 percent) and the Asian-born (12.8 percent). In the case of occupational groups, the Asian-born have more uneven distribution

than other groups. The Asian-born have a smaller distribution among social scientists (1 percent) than other two groups (8.4 percent and 7.9 percent), although whole groups have a similar pattern: relatively more engineers and natural scientists. This result may reflect that jobs requiring less verbal skills are more preferable for immigrants.

The native-born and the Asian-born have similar distributions in monopoly labor markets (37.4 percent and 36.7 percent, respectively). The native-born Asian have smaller numbers (30.7 percent) in monopoly labor market, compared to other two groups.

Group Difference

Table 3 presents effects of individual attributes, occupational groups, and labor market segments on log wages per week. As seen in model 1, human capital, such as education, experience, experience squared, and English usage have significant effects on log wages per week. Sex has also significant effect. However, there is no significant difference of log wages per week among native-white, native-Asian, and Asian-born scientists and

TABLE 2. MEANS AND STANDARD DEVIATIONS BY GROUP

Variables	Native-Born White (N=2313)	Native-Born Asian (N=101)	Foreign-Born Asian (N=196)
Log Wages per week	6.263	6.158	6.154
	(.65)	(.67)	(.61)
Education	7.978	18.366	19.413
	(2.33)	(1.86)	(1.89)
Experience	16.786	14.208	9.776
	(11.42)	(10.46)	(8.39)
Experience Squared	412.195	310.168	165.571
	(437.54)	(321.14)	(249.66)
English	4.936	4.624	3.735
	(.31)	(.61)	(.64)
Sex (Female=1)	.116	.168	.128
	(.32)	(.38)	(.33)
Engineers	.681	.673	.730
	(.47)	(.47)	(.45)
Social Scientists	.084	.079	.010
	(.28)	(.27)	(.10)
Monopoly	.374	.307	.367
	(.48)	(.46)	(.48)
Regional	.056	.050	.092
	(.23)	(.22)	(.29)

engineers.

In model 2, the variables for occupational groups are included. Again, human capital variables and English usage are found to be significant. There is no difference between the Asian-born and other two groups. The difference of occupational group has a significant effect on wages per week. Compared to natural scientists, engineers have 6 percent higher wages and social scientists have 22 percent lower wages. As shown in table 4, model 2 is significantly different from the model 1 at the level of 0.05.

The variables for labor market segments are included in model 3. Except race variables, individual attributes have significant effects. Occupational groups have a significant effect on wages. In the case of labor market segments, only the monopoly segment has a significant impact on log wages per week. Scientist and engineers in the regional segment do not have different weekly wages, compared to those in local labor market segments.

In order to examine the difference of effect of human capital across race groups, the interaction term of education and experience, and the race variables are introduced in model 4 and model 5. As indicated by unstandardized coefficients in the models, there is no significant difference in the ways in which the education and experience influence log wages per week each group. This result supports earlier arguments on non-cultural-bound skills of scientists and engineers (Kidd 1964; Oh 1977).

In the last model, the interactions of monopoly labor market segments and the race group variables are included to examine the of effects of different placement of each group in the labor market segments on wages. There is no evidence that the native-born white or the native-born Asian have different chances to find jobs in the monopoly labor market segment and that the placement affects on wages.

DISCUSSION

The result of empirical analysis indicates that Asian-born scientists and engineers are integrated into the labor market in term of wages. There is no evidence that shows their wages are significantly different from native born white and native-born Asian scientists and engineers, when individual attributes, occupational group, and labor market segments are controlled. The different returns to human capital across groups are not found. And the handicap of race or the foreign-born is not associated with labor market segment in determining wages. This result is consistent with the argument that some Asian-American groups have reached parity with white

TABLE 3. REGRESSION OF LOG WAGES PER WEEK ON INDIVIDUAL ATTRIBUTES, OCCUPATIONAL GROUP AND LABOR MARKET SEGMENTS: UNSTANDARDIZED REGRESSION COEFFICIENTS

Models	(1)	(2)	(3)	(4)	(5)	(6)
Individual Attributes						
Education	.038**	.041**	.041**	.053*	.042**	.042**
Experience	`.045**	.043**	.043**	.043**	.035**	.043**
Experience Squared × 10	−.008**	−.008**	−.008**	−.008**	−.008**	−.008**
English	.093**	.091**	.091**	.091**	.092**	.089**
Sex	−.321**	−.244**	−.241**	−.241**	−.240**	−.241**
Native White	−.062	−.029	−.027	.207	−.127	−.067
Native Asian	−104	−.079	−.074	.410	−.180	−.130
Occupational Groups						
Engineers	.059*	.050*	.050	.049	.049	
Social Scientists	−.221**	−.212*	−.211**	−.211**	−.211**	
Labor Market Segments						
Monopoly	.059*	.059*	.058*	.050		
Regional	.056	.057	.055	.053		
Interaction						
Education x Native White	−.012					
Education x Native Asian		−.025				
Experience x Native White		.010				
Experience x Native Asian	.010					
Monopoly x Native White					.116	
Monopoly x Native Asian		.169				
Constant	4.833	4.716	4.691.	4.462	4.772	4.740
R-square	.361	.376	.379	.379	.380	.380

*p < 0.05,   ** p < 0.01.

TABLE 4. R-SQUARE CHANGES AND F-STATISTICS FOR MODELS OF SCIENTISTS AND ENGINEERS' LOG WAGES PER WEEK

Model	R-Square Change	F-Statistics
Model 1 vs. 2	.011	17.255***
Model 2 vs. 3	.002	2.872*
Model 3 vs. 4	.000	0.230
Model 3 vs. 5	.001	1.711
Model 3 vs. 6	.001	0.889

*p < 0.1,   ** P < 0.05,   *** p < 0.01.

Americans (Hirshman and Wong 1981; Nee and Sanders 1985).

The supply and demand for Asian scientist and engineer immigration are driven by the differential in scientist and engineer salaries between the U.S. and Asian countries, and by the structural disparity in educational and professional opportunities. The fact that Asian scientist and engineer immigrants reach wage parity with the native-born groups may stimulate immigration flow to increase. However, the flow is regulated by economic and political factors which are mediated by immigration laws and regulations.

This study has several limitations. First, since this study is based on the data that have limited variables, some potentially important variables, such as the characteristics of work place and authority of jobs, are not explored. Second, especially in the case of immigrants, the origin of human capital is not considered. It will be important in examining transferability of human capital from other countries. Third, since the study is based on the Asian-born scientists and engineers who already have jobs, it may not be appropriate to show the whole picture of labor market adjustment of the immigrant scientists and engineers. Parlin (1976) notes the disadvantage of employment of professional immigrants as a crucial aspect of immigrants' labor market adjustment.

There is no information on Asian scientists and engineers who are unable to find work within their fields. The proportion of those scientists and engineers may be higher for Asian immigrants, especially for those who did not enter through the occupational preferences. Since they do not have a sponsoring firm, they are likely to go further down the hiring queue, and likely have less job security. There is evidence that some highly educated Asian immigrants are unable to use their training in the United States (Hurh and Kim 1984). Finally, there may be other aspects in the labor market adjustment of immigrant scientists and engineers. There are many kinds of rewards for the performance of scientific and engineering roles, such as prestige and function in the organization (Leventman 1981; Allison and Long 1987). The present analysis is limited to wage rates.

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