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The Effect of College Major on Labor Market Outcomes of Chinese Immigrants

An Examination of Undergraduate Major Choices and Their Impact on Employment and Earnings

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Abstract Education is a crucial factor that determines labor market outcomes, especially for immigrants. This paper specifically examines the undergraduate major choice for Chinese immigrants and its relationship to their labor market outcome. Compared to other Asian groups and the mainstream society, Chinese immigrants are uniquely congregated in business and science categories. The level of popularity to a major is positively related to their labor market outcome. This finding reveals the current premarket educational investment pattern for Chinese immigrants and adds to the existing literature by focusing on how detail education quality in terms of major relates to labor market performance.

Keywords Labor · Immigration · Higher Education · Human Capital · Asian Immigrants

Introduction

Since the passage of the Immigration and Nationality Act in 1965 that removed all previous quotas and immigration restrictions, Asia has quickly become the second largest source of immigrants to the USA (Xie & Goyette 2003). According to the 2010 Census, Asians constitute 4.8 % of the national population, an increase of 43.3 % from 2000. Among all the Asian groups, the largest share is Chinese Americans at 1.1 % of the national

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population, compared to 0.2 % for Japanese Americans, 0.5 % for Korean Americans, and 0.9 % for Asian Indians. Despite this rapid growth in population, only a modest amount of economic research has been done on Asian Americans. Further, the work that has been done has looked at Asian Americans as one homogeneous group. It should be noted, however, that there is an enormous variation among the different Asian-American ethnic groups. Thus, these groups should be examined separately (Barringer et al. 1990).

This study targets Chinese immigrants in the USA with a college degree. The choice of a college major for Chinese immigrants is compared to that of other groups, specifically, Japanese immigrants and Korean immigrants, as well as native born non-Hispanic whites. The study specifically focuses on how the choice of major affects employment opportunities and pay. The three main research questions are stated below:

Question 1: Are there certain majors most frequently chosen by Chinese immigrants? Are they different from other groups' choices?

Question 2: Which majors that Chinese immigrants have had have lead to a better chance of being employed? Do those majors correspond to the most popular ones?

Question 3: Which majors that Chinese immigrants have had have yielded a higher monetary return? Are those majors the most popular ones? How does the pay level for Chinese immigrants compare to pay level for non-Hispanic Whites and the other Asian immigrants who graduated with the same major?

According to the blocked opportunity theory and the assumption of ability preference, I hypothesize that science-related majors are most frequently chosen by Chinese immigrants, and that these majors yield a higher probability of being employed and a higher wage rate for Chinese immigrants than other majors. The level of wage differential for individuals from China than from other groups under the same college major is yet unknown.

The paper will proceed as follows: "Literature Review and Theoretical Background" presents some key literature and theoretical background on minorities' education and pay. "Empirical Model" discusses the empirical model and its applications to this research. "Data" includes the explanation of the data set including sample restrictions, size, observations, variables, and how they will be applied in the model. "Analysis and Results" presents regression results, and "Summary and Conclusion" concludes this research with a summary and implications.

Literature Review and Theoretical Background

Although Chinese immigrants have the longest history in the USA among Asian groups, their real prosperity did not come until the removal of immigration quotas. Generally, the USA has adopted "selective immigration policies," which admit immigrants for family reunification or with skills valued in the US labor market. The 1990 Immigration Act introduced the system of visas "allowing entry of high-tech workers with a sponsoring employer for up to six years (with the subsequent chance of applying for US citizenship) and also raised the share of employment-based visas in the total immigrant flow" (de Coulon & Wadsworth 2010). Chinese and Japanese immigrants have benefited the most from allowing skilled workers to migrate to the USA. This, in

part, explains the fact that 41 % of people born in China and living in the USA have at least a bachelor's degree compared to only 26 % of the native population.[1]

Previous research has largely focused on comparing all Asian immigrants as one homogeneous group with other racial ethnicity groups, and little attention has paid on the difference within the Asian American group. Especially for China, Japan, and Korea, there are a lot of cultural similarities. For example, their languages are all derived from China in history; their common appreciation of Confucius also has a large impact on their choice of education (Yoo & Jin 2009). However, many differences exist as well among these Asian American groups, stemming from their history in the USA and their native country's relationship with the US. Therefore, to compare how undergraduate education affects pay of Chinese immigrants differently than other Asian groups is an interesting and important topic.

In Human Capital Theory, education is a crucial pre-market factor that determines labor market outcomes (Ehrenberg et al. 2006). Chiswick (1983), using the 1970 Census, found that an extra year of schooling raises earnings by about 6.5 to 6.9 % on average, and the rate has been increasing steadily. Various researches have indicated that Asian immigrants in the USA tend to have higher levels of schooling than other ethnicity groups. Chiswick (1983) pointed out only 26 % of other Americans achieved the same level of education as Chinese and Japanese immigrants. Since then, Asian immigrants have always been regarded as "model minorities" (Kitano 1976). Arabsheibani and Wang (2010) find that among the recent newcomers from Asia, the large endowment advantages of Asian Indians and Chinese mitigate the negative effect of discrimination and lead to higher income compare to white; however, they are still discriminated against, such as lack of physical and mental health attention from employer, hiring barrier due to language (de Castro et al. 2010).

According to Black et al. (2006), much of the variation in completed education across racial ethnicity groups is at the college level. They also found that the role of labor market discrimination shows a stronger interest at the top end of the labor market. In this paper, I focus on the effect of undergraduate education on one's labor market return. While measuring the quality of education, college major is the most important indicator for the purpose of this paper. Most existing studies choose years of schooling to measure the contribution of education to earnings, but this is not sufficient. The quality of education leads to the variation of returns to earnings, and the specific domain of knowledge represented by college major is usually a good indicator of education quality (Black et al. 2006). Research shows that Asian American college students are disproportionately more likely to major in engineering, math, and various sciences and are less likely to choose fields in the humanities, art, and education than any other groups (refer to Table 1). Xie and Goyette as well as many other researchers have identified two theories to explain this phenomenon.[2]

One theory is called "blocked opportunities." According to Xie and Goyette (2004), Asian Americans take education as a means to overcome obstacles to social mobility. There is a direct association between one's educational credentials and one's entry into certain occupations; it always requires a medical degree to be a physician and a doctoral degree in a science field to be a researcher in the sciences. Xie and Goyette (2004) say

[1] Data from the 2010 CPS March Supplement

[2] Similar theories can be found from Kao & Thompson 2003; Sue & Okazaki 1990; Chen & Stevenson 1995.

Table 1 Mean wage and college major choices

	Mean wage bachelor's degree ($)	Asian (%)	White (%)	Black (%)	Hispanic (%)
Engineering	24.73	29.75	12.72	5.97	13.73
Mathematical sciences	21.75	3.28	2.58	2.70	2.10
Business and economics	21.38	21.07	28.10	25.16	23.79
Physical sciences	19.74	7.33	4.57	3.05	3.50
Social sciences	19.24	7.42	13.91	17.89	13.79
Health professions	19.09	5.2	2.61	2.48	3.53
Engineering technology	19.00	2.45	1.88	2.41	2.12
Computer sciences	18.49	3.64	1.75	1.25	2.48
Life sciences	17.44	5.22	4.94	4.54	6.04
Humanities	17.14	4.43	6.76	5.15	7.38
Education	17.05	2.39	8.10	14.04	8.80
Professional degree	17.01	2.18	5.33	8.08	5.96
Agricultural sciences	16.47	2.68	2.58	1.88	2.82
Fine arts	16.13	1.77	3.30	3.50	3.01
Major not elsewhere classified	–	1.20	0.91	0.92	0.96

The data are weighted to account for sample stratification. Wage estimates are for all men whose highest degree is a bachelor's reporting positive earnings for the year with non-imputed data on earnings, weeks worked, and usual hours of work per week. Other estimates are based on the sample of men (or men and women) with non-imputed gender, highest degree, and major who were in the NSCG

Table obtained from *Why Do Minority Men Earn Less? A Study of Wage Differentials Among the Highly Educate*, by Black et al. (2006)

"regardless of one's social origin, job opportunities in these fields are widely open once one attains the educational credentials." Given this close link, one's choice of major is often made to maximize socioeconomic outcomes. A quote in *Asian Americans*: *A Demographic Portrait* from a Korean American best describes this:

> I don't think that Asians prefer the sciences. Sometimes it is the only avenue open to them. In the sciences, empirical results matter more than in the esoteric discussion of humanities. So that at least as an engineer, you know how to put machines in, and you can be a useful bolt and nut. And I think the job opportunities for us lie in this field. (Xie & Goyette 2004)

Another theory to explain the concentration of majors is based on the assumption about "ability." On various standardized tests, Chinese Americans show a greater proficiency in math and only slightly lower verbal aptitude than whites (Xie & Goyette 2004). For Chinese students, the better performance in certain areas encourages them to go into that major in college in order to earn greater occupational prestige, social standing, and income.

Based on theoretical assumptions, I examine how much each college major is "worth" to a Chinese immigrant; and I would hypothesize that for Chinese immigrants,

the most popularly chosen fields will yield a better chance of being employed and will result in higher pay.

While education has shown to be crucial for immigrants in the destination labor market, the transferability of human capital also determines the process of assimilation. According to the "search and match theory" (Chiswick & Miller 2009), it is hard for new immigrants to find jobs that really match their ability because of imperfect information in the labor market. Chiswick and Miller (2009) say "This would suggest that immigrants may substitute schooling for non-recognized labor market experience." However, over time, the mismatch decreases and the "overeducated" phenomena also decrease as well. Ehrenberg et al. (2006) say, "While immigrants start work in the United States with earnings that average only 60 percent of the native-born earnings level, 15 years later, their relative earnings have climbed to roughly 80 percent."

Marital status, number of children, occupation, self-employment, urban residence, years in the USA, English proficiency, and citizenship status are control variables seen in many labor economic studies. Married men tend to earn more than unmarried men (Fang 1996). The number of children is predicted to have a positive relationship with the probability of being employed and with the pay level (Apps & Rees 2001). Fang (1996) found that Chinese immigrants tend to be in professional occupations while Japanese immigrants tend to be in managerial occupations. There is a tendency for immigrants from the same country to live in the same area (Borjas 1999). Chinese immigrants tend to congregate on the east and west coasts (Scott et al. 2005). With immigrants from the home country residing in the neighborhood, the many possible networking opportunities are provided for an easier transition for new immigrants. However, the high concentration of certain immigrants is also likely to form ghetto economies. One example is Chinatown (Borjas 1999). English proficiency is the most important indicator of how a non-native-English-speaking immigrant adjusts to a new environment. It also serves as a signal of a more able worker (Borjas 1999). Zhou and Kamo (1994) indicate in their research that being bilingual increases an immigrant's job options and the chances of getting better-paying jobs.

Empirical Model

In order to solve the problem and test the hypotheses, I use both logit and linear models. I attempt to show the effect of a Chinese immigrant's pre-market human capital from education through evaluating both the possibility of being employed by logit model and the wage level by log-linear model.

The advantage of the logit model is to offer conditional probabilities of specific outcomes to be calculated from the estimated coefficients (Mattoo et al. 2008). More formally, I estimate the following model of immigrants' probability of being employed:

$$\text{Prob}(\text{Yi} = 1) = \frac{e^z}{1+e^z}, \quad \text{while } Z_i = \sum\nolimits_{\kappa} \beta_{\kappa i} X_{\kappa i} \tag{1}$$

In model (1), Yi=1 is an individual being employed under the logit Z_i. Logit Z_i is evaluated as:

$$Z_i = f\left(\text{college-major}_i,\ \text{educational-attainment}_i,\ \text{years-in-USA}_i,\ \text{years-in-USA}^2{}_i,\ \text{age}_i,\ \text{age}^2{}_i,\ \text{English-proficiency}_i,\ \text{urban-residence}_i,\ \text{number-of-children}_i,\ \text{marital-status}_i,\ \text{citizenship-status}_i,\ \text{geographic-residence}_i\right)$$

When evaluating a group's labor market success, earnings are arguably the most important measure. Earnings directly reflect the demand and supply for a worker's skill and productivity in the labor market (Xie & Goyette 2004). For example, two different industries can have the same demand for workers but one might get paid much more because of a smaller pool of workers with the needed skills. As for estimating earnings, I use a multiple regression log-linear model to identify the percentage change in earnings caused by each unit of change in the independent variables.

$$\begin{aligned}\text{LnEarnings}_{ik} = f\,(&\text{college-major}_{ik}, \text{educational-attainment}_{ik}, \text{age}_{ik}, \text{English-proficiency}_{ik},\ \text{urban-residence}_{ik},\ \text{number-of-children}_{ik},\ \text{marital-status}_{ik},\\ &\text{occupation}_{ik}, \text{self-employment}_{ik}, \text{citizenship-status}_{ik}, \text{geographic-residence}_{ik})\end{aligned} \quad (2)$$

LnEarnings_{ik} is the log annual earnings of individual i from group k. College majors are the most important explanatory variables. Fourteen dummies are created for college majors in comparison to Arts as the omitted category. The coefficient thus represents a wage premium associated with each college major compared to Arts for individuals from country k. The pay level for Chinese immigrants compare to pay level for non-Hispanic whites and the other Asian immigrants who graduated with the same major is then measured by the differentials of coefficient for each college-major variable across k's.

Data

Data for this research is taken from the American Community Survey 2009, 1 % sample, generated from the 2010 Integrated Public Use Micro Series created by Ruggles, Alexander, Goeken, Schroeder, and Sobek at the University of Minnesota. Immigrant is defined by birthplace outside of the USA and is currently in the USA on the track of earning the citizenship. To exclude students and retired people, individuals from age 25 to 70 (as of 2009, the survey year) were selected. For the simplicity of analysis, data is restricted to males. For the purpose of this paper, I selected all individuals with at least a bachelor's degree. Further, if an individual only works a few weeks in a year but achieves a relatively high level of pay, the relationship of his/her human capital and the pay level may be biased by other reasons, e.g. the nature of the job; and this will cause unnecessary outliers for the model. Therefore, for the wage model, I further limited the data to all who were employed for more than 40 working weeks in 2008, the year before the survey. According to the raw data from IPUMS ACS 2009 sample, there are 38 general major categories. I recoded them into 15 large categories according to the major grouping method from Georgetown University Public Policy Institute, Center on Education and the Workforce.[3]

Each observation is an individual. A logistic model is applied in finding the relationship between one's major and the probability of being employed. In valuing

[3] Detail coding method is attached in Appendix.

the relationship between one's college major and the wage level, I use a log-linear model. To compare the results among Chinese immigrants and other racial and ethnicity groups, I divided the data into four different categories defined by each individual's native country: Chinese immigrants, Japanese immigrants, Korean immigrants, and US born non-Hispanic whites. A total of five samples have taken (one for the logit model; the rest for the log linear model), as shown by Table 2.

For the logit model, employment status is the dependent variable. It is coded as 1 if one is employed, otherwise 0. For the LnWage model, the dependent variable is the natural log of one's total annual income (LnWage). The total income is defined as the total annual pre-tax wage and salary income for an individual the year before the survey, i.e., 2008. For details of independent variables, refer to Tables 3 and 4).

Analysis and Results

To research on the three questions mentioned at the opening of this paper, a combination of statistical methods are applied.

Question 1 seeks to examine if there are certain major categories more popular among Chinese immigrants than the other majors and if this popularity is statistically significantly different from other groups. Table 5, organized from the unweighted descriptive statistics, offers an overview of the percentage of Chinese immigrants graduated from each major. It also compares the percentage of Japanese immigrants, Korean immigrants, and non-Hispanic whites in each major to see the different patterns existing in their major choices. The descriptive statistics show that engineering and business are the two majors chosen most frequently out of a total of 15 major categories by all groups. About 36 % of Chinese immigrants choose engineering and 13 % choose business. While other groups choose social science, humanities, and other categories most often, Chinese immigrants have all their top five choices related to science and business, among which math and computer science are their second most preferred field with 13.93 % of them chosen, and physical science as the fourth with 10.19 % and biology and life science the fifth with 8.51 %.

Table 2 Sample sets and size

	Chinese immigrants[a]	Japanese immigrants[b]	Korean immigrants[c]	Native-born non-Hispanic whites[d]
Logit model	3,990	–	–	–
LnWage model	3,209	699	1,381	14,232

[a] Chinese immigrant: born in China, currently either a permanent resident in the US (green card holder) or a US citizen

[b] Japanese immigrant: born in Japan, currently either a permanent resident in the USA (green card holder) or a US citizen

[c] Korean immigrant: born in Korea, currently either a permanent resident in the USA (green card holder) or a USA citizen

[d] Native-born non-Hispanic whites: born in the USA, a U.S. citizen or green card holder, self-identified as white, and not Hispanic origin

Table 3 Variable names, definitions, and descriptive statistics for the logistic model

Note	Standard deviation	Mean	Definition	Variable name
	0.116	0.01	1 if with Agriculture and Nature degree, 0 otherwise	Agriculture Nature
	0.338	0.13	1 if with Business degree, 0 otherwise	Business
	0.127	0.02	1 if with Education degree, 0 otherwise	Education
	0.199	0.04	1 if with Humanity and Liberal Arts Degree, 0 otherwise	Humanity Liberal Arts
	0.089	0.01	1 if with Communication degree, 0 otherwise	Communication
	0.266	0.08	1 if with Biology degree, 0 otherwise	Biology Life Science
	0.339	0.13	1 if with Math/Computer Science de gree, 0 otherwise	Math Computer
	0.479	0.36	1 if with Engineering degree, 0 otherwise	Engineering
	0.293	0.09	1 if with Physical science degree, 0 otherwise	Physical Science
	0.173	0.03	1 if with Health degree, 0 otherwise	Health
	0.074	0.01	1 if with Industrial Consumer Service degree, 0 otherwise	Industrial Consumer Service
	0.11	0.01	1 if with Psychology degree, 0 otherwise	Psychology
	0.235	0.06	1 if with Social Science degree, 0 otherwise	Social Science
Omitted for model 4	0.063	0	1 if with Law and Public Policy degree, 0 otherwise	Law Public Policy
Omitted for model 2, 3, and 5	0.131	0.02	1 if with Arts Degree, 0 otherwise	Arts
	0.146	0.98	1 if live in metropolitan area, 0 otherwise	Metro
	0.931	0.86	Number of child	Nchild
	11.444	44.89	Age (from 25 to 70)	Age
	1065.219	2145.62	Age^2	Age^2
	0.432	0.75	1 if married and spouse present, 0 otherwise	Marst
	0.475	0.66	1 if US citizenship, 0 otherwise	Citizen
	11.964	20.05	Years in the USA	Yearsusa
	585.724	545.21	Square of years in the USA	$Yearsusa^2$
	0.257	0.93	1 if one speaks English well or very well, 0 otherwise	Speakeng
Omitted	0.304	0.1	1 if lives in Midwest, 0 otherwise	Midwest
	0.425	0.24	1 if lives in Northeast, 0 otherwise	Northeast
	0.406	0.21	1 if lives in South, 0 otherwise	South
	0.498	0.45	1 if Lives in West, 0 otherwise	West
Omitted	0.474	0.34	1 if has bachelor's degree, 0 otherwise	Bachelor's
	0.481	0.36	1 if has master's degree, 0 otherwise	Master
	0.24	0.06	1 if has professional degree, 0 otherwise	Professional
	0.423	0.23	1 if has doctoral degree, 0 otherwise	Doctoral

Table 4 Variable names, definitions, and descriptive statistics for the log-linear model

Note	Stamdard deviation	Mean	Definition	Variable name
	0.11	0.01	1 if with Agriculture and Nature degree, 0 otherwise	Agriculture Nature
	0.33	0.13	1 if with Business degree, 0 otherwise	Business
	0.1	0.01	1 if with Education degree, 0 otherwise	Education
	0.19	0.04	1 if with Humanity Liberal Arts degree, 0 otherwise	Humanity Liberal Arts
	0.09	0.01	1 if with Communication degree, 0 otherwise	Communication
	0.28	0.09	1 if with Biology degree, 0 otherwise	Biology Life Science
	0.35	0.14	1 if with Math/Computer Science degree, 0 otherwise	Math Computer
	0.48	0.36	1 if with Engineering degree, 0 otherwise	Engineering
	0.3	0.1	1 if with Physical Science degree, 0 otherwise	Physical Science
	0.17	0.03	1 if with Health degree, 0 otherwise	Health
	0.07	0	1 if with Industrial Consumer Service degree, 0 otherwise	Industrial Consumer Service
	0.1	0.01	1 if with Psychology degree, 0 otherwise	Psychology
	0.23	0.06	1 if with Social Science degree, 0 otherwise	Social Science
Omitted for model 4	0.07	0	1 if with Law and Public Policy degree, 0 otherwise	Law Public Policy
Omitted for model 2,3,5	0.13	0.02	1 if with Arts degree, 0 otherwise	Arts
	0.15	0.98	1 if live in metropolitan area, 0 otherwise	Metro
	0.94	0.92	Number of child	Nchild
	10.21	43.98	Age (from 25 to 70)	Age
	926.21	2038.13	Age^2	Age^2
	0.42	0.77	1 if married and spouse present, 0 otherwise	Marst
	0.47	0.67	1 if US citizenship, 0 otherwise	Citizen
	11.17	19.94	Years in the USA	Yearsusa
	543.27	522.45	Square of years in the USA	$Yearsusa^2$
	0.21	0.95	1 if one speaks English well or very well, 0 otherwise	Speakeng
Omitted	0.3	0.1	1 if lives in Midwest, 0 otherwise	Midwest
	0.43	0.24	1 if lives in northeast, 0 otherwise	Northeast
	0.41	0.21	1 if lives in South, 0 otherwise	South
	0.5	0.44	1 if Lives in West, 0 otherwise	West
Omitted	0.47	0.34	1 if has bachelor's degree, 0 otherwise	Bachelor's
	0.48	0.37	1 if has master's degree, 0 otherwise	Master
	0.24	0.06	1 if has professional degree, 0 otherwise	Professional
	0.44	0.26	1 if has doctoral degree, 0 otherwise	Doctoral
	0.3	0.1	1 if self-employed, 0 otherwise	Self Emp
Omitted	0.46	0.7	1 if occupation is managerial/professional, 0 otherwise	Managerial & Professional
	0.43	0.24	1 if occupation is technical, sales, or admin support, 0 otherwise	Technical Sales Admin
	0.17	0.03	1 if occupation is service, 0 otherwise	Service

Table 4 (continued)

Note	Stamdard deviation	Mean	Definition	Variable name
	0.04	0	1 if occupation is farming, forestry, fishing, 0 otherwise	Farming Forestry Fishing
	0.13	0.02	1 if occupation is precision production, craft, repair, 0 otherwise	Precision Craft
	0.11	0.01	1 if occupation is operator, fabricator, laborer, 0 otherwise	Operator Fabricator

To answer if the special preference is statistically significantly different from other groups, I proposed the null hypothesis: the pattern of major choice is independent from the native groups, i.e., there is no statistical uniqueness for each group's major choice. I use the chi-square test to examine the independence of the pattern. The test returns a chi-square of 2,341.394 with a degree of freedom of 42. The *P* value is approximately zero, less than a 0.05 level of statistical significance. We reject the null hypothesis and conclude that the pattern of major choices for each native group is not independent of the native groups. In another words, the chi-square test concludes that the major choice pattern for Chinese immigrants was statistically different from other groups' choices.

The results show that Chinese immigrants tend to study science and engineering, even more so than Koran immigrants and Japanese immigrants, who have their top interests spread out into humanities and other non-science areas. Examining the top five choices of each group, it is surprising to see that Japanese immigrants and Korean immigrants share more similarities with non-Hispanic whites (four out of five of the mostly chosen fields are the same).

The second research question looks for one's probability of being employed after graduation with certain major. I use the logistic model (model 1) to examine the relationship.

$$\text{Model 1}: \text{Prob}(\text{Yi}=1)=\frac{e^{z}}{1+e^{z}},\ \text{where logit}\ Z_i=\sum\nolimits_{\kappa}\beta_{\kappa i}X_{\kappa i}\ \text{(Specific variables refer to Table 3 in the Data Section)}$$

As stated in the theory section, logit regression better interprets the non-linear probability model and returns conditional probabilities of specific outcomes (Mattoo et al. 2008).

According to results presented in Table 6, model 1 has a chi-square of 663.442 with 29 degrees of freedom, which yields a *P* value of less than 0.00. It is overall statistically significant at the 5 % level. Among the major category variables, Biology Life Science, Math Computer, Engineering, Physical Science, Social Science, and Law Public Policy are statistically significant at the 10 % level of significance.

In order to better interpret the model results, I present the expected probability of being employed under each major category by fixing the other control variables, which creates a hypothetical person whose profile constitutes of mean values assigned to each other variable: age 43, married, has one child, US citizen, lives in the northeast metropolitan area, has been in the USA for 20 years, speaks good English, and has a

Table 5 Major popularity ranking for Chinese immigrants

Non-Hispanic whites		Korean immigrants		Japanese immigrants		Chinese immigrants		
Majors	%	Majors	%	Majors	%	Majors	%	
Business	25.07	Engineering	26.86	Engineering	24.18	Engineering	35.65	#1
Engineering	13.51	Business	17.74	Business	17.74	Math and Computer Science	13.93	#2
Social Science	10.62	Social Science	11.15	Social Science	16.60	Business	12.59	#3
Humanity and Liberal Arts	10.34	Humanity and Liberal Arts	10.28	Humanity Liberal Arts	7.15	Physical Science	10.19	#4
Education	6.83	Biology and Life Science	7.31	Biology Life Science	6.44	Biology Life Science	8.51	#5
Math and Computer Science	5.42	Math and Computer Science	7.17	Math and Computer Science	5.87	Social Science	5.70	#6
Biology and Life Science	5.31	Physical Science	5.94	Physical Science	5.87	Humanity and Liberal Arts	3.80	#7
Communication	3.58	Arts	3.69	Education	3.29	Health	3.02	#8
Physical Science	3.20	Education	2.03	Agriculture and Nature	2.43	Arts	1.46	#9
Psychology	3.19	Agriculture and Nature	1.74	Arts	2.29	Agriculture and Nature	1.28	#10
Arts	3.16	Law and Public Policy	1.67	Health	2.15	Psychology	1.09	#11
Agriculture and Nature	3.01	Health	1.52	Communication	1.86	Education	1.06	#12
Law and Public Policy	2.54	Psychology	1.30	Psychology	1.43	Communication	0.81	#13
Health	2.12	Communication	1.23	Industrial Consumer Service	1.43	Industrial Consumer Service	0.47	#14
Industrial Consumer Service	2.08	Industrial Consumer Service	0.36	Law and Public Policy	1.29	Law and Public Policy	0.44	#15

Table above is generated from unweighted descriptive statistics of the dataset by the author. Ranking is based on percentage of people graduated from certain major field and comparisons

Table 6 Logit model regression output

Constant, −7.103*** (0.000)	Chi-square, 663.44	*N*=3,990
Variable name	Beta	(*P* value)
Agriculture Nature	0.290	(0.567)
Business	0.414	(0.201)
Education	0.051	(0.905)
Humanity Liberal Arts	0.300	(0.416)
Communication	0.852	(0.175)
Biology Life Science	1.012***	(0.009)
Math Computer	0.844**	(0.012)
Engineering	0.582*	(0.063)
Physical Science	0.858**	(0.016)
Health	0.603	(0.136)
Industrial Consumer Service	−0.190	(0.755)
Psychology	−0.240	(0.610)
Social Science	0.627*	(0.080)
Law Public Policy	2.713**	(0.017)

*Significant at the .1 level
**Significant at the .05 level
***Significant at the .01 level; () is the *P* value

master's degree. Table 7 shows the results from model 1, depicting how each undergraduate major correlates to a Chinese immigrant's probability of being employed.

From Table 7, the five majors that yield the highest probability of being employed for Chinese immigrants are Law and Public Policy, Biology and Life Science, Physical Science, Communications, and Math and Computer Science. Among these fields, only Communication is not statistically significant at a 5 % level. In the descriptive statistics, Math and Computer Science, Physical Science, Biology and Life Science are among

Table 7 Majors ranking based on probability of being employed

Rank	Degree of fields	Probability (%)
#1	Law and Public Policy	99.31
#2	Biology and Life Science	96.31
#3	Physical Science	95.72
#4	Communication	95.70
#5	Math and Computer Science	95.66
#6	Social Science	94.67
#7	Health	94.55
#8	Engineering	94.44
#9	Business	93.48
#10	Humanity and Liberal Arts	92.75
#11	Agriculture and Nature	92.69
#12	Education	90.89
#13	Industrial Consumer Service	88.69
#14	Psychology	88.18

Data computed from regression output based on the hypothetical person. Ranking based on the probability of being employed

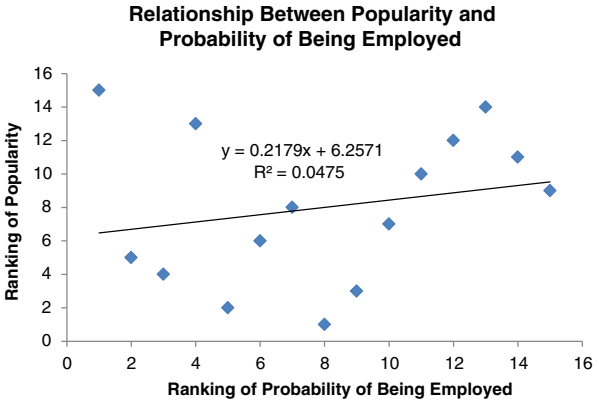
the top five most preferred majors by Chinese immigrants and are among the top five majors with the highest probability of being employed as well. However, engineering and business, the other two most preferred majors, do not show such a high probability of employment. I pair up the ranking of each major based on popularity level by Chinese immigrants, (as shown in Table 5) and the ranking of each major based on the probability of being employed for Chinese immigrants (as shown in Table 7), resulting in Graph 1. Graph 1 reveals a weak positive relationship between the probability of a Chinese immigrant being employed with a certain major and the preference of choosing that major. Coefficient shows that to improve the probability of being employed ranking by one level, it is predicted to have the popularity ranking improving by 21.8 %.

I used log-linear models to approach the third question of this research, answering if the most popular majors correlate to higher levels of pay for Chinese immigrants and how the result compares to non-Hispanic whites and to other Asian immigrants. Model 2 reveals the relationship of each college major Chinese immigrants graduated with and the pay level received, while controlling for other factors. The dependent variable is natural log of total annual pre-tax wage and salary income (LnWage). Models 3, 4, and 5 reveal the result for non-Hispanic whites, Japanese immigrants, and Korean immigrants. The cross-sectional effect will be reviewed by comparing the coefficient of the college major variable on each nativity group.

In Table 8, the regression output of the key variables, i.e., college degree variable, is shown. Model 2, the model of Chinese immigrants, has an R^2 of 0.38, which explains approximately 38 % of the variation for the LnWage for Chinese immigrants. It is overall statistically significant at the 5 % level. I omit Arts in this model; therefore, the effect of other college major variable serves as a comparison to the effect of Arts.[4] It turns out that most categories are statistically significant at the 5 % level; Law Public Policy is the only variable statistically significant at the 10 % level. Education, Humanity Liberal Arts, and Industrial Consumer Service are not statistically significant at 10 % level. Compared to Arts, all the fields show a positive effect on Chinese immigrants' pay. From the regression output, a Psychology degree shows the highest return on education for Chinese immigrants. *Ceteris paribus*, a Chinese immigrant with a Psychology degree is predicted to have 117.6 % higher earnings than one with an Arts degree. Besides Arts, Humanity Liberal Arts degree shows the least return on Chinese immigrants' pay, predicted to be 43.6 % higher than one with Arts degree while holding other things constant. Table 9 reorganizes the effect of each field on Chinese immigrant's earnings. The result reveals that degrees in certain fields do yield higher pay back than others. From the table, Psychology, Health, Math and Computer Science, Engineering, and Biology and Life Science are the five majors predicted to have the highest return on earnings.

To compare the list of the top five mostly chosen majors and the top five fields with the largest effect on pay, we see that Engineering, Math and Computer Sciences, and Biology and Life Science are on both lists. While putting the ranking result from model 2, as shown in Table 9 with the ranking of major popularity, as shown in Table 5, a

[4] Regression on various omitted categories are tested, omitting Arts returns more statistically significant variables for model 2, 3, 5 and omitting Law and Public Policy returns more statistically significant variables for model 4.



Graph 1 Relationship between popularity and probability of being employed

moderate positive relationship can be seen from Graph 2, which shows that for Chinese immigrants, one level of improvement in the ranking of monetary return from a major is predicted to have 43.57 % improvement on the popularity ranking on that major.

To answer the last part of the third research question, what the cross-sectional return on education comparison is like among Chinese immigrants, Japanese immigrants, Korean immigrants, and native-born non-Hispanic whites, I present the comparison by subtracting the coefficient of each major variable for the other groups from the coefficient of the major for Chinese immigrants.[5] Table 10 shows a detailed comparison results.

In general, most majors are predicted to have a larger effect on Chinese immigrants than on other groups compared to Art.[6] The only majors with disadvantage to Chinese immigrants are Law and Public Policy to Japanese immigrants, Communication and Humanity and Liberal Arts to Korean immigrants. Law and Public Policy degree shows that Japanese immigrants have a 58.6 % advantage over Chinese immigrants; Humanity and Liberal Arts degree shows a 15.10 % advantage for Korean immigrants over Chinese immigrants; and a Communication degree returns a 49.30 % advantage for Korean immigrants.

When comparing the differences, a degree in Psychology has the largest differences for Chinese immigrants compared to all the other nativity groups. Ceteris paribus, Psychology degree is predicted to have 71.9 % larger effect on Chinese immigrants than on non-Hispanic whites, 141.4 % larger effect than on Japanese immigrants, and 96.7 % larger effect than on Korean immigrants. Other majors sometimes show a larger difference in monetary return on education to Chinese immigrants, but smaller differences in return on education to other group. For example, Law and Public Policy degree shows the least effect on Chinese immigrants' pay among all other majors in

[5] In model 4, for Japanese immigrants, since the regression output generated upon omitting Law and Public Policy instead of omitting Arts, I first translate the meaning of each coefficient by comparing each one to the coefficient of Arts in model 4 and then proceed to the same experiment as with the other groups in comparison to coefficient of model 2.

[6] The baseline mean wage of Art degree across groups refer to Table 12 in Appendix II

Table 8 LgWage regression key variables cross-sectional comparison

Korean		Japanese		Non-Hispanic whites		Chinese		Variable name
(Model 5)		(Model 4)		(Model 3)		(Model 2)		
P value	Beta	*P* value	Beta	*P* Value	Beta	*P* value	Beta	
0.395	0.595	0.352	−0.829	0	0.65***	0.023	0.871**	Agriculture Nature
0.034	0.905**	0.105	−1.127	0	0.741***	0.001	0.947***	Business
0.956	0.036	0.062	−1.459*	0.106	0.209	0.108	0.646	Education
0.196	0.587	0.021	−1.672**	0.007	0.329***	0.155	0.436	Humanity Liberal Arts
0.068	1.415*	0.435	−0.671	0	0.586***	0.034	0.922**	Communication
0.437	0.382	0.135	−1.107	0	0.917***	0	1.005***	Biology Life Science
0.356	0.443	0.385	−0.644	0	0.688***	0	1.081***	Math Computer
0.06	0.784*	0.153	−0.995	0	0.815***	0	1.043***	Engineering
0.059	0.949*	0.164	−1.03	0	0.662***	0.001	0.966***	Physical Science
0.24	0.877	0.089	−1.417*	0	0.817***	0	1.132***	Health
0.644	0.605	0.025	−2.029**	0	0.685***	0.182	0.706	Industrial Consumer Service
0.774	0.219	0.052	−1.769*	0.002	0.457***	0.003	1.176***	Psychology
0.051	0.877*	0.021	−1.61**	0	0.647***	0.001	0.982***	Social Science
0.583	0.383		Omitted	0	0.68***	0.082	0.945*	Law Public Policy
	Omitted	0.065	−1.531*		Omitted		Omitted	Arts
0.001	5.021***	0	6.922***	0	7.346***	0	6.946***	(Constant)
44.70 %		45.40 %		39.10 %		38.20 %		R^2
31.006***		15.728***		284.989***		55.930***		*F*

*Significant at the .1 level

**Significant at the .05 level

***Significant at the .01 level

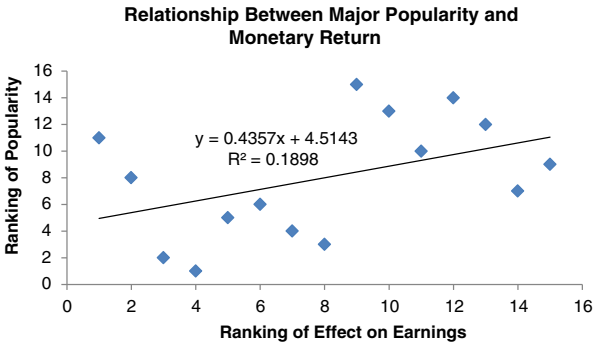
Table 9 Ranking of majors based on their effect on Chinese immigrants' earnings

Rank	Degree of fields	Percentage
#1	Psychology	117.60***
#2	Health	113.20***
#3	Math and Computer Science	108.10***
#4	Engineering	104.30***
#5	Biology and Life Science	100.50***
#6	Social Sciences	98.20***
#7	Physical Science	96.60***
#8	Business	94.70***
#9	Law and Public Policy	94.50*
#10	Communication	92.20**
#11	Agriculture and Nature	87.10**
#12	Industrial Consumer Services	70.60
#13	Education	64.60
#14	Humanity and Liberal Arts	43.60
#15	Arts	–

Ranking computed from regression output; the percentage shows the effect of the certain major on Chinese immigrants compared to the effect of the Art major
*Significant at the .1 level
**Significant at the .05 level
***Significant at the .01 level

comparison to Japanese immigrants, but it has the fifth largest effect on Chinese immigrants' pay among all other majors in comparison to the effect on pay of Korean immigrant.

In summary, results suggest that certain preferred fields of study yield higher return in the labor market than others. Table 11 selects the top five majors from the preference list, probability of being employed list, and the effect on earnings list. Among all fields, most of the Chinese immigrants graduated from Engineering, and this category yields the fourth highest pay level. While Math and Computer Science is the second most preferred major for Chinese immigrants, this category yields the fifth highest probability of being employed and the third highest pay level. Biology Life Science is the fifth highest paid and has the second highest probability of being employed. Business is the only major field on the top five mostly chosen majors that is left neither among the top five highest the probability of being employed nor among the top five highest level of



Graph 2 Relationship between major popularity and monetary return

Table 10 Comparison of the effect of each major on Chinese immigrants versus on other groups

	Versus non-Hispanic whites (%)	Versus Japanese (%)	Versus Korean (%)
Agriculture and Nature	22.10	16.90	27.60
Business	20.60	54.30	4.20
Education	43.70	57.40	61.00
Humanity and Liberal Arts	10.70	57.70	−15.10
Communication	33.60	6.20	−49.30
Biology and Life Science	8.80	58.10	62.30
Math and Computer Science	39.30	19.40	63.80
Engineering	22.80	50.70	25.90
Physical Science	30.40	46.50	1.70
Health	31.50	101.80	25.50
Industrial Consumer Service	2.10	120.40	10.10
Psychology	71.90	141.40	95.70
Social Science	33.50	106.10	10.50
Law and Public Policy	26.50	−58.60 %	56.20

The percentage is the predicted effect of certain major on Chinese immigrants than on the other groups; data generated from the regression output

pay compared to other majors. Graph 3 assembles rankings from each of the ranking tables (Tables 5, 7, and 9). It demonstrates again that there is a positive correlation among the three factors: a major's level of popularity among Chinese immigrants, their probability of being employed, and their pay level received after graduating from the major.

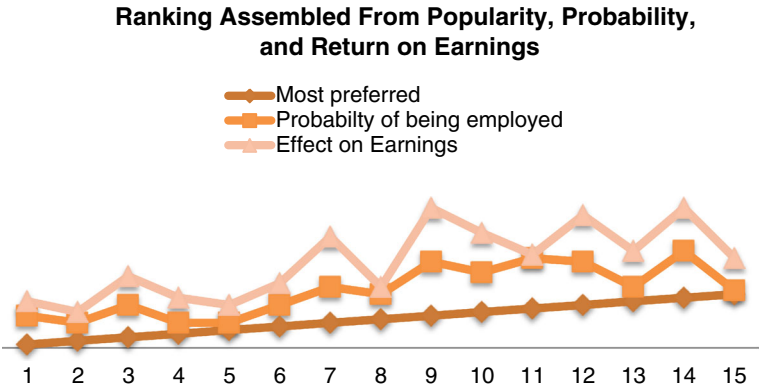
Summary and Conclusion

Asian immigrants have demonstrated an increasingly large role in the US economy. Their participation has also become an important force in the US labor market.

Table 11 Chinese immigrants degree of fields comprehensive comparison

Ranking	Highest probability	Mostly popular	Highest paid
#1	Law and Public Policy	Engineering	Psychology
#2	Biology and Life Science	Math and Computer Science	Health
#3	Physical Science	Business	Math and Computer Science
#4	Communication	Physical Science	Engineering
#5	Math and Computer Science	Biology and Life Science	Biology and Life Science

Ranking assembled from Tables 5, 7, and 9



Graph 3 Ranking assembled from popularity, probability, and return on earnings

Immigrants from China have the longest migration history with the largest population among all Asian immigration groups. More and more highly educated and skilled Chinese immigrants are coming into the US labor market seeking professional positions. In the past 5 years, a growing number of Chinese students have chosen US colleges for undergraduate study, and a substantial number choose to stay after finishing their education program. However, only modest research has targeted this group's labor market performance. This paper seeks to examine the relationship between Chinese immigrants' educational backgrounds and their labor market outcome.

There are always certain college majors more popular among students. Descriptive statistics offers a direct way to the most popular majors among Chinese immigrants. The sample statistics show that Chinese immigrants have a uniquely high tendency for choosing engineering, various sciences, and business categories, while the choices of other Asian race and ethnicity groups, i.e., Japanese immigrants, Korean immigrants, and non-Hispanic whites, are more spread out in humanities and other liberal arts categories. The chi-square test gives strong supports to the hypothesis that the major choices of Chinese immigrants are statistically different from the choices of other racial and ethnic groups.

To find the relationship between college major and employment probability, I used a binary logistic model. In order to interpret the model result, I created a hypothetical person according to the mean value of descriptive statistics to control for other variables. By fitting different college majors in the hypothetical person, I get the result of which major yields higher probability of being employed. Biology and Life Science, Physical Science, and Math and Computer Science are three of the top five most preferred majors and are among three of the top five majors with the highest probability of being employed for Chinese immigrants. While matching the ranking of popularity and the ranking of employment probability, a simple linear model shows weak positive correlation between a major's employment probability and preference.

To examine the relationship between major choices and their monetary return, i.e., pay level in the labor market, I use log-linear model. Three other separate log-linear models in testing native-born non-Hispanic whites, Japanese immigrants, and Korean immigrants are also created in order to compare the returns with Chinese immigrants.

Table 12 Mean wage of art degree across groups

Variable	Mean	Standard deviation	Min	Max
Chinese	69927.66	90241.72	0	499,000
Japanese	48831.25	48671.55	0	200,000
Korean	45070.59	35835.67	0	150,000
Non-Hispanic whites	58035.72	62373.96	0	641,000

The results reveal the pattern of the wage distribution among college majors for Chinese immigrants and for other groups (Table 12). From the model, Psychology, Health, Math and Computer Science, Engineering, and Biology and Life Science are among the top five highest payback undergraduate majors for Chinese immigrants. Three of the five mostly chosen majors for Chinese immigrants are also among top five highest paid majors. Another interesting finding from comparing the effect of each major on Chinese immigrants to the effect on other groups shows that Chinese immigrants generally enjoy a higher return on education from most majors. When comparing the differences, a degree in Psychology has the largest differences for Chinese immigrants compared to the other nativity groups. Other majors sometimes show a larger difference in monetary return on education to Chinese immigrants, but smaller differences in return on education to other group.

The findings of this research add to the existing labor economics literature and theory by focusing on examining detail educational quality in terms of one's major background in undergraduate study and one's labor market performance. It further plots the current labor market performance and the pre-labor market educational investment preference for Chinese immigrants. With the growing Chinese population in the USA attending college and finding jobs in the US labor market, there is heightened competition for science, engineering, and business major college graduates who want the same jobs. The result of the analysis will help Chinese undergraduate students obtain a general overview of their major choice and their future plan. The result could lead to a policy support to Chinese citizens majoring unpopular fields seeking study in the USA through the allocation of F-1 student visa and green card in the following process. For example, US Embassy could open an expedited path for the screening admission for students from these fields and allow specific field-related requirements for these students in the green card application. In order to retain high-skill human capital, policy could also seek for more tolerance towards qualified immigrants with science, engineering, and business major, such as adding green card quota allocation and extending their OPT period. Whether a protective policy should be supported would need further research on how the influx of immigrants with certain college major influences the native's labor market performance. Further research can also be done on comparing more nativity and minority groups across the USA in a longer time span to examine the educational quality and issues related to labor market discrimination. As the changing immigration demographic profile, immigrants' changing skill set from their college major choices is worth examination. It would be also interesting to explore immigrants' major choices and their occupations from models in the scope of labor ability matching theory.

Acknowledgment This research was supported by the Norman Leonard Research Grant from the economics department, Ohio Wesleyan University.

Appendix

Table of major groups

- Agriculture and Natural Resources
  - Agricultural Economics
  - Agriculture Production and Management
  - Animal Sciences
  - Food Science
  - Forestry
  - General Agriculture
  - Miscellaneous Agriculture
  - Natural Resources Management
  - Plant Science and Agronomy
  - Soil Science
- Arts
  - Commercial Art and Graphic Design
  - Drama and Theater Arts
  - Film Video and Photographic Arts
  - Fine Arts
  - Music
  - Studio Arts
  - Visual and Performing Arts
- Biology and Life Science
  - Biochemical Sciences
  - Biology
  - Botany
  - Cognitive Science and Biopsychology
  - Ecology
  - Environmental Science
  - Genetics
  - Microbiology
  - Miscellaneous Biology
  - Molecular Biology
  - Neuroscience
  - Pharmacology
  - Physiology
  - Zoology
- Business
  - Accounting
  - Actuarial Science

- Business Economics
- Business Management and Administration
- Finance
- General Business
- Hospitality Management
- Human Resources and Personnel Management
- International Business
- Management Information Systems and Statistics
- Marketing and Marketing Research
- Miscellaneous Business and Medical Administration
- Operations Logistics and E Commerce

Communications and Journalism
- Advertising and Public Elations
- Communications
- Journalism
- Mass Media

Computers and Mathematics
- Applied Mathematics
- Communication Technologies
- Computer Administration
- Management and Security
- Computer and Information Systems
- Computer Engineering
- Computer Networking and Telecommunications
- Computer Programming and Data Processing
- Computer Science
- Information Sciences
- Mathematics
- Mathematics and Computer Science

Education
- Art and Music Education
- Early Childhood Education
- Educational Administration and Supervision
- Elementary Education
- General Education
- Language and Drama Education
- Library Science
- Mathematics Teacher Education
- Miscellaneous Education
- Physical and Health Education Teaching
- School Student Counseling
- Science and Computer Teacher Education
- Secondary Teacher Education
- Social Science or History Teacher Education

- Special Needs Education
- Teacher Education: Multiple Levels

Engineering
- Aerospace Engineering
- Architectural Engineering
- Architecture
- Biological Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Electrical Engineering Technology
- Engineering and Industrial Management
- Engineering Mechanics Physics and Science
- Engineering Technologies
- Environmental Engineering
- General Engineering
- Geological and Geophysical Engineering
- Industrial and Manufacturing Engineering
- Industrial Production Technologies
- Materials Engineering and Materials Science
- Mechanical Engineering
- Mechanical Engineering Related Technologies
- Metallurgical Engineering
- Mining and Mineral Engineering
- Miscellaneous Engineering
- Miscellaneous Engineering Technologies
- Naval Architecture and Marine Engineering
- Nuclear Engineering
- Petroleum Engineering

Health
- Community and Public Health
- General Medical and Health Services
- Health and Medical Administrative Services
- Health and Medical Preparatory Programs
- Medical Assisting Services
- Medical Technologies Technicians
- Miscellaneous Health Medical Professions
- Nursing
- Nutrition Sciences
- Pharmacy Pharmaceutical Sciences and Administration
- Treatment Therapy Professions

Humanities and Liberal Arts
- Anthropology and Archeology

- Area, Ethnic, and Civilization Studies
- Art History and Criticism
- Composition and Speech
- English Language and Literature
- French, German, Latin, and Other
- Common Foreign Language Studies
- History
- Humanities
- Intercultural and International Studies
- Liberal Arts
- Linguistics and Comparative Language and Literature
- Other Foreign Languages
- Philosophy and Religious Studies
- Theology and Religious Vocations
- United States History

Industrial Arts and Consumer Services

- Construction Services
- Cosmetology Services and Culinary Arts
- Electrical and Mechanic Repairs and Technologies
- Family and Consumer Sciences
- Military Technologies
- Physical Fitness, Parks, Recreation, and Leisure
- Precision Production and Industrial Arts
- Transportation Sciences and Technologies

Law and Public Policy

- Court Reporting
- Criminal Justice and Fire Protection
- Pre-Law and Legal Studies
- Public Administration
- Public Policy

Physical Sciences

- Astronomy and Astrophysics
- Atmospheric Sciences and Meteorology
- Chemistry
- Geology and Earth Science
- Geosciences
- Multi-Disciplinary or General Science
- Nuclear, Industrial Radiology, and Biological Technologies
- Oceanography
- Physical Science
- Physics

Psychology and Social Work

- Clinical Psychology
- Counseling Psychology

	Educational Psychology
	Human Services and Community Organization
	Industrial and Organizational Psychology
	Miscellaneous Psychology
	Psychology
	Social Psychology
	Social Work
Social Science	
	Criminology
	Economics
	General Social Sciences
	Geography
	Interdisciplinary Social Sciences
	International Relations
	Miscellaneous Social Sciences
	Political Science and Government
	Sociology
	Statistics And Decision Science

Group methods coming from Georgetown University Public Policy Institute, Center on Education and the Workforce http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/majorslist.pdf

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