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Yanhong H. Jin [a], James W. Mjelde [b] & Kerry K. Litzenberg [b]

[a] Department of Agricultural, Food, and Resource Economics, Rutgers University, New Brunswick, NJ, 08901, USA

[b] Department of Agricultural Economics, Texas A&M University, College Station, TX, 77843-2124, USA

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Economic analysis of job-related attributes in undergraduate students' initial job selection

Yanhong H. Jin[a]*, James W. Mjelde[b] and Kerry K. Litzenberg[b]

[a]*Department of Agricultural, Food, and Resource Economics, Rutgers University, New Brunswick, NJ, 08901, USA;* [b]*Department of Agricultural Economics, Texas A&M University, College Station, TX, 77843-2124, USA*

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Economic tradeoffs students place on location, salary, distances to natural resource amenities, size of the city where the job is located, and commuting times for their first college graduate job are estimated using a mixed logit model for a sample of Texas A&M University students. The Midwest is the least preferred area having a mean salary premium of $15,230 necessary to locate in this area relative to a job in Texas. States bordering Texas had the smallest salary premium at $6388. Students also value shorter commute times and shorter distances to natural resource amenities. Job recruiters and students can use knowledge of the magnitude of these economic premiums associated with these job attributes as the basis for employment negotiations. Further, companies may consider including descriptions of the area's opportunities in commuting time and distance to natural resource amenities in their interactions with potential new hires.

Keywords: job choice; preferences; salary premium; mixed logit

Introduction

One of the greatest challenges facing undergraduate students is finding the right job after graduation to launch their career. In selecting this job, students balance preferences for different job-related attributes. Students may exclude considering job opportunities because they do not fully recognize that balancing these attributes involves economic tradeoffs. Although the first job choice does not determine a career, the first job has significant impacts on one's personal and career development. To help students obtain career goals, researchers have identified skill sets managers desire (Litzenberg and Schneider 1987) and the impact of curriculum choice on salary (Hamermesh and Donald 2008). Furthermore, departments are continually evolving their curriculum (Starbird 2003, 2004; Hudson and Lusk 2004), and universities provide numerous opportunities for students and companies to interact.

On the job supply side, companies vying for the best talent have a competitive edge if they: (1) know students can implicitly, if not explicitly, value job-related attributes and (2) understand the relative value students place on different job-related attributes. Knowledge of the economic value students place on different job-related attributes provides a basis for employment negotiations. Academia, however, has paid little rigorous attention to estimating students' valuation of job-related attributes.

*Corresponding author. Email: yjin@aesop.rutgers.edu

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One particular attribute, job location or mobility of job candidates, appears to be important in students' job selection. Dette and Dalbert (2005, 1720) define mobility as '... the transition of individuals from one geographical area to another'. In this global economy age of technologically minded multiregional/national corporations with relatively easy transportation between regions, one would expect to see a high degree of mobility. Theories and studies from various disciplines addressing mobility generally rely on some form of utility analysis. People tend to work where their satisfaction is the greatest, taking into account job attributes, along with location, social, and other nonjob-related factors. As inferred from wage-differential (Hicks 1963) and job-vacancy theories (Orsagh and Mooney 1970), wages, at least in part, explain mobility (Takalkar 1996; Iacovou, Shirland, and Thompson 2004). Studies, however, have shown that job location choice is influenced by many other factors (Johnston, Clark, and Boles 1989; Noe and Barber 1993; White 2000; Koc 2007).

Ad hoc surveys of recent college graduates indicate that college students have regional ties and limited mobility. Opportunities and/or transaction costs associated with mobility, for whatever reason, appear to outweigh the benefits of mobility. University of Washington (2007), for example, reports that 82% of their 2007 bachelor's degree recipients accepted employment in the state of Washington. Approximately 72% of Cornell University's undergraduate class of 2008 was employed in New York (47%) and Mid-Atlantic/New England states (25%) (Cornell University Career Services 2008). University of Oklahoma (2008), Price College of Business indicates that approximately 90% of students accepted employment in the Southwest region. Universities in less-populated states, presumably with fewer opportunities, also report that a high percentage of graduates are employed in-state. Montana State University-Bozeman (2007) and University of Nebraska-Lincoln (2010) report that approximately 64–68% of their graduates accepted employment in their home state.

This study's objective is to determine the economic value students place on various job-related attributes, associated with their first post-college graduation job concentrating on location or mobility. Job-related attributes (henceforth, job attributes) are defined as salary, regional location, population of the city, distance to natural resource amenities, and commuting time. To achieve this objective, primary data from a web-based choice experiment questionnaire are used in a mixed logit estimation to obtain the economic value students place on these job attributes. Mixed logit analysis allows for individual heterogeneous preferences. Within the model, the influence of socio-demographic factors on job choice decisions and attribute valuation is also estimated.

Selected literature review

Given its importance, it is not surprising that considerable research from various disciplines has examined career decisions from a multitude of viewpoints. Studies, for example, have focussed on minority issues (White 2000; Selod and Zenou 2006), occupational gender differences (Joy 2006), and mobility (So, Orazem, and Otto 2001), to name a few. As expected, a wide range of data types have been used, ranging from aggregate data (Davies, Greenwood, and Li 2001) to person-specific survey data (Dette and Dalbert 2005).

Another related aspect within labor economics is the theory of compensating wage differentials. Tracing its origin back to at least Adam Smith, this theory is based on the idea that people are compensated by higher wages to work in more risky occupations (Shrader-Frechette 2002; Viscusi and Aldy 2003). This theory provides the basis for studies such as those determining if a wage premium exists in working in pollution-intense industries (Cole, Elliott, and Lindley 2009) and estimating the value of a statistical life (Viscusi and Aldy 2003). Wage-differential theory has evolved to include issues beyond risky occupations. Michaelides (2010, 476) notes the compensating differentials theory '... suggests that workers value on-the-job consumption of job characteristics associated with the nature and location of their employment'. Implicitly or explicitly, the underlying basis is that workers' job choice is based on income or utility maximization, given a set of skills and constraints (Sattinger 1993). As illustrated, a wide diversity of professions and issues are associated with job choice. Given this multitude of issues and literatures, the remainder of this review concentrates on mobility associated with the choice of the first job post-college graduation.

Studies on students' first career choices generally rely on primary survey data. Differences in the studies are found in the types of questions asked and statistical techniques used to analyze the data. One line of study involves scale-type questions pertaining to preferences for various job/community attributes. The second pertains to providing respondents different specific job/community scenarios in which students choose which job they prefer. Generally, regression analysis is used to analyze the data. Davies, Greenwood, and Li (2001) indicate that the conditional logit is a better method of approaching the problem of migration, thus job choice. As stated by Davies, Greenwood, and Li (2001, 338), 'the most important distinction between conditional logit model and the approach used in early studies' ... 'is that the former' (logit) 'has a sound microeconomic foundation'.

Using scale-type questions and summary statistics, Knowledge Industry Partnership (2004) and Khan and Cannon (2006) support the *ad hoc* observations presented earlier, which suggest that students prefer to start their careers in or near their college town and/or state. Knowledge Industry Partnership (2004) using a web-based survey of recent graduates of colleges in the greater Philadelphia area indicates that 86% of graduates originally from the Philadelphia area stay in the area, whereas only 29% of students not originally from the Philadelphia area stay in the area. Khan and Cannon (2006) surveyed students enrolled at Texas Tech University at Lubbock in the spring of 2006. Their results indicate that Lubbock rates high on factors necessary to retain students in the area, but there are measures that the city could undertake to help attract and retain young professionals. Among the suggested measures that the city could undertake are improving recreational facilities and cultural aspects. Other studies along these lines find that factors such as salary appeared to be important at the onset of job hunting, but play less of a role in actual job decisions (Boswell et al. 2003). As an example of other factors, Scott et al. (1992) find that pharmacists reared and trained in rural areas tended to practice in rural areas, indicating that location and familiarity are important in job choice.

More sophisticated statistical analysis has been employed by other studies. Johnston, Clark, and Boles (1989) use factor analysis to identify three distinct orientations to job selection: lifestyle, career/work-related, and location, which influence the selection process. They suggest that 'Recruiting departments might wish to consider these orientations as market segments' (Johnston, Clark, and Boles 1989, 20). Further results indicate that married and unmarried candidates weigh the criteria differently. Using job choice questions, Richardson (1966) surveyed 113 male business administration students at the University of North Carolina – Chapel Hill. Two locations, South Bend, IN and Winston Salem, NC, along with two salary levels, type of work, and company size, were included. Salary was the most important factor in the job choice decision, with location being the second most important. Richardson (1966) determines that the preferred job location of Winston Salem was worth $639 annually.

Using the National Longitudinal Survey of Youth, which encompasses graduating classes from the late 1970s to early 1990s, Kodrzycki (2001) finds that within 5 years of graduation, 35% of the graduates no longer live in the state where they attended high school and 30% no longer live in the state where they attended college. She states that these rates are approximately twice those of young adults with less education. Among the factors increasing the tendency to move are economic and quality of life conditions and if the person had experienced a move during childhood or to attend college. Kodrzycki (2001, 30) states that 'These results imply that location preferences vary from individual to individual…', with migration being explained more by individual characteristics than by opportunities in the state where they graduated.

Regardless of the objective of the studies, data, and statistical methods used, general conclusions from previous studies indicate that people's job location decisions are complex and dependent on many factors (Figure 1). Iacovou, Shirland, and Thompson (2004, 88) in summarizing previous results state:

> We assert that the apparent lack of consistency in the rankings of some of the job attributes is caused by at least two reasons: (1) the use of diverse (and sometimes inappropriate) empirical methods in surveying the students and (2) natural variations in the preferences of students depending on the timing of the survey inquiry, the students' recruitment status, and the their specific socio-demographic traits.

Although results from specific studies vary, generalities from previous studies can be made even with the above limitations (Figure 1). Job choice, in general and not specific to first post-college job, has been shown to be influenced by factors such as: (1) salary and benefits, with salary being more important (Takalkar 1996); (2) tradeoffs between job and home locations with factors such as neighborhood preferences

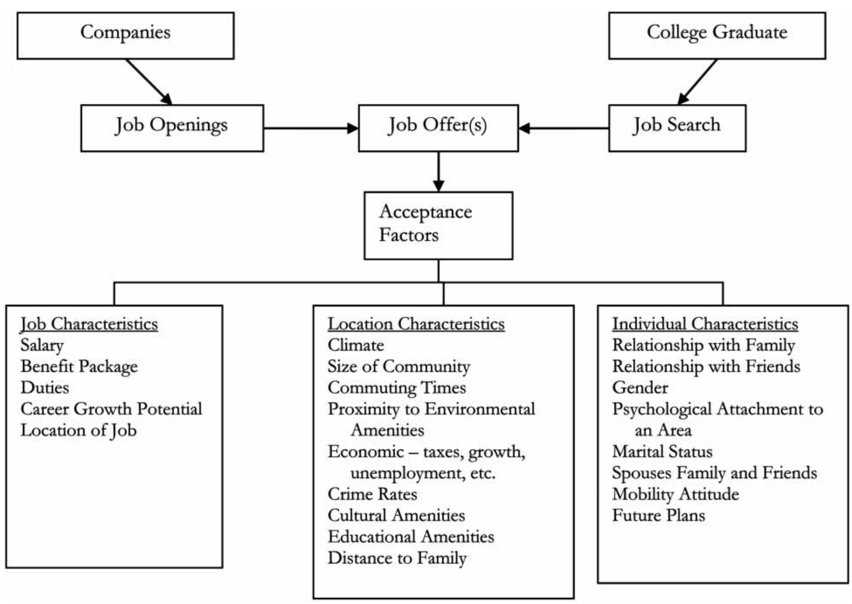


Figure 1. Stylized factors affecting the first job choice among college graduates.

affecting the decision process differently based on the people's life cycle (Kim, Horner, and Marans 2005); (3) geographical factors with individuals being reluctant to move between dissimilar areas (Noe and Barber 1993); (4) community and city characteristics (Scott et al. 1992); (5) attachment to family and friends (Hansen and Yukhin 1970; Punj and Staelin 1978; Dette and Dalbert 2005; Koc 2007); and (6) environmental amenities (Kodrzycki 2001; Kim, Horner, and Marans 2005). Kim, Horner, and Marans (2005) find that people value natural scenic areas, size of the natural area, and recreational opportunities more in their residential location decision compared to their work location. Kodrzycki (2001) shows that students are less likely to move from states with seacoasts or low average wind speed. Interestingly, the average number of cooling or heating degree days does not affect relocation decisions. Few studies specifically included natural environmental amenities associated with recreation/outdoor opportunities in the decision for the first job location or addressed salary premiums associated with various attributes including job location.

Methodology and data

Louviere and Hensher (1982) and Louviere and Woodworth (1983) are usually credited with development of the choice experiment approach. Being part of the family of survey-based methodologies commonly known as choice modeling, choice experiment is one approach that can provide welfare consistent estimates (Hanley, Mourato, and Wright 2001). Choice experiments are similar to dichotomous choice models, in that the theoretical basis is the random utility model and limited dependent variable models are used in the empirical analysis. In a choice experiment, individuals are asked to choose their preferred alternative from a set of alternatives that differ in attributes and levels (Hanley, Mourato, and Wright 2001). The choice experiment in this study is conducted using a web-based survey and analyzed using a mixed logit model.

Web-based survey and data

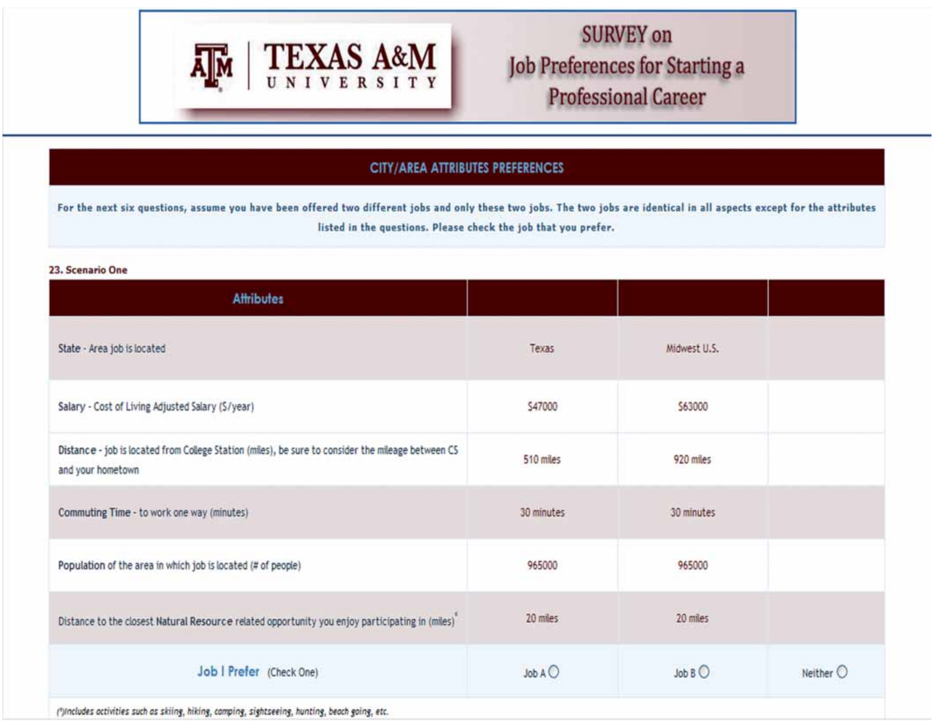
The survey was conducted over four semesters: spring, summer, and fall semesters in 2008 and spring semester in 2009. The survey was presented to undergraduate students at Texas A&M University taking marketing classes (classes taught in both the colleges of agriculture and business) from the same professor with Institutional Review Board approval. A total of 670 students completed the survey. After excluding 6 graduate students and another 32 non-Texas resident students, the sample used for this study consists of 632 Texas resident undergraduate students.

The choice of the number of job attributes to include in the choice experiment is a delicate balancing issue. On the one hand, it is desirable to include numerous job attributes so that the relative importance of and tradeoffs between different job attributes can be identified. The number of job attributes included, however, is limited by the feasibility of answering the questionnaire. Studies have shown that a fatigue effect may occur, as respondents handle complex choice scenarios with numerous attributes (Hensher, Louviere, and Swait 1999; Swait and Adamowicz 2001a, 2001b; Hu, Adamowicz, and Veeman 2006). Six job attributes, salary, job location, distance to College Station where Texas A&M University is located, commuting time, population of the city, and distance to the closest natural resource amenity the respondent enjoys, are included. An example of one choice scenario is presented in Figure 2. The questionnaire stated that the two jobs provided in each scenario are identical in all aspects, except those attributes listed. There were three options the student could choose: job A, job B, or neither. If a respondent chose the 'neither' option, the location alternative was coded as 'neither'. Taking potential fatigue effects into account, each student was presented six choice scenarios with different levels of job attributes.

A unique aspect of the questionnaire is that the design took advantage of the flexibility and power of web-based questionnaires. The attributes for the two jobs presented to each respondent in each choice set are randomly assigned. Job location in each choice set can be any two of the six locations: Texas, Northeast, Western, Southeastern, Midwest, and states bordering Texas. The values of the other job attributes, salary, population, commute time, distance to the nearest natural resource amenity, and distance to College Station, are randomly generated from uniform distributions based on a pretest of the survey (Zaman 2009).[1]

Distance to College Station is highly collinear with locations; therefore, it is excluded from the statistical analysis. Summary statistics for the attributes by location are provided in Table 1. For the scenarios presented to students, mean annual salary is $46,000 and mean city population is 513,000 people. The average daily one-way commuting time is approximately 50 min. Distance to the nearest natural resource amenity averages approximately 205 miles. Summary statistics for each job attribute are similar across the locations.

It is also of interest to identify and quantity the impacts of individual characteristics on job choices, especially the preference of taking jobs located outside of Texas. Besides the choice scenarios, respondents provided information on college enrolled, demographics, and family. Summary statistics are provided in Table 2



Attributes			
State - Area job is located	Texas	Midwest U.S.	
Salary - Cost of Living Adjusted Salary ($/year)	$47000	$63000	
Distance - job is located from College Station (miles), be sure to consider the mileage between CS and your hometown	510 miles	920 miles	
Commuting Time - to work one way (minutes)	30 minutes	30 minutes	
Population of the area in which job is located (# of people)	965000	965000	
Distance to the closest Natural Resource related opportunity you enjoy participating in (miles)*	20 miles	20 miles	
Job I Prefer (Check One)	Job A	Job B	Neither

(*)Includes activities such as skiing, hiking, camping, sightseeing, hunting, beach going, etc.

Figure 2. Sample choice scenario randomly faced by a respondent.

Table 1. Mean and standard deviation (in parenthesis) of the value for each job attribute in the choice experiment design.

Job location	Annual salary ($1000)	Commute time (min)	City population (1000)	Distance to nearest natural resource amenity (miles)
Midwest	47.26 (11.49)	49.87 (24.17)	539.40 (279.69)	201.02 (109.64)
Northeast	48.37 (11.72)	50.83 (22.70)	510.24 (287.18)	212.70 (110.17)
Southeast	48.03 (11.64)	49.76 (23.54)	511.60 (273.73)	207.33 (114.05)
Texas	44.74 (11.52)	49.74 (23.66)	510.92 (283.15)	203.61 (113.90)
States bordering Texas	47.82 (11.60)	49.67 (23.24)	507.68 (284.01)	207.36 (112.20)
West	48.15 (11.60)	49.67 (24.65)	521.26 (279.49)	202.48 (113.96)
All location	46.07 (11.66)	49.84 (23.56)	513.69 (282.31)	204.77 (112.52)

for individual-specific questions. The majority of respondents were enrolled in agricultural-related majors (71%), followed by liberal arts and education (17%) and technology-related majors (10%). The majority of respondents claimed that they were primarily self-funded (51%). The sample was predominantly white students (88%). On average, a respondent was 22 years old and expected to graduate within a year and half. Male students accounted for slightly more than half of the sample (56%).

Questions were asked that pertained to the respondents' family roots and marital status. In particular, 44% of respondents stated that they had either a spouse or significant other living in Texas, while 52% were single with no serious relationship, widowed, or divorced. Family roots indicated that over 80% of respondents had at least one parent who was a native Texan. The majority of respondents (94%) had at least one sibling. Only 13% of the respondents had one or more sibling living outside of Texas. Two indices are created based on the respondents' answers to questions that reflect the students': (1) perceived attachment to Texas and (2) attitudes toward mobility. Students were asked two questions to indicate their relationship with family and friends on a Likert scale ranging from 1 (poor) to 5 (excellent). The sum of a student's answers to these two questions (family plus friends) is the Texas attachment index. If a student, for example, indicated that his/her relationship with family was a 4 (very good) and his/her relationship with friends was a 2 (fair), the Texas attachment index would equal 6 ($4 + 2 = 6$). Similarly, the mobility index is based on the sum of respondents' answers to two questions on their capability to adjust to a new environment and their perceived ability to meet new friends. The range of these two indices is between 2 and 10. The larger the value of the attachment index, the greater the students' attachment to Texas. Likewise, larger mobility indices indicate a greater perceived willingness to move. As shown in Table 2, the average values of the Texas attachment and the mobility are approximately 8.

Mixed logit model

The logit family of models is recognized as the essential toolkit for analyzing discrete choices (Hensher and Greene 2002) because of their theoretical basis, namely random utility theory. Within this family of models, the mixed logit model is increasing in

Table 2. Summary statistics of individual-specific variables included in the model.

Variable	Frequency	Per cent
Semester dummies		
Spring 2008	334	52.85
Summer 2008	50	7.91
Fall 2008	125	19.78
Spring 2009	123	19.46
College enrolled (%)		
Agriculture-related majors	448	70.89
Technology-related majors	61	9.65
Liberal art and education majors	108	17.09
Others	15	2.37
Majority funding source is self-funded	323	51.11
Male	355	56.17
Race		
White	557	88.13
Hispanics	50	7.91
Others	54	3.96
Marital status		
Spouse or significant in Texas	275	43.51
Spouse or significant other outside of Texas	29	4.59
Single without serious relation, widowed, divorced	328	51.9
At least one parent is native Texan	511	80.85
Sibling information		
No sibling	42	6.65
Having sibling but no sibling outside of Texas	509	80.54
Having siblings outside of Texas	81	12.82
	Mean	Standard deviation
Time expected to graduate (months)	18.29	7.76
Age (years)	21.74	2.45
Attachment to Texas (scale ranging from 2 to 10)	8.03	1.51
Mobility (scale ranging from 2 to 10)	7.76	1.48

popularity, being used in areas diverse as natural resource economics (Parsons et al. 2009), consumer choice (Swait and Adamowicz 2001a, 2001b; Hu, Adamowicz, and Veeman 2006), and transportation (Bhat 2001). The mixed logit model was developed to overcome two limitations, independence of irrelevant alternatives and independent and identically distributed error terms, associated with the multinomial logit model (Whitehead et al. 2008). The mixed logit overcomes these limitations by allowing the preferences reflected by the coefficients of independent variables to vary between individuals and alternatives. These benefits, however, come at the expense of computational complexity.

A mixed logit model is capable of capturing the heterogeneity in individual preferences for job attributes by allowing specific parameters to vary by individual (random coefficients). A mixed logit model usually has variables whose coefficients are fixed or the same between individuals, hence the name mixed logit. Estimating a mixed logit model requires specification of: (1) which independent variables will have random coefficients; (2) distributions for each of the random coefficients; and (3) maximum likelihood simulation techniques to be used for estimation (Whitehead et al. 2008). Interpretation of mixed logit models is similar to the entire family of logit models because they employ the same underlying theoretical basis. Appendix 1 provides technical details on the use of the mixed logit model.

Model specifications

The dependent variable of the mixed logit model is an index variable indicating whether a certain job is chosen. Independent variables included in the mixed logit model are socioeconomic characteristics of the respondents (individual characteristics) and the job attributes varied in the choice alternatives.

Variables with fixed coefficients

Individual characteristics included are attachment index; mobility index; categorical variables indicating major funding support sources, gender, race, age marital status, and sibling information; a categorical variable identifying whether at least one parent is a native Texan; expected months to graduation; and semester dummies indicating when a respondent completed the survey (Table 3). To explore whether any of the above socioeconomic variable affects the preference toward jobs located in Texas, a dummy variable indicating whether a job is located in Texas (Texas dummy) is interacted with the individual characteristics. Coefficients associated with individual characteristics are assumed to be fixed. A positive coefficient of a certain interaction variable indicates a preference for jobs in Texas.

Although it is likely that the preference for annual salary is of the same sign (positive) but different magnitudes in the population, the coefficient of salary is assumed to be fixed for practical reasons. Under such an assumption, the distribution of willingness-to-pay (or accept) for each nonwage job attribute has the same distribution type as the attribute's coefficient.

Variables with random coefficients

The coefficients for job location, population, distance to the nearest natural resource amenity, and commute time are assumed to be random. Consistent with the previous literature using random coefficient models, a distinction is made between the population and the sample. Here, the population refers to in-state undergraduates enrolled at Texas A&M University in 2008–2009, whereas the sample refers to those students who completed the choice experiment. As noted earlier, it is necessary to specify distributions for the random coefficients associated with the various job attributes to characterize heterogeneous preferences. Respondents may have different preferences as to where they prefer to live, Midwest, Northeast, Southeast, West, Texas, or states bordering Texas, because of different personal and family characteristics. People may like or dislike jobs located in a highly populated city. Some people may prefer

Table 3. Estimated coefficients and standard deviations from the mixed logit model[a].

Variables with a random coefficient	Mean of the coefficient	Standard deviation of the coefficient	Variables with a fixed coefficient	Coefficient
Population (1000)	0.000 (0.000)	0.001 (0.000)***	Annual salary ($1000)	0.121 (0.005)***
Distance to natural resource amenity (miles)	−0.002 (0.000)***	0.004 (0.001)***	Attachment to Texas	0.071 (0.040)*
Negative of commute time (min)	−3.956 (0.120)***	0.628 (0.064)***	Mobility	−0.154 (0.041)***
Job location dummies			Survey semester (base = Spring 2008)	
Midwest	−1.809 (0.844)**	0.940 (0.298)***	Summer 2008	−0.166 (0.241)
Northeast	−2.318 (0.846)***	1.714 (0.314)***	Fall 2008	−0.140 (0.140)
Southeast	−1.357 (0.846)	0.373 (0.351)	Spring 2009	−0.323 (0.194)*
States bordering Texas	−0.756 (0.842)	0.351 (0.386)	No. of months till graduate	−0.000 (0.009)
West	−1.757 (0.853)**	1.473 (0.301)***	Funding source = 1 if majority self-funding	−0.002 (0.122)
Neither	−0.940 (0.937)	−2.863 (0.282)***	Male	−0.217 (0.123)*
			Age	0.054 (0.031)*
			No. of months till graduation	−0.000 (0.009)
			Declared major (base = agriculture-related)	
			Technology-related	−0.744 (0.226)***
			Liberal arts and education	−0.560 (0.187)***
			Other majors	−0.492
			Race (base white)	
			Hispanics	−0.0208 (0.2190)
			Other	−0.0554 (0.303)***
			Marital status (base = spouse or significant other in Texas)	
			Spouse or significant other outside of Texas	−0.505 (0.287)*

(*Continued.*)

Table 3. (*Continued*.)

Variables with a random coefficient	Mean of the coefficient	Standard deviation of the coefficient	Variables with a fixed coefficient	Coefficient
			Single without serious relation or divorced	−0.254 (0.123)**
			Sibling status	
			No sibling	−0.101 (0.235)
			Have at least one sibling outside of Texas	−0.75 (0.180)
			At least one parent is native Texan	0.400 (0.156)**

Prediction assessment

	Actual outcomes			
Predicted outcome	Job A	Job B	Neither	Total
Job A	1560	327	120	2067
Job B	327	1282	116	1725
Neither	0	0	0	0
Total	1917	1639	236	3792

Percentage of correctly predicted outcomes = 75.9%

Estimation summary	
Number of respondents	632
Number of choice sets (6 × 632)	3792
Likelihood ratio index	0.48
Log likelihood	−2217

All variables, except salary, listed under the fixed coefficient column interact with the Texas dummy (see text).

[a]Figures in parenthesis are standard deviations of the estimated parameter. *, **, and *** represent the 10%, 5%, and 1% significance levels. The estimated mean and standard deviations are the parameters of the associated log normal distribution for commuting time or the normal distribution for other variables with random coefficients, including job location dummies, population, and distance to environmental amenities, the negative of commuting time.

living close to natural resource amenities for the potential benefits, whereas others may prefer living reasonable distance from such amenities to avoid the flow of tourists. Hence, it is assumed that the coefficients of job location, population, and distance to natural resource amenities can be either positive or negative. Each of these coefficients is assumed to be independent and normally distributed, with mean and standard deviation to be estimated.

The coefficient of commuting time is expected to have the same sign for all respondents, as it is assumed that individuals dislike commuting. Between individuals, the magnitudes, however, may differ. This coefficient is assumed to be drawn from an independent lognormal distribution. Because the lognormal distribution is defined only over the positive range and commuting time is expected to have a negative impact on utility, the negative of commuting time enters the model. The mean and standard deviation of the associated normal distribution for the log of the coefficient are estimated, which are denoted by μ_{comm} and σ_{comm}. The estimated mean and standard deviation characterizing the population distribution of the coefficients are calculated from these estimates using the following formulas: $E(\beta_{\text{comm}}) = \exp((\mu_{\text{comm}} + \sigma^2_{\text{comm}})/2)$ and $\text{SD}(\beta_{\text{comm}}) = \sqrt{(\exp(\sigma^2_{\text{comm}}) - 1)\exp(2\mu_{\text{comm}} + \sigma^2_{\text{comm}})}$.

Estimating preferences and salary premiums

The mixed logit model estimates the population distribution of each random coefficient that can be used to estimate preferences and salary premiums for nonwage job attributes. In the case of the normally distributed coefficients, the share of respondents who place either a positive or negative value on the job can be estimated. That is, population shares of students who like or dislike (denoting preference) a certain job attribute are estimated.

Let ζ denote the estimated coefficient of salary and γ denote the estimated mean parameter of the distribution associated with the coefficient of a particular nonwage job attribute. Salary premium of this nonwage job attribute is calculated as $-\gamma/\zeta$, which is the marginal rate of substitution between salary and the nonwage job attribute. In other words, the negative ratio of the attributes' population (individual) coefficients to the salary coefficient represents the population average (individual) salary premium associated with a particular attribute.

Results

Estimation results for the mixed logit model are provided in Table 3. The estimated standard deviations of the coefficients of nonwage, nonlocation job attributes are significant at the 1% significance level. This is also the case for the job location coefficients for Midwest, Northeast, West, and neither. Statistical significance of the estimated standard deviations of these coefficients implies that respondents have different preferences for the job attributes, which suggest that the mixed logit model is an appropriate model as it is able to model the individual-specific preferences.[2]

Estimation results of the population parameters and preferences

Based on the estimated population parameters in Table 3, the population share that places a positive value (positive preference) on each job attribute is provided in Table 4 (column 3). The sign of the estimated premium for nonsalary attributes indicates whether students prefer (positive sign) or do not prefer (negative sign) the certain attribute, while the size of the estimated premium reflects the strength of the

Table 4. Estimated preferences and salary premiums of job attributes among the population and sample as well as individuals based on the mixed logit estimation results[a].

	Based on population parameters		Salary premium based on individual parameters				
	Population mean premium (standard deviation)	Positive per cent[b]	Sample mean (standard deviation)	Sample min (max)[c]	Student 1	Student 2	Student 3
Midwest	14,906 (7745)	2.71	15,230 (2549)	3785 (28,947)	17,275	9233	13,989
Northeast	19,099 (14,119)	8.81	19,737 (6548)	−6883 (35,563)	23,838	16,476	20,177
Southeast	11,184 (3076)	0.02	11,507 (851)	6566 (16,942)	11,208	11,259	11,661
States bordering Texas	6229 (3179)	2.50	6388 (874)	1843 (10,218)	5409	6648	7146
West	14,476 (12,137)	11.65	14,846 (5433)	−12,533 (34,091)	9401	6576	15,018
Less-populated city	−0.6 (7)	53.36	−0.7 (2.4)	−10 (14)	4	2	−1
One mile longer distance to natural resource amenity	13 (30)	77.32	14 (13)	−60 (84)	21	15	11
One minute less commuting time	195 (145)	0.00	204 (86)	102 (1196)	270	158	240

[a]Population refers to Texas resident undergraduates who enrolled at the Texas A&M University. Sample refers to those Texas resident undergraduates who completed the web choice experiments.

[b]Population share with a positive premium for each job attribute.

[c]We first derive the salary premium for each individual based on his/her choice history of the six choice sets, and then statistic summary is calculated.

preference. The majority of the population, Texas resident undergraduates enrolled at Texas A&M University, prefer jobs in Texas. Percentages of the population that prefers jobs outside of Texas are small: 11.65% for the West, followed by 8.81% for the Northeast, 2.71% for the Midwest, 2.50% for states bordering Texas, and almost negligible for the Southeast 0.02%. Given this result, it is not surprising to see that an increased salary is necessary to induce students to take jobs located outside of Texas. The population mean salary premium is highest for Northeast ($19,099), followed by Midwest ($14,906), West ($14,476), Southeast ($11,184), and states bordering Texas ($6229). Standard deviations of salary premium for job locations within the population suggest that the variation in premiums is greater for jobs located in northeastern and western states.

Whether jobs are located in a populated city seems to have little-to-no effect on the average respondents' job preference because the population is nearly split down the middle in terms of whether they prefer a job in a larger city. About 53% of the population prefers a job in a larger populated city, while the remaining students prefer a less populated city. The monetary values of nonwage, nonlocation job attributes are statistically significant, but smaller in magnitude than the monetary values associated with different locations. The average student requires at least $13 more in annual salary for an additional mile further away from the nearest natural resource amenity and $195 for an additional minute of one-way commuting time. One reason for the size of the difference in the salary premium for distance to natural resource amenity and commuting time is the key difference between two attributes: commuting is a daily event, whereas visiting the amenity is less frequent.

Estimation results of individual preferences and subsamples

Given the estimated population distribution of the coefficients of job attributes along with individual's sequence of choices, the subsample distribution of individual preferences as shown in Equation (A7) can be obtained. The conditional subsample distributions of coefficients associated with the five job locations and the three nonlocation job attributes are illustrated in Figure 3. For each job attribute, the conditional subsample distribution has a smaller variance than the population distribution, indicating that the model provides better information about the person's preference conditional on his/her choices.

Summary statistics of the estimated salary premiums for each respondent based on his/her choices on the six job scenarios are presented in Table 4 (columns 4 and 5). All respondents in the sample dislike jobs in Midwest, Southeast, and states bordering Texas, as suggested by positive salary premiums for all respondents for these locations (column 5). Several respondents in the sample, however, preferred jobs in Northeast and West as suggested by negative minimum premiums (column 5). The salary premium for jobs in Southeast has the smallest standard deviation, suggesting that the dislike for jobs in Southeast is more homogenous than the preferences for jobs in other locations (column 4). Furthermore, all respondents in the sample prefer a job closer to natural resource amenities and by assumption prefer less commuting time. Based on the salary premiums for jobs located outside of Texas, students can be categorized as those: (1) students who may prefer jobs outside of Texas (negative salary premium for at least one non-Texas location); and (2) students who are less likely to be induced to take a job outside of Texas (positive salary premium for all non-Texas locations). The corresponding percentages for these two groups are 2.53% and 97.47%, respectively.

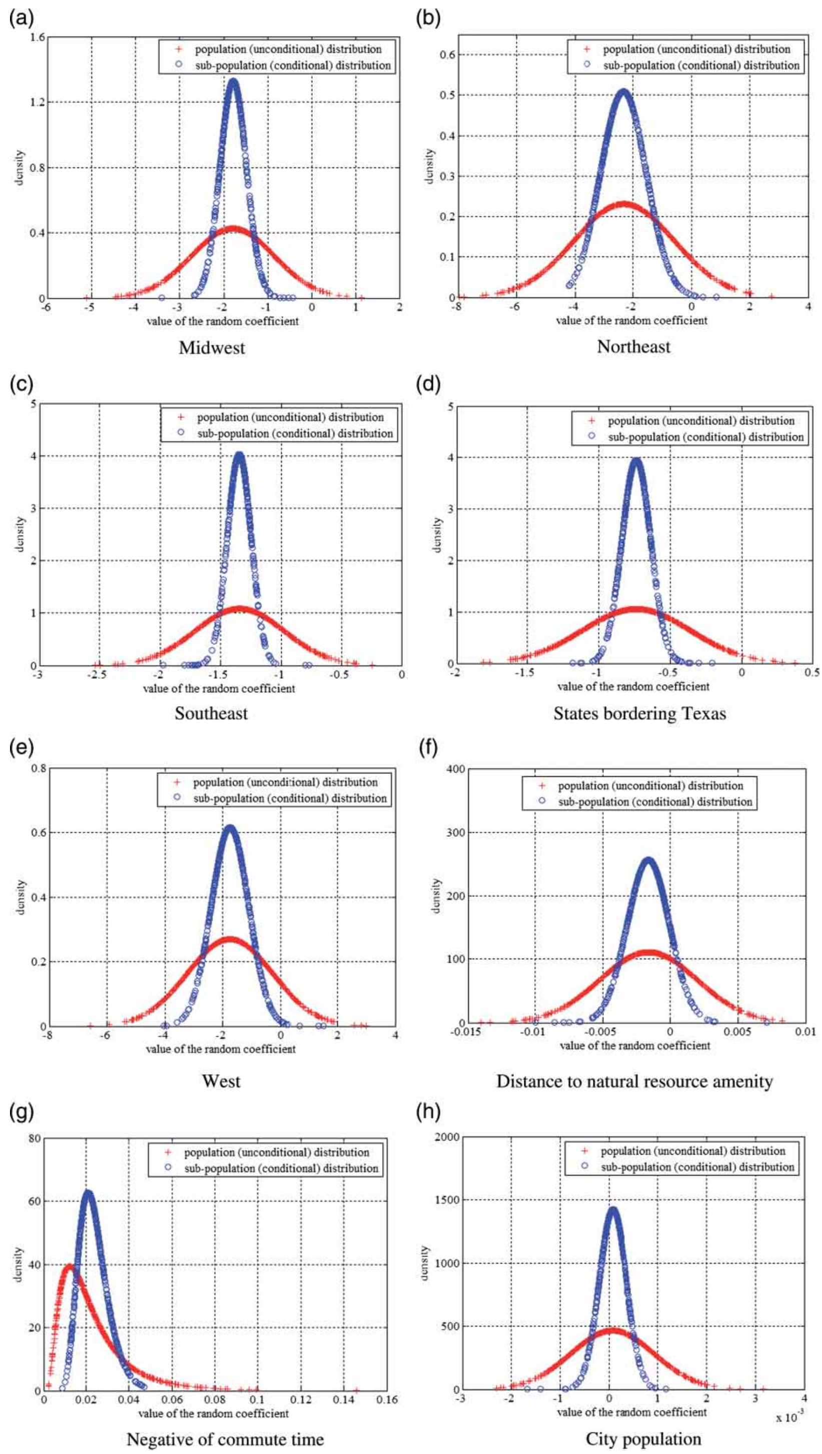


Figure 3. Population unconditional distribution $f(\boldsymbol{\beta}|\theta)$ and conditional distribution $h(\boldsymbol{\beta}|\mathbf{y}_i, \mathbf{X}_i, \theta)$ for the coefficients of five location dummies and other three job attributes.

To further illustrate the use of estimated individual information, three students' preferences for job attributes are compared to the population and sample averages, as well as among themselves. Columns 6–8 in Table 4 present the individual-level premiums for these three students. The first student is a male, Hispanic student major in agricultural education and expecting to graduate within a semester. At least one of his parents is a Texas native, and his significant other is from outside of Texas. This student dislikes the Northeast the most as the premium associated with this location is the largest among the different regions. His salary premium for Northeast is also the highest among these three respondents ($23,838 compared to $16,476 and $20,177). Compared with the average population (column 2), this student has a higher salary premium for Northeast and Midwest. He has a lower premium for Western states ($9401), which is approximately two-thirds of the corresponding population average premium ($14,476). Salary premiums for the nonwage, nonlocation attributes are $4 for a 1000 person increase in population, $21 for an additional mile far away from natural resource amenity, and $270 for an additional commuting minute. Compared with the average population or the average sample, this student has higher premiums for access to natural resource amenities ($21 *vs*. $13) and less commuting time ($270 *vs*. $195).

The second student is a white female in the College of Science who is expecting to graduate within 2 years. She is single and not in a serious relationship; both parents are not Texan natives. Her salary premium for jobs in West ($6576) is the lowest among all locations for her individual premiums. It is also the smallest premium across the three students for jobs in West. It is less than half of the population average ($14,486) or the sample average, column 5 in Table 4 ($14,846). These results imply that this student dislikes jobs in West less compared to the population average (column 2) and the sample average (column 4). This student's preferences (column 7) for shorter commuting times and short distances to natural resource amenity are less strong than the population average (column 2), the sample average (column 4), or the other two students (columns 6 and 8).

Similar inferences on individual-level information for the third student can be drawn. This student is a Hispanic male majoring in agricultural leadership and development. Neither of his parents are Texas natives. He has no siblings nor is in a serious relationship. Among the first three students, student 3 is the only one who may slightly prefer a job located in a more populated city, indicated by a negative premium. He also dislikes jobs located in West more than the other two respondents, the population average, or the sample average.

Based on the individual preferences and salary premiums, comparisons and statistical tests between cohorts in the sample with different socio-demographic characteristics can be made. There appear to be gender- and race-specific differences in salary premiums for nonwage job attributes (Figure 4). The least preferred job location for the entire sample is the Midwest, as suggested having the largest salary premium among the locations (Figure 4a). Furthermore, the salary premium for Midwest is slightly higher for males than for females among Whites, but the gender difference in salary premium for Midwest is just the opposite for Hispanics and Others. Males and females exhibit different preferences toward whether a job is located in a populated city or not, especially among non-Whites (Figure 4b). Compared to Whites, females from other races are willing to take a larger salary cut to take a job in a lower populated city (Figure 4b). Other races also have a smaller salary premium associated with an additional mile natural resource amenities than Whites (Figure 4c). Females show a

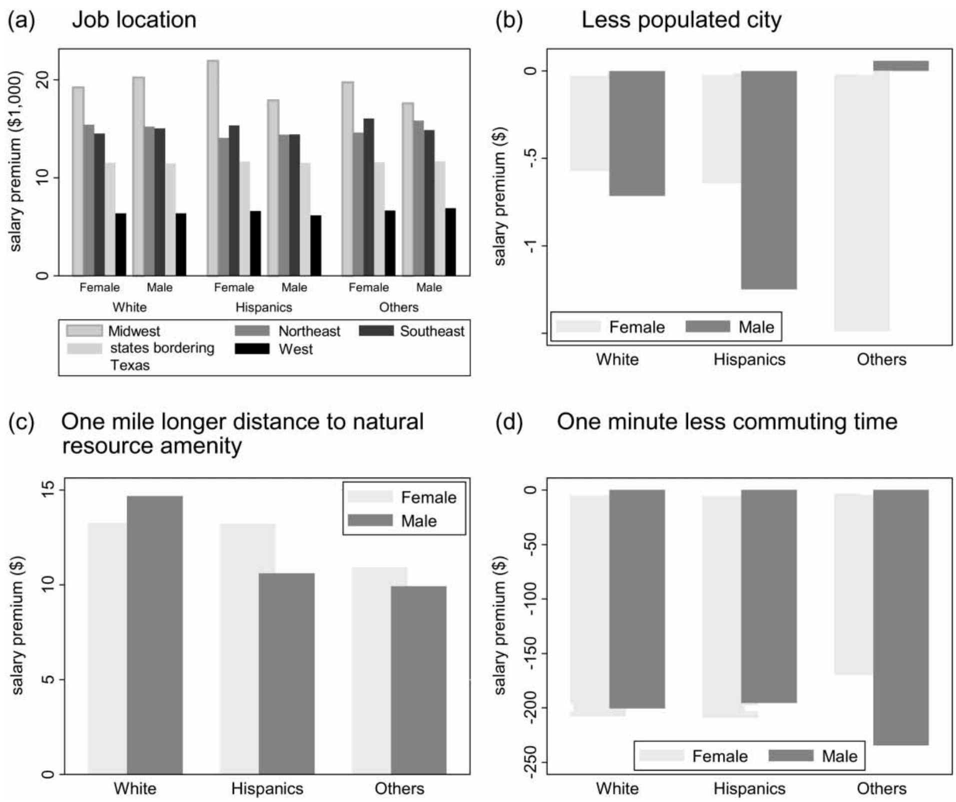


Figure 4. Sample average annual salary premium by gender and race.

slightly higher preference for less commuting time than males among White and Hispanics (Figure 4d). Statistical tests on the equality of the means are conducted. Among the different cohorts in the figure, a total of 142 tests are conducted. Out of the 142 tests, slightly more than half (76) suggest a statistical mean difference at the 10% significance level. Furthermore, the majority of the statistically significant mean differences are detected for salary premium among specific cohorts between job locations (53 out of 60 statistical tests).

Estimation results on individual-specific characteristics

Estimation results of the mixed logit model presented in Table 3 also suggest that the following individual characteristics significantly, positively contribute to students preferring a job located in Texas: attachment to Texas as measured by the attachment index; decrease in the mobility index; having at least one parent who is a native Texan; being older; and being female. Respondents whose spouses or significant others are living outside of Texas are more likely to dislike a job outside of Texas, but whether siblings live outside of Texas is statistically insignificant. Compared to students majoring in agricultural-related fields, students who are majoring in technology-related fields, liberal arts, or education are more likely to dislike a job outside of Texas. The location preference for Hispanic students is not statistically different from white students, but students of other racial background tend to have a higher preference for jobs located outside of Texas.

Conclusions and discussion

Ad hoc surveys suggest that students have regional ties; furthermore, informal discussions with hiring companies indicate that companies recruit based on these regional ties. The study quantifies how students value job-related attributes including location. Quantification of these tradeoffs is helpful to both Texas A&M University students and companies in conducting successful employment negotiations. Students and companies should realize that students have heterogeneous values for various job attributes, and tradeoffs between the attributes may overcome location preferences.

For hiring companies, the estimated premiums indicate that students can, at least implicitly, place a value of different job attributes. An implication is that companies can overcome regional preferences, but at a cost. Companies should engage in negotiations with the 'best' college graduates that meet their hiring criteria rather than excluding students from their recruiting pool because of preconceived attribute/location preferences. By knowing the value students place on job attributes, companies are in a better position as they enter into negotiations with students they desire to employ. Companies not only need to negotiate salaries but may be able to leverage negotiations as well based on tradeoffs between the other job attributes. To overcome location preferences, for example, either salary premiums have to be paid or the company must exploit some other attributes. Students can also use the information as a starting point for negotiations. Knowledge of the mean premium would indicate to a student what they can reasonably expect to locate outside of Texas. Students with premiums below the mean premium may be able to obtain a larger premium than necessary to locate outside of Texas. On the other side, students with premiums larger than the mean premium may have to adjust their expectation or consider jobs within Texas.

Although the quantitative results are specific to Texas A&M University undergraduate students, the results may be more general. *Ad hoc* surveys previously presented indicate that students around the USA have regional preferences. Therefore, there is no reason to feel that the general inferences drawn will differ for students outside of Texas A&M University. Students from universities other than Texas A&M University will most likely also show location preferences. Further, it would be expected that these premiums vary by individual; students have heterogeneous preferences. Companies, however, should be able to overcome some of the location preferences graduates show by not only explaining the job attributes to students but also including the location-specific attributes.

Some indication of the impact of demographic variables, such as having a parent from Texas, having a spouse or significant other in Texas, or siblings in Texas, on the relative likelihood of a given student to be open to relocation is provided by this study. (Again, there is no reason to believe that appropriately defined variables for different regions will not have similar impacts on students.) Although some demographic variables are not legal to use in selection among job candidates (for example, gender), evaluating the likelihood that the graduate would be willing to relocate to other areas could be important to the candidate selection process. More importantly, the willingness to relocate, or more correctly the distaste of living and working in other regions, may have significant effect on the tenure of graduates hired and subsequently assigned to region. While this should not be the sole selection criterion, when two candidates are equally qualified for a particular job, the results from this research may help companies decide where to locate the graduate or, conversely, the likelihood that the candidate will take the job and be satisfied and successful.

Notes

1. Based on the pretest of the survey (Zaman 2009), each of the job attributes other than job location follows a uniform distribution with the following minimum and maximum values: salary in Texas $25,000–65,000 to the nearest 1000 and salary outside of Texas $28,000–68,000; commuting time 0–90 min to nearest 10 min; population 25,000–1,000,000 to nearest 1000; and distance to environmental amenity 0–400 miles to nearest 10 miles. The minimum and maximum values for miles from College Station varied with job location as follows: Texas 0–680 miles; Northeast 1180–1860; West 1050–2370; Southeast 530–1150; Midwest 530–1350; and states bordering Texas 230–800. Texas salary ranges are based on the survey of recent bachelor graduate salary offers which ranged from $12,000 to $100,000 (Texas A&M University 2008). The majority of offers were in the $25,000–70,000 range. Based on the pretest of the survey, out-of-state salary range is increased to entice students to choose jobs outside of Texas. Commuting time upper bound is based on the fact that in some areas of the country, over 4% of the population commutes 90 or more minutes (U.S. Census Bureau 2005). Using the upper bound and a uniform distribution biased the average commute time to a mean value time longer than the national average of 24.3 min. Population and distance to amenities are *ad hoc* bounds to obtain a wide range of cities and distances to amenities. Population range captures all but the largest and smallest cities. Distances from College Station to the various job locations are based on distances from College Station to two cities at opposite boundaries of each region.
2. A conditional logit model is also estimated, but the mixed logit model outperforms the conditional model. Train (2003, 73) notes that 'It is usually valid to say that the model with the higher likelihood ratio index fits the data better.' The likelihood ratio index for the mixed logit model is 0.48 which slightly exceeds the conditional logit model's likelihood ratio of 0.43. Furthermore, both the Akaike information criterion and the Bayesian information criterion favor the mixed logit model over the conditional logit model. It is, therefore, not surprising that the mixed logit model has a marginally higher per cent of corrected predicted outcomes than the conditional logit model (75.79% *vs*. 75.90%).

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Appendix 1. Mixed logit: technical details

The starting point for the logit analysis is the random utility model. In this model, the sampled individuals are assumed to have considered the full set of job alternatives and choose the alternative that provides the highest utility level. Let t denote the choice set, i the individual respondent, and j the choice alternatives (job A, job B, or neither). Random utility theory states that the indirect utility function for individual i choosing alternative j in a choice set t is

$$U_{ijt} = \boldsymbol{\beta}_i \mathbf{X}_{ijt} + \varepsilon_{ijt}, \tag{A1}$$

where $\mathbf{X}_{ijt}$ is a vector representing job attributes and individual characteristics, $\boldsymbol{\beta}_{\mathrm{i}}$ a vector of individual-specific coefficients to be estimated, and ε_{ijt} the error term or random component that captures unobserved factors that may affect choices. By allowing $\boldsymbol{\beta}_i$ to vary by individual i, the model is able to estimate individual preferences.

Each respondent chooses his/her preferred job for six different choice sets. Let $\mathbf{y}_i = \{y_{i1}, \ldots, y_{i6}\}$ be a vector denoting the sequence of chosen job alternatives by individual i in the six different choice sets. Conditional on $\boldsymbol{\beta}_i$, the probability of decision maker i choosing alternative j under choice set t is the logit:

$$L_{ijt}(y_{it}|\boldsymbol{\beta}_i) = \frac{e^{\boldsymbol{\beta}_i \mathbf{X}_{ijt}}}{\sum_j e^{\boldsymbol{\beta}_i \mathbf{X}_{ijt}}}. \tag{A2}$$

Because the error term is assumed to be independent over choice sets, the probability of decision maker who makes the sequence of choices is the product of logits:

$$P_i(y_i|\mathbf{X}_i, \boldsymbol{\beta}_i) = L_{i1}(y_{i1}|\boldsymbol{\beta}_i) \cdot L_{i2}(y_{i2}|\boldsymbol{\beta}_i) \cdots L_{i6}(y_{i6}|\boldsymbol{\beta}_i). \tag{A3}$$

Individual preferences for job attributes are private information. Researchers may observe the population distribution of $\boldsymbol{\beta}_i$ up to population parameters, θ, denoted by $f(\boldsymbol{\beta}|\theta)$. The unconditional probability of individual i chooses a sequence of choice alternatives in the entire choice occasions that is denoted by y_i, which is the integral of $P_i(y_i|\mathbf{X}_i, \boldsymbol{\beta}_i)$ over all the possible values of $\boldsymbol{\beta}_i$:

$$P(y_i|\mathbf{X}_i, \theta) = \int (P(y_i|\mathbf{X}_i, \boldsymbol{\beta}_i) f(\boldsymbol{\beta}|\theta)) \mathrm{d}\boldsymbol{\beta}. \tag{A4}$$

Because the integral in Equation (A4) does not have a closed form, a simulated maximum likelihood approach is employed to estimate the associated population parameters of the population distribution of $\boldsymbol{\beta}$.

The question arises is where in the population distribution does a particular individual reside, given his/her choices. Train (2003) provides details on estimating the individual-level parameters. Application of this estimator is emerging in the literature (Revelt and Train 2000; Kamakura and Wedel 2004; Hensher, Greene, and Rose 2006). Let $h(\boldsymbol{\beta}_i, \mathbf{X}_i, \theta)$ denote the distribution of $\boldsymbol{\beta}$ for the subpopulation of people who would choose the sequence of choices y when facing a series of choice situations described by $\mathbf{X}$. Using Bay's rule, one obtains:

$$h(\boldsymbol{\beta}|Y_i, \mathbf{X}_i, \theta) \times P(y_i|\mathbf{X}_i, \theta) = P(y_i|\mathbf{X}_i, \boldsymbol{\beta}) f(\boldsymbol{\beta}|\theta). \tag{A5}$$

Rearranging Equation (A5) yields

$$h(\boldsymbol{\beta}|Y_i, \mathbf{X}_i, \theta) = \frac{P(y_i|\mathbf{X}_i, \boldsymbol{\beta}) f(\boldsymbol{\beta}|\theta)}{P(y_i|\mathbf{X}_i, \theta)}, \tag{A6}$$

where $P(y_i|\mathbf{X}_i, \boldsymbol{\beta}) f(\boldsymbol{\beta}|\theta)$ is the product of the probability of y_i conditional on $\boldsymbol{\beta}$ and the probability of $\boldsymbol{\beta}$, and $P(y_i|\mathbf{X}_i, \theta)$ is the probability of y_i. Both the denominator and nominator of Equation (A6) based on the choice data and the estimated parameters of the population distribution can be calculated. Based on Equation (A6), the mean $\boldsymbol{\beta}$ of the subpopulation of people who would choose y_i, denoted by $\bar{\boldsymbol{\beta}}(y_i)$, when facing $\mathbf{X}_i$ can be derived using the formula:

$$\bar{\boldsymbol{\beta}}(y_i) = \int h(\boldsymbol{\beta}_i, \mathbf{X}_i, \theta)\, \boldsymbol{\beta}\, \mathrm{d}\boldsymbol{\beta}. \quad \text{(A7)}$$

The integral in Equation (A7) does not have a closed form, but can be readily simulated. Details of the procedure are given in Train (2003, 206–67).