The Importance of Geographical Attributes in the Decision to Attend College

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Abstract: Studies of educational achievement have focused primarily on individual, family, and school-level influences. Yet, economic theory suggests that the expected economic returns to obtaining an education are important also. Two important determinants of these returns, the costs of obtaining an education and the employment opportunities available after receiving education, are often shaped at the local and regional level. This paper examines the socio-economic correlates with the decision to attend college in Sweden in 1995. Data obtained from a unique geographically descriptive micro database called TOPSWING (*TOtal Population of SWeden, INdividual and Geographical database*) make it possible to conduct analyses of the decision to attend college using numerous individual, family, neighborhood, and labor market region variables. This paper shows that few geographical variables are associated with college attendance. However, the proportion of college educated residents at both the neighborhood and labor market level and proximity to a college increase the likelihood of attending college.

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1.0 Introduction

Human capital is recognized as an important input in modern economic growth and development [1, 14, 15]. Therefore, the social sciences have devoted increasing attention to the question of what affects human capital investment decisions. Ranking high among the variables thought to be important in these decisions are various individual, family, and school-level characteristics. Geographical attributes such as distance, neighborhood qualities, and characteristics of regional labor markets have received much less attention.

The question of the role of geographical attributes in educational decisions is an important one. Much of the current education policy debate centers on the amounts of financial aid received by school districts, teacher quality, class sizes and school administrative practices. Yet, geographical variables may be important also. These variables may be ones that planners can affect (e.g., distance to educational institutions) or they may reflect deeper differences of economic structure (e.g., percentage of employment in agricultural or mining activities) that are difficult to change. If the latter is true, it is important to acknowledge the fact in order not to create unrealistic benchmarks and expectations for areas that at first glance appear to suffer from human capital deficits.

This paper focuses on the effect of geographical attributes within a standard human capital investment model. Rather than attempt the formidable task of examining every educational decision in every country, this paper focuses on one aspect of education, entry to college, for one particular place, Sweden. Using data from a unique geographically descriptive micro database called TOPSWING (*TOtal Population of SWeden, INdividual and Geographical database*), the paper examines the decision to attend college using numerous individual, family, neighborhood, and labor market region variables.

It must be recognized that the Swedish experience is much different from that of the U.S. Social and economic differences are relatively small in comparison, and public funding for education and related social services is relatively generous. On the other hand, the post-secondary educational services sector is smaller and a much smaller percentage of the Sweden population receives a post-secondary education. Therefore, the differences may seem muted. However, if it can be demonstrated that individual, family, local, and regional attributes matter in Sweden, it may be reasonable to infer that the same holds elsewhere.

This paper is divided into several sections. The first section briefly reviews the literature concerning educational achievement, with special emphasis on understanding geographical determinants of educational entry. The second section discusses the micro database that was used for estimation purposes. The third section introduces a model of educational entry and presents the variables used in the analysis. The fourth section discusses the results of the empirical analysis. The paper finishes with a summary and conclusion.

2.0 Literature Review

Educational achievement can be influenced by individual traits and the characteristics of the various social groups into which an individual is embedded during a life cycle, including childhood family, adult family, schools, neighborhood, and region. Among these categories, however, family and individual influences have received the most attention. It is the purpose of this section to detail these influences, review some studies that gauge their effect, and examine the more limited literature that looks at the effect of geographical attributes on educational decisions and outcomes.

Family attributes during childhood are thought to play a dominant role in forming educational decisions and outcomes. Recent research in economics suggests that intergenerational transmission of educational achievement is profound, with the educational levels of mothers having a greater effect than fathers [10, 20]. Other indicators of parental maturity, for instance the age of mother at marriage and first birth, may be important also [13]. One argument for this finding is that younger mothers are less experienced and have accumulated less human capital to pass on to their children. Transmission of human capital may also be interrupted by parental obligations outside the household. For instance, children whose mothers were employed during their early development have been found to exhibit lower achievement than those whose mothers did not work [10]. However, a mother's employment during a child's adolescent years may have little effect [10].

Disruptive family events and limited family resources can hinder educational achievement. For instance, divorce and family dissolution may contribute to childhood stress and remove positive role models from close proximity [10, 13]. Thus, two parent families may rear children with higher educational achievement than single parent families [10, 13, 28], and two-parent families in which the original father is present may be even more successful than stepfamilies [10]. Family social class and income are also important [10, 13, 20]. Lower income families may have fewer resources for nurturing children, maintaining a secure environment, and exposing them to intellectually stimulating experiences. Frequent moving and changing of jobs by parents, which requires children to change schools, may also contribute to disruption and stress which may affect subsequent child development [9, 10].

Size and family composition, because they potentially can affect the amount of attention that is available to any single child, are important factors to consider. Some studies have found that smaller families are more successful than larger families in fostering higher educational achievement [10, 13]. Researchers have also investigated the role of birth order [25] and sibling gender [12] on educational performance. It has been argued that first-born children have a slight advantage over their subsequent brothers and sisters because of the extra time that new parents tend to devote to their young children and that having female siblings may be advantageous because of possible parental favoritism towards sons, although the evidence for these hypotheses to date is mixed.

Individual level demographic characteristics can shape educational opportunities. For instance, gender, race, and national origin may potentially affect the quality of an individual's educational experiences and economic returns [4, 20, 24]. If educational institutions systematically discriminate against certain groups, group members will be presented with more obstacles and may exhibit lower educational achievement. If discrimination is prevalent only in the labor market then Becker's model of discrimination predicts that they are less likely to invest in human capital and should exhibit lower educational achievement [24]. However, there is little empirical evidence to suggest that racial minorities in the United States are at a disadvantage once family background and other relevant characteristics are taken into account [10]. Immigrants, on the other hand, may face additional barriers that arise because they have not accumulated enough cultural know-how or language familiarity to facilitate educational advancement.

Household characteristics during adulthood may influence adult educational achievement. For instance, having children should increase the costs of investing in education because of additional childcare expenses and obligations. Also, spouses may influence educational aspirations--a more educated spouse may increase pressures to achieve parity and provide information about educational opportunities. Having an employed spouse and the additional earnings that entails may increase financial access to higher education.

Neighborhood or community attributes may influence educational outcomes directly or indirectly by shaping the quality of neighborhood schools. The quality of schools is of significant interest to policymakers because it is amenable to public policy. Various aspects of school quality have been investigated including teacher quality [21], class size, school size [22], private versus public control [17], and the socioeconomic characteristics of school pupils (e.g., race, academic achievement, and family background) [10]. In the U.S., these variables are influenced primarily at the state and local level. Since children mix with their neighborhood peers, neighborhood socioeconomic characteristics may exert a role independent of school choice. For example, average educational attainment in the area, occupational mix, and the opportunity to make contact with people who value higher education [3, 10, 13, 19, 26, 27] may be important. The level of neighborhood social disorder may also affect educational outcomes. In a study of predominantly minority inner-city neighborhoods, high crime rates were found to hinder school attendance and educational achievement [8].

Regional labor market characteristics have received less attention as potential explanatory factors in individual educational investment decisions. Yet, particularly in regions where outmigration is relatively low, regional labor market opportunities should exercise a powerful influence over the decision. For instance, higher regional unemployment rates may increase the likelihood of educational investment by both lowering the opportunity costs of obtaining education for a part of the population and increasing its expected economic benefits [5, 20].[1] Alternatively, regional occupational earning profiles may affect the earnings expectations and concomitantly the decision to invest in new skills [2]. Regional industrial structure offers still another potential indicator of the expertise required by regional employers, and thereby the potential benefits to additional education [7, 23]. For instance, one study finds that counties with large underground mining sectors (an industry requiring relatively little formal education or training) are characterized by lower educational achievement levels [18], while another [16] argues that the presence of the defense industry (which requires technical training for many entry-level positions) boosts educational achievement.

Location within the urban-rural continuum may also affect educational achievement. Residents of rural areas may have less incentive to invest in education because resource extraction and lower value-added manufacturing are more common and require employees with relatively low levels of formal education [23]. Urbanization may increase demand for education because more varied and specialized occupations become available, and these opportunities create incentives for residents to acquire additional education in order to facilitate lateral occupational mobility and reduce unemployment risk. .

Finally, proximity to regional educational resources may influence achievement [11, 26]. For instance, being in close proximity to a college or university should have three effects. First, it should reduce the out-of-pocket costs of enrolling in higher education. If an individual chooses to reside at home, he/she would incur lower costs of travel and transportation. Second, it would reduce the psychic costs of additional education. Those who have a strong attachment to place might be more willing to enroll in higher education. Third, information about post-secondary educational opportunities would probably be greater near the institution. Visibility and outreach efforts are likely to be stronger in close proximity and information about vacancies and programs offered may diffuse to peripheral areas with a time lag.

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[1] Even if an individual is employed, regional unemployment rates may act as a signal of the risk of unemployment. Higher risks of unemployment might be expected to encourage additional

3.0 Data

The data used for this study are drawn from a longitudinal, geographically descriptive micro database called TOPSWING (*TOtal Population of SWeden Individual and Geographical database*) obtained from Statistics Sweden and housed temporarily at the Spatial Modelling Centre in Kiruna, Sweden. The database contains detailed demographic and socio-economic information for every Swedish resident during the period 1985-1995 derived from quintennial censuses and tax and social insurance records. Some of the items useful for this study are variables representing age, sex, marital status, number and age of dependants, level of education, country of birth, length of residency in Sweden, income, employment status, and dates for changing residences.

In addition, the database identifies the location of residences and workplaces with geographical coordinates measured at a level of accuracy of 100 meters squared. This resolution makes it possible to aggregate individuals into various user-specified geographical units for analysis and to visualize spatial outcomes with Geographical Information Systems. For the purposes of the present study, two geographical units are used: neighborhoods and labor market regions. Neighborhoods are defined by imposing a grid of 1 kilometer squares on a map of Sweden. Labor markets region data (also known as "LA regions") are computed according to 1990 definitions developed by Statistics Sweden and the Swedish Department of Finance [6]. The labor market boundaries were selected to maximize intra-regional commuting flows and minimize interregional flows. Since labor market areas are the most appropriate geographical units for defining labor market opportunities, they are used here instead of administrative regions such as counties or municipalities.

Although TOPSWING has information on nine million Swedish residents, in order to make the empirical work for this study manageable it was decided to draw a 5% sample of Swedish families from the database. This sample was created by utilising a stratified random sampling method of Swedish residents. It includes 89,065 19-65 year olds whose highest degree was a high school diploma, 2,681 of whom were college entrants in 1995. For the subsequent

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investment in education.

analysis all values are measured in 1995. Moreover, only individuals between the ages of nineteen and sixty-five are used.

The amount of information available from the longitudinal database varies by age cohort, mainly because it is impossible to extract parental information for individuals who did not live with their parents during the period for which longitudinal information is available (i.e., 1985-1995). Therefore, two different analyses are conducted here. The first analysis uses the entire sample of 89,065 individuals between the ages of 19 and 65. The primary drawback of using this sample is the absence of family background information. Its primary advantages lie in the sizeable number of observations available and its ability to potentially explain the college entry decisions of adults, including those who make educational entry decision after accumulating some labour market experience. Such individuals make up the majority of first-time college students. The second analysis uses a cohort of 2,693 nineteen-year-olds (897 of who entered college in 1995). The primary advantage of using this group is that detailed family history and parental background information is available—these variables are thought to play an important role in educational success. Because each sample permits a slightly different variety of explanatory variables to be utilized, the models differ.

4.0 The model

The dependent variable to be explained here is an individual's decision to enter college. No distinction is made based on program or program duration. Although the typical Swedish undergraduate program can be completed in three years, some programs, particularly vocational ones, are two years in length and others, for instance technical or professional, are four years in duration. As described in the previous section, in order to utilize fully the TOPSWING database, two models are constructed. The first one is used to explain the educational decisions of working-age adults (19-65 years) and the second one is used to describe the educational decisions of new high school graduates (19 years) who decide whether or not to persist into post-secondary education.

Ordinarily, bivariate models such as the one described here are estimated with logit and probit regression. This paper uses the logit model, which computes the probability for college entry (***COLLEGE***) as follows:

(4.1) $$\Pr \mathbf{ob}(\mathbf{COLLEGE}=1)=\frac{\mathbf{e}^{\boldsymbol{\beta}'\mathbf{x}}}{1+\mathbf{e}^{\boldsymbol{\beta}'\mathbf{x}}}$$

The **x** matrix includes independent variables that are reported in table 1. For the initial model of adult college entry decisions, **β'x** is as follows:

(4.2) $$\boldsymbol{\beta}'\mathbf{x}=\beta_0+\beta_1\mathbf{AGE}+\beta_2\mathbf{AGE2}+\beta_3\mathbf{DIVSEP}+\beta_4\mathbf{EARN}+\beta_5\mathbf{IMM}+\beta_6\mathbf{MARRIED}+\beta_7\mathbf{SEX}$$
$$+\beta_8\mathbf{WORK}+\beta_9\mathbf{DISTANCE}+\beta_{10}\mathbf{NEARN}+\beta_{11}\mathbf{NIMM}+\beta_{12}\mathbf{NPCOLL}$$
$$+\beta_{13}\mathbf{NPOPDEN}+\beta_{14}\mathbf{REARN}+\beta_{15}\mathbf{RPOP}+\beta_{16}\mathbf{RUNEMP}+\beta_{17}\mathbf{RPOCC}+\beta_{18}\mathbf{RPCOLL}$$

And for new high school graduates, it is:

(4.3) $$\boldsymbol{\beta}'\mathbf{x}=\beta_0+\beta_1\mathbf{DIVSEP}+\beta_2\mathbf{IMM}+\beta_3\mathbf{MARRIED}+\beta_4\mathbf{SEX}+\beta_5\mathbf{WORK}+\beta_6\mathbf{CHILDREN}+\beta_7\mathbf{EDMOM}$$
$$+\beta_8\mathbf{EDDAD}+\beta_9\mathbf{FAMINC}+\beta_{10}\mathbf{MOMMOVE}+\beta_{11}\mathbf{DISTANCE}+\beta_{12}\mathbf{NEARN}$$
$$+\beta_{13}\mathbf{NIMM}+\beta_{14}\mathbf{NPCOLL}+\beta_{15}\mathbf{NPOPDEN}+\beta_{16}\mathbf{REARN}+\beta_{17}\mathbf{RPOP}+\beta_{18}\mathbf{RUNEMP}$$
$$+\beta_{19}\mathbf{RPOCC}+\beta_{20}\mathbf{RPCOLL}$$

The third column in table 1. summarizes the expected signs of each of the variables and table 2 provides variable descriptive statistics for each sample. However, it is probably worthwhile to review each of these variables. Individual characteristics are expected to play a key role in the college attendance decision. For all adults, age (***AGE***) is expected to follow a parabolic path with a maximum likelihood of entering college achieved in the early 20s and diminishing rapidly thereafter. Being employed (***WORK***) and having higher earnings (***EARN***) should decrease the propensity to attend college because better job market opportunities would mean fewer benefits for obtaining additional schooling and higher opportunity costs of leaving the workforce. Being married (***MARRIED***) is expected to decrease school attendance. This result is hypothesized because leisure time may be lower for married than single persons, and marriage may also indicate plans for having children in the future. On the other hand, divorce or separation (***DIVSEP***) may release individuals from former household responsibilities that may have hindered their career development in the past. Male gender (***SEX***) is expected to have, perhaps, a small negative affect on the college attendance decision, mainly because Swedish men often start university one to two years later as a result of compulsory military service, and this delayed start will slightly reduce the period of time over which educational costs may be recouped. Finally, foreign-born individuals (***IMM***) are expected to have a lower propensity to enroll in higher education because they may have less information about post-secondary educational opportunities, may have fewer peer references, and are more likely to encounter labor market discrimination. However, this sign may be indeterminate because the numbers of foreign-born who arrive in Sweden with student visas is not negligible.

Five additional family variables are used in the regression analysis for new high school graduates. The size of a graduate's family (***CHILDREN***) is anticipated to have a slightly negative effect on college entry decisions because the amount of parental time available to nurturing an individual sibling is less. Mother (***EDMOM***) and father (***EDDAD***) educational achievement levels should be positively associated with college entry, although as discussed previously, the mother's educational background has been found more important in past studies. Higher family earnings (***FAMINC***) are expected to be positively associated with college entry because they indicate higher social class status and the availability of more resources for funding college studies. Although the Swedish government covers most college expenses, there may be a role for family resources in defraying some indirect costs. Finally, past disruptive family events may hinder college entry. The frequency of parental moving (***MOMMOVE***) is used as an indicator of past disruption and stress.

The primary focus of this paper concerns the influence of local and regional variables on educational entry. Two geographical units are used: neighborhoods and labor market regions. Neighborhood effects are expected to derive mainly from the influence of peers in the locale.

That is to say, individuals evaluate their own prospects and form their own goals with respect to reference groups where they live. Hence, the average earnings (***NEARN***) and presence of college educated residents (***NPCOLL***) should have a positive effect on college entry, while the presence of relatively large numbers of immigrants (***NIMM***) might have a negative effect. Two additional neighborhood indicators are used, population density (***NPOPDEN***) and distance to a college or university (***DISTANCE***). Population density may have a positive effect on educational entry if rural or less dense settlements offer fewer opportunities for human interaction and peer reference opportunities and thereby inhibit goal formation. College entry is expected to have a negative distance gradient because college out-of-pocket (mainly transportation costs but also living expenses) would be greater for those who choose to commute to University and because the visibility of the University and outreach activities might be weaker.

Five regional labor market indicators are also introduced. The expectation is that workforce characteristics such as the percentage belonging to white collar occupations (**RPOCC**) and percentage who have obtained a college education (**RPCOLL**) will capture the regional demand for workers with more advanced training. Hence, these variables should be associated with a greater likelihood of college entry. However, one might argue that some peer effects are important too; individuals may tend to use regional reference groups for informing their educational choices regardless of the realities of the local labor market. These effects would reinforce labor market effects in this instance. The unemployment rate (**RUNEMP**) is included to represent the overall vibrancy of the regional labor market. Ordinarily, one might expect the unemployment rate to be positively associated with college entry; when unemployment rates are higher, they tend to impact lower skilled and blue-collar professions disproportionately. Therefore, not only should the anticipated returns to college education be higher for lower skilled and displaced workers, but also the expected opportunity costs would be reduced. Regional average earnings (***REARN***) should have, basically, the same relationship. Higher regional average earnings, ceteris paribus, will increase the opportunity costs of education and reduce college attendance. The final regional variable, labor market population (***RPOP***), is included as a rough measure of labor market economies; it is anticipated that regions with larger labor markets have more specialized occupational niches available and more lateral mobility. Because a worker need not migrate in order to take advantage of employment opportunities (only change his/her commuting pattern), it is likely that the long run discounted net benefits of a college education are greater than they would be in a less urbanized area.

5.0 Analysis

The results of logit regression using the variables listed in equation 4.2 for adults aged 19 to 65 are reported in table 3. Five different regressions are shown. The first column shows a comprehensive regression with all of the available independent variables included. In order to observe the sensitivity of these results to different specifications, four additional results are shown. The second regression reports only individual level factors; the third column shows neighborhood variables; the fourth column introduces only labor market region variables; and the final column reports the results of a stepwise regression that introduces only variables which are statistically significant at the α=.10 level. The same reporting convention is used for recent high school graduates (i.e., 19 year olds) using the variables listed in equation 4.3 with the exception that regression using a subset of family only variables is shown. Each regression reports maximum likelihood parameter estimates (b slope), corresponding p values[5], the chi-square test statistic[6], and Somers' D[7].

Table 3 shows that mainly individual level characteristics are statistically significant and that they generally have the hypothesized signs. Although age (***AGE***) is not statistically significant, age-squared (***AGE2***) is, indicating that the likelihood of college entry drops rapidly

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[5] These p values are based on the Wald chi-square statistic which is computed by squaring the ratio of the parameter estimate divided by its standard error estimate. They provide a test for the individual effects of each of the independent variables in the model.

[6] These p values are based on the –2 Log L statistic which has a chi-square distribution under the null hypothesis. They are used to test the joint effect of the independent variables included in the model.

[7] Somers' D is a rank correlation measure between probabilities predicted by the estimated equations and observed responses.

after high school graduation. Consistent with expectations, being married (***MARRIED***), foreign-born (***IMM***), a higher earner (***EARN***) and male (***SEX***) decreases the likelihood that an individual will enter college. The only unexpected result is the sign of the employment (***WORK***) coefficient; it suggests that employed workers are more likely to enter college than either individuals who are unemployed or not members of the workforce. One possible explanation for this result may be found in the way ***WORK*** is represented; ***WORK*** makes no distinction between part-time and full-time employees and its null condition does not distinguish between those who are removed from the labor force and those who are actively seeking work. Therefore, it may partly reflect the fact that those who are currently working are more likely to aspire than those who are not.

Table 3 also shows that very few local or regional variables are robustly statistically significant. Only the variables representing percentage of neighborhood and labor market residents with college degrees (***NPCOLL*** and ***RPCOLL***) are statistically significant in each of the comprehensive, neighborhood, regional, and stepwise regressions. Consistent with expectations, the signs for these variables suggest that college entry is more likely to occur where the relative share of the population is college educated. Actual proximity to a college or university (***DISTANCE***) is not important. Since residential and labor market characteristics are both represented here, it is plausible to argue that both peer influences and labor market demand are important in the college entry decision. However, it appears likely that the proportion of residents is a better gauge of regional labor demand than the proportion of workers in white-collar occupations (***RPOCC***), who in many instances receive only firm-specific training.

In order to illustrate the marginal effects of variables and demonstrate the relevancy/accuracy of the model, the complete equation shown in column one is used to simulate the probability of entering college for some representative individuals by age. These results are shown in figure 1 and unless otherwise stated assume variables are evaluated at their mean values. The first example (A) is an unmarried, native-born female who has neither job nor earnings. The second (B) is a married, native-born female who is not employed and without earnings.   The third (C) is an unmarried, foreign-born female with neither job nor earnings. The fourth (D) is an unmarried, native-born male with no job or earnings. The fifth (E) is an unmarried, native-born female who is employed and earns approximately 100,000 SEK per year (i.e., a relatively low income). The sixth (F) is an unmarried, native-born female who has neither job nor income and lives in a neighborhood and a labor market region with no college graduates. The final example (G) is an unmarried, native-born female who is employed and earns approximately 250,000 SEK per year (i.e., a relatively high income).

Figure 1 shows the marginal effects of these conditions. The baseline condition described by A is similar in many respects to the typical female entrant for the traditional college student entry age group, 19-25. The likelihood of college entry is .22 at age 19 and drops in a parabolic pattern to .05 by the average age of 40 and to less than .01 by age 57. Looking at the traditional college student entry age group, one finds that being married decreases likelihood of college entry by about two percentage points (.02), being foreign born by four percentage points (.04), and being male by six percentage points (.06). Employment earnings has a large probabilistic impact on college entry: an employed, low earnings female entrant has a likelihood of college entry of .12 while a high earnings female's probability is only .03 (nineteen percentage points below the baseline case). However, the statistically significant geographical variables (**NPCOLL** and **RPCOLL**) also have a relatively large probabilistic impact. A fresh high school graduate with baseline conditions but living in a hypothetical neighborhood and labor market region with no college graduates has a likelihood of college entry of only .09.

Table 4 shows the results for recent high school graduates. Some of the robust findings here are consistent with the adult regressions. For instance, males (***SEX***) are less likely to enroll than females, and individuals living in neighborhoods with high proportions of college educated (***NPCOLL***) are more likely to enroll. However, these regressions allow additional family background characteristics to be tested. Results show high school graduates whose mothers have higher educational achievement (***EDMOM***) and moved lest frequently (***MOMMOVE***) are more likely to attend college as are individuals drawn from smaller families (***CHILDREN***). Some results deviate from those obtained for all adults. For instance, employed (***EMP***) individuals and those living further away from a college or university are less likely to enter college. Finally, while the percentage of the labor market with college degrees (***RPCOLL***) is statistically significant for the complete and regional regression equations, it was not selected for inclusion by the stepwise regression procedure.

Overall, the results here suggest that local and regional factors play a secondary role in the college entry decision. Individual and family level variables appear to be the most important, even in a country such as Sweden where individual and family differences are less marked. The only influential geographical variables are those that have a direct connection with education, percentage of neighborhood residents with college education, percentage of labor market with college education, and distance to a college or university. Therefore, one might plausibly argue that peer educational attributes and, perhaps secondarily, labor demand characteristics and proximity of higher education resources are relevant to educational choices. In essence, individuals are more likely to attend college if their neighbors already do or already have.

6.0 Summary and Conclusions

This paper focuses on the role of geographical variables in the individual decision to enter higher education. The results obtained here confirm the importance, even the predominance, of individual and family level covariates. However, there remains a role for local and regional influences; in particular the educational achievement of residents and proximity to college or university appear to have measurable effects on individual decisions. These effects might be connected with the role of neighborhood peers, labor market demand and the costs (out-of-pocket and informational) of attending college.

These preliminary results may have certain implications for policy. For most colleges and universities, recruitment is a constant administrative concern. One might ordinarily think that the greatest opportunities for “harvesting” new recruits lie in areas with a relatively low ratio of current college graduates. However, the results here suggest that it may be easier to entice new students in places where there are already a proportionally high number of graduates. Second, for many colleges and universities, new university and state accountability guidelines require institutions to establish clear goals and benchmarks for recruitment and enrollment. The results here suggest that areas with relatively lower levels of educational achievement will, holding all else constant, have a more difficult time of maintaining or expanding enrollment through recruitment. If institutions are rewarded based on their recruitment success, the effect could be to further aggravate geographical educational disparities. Third, the tendency to find lower rates of college attendance in rural areas should not be regarded as an aberrant phenomenon. It may merely be the outcome of a rational financial calculus undertaken by individuals in the region; where there is little latent demand for higher educational skills, there is less incentive for an immobile individual to invest the time in obtaining a degree. Fourth, this paper suggests one more reason that some areas might continue to lag behind other areas in average educational achievement—human capital externalities. Since the propensity to attend college is greater where the relative size of the college graduate pool is greater, those areas whose initial endowments are greater and those areas that receive an influx of college graduates from elsewhere will produce even more residents who choose college entry. The opposite will occur for areas with low levels of graduates and areas losing college graduates. Finally, educational planners might reasonably hope to counter tendencies toward geographical college attendance imbalance by adopting a policy of starting regional or community colleges in areas exhibiting lower educational achievement.

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Table 1. Determinants of decision to attend college/university.

Variable		Expected Sign
Dependent variable		
COLLEGE	Dummy variable indicating entry to college[2]	
Individual		
AGE	Age in years	+
AGE2	Age in years squared	–
DIVSEP	Dummy variable indicating divorced, separated, or widowed	–
EARN	Individual earnings (100s SEK)	–
IMM	Dummy variable indicating foreign born	–
MARRIED	Dummy variable indicating married	–
SEX	Dummy variable indicating male	+
WORK	Dummy variable indicating employed	–
Family background		
CHILDREN	# of children in family	–
EDMOM	Educational level of mother[3]	+
EDDAD	Educational level of father[3]	+
FAMINC	Family earnings (100s SEK)	+
MOMMOVE	# of times mother has moved within 5 year period	–
Neighborhood		
DISTANCE	Distance to a college/university[4]	–
NEARN	Average earnings (100s SEK)	+
NIMM	Percentage of residents who are immigrants	–
NPCOLL	Percentage of residents 25-65 years of age with a college education.	+
NPOPDEN	Population density (population per sq. km)	+
Regional		
REARN	Average earnings (100s SEK)	–
RPOP	Population (1,000s)	+
RUNEMP	Unemployment rate	+
RPOCC	Percentage of workforce in white collar occupations	+
RPCOLL	Percentage of residents 25-65 years of age with a college education	+

Source: TOPSWING, Kiruna, Sweden: Spatial Modelling Centre.

[2] College =1 if entry into college in 1995 but not college student in 1994 or 1995; College=0 if no entry into college in years 1993-1995. All other individuals are excluded from the regression.

[3] Educational levels are as follows: (1) less than Grundskola, (2) Grundskola, (3) Gymnasium (2 year program), (4) Gymnasium (3 year program), (5) Högskola (2 year program), (6) Högskola (3 year program), and (7) Forskarutbildning. Grundskola is compulsory school. Gymnasium is secondary school (i.e., “high school”). Högskola is college/university. Forskarutbilding is graduate or professional school.

[4] Minimum distance from coordinate of place of residence to coordinate of workplace with at least 50 employees in the higher education sector.

Table 2. Descriptive statistics.

19-65 years of age

	Mean	St Dev	Min	Max
FIRSTED	0.030	0.171	0	1
AGE	39.578	12.290	19	65
DIVSEP	0.117	0.322	0	1
EARN	1,435	980	0	40,012
IMM	0.086	0.280	0	1
MARRIED	0.513	0.500	0	1
SEX	0.518	0.500	0	1
WORK	0.881	0.323	0	1
DISTANCE	40	43	0	358
NEARN	1,292	289	0	4,418
NIMM	9.962	8.831	0	100
NPCOLL	24.041	13.106	0	100
NPOPDEN	2,011	2,758	1	22,903
REARN	1234	115	883	1441
RPOP	547.667	659.310	3.392	1,791.060
RUNEMP	9.468	0.915	6.859	14.117
RPOCC	13.813	3.138	6.202	18.732
RPCOLL	11.899	4.063	4.185	18.554

19-year-olds

	Mean	St Dev	Min	Max
FIRSTED	0.333	0.471	0	1
DIVSEP	0.000	0.019	0	1
IMM	0.041	0.199	0	1
MARRIED	0.002	0.047	0	1
SEX	0.480	0.500	0	1
WORK	0.837	0.370	0	1
CHILDREN	2.404	0.934	1	11
EDMOM	3.522	1.694	1	7
EDDAD	3.499	1.535	1	7
FAMINC	3,211	1,437	0	18,878
MOMMOVE	0.304	0.667	0	5
DISTANCE	38	41	0	301
NEARN	1,323	329	59	4,274
NIMM	9.255	8.415	0	61.311
NPCOLL	27.008	14.839	0	100
NPOPDEN	1,716	2,371	3	22,903
REARN	1,227	108	883	1,441
RPOP	503.850	623.264	3.697	1,791.060
RUNEMP	9.503	0.910	6.859	14.117
RPOCC	13.717	3.005	6.901	18.732
RPCOLL	11.859	3.950	4.184	18.554

Table 3. Results for adults, 19-65 years of age.

	(1) Complete Parameter Estimate	(1) Pr>χ^2	(2) Individual Parameter Estimate	(2) Pr>χ^2	(3) Neighborhood Parameter Estimate	(3) Pr>χ^2	(4) Regional Parameter Estimate	(4) Pr>χ^2	(5) Stepwise Parameter Estimate	(5) Pr>χ^2
Constant	-4.1095	0.0001*	-0.5436	0.0524*	-3.2173	0.0001*	-5.3881	0.0001*	-1.6948	0.0001*
AGE	-0.0215	0.1922	-0.0238	0.1469						
AGE2	-0.00089	0.0001*	-0.00084	0.0001*					-0.00116	0.0001*
DIVSEP	0.0951	0.3085	0.0626	0.5006						
EARN	-0.00113	0.0001*	-0.00111	0.0001*					-0.00113	0.0001*
IMM	-0.2355	0.0049*	-0.1781	0.0270*					-0.2225	0.0060*
MARRIED	-0.1177	0.0308*	-0.2003	0.0002*					-0.1607	0.0010*
SEX	-0.4112	0.0001*	-0.4372	0.0001*					-0.4164	0.0001*
WORK	0.5122	0.0001*	0.5032	0.0001*					0.5161	0.0001*
DISTANCE	0.0005	0.3964			0.00043	0.4284				
NEARN	-0.00001	0.8931			-0.00072	0.0001*				
NIMM	0.00131	0.1754			-0.00219	0.4002				
NPCOLL	0.0211	0.0001*			0.0249	0.0001*			0.0164	0.0034*
NPOPDEN	0.00001	0.2037			0.00003	0.0001*				
REARN	0.00253	0.0014*					0.00119	0.1053		
RPOP	-0.00029	0.0057*					-0.00026	0.0082*		
RUNEMP	0.0464	0.1622					0.0153	0.6123		
RPOCC	-0.0657	0.0937*					-0.0166	0.6567		
RPCOLL	0.0413	0.0667*					0.0553	0.0096*	0.0217	0.0001*
Observations	89,065		89,065		89,065		89,065		89,065	
Chi Square (d.f.)	4,091(18)	0.0001	3,807 (8)	0.0001	318 (5)	0.0001	63 (5)	0.0001	4,073 (8)	0.0001
Somers' D	0.642		0.628		0.192		0.082		0.642	

* Statistically significant for two tailed test at α=.10

Table 4. Results for 19-year-olds.

	(1) Complete		(2) Individual		(3) Family		(4) Neighborhood		(5) Regional		(6) Stepwise	
	Parameter Estimate	$Pr>\chi^2$	Parameter Estimate	$Pr>\chi^2$	Parameter Estimate	$Pr>\chi^2$	Parameter Estimate	$Pr>\chi^2$	Parameter Estimate	$Pr>\chi^2$	Parameter Estimate	$Pr>\chi^2$
Constant	-0.2788	0.8707	-0.1141	0.3002*	-1.0634	0.0001*	-0.6157	0.0071*	0.5156	0.7539	-12762	0.0306*
DIVSEP	-17.3702	0.9976	-16.7721	0.9977								
IMM	0.00246	0.9911	0.0053	0.9794								
MARRIED	-0.0903	0.9184	-0.1878	0.8294								
SEX	-0.4056	0.0001*	-0.3980	0.0001*							-0.4145	0.0001*
WORK	-0.3479	0.0021*	-0.4761	0.0001*							-0.3711	0.0009*
CHILDREN	-0.0910	0.0517*			-0.0885	0.0562*					-0.0871	0.0596*
EDMOM	0.0904	0.0028*			0.1239	0.0001*					0.1069	0.0001*
EDDAD	0.0498	0.1332			0.0709	0.0267*						
FAMINC	-0.00001	0.7029			-0.00003	0.4394						
MOMMOVE	-0.1514	0.0246*			-0.1093	0.0928*					-0.1516	0.0226*
DISTANCE	-0.00271	0.0540*					-0.00343	0.0052*			-0.0035	0.0040*
NEARN	-0.0002	0.2302					-0.00045	0.0031*			-0.0004	0.0189*
NIMM	0.0146	0.0245*					0.0083	0.1486			0.0106	0.0531*
NPCOLL	0.0128	0.0007*					-0.0203	0.0001*			0.0149	0.0001*
NPOPDEN	0.0000	0.1940					0.00000	0.8094				
REARN	-0.00014	0.9332							-0.00152	0.3379		
RPOP	-0.0000	0.2112							-0.00026	0.2025		
RUNEMP	-0.00138	0.9847							-0.0547	0.4157	0.1127	0.0488*
RPOCC	-0.0817	0.3198							-0.0259	0.7459		
RPCOLL	0.0973	0.0378*							0.1386	0.0022*		
Observations	2,693		2,693		2,693		2,693		2,693			
Chi Square (df)	147(20)	0.0001	39 (5)	0.0001	47 (5)	0.0001	74 (5)	0.0001	48 (5)	0.0001	129 (8	0.001
Somers' D	0.282		0.130		0.163		0.182		0.161		0.256	

* Statistically significant for two tailed test at α=.10

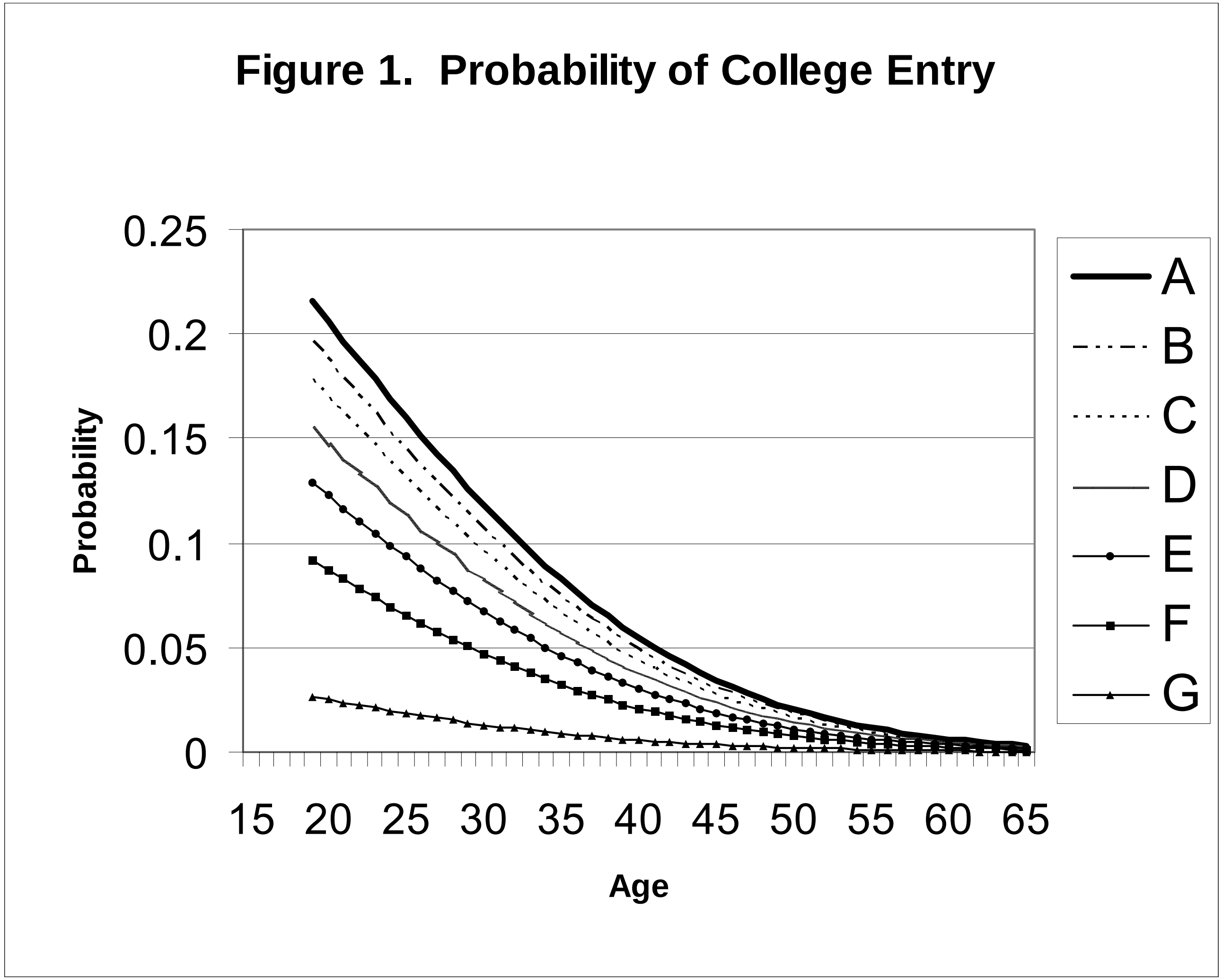
Figure 1. Probability of College Entry
Probability
0.25
0.2
0.15
0.1
0.05
0
15
20
25
30
35
40
45
50
55
60
65
Age
A
B
C
D
E
F
G