Pergamon

Economics of Education Review 22 (2003) 379–388

Economics of Education Review

www.elsevier.com/locate/econedurev

Determinants of school enrollment and completion of 10 to 18 year olds in China

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Received 3 December 2001; accepted 2 July 2002

Abstract

This paper provides an analysis of school enrollment and graduation rates in China using the 1990 Chinese Census. Five education milestones: (1) entering primary school, (2) graduating from primary school, (3) entering middle school, (4) graduating from middle school and (5) entering high school, are analyzed. Location of residence and sex are shown to be highly correlated with enrollment and graduation, with rural girls being especially disadvantaged in terms of both enrollment and graduation rates. Parental education, the presence of siblings, county level income and village level in-school rates also have consistent effects on enrollment and graduation milestones.

JEL classification: I21; J16; J24

Keywords: Demand of schooling; Economic development

1. Introduction

This paper uses the 1990 Chinese Census to analyze educational enrollment and completion patterns of the cohort of youth born between 1972 and 1980.[1] These youths are China's first generation post-Cultural Revolution, the first generation to grow up in the period of economic reform. Academic meritocracy was again touted as the decision making rule for academic advancement, though the ability to pay cannot be discounted since school fees can be quite substantial relative to the budgets of poor families. To our knowledge, this is the first analysis of the microdata files of the 1990 Chinese Census data for this purpose in either Chinese or English. The large sample provides us with a detailed description of enrollment rates across the country and allows us to control for village-level fixed effects. The data also provides us with potential covariates such as parental education, number of siblings, and family composition. The data do not tell us what grade the young people are in, but we are able to distinguish between primary school enrollment and middle school enrollment.

Our main findings, which echo those of previous researchers for both China and elsewhere, are that place of residence and sex and the interactions between them are the most important categories for understanding school enrollment and graduation patterns in China. In terms of the absolute size of the gaps, rural residence is the largest negative determinant of enrollment and graduation. While about three-fourths of urban youth 10–18 who ever attended school are in school in 1990, only about one-half of the rural youth of the same age are in school. Rural girls are thrice disadvantaged in school attainment: as rural youth, they have lower enrollment

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[1] More exactly, we define our sample as youths who were aged 10 to 18 on September 1, 1990.

0272-7757/02/$ - see front matter
doi:10.1016/S0272-7757(02)00058-4

rates than urban youth, as rural girls, they have lower rates than rural boys, and as girls in a country with still strong sex preference for boys, they are more likely to have a younger sibling, which in turn reduces the probability of being in school. However, rural boys are also substantially disadvantaged compared to urban boys and girls. Parents' education and number and sex of siblings are also consistent significant determinants of enrollment and graduation rates. Village and county level variables also matter, such as the proportion of children 10–18 years old in the village who are in school, the terrain, and the county level of income. Our analysis is done separately by rural/urban residence and fully interacted with sex because the differences among these groups are too substantial to rely on shift parameters alone.

The rest of the paper proceeds as follows. Section 2 provides a framework for understanding educational enrollment and completion rates across the population. Section 3 provides a brief description of the Chinese context and Section 4 reviews the existing literature on Chinese educational attainment. Section 5 presents a multivariate analysis of enrollment and graduation rates.Section 6 summarizes our findings and offers directions for further work.

2. A framework for understanding school enrollment and completion decisions

School enrollment and completion are functions of three main factors: demand, supply, and government policy. By demand we mean the individual decisions made by students or their parents comparing the costs and benefits of staying in school. Costs include direct costs, opportunity costs of wage income and/or home production forgone and non-pecuniary costs, such as, whether the child enjoys school. On the benefits side are the higher wages available from jobs attainable with more education and quality of life benefits. When circumstances change, the decisions about when a given student leaves school may also change. Rapid economic growth and substantial institutional reform changes decision-making about children's educational attainment both through changes in the returns to education and changes in the opportunity cost of staying in school. In addition, we expect community standards to play a critical role. If few in the village attend middle school, any individual student is unlikely to demand attendance. For example, Binder (1999) finds in Mexico that community of residence is a significant predictor of desired schooling, even after controlling for household level traits.

Young people may also leave school for "supply side" reasons such as the availability or quality of education. In many developing countries, schools are not available for all students or schools may be located too far from the student's home. In China, this problem is felt more acutely at the middle school and high school level than at the primary school level. In addition, in many developing countries including China, the lack of resources may make the quality of schooling so low that students choose not to attend.

Government policy toward education also affects educational choices. Government policy can be as specific as setting the age at which students begin school and the years of compulsory education to more general policies on funding, jurisdiction, curriculum, and governance. In every country, school attendance rates are affected by these institutional constraints.

Based on this general framework of choice within a set of constraints, future earnings expectations, community standards, supply considerations, and government policy, certain characteristics of the child and the child's family are expected to be important determinants of enrollment and completion. These characteristics include the age and sex of the child, family size, parental education, household income, rural versus urban residence, and the proportion of children in the community who attend school. These indicators, most of which are available in our data, affect schooling outcomes as they affect the demand and supply of schooling.

In addition to direct effects, sex and rural versus urban residence often interact with one another such that gender gaps in educational attainment are larger in rural areas than urban areas. Economic theory offers a number of reasons for this interaction. To the extent that education of children (particulary girls) is a consumption good, its consumption should increase with the general income level of urban areas. Also urban jobs may be less gender bound that rural jobs, urban marriage is often at an older age allowing more time for daughters to remit to the household before marriage, urban family connections may be less likely to involve co-residence, and co-residence of urban elderly parents with grown daughters may be as likely as with grown sons.

3. The Chinese context in 1990

Chinese universities can only accommodate a small percentage of college-age youth. Because of this, the main factors limiting the attainment of higher education in China are on the supply side. However, this research is concerned with the other end of the education spectrum. At lower levels of education, education decisions are driven mainly by the demand side; students who leave school "early" are those for whom the costs of staying in school are greater than the benefits. Of course, there are supply considerations as well, especially at the middle school and high school level. Along with economic reform in May 1985, the "Resolution on Educational System Reform" assigned the total responsibility of primary education to local government. This has

resulted in increased inequality of funding between rural and urban schools and among rural schools (Tsang, 2000; Hannum, 1999a).

While the "Law of Compulsory Education" of 1986 officially made nine years of schooling compulsory throughout China, the implementation of universal nine years of schooling (six years of primary school, three years of middle school) was to be carried out in different phases depending on the level of socioeconomic development (He, 1996). By 1990, all areas were expected to have primary education available for all students but medium developed and underdeveloped areas were not expected to have completed the transition to universal compulsory middle school. In reality, by 1990, according to official Chinese government statistics, only 76% of the counties had realized universal primary education though the population of those counties was 91% of the national total (He, 1996). In addition, supply concerns may still be appropriate even in areas where middle school slots are technically available for all students because many rural students travel a long way to middle school, forcing them to live away from home during the week. Schools are often poorly funded, inadequately staffed, and living conditions are poor. Parents may be reluctant to have their children away from home or living under these conditions for the quality of education being offered.

The economic reforms of the late 1980s have led to increased wealth in both urban and rural areas that are close to urban areas and/or coastal areas. This increase in wealth has, for the most part, meant that more resources are available for education, increasing the quality and availability of middle school and high school education in rural areas. The increased educational resources, holding everything else constant, should increase the probability that students complete nine grades. However, economic reform also changed the opportunity cost of the young people's time. A rural family's income is now more closely linked to its own work effort. Because there is now a real gain to the family from their children's labor, rural families may be more likely to pull their children out of school before graduation.

Increased light manufacturing jobs fueled by the new economic climate may also pull some students out of school, especially in rural areas, since large employers in urban areas seem to have rules against hiring anyone who has not graduated from middle school while the rural enterprises do not seem to have such rules. The role of increased manufacturing opportunities on educational outcomes will depend on how strictly prohibitions against hiring middle school dropouts are enforced. If they are strictly enforced, attractive manufacturing jobs in urban areas may serve to reduce the rate of school dropouts even in rural areas. If they are largely ignored, then these jobs may tempt students to drop out of middle school.

4. Previous research on educational attainment

The analysis of educational attainment in China has been limited until recently by lack of data. In Chinese, we found ten empirical studies of Chinese education since 1989. These studies each make use of aggregate data from the State Education Commission, which provides province level measures of school enrollment by grade and sex. Many of the studies also analyze small scale surveys. For example, Yang and Han (1991) present results from a 1989 sample of nine provinces and 60 counties. Their interest was in why primary and middle school students repeat grades and drop out. Having to repeat a grade is one reason students give for dropping out. Parents and teachers also identified economic factors, geographic factors, the temptation of temporary jobs, the overcrowding of schools, the lack of resources within the school and lack of teachers as factors contributing to early school leaving. Wang and Yuan (1993) analyzed the much larger 1992 Children's Survey of China and found that mother's education, occupation, and family income were all significant determinants of primary school attendance. Most of the other studies concentrated on the poor Western region of China and on various minority populations. In some areas of Western China initial enrollment rates are 20 points lower than the national average and girls appear to be particularly disadvantaged (Zhou, Ma, & Wu, 1995).

In the English language academic literature, there has been a recent flurry of research on Chinese education. Knight & Li (1993, 1996) use the 1988 China Household Income Project (CHIP) survey to explore the determinants of educational attainment. Knight and Li (1996) focus specifically on differences in educational attainment by place of residence, finding that urban residence is a substantial positive predictor of increased educational attainment in the population 16 years of age and older. Broaded and Liu (1996) concentrate on urban youth's transition from middle school to high school. They analyze a 1992 sample of 670 students from 15 classrooms in Wuhan. Their study shows the importance of gender as a determinant of both educational aspirations and high school enrollment even in a large urban area.

Hannum (1999a, 2002b) used tabular data from the 1990 Chinese Census and State Education Commission to show rising urban–rural differences in basic educational provision and enrollment in the years leading up to 1990, and a slowdown in the trend of progress toward gender equality in basic education in the earliest reform years. Using microdata from the rural component of the 1988 CHIP survey and the 1992 Children Survey, Han-

num (1999b; 2002a, b) showed an interaction between rural poverty and gender inequality in enrollments, and documented the significance of poverty in producing observed ethnic disparities in enrollment.

More recent data are presented in Knight and Song (2000) and Brown and Park (2002). Knight and Song (2000) use 1995 CHIP data to explore an intra-household bargaining model. They find that boys have a higher probability of enrollment at all levels and that children, especially boys, whose mother has a higher education level than the father are more likely to be in school. Brown and Park use a 1997 dataset of rural residents in six poor counties in six provinces to explore issues of credit constraints, women's empowerment, and school quality on enrollment, test scores, and the probability of repeating a year. They find that children from more wealthy families in these poor counties have higher test scores and are less likely to repeat a grade, children in families with severe credit constraints are less likely to be enrolled. They also find evidence of gender bias in which girls who are doing poorly in school are more likely to drop out of primary school, whereas boys usually stay in school through middle school.

Our study of the 1990 Census microdata provides a complement to these studies. The census provides us with a national data source that is large enough to measure community effects, and includes older children aged 15–18 in the analysis so that middle school attendance, graduation, and high school enrollment can be studied. Its chief drawback is the lack of data on household income. We have constructed village level in-school rates from the Census data itself and added information on county level income and terrain from the County Databook (1990) but clearly these location-based measures do not completely address this omission.

5. Determinants of educational outcomes for children aged 10 to 18 in 1990

The overall proportion of Chinese youth aged 10–18 who were in school in 1990 ranges from 73.6% for urban boys, 72.0% for urban girls, 54.6% for rural boys, and 44.4% for rural girls. In-school rates vary due to a number of different causes. Communities can differ in the percent of children who ever attend school, in the percent that drop out of school before completion, and in the percent of children who go on to the next level of education. In China from 1978–1986 (the approximate years when the cohort being examined would have entered school for the first time) the vast majority of children did start school. Still differences in the opportunity to attend primary school between rural and urban youth and between boys and girls are clear. Only 0.5% of urban youth, both boys and girls, never attended school compared to 3% of rural boys and 8.5% of rural girls. Of those who began school, 74% of urban boys and 72% of the urban girls are currently in school, compared to 56% of rural boys and 47% of rural girls.

Education enrollment and completion rates vary substantially across China. Terrain, per capita income, and ethnicity explain some of these difference, however, other locational differences exist simply because education is locally provided and funded.[2] Western provinces have lower initial enrollment in primary school. Provinces also differ in continuation rates with no consistent regional pattern. These differences may come from differences in access to middle school, school fees, or school quality. Provinces also differ in the size of the attendance gender gap. In almost all locations boys' in school rates are higher than girls'. This is true in both urban and rural areas though the largest differentials are found in rural areas. Differentials between boys' and girls' in-school rates greater than 10 percentage points can be found in rural Anhui, Jiangxi, Shandong, Hunan, Guandong, and Sichuan. Below we explore these differentials in more detail by examining individual level determinants of enrollment and graduation.

For our analysis we define five progressive measures of educational attainment: (1) having ever attended primary school, (2) having graduated from primary school, (3) having attended middle school, (4) having graduated from middle school, and (5) having attended high school.[3] At each level we limit the analysis to those who have progressed to the previous level. For example, youths 15–18 who have attended primary school are included in our sample when considering the determinants of graduating from primary school.[4] This strategy introduces a potential selection bias in which the sample who have successfully progressed to the next level may be different in ability or motivation from the group left behind. Correcting for this bias requires an identifier that affects the choice to be in the sample (in this case, success at a previous educational milestone) but does not affect the current decision. We have no such identifier,

[2] Appendix Table A available from the authors shows a full array of education status variables by province.

[3] Here high school is shorthand for high school or vocational school beyond middle school.

[4] We also limit the samples by age. While we include all youths 10–18 in our analysis of the decision to initially enroll in primary school, we use youths aged 15–18 to examine primary school graduation rates and middle school attendance rates because almost all students who will ultimately attend middle school have begun by age 15. Similarly, we limit our analysis of middle school graduation and high school attendance to 17–18 year olds. We cannot push the age beyond 18 because many youths above 18 have already left the family home. This decision may lead to truncation bias if many youths enter high school after age 18, however we believe this number to be small.

thus estimated effects will be upwardly biased. The bias should be small in early levels of education where most children attend and in all the urban categories. Also in terms of policy, often the group most likely to be affected will be the group included in our sample, that is, the group that have made it past the last hurdle. Thus, for example, a campaign to increase start-up rates for middle school will most likely affect those who have finished primary school.

For each of the five education status variables we estimate the effects of individual, household, and contextual variables using a logit model.[5] The analysis is done separately for rural and urban youths given the substantial gross differences in their rates. Since determinants may differ in their effect on girls' enrollment versus boys' enrollment we fully interacted sex with the other variables in the analysis. This may appear excessive but there are no good a priori reasons to expect differential effects by sex in some variables and not others.

5.1. Determinants of educational status of rural youth

Table 1 presents the estimated log odds for the rural sample[6] and Table 2 presents the log odds for the urban sample.[7] For each milestone, we estimate both a standard logit and a community fixed-effects logit. This latter estimate controls for possible correlations between household variables and unobserved school quality or other local factors which would also affect educational decision-making. The fixed effects logit provides unbiased estimates of the household and individual level variables by exploiting the differences within a village.[8]

For rural youth, almost all the variables included have a significant effect on the probability of primary school attendance or graduation and middle school attendance. Fewer variables are significant predictors of middle school graduation or high school attendance. Similarly, while a pseudo R^2 value provides much less information than the R^2 of an OLS regression, we can see by comparing across the milestones of Table 1 that the overall explanatory power of equations diminishes as the level of schooling increases. As the level of schooling increases, the student's aptitude for learning which is omitted from our analysis becomes a more important determinant of continuation in school. In addition, supply side constraints and school fees also play a more important role at higher levels of education.

5.1.1. Individual characteristics: age and sex

Age was controlled for using a full set of single year dichotomous variables. (The log odds are not shown.[9]) Fourteen to 18 year olds were less likely to attend primary school than younger ages, showing an improvement of access to education over the decade of the 1980s. There were no significant differences of the effect of age for boys versus girls.

Boys have significantly higher enrollment rates in primary and middle school, and higher rates of graduation from primary school than rural girls, everything else held constant. Note that these are only the direct effects which remain after fully interacting sex with all the independent variables. Because every term is interacted with sex, the total effect of sex on education is the combination of the direct effect reported here and the indirect effects commented on below.

[5] The standard errors have not been corrected for the clustering that may occur because we have included each 10–18 year old, some of whom are members of the same household. Given the size of our samples and the strength of the relationships we are finding, it is our feeling for adjusting for within family correlation across children would do little to change our results. Similarly, we have not corrected for the relationship between equations. Theoretically we could account for the correlation across equations by using a two-stage procedure analogous to seemingly unrelated regression. However, this procedure would require the same sample for all equations causing us to lose all but the 17 and 18 year olds. It is our sense that including the younger children who are more recent participants in the changing educational scene is more important than increasing the efficiency of the estimates.

[6] For the analysis of individual level rural data we used a 10% sample of the original 1% sample of the Census. For the analysis of individual level urban data we used a 20% sample of the original 1% sample of the census. The number of observations in our rural sample was reduced below the 0.1% sample by the inclusion of the county level income variable since a substantial number of counties were missing. Missing counties were not concentrated in any province or area and we did extensive sensitivity analysis to assure that the remaining sample was similar to the original one. Multivariate results without the county level variable, from the sample before and after the exclusion were compared and were virtually identical. Including the county level variable does not have a very large effect on most of the other included independent variables but we felt that the significance of the variable itself and its effect on a few of the other independent variables justified its inclusion even with its negative impact on our useable sample size.

[7] Sample means, logit coefficients, and standard errors for both rural and urban youths are available in appendix tables available upon request.

[8] Unbiased in the sense that household variables may be correlated with unobservable local effects. The fixed effect estimates still suffer from the potential sample selection bias discussed in the text above. The cost of the procedure is in the number of observations since observations in villages with no variation in the dependent variable are eliminated.

[9] Available from the authors.

Table 1
Log odds of the determinants of educational status for rural youths

	(1) Ever attend p.s. youth 10–18		(2) Graduate p.s. youth 15–18		(3) Ever attend m.s. youth 15–18		(4) Graduate m.s. youth 17–18		(5) ever attend h.s. youth 17-18	
	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects
% of village in school	741.149*		20.268**		60.301**		0.675		17.945**	
% of village in school *boy	0.729		0.291**		0.311**		1.759		0.397	0.598
Number of younger brothers	0.786**	0.869**	0.893**	0.944*	0.851**	0.896**	0.914*	1.007	0.897	1.037
Younger brothers *boy	1.041	1.013	0.969	0.996	1.040	1.049	1.006	0.978	1.081	1.070
Number of younger sisters	0.830**	0.871**	0.907**	0.925**	0.889**	0.926**	0.967	1.033	0.992	1.072
Younger sister*boy	1.063*	1.131**	1.000	1.077*	1.071**	1.101**	0.954	0.939	1.077	0.951
Older sibling dummy	0.616**	0.717**	0.760**	0.825**	0.603**	0.664**	0.826	0.921	0.789	0.878
Older sibling dummy* boy	1.200*	1.131	0.984	0.997	1.113	1.078	1.051	0.976	1.000	0.987
Presence of grandparents	0.982	1.068	1.090	1.130	1.258**	1.298**	0.895	0.881	1.227	1.199
Grandparents*boy	1.032	1.051	1.041	1.069	0.893	0.898	1.185	1.084	1.024	1.252
Parents attended p.s.	3.230**	1.902**	1.521**	1.347**	1.402**	1.408**	1.220	1.219	1.439*	1.306
Parents' p.s. *boy	1.079	1.005	1.228**	1.091	0.939	0.979	0.984	0.921	0.755	0.829
Parents attended m.s.	4.760**	3.250**	2.667**	2.460**	2.742**	2.743**	1.756**	1.879**	2.093**	1.797**
Parents' m.s. *boy	1.043	0.897	1.232*	0.999	1.090	1.089	0.830	0.642*	0.728	0.877
Nonhan	0.533**	0.586**	0.888	1.078	0.943	1.396**	0.998	1.692*	1.466*	1.636
Nonhan *boy	0.819*	1.038	0.806*	0.755*	0.777**	0.798*	0.694	0.828	0.709	0.514*
Per capita rural income	4.411**		0.852		1.434**		1.231		1.218	
Per capita rural * boy	0.275**		0.943		0.982		0.677		0.974	
Hill county	1.868**		1.139*		0.928		0.805*		0.904	
Hill county * boy	0.558**		0.958		0.984		1.343*		1.089	
Mountain county	1.207**		0.819**		1.076		0.946		1.218	
mountain county * boy	0.599**		1.087		1.059		0.999		1.059	
Boy	6.814**	4.221**	1.451*	1.317**	2.497**	1.970**	0.820	1.377	2.924**	2.232
Observations	100975	47584	44311	26638	38497	34119	11453	6259	8695	3852
Pseudo R^2	26.74%	12.50%	9.86%	5.07%	8.89%	6.54%	3.62%	2.33%	3.71%	2.79%
Sample probability	93.79%	87.24%	86.88%	78.65%	61.42%	58.71%	75.92%	65.62%	18.31%	32.71%

Variable significant at 5% level *; significant at 1% level **. NB: other variables included in the analysis are single years of age, age interacted with sex, regional dummies, and region interacted with sex.

Table 2
Log odds of the determinants of educational status for urban youths

	(1) Ever attend p.s. youth 10–18		(2) Graduate p.s. youth 15–18		(3) Ever attend m.s. youth 15–18		(4) Graduate m.s. youth 17–18		(5) Ever attend h.s. youth 17–18	
	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects	logit	Fixed effects
Proportion of neighborhood in school	34.961**		15.705**		91.800**		0.868		17.466**	
Proportion of neighborhood in school *boy	0.358		0.290		0.719		2.796		0.792	
Number of younger brothers	0.757*	0.829	0.631**	0.697**	0.823*	0.859	0.807*	0.878	0.910	0.967
Younger brothers *boy	0.951	0.978	1.220	1.172	1.012	0.997	1.020	1.154	0.990	0.956
Number of younger sisters	0.745**	0.795*	0.779*	0.803	0.724**	0.700**	0.895	0.981	0.817**	0.853**
Younger sister*boy	1.133	1.223	0.934	1.277	1.145	1.300*	0.947	1.026	1.201**	1.142
Older sibling dummy	0.490**	0.680	0.583*	0.786	0.487**	0.628*	0.715	0.780	0.768**	0.830
Older sibling dummy* boy	1.792	1.665	1.020	1.156	1.235	1.040	0.861	1.005	1.120	1.089
Presence of grandparents	0.850	1.304	0.953	0.696	0.735	0.560*	1.142	1.055	0.967	1.043
Grandparents*boy	0.767	0.694	1.450	3.361*	1.194	1.669	0.829	1.078	1.027	0.997
Parents attended p.s.	3.323	1.851	2.161**	1.405	2.066**	1.791**	1.638*	1.290	1.705**	1.457
Parents' p.s. *boy	0.455*	0.599	0.814	1.090	0.816	0.962	0.695	0.490	0.758	0.909
Parents attended m.s.	4.870**	2.502*	7.556**	4.540**	4.194**	3.627**	3.139**	2.383**	4.206**	3.434**
Parents' m.s. *boy	1.274	1.243	0.775	0.944	1.234	1.262	0.601	0.390*	0.726	0.835
Nonhan	0.773	0.918	0.757	0.947	0.779	1.113	0.699	0.629	1.285	1.093
Nonhan *boy	0.320**	0.417*	0.625	0.488	0.807	0.534	0.992	1.076	.847	0.766
Per capita urban income(province level)	0.318**		0.560		1.073		0.898		1.274	
Per capita urban * boy	2.222		0.778		1.151		0.892		1.404	
Boy	0.604	0.877	2.712	0.579	0.453	0.596	0.795	1.728	0.815	1.168
Observations	32968	8259	15617	4190	15597	6072	7490	3198	6981	5891
Pseudo R^2	12.07%	6.76%	12.56%	9.20%	10.94%	6.26%	6.17%	5.31%	8.47%	3.75%
Sample probability	99.37%	97.57%	98.48%	94.51%	97.04%	92.93%	93.20%	86.68%	54.72%	54.52%

Variable significant at 5% level *; significant at 1% level **. NB: other variables included in the analysis are single years of age, age interacted with sex, regional dummies, and region interacted with sex.

5.1.2. Household characteristics: siblings, parents' education, presence of grandparents, and ethnicity

The number of younger brothers and younger sisters were included separately in order to test the hypothesis that boys are favored compared to girls. If more resources are devoted to the education of boys then we would expect a smaller negative effect of a younger sister on the probability of school attendance or completion of the given child. Table 1 shows that girls are equally disadvantaged by having a younger brother or a younger sister but boys are less disadvantaged by a younger sister than by having a younger brother.[10] We could not count the number of older siblings nor distinguish between older brothers and sisters as some of them have already left the household.[11] But having an older sibling is shown to have a significant negative impact of the probability of the three earliest educational milestones for both boys and girls implying a competition for limited family resources is a determinant of school attendance. As girls in China in 1990 are much more likely to have a sibling through the combination of strong son preference and China's strict family planning policy, girls in the early stages of education are disadvantaged both by the difference in the probability of having a sibling and directly as seen in the positive direct effect of the boy variable itself.

Having grandparents coresiding might also increase the competition for family resources but this does not appear to be the case. In most of the equations, the presence of grandparents has no effect, however, the presence of grandparents increases the probability of attending middle school for both boys and girls. Here grandparents appear to add to the resources of the household, adding adult time and income, perhaps even income per capita.[12]

In every study of educational attainment that has information on parents' education, parents' education has been shown to have a strong effect on the educational attainment of their children. China in 1990 was no exception. For the earliest three educational milestones, having a parent who attended primary school increases the log odds, and having a parent who attended middle school increases log odds even more. Having a parent who attended middle school also increases the log odds of graduating from middle school and attending high school. This effect may be partially due to differences in household income though we suspect that there are independent effects of parental education beyond income. Income levels in rural China are not as strongly linked with education as they are in other countries. The policy implication of this intergenerational connection in educational attainment is that campaigns to increase school attendance will pay off twice, once in this generation and once in the next. The effect of parental education on educational attainment is not significantly different for boys versus girls except for graduating from middle school (using the conditional logit results). In this case, having parents who have attended middle school has a larger positive effect on girls than boys.

The last household characteristic included, being non-Han, significantly reduces the log odds of attending primary school and for boys of graduating from primary school. Of those who have graduated from primary school, non-Han girls are likely to attend middle school and all non-Han youths are more likely to complete middle school given that they attended. It is interesting that these ethnic differences remain even after controlling for village fixed effects.

5.1.3. Contextual variables: village in-school rates, county income levels, terrain, and regional dummies

Living in a village where a higher proportion of youth, aged 10–18, attend school has a large and consistent effect on all schooling with the exception of middle school graduation rates. Furthermore, for graduation from primary school and attendance of middle school, village in school rates have significantly larger effects for girls than boys. Sample sizes within villages were large enough that this is not simply the effect of the child's attendance on the village rate. Instead, this indicates a strong neighborhood effect is at work and/or that unobservables in this family's decision are correlated with those of other families in the village. The policy implication is that increasing in school rates creates positive externalities at almost all levels and that girls are particularly positively affected by these external effects at the crucial moments of primary school completion and middle school attendance.

Higher county per capita income is positively correlated with initial enrollment in primary school and middle school. The effects of these results are consistent with the findings of Hannum (1999b) and Brown and Park (2002). The effects of county income levels are larger for girls than boys for initial enrollment in primary school as evidenced by the log odds of the interaction term between per capita income and boys being less than one.

We expected that hilly or mountainous terrain would be correlated with lower educational attainment. However, having controlling for other factors, particularly county level income and the in-school rate, living in a mountainous county has a significant negative effect only on graduation from primary school, and living in a hilly

[10] This result comes from the significant log odds of the number of younger sisters interacted with being a boy being greater than one.

[11] We define having an older sibling as one if the number of births by the mother of the child minus the number of younger siblings was greater than one.

[12] In other countries co-residence with grandparents is a proxy for financial need but that is not the case in China where co-residence with the elderly is the overwhelming pattern.

county has a significant negative effect only on graduating from middle school for girls. In fact, having controlled for other factors, the effect of living in hilly counties has a positive effect on primary school attendance and completion, and in mountainous counties on primary school attendance.

Based on geographical patterns seen in aggregate enrollment rates, we included four regional dummies indicating residence in South Central, South Coastal, Mid-coastal, and South Western regions.[13] (Log odds not shown.[14]) For each of these regions, boys are significantly more likely to enter and graduate from primary school and to enter middle school than girls. There are no significant differences between boys and girls in these regions for the upper two education thresholds. These regional differences may be the result of cultural differences or of higher opportunity costs of girls staying in school attributable to the large number of light manufacturing jobs in the southern areas or of a higher return to education to boys in the mid coast area due to more demand for skilled employment.

5.2. Determinants of educational status of urban youth

Table 2 contains the determinants of school enrollment and graduation for urban youth.[15] In general, fewer variables are significant determinants of urban rates than rural. Consistently positive significant determinants include the proportion of the neighborhood that is in school (except for middle school graduation) and parental education. Having siblings has a mostly negative effect on educational accomplishments of urban youth just as they had on rural youth.

Interesting in their nonsignificance are the boy dummy and almost all of the interaction terms with boys. The only exception is the effect of younger sisters on middle school enrollments where having a younger sister has a less negative effect on boys' enrollment than girls'. Thus, as predicted, we conclude that sex is much less important in urban China's educational choices than it is in rural China. In China, because of expectations of daughters leaving the parental home but sons remaining, girls' education has a higher consumption component than boys. This difference is expected to be larger in rural areas because of later urban marriage and less reliance of urban elderly on income from their grown children. Urban elderly are also more likely than rural elderly to live with daughters or maintain separate housing unless they become infirmed. In addition, Brown and Park (2002) showed the importance of credit constraints in determining educational outcomes and that these credit constraints seem to affect girls more severely than boys. Rural families are more likely than urban to face credit constraints since rural families operate with less cash per level of consumption.

6. Summary and directions for further research

This paper has provided an analysis of Chinese school enrollment and completion patterns of youth aged 10–18, using data from the 1990 Census. While overall levels of school enrollment are high for a country with China's level of per capita income, the data reveal substantial variations between urban and rural residence and between boys and girls in the rural areas. Analyses done at the individual level find consistent correlates with enrollment and graduation rates. Sex was shown to be an important predictor of difference in rural areas but not in urban areas. A common pattern of effects of parental education (positive) and the number of siblings (negative) emerges for all five educational milestones in both urban and rural areas. Higher village in-school rates affects attendance and completion in both rural and urban areas except for middle school graduation. In rural areas, for the three earliest educational thresholds, girls were more positively affected than boys by higher village rates, leading to a finding of positive externalities especially to girls when a community raises its enrollment rates or makes middle school more accessible. Finally, county level wealth measures were consistently positive in their predictive power for rural areas but not in urban areas

Our findings are not only consistent with other studies done in China but also with similar studies done in very different parts of the world. For example, in every developing country where economists have applied these determinants of educational attainment models, sex, rural versus urban residence, family size, and parental schooling have been found to be important determinants of youth enrollment. The transition points such as moving from primary to middle school and later from middle school to high school seem to be moments when poor rural girls are particularly vulnerable to not continuing.

For future research, better measures of differences in school availability and school quality are needed in order to differentiate between supply and demand differences that are intermingled in our model. We are currently engaged in a micro level data collection for this explicit

[13] We experimented with different regional groupings and these seem to be the only important ones. Why the Southern and Mid-coastal regions exhibit such high differentials between boys' and girls' education rates is an important question for future research.

[14] Available from the authors.

[15] All variables are the same as in our rural analysis with the exception of the per capita income measure. For our urban analysis we use a provincial level measure of per capita urban income. The neighborhood in-school rate is calculated exactly the same as our rural village in-school rate, using "village" codes within the Census.

purpose, towards our goal of understanding the factors leading to school attendance and completion for rural girls and boys. In addition, we look forward to the 2000 Chinese Census so that we can observe changes over time in the effect of economic expansion and the further decentralization of governmental control on school enrollment rates.

References

Binder, M. (1999). Community effects and desired schooling of parents and children in Mexico. *Economics of Education Review*, *18*(3), 311–325.

Broaded, C. M., & Liu, C. (1996). Family background, gender and educational attainment in urban China. *The China Quarterly*, *145*, 53–86.

Brown, P., & Park, A. (2002). Education and poverty in rural China. *Economics of Education Review*, *21*(6), 523–541.

County Databook (1990). Beijing: Statistical Bureau of China, (in Chinese).

Hannum, E. (1999a). Political change and the urban–rural gap in basic education in China. *Comparative Education Review*, *43*(2), 193–211.

Hannum, E. (1999b). Poverty and educational access in rural China: Constraints in the household and village. Paper presented at the Annual Meeting of the Population Association of America (New York, March).

Hannum, E. (2002a). Ethnic differences in basic education in reform-era rural China. *Demography*, *39*(1), 95–117.

Hannum, E. (2002b). Explaining educational gender inequality in reform-era rural China. Working paper, University of Pennsylvania.

He, D. (1996). *Educational in contemporary China* (in Chinese). Beijing: Contemporary China Press.

Knight, J., & Li, S. (1993). The determinants of educational attainment in China. In K. Griffin, & R. Zhao (Eds.), *The distribution of income in China* (pp. 285–330). London: Macmillan Press.

Knight, J., & Li, S. (1996). Educational attainment and the rural–urban divide in China. *Oxford Bulletin of Economics and Statistics*, *58*(1), 83–117.

Knight, J., & Song L. (2000). Differences in educational access in rural China. Working paper, Department of Economics, University of Oxford.

Tsang, M. (2000). School choice in People's Republic of China. Occasional paper 9, Nov. Teachers College, Columbia University.

Wang, S., & Yuan, M. (1993). Children's education and problems in China (in Chinese). In *1992 children survey of China*. Beijing: China Statistics Press.

Yang, N.-L., & Han, M. (1991). School enrollment, dropping out, and grade repetition in primary and middle school in China (in Chinese). *Education and Research*, 45–57.

Zhou, W., Ma, Y.-Q. & Wu, S.-Q. (1995). The analysis of girls educational problems in Ling Sha Hui minority (in Chinese). *Nationalities Education Research*, 18–19.