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Changes in college attainment and the economic returns to a college degree in urban China, 2003–2010: Implications for social equality

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ABSTRACT

Expansion of higher education is expected to reduce social inequality under the conditions that (1) higher education should become increasingly egalitarian; (2) educational attainment should be the main determinant of class destinations; and (3) individuals from different social backgrounds should benefit from higher education homogeneously. Using representative data collected in mainland China from 2003 to 2010, we find (1) social background factors, especially parents' education, are significantly associated with the opportunity of completing college across periods; (2) the economic returns to a college degree have been longitudinally increasing; and (3) for both 2003 and 2010, people from different social origins benefit from higher education attainment in a homogeneous way. An overall assessment of the findings suggests that changes in college attainment and the returns to higher education in urban China are not in favor of the promotion of general social equality, but maintain the existing extent of inequality.

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1. Introduction

Chinese higher education has undergone a rapid, large-scale expansion since the late 1990s. The number of college graduates nearly tripled over the seven-year period between 2003 and 2010 alone, increasing from 1,877,492 to 5,754,245 (Ministry of Education of PRC, 2003, 2010). This tremendous higher education expansion implies a correspondingly rapid increase in the supply of college-educated workers. The Chinese economy expanded over the same period, as GDP per capita in China grew from 6,392 RMB Yuan in 2000 to 30,015 RMB Yuan in 2010 (National Bureau of Statistics of China, 2011; Wu, 2010). This rapid economic growth, along with the development of polytechnic industries and intensive involvement in the global market following China's entry into the WTO, has increased the demand for technically trained personnel (e.g. Zhao and Jiang, 2011).

Against this background, there are clear reasons to expect that the process of college attainment and the economic returns to higher education have changed, which may bear important implications for social equality in China. Stated broadly, a society possesses a high level of social equality if individuals experience equal opportunity to attend college across social origins, the major determinant of people's life chances is achieved status (especially educational achievement), and those from high-status social origins do not benefit more from a college degree than their lower class counterparts. In the present study, we examine whether changes in the college attainment process and the economic returns to a college degree were in

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favor of these three conditions in urban China from 2003 to 2010. Our findings provide preliminary evidence of the effects of China's grand social changes in the 21st century with respect to general social equality.

We focus on the period between 2003 and 2010 for multiple reasons. Concerted higher education expansion has been the major factor driving increases in the supply of college-educated workers in China in recent years. This expansion was initiated in 1999 when the Ministry of Education of the People's Republic of China launched the project, *Action Scheme for Invigorating Education Towards the 21st Century*, setting forth the explicit goal that the rate of gross higher education enrollment among the school-age population would reach 15% by 2010. As a result of this policy recommendation, Chinese higher education enrollments achieved and subsequently maintained a high level throughout the first decade of the 21st century. Because the first cohort of college graduates who enrolled in college amidst intensive higher education expansion entered the labor market in 2003, we focus on the period between 2003 and 2010 to examine the consequences of higher education expansion with respect to the supply-driven changes in the educational attainment process and the economic returns to higher education. Our data source, the 2003 and 2010 waves of the Chinese General Social Survey (CGSS), are respectively the earliest and the latest available waves of CGSS to date.

The rest parts of this research proceed with a review of previous studies, which is followed by the introduction of data and methodology. Subsequently, we present the major empirical findings and conclusions.

2. Theoretical background

2.1. Social equality, college attainment, and the economic returns to higher education

Social equality is frequently defined in terms of the influence of parental characteristics on children's access to life chances such as educational opportunities. Hout (1988) described this point of view by arguing that "we characterize a society as open or closed, fair or unfair, equitable or inequitable, depending on how advantages and disadvantages are passed from one generation to the next" (Hout, 1988: 1358). A society with a high degree of equality is usually characterized by *social fluidity* in the sense that social origin factors such as parents' educational attainments have weak or null associations with their adult children's access to various social and economic resources. Studies conducted in many industrialized countries have shown that higher education is one important institution with the potential to weaken such intergenerational status transmission linkages and promote social equality (e.g. Breen, 2010; Hout, 1988, 2012). We therefore approach the study of social equality in China by examining relationships among (1) social origins, (2) higher education attainment, and (3) economic outcomes. This triangular relationship has been termed the Origin-Education-Destination (OED) Triangle Model (Breen, 2005: 392; Blau and Duncan, 1967; Hout, 1988; Treiman, 1970), illustrated in Fig. 1.

The OED Triangle Model, as an analytical framework, emphasizes how educational attainment mediates between social background factors and indicators of socio-economic status, so this model illustrates both the determinants of education opportunities and the outcomes of educational attainment. In this light, the OED Triangle Model supplements the classic Blau-Duncan status attainment model (Blau and Duncan, 1967) where the focus was mainly set on the intergenerational transmission of class status (e.g., job status and educational level). The OED Triangle Model's significance to social equality has been established mainly in industrialized societies (e.g. Breen, 2005), but comparable studies using the OED framework are few in developing societies. In China, state-driven higher education expansion brought about a rapid growth in college enrollment within a comparatively short period of time. For instance, the goal set forth in 1999 (a higher education enrollment rate of 15% in 2010) was actually accomplished eight years ahead of schedule due to comprehensive efforts from the central government. Such a rapid rate of state-driven higher education expansion is without precedent among Western societies, and is unlikely to be witnessed there in the future. In this regard, contemporary Chinese society represents an ideal case to which the OED model can be applied to investigate the consequences of higher education expansion on social inequality.
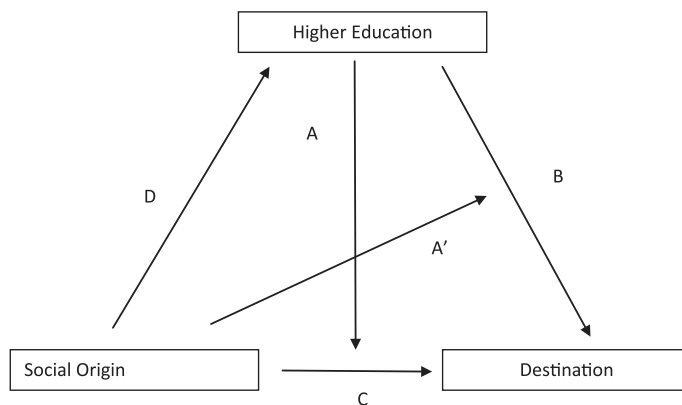

Fig. 1. The origin-education-destination triangle model.

2.2. Social reform, equality, and higher education in China

In the late 1980s, Nee (1989) proposed the market transition theory, highlighting the institutional changes accompanying the shift from a redistributive economy to a market-driven economy in mainland China, as well as the potential effects on income inequality. Since then, sociologists have been actively involved in debates over the market transition's consequences for social stratification (e.g. Bian and Logan, 1996; Bian and Zhang, 2002; Walder, 1996, 2002; Zang, 2002; Zhou, 2000). According to Nee, the market transition in China should bring about rising returns to human capital. In a 2005 paper, Nee and Cao specified three mechanisms to support this point of view. First, formerly state-owned enterprises limit the magnitude of differentials in compensation by arranging payment in an egalitarian manner within the enterprise (Walder, 1995). However, the higher marginal productivity of private enterprises relative to state-owned enterprises in the Reform Era suggests that private enterprises would be able to attract skilled workers by offering a higher income. Second, the labor market's maturation following the demise of the state monopoly on labor allocation facilitates unfettered job hunting among workers. Third, the increased competition between enterprises on the market drives firms, both private and public, to evaluate the performance of employees based on their contributions, which expands the merit-based reward system.

These three mechanisms articulated by Nee and Cao underscore the importance of human capital in obtaining access to life chances in China's Reform Era. Since higher education has always operated as an institution to cultivate human capital (Becker, 1964), the access to higher education opportunities and the "market value" of a college degree lie at the core of research on social inequality. In this regard, examining the OED model may allow us to obtain new insights into the situation of social equality in contemporary China and the potential impacts of rapid, large-scale higher education expansion.

Based on previous studies, social equality is associated with the following three conditions: (1) the extent of equal opportunity to attend college; (2) the strength of higher education attainment's influence on people's life chances; and (3) the pattern of heterogeneity in the economic returns to higher education across social origins. We examine these conditions in detail below.

2.3. Social equality and higher education attainment

As early as the 1970s, Treiman (1970) proposed that the increasing importance of educational attainment to social mobility in industrialized societies would weaken the association between social origins and class destinations. Hout (1988) empirically showed that the association between social origins and class destinations was eliminated among college-degree holders in the United States (Hout, 1988). Treiman's and Hout's pioneering research has proven to be far-reaching, and many subsequent studies have supported their core insights (e.g., Breen and Luijkx, 2007; Erikson and Jonsson, 1998; Fischer and Hout, 2006; Vallet, 2004). The logic underlying this line of thought can be illustrated by the negative effects of path A upon path C in Fig. 1. That is, higher education attainment may function to *reduce the strength* of the association between social origin and class destinations.

The weakening effect of path A on path C, however, depends on the satisfaction of certain conditions. Breen (2010) argued that educational expansion can only lead to greater social mobility when it is accompanied by educational equalization. In particular, two conditions are critical to the equalization functions of higher education: (1) there must be a weak or null association between social origins and opportunities to receive higher education and (2) there must be a strong positive association between higher education attainment and economic status.

In Fig. 1, condition (1) is represented by the weakness of path D. This condition suggests that the opportunity to attend college should be equal so that social origins cannot indirectly determine economic status by influencing access to higher education. This condition is highlighted in research on intergenerational occupational mobility regarding the distinction between attributed and achieved statuses (e.g., Blau and Duncan, 1967).

However, even a seemingly equal system of access to higher education fails to produce social equality to the extent that individuals are allocated to higher- or lower-status occupations as a consequence of social background characteristics. Condition (2) is represented in Fig. 1 by the strength of path B. A strong link between educational attainment and economic status contributes to general social equality because it implies the *meritocratic basis* of status attainment. In the meritocratic situation, employers rely heavily on educational qualifications when making hiring decisions (Breen, 2010). By contrast, if higher educational attainment is not the major factor determining people's economic status, social inequality might be exacerbated as employers instead rely on individuals' non-educational, non-technical, and social-origin-related characteristics when recruiting employees. Goldthorpe and Jackson (2008), for example, point out that when educational and technical qualifications are not clearly indicated for a position in the labor market, employers often take non-educational attributes into consideration when making hiring decisions. Thus, in more open societies, educational attainment should be a strong indicator of personal merits (i.e., human capital) so that factors associated with class origins would not enter the occupational attainment equation.

To summarize, we can say higher education expansion could promote general social equality so long as the association between social origins and higher education opportunity is weak and the association between higher education attainment and economic status is strong. To date, however, empirical studies have not provided much support for the satisfaction of these two conditions.

In the case of condition (1), studies in many countries have documented the persistence in the impacts of parental characteristics on children's higher education attainment (e.g., Shavit and Blossfeld, 1993). Two classic themes, maximally

maintained inequality (MMI) and effectively maintained inequality (EMI), speak to this reality. In developing the MMI theory, Raftery and Hout's (1993) research on the expansion of secondary education in Ireland showed that children from upper class backgrounds were better equipped to take advantage of educational opportunities, and the lower-class children were on average disadvantaged unless "the demand for a given level of education is saturated for the upper class" (Raftery and Hout, 1993: 57). Lucas's EMI perspective (2001) asserts that students with advantageous family backgrounds always obtain higher-quality education than their disadvantaged counterparts, even at the same nominal educational level. Thus, class differences in educational attainment can be both quantitatively and qualitatively maintained. Such comparative advantages among students from higher-status social origins in the educational opportunity hierarchy have been empirically supported in many industrialized countries including Sweden (Jonsson and Erikson, 2007) and Germany (Reimer and Pollak, 2010).

Parental characteristics such as parental education or political identities are also relevant to children's higher educational attainment in China (Fu and Ren, 2010; Hannum and Xie, 1998; Wu, 2010; Zhou et al., 1998). For example, based on census data collected in 1990 and 2000, Wu (2010) found that family background continues to play an important role in determining both school enrollment status and school transitions.[1] In light of the strong exogenous determinants of educational attainment in China, the influence of social origins upon college attainment may not be sufficiently weakened by the concomitant expansion of higher education and increasing demand for technically trained personnel to promote social equality. Therefore, we propose:

H1. There is no significant decline in the strength of the association between social origins and educational attainment from 2003 to 2010.

Condition (2) may also be unlikely to hold according to existing literature (Collins, 2011; Yang et al., 2011). This stance is firstly supported by the "credential inflation" phenomenon, which was addressed by Weber (1946) and has regained academic attention in recent decades (Collins, 1971, 2011). Credential inflation refers to a process in which the market requires increasing levels of educational attainment for the same occupations over time. Consequently, the "market value" of a college degree declines as occupations' minimum degree requirements rise, leading to a decline in the economic returns to higher education. In addition to sociological studies, economists draw a similar conclusion from the perspective of the dynamics between labor demand and supply. As increasing numbers of workers obtain the college degree, the supply of college-educated labor is inflated, which, based on the basic market reasoning, decreases the economic returns to a college degree. The "overeducated worker problem" has been documented in many industrialized countries, such as the U.S. (Rumberger, 1981), Australia (Kler, 2005), Russia (Cheidvasser and Benitez-Silva, 2007), and the U.K. (Dolton and Vignoles, 2000). Over-education has also been identified in Taiwan. For instance, Yang et al. (2011) find that the wage premium of postgraduate education in Taiwan dropped sharply after 2004, which, the authors suggest is a negative consequence of educational expansion.

Despite mainly being identified in industrialized societies, the overeducated worker problem may also apply to Reform-Era China. Although studies focusing on the period before the implementation of higher education expansion policy consolidate the increasing returns to higher education (e.g., Fleisher et al., 2005; Knight and Song, 2003; Wang, 2012; Zhang et al., 2005), it remains to be seen whether such a previously documented pattern will persist in the context of an explosive increase in the supply of college-educated workers. In light of the proliferation of college graduates entering China's labor force following higher education expansion, we hypothesize:

H2. There was a significant decline in the returns to a college degree from 2003 to 2010.

2.4. Heterogeneous returns to higher education

In recent decades, an emerging strand of research has called attention to the pattern of heterogeneity in the economic returns to higher education (Brand and Xie, 2010; Heckman and Li, 2004; Heckman et al., 2006; Henderson et al., 2011; Hout, 2012; Lemieux, 2006; Tsai and Xie, 2008, 2011; Zhu, 2011). Specifically, this line of research focuses on the differential economic benefits of a college degree across members of different status groups. In Fig. 1, such heterogeneity is represented by the line A'.

Answering the question of who benefits most from a college degree is central to understanding the likely impact of higher education expansion on social equality. Depending on how higher education's rewards are distributed, higher education expansion could maintain, narrow, or expand economic gaps between social classes. Generally speaking, the heterogeneous returns to a college degree may exhibit three patterns, as shown in Fig. 2.

In Fig. 2, solid lines and dotted lines stand for the economic status of people from low- and high-status social origins, respectively. Δ_1 and Δ_2 are the economic gaps between social origin groups before and after attending college, respectively. Differences between Δ_1 and Δ_2 are assumed to represent the effect of higher education attainment on economic inequality. If people with different social backgrounds benefitted from a college degree in a uniform manner ($\Delta_1 = \Delta_2$), we would observe the pattern shown in Fig. 2(a), which indicates no effect heterogeneity exists. However, if economic outcomes of college

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[1] A widely documented factor influencing Chinese citizens' access to higher education is household registration status, or *hukou*. However, it is not necessary to control for this variable because the respondents in our analysis all hold urban household registration status.
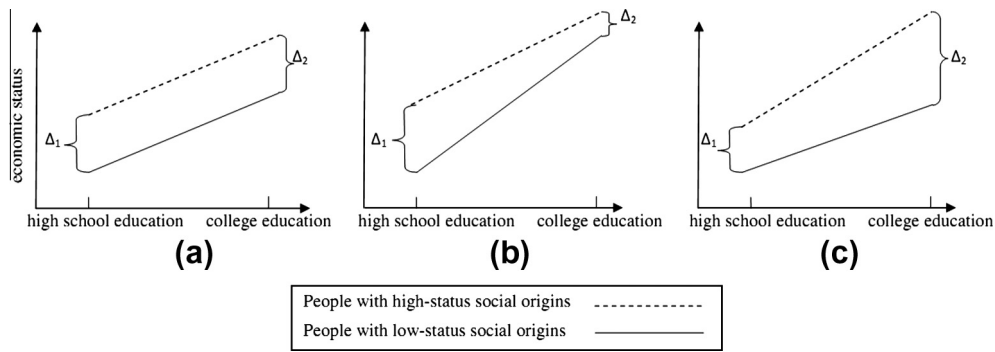
Fig. 2. Patterns of heterogeneous returns to a college degree.

credentials are associated with social origins, we may observe of the other two patterns. In Fig. 2(b), disadvantaged individuals benefit more from higher education than those from high-status social origins, suggesting that the economic gap between them declines as a result of higher education attainment ($\Delta_1 > \Delta_2$). In contrast, Fig. 2(c) illustrates a scenario in which the post-high school gap widens following college completion ($\Delta_1 < \Delta_2$) as individuals from high-status social origins derive additional benefits.

Extant research contains empirical and theoretical support for both patterns of effect heterogeneity. Specifically, Fig. 2(b) implies that "students who got more education than they would otherwise have received actually benefited more than their peers" (Hout, 2012: 384). A number of sociological studies support this conclusion, which is often termed a "negative selection pattern" (Brand and Xie, 2010; Xie, Brand, and Jann, 2012). For instance, African Americans and women are on average disadvantaged with respect to their odds of attending college, but both groups derived especially strong earnings benefits after obtaining a college degree (Bowen and Bok, 1998). Similarly, Brand and Xie (2010) analyzed two data sets from the National Longitudinal Survey of Youth 1979 using propensity scores to calculate each individual's likelihood of attending college, and their findings also lend support to the negative selection pattern.

The theoretical rationale underpinning pattern shown in Fig. 2(c) mainly comes from economics research. In the framework of human capital theory, college education is an investment decision; therefore, people who pursue a college degree have the expectation of higher returns to college education than those who elect to not attend college (Averett and Burton, 1996; Carneiro et al., 2005). This mechanism is often called a "positive selection pattern" (Brand and Xie, 2010). A consequence of positive selection is that the individuals who benefit most from a college degree are those who are best prepared to extract human capital benefits from their higher education experiences. Since successful preparation for college is more readily cultivated by upper class parents who have greater access to human, social, and cultural capital than lower-status parents (Bourdieu, 1977; DiMaggio, 1982), the pattern of positive selection implies that those from higher-status social origins would derive the greatest economic benefits from college education.

What, then, are the implications of these three patterns for broader social equality? Homogeneous returns to higher education do not alter the economic distance between status groups. Although both upper and lower classes benefit from their educational attainments, the economic gap between them is kept at a constant level and the society's degree of social equality is unaltered. A negative selection pattern implies that the economic gap between individuals from disparate social origins is reduced through higher education institutions, thereby promoting social equality. In the case of the positive selection pattern, class differences in economic status are magnified through education, producing a "Matthew effect" (Merton, 1968) by which "the rich get richer and the poor get poorer." This consequence would clearly erode the society's level of equality. In the context of mainland China, the form and extent of heterogeneous returns to a college degree have been understudied, providing little basis upon which to draw a specific, directional hypothesis. We therefore consider the present analysis of higher education's heterogeneous returns exploratory.[2]

3. Data, measures, and methodology

3.1. Data

The data used in this study came from the *Chinese General Social Survey* (CGSS) collected in 2003[3] and 2010 (urban section). Both surveys adopted multi-level random sampling and covered 22 provinces (omitting Tibet), 4 autonomous regions,

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[2] See (author cited) for further discussion of economic returns heterogeneity among Chinese college graduates, including an analysis of longitudinal changes in this heterogeneity.

[3] CGSS 2003 was originally designed to focus on urban residents.

and 4 municipalities directly under the Central Government. CGSS respondents were above 18 years old, and the final original sample sizes were 5,894 in 2003 and 5,745 in 2010.

In the following analysis, we restrict cases to those who (1) were aged between 25 and 32; (2) completed high school education; and (3) were employed. These restrictions are necessary for our research objectives. The 25-to-34 age interval is commonly used in examinations of economic returns to higher education because people in this age group are more likely to be influenced by their educational credentials on the job market than those who are older, and who are consequently more affected by work experience and performance (Tsai and Xie, 2008, 2011). We adjust the upper limit of this age range to be 32 to reflect the seven year interval between data waves. This operation allows us to focus on two distinct cohort groups: those who were born between 1971 (2003–2032) and 1978 (2003–2025) and those between 1978 (2010–2032) and 1985 (2010–2025). This is a desirable quality as the findings of our study are sensitive to potential cohort variations. The restriction on the completion of high school education is applied in consideration of Mare's school transition model (Mare, 1981). To examine higher education's effects on earnings, we first calculate the conditional probability, namely, the likelihood of completing college conditional upon the completion of high school. With this operation, the causal effect of higher education would be estimated in contrast to those who finished high school but did not complete college.

After sample restriction, our final sample sizes are 482 and 541 respectively for CGSS 2003 and CGSS 2010. These relatively small sample sizes raise a potentially important issue. As Breen et al. (2009) pointed out, the potentially limited statistical power associated with small sample size may conceal significant findings. We therefore performed two sets of power analyses to assess the extent to which these sample sizes might limit our ability to draw reliable conclusions. The first power analysis is based on the formula provided by Maxwell (2000), which confirms that our sample sizes for CGSS 2003 and 2010, with conventional assumptions, are large enough to guarantee at least 80% statistical power. We conducted the second analysis using Stata's *powerreg* procedure. The result suggests that, given the number of predictors in our analytic model, we would only need 181 cases to guarantee 90% statistical power. Additionally, according to the standard provided by Knofczynski and Mundfrom (2007); 438, the sample size for a satisfactory prediction level in this study is between 340 and 440, which is largely satisfied.[4] Family background variables, such as parents' educational levels and political identities, are included in the two waves of CGSS, making these data sets ideal for our research objectives. Moreover, these two data sets applied consistent sampling procedures, making comparisons between the two waves appropriate.

3.2. Measures

The two outcome variables we examine are economic status and educational attainment (college completion). *Economic status* is measured by the log transformation of respondents' comprehensive annual income, which includes occupational wage and other sources of income such as business income or subsidies. *Educational attainment* is dichotomized into two levels: 1 refers to *"finishing college degree or above"* and 0 refers to *"finishing high school education but not college education"*. In a recent study, Torche (2011) found a significant connection between social origin and educational attainment at the graduate level in the United States, which calls for further distinction between undergraduates and graduates. However, because the percentages of graduate students were very low in our analytic samples (1.9% in 2003 and around 6% in 2010), such an examination is not feasible in the present study. This limitation might be addressed in future research, should more extensive data on graduate-level education in China become available.

Several variables are used to measure respondents' family backgrounds, including *parents' educational levels* and *political identities*. Because of the low percentage of college degree holders among respondents' parents, we dichotomize parents' education into 1 = *"high school and above"* and 0 = *"below high school"*. Political identity is also a dichotomous variable with 1 = *"member of Communist Party, Democratic Parties, or the Communist Youth League"* and 0 = *"no explicit political identities"*. The potential connection between parental education and children's educational attainment is straightforward. Political identity's salience in Chinese society, on the other hand, may require some explanation. Membership in the Communist Party, Democratic Parties, or the Communist Youth League was associated with access to a variety of social resources in the centrally planned society prior to the reform (e.g., Bian et al., 2001; Li and Walder, 2001). This differential access to valuable social resources influenced individuals' life chances, including the odds of gaining entrance to college. Since the parents of CGSS respondents examined in this study all experienced the centrally planned society before 1978 and were accordingly influenced by their political identities, we include the measure of political identity as an indicator of political capital in this analysis of intergenerational status transmission.

Several control variables are considered in the analysis. *Gender* is a binary variable where 1 represents *"female"* and 0 represents *"male"*. *Age* is a continuous variable calculated by subtracting birth years from corresponding survey years. *Ethnicity*

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[4] Knofczynski and Mundfrom (2007) provide recommended sample sizes when multiple regression models are used for *prediction* purposes. This sample size is correlated with the level of squared population multiple correlation coefficients and the numbers of predictor variables. In our OLS models shown in Table 2, we have six predictors with adjusted R^2 between 0.13 and 0.17, so the sample size for satisfactory prediction would be between 340 and 440 according to the standard provided in Table 1 in Knofczynski and Mundfrom (2007: 438). It is worth mentioning that Knofczynski and Mundfrom's study focuses on the situation in which multiple regression models are used for prediction purposes, while the objective of the OLS models in this study is statistical estimation of the regression coefficients. The sample sizes for estimation and prediction differ from each other. Maxwell (2000) argues that "sample size will almost certainly have to be much larger for obtaining a useful prediction equation than for testing the statistical significance of the multiple correlation coefficient" (435). Therefore, the recommended sample size by Knofczynski and Mundfrom (2007) should be larger than the required one for estimation. In other words, the sample sizes needed in this study should be even smaller than 340 and 440 respectively for the CGSS 2003 and 2010.

is coded into 1 = "*Han ethnicity*" and 0 = "*others*". In the analysis of the economic returns to higher education, we also control for respondents' work unit types and experience.[5] After recoding, *work unit types* in both CGSS 2003 and 2010 are coded into 1 = "*Chinese Communist Party and government offices and public institutions*"; 2 = "*state-owned or collective enterprises*"; 3 = "*private enterprises*"; and 4 = "*others*".[6] The CGSS 2003 and 2010 do not directly measure work experience, so we adopt *years of Mincer experience* (defined as age minus years of schooling minus 6) (Mincer, 1974). Descriptive information for these variables can be found in the Appendix.

Like other studies of the returns to educational attainment, the present study is also subject to the potential bias caused by omitting the variable *ability* (e.g. Brand and Halaby, 2006; Card, 2001; Dale and Krueger, 2002; Heckman and Singer, 1984).[7] Personal ability is related to the likelihood of attending and completing college as well as labor market outcomes, making it necessary to control for ability when estimating the *causal* effect of college completion on economic status. However, this has proved to be very difficult, not only because a direct measure of ability is usually not available in a generic social survey like the CGSS, but also because even purportedly direct measures (e.g., IQ scores) cannot reflect every relevant aspect of personal ability (Hout, 2012). Thus, scholars usually take one of two approaches to address the omitted ability variable problem. The first approach is to control for variables associated with personal ability so that personal ability is indirectly controlled. For instance, Heckman and Li (2004) use parental income as a proxy for ability. The second approach is to conduct sensitivity analysis to evaluate the extent to which conclusions are robust to personal ability's omission (e.g., Altonji et al., 2005; Riphahn and Schieferdecker, 2012). We employ both approaches in this study. Using propensity score matching, we matched the cases according to family background measures in the region of common support. Since family origins, especially among the family-centered Chinese, determine much of the environment in which individuals cultivate an assortment of abilities, propensity score matching allows us to *indirectly* control for ability. Additionally, we conducted the Rosenbaum bound test to check the robustness of our conclusions, the results of which were satisfactory (see detailed description below). In summary, we acknowledge the potential complications associated with omitting variable measure of ability in the current study, and address this problem using multiple statistical procedures. The results suggest that omitting the ability variable does not introduce material biases.

3.3. Methods

We construct a model regressing higher educational attainment on the social background variables age, gender, ethnicity, parental education, and parental political identities to examine changes in the process of college attainment. We use logistic regression to examine the effects of different predictors on respondents' log-odds of completing college.

In addition to the effects of specific predictors, we also compare the coefficients obtained from the two models fitted respectively for CGSS 2003 and 2010. One problem in the generic logistic model is the heterogeneous variances of the error terms for different research groups/populations. Because logistic regression coefficients are obtained by integrating the information of the heterogeneous variance of error terms, a direct comparison of logistic regression coefficients across groups would be problematic (Mood, 2010; Williams, 2009). One solution to this problem, suggested by Mood (2010) and Breen and Karlson (2013), is to estimate a linear probability model by treating the binary dependent variable as if it were continuous, and then compare coefficients based on these linear regression results rather than logistic regression. In this study, we conduct the cross-period comparison analysis using a simple Wald test proposed by Liao (2004, 2012).[8]

Our second research question concerns changes in the earning returns to higher education between 2003 and 2010. A simple approach to address this question would seem to be the comparison of returns over time with a Mincer-type regression model (Mincer, 1974). However, selection bias may lead people to have different likelihoods of receiving the "treatment" of higher education. A commonly used method of dealing with this selection bias in non-experimental environment is propensity score matching (Morgan and Winship, 2007; Rubin, 1997). We apply propensity score matching by predicting the probability of completing college education (the propensity score) based on individual's exogenous social background variables. We then restrict a Mincer-type regression model to those cases in the region of common support (i.e., the region of propensity score within which both treated [those who complete higher education] and control individuals

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[5] Because of differential access to life chances across different work units, we want to investigate the returns to higher education *conditional on* the types of work unit, hence we control for the variable of work unit types. Since no previous studies, to the best of our knowledge, suggest that college graduates concentrate in certain types of work units, controlling for work unit type should not produce underestimated effects of college education on income.

[6] The original codings in the CGSS 2003 and 2010 are different. In CGSS 2003, work unit types are coded into 1 = "Party and government offices"; 2 = "state-owned enterprises"; 3 = "public institutions"; 4 = "collectively owned enterprises or institutions"; and 5 = "others", while that for the CGSS 2010 is 1 = "Party and government offices"; 2 = "enterprises"; 3 = "public institutions"; 4 = "social groups"; and 5 = "others". Since it is desirable to use the same model specification when comparing two waves of survey data, we recoded the work unit types variable to ensure consistent operationalization across these two surveys. In order to further differentiate private enterprises from state-owned ones in CGSS 2010, we take into consideration another variable which indicates enterprises' type of ownership. We thank an anonymous reviewer for bringing this variable to our attention.

[7] For instance, omitting ability in regression model may incur selection bias (e.g., Brand and Xie, 2010; Brand and Halaby, 2006). In the literature of econometrics, this problem is also called unobserved heterogeneity (e.g., Heckman and Singer, 1984; Dale and Krueger, 2002).

[8] There is another approach to compute cross-period variation, as described in Tsai and Xie (2008). In the Tsai-Xie approach, the first step is to pool the data of the CGSS 2003 and CGSS 2010. Then, regression models with the interaction term between college education and a dummy variable representing period (2003 and 2010) are fitted. A significant interaction term is an evidence for cross-period variation. We initially followed this strategy and performed supplementary analysis. Although the interaction terms are significant, adding them to the regression model brings about severe multicollinearity problems (VIFs are extraordinarily large). In light of this problem, we decided not to pool the CGSS 2003 and 2010 and instead fit separate OLS models and made coefficient comparisons using the method proposed by Liao (2004, 2012).

[those who do not have higher education] are observed and matched). The advantage of focusing on cases in the region of common support is to create a quasi-random experiment environment in which both college-educated adults (treated) and less-educated adults (untreated) in the Mincer regression model have comparable probabilities of having completed college. When implementing propensity score matching, it is important to assess the balancing of covariates and the robustness to omitted variables. The balancing test is performed automatically in our statistical procedure, and sensitivity analysis (Rosenbaum bounds test) is used to evaluate the robustness to the omitted variable problem.[9]

Our final research question asks whether people from different social origins benefitted equally from higher education in economic terms. Following Brand and Xie's (2010) method for detecting heterogeneous treatment effects, we investigate the changes in the returns of education across different blocks of propensity score in 2003 and 2010. Individuals within a given block have similar values of the propensity score, which means they have roughly equivalent predicted probabilities of completing college, conditional on our set of exogenous characteristics. We first regress income on education in each block to obtain the block-based regression coefficients. We then perform a second linear regression to examine the relationship between those block-based regression coefficients and propensity score values. Because the propensity score is calculated based on social background factors, we can conclude that the returns to higher education are homogenous if the regression model's predicted returns to higher education are similar across different propensity score blocks.

Each of these statistical analyses was performed in Stata 11. Propensity score matching was accomplished using *pscore* and *psmatch2* procedures, and the Rosenbaum bounds analysis was performed using *rbounds* procedure. We analyzed the uniformity of higher education returns using the *hte* procedure (Jann et al., 2008).

4. Findings

4.1. Changes in the equality of higher education opportunity between 2003 and 2010

Table 1 presents the results of logistic and linear regression models with educational attainment as the dependent variable. Here we are interested in the effects of parental characteristics on individuals' educational attainment.

In CGSS 2003, we find father's and mother's education have similar positive impacts on their children's likelihood of completing higher education. Compared with the likelihood of completing college education among people whose fathers did not complete high school, the odds of attending college among those whose fathers completed high school is 0.75 ($e^{0.56}-1$) times higher. The corresponding increase in such odds for mother's education is 1.61 ($e^{0.96}-1$) times. These impacts of parental education remain statistically significant in the 2010 sample. The likelihood of completing college among individuals with fathers and mothers who completed high school education is respectively 1.52 and 1.99 times the likelihoods for people whose parents were less educated in 2010. Thus, the findings presented in Table 1 suggest the persistence of parental education's influence on children's educational attainment in the wake of large-scale higher education expansion.

By contrast, we find no significant effect of parents' China Communist Party (CCP) membership in 2003 or 2010. We interpret this result in light of market transition history. Taking the 2003 survey for example, since we restricted our sample to ages 25–32, the respondents' parents were generally born in the 1950s and subsequently experienced the comprehensive social reform as young adults. As a result of reform, a CCP membership no longer guarantees an advantage in life chances. In fact, many CCP members who formerly worked in state-owned enterprises were laid off following the reform, a phenomenon known as *xiagang* (Lee, 2000). Thus, the market-oriented transition might account for the nonsignificant effect of parental CCP membership.[10]

We examine longitudinal changes in these effects by testing the difference in parental education's regression coefficients in linear regression models across periods. As shown in the rightmost column of Table 1, we find that the effects of parental education on children's likelihood of completing college education do not show statistically significant changes from 2003 to 2010 at the 0.05 level. In other words, in the process of higher education expansion and the increasing demand for skilled labor between 2003 and 2010, the link between parental education and children's likelihood of completing higher education

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[9] In the Rosenbaum bound test, the gamma coefficient is used to denote the impact of a hypothesized omitted covariate on the probability of getting into college. If gamma is equal to 1, it means this covariate has no effect. If gamma is equal to 2, then an individual is predicted to have two times the estimated probability of getting into college than another individual if their values on this hypothesized omitted covariate differ. This probability difference persists even when these two individuals' scores on the observed covariates in the logistic model are the same. Thus, as gamma becomes larger, the hypothesized omitted covariate becomes more important, and accordingly our conclusion based on the existing model becomes more tenuous. This is statistically reflected by the significance level of certain statistics (for binary outcomes, the statistic is McNemar's test). If the statistic is significant, then our conclusion is still valid. In Rosenbaum bounds analysis, we typically test how large the gamma value has to be in order to make the statistic NOT significant. If the gamma coefficient has to be very large to make the statistic nonsignificant, this indicates that the hypothesized omitted covariate is rare and this suggests our model is acceptable. A rule of thumb for the social sciences is to set the range of gamma coefficient between 1 and 2. If the gamma coefficient has to be quite large (close to 2) to make corresponding statistic nonsignificant, then our model used to predict propensity score can be considered robust to omitted-covariate bias.

[10] An anonymous reviewer raised the question of whether parental political identity may affect the association between parental education and children's educational attainment. We conducted supplementary analyses by adding the interaction terms between parental education and parental political identity to the models that predict the likelihood of attending college. These interactions terms are not significant for both the CGSS 2003 and 2010, suggesting parental political identity does not moderate the association between parental education and children's educational attainment.

Table 1
Logistic regression and multiple regression results predicting the higher education attainment.

	CGSS 2003		CGSS 2010		CGSS 2003–CGSS 2010
	Logistic model	OLS	Logistic model	OLS	OLS
Father education (high school or above = 1)	0.56(0.21)**	0.13(0.05)**	0.42(0.24)#	0.08(0.05)#	0.05(0.07)
Mother education (high school or above = 1)	0.96(0.29)***	0.22(0.06)***	0.69(0.27)**	0.12(0.05)**	0.10(0.08)
Father political identity (Communist Party, Democratic Parties, or the Communist Youth League = 1)	0.27(0.20)	0.06(0.05)	−0.12(0.23)	−0.02(0.04)	0.08(0.06)
Mother political identity (Communist Party, Democratic Parties, or the Communist Youth League = 1)	−0.05(0.33)	−0.01(0.07)	0.83(0.47)#	0.10(0.07)	−0.11(0.10)
Gender(female = 1)	0.05(0.19)	0.01(0.04)	−0.19(0.20)	−0.04(0.04)	0.05(0.06)
Ethnicity (Han ethnicity = 1)	−0.28(0.39)	−0.06(0.09)	−0.28(0.42)	−0.05(0.08)	−0.01(0.12)
Age	−0.01(0.04)	0.00(0.01)	0.02(0.05)	0.00(0.01)	0.00(0.01)
Intercept	0.06(1.23)	0.51(0.29)	0.40(1.36)	0.62(0.26)	−0.11(0.39)
Adj. R^2 (Pseudo R^2)	0.06	0.06	0.05	0.04	
N	474	474	524	524	

Note: regression coefficient with standard errors in parentheses.
* $p < 0.05$.
Data sources: the Chinese General Social Survey 2003 and 2010.
# $p < 0.1$.
** $p < 0.01$.
*** $p < 0.001$ (two-sided test).

Table 2
Results of miner regression based on matched sample.

	CGSS 2003	CGSS 2010	CGSS 2003–CGSS 2010
College	0.33(0.09)***	0.64(0.11)***	−0.31(0.14)*
Gender(female = 1)	−0.19(0.07)**	0.40(0.08)***	−0.59(0.10)***
Ethnicity (Han ethnicity = 1)	0.09(0.14)	0.22(0.15)	−0.13(0.21)
Mincer experience	−0.02(0.07)	0.08(0.06)	−0.10(0.09)
Mincer experience2	0.00(0.00)	−0.01(0.00)	0.01(0.01)
Work unit (reference = Party and government offices and public institutions			
State-owned or collective enterprises	−0.35(0.09)***	0.26(0.11)*	−0.61(0.12)***
Private enterprises	0.05(0.11)	0.31(0.09)***	−0.26(0.16)
Others	0.97(0.32)**	0.30(0.11)**	0.67
Intercept	9.34(0.34)***	8.94(0.29)***	0.40(0.45)
Adj. *R*-squared	0.15	0.16	
N	394	448	

Note: regression coefficient with standard errors in parentheses.
# $p < 0.1$.
Data sources: the Chinese General Social Survey 2003 and 2010.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (two-sided test).

did not change significantly. In light of this persistence of parental effects, H1 is supported and we do not find evidence of increasingly egalitarian educational opportunities.

4.2. Changes in the returns to higher education between 2003 and 2010

To examine the returns to higher education, we perform propensity score matching based on the logistic model results in Table 1. In CGSS 2003 and CGSS 2010, the range of common support is respectively [0.35, 0.84] and [0.59, 0.94]. The number of respondents in common support is 473 (232 untreated and 241 treated) in 2003 and 523 (142 untreated and 381 treated) in 2010.

The balancing of the matched sample is assessed by *t*-tests of covariates' mean values between the treated and control groups. The matching procedures for both CGSS 2003 and CGSS 2010 satisfy this test (results not shown). In addition to balancing, we tested the matching model's robustness to potential omitted variable problems using the Rosenbaum bounds test. As of this writing, there is no consensus criterion for the assessment of Rosenbaum bounds test results. A rule-of-thumb standard is to check the significance of the Rosenbaum bounds test when gamma value is around 2. In the present analysis, the p-values for Rosenbaum bounds test are 0.05 and 0.01 when gamma value is 2, respectively for CGSS 2003 and CGSS
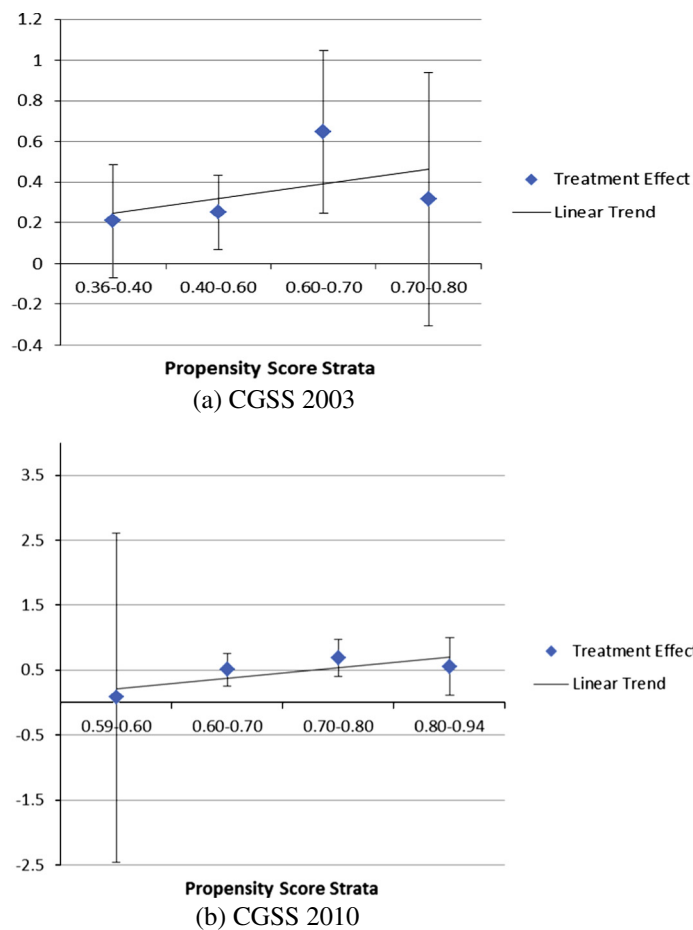
(a) CGSS 2003

(b) CGSS 2010

Fig. 3. The heterogeneous returns to higher education. Data sources: the Chinese General Social Survey 2003 and 2010.

2010. In this regard, we may say the matching procedure in our analysis is moderately accepted with regard to the potential omitted-variable problem.

Results of the Mincer-type regression models based on matched samples are reported in Table 2. A potential concern in Table 2 relates to missing data when fitting the OLS models. However, further examination of the variables in the OLS models suggests that this missingness is primarily due to missing values of the outcome variable. Following Von Hippel (2007), who explains that it is inappropriate to impute scores for the dependent variable using multiple imputation, we do not perform multiple imputation to correct for item missingness.

College education was significantly associated with increased income levels in both 2003 and 2010. The regression coefficient for 2003 is 0.35, increasing to 0.64 in 2010. Further examination of the difference between these two coefficients suggests that this increase is statistically significant. Hence, the results reported in Table 2 of increasing economic benefits of higher education reject H2 and indicate that the growing demand for better-skilled labor as Chinese society deepens marketization and gradually transitions from a labor-intensive economy to a skill- and technology-intensive economy *exceeds* the increasing supply of college-educated personnel, which raises the equilibrium point of wage level for college graduates.

4.3. Changes in the homogeneity of returns to higher education between 2003 and 2010

Fig. 3(a) and (b) shows the relationship between the treatment effects (the economic returns to higher education) and the estimated propensity scores across different blocks in 2003 and 2010. Because the propensity score is estimated based on social background factors, the score values can be interpreted as a measure summarizing social origin information. Following Brand and Xie (2010)'s method, Fig. 3(a) and (b) illustrates the extent of heterogeneity in the economic returns to higher education across different propensity score blocks respectively for CGSS 2003 and CGSS 2010. Additional details of the results of these models can be found in the Appendix.

We find the returns to higher education are relatively stable across blocks of propensity score in both 2003 and 2010, as the regression slopes in both models are nonsignificant. This finding suggests that people from different social origins

benefitted economically from a college education in a generally uniform way. Thus, we conclude that the economic returns to higher education were homogeneous following large-scale higher education expansion in China, suggesting that social equality neither increased nor decreased as a result.[11]

5. Summary and conclusion

We addressed the following question in this study: are changes in the college attainment process and economic returns to higher education following concerted expansion of higher education in favor of general social equality in urban China? We addressed this question using the OED framework by investigating the relationships among social origins, educational attainment, and economic status destination. Using data from CGSS 2003 and CGSS 2010, our findings empirically demonstrate that social origin factors, especially parents' educational levels, are significantly associated with the likelihood of completing college, and such effects were stable from 2003 to 2010. Additionally, a college degree became increasingly important to urban residents' economic life, as we identified a significant increase in the economic returns to college education following education expansion. Finally, the returns to higher education remained homogenous across social classes from 2003 to 2010.

Taken together, these findings describe a complex pattern of OED relationships from which we can assess implications for social equality in contemporary urban China. Overall, we interpret the findings as supportive of the conclusion that recent higher education expansion does *not* contribute to social equality among Chinese urban residents. Because upper class individuals have marked advantages in college attendance, the pattern identified in this research resonates with the classic "maximally maintained inequality" theme (Raftery and Hout, 1993).

Does this, then, imply that the economic gap between social classes in urban China was widened by the expansion of higher education from 2003 to 2010? The homogeneous returns to a college degree across period suggest that the between-class economic gap is largely "maintained" rather than "exacerbated" through higher education. The form of inequality that intensified most noticeably, however, was the economic gap between college-educated and less-educated individuals in urban China, as indicated by the increasing (but homogenous) returns to a college degree across social origins. In other words, if we define individuals from upper- and lower-class family origins as two distinct groups, the expansion of higher education in China does not increase, but rather maintains *between-group* inequality. However, the increasing value of the college credential exacerbates *within-group* inequality by widening the economic distance between the well-educated and the less-educated among members of both the upper- and lower-class groups.

The present study builds upon findings from recent related work. First, most studies on the relationship between social equality and higher education focus on the equality of opportunity, namely, the extent of equality in college attendance (e.g. Shavit et al., 2007; Shavit and Blossfeld, 1993). As this body of research shows, equal higher educational opportunity is an important condition for the promotion of social equality in the process of higher education expansion. It is not the sole relevant condition, however. In addition to equal opportunity, we must also attend to the strength of the link between college degree attainment and economic status as well as the potential heterogeneity in the returns to a college degree. In this regard, the present study helps to construct a more comprehensive conceptual framework examining the relationship between education and social equality.

As a second contribution, our analysis highlights the fact that mainland China is an important case to add to the library of the sociological studies of higher education expansion. In previous research in the sociology of education, only Taiwan has been extensively studied as a representative of Eastern Asian countries (e.g. Tsai and Shavit, 2007). This is undoubtedly insufficient. Our findings underscore the differences between mainland China and Taiwan. For example, the expansion of higher education in Taiwan was associated with a decline in the influence of parental education on children's college entrance opportunity (Tsai and Shavit, 2007), while we do not detect a similar decline in mainland China. Additionally, ethnicity has been a key variable determining people's college opportunity in Taiwan, and the decline of its influence is a primary indicator of progress toward educational equality. However, ethnicity was not as relevant to college completion among urban residents in mainland China in either 2003 or 2010. All in all, the social consequences of higher education expansion and economic transition in mainland China show distinctive characteristics from those of Taiwanese society and many other industrialized countries, which highlight the necessity of continuing to study mainland China in detail in the future.

Finally, the increasing significance of educational attainment in determining people's economic status also sheds light on the theoretical debate surrounding the major determinants of people's life chances in the Reform Era of China (Bian and Logan, 1996; Nee, 1989). As educational attainment becomes increasingly consequential, it is reasonable to assume that the leeway for the economic effects of political identities or work unit types should be accordingly narrowed, which lends support to arguments about the changing relative significance of political capital and human capital in the process of market transition (Nee, 1989).

This study possesses certain limitations that might be addressed in future work. First, the present study does not include rural residents in the analysis. Chinese rural residents face enormous disadvantages in their access to higher education due to their financial straits, limited educational resources, and structural barriers to full participation. Thus, we might

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[11] We double-checked this finding by performing the same analysis using *hte2* and *hte3*, two nonparametric procedures assess the relationship between treatment effects and propensity score values. The results of both methods were consistent with those reported.

Table A1
Descriptive statistics of covariates.

	CGSS 2003 Mean/Percentage (S. D.)	CGSS 2010 Mean/Percentage (S. D.)
College	52%	73%
Gender (female = 1)	49%	55%
Ethnicity (Han ethnicity = 1)	93%	93%
Age	28.78 (2.36)	28.55 (2.25)
Father education (high school or above = 1)	40%	44%
Father political identity (Communist Party, Democratic Parties, or the Communist Youth League = 1)	41%	35%
Mother education (high school or above = 1)	21%	33%
Mother political identity (Communist Party, Democratic Parties, or the Communist Youth League = 1)	13%	11%
Work unit types		
Party and government offices and public institutions	32.03%	28.89%
State-owned or collective enterprises	47.71%	16.85%
Private enterprises	18.52%	35.00%
Others	1.74%	19.26%
Mincer experience	8.95 (3.01)	7.61 (3.00)
Log income	9.37 (0.73)	10.31 (0.86)

Data sources: the Chinese General Social Survey 2003 and 2010.

Table A2
Heterogeneous effects of higher education on log income by propensity score strata.

CGSS 2003		CGSS 2010	
Strata of Propensity Scores	Coef. (S. E.)	Strata of Propensity Scores	Coef. (S. E.)
0.36–0.40	0.21(0.14)	0.59–0.60	0.08(1.29)
0.40–0.60	0.25(0.09)[***]	0.60–0.70	0.51(0.13)[***]
0.60–0.70	0.65(0.20)[***]	0.70–0.80	0.69(0.14)[***]
0.70–0.80	0.32(0.32)	0.80–0.94	0.55(0.23)[**]
Linear trend		Linear trend	
Slope	0.12 (0.09)	Slope	0.06(0.12)
Intercept	−0.05 (0.29)	Intercept	0.28(0.57)

Data sources: the Chinese General Social Survey 2003 and 2010.
[*] $p < 0.1$.
[**] $p < 0.05$.
[***] $p < 0.01$ (two tails test).

reasonably expect a different pattern to be revealed should future scholars integrate rural residents into a similar study. Also, Brand and Xie (2010) showed that omitting a measure of personal ability can change the direction of selection bias based on U.S. survey data. Although the results of sensitivity analysis suggest that our propensity score matching procedure is generally robust to unobservable biases, it will be more persuasive if future studies can take ability variables into consideration in the event that such data become available. Bearing these limitations in mind, our results should prove informative for future social stratification research, as our findings represent a significant step toward establishing comprehensive connections between large-scale changes in college attainment and the economic returns to a college degree in urban China.

Acknowledgment

Appendix A

See Tables A1 and A2.

References

Altonji, Joseph, Elder, Todd, Taber, Christophe., 2005. Selection on observed and unobserved variables: assessing the effectiveness of catholic schools. J. Pol. Econ. 113, 151–184.
Averett, Susan L., Burton, Mark L., 1996. College attendance and the college wage premium: differences by gender. Econ. Educ. Rev. 15, 37–49.
Becker, Gary.S., 1964. Human Capital: a Theoretical and Empirical Analysis, with Special Reference to Education. Columbia University Press, New York.
Bian, Yanjie, Logan, John, 1996. Market transition and the persistence of power. Am. Sociol. Rev. 61, 739–758.

Bian, Yanjie, Zhang, Zhanxin, 2002. Marketization and income distribution in urban China: 1988 and 1995. Res. Soc. Stratification Mobility 19, 377–415.
Bian, Yanjie, Shu, Xiaoling, Logan, John R., 2001. Communist party membership and regime dynamics in China. Soc. Forces 79, 805–841.
Blau, Peter M., Duncan, Otis D., 1967. The American Occupational Structure. Wiley, New York.
Bourdieu, Pierre, 1977. Cultural reproduction and social reproduction. In: Jerome, Karabel, Halsey, A.H. (Eds.), Power and Ideology in Education. Oxford University Press, New York, pp. 487–511.
Bowen, William G., Bok, Derek, 1998. The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions. Princeton University Press, Princeton.
Brand, Jennie E., Halaby, Charles N., 2006. Regression and matching estimates of the effects of elite college attendance on educational and career achievement. Soc. Sci. Res. 35, 749–770.
Brand, Jennie E., Xie, Yu, 2010. Who benefits most from college? Evidence for negative selection in heterogeneous economic returns to higher education. Am. Sociol. Rev. 75, 273–302.
Breen, Richard, 2010. Educational expansion and social mobility in the 20th century. Soc. Forces 89, 365–388.
Breen, Richard, 2005. Social Mobility in Europe. Oxford University Press, New York.
Breen, Richard, Karlson, Kristian B., 2013. Counterfactual causal analysis and nonlinear probability models. In: Morgan, Stephen L. (Ed.), Handbook of Causal Analysis for Social Research. Springer, New York, pp. 167–188.
Breen, Richard, Luijkx, Ruud, 2007. Social mobility and education: a comparative analysis of period and cohort trends in Britain and Germany. In: Scherer, Stefani, Pollak, Reinhardt, Otte, Gunnar, Gangl, Markus (Eds.), From Origin to Destination: Trends and Mechanisms in Social Stratification Research. Campus, Frankfurt, pp. 102–124.
Breen, Richard, Luijkx, Ruud, Muller, Walter, Pollak, Reinhard, 2009. Nonpersistent inequality in educational attainment: evidence from eight European countries. Am. J. Sociol. 114, 1475–1521.
Card, David, 2001. Estimating the returns to schooling: progress on some persistent econometric problems. Econometrica 69, 1127–1160.
Carneiro, Pedro, Heckman, James J., Vytlacil, Edward, 2005. Understanding what instrumental variables estimate: estimating marginal and average returns to education. Paper presented as Economic Journal Lecture at the Royal Economic Society Meeting, Durham, England.
Cheidvasser, S., Benitez-Silva, H., 2007. The educated Russian's curse: returns to education in the Russian federation during the 1990s. Labor 21, 1–41.
Collins, Randall, 1971. Functional and conflict theories of educational stratification. Am. Sociol. Rev. 36, 1002–1019.
Collins, Randall, 2011. Credential inflation and the future of universities. Ital. J. Sociol. Educ. 2, 228–251.
Dale, Stacy B., Krueger, Alan B., 2002. Estimating the payoff to attending a more selective college: an application of selection on observables and unobservables. Q. J. Econ. 117, 1491–1527.
DiMaggio, Paul, 1982. Cultural capital and school success: the impact of status culture participation on the grades of US. High school students. Am. Sociol. Rev. 47, 189–201.
Dolton, Peter, Vignoles, Anna, 2000. The incidence and effects of overeducation in the UK graduate labor market. Econ. Educ. Rev. 19, 179–198.
Erikson, Robert, Jonsson, Jan O., 1998. Qualifications and the allocation process of young men and women in the Swedish labor market. In: Shavit, Yossi, Müller, Walter (Eds.), From school to work: a comparative study of educational qualifications and occupational destinations. Oxford University Press, New York, pp. 369–406.
Fischer, Claude S., Hout, Michael, 2006. Century of difference. How America changed in the last one hundred years. Russell Sage Foundation, New York.
Fleisher, Belton M., Sabirianova, Klara, Wang, Xiaojun, 2005. Returns to skills and the speed of reforms: evidence from central and Eastern Europe, China, and Russia. J. Comp. Econ. 33, 351–370.
Fu, Qiang, Ren, Qiang, 2010. Educational inequality under China's rural-urban divide: the Hukou system and return to education. Environ. Plan. 42, 592–610.
Goldthorpe, John H., Jackson, Michelle, 2008. Education-based meritocracy: the barriers to its realization. In: Lareau, Annette, Conley, Dalton (Eds.), Social Class: How does it Work? Russell Sage Foundation, New York, pp. 93–117.
Hannum, Emily, Xie, Yu, 1998. Ethnic stratification in northwest China: occupational differences between Han Chinese and National Minorities in Xinjiang, 1982–1990. Demography 35, 323–333.
Heckman, James, Li, Xuesong, 2004. Selection bias, comparative advantage and heterogeneous returns to education: evidence from China in 2000. Pac. Econ. Rev. 9, 155–171.
Heckman, James, Singer, Burton, 1984. A method for minimizing the impact of distributional assumptions in econometric models for duration data. Econometrica 52, 271–320.
Heckman, James, Urzua, Sergio, Vytlacil, Edward, 2006. Understanding instrumental variables in model with essential heterogeneity. Rev. Econ. Stat. 88, 389–432.
Henderson, Daniel, Polachek, Solomon, Wang, Le, 2011. Heterogeneity in schooling rates of return. Econ. Educ. Rev. 30, 1202–1214.
Hout, Michael, 1988. More universalism, less structural mobility – the American occupational structure in the 1980s. Am. J. Sociol. 93, 1358–1400.
Hout, Michael, 2012. Social and economic returns to college education in the United States. Annu. Rev. Sociol. 38, 379–400.
Jann, Ben, Brand, Jennie E., Yu Xie 2008. Hte–Stata Module to Perform Heterogeneous Treatment Effect Analysis. <http://ideas.repec.org/>.
Jonsson, Jan O., Erikson, Robert, 2007. Why educational expansion is not such a great strategy for equality: theory and evidence for Sweden. In: Shavit, Yossi, Arum, Richard, Gamoran, Adam (Eds.), Stratification in Higher Education: A Comparative Study. Stanford University Press, Stanford, pp. 113–139.
Kler, Parvinder, 2005. Graduate overeducation in Australia: a comparison of the mean and objective methods. Educ. Econ. 13, 47–72.
Knight, John, Song, Lina, 2003. Increasing urban wage inequality in China: extent, elements and evaluation. Econ. Transit. 11, 597–619.
Knofczynski, Gregory. T., Mundfrom, Daniel, 2007. Sample sizes when using multiple linear regression for prediction. Educ. Psychol. Meas. 68, 431–442.
Lee, Hong Yung, 2000. Xiagang, the Chinese Style of laying off workers. Asian Survey 40, 917–937.
Lemieux, Thomas, 2006. Post-secondary education and increasing wage inequality. Am. Econ. Rev. 96, 195–199.
Li, Bobai, Walder, Andrew G., 2001. Career advancement as party patronage: sponsored mobility into the Chinese administrative elite, 1949–1996. Am. J. Sociol. 106, 1371–1408.
Liao, Tim F., 2004. Comparing social groups: Wald statistics for testing equality among multiple logit models. Int. J. Comp. Sociol. 45, 3–16.
Liao, Tim F., 2012. Group differences in generalized linear models. In: Morgan, Stephen L. (Ed.), Handbook of Causal Analysis for Social Research. Springer, New York, pp. 153–166.
Lucas, Samuel R., 2001. Effectively maintained inequality: education transitions, track mobility, and social background effects. Am. J. Sociol. 106, 1642–1690.
Mare, Robert D., 1981. Change and stability in educational stratification. Am. Sociol. Rev. 46, 72–87.
Maxwell, Scott E., 2000. Sample size and multiple regression analysis. Psychol. Methods 5, 434–458.
Merton, Robert K., 1968. The Matthew effect in science. Science 159, 56–63.
Mincer, Jacob, 1974. Schooling, Experience, and Earnings. National Bureau of Economic Research, New York.
Ministry of Education of PRC, 2003. Statistical Data of Education. <http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/moe_564/index.html> (Retrieved from 25.07.12).
Ministry of Education of PRC, 2010. Statistical Data of Education. <http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s6200/index.html (Retrieved from 25.07.12).
Mood, Carina, 2010. Logistic regression: why we cannot do what we think we can do, and what we can do about it. Eur. Sociol. Rev. 26, 67–82.
Morgan, Stephen L., Winship, Chrstopher, 2007. Counterfactuals and Causal Inference. Methods and Principles for Social Research. Cambridge University Press, New York.
National Bureau of Statistics of China, 2011. Gross Domestic Product. <http://www.stats.gov.cn/tjzs/gnsczz.pdf> (Retrieved from 25.07.12).
Nee, Victor, 1989. A theory of market transition: from redistribution to markets in state socialism. Am. Sociol. Rev. 54, 663–681.

Raftery, Adrian E., Hout, Michael, 1993. Maximally maintained inequality – expansion, reform, and opportunity in Irish education, 1921–1975. Sociol. Educ. 66, 41–62.

Reimer, David, Pollak, Reinhard, 2010. Educational expansion and its consequences for vertical and horizontal inequalities in access to higher education in west Germany. Eur. Sociol. Rev. 26, 415–430.

Riphahn, Regina T., Schieferdecker, Florian, 2012. The transition to tertiary education and parental background over time. J. Popul. Econ. 25, 635–675.

Rubin, Donald B., 1997. Estimating causal effects from large data sets using propensity scores. Ann. Intern. Med. 127, 757–763.

Rumberger, Russell, 1981. Overeducation in the U.S. Labor Market. Praeger Publishers, Westport.

Shavit, Yossi, Blossfeld, Hans-Pter, 1993. Persistent Inequality: Changing Educational Attainment in Thirteen Countries. Westview Press, Boulder.

Shavit, Yossi, Arum, Richard, Gamoran, Adam, 2007. Stratification in Higher Education: A Comparative Study. Stanford University Press, Stanford.

Torche, Florencia, 2011. Is a college degree still the great equalizer? Intergenerational mobility across levels of schooling in the United States. Am. J. Sociol. 117, 763–807.

Treiman, Donald J., 1970. Industrialization and social stratification. Sociol. Inquiry 40, 207–234.

Tsai, Shuling, Yossi, Shavit, 2007. Taiwan: higher education-expansion and equality of educational opportunity. In: Yossi, Shavit, Arum, Richard, Gamoran, Adam (Eds.), Stratification in Higher Education: A Comparative Study. Stanford University Press, Stanford, Pp, pp. 140–164.

Tsai, Shuling, Xie, Yu, 2008. Changes in earnings returns to higher education in Taiwan since the 1990s. Popul. Rev. 47, 1–20.

Tsai, Shuling, Xie, Yu, 2011. Heterogeneity in returns to college education: selection bias in contemporary Taiwan. Soc. Sci. Res. 40, 796–810.

Vallet, Louis-Andre, 2004. Change in intergenerational class mobility in France from the 1970s to the 1990s and its explanation: an analysis following the CASMIN approach. In: Breen, Richard (Ed.), Social Mobility in Europe. Oxford University Press, New York, Pp, pp. 115–147.

Von Hippel, Paul T., 2007. Regression with missing Ys: an improved strategy for analyzing multiply-imputed data. Sociol. Methodol. 37, 83–117.

Walder, Andrew, 1995. Career mobility and the communist political order. Am. Sociol. Rev. 60, 309–328.

Walder, Andrew, 1996. Markets and inequality in transitional economies: Toward testable theories. Am. J. Sociol. 101, 1060–1073.

Walder, Andrew, 2002. Markets and income inequality in rural China: political advantage in an expanding economy. Am. Sociol. Rev. 67, 231–253.

Wang, Le, 2012. Economic transition and college premium in urban China. China Econ. Rev. 23, 238–252.

Weber, Max, 1946. From Max Weber: Essays in Sociology. Oxford University Press, New York.

Richard, Williams, 2009. Using heterogeneous choice models to compare logit and probit coefficients across groups. Sociol. Methods Res. 37, 531–559.

Wu, Xiaogang, 2010. Economic transition, school expansion and educational inequality in China, 1990–2000. Res. Soc. Stratification Mobility 28, 91–108.

Xie, Yu, Brand, Jennie E., Jann, Ben, 2012. Estimating heterogeneous treatment effects with observational data. Sociol. Methodol. 42, 314–347.

Yang, Chih-Hai et al, 2011. Dynamics of rate of returns for postgraduate education in Taiwan: the impact of higher education expansion. Asia Pac. Educ. Rev. 12, 359–371.

Zang, Xiaowei, 2002. Labor market segmentation and income inequality in urban China. Sociol. Quart 43, 27–44.

Zhang, Junsen, Yaohui, Zhao, Park, Albert, Song, Xiongqing, 2005. Economic returns to schooling in urban China, 1988 to 2001. J. Comp. Econ. 33, 730–752.

Zhao, Li, Jiang, Junwu, 2011. An empirical research into the influence of technological progress on laborers' quality in China. Econ. Survey 2, 82–85.

Zhou, Xueguang, 2000. Economic transition and income inequality in urban China: evidence from a panel data. Am. J. Sociol. 105, 1135–1174.

Zhou, Xueguang et al, 1998. Educational stratification in urban China: 1949–1994. Sociol. Educ. 71, 199–222.

Zhu, Rong, 2011. Individual heterogeneity in returns to education in urban China during 1995–2002. Econ. Lett. 113, 84–87.