Labor Market Returns to Education and English Language Skills in the People's Republic of China: An Update

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We reexamine the economic returns to education in the People's Republic of China (PRC) using data from the Chinese General Social Survey 2010. We find that the conventional ordinary least squares estimate of wage returns to schooling is 7.8%, while the instrumental variable estimate is 20.9%. The gains from schooling rise sharply with higher levels of education. The estimated returns are 12.2% in urban provinces and 10.7% in coastal provinces, higher than in rural and inland areas. In addition, the wage premium for workers with good English skills (speaking and listening) is 30%. These results are robust to controls for height, body mass index, and English language skills, and to corrections for sample selection bias. Our findings, together with a critical review of existing studies, confirm the growing significance of human capital as a determinant of labor market performance in postreform PRC.

Keywords: endogeneity bias, health, language skills, schooling
JEL codes: I26, J30

I. Introduction

The People's Republic of China (PRC) saw a four-fold increase in the level of consumption per capita and unprecedented economic growth during 1980–2010. The country's transition to a market economy saw the dissolution of social safety net programs and the end of full employment. Substantial physical capital investment during this transition led to greater demand for high-skilled labor, thereby increasing the importance of education as a determinant of labor market earnings (Heckman and Yi 2012). In prereform years, wages were administratively

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set, which suppressed the true returns to cognitive skills and schooling (Fleisher and Chen 1997, Chen and Feng 2000, Démurger 2001, Fleisher and Wang 2004). Returns to schooling were low in the early years after the beginning of economic reform in 1978 but increased in the 1990s (Zhao and Zhou 2002).[1] Therefore, an updated analysis of how education is paying off in the labor market is important for understanding the evolution of income distribution in transition economies.

The PRC's rapid economic growth was accompanied by a considerable increase in earnings inequality.[2] Moreover, the country's postreform "open door" policy attracted foreign direct investment and multinational companies, leading to strong demand for skilled workers along the rapidly expanding industrial coast.[3] Therefore, it is important to understand how skills and education are rewarded across rural and urban locations, and across coastal and inland cities.[4]

Understanding the determinants of rising returns to education—a labor market phenomenon in transition economies—can also help us understand the difference between the PRC and other transition countries in terms of labor market characteristics. Unsurprisingly, following the shift from an administratively determined wage system to a market-oriented one in the early 1990s, there has been a significant increase in research on the economic profitability of human capital investment in the PRC.

Most estimates of labor market returns correspond to the early years of reform and hence are unlikely to be a good guide given the unprecedented transformation of the PRC economy during the 1990s. Spatial differences in infrastructure growth and physical investment are also likely to have caused important variations in the way schooling impacts labor market earnings (Fleisher and Chen 1997). Therefore, we add to the existing literature by using the Chinese General Social Survey (CGSS) 2010 dataset and provide an up-to-date account of the labor market returns to education in the PRC.

Our empirical model accounts for two important determinants of earnings: health capital, which includes height, body mass index (BMI), and self-reported health status; and English language proficiency that were both ignored by most of the recent studies on the PRC. Moreover, our empirical analysis addresses concerns over endogeneity and sample selection biases. We use information on parental death during the respondent's childhood and parental schooling as excluded instruments to estimate the instrumental variable (IV) model. Nonrandom selection into waged work is modeled using data on various measures of nonlabor income. Lastly, we

[1] This pattern of rising returns to education is similar to the experience of other economies in Central and Eastern Europe that went through the transition from a planned economy to a market economy (Hung 2008).

[2] According to one account, the average real earnings of Chinese urban male workers increased by 350% during 1988–2009, increasing the variance in log earnings by 94% (Meng, Shen, and Xue 2013).

[3] For the interplay between human capital and foreign direct investment in the PRC, see Liu, Xu, and Liu (2004); Su and Liu (2016); and Salike (2016).

[4] According to Hung (2008), the returns to education in Central and Eastern Europe were about 2%–4% in the pretransition period, while those in the PRC were even lower at less than 2%.

report estimates for various subgroups—men versus women, rural versus urban, and coastal versus inland provinces—to document the heterogeneous nature of returns to schooling and skills in postreform PRC.

The rest of the paper is organized as follows. Section II briefly reviews the literature. Section III and section IV describe the data and empirical framework used in our study, respectively. Section V presents our econometric results. We conclude in section VI.

II. Literature Review: What Do We Know about Returns to Education in the People's Republic of China?

Existing studies on the PRC have estimated a Mincer-type earnings function using a variety of micro datasets. Our review of the published literature on returns to education for the period 1987–2016 identified a total of 68 studies (Table 1).[5]

Of these studies, 52 included residents in urban areas, 8 included residents in rural areas, and 10 were rural–urban migrants, while only 6 covered both urban and rural areas. Most studies (59) used household survey datasets. These include the Chinese Household Income Project (CHIP, 27 studies); China Health and Nutrition Survey (CHNS, 5); Chinese Twins Survey (4); China Urban Labor Survey (CULS, 3); Panel Data of Urban Residents from 20 cities in six provinces (3); China Urban Household Income and Expenditure Survey (CUHIES, 2); and Urban Household Survey (UHS, 2). A total of 13 studies used data from other well-established household surveys, such as the Chinese Labor Market Research Project (CLMRP) and Rural Urban Migration in China (RUMiC), among others. The remaining 8 studies used data from several firm-based surveys, while only 1 study (Mishra and Smyth 2015) used data from both a household survey (China Household Finance Survey) and a firm-level survey (Shanghai matched worker-firm survey 2007). In this section, we discuss only those studies that used household survey datasets.

A stylized fact from the literature is that returns to education in the PRC labor market in the 1980s and early 1990s were extremely low compared with the average returns in other Asian countries (9.6%), low- and middle-income countries (11.2%–11.7%), and the world (10.1%) (Psacharopoulos 1994). The rate of return in studies using data from the 1986, 1988, and 1993 CHIP surveys ranged from 1.5% to 4.5% for urban areas (Knight and Song 1991, 1995; Xie and Hannum 1996; Johnson and Chow 1997; Liu 1998; Maurer-Fazio 1999) and 0%–4% for rural areas (Knight and Song 1993; Parish, Zhe, and Li 1995; Johnson and Chow 1997). Apart from the findings using CHIP dataset, researchers who employed data from other household surveys during this period found comparatively low rates of return to

[5] For existing meta-analyses of studies on returns to education in the PRC, see Liu and Zhang (2013) and Awaworyi and Mishra (2014). Moreover, for a review of developing country estimates, see Psacharopoulos and Patrinos (2004).

Table 1. **Summary of Existing Studies on Returns to Education in the People's Republic of China**

Data Source	Sample	Author	Study Period	Method	Returns Estimate (%)
Chinese Household Income Project (CHIP)	Urban and rural	Johnson and Chow (1997)	1988	OLS	3.3–4.0
	Urban	Knight and Song (1991)	1986	OLS	2.4–3.0
		Knight and Song (1995)	1988	OLS	2.3
		Xie and Hannum (1996)	1988	OLS	2.2–4.5
		Liu (1998)	1988	OLS	2.9–3.6
		Maurer-Fazio (1999)	1988	OLS	4.5 (female), 2.9 (male)
		Li (2003)	1995	OLS	5.4
		Bishop and Chiou (2004)	1988–1995	OLS	2.8 (1988)–5.6 (1995)
		Li and Luo (2004)	1995	OLS; IV; GMM	7.5–8.9; 15.3–15.6; 15.0
		Appleton, Song, and Xia (2005)	1988–2002	OLS	3.6 (1988)–7.5 (2002)
		Bishop, Luo, and Wang (2005)	1988–1995	OLS	1.5 (1988)–4.4 (1995)
		Hauser and Xie (2005)	1988–1995	OLS	2.0 (1988)–7.4 (1995)
		Knight and Song (2005)	1995–1999	OLS	3.2 (1995)–4.1 (1999)
		Yang (2005)	1988–1995	OLS	3.3–3.9 (1988) to 5.9–7.3 (1995)
		Démurger et al. (2009)	2002	OLS	4.2–7.4
		Zhong (2011)	2002	OLS; IV	6.0–6.8; 4.2–6.5
		Wang (2013)	1995–2002	OLS; IV	5.6 (1995, female)–8.1 (2002, female), 3.6–6.6 (male); 7.3–11.8 (female), 4.4–8.8 (male)
		Qu and Zhao (2017)	2002–2007	OLS	6.0–9.6 (2002) to 2.1–4.0 (2007)
	Rural	Knight and Song (1993)	1988	OLS	Not statistically different from 0
		Parish, Zhe, and Li (1995)	1993	OLS	3.1
	Migrants	Démurger et al. (2009)	2002	OLS	3.6–7.3
		Zhu (2015)	2002–2007	OLS; NP	3.8 (2002)–4.9 (2007); 4.8–5.5
		Qu and Zhao (2017)	2002–2007	OLS	2.3–2.9 (2002) to 3.3–3.8 (2007)

Continued.

Table 1. *Continued.*

Data Source	Sample	Author	Study Period	Method	Returns Estimate (%)
China Health and Nutrition Survey (CHNS)	Urban and rural	Fang et al. (2012)	1997–2006	OLS; IV	9; 20
	Urban	Chen and Hamori (2009)	2004–2006	OLS; IV	7.7 (female), 8.1 (male), 7.9 (married women), 8.0 (married men); 14.5 (married women), 12.6 (married men)
		Qiu and Hudson (2010)	1989–2000	OLS	5.1–6.9
		Kang and Peng (2012)	1989–2009	OLS; IV	2.2 (1989, female)–10.3 (2009, female), 2.6–7.0 (male); 5.7–8.9 (female), 5.6–11.0 (male)
		Ren and Miller (2012)	1993–2006	OLS	2.0 (1993, female)–5.2 (2006, female), 0.8–5.6 (male)
Chinese Twins Survey	Urban	Li, Liu, Ma, and Zhang (2005)	2002	OLS; FE; GLS	8.2–8.4; 2.5–2.7; 2.5–2.7
		Li et al. (2007)	2002	OLS; FE; GLS	6.3–7.0; 3.2; 3.3
		Zhang, Liu, and Yung (2007)	2002	OLS; IV	8.8–9.8; 9.1–10.5
		Li, Liu, and Zhang (2012)	2002	OLS; FE	8.4; 2.7–3.8
China Urban Labor Survey (CULS)	Urban	Giles, Park, and Wang (2008)	2001	OLS; IV	8.3–9.6; 8.0–8.3
		Cai and Du (2011)	2001–2010	OLS	10.2 (2001)–11 (2010)
		Gao and Smyth (2015)	2001–2010	OLS; IV; Lewbel IV	6.8 (2001)–8.6 (2010); 8.2–9.1; 5.2–4.8
Panel Data of Urban Residents in 20 cities	Urban	Zhao and Zhou (2002)	1978–1993	OLS	1.8–3.5
		Fleisher and Wang (2005)	1975–1991	OLS; IV	1.4 (1975)–5.9 (1991); -0.1–15.8
Urban Household Survey (UHS)	Urban	Zhang et al. (2005)	1988–2001	OLS; Heckman	5.2 (1988, female)–13.2 (2001, female), 2.9–8.4 (male); 5.2–12.5 (female), 2.8–7.5 (male)
		Ge and Yang (2011)	1988–2007	OLS	3.6 (1988)–11.4 (2007)
Rural Urban Migration in China (RUMiC)	Urban	Sakellariou and Fang (2016)	2009	IV	6–9
	Migrants	Sakellariou and Fang (2016)	2009	IV	7–8
China Household Finance Survey (CHFS)	Urban	Mishra and Smyth (2015)	2011	OLS; IV; Lewbel IV	8.6–8.7; 17.5–18.9; 12.9–13.5

Continued.

Table 1. *Continued.*

Data Source	Sample	Author	Study Period	Method	Returns Estimate (%)
Others	Urban	Jamison and Van Der Gaag (1987)	1985	OLS	5.5 (female), 4.5 (male)
		Byron and Manaloto (1990)	1986	OLS; WLS	3.7; 3.9
		Maurer-Fazio (1999)	1992	OLS	4.9 (female), 3.7 (male)
		Qian and Smyth (2008b)	2005	OLS	12.1 (full sample), 9.3 (female), 13.6 (male)
		Deng and Li (2010)	2008	OLS	5.6–6.8
		Mishra and Smyth (2013)	2009–2010	OLS; IV	10.8–11.9; 21.4–22.9
		Jamison and Van Der Gaag (1987)	1985	OLS	5.5 (female), 4.5 (male)
	Rural	Yang (1997)	1990	OLS	2.3
		Wei et al. (1999)	1991	OLS	4.8
		De Brauw and Rozelle (2008)	2000	Heckman	4.3
	Migrants	Meng and Zhang (2001)	1996	OLS	4.8
		De Brauw and Rozelle (2008)	2000	Heckman	7.8
		Deng and Li (2010)	2008	OLS	6.8
		Frijters, Lee, and Meng (2010)	2008	OLS	3.0–4.0

FE = fixed effects, IV = instrumental variable, GLS = generalized least squares, GMM = generalized method of moments, NP = nonparametric kernel regression (nonparametric estimation), OLS = ordinary least squares, WLS = weighted least squares.

Notes: Only studies that used household survey data are presented in the table. Eleven studies that estimated only returns to higher education (college education) were excluded from the table (Gustafsson and Li 2000; Zhou 2000; Knight and Song 2003; Heckman and Li 2004; Fleisher et al. 2005; Wang et al. 2007; Li et al. 2012; Wang 2012; Carnoy et al. 2013; Meng, Shen, and Xue 2013; Messinis 2013). Eight studies that used only firm survey data were excluded from the table (Peng 1992; Gregory and Meng 1995; Fleisher, Dong, and Liu 1996; Meng and Kidd 1997; Fleisher and Wang 2001, 2004; Ho et al. 2002; Maurer-Fazio and Dinh 2004). One study (Mishra and Smyth 2015) used both household survey data (CHFS) and firm survey data (2007 Shanghai-matched worker–firm survey), but only the results based on household survey data are listed in the table.

Source: Authors' review of the literature.

schooling, around 3.7%–5.9% for urban areas, compared with 2.3%–4.8% for rural areas (Jamison and Van Der Gaag 1987, Byron and Manaloto 1990, Yang 1997, Wei et al. 1999, Maurer-Fazio 1999, Zhou 2000, Zhao and Zhou 2002, Fleisher and Wang 2005).

Another stylized fact is that returns to education have increased since the mid-1990s, along with improvements in wages and workers' contractual rights (Chan and Nadvi 2014). Studies that employed CHIP datasets found that the economic returns to each additional year of schooling increased to around 4.4%–8.9% in 1995 (Li 2003; Bishop and Chiou 2004; Li and Luo 2004; Bishop, Luo, and Wang 2005; Hauser and Xie 2005; Yang 2005), 4.1% in 1999 (Knight and Song 2005), 7.5%–8.1% in 2002 among urban residents (Appleton, Song, and Xia 2005; Wang 2013), and 3.6%–7.3% in 2002 among migrants (Démurger et al. 2009).

Findings from studies using non-CHIP datasets also indicate an increased rate of return after 1995. For example, research using another widely used dataset, CHNS, found that the rate of return rose sharply to 6.9% in 2000 (Qiu and Hudson 2010), 8.1% in 2004 (Chen and Hamori 2009), and around 9% in 2006 (Fang et al. 2012) in urban areas. Again, based on the CHNS dataset, Ren and Miller (2012) found that the returns to women increased from 2% in 1993 to 7% in 2004, while the returns to men increased from 0.8% to 3.1%. Similarly, Kang and Peng (2012) documented a larger increase in returns to education for Chinese women than men using the expanded CHNS dataset from 1989 to 2009. More precisely, the rate increased from 2.2% in 1989 to 10.3% in 2009 for women, but only from 2.6% to 7% for men. Additionally, these increased returns to schooling since the mid-1990s have been recorded in a large number of studies that used non-CHIP or non-CHNS survey datasets, including studies on rural workers (De Brauw and Rozelle 2008); migrant workers (Meng and Zhang 2001; Maurer-Fazio and Dinh 2004; De Brauw and Rozelle 2008; Deng and Li 2010; Frijters, Lee, and Meng 2010; Sakellariou and Fang 2016); and urban workers using the Chinese Twins Survey dataset (Li, Liu, Ma, and Zhang 2005; Zhang, Liu, and Yung 2007; Li et al. 2007; Li et al. 2012); CULS (Giles, Park, and Wang 2008; Cai and Du 2011; Gao and Smyth 2015); and CUHIES (Meng, Shen, and Xue 2013).

Apart from the overall returns to education, earlier studies looked into returns to specific education levels. Studies based on data from the period after higher education reform documented a sharp increase in returns to college education (Heckman and Li 2004; Fleisher et al. 2005; Giles, Park, and Wang 2008; Qian and Smyth 2008b; Zhong 2011; Li et al. 2012; Wang 2012; Carnoy et al. 2013; Meng, Shen, and Xue 2013), compared with those from before the reform period (Gustafsson and Li 2000, Knight and Song 2003, Li 2003, Bishop and Chiou 2004). Moreover, research on the postreform period argued that graduates from elite colleges earned a premium over other college graduates even after controlling for cognitive ability, academic major, college location, and students' individual

characteristics and family backgrounds (Zhong 2011, Li et al. 2012). Existing literature also found that women benefited more from a university education than men, and similarly, urban residents earned more than rural residents with the same college degree (Qian and Smyth 2008, Wang 2012).

The pattern of returns to education in different regions has also changed since the mid-1990s. In contrast to the finding of Liu (1998), Li (2003) observed that the rate of return was higher in less developed provinces, such as Gansu, than in high-income provinces, such as Guangdong.

There are additional stylized facts relating to methodological issues. First, recent research has employed an instrumental variable (IV) approach to solve the endogeneity bias in educational attainment.[6] For the PRC, the IV estimates were higher than the corresponding ordinary least squares (OLS) estimates (Fleisher and Wang 2004; Heckman and Li 2004; Li and Luo 2004; Fleisher et al. 2005; Fleisher and Wang 2005; Zhang, Liu, and Yung 2007; Giles, Park, and Wang 2008; Chen and Hamori 2009; Zhong 2011; Fang et al. 2012; Kang and Peng 2012; Wang 2012; Mishra and Smyth 2013; Wang 2013; Gao and Smyth 2015; Mishra and Smyth 2015; Sakellariou and Fang 2016). Most of these studies used family-background variables to estimate the IV model. For instance, Heckman and Li (2004) used the 2000 CUHIES, and parental education and year of birth as instruments for an individual's education. Similarly, based on the 1995 CHIP data, Li and Luo (2004) estimated returns to schooling for young workers in urban areas using parental education and variables related to siblings as instruments. Moreover, using the 1988–2002 CHIP data, Fleisher et al. (2005) explored the private returns to schooling at the university level. They found that the IV and semiparametric estimates on the rate of return for college graduates were higher when parental schooling was the proxy for ability.[7]

In summary, while findings from existing research vary in terms of data sources, methods, and study periods, they generally confirm that gains from schooling have increased significantly. The estimated returns to schooling are higher in urban areas than in rural locations, and higher for female workers than for male workers. Moreover, the IV estimates that used parental education as instruments for an individual's schooling yielded higher returns than the OLS estimates. For the prereform period, the OLS estimates of the rate of return are around 1.4%–1.9% in urban areas, compared with 0%–2.6% in rural areas. For the postreform period, the OLS estimates show an increase of 3.3%–9% for the full sample, compared with the IV estimates of up to 20%. The OLS estimates also show an increase of

[6] For relevant international studies, see Arabsheibani and Lau (1999); Trostel, Walker, and Woolley (2002).

[7] Recently, some researchers have used the Lewbel (2012) IV method rather than the traditional IV approach to study the returns to schooling in the PRC, especially in urban areas (Gao and Smyth 2015, Mishra and Smyth 2015). Findings from either the conventional IV approach or the Lewbel IV method suggest that measurement errors exert a downward bias on OLS estimates.

0%–4.8% for the rural sample, and OLS estimates of 1.5%–12.1% for the urban sample, compared with the IV estimates of 4.2%–22.9%.

III. Data

In this paper, we use data from the CGSS 2010. The main advantage of CGSS over existing datasets (such as CHNS, CHIP, CLMRP, and RUMiC) is that, in addition to being representative of rural and urban areas of the PRC, it offers information on both language skills and health of the respondents. The CGSS 2010 sampled a total of 11,783 individuals, where 38.7% were from rural areas and 51.8% were women. Table A1 provides a breakdown of the sample observations across different groups and work status: (i) agricultural waged work, (ii) nonagricultural waged work, (iii) self-employed, (iv) in the labor force but unemployed, and (v) not in the labor force. Most studies relied on the second age group, females age 16–55 years and males age 16–60 years (16 is the youngest legal working age in the PRC, while 55 and 60 are the official retirement age). In this study, we follow Schultz (2002) and restrict the analysis to women age 25–55 years and men age 25–60 years. Our main analysis is restricted to individuals in waged work, both in agricultural and nonagricultural sectors. After ignoring cases with missing data, our working sample contains 4,223 waged workers. Table A2 summarizes all variables used in the regression analysis.

IV. Empirical Framework

As explained in section II, past studies on the PRC rarely controlled for cognitive skills despite the fact that market reforms of the 1990s were likely to have increased demand for such language and numeracy skills. Although schooling is expected to capture returns to cognitive skills, recent research documents a systematic economic return to cognitive skills around the world independent of schooling completed (Hanushek et al. 2015). Therefore, it is useful to know, in the context of the PRC, the pathways through which schooling is rewarded in the labor market.

Similarly, individuals with more schooling may have higher wages because they have better health and healthier behaviors.[8] At the same time, school attendance may ignore skills acquired through social channels and in the workplace. Existing studies on the PRC have not fully considered the interaction between schooling, skills, and health capital in determining labor market success. Recent studies have instead focused on the possibility that schooling is endogenous, owing to omitted health components, or that return to schooling is understated,

[8] The positive relationship between schooling and health is well established in the literature (see, for example, Grossman 2008; Silles 2009; Conti, Heckman, and Urzua 2010; and Heckman et al. 2014).

because it does not capture the quality of human capital. Consequently, researchers have modeled schooling attainment as an endogenous determinant of earnings by employing instrumental variable techniques (Li and Luo 2004, Heckman and Li 2004, Mishra and Smyth 2013, Chen and Hamori 2009, Mishra and Smyth 2015, Gao and Smyth 2015, Sakellariou and Fang 2016). In addition, some researchers have accounted for nonrandom selection into waged work by employing Heckman's (1979) two-step procedure (Zhang et al. 2005, Chen and Hamori 2009).

Keeping the above issues in mind, we specify a Mincerian earnings function where the log of monthly employment income (measured in renminbi) is regressed on years of schooling; work experience; work experience squared; gender; marital status; and a series of additional control variables including ethnicity; *hukou* type; marital status; health factors (height, self-reported health status, and BMI); proficiency in English; and location dummies.[9] In addition, we account for the endogeneity of years of schooling in the earnings function.

Existing studies on developed and developing countries such as the PRC have attempted to address the issue in an IV framework in two settings: experimental and nonexperimental. Experimental studies rely on various institutional reforms, such as changes in the minimum age of leaving school (Harmon and Walker 1995), which result in exogenous variation in educational attainment. Nonexperimental studies, on the other hand, use family background (Li and Luo 2004); parents' education (Heckman and Li 2004, Mishra and Smyth 2013); and spouse's education (Chen and Hamori 2009, Mishra and Smyth 2013, Gao and Smyth 2015) as instruments for education in the PRC and other countries (Trostel, Walker, and Woolley 2002). In this paper, we follow the second approach.

Therefore, in addition to OLS estimates, we present IV estimates where we instrument schooling completed using the following as excluded instruments: whether a parent died when the respondent was 14 years old, father's education, and mother's education. Following Case, Paxson, and Ableidinger (2004) and Gertler, Levine, and Ames (2004), we assume that timing of parental death is exogenous and serves as a negative shock to the respondent's schooling. On the other hand, the father's and mother's education are not correlated to their children's inherent abilities but have influence on their children's education when we use them as excluded instruments. It should be noted that studies that used parental education as an instrument to estimate returns to education in the PRC have often done so only for a subsample. This is because of how the survey is designed, where the instruments are available only for the respondents whose parents are present in the

[9]Since CGSS does not have data on work experience or tenure, we use information on age and school completion to define postschool experience. We assume the legal age for starting work is 16 years old. For those who completed secondary schooling, we calculate experience as current age minus years of schooling minus 6, but for those who didn't complete secondary schooling, experience is current age minus 16. This definition is consistent with existing studies on the PRC (Qian and Smyth 2008b, Gao and Smyth 2015, Mishra and Smyth 2015).

same household (Wang 2013). Our dataset doesn't suffer from this problem as all respondents are asked about parental background in a retrospective manner.

Apart from the endogeneity problem, another common methodological concern is the sample selection problem. If individuals select into the labor force on the basis of some unobserved attributes that also affect their wages, OLS estimates would yield biased estimates of the correlation between education and wages. In this paper, we follow Heckman (1979) to correct for nonrandom selection into waged work. First, we estimate a probit function for labor force participation where a sample selection correction term, lambda, is computed. Then the earnings function is estimated with the selection correction term as an extra variable. For the purpose of identifying the lambda term, at least one variable needs to be excluded from the wage equation, which is otherwise included in the probit equation. In our model, we follow Duraisamy (2002) and Asadullah (2006) who used data on nonlabor income (i.e., income received from bequest) as an excluded variable, leaving it out of the wage equation.[10]

V. Results

A. Ordinary Least Squares Estimates of Returns to Education

In this section, we estimate returns to education by adding additional controls for factors that are correlated with both wages and schooling. Moreover, we formally include a measure of English language skills alongside schooling.[11] Table 2 reports OLS estimates of the Mincerian earnings function for the full sample. To understand the true returns to education, we pursue a stepwise approach, sequentially adding controls for language proficiency and three measures of health—height, self-reported health status, and BMI—in the regression function. Four patterns follow from our analysis.

First, education has a significant and positive impact on earnings in the PRC even after we control for English language proficiency and health capital (specification 3). The rate of return to an additional year of schooling ranges from 7.8% to 8.8% in the full sample. Our OLS estimate is similar to the estimated average rate reported in existing literature on the PRC, which ranges between 7% and 10% (Chen and Hamori 2009, Mishra and Smyth 2015). The biggest decline in estimated returns to education (from 8.8% to 8%) occurs when we control for language proficiency (specification 1 versus 2). The decline in the rate of return to education after controlling for language skills may simply be because English is part of the institutional education received in school. Therefore, when such components

[10] We also considered income from land leasing and sale of property as additional identifying variables, but these were not significant in the first stage.

[11] English language skills are measured as a binary indicator and refers to proficiency at or above the standard level.

Table 2. **Ordinary Least Squares Estimates of the Determinants of Earnings with and without Controls for Language Skills and Health Endowments (full sample)**

	(1)	(2)	(3)	(4)	(5)
Personal characteristics					
Experience	0.004	0.005	0.006	0.008	0.008
	(0.59)	(0.75)	(1.03)	(1.30)	(1.20)
Experience squared	−0.001	−0.001**	−0.001**	−0.001**	−0.001**
	(1.01)	(2.22)	(2.32)	(2.27)	(2.19)
Female	−0.376***	−0.393***	−0.246***	−0.237***	−0.235***
	(14.64)	(15.32)	(7.05)	(6.83)	(6.75)
Minority	−0.002	0.003	0.007	−0.012	−0.011
	(0.04)	(0.06)	(0.17)	(0.27)	(0.27)
Nonagricultural *hukou*	0.205***	0.196***	0.175***	0.174***	0.173***
	(5.59)	(5.36)	(4.79)	(4.79)	(4.76)
Currently married	0.055	0.074	0.071	0.048	0.048
	(1.29)	(1.76)	(1.69)	(1.16)	(1.15)
Schooling and cognitive skills					
Years of education	0.088***	0.080***	0.079***	0.078***	0.078***
	(20.98)	(18.51)	(18.39)	(18.24)	(18.16)
Good English skills		0.317***	0.306***	0.306***	0.307***
		(7.10)	(6.88)	(6.92)	(6.94)
Health capital					
Height (centimeters)			0.014***	0.013***	0.014***
			(6.14)	(5.79)	(5.84)
Self-reported health status:					
Bad				−0.178***	−0.179***
				(3.94)	(3.95)
Good				0.116***	0.112***
				(3.75)	(3.60)
Body mass index (BMI):					
BMI < 18.5, underweight					−0.061
					(1.24)
25 ≤ BMI < 30, overweight					0.002
					(0.07)
BMI≥30, obese					−0.147*
					(1.68)
Geographic location					
Rural	−0.420***	−0.423***	−0.423***	−0.413***	−0.413***
	(11.54)	(11.68)	(11.73)	(11.52)	(11.50)
Eastern (coastal) region	0.404***	0.388***	0.376***	0.370***	0.371***
	(12.90)	(12.43)	(12.10)	(11.97)	(12.00)
Western region	−0.052	−0.057	−0.039	−0.022	−0.021
	(1.60)	(1.77)	(1.21)	(0.68)	(0.66)
Constant	6.238***	6.164***	3.712***	3.770***	3.773***
	(60.03)	(59.35)	(9.01)	(9.19)	(9.19)
Number of observations	4,223	4,223	4,223	4,223	4,223
Adjusted R-squared	0.49	0.49	0.50	0.51	0.51

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. "Good English skills" is a dummy variable which indicates whether a respondent's English skills (including speaking and listening) are at or above the standard proficiency level (=1) or not (=0). For self-reported health status, the reference category is "in normal health condition." For body mass index (BMI), the reference category is "normal, 18.5 ≤ BMI < 25." For regional dummies, the reference group is "central region."
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

of education are included in the regression, they underestimate the true returns to education.

Second, in contrast to Mishra and Smyth (2015) where language proficiency has no statistically significant relationship with wages in the PRC, our results indicate a clear correlation—individuals with good English speaking and listening abilities earn wages that are 30% higher than those who do not have these skills (column 5). This positive earnings premium from foreign language skills is consistent with existing studies focusing on both developed countries (Leslie and Lindley 2001, Dustmann and Fabbri 2003 on the United Kingdom, Bleakley and Chin 2004 on the United States) and other developing countries (Azam, Chin, and Prakash 2013 on India; Di Paolo and Tansel 2015 on Turkey). Moreover, compared with returns to other skills, the returns to a foreign language (i.e., English skills) are extremely high (Fasih, Patrinos, and Sakellariou 2013).[12]

Third, consistent with the literature for both developed countries (Case and Paxson 2008, 2009; Heineck 2008; Hübler 2006) and developing countries (Schultz 2002, 2003; Dinda et al. 2006), health capital matters for earnings in the PRC. The OLS estimates suggest an additional centimeter of adult height is associated with a 1.4% higher wage in the full sample. This result is very close to some of the recent studies on returns to health capital in the PRC, including Gao and Smyth (2010) who were the first to confirm the height–wage premium in the PRC using the CULS 2005 data. They found that the wage return to height in urban areas is 1.1% and 0.9% for men and women, respectively. A later study by Elu and Price (2013) documented a similar rate of return to height (1.1%) based on urban and rural sample data from the CHNS 2006. Besides the height–wage premium, the returns to self-reported health status in our paper are also close to the results found by Zhang (2011) and Fang et al. (2012).

Fourth, work experience is not rewarded in terms of higher wages in the full sample. Subsample estimates of the earnings function presented in Table 3 show that this is also true for rural areas of the PRC.[13] However, we find a significant and inverse U-shaped relationship between experience and earnings in urban areas of the PRC. This is consistent with previous studies on urban areas of the PRC (Bishop and Chiou 2004; Appleton, Song, and Xia 2005; Gao and Smyth 2015). The return to work experience is low, only 2.7% in urban areas of the PRC using the CGSS 2010 dataset. This is in line with Appleton, Song, and Xia (2005), who document an increase in returns to education but a decrease in the returns to work experience in postreform PRC. Bishop and Chiou (2004) also report evidence of declining returns to experience in urban areas of the PRC between 1988 and 1995. One

[12] This is also true for the PRC. For example, Giles et al. (2003), using data from the China Adult Literacy Survey (CALS), find that the estimated return to adult literacy (capturing knowledge of the vernacular) for residents in urban areas of the PRC is 9.3%–11.4%.

[13] For rural areas of the PRC, Li, De Brauw, Rozelle, and Zhang (2005) also find experience to be insignificant, based on Heckman estimates of the earnings function.

Table 3. **Ordinary Least Squares Estimates of the Determinants of Earnings with and without Controls for Language Skills and Health Endowments (urban versus rural)**

	Urban					Rural				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Personal characteristics										
Experience	0.021***	0.027***	0.028***	0.028***	0.027***	0.009	0.006	0.004	0.001	0.001
	(2.57)	(3.28)	(3.42)	(3.42)	(3.35)	(0.83)	(0.57)	(0.35)	(0.07)	(0.01)
Experience squared	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001	−0.001	−0.001	−0.001	−0.001
	(2.87)	(3.46)	(3.52)	(3.36)	(3.33)	(0.94)	(1.17)	(1.27)	(1.45)	(1.38)
Female	−0.369***	−0.377***	−0.278***	−0.278***	−0.278***	−0.503***	−0.511***	−0.336***	−0.321***	−0.319***
	(12.16)	(12.49)	(6.29)	(6.30)	(6.28)	(11.71)	(11.85)	(6.19)	(5.94)	
Minority	−0.102	−0.091	−0.093	−0.101	−0.099	0.041	0.041	0.053	0.029	0.030
	(1.63)	(1.47)	(1.50)	(1.64)	(1.61)	(0.68)	(0.69)	(0.90)	(0.51)	(0.51)
Nonagricultural *hukou*	0.045	0.045	0.034	0.031	0.031	0.634***	0.611***	0.595***	0.586***	0.584***
	(1.25)	(1.28)	(0.95)	(0.88)	(0.88)	(6.12)	(5.86)	(5.75)	(5.72)	(5.69)
Currently married	−0.032	−0.017	−0.013	−0.024	−0.025	0.265***	0.266***	0.241***	0.197**	0.197**
	(0.69)	(0.37)	(0.29)	(0.53)	(0.54)	(3.32)	(3.34)	(3.04)	(2.50)	(2.50)
Schooling and cognitive skills										
Years of education	0.132***	0.124***	0.123***	0.122***	0.122***	0.026***	0.024***	0.024***	0.023***	0.022***
	(26.64)	(23.89)	(23.68)	(23.59)	(23.51)	(3.75)	(3.42)	(3.35)	(3.29)	(3.22)
Good English skills		0.215***	0.210***	0.209***	0.208***		0.298**	0.289**	0.282**	0.285**
		(5.08)	(4.96)	(4.96)	(4.92)		(1.91)	(1.86)	(1.83)	(1.86)
Health capital										
Height (centimeters)			0.009***	0.009***	0.009***			0.018***	0.016***	0.016***
			(3.08)	(3.01)	(3.08)			(5.19)	(4.61)	(4.64)
Self-reported health status:										
Bad				−0.192***	−0.194***				−0.109*	−0.108*
				(2.91)	(2.95)				(1.71)	(1.70)
Good				0.042	0.035				0.214***	0.211***
				(1.13)	(0.96)				(4.24)	(4.16)

Continued.

Table 3. *Continued.*

	Urban					Rural				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Body mass index (BMI):										
BMI < 18.5, underweight					−0.052					−0.046
					(0.81)					(0.64)
25 ≤ BMI < 30, overweight					−0.012					0.044
					(0.33)					(0.79)
BMI ≥ 30, obese					−0.240**					−0.023
					(2.38)					(0.16)
Geographic location										
Eastern (coastal) region	0.475***	0.465***	0.458***	0.452***	0.453***	0.244***	0.244***	0.233***	0.216***	0.216***
	(13.00)	(12.74)	(12.55)	(12.40)	(12.45)	(4.41)	(4.41)	(4.25)	(3.98)	(3.97)
Western region	0.084	0.085*	0.098**	0.102**	0.102**	−0.198***	−0.200***	−0.178***	−0.152***	−0.149***
	(1.87)	(1.89)	(2.19)	(2.28)	(2.27)	(4.35)	(4.40)	(3.94)	(3.38)	(3.29)
Constant	5.449***	5.418***	3.878***	3.906***	3.898***	6.395***	6.366***	3.192***	3.361***	3.354***
	(45.35)	(45.28)	(7.54)	(7.60)	(7.58)	(35.68)	(35.42)	(5.01)	(5.32)	(5.30)
Number of observations	2,288	2,288	2,288	2,288	2,288	1,935	1,935	1,935	1,935	1,935
Adjusted R-squared	0.43	0.44	0.44	0.44	0.45	0.19	0.19	0.21	0.22	0.23

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. "Good English skills" is a dummy variable which indicates whether a respondent's English skills (including speaking and listening) are at or above the standard proficiency level (=1) or not (=0). For self-reported health status, the reference category is "in normal health condition." For body mass index (BMI), the reference category is "normal, 18.5 ≤ BMI < 25." For regional dummies, the reference group is "central region."
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

possible explanation for this declining return is that, unlike education, experience was overrewarded prior to the reform. Payments for seniority were a central feature of the prereform wage structure.[14] The other possibility is that skills acquired in a socialist economy by older workers have declined in value following the PRC's labor market transition to one more market oriented.

B. Ordinary Least Squares Estimates versus Instrumental Variable and Heckman Two-Step Estimates

We check the reliability of OLS estimates on the causal relationship between education capital and wages by comparing them with estimates using the IV and Heckman two-step models. Table 4 presents the returns to schooling based on OLS, IV, and Heckman sample selection correction estimation models for the full sample. Subsample specific results (female versus male, urban versus rural, and coastal versus inland regions) are also presented in the bottom panels of Table 4. All regressions control for personal characteristics, location dummies, and height, which is a predetermined health endowment (height). IV estimates are based on early parental death and parental education as excluded instruments. This serves as a way to address potential endogeneity bias in the estimated returns to education. On the other hand, excluding nonlabor income from bequest in the Heckman model identifies the selectivity term (lambda). Comparing OLS and selectivity-corrected Heckman estimates can help us understand the extent of sample selection bias in the OLS estimates.

In the OLS model, the estimated return is 7.8%. Furthermore, the result of the endogeneity test in column 2 rejects the null hypothesis that the OLS estimates are consistent. Using father's and mother's education and whether a parent died when the respondent was 14 years old as instruments, the IV rate of return yields 20.9%, which is 13.1 percentage points higher than the OLS return. Moreover, consistent with the international literature (Mendolicchio and Rhein 2014), we find that returns to education for female workers (OLS: 9%; IV: 23.7%) are higher than for male workers (OLS: 7.1%; IV: 17.9%) in both methods. The gender difference in returns to schooling increases by approximately 3% after correcting for endogeneity bias.

Table 4 also reports returns to schooling for urban versus rural residents, and coastal versus inland provinces. Returns to schooling are higher for urban workers (OLS: 12.2%) than their rural counterparts (OLS: 2.2%), which is consistent with earlier studies that report a clear gap in returns to education between urban and

[14]Moreover, Appleton et al. (2002) document an inverse U-shaped relationship between general work experience and the probability of retrenchment in the PRC in 1999. If experience was overrewarded in the prereform period, then experienced workers would be at greater risk of retrenchment and their wage premiums would subsequently decline. Other studies employing a similar measure of "postschool experience" in the context of urban areas of the PRC are Qian and Smyth (2008b) and Mishra and Smyth (2015). While Qian and Smyth (2008b), using 2005 survey data from the PRC's Institute of Labor Studies (ILS), do not find any significant relationship between experience and wages, Mishra and Smyth (2015) confirm a convex relationship between experience and earnings.

Table 4. **Ordinary Least Squares, Instrumental Variable, and Heckman Estimates of the Returns to Education**

	OLS	IV	Heckman Two-Step
Full sample (N = 4,223)	0.078*** (18.16)	0.209*** (10.42)	0.082*** (16.19)
F-test on excluded IVs		171.19	
Sargan overid test (p-value)		0.56	
Lambda			−0.045 (0.25)
Female sample (N = 1,797)	0.090*** (13.80)	0.237*** (8.39)	0.097*** (5.72)
F-test on excluded IVs		99.05	
Sargan overid test (p-value)		0.48	
Lambda			−1.974 (2.20)
Male sample (N = 2,426)	0.071*** (12.00)	0.179*** (6.47)	0.074*** (12.00)
F-test on excluded IVs		78.76	
Sargan overid test (p-value)		0.68	
Lambda			0.085 (0.36)
Urban sample (N = 2,288)	0.122*** (23.51)	0.219*** (11.77)	0.134*** (18.08)
F-test on excluded IVs		161.69	
Sargan overid test (p-value)		0.77	
Lambda			0.165 (0.90)
Rural sample (N = 1,935)	0.022*** (3.22)	0.088*** (1.52)	0.021*** (2.72)
F-test on excluded IVs		41.39	
Sargan overid test (p-value)		0.72	
Lambda			0.054 (0.14)
Eastern (coastal) region (N = 1,586)	0.107*** (15.41)	0.248*** (10.55)	0.123*** (13.84)
F-test on excluded IVs		107.54	
Sargan overid test (p-value)		0.52	
Lambda			0.596 (2.51)
Central region (N = 1,435)	0.056*** (7.69)	0.249*** (3.05)	0.063*** (6.39)
F-test on excluded IVs		22.87	
Sargan overid test (p-value)		0.24	
Lambda			−0.458 (1.48)
Western region (N = 1,202)	0.054*** (6.77)	0.101*** (2.89)	0.057*** (6.73)
F-test on excluded IVs		44.48	
Sargan overid test (p-value)		0.23	
Lambda			−0.075 (0.20)

IV = instrumental variable, OLS = ordinary least squares.
Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Early parental death along with father's and mother's education are used as excluded instruments in the IV model. Nonlabor income received from bequest is used as an excluded identifying variable in the Heckman model. For regional dummies, the reference group is "central region." All regressions were controlled for covariates included in model 5 of Table 2.
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

rural areas (Zhang 2011). Once again, the OLS estimates are smaller than the IV estimates in all of these subsamples. In addition, the true rate of return is underestimated by 9.7 percentage points for urban workers and by 14.1 percentage points for workers in the coastal region, compared with only 6.6 percentage points for rural workers and 4.7 percentage points for workers in the western area.

One explanation for the relatively larger size of the IV estimates is that the instruments are weak or nearly invalid, or both (Murray 2006, Wooldridge 2002). The first stage regression results of the IV model along with the diagnostic test results are presented in Table A3. The F-test statistic corresponding to the estimated coefficients of early parental death and parental education are both significant and large (19 and 151, respectively), implying that the instruments are strong and significant determinants of years of schooling completed. Results also show that if a parent died when the child was 14 years old, then his years of schooling are reduced dramatically.

Turning to Heckman estimates, we do not find significant evidence of sample selection bias in our analysis. The identifying variable in the probit model has the expected sign (see Table A3). Higher unearned income from bequest is found to significantly decrease labor market participation. Nonetheless, the lambda term is not significant.

Overall, results from Table 4 confirm that for CGSS data, we can rely on OLS estimates to examine the causal relationship between schooling and earnings. OLS, if anything, only leads to more conservative estimates of the true returns to years of education completed in the PRC.[15] Therefore, the next section exclusively discusses estimates obtained from the OLS regression of wages to understand how returns to education and language skills vary in the PRC.

C. Heterogeneous Returns to Education and Language Skills

Next, we explore two particular channels through which returns to skills and schooling may have changed in postreform years. First, we reestimate returns to education and language skills for all subsamples. Second, we reestimate the returns to different levels of education vis-à-vis language skills for the full sample and all subsamples. Because the OLS method is shown to consistently produce a conservative estimate in the previous section, we use this to understand the heterogeneous nature of the returns in our data.[16]

Table 5 repeats the analysis presented in Table 2 for various subsamples, but only results specific to education and language skills are reported. The subsamples are female, male, urban, rural, eastern region, central region, and western region. First, we find that returns to education for female workers (9%) are still higher than

[15] Another reason to treat OLS estimates as conservative is because the larger value of the IV estimates may be capturing treatment effects only for the subgroup of observations that comply with the instrument, i.e., the causal effect is identified for the observations affected by the instrument ("compliers") so that the estimates are of a "local average treatment effect" (LATE), averaged across these compliers (Imbens and Rubin 1997, Wooldridge 2002, Murray 2006). In our case, the IV estimation arguably captures the returns to education only for those individuals whose schooling are very sensitive to their parents' support. If so, the effect size cannot be generalized to the whole population.

[16] This approach to using OLS to understand heterogeneous returns assumes that across subsamples studied, the direction and extent of downward bias in OLS estimates remain the same.

Table 5. **Ordinary Least Squares Estimates of the Returns to Education versus Language Skills, by Gender and Location**

		(1)	(2)	(3)	(4)	(5)
Female sample (N = 1,797)	Years of education	0.103***	0.093***	0.091***	0.090***	0.090***
		(16.13)	(14.17)	(13.98)	(13.90)	(13.80)
	Good English skills		0.379***	0.372***	0.369***	0.362***
			(5.88)	(5.79)	(5.80)	(5.67)
	Adjusted R-squared	0.51	0.52	0.52	0.53	0.53
Male sample (N = 2,426)	Years of education	0.079***	0.072***	0.071***	0.071***	0.071***
		(13.67)	(12.21)	(12.04)	(12.08)	(12.00)
	Good English skills		0.243***	0.232***	0.232***	0.232***
			(3.95)	(3.78)	(3.80)	(3.80)
	Adjusted R-squared	0.45	0.46	0.46	0.47	0.47
Urban sample (N = 2,288)	Years of education	0.132***	0.124***	0.123***	0.122***	0.122***
		(26.64)	(23.89)	(23.68)	(23.59)	(23.51)
	Good English skills		0.215***	0.210***	0.209***	0.208***
			(5.08)	(4.96)	(4.96)	(4.92)
	Adjusted R-squared	0.43	0.44	0.44	0.44	0.45
Rural sample (N = 1,935)	Years of education	0.026***	0.024***	0.024***	0.023***	0.022***
		(3.75)	(3.42)	(3.35)	(3.29)	(3.22)
	Good English skills		0.298**	0.289**	0.282**	0.285**
			(1.91)	(1.86)	(1.83)	(1.86)
	Adjusted R-squared	0.19	0.19	0.21	0.22	0.23
Eastern (coastal) region (N = 1,586)	Years of education	0.122***	0.109***	0.108***	0.108***	0.107***
		(18.32)	(15.50)	(15.33)	(15.39)	(15.41)
	Good English skills		0.319***	0.312***	0.309***	0.304***
			(5.70)	(5.56)	(5.55)	(5.46)
	Adjusted R-squared	0.44	0.45	0.45	0.45	0.46
Central region (N = 1,435)	Years of education	0.063***	0.059***	0.058***	0.056***	0.056***
		(8.76)	(8.04)	(7.95)	(7.72)	(7.69)
	Good English skills		0.209**	0.214**	0.194**	0.196**
			(2.29)	(2.34)	(2.16)	(2.19)
	Adjusted R-squared	0.34	0.35	0.35	0.37	0.37
Western region (N = 1,202)	Years of education	0.060***	0.057***	0.056***	0.056***	0.054***
		(7.44)	(7.00)	(6.99)	(6.93)	(6.77)
	Good English skills		0.221**	0.214*	0.212*	0.230**
			(1.88)	(1.83)	(1.82)	(1.98)
	Adjusted R-squared	0.42	0.43	0.44	0.44	0.45

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. "Good English skills" is a dummy variable which indicates whether a respondent's English skills (including speaking and listening) are at or above the standard proficiency level (=1) or not (=0). Full specifications for models 1–5 are shown in Table 2.
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

for male workers (7.1%), even after controlling for personal characteristics; health indicators (height, self-reported health status, and BMI); and geographic locations, which is consistent with findings from previous studies (Kang and Peng 2012, Mishra and Smyth 2013, Wang 2013). The returns to women with good English skills (36%) are also higher than the returns to men (23%, see column 5). Second,

in addition to this gender gap in returns to schooling, we observe a clear rural–urban gap in the returns. Our finding is consistent with Meng, Shen, and Xue (2013) who find that the rates of return to each additional year of schooling increased from 8% to 9.3% during 1988–2009. This increase is even larger in urban areas (about 3 percentage points higher), which is similar to the finding of Gao and Smyth (2015) for the period 2001–2010.

Turning to region-specific estimates, our analysis shows clear regional differences in the returns to education. The bottom three panels of Table 5 report estimates by region. We find that the eastern region of the PRC (i.e., coastal provinces) has a comparatively higher rate of return to schooling (10.7%) than the central (5.6%) and western regions (5.4%).

One explanation for this regional difference in returns to education might be the observed widening gap in the production of cognitive skills, assessed in terms of differences in per student recurrent expenditure, teacher quality, and physical conditions of schools between coastal and inland areas (Qian and Smyth 2008a; Cheng 2009; Bickenbach and Liu 2013; Yang, Huang, and Liu 2014; Whalley and Xing 2014). Zhong (2011) examined the relationship between college quality and returns to higher education in the PRC and confirmed that the returns vary significantly depending on school quality. Moreover, he found that the maximum earnings gap between recipients of high- and low-quality higher education is 28%, and the gap for annual returns reached 1.4% after controlling for ability. Thus, better education quality at both basic education level (Cheng 2009) and higher education level (Bickenbach and Liu 2013) has resulted in higher returns to education in coastal areas of the PRC.

Table 6 shows the returns to different levels of education for the full sample and seven subsamples. We find that the returns to schooling increase with higher levels of education, which are consistent with results found in studies of developing countries (Kuepié and Nordman 2016). We calculate the average rate of return r_i specific to each level using the estimated OLS coefficients in the following way:

$$r_i = (\beta_i - \beta_{i-1}) / (Y_i - Y_{i-1})$$

where i is the level of education, Y_i is the year of schooling at education level i, and β_i is the estimate of the coefficient on the corresponding education level dummy in the wage regression. Thus, the rate of return to higher education, a bachelor's degree and above, is 31.9%, which is higher than the returns found in some studies that focused on the prehigher education expansion period. For example, based on 1981–1987 data from the Chinese Academy of Social Sciences, Meng and Kidd (1997) found that the rate of return to a bachelor's degree or higher relative to primary education is 29.1% in 1981 and 31.3% in 1987.[17] Moreover, we also find

[17] Studies based on data from the posthigher education reform period documented a sharp increase in returns to college education (Heckman and Li 2004, Fleisher et al. 2005, Qian and Smyth 2008b).

Table 6. **Ordinary Least Squares Estimates of the Returns to Schooling by Levels of Education (full sample and subsamples)**

	Full Sample	Female	Male	Urban	Rural	Eastern (Coastal) Region	Central Region	Western Region
Level of education								
Junior secondary	0.149***	0.149***	0.126***	0.229***	0.088*	0.183***	0.097*	0.137**
	(4.29)	(2.83)	(2.72)	(3.97)	(1.88)	(2.67)	(1.84)	(2.14)
Senior secondary	0.453***	0.582***	0.366***	0.602***	0.251***	0.529***	0.306***	0.474***
	(10.53)	(8.40)	(6.58)	(10.04)	(3.51)	(7.09)	(4.42)	(5.42)
Semibachelor	0.872***	1.114***	0.693***	1.018***	0.665***	0.916***	0.704***	0.915***
	(15.92)	(13.36)	(9.44)	(15.58)	(3.23)	(10.68)	(7.23)	(7.57)
Bachelor and above	1.191***	1.501***	0.981***	1.335***	0.733***	1.296***	0.904***	1.018***
	(20.06)	(16.23)	(12.58)	(19.25)	(2.72)	(14.51)	(7.46)	(7.77)
Good English skills	0.150***	0.147**	0.115*	0.154***	0.158	0.205***	0.055	0.103
	(3.28)	(2.24)	(1.80)	(3.55)	(1.00)	(3.61)	(0.58)	(0.87)
Number of observations	4,223	1,797	2,426	2,288	1,935	1,586	1,435	1,202
Adjusted R-squared	0.53	0.56	0.48	0.45	0.23	0.48	0.38	0.46

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. "Good English skills" is a dummy variable which indicates whether a respondent's English skills (including speaking and listening) are at or above the standard proficiency level (=1) or not (=0). Full specification is in model 5 of Table 2. For "level of education," the reference category is "at or below primary level," following Meng and Kidd (1997).
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

that female workers benefit more from having higher education than men. Similarly, urban residents are rewarded more than rural residents with the same level of college education, which is consistent with findings from Qian and Smyth (2008b) and Wang (2012).

Given such convexities in the earnings function, income inequality is unlikely to be reduced through school education unless equality in access to higher education is ensured.[18] This is also confirmed by the fact that educational endowments (schooling as well as skills) are distributed unequally in the PRC. The average number of years of schooling in Shanghai is 13.8, which is clearly higher than in the full sample (9.7), the eastern region including Shanghai (11.6), the eastern region excluding Shanghai (11.4), the central region (8.9), and the western region (8.1). Moreover, the percentage of respondents that have good English skills in Shanghai is also higher (43.1%) than in the full sample (11.2%), the eastern region including Shanghai (20.1%), the eastern region excluding Shanghai (17.8%), the central region (6.3%), and the western region (5.4%).

VI. Conclusion

In this paper, we have reexamined the economic returns to education in the PRC using a recent dataset that is representative of all provinces. When the endogeneity problem is not addressed, OLS estimates underestimate the true returns to schooling in the PRC. The IV estimates yield a much higher return to schooling—20.9% compared with the OLS estimate of 7.8%. In addition to commonly used instruments such as father's and mother's education, we used parental death when the respondent was 14 years old, which proved to be a strong excluded instrument in the first stage regression.

In general, our estimates are much higher than what has been reported in earlier studies on the PRC, particularly those that used prereform labor market datasets. This confirms that returns to education have steadily increased following the process of transition toward a market economy. Our evidence also confirms that individuals in coastal and urban locations (particularly nonstate sector employees) and young workers with market-relevant language skills were rewarded with higher returns to their education than their counterparts in rural and inland locations. The findings support the conclusions of recent studies that it took about 2 decades for the PRC to raise their workers' respective returns to education to the 10% level (Hung 2008; Meng, Shen, and Xue 2013).

The transition of the Chinese labor market from a centrally planned to a market-oriented system has contributed to a significant increase in earnings inequality by increasing the rewards for education and work experience. The

[18] For evidence on the role of higher education in explaining income inequality in the PRC, see Yang and Qiu (2016).

estimated return is much larger for higher education compared with secondary education. Market reforms may have also increased the price of unobserved skills (Meng, Shen, and Xue 2013). This may explain why we find a systematic labor market advantage enjoyed by those with English language skills and why the return is highest in coastal provinces where private sector jobs have the highest concentration. This finding is consistent with the evidence that schooling contributes to labor market performance in educationally advanced countries by enhancing labor market relevant functional literacy skills. Given our evidence on the convexities in returns to education and the significance of human capital as a determinant of labor market performance in postreform PRC, policies that improve access to cognitive skills are likely to reduce income inequality and boost economic growth in the coming decades.

References

Appleton, Simon, John Knight, Lina Song, and Qingjie Xia. 2002. "Labor Retrenchment in China: Determinants and Consequences." *China Economic Review* 13 (2–3): 252–75.

Appleton, Simon, Lina Song, and Qingjie Xia. 2005. "Has China Crossed the River? The Evolution of Wage Structure in Urban China during Reform and Retrenchment." *Journal of Comparative Economics* 33 (4): 644–63.

Arabsheibani, G. Reza, and Lisa Lau. 1999. "Mind the Gap: An Analysis of Gender Wage Differentials in Russia." *Labour* 13 (4): 761–74.

Asadullah, M. Niaz. 2006. "Returns to Education in Bangladesh." *Education Economics* 14 (4): 453–68.

Awaworyi, Sefa, and Vinod Mishra. 2014. "Returns to Education in China: A Meta-Analysis." Department of Economics of Monash University Discussion Paper No. 41.

Azam, Mehtabul, Aimee Chin, and Nishith Prakash. 2013. "The Returns to English-Language Skills in India." *Economic Development and Cultural Change* 61 (2): 335–67.

Bickenbach, Frank, and Wan-Hsin Liu. 2013. "Regional Inequality of Higher Education in China and the Role of Unequal Economic Development." *Frontiers of Education in China* 8 (2): 266–302.

Bishop, John A., and Jong-Rong Chiou. 2004. *Journal of Asian Economics* 15 (3): 549–62. https://www.sciencedirect.com/science/article/pii/S1049007804000594.

Bishop, John A., Feijun Luo, and Fang Wang. 2005. "Economic Transition, Gender Bias, and the Distribution of Earnings in China." *Economics of Transition* 13 (2): 239–59.

Bleakley, Hoyt, and Aimee Chin. 2004. "Language Skills and Earnings: Evidence from Childhood Immigrants." *The Review of Economics and Statistics* 86 (2): 481–96.

Byron, Raymond P., and Evelyn Q. Manaloto. 1990. "Returns to Education in China." *Economic Development and Cultural Change* 38 (4): 783–96.

Cai, Fang, and Yang Du. 2011. "Wage Increases, Wage Convergence, and the Lewis Turning Point in China." *China Economic Review* 22 (4): 601–10.

Carnoy, Martin, Prashant Kumar Loyalka, Greg Androushchak, and Anna Proudnikova. 2013. "The Economic Returns to Higher Education in the BRIC Countries and Their Implications for Higher Education Expansion." University of Stanford REAP Working Paper No. 253.

Case, Anne, and Christina Paxson. 2008. "Stature and Status: Height, Ability and Labor Market Outcomes." *Journal of Political Economy* 116 (3): 499–532.

_____. 2009. "Making Sense of the Labor Market Height Premium: Evidence from the British Household Panel Survey." *Economics Letters* 102 (3): 174–76.

Case, Anne, Christina Paxson, and Joseph Ableidinger. 2004. "Orphans in Africa: Parental Death, Poverty, and School Enrollment." *Demography* 41 (3): 483–508.

Chan, Chris King-Chi, and Khalid Nadvi. 2014. "Changing Labour Regulations and Labour Standards in China: Retrospect and Challenges." *International Labour Review* 153 (4): 513–34.

Chen, Baizhu, and Yi Feng. 2000. "Determinants of Economic Growth in China: Private Enterprises, Education, and Openness." *China Economic Review* 11 (1): 1–15.

Chen, Guifu, and Shigeyuki Hamori. 2009. "Economic Returns to Schooling in Urban China: OLS and the Instrumental Variables Approach." *China Economic Review* 20 (2): 143–52.

Cheng, Henan. 2009. "Inequality in Basic Education in China: A Comprehensive Review." *International Journal of Educational Policies* 3 (2): 81–106.

Conti, Gabriella, James Heckman, and Sergio Urzua. 2010. "The Education–Health Gradient." *American Economic Review: Papers and Proceedings* 100 (2): 1–5.

De Brauw, Alan, and Scott Rozelle. 2008. "Reconciling the Returns to Education in Off-Farm Wage Employment in Rural China." *Review of Development Economics* 12 (1): 57–71.

Démurger, Sylvie. 2001. "Infrastructure and Economic Growth: An Explanation for Regional Disparities in China." *Journal of Comparative Economics* 29 (1): 95–117.

Démurger, Sylvie, Marc Gurgand, Shi Li, and Ximing Yue. 2009. "Migrants as Second-Class Workers in Urban China? A Decomposition Analysis." *Journal of Comparative Economics* 37 (4): 610–28.

Deng, Quheng, and Shi Li. 2010. "Wage Structures and Inequality among Local and Migrant and Urban Workers." In *The Great Migration: Rural–Urban Migration in China and Indonesia*, edited by Meng Xin, Chris Manning, Shi Li, Tadjuddin Noer Effendi, and Gadjah Mada. Cheltenham, UK: Edward Elgar.

Di Paolo, Antonio, and Aysit Tansel. 2015. "Returns to Foreign Language Skills in a Developing Country: The Case of Turkey." *The Journal of Development Studies* 51 (4): 407–21.

Dinda, Soumyananda, P. K. Gangopadhyay, B. P. Chattopadhyay, H. N. Saiyed, M. Pal, and P. Bharati. 2006. "Height, Weight, and Earnings among Coalminers in India." *Economics and Human Biology* 4 (3): 342–50.

Duraisamy, Palanigounder. 2002. "Changes in Returns to Education in India, 1983–1994: by Gender, Age-Cohort, and Location." *Economics of Education Review* 21 (6): 609–22.

Dustmann, Christian, and Francesca Fabbri. 2003. "Language Proficiency and Labour Market Performance of Immigrants in the UK." *Economic Journal* 113 (489): 695–717.

Elu, Juliet U., and Gregory N. Price. 2013. "Does Ethnicity Matter for Access to Childhood and Adolescent Health Capital in China? Evidence from the Wage–Height Relationship in the 2006 China Health and Nutrition Survey." *Review of Black Political Economy* 40 (3): 315–39.

Fang, Hai, Karen N. Eggleston, John A. Rizzo, Scott Rozelle, and Richard J. Zeckhauser. 2012. "The Returns to Schooling: Evidence from the 1986 Compulsory Education Law." National Bureau of Economic Research Working Paper No. 18189.

Fasih, Tazeen, Harry A. Patrinos, and Chris Sakellariou. 2013. "Functional Literacy, Heterogeneity and the Returns to Schooling: Multi-Country Evidence." World Bank Policy Research Working Paper No. 6697.

Fleisher, Belton M., and Jian Chen. 1997. "The Coast–Noncoast Income Gap, Productivity, and Regional Economic Policy in China." *Journal of Comparative Economics* 25 (2): 220–36.

Fleisher, Belton M., Keyong Dong, and Yunhua Liu. 1996. "Education, Enterprise Organization, and Productivity in the Chinese Paper Industry." *Economic Development and Cultural Change* 44 (3): 571–87.

Fleisher, Belton M., Haizheng Li, Shi Li, and Xiaojun Wang. 2005. "Sorting, Selection and Transformation of Return to College Education in China." Ohio State University Working Paper No. 07.

Fleisher, Belton M., and Xiaojun Wang. 2001. "Efficiency Wages and Work Incentives in Urban and Rural China." *Journal of Comparative Economics* 29 (4): 645–62.

_____. 2004. "Skill Differentials, Return to Schooling, and Market Segmentation in a Transition Economy." *Journal of Development Economics* 73 (1): 315–28.

_____. 2005. "Returns to Schooling in China under Planning and Reform." *Journal of Comparative Economic* 33 (2): 265–77.

Frijters, Paul, Leng Lee, and Xin Meng. 2010. "Jobs, Working Hours, and Remuneration Packages for Migrants and Urban Residents." In *The Great Migration: Rural–Urban Migration in China and Indonesia*, edited by Meng Xin, Chris Manning, Shi Li, and Tadjuddin Noer Effendi, 47–73. Edward Elgar Publishing Ltd.

Gao, Wenshu, and Russell Smyth. 2010. "Health Human Capital, Height, and Wages in China." *Journal of Development Studies* 46 (3): 466–84.

_____. 2015. "Education Expansion and Returns to Schooling in Urban China, 2001–2010: Evidence from Three Waves of the China Urban Labor Survey." *Journal of the Asia Pacific Economy* 20 (2): 178–201.

Ge, Suqin, and Dennis Tao Yang. 2011. "Labor Market Developments in China: A Neoclassical View." *China Economic Review* 22 (4): 611–25.

Gertler, Paul, David I. Levine, and Minnie Ames. 2004. "Schooling and Parental Death." *Review of Economics and Statistics* 86 (1): 211–25.

Giles, John, Emily Hannum, Albert Park, and Juwei Zhang. 2003. "Life-Skills, Schooling, and the Labor Market in Urban China: New Insights from Adult Literacy Measurement." The International Centre for the Study of East Asian Development Working Paper No. 21.

Giles, John, Albert Park, and Meiyan Wang. 2008. "The Great Proletarian Cultural Revolution, Disruptions to Education and Returns to Schooling in Urban China." World Bank Policy Research Working Paper No. 4729.

Gregory, Robert G., and Xin Meng. 1995. "Wage Determination and Occupational Attainment in the Rural Industrial Sector of China." *Journal of Comparative Economics* 21 (3): 353–74.

Grossman, Michael. 2008. "The Relationship between Health and Schooling: Presidential Address." *Eastern Economic Journal* 34 (3): 281–92.

Gustafsson, Björn, and Shi Li. 2000. "Economic Transformation and the Gender Earnings Gap in Urban China." *Journal of Population Economics* 13 (2): 305–29.

Hanushek, Eric A., Guido Schwerdt, Simon Wiederhold, and Ludger Woessmann. 2015. "Returns to Skills around the World: Evidence from PIAAC." *European Economic Review* 73 (C): 103–30.

Harmon, Colm, and Ian Walker. 1995. "Estimates of the Economic Returns to Education for the UK." *American Economic Review* 93 (5): 1799–812.

Hauser, Seth M., and Yu Xie. 2005. "Temporal and Regional Variation in Earnings Inequality: Urban China in Transition between 1988 and 1995." *Social Science Research* 34 (1): 44–79.

Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (1): 153–61.

Heckman, James J., John Eric Humphries, Greg Veramendi, and Sergio S. Urzua. 2014. "Education, Health, and Wages." National Bureau of Economic Research Working Paper No. 19971.

Heckman, James J., and Xuesong Li. 2004. "Selection Bias, Comparative Advantage, Heterogeneous Returns to Education: Evidence from China in 2000." *Pacific Economic Review* 9 (3): 155–71.

Heckman, James J., and Junjian Yi. 2012. "Human Capital, Economic Growth, and Inequality in China." National Bureau of Economic Research Working Paper No. 18100.

Heineck, Guido. 2008. "A Note on the Height–Wage Differential in the UK: Cross-Sectional Evidence from the BHPS." *Economics Letters* 98 (3): 288–93.

Ho, Samuel P. S., Xiao-Yuan Dong, Paul Bowles, and Fiona Macphail. 2002. "Privatization and Enterprise Wage Structures during Transition: Evidence from Rural Industry in China." *Economics of Transition* 10 (3): 659–88.

Hübler, Olaf. 2006. "The Non-Linear Link between Height and Wages: An Empirical Investigation." IZA Discussion Paper No. 2394.

Hung, Fan-sing. 2008. "Returns to Education and Economic Transition: An International Comparison." *Compare: A Journal of Comparative and International Education* 38 (2): 155–71.

Imbens, Guido W., and Donald B. Rubin. 1997. "Estimating Outcome Distributions for Compliers in Instrumental Variables Models." *Review of Economic Studies* 64 (4): 555–74.

Jamison, Dean T., and Jacques Van der Gaag. 1987. "Education and Earnings in the PRC." *Economics of Education Review* 6 (2): 161–66.

Johnson, Emily N., and Gregory C. Chow. 1997. "Rate of Return to Schooling in China." *Pacific Economic Review* 2 (2): 101–13.

Kang, Lili, and Fei Peng. 2012. "Sibling, Public Facilities, and Education Returns in China." MPRA Paper No. 38922.

Knight, John, and Lina Song. 1991. "The Determinants of Urban Income Inequality in China." *Oxford Bulletin of Economic and Statistics* 53 (2): 123–54.

_____. 1993. "Why Urban Wages Differ in China." In *The Distribution of Income in China*, edited by Keith B. Griffin and Renwei Zhao. New York City: St. Martin's Press.

_____. 1995. "Toward a Labor Market in China." *Oxford Review of Economic Policy* 11 (4): 97–117.

_____. 2003. "Increasing Wage Inequality in China: Extent, Elements and Evaluation." *Economics of Transition* 11 (4): 597–619.

_____. 2005. "Wages, Firm Profitability, and Labor Market Segmentation in Urban China." *China Economic Review* 16 (3): 205–28.

Kuepié, Mathias, and Christophe J. Nordman. 2016. "Where Does Education Pay Off in Sub-Saharan Africa? Evidence from Two Cities of the Republic of Congo." *Oxford Development Studies* 44 (1): 1–27.

Leslie, Derek, and Joanne Lindley. 2001. "The Impact of Language Ability on Employment and Earnings of Britain's Ethnic Communities." *Economica* 68 (272): 587–606.

Lewbel, Arthur. 2012. "Using Heteroscedasticity to Identify and Estimate Mismeasured and Endogenous Regressor Models." *Journal of Business and Economic Statistics* 30 (1): 67–80.

Li, Haizheng. 2003. "Economic Transition and Returns to Education in China." *Economics of Education Review* 22 (3): 317–28.

Li, Haizheng, and Yi Luo. 2004. "Reporting Errors, Ability Heterogeneity and Returns to Schooling in China." *Pacific Economic Review* 9 (3): 191–207.

Li, Hongbin, Pak Wai Liu, Ning Ma, and Junsen Zhang. 2005. "Does Education Pay in Urban China? Estimating Returns to Education Using Twins." Chinese University of Hong Kong Discussion Paper. No. 00013.

Li, Hongbin, Pak Wai Liu, and Junsen Zhang. 2012. "Estimating Returns to Education Using Twins in Urban China." *Journal of Development Economics* 97 (2): 494–504.

Li, Hongbin, Pak Wai Liu, Junsen Zhang, and Ning Ma. 2007. "Economic Returns to Communist Party Membership: Evidence from Urban Chinese Twins." *The Economic Journal* 117 (523): 1504–20.

Li, Hongbin, Lingsheng Meng, Xinzheng Shi, and Binzhen Wu. 2012. "Does Attending Elite Colleges Pay in China?" *Journal of Comparative Economics* 40 (1): 78–88.

Li, Qiang, Alan De Brauw, Scott Rozelle, and Linxiu Zhang. 2005. "Labor Market Emergence and Returns to Education in Rural China." *Review of Agricultural Economics* 27 (3): 418–24.

Liu, Elaine, and Shu Zhang. 2013. "A Meta-Analysis of the Estimates of Returns to Schooling in China." University of Houston Department of Economics Working Paper No. 201309855.

Liu, Minquan, Luodan Xu, and Liu Liu. 2004. "Wage-Related Labour Standards and FDI in China: Some Survey Findings from Guangdong Province." *Pacific Economic Review* 9 (3): 225–43.

Liu, Zhiqiang. 1998. "Earnings, Education and Economic Reforms in Urban China." *Economic Development and Cultural Change* 46 (4): 697–725.

Maurer-Fazio, Margaret. 1999. "Earnings and Education in China's Transition to a Market Economy. Survey Evidence from 1989 and 1992." *China Economic Review* 10 (1): 17–40.

Maurer-Fazio, Margaret, and Ngan Dinh. 2004. "Differential Rewards to and Contributions of Education in Urban China's Segmented Labor Markets." *Pacific Economic Review* 9 (3): 173–89.

Mendolicchio, Concetta, and Thomas Rhein. 2014. "The Gender Gap of Returns on Education across West European Countries." *International Journal of Manpower* 35 (3): 219–49.

Meng, Xin, and Michael P. Kidd. 1997. "Labor Market Reform and the Changing Structure of Wage Determination in China's State Sector during the 1980s." *Journal of Comparative Economic*s 25 (3): 403–21.

Meng, Xin, Kailing Shen, and Sen Xue. 2013. "Economic Reform, Education Expansion, and Earnings Inequality for Urban Males in China, 1988–2009." *Journal of Comparative Economics* 41 (1): 227–44.

Meng, Xin, and Junsen Zhang. 2001. "The Two-Tier Labor Market in Urban China: Occupational Segregation and Wage Differentials between Urban Residents and Rural Migrants in Shanghai." *Journal of Comparative Economics* 29 (3): 485–504.

Messinis, George. 2013. "Returns to Education and Urban-Migrant Wage Differentials in China: IV Quantile Treatment Effects." *China Economic Review* 26: 39–55.

Mishra, Vinod, and Russell Smyth. 2013. "Economic Returns to Schooling for China's Korean Minority." *Journal of Asian Economics* 24: 89–102.

_____. 2015. "Estimating Returns to Schooling in Urban China Using Conventional and Heteroskedasticity-Based Instruments." *Economic Modelling* 47: 166–73

Murray, Michael P. 2006. "Avoiding Invalid Instruments and Coping with Weak Instruments." *Journal of Economic Perspectives* 20 (4): 111–32.

Parish, William L., Xiaoye Zhe, and Fang Li. 1995. "Nonfarm Work and Marketization of the Chinese Countryside." *The China Quarterly* 143: 697–730.

Peng, Yusheng. 1992. "Wage Determination in Rural and Urban China: A Comparison of Public and Private Industrial Sectors." *American Sociological Review* 57 (2): 198–213.

Psacharopoulos, George, G. 1994. "Returns to Investment in Education: A Global Update." *World Development* 22 (9): 1325–43.

Psacharopoulos, George, and Harry Anthony Patrinos. 2004. "Returns to Investment in Education: A Further Update." *Education Economics* 12 (2): 111–34.

Qian, Xiaolei, and Russell Smyth. 2008a. "Measuring Regional Inequality of Education in China: Widening Coast–Inland Gap or Widening Rural–Urban Gap?" *Journal of International Development* 20 (2): 132–44.

_____. 2008b. "Private Returns to Investment in Education in China: An Empirical Study of Urban China." *Post-Communist Economies* 20 (4): 483–501.

Qiu, Tian, and John Hudson. 2010. "Private Returns to Education in Urban China." *Economic Change and Restructuring* 43 (2): 131–50.

Qu, Zhaopeng, and Zhong Zhao. 2017. "Glass Ceiling Effect in Urban China: Wage Inequality of Rural-Urban Migrants during 2002–2007." *China Economic Review* 42: 118–44.

Ren, Weiwei, and Paul W. Miller. 2012. "Changes over Time in the Return to Education in Urban China: Conventional and ORU Estimates." *China Economic Review* 23 (1): 154–69.

Sakellariou, Chris, and Zheng Fang. 2016. "Returns to Schooling for Urban and Migrant Workers in China: A Detailed Investigation." *Applied Economics* 48 (8): 684–700.

Salike, Nimesh. 2016. "Role of Human Capital on Regional Distribution of FDI in China: New Evidences." *China Economic Review* 37: 66–84.

Schultz, T. Paul. 2002. "Wage Gains Associated with Height as a Form of Health Human Capital." *American Economic Review* 92 (2): 349–453.

_____. 2003. "Wage Rentals for Reproducible Human Capital: Evidence from Ghana and the Ivory Coast." *Economics and Human Biology* 1 (3): 331–66.

Silles, Mary A. 2009. "The Causal Effect of Education on Health: Evidence from the United Kingdom." *Economics of Education Review* 28 (1): 122–28.

Su, Yaqin, and Zhiqiang Liu. 2016. "The Impact of Foreign Direct Investment and Human Capital on Economic Growth: Evidence from Chinese Cities." *China Economic Review* 37: 97–109.

Trostel, Philip, Ian Walker, and Paul Woolley. 2002. "Estimates of the Economic Return to Schooling for 28 Countries." *Labour Economic*s 9 (1): 1–16.

Wang, Le. 2012. "Economic Transition and College Premium in Urban China." *China Economic Review* 23 (2): 238–52.

_____. 2013. "How Does Education Affect the Earnings Distribution in Urban China?" *Oxford Bulletin of Economics and Statistics* 75 (3): 435–54.

Wang, Xiaojun, Belton Fleisher, Haizheng Li, and Li Shi. 2007. "Access to Higher Education and Inequality: The Chinese Experiment." IZA Discussion Paper No. 2823.

Wei, Xin, Mun C. Tsang, Weibin Xu, and Liang-Kun Chen. 1999. "Education and Earnings in Rural China." *Education Economics* 7 (2): 167–87.

Whalley, John, and Chunbing Xing. 2014. "The Regional Distribution of Skill Premia in Urban China: Implications for Growth and Inequality." *International Labour Review* 153 (3): 395–419.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Xie, Yu, and Emily Hannum. 1996. "Regional Variation in Earnings Inequality in Reform-Era Urban China." *American Journal of Sociology* 101 (4): 950–92.

Yang, Dennis Tao. 1997. "Education and Off-Farm Work." *Economic Development and Cultural Change* 45 (3): 613–32.

_____. 2005. "Determinants of Schooling Returns during Transition: Evidence from Chinese Cities." *Journal of Comparative Economics* 33 (2): 244–64.

Yang, Juan, and Muyuan Qiu. 2016. "The Impact of Education on Income Inequality and Intergenerational Mobility." *China Economic Review* 37: 110–25.

Yang, Jun, Xiao Huang, and Xin Liu. 2014. "An Analysis of Education Inequality in China." *International Journal of Educational Development* 37: 2–10.

Zhang, Chuanchuan. 2011. "Empirical Analysis on Impact of Health Change on Labor Supply and Income." *Economic Review* 4: 79–88.

Zhang, Junsen, Pak-Wai Liu, and Linda Yung. 2007. "The Cultural Revolution and Returns to Schooling in China: Estimates Based on Twins." *Journal of Development Economics* 84 (2): 631–39.

Zhang, Junsen, Yaohui Zhao, Albert Park, and Xiaoqing Song. 2005. "Economic Returns to Schooling in Urban China, 1988–2001." *Journal of Comparative Economics* 33 (4): 730–52.

Zhao, Wei, and Xueguang Zhou. 2002. "Institutional Transformation and Returns to Education in Urban China: An Empirical Assessment." *Research in Social Stratification and Mobility* 19: 339–75.

Zhong, Hai. 2011. "Returns to Higher Education in China: What is the Role of College Quality?" *China Economic Review* 22 (2): 260–75.

Zhou, Xueguang. 2000. "Economic Transformation and Income Inequality in Urban China: Evidence from Panel Data." *American Journal of Sociology* 105 (4): 1135–74.

Zhu, Rong. 2015. "Heterogeneity in the Economic Returns to Schooling among Chinese Rural–Urban Migrants, 2002–07." *Economics of Transition* 23 (1): 135–67.

Appendix Table A1. **Distribution of Sample Individuals by Work Status**

		N	Waged Work (Agricultural)	Waged Work (Nonagricultural)	Self-Employed	In Labor Force but Unemployed	Not in Labor Force
Without age limitation	Full sample	11,724	24.9%	29.0%	9.8%	6.7%	29.6%
	Female	6,079	25.1%	23.2%	7.5%	6.3%	37.9%
	Male	5,645	24.8%	35.2%	12.3%	7.1%	20.6%
	Urban	7,173	4.4%	39.0%	12.4%	7.3%	36.9%
	Rural	4,551	57.2%	13.2%	5.7%	5.7%	18.2%
Female: 16–55 years old	Full sample	8,644	24.5%	38.1%	12.5%	7.2%	17.7%
	Female	4,279	25.5%	31.8%	10.1%	6.9%	25.7%
	Male	4,365	23.6%	44.2%	15.0%	7.5%	9.7%
Male: 16–60 years old	Urban	5,363	4.0%	50.7%	15.7%	8.1%	21.5%
	Rural	3,281	58.1%	17.5%	7.4%	5.8%	11.2%

Continued.

Appendix Table A1. *Continued.*

		N	Waged Work (Agricultural)	Waged Work (Nonagricultural)	Self-employed	In Labor Force but Unemployed	Not in Labor Force
Female:	Full sample	7,747	26.3%	38.2%	13.3%	7.2%	15.0%
25–55	Female	3,809	27.3%	31.6%	10.8%	6.9%	23.4%
years old	Male	2,938	25.4%	44.6%	15.6%	7.4%	7.0%
Male:	Urban	4,745	4.5%	51.7%	16.9%	8.1%	18.8%
25–60	Rural	3,002	60.9%	16.8%	7.6%	5.6%	9.1%
years old							

Source: Chinese General Social Survey (CGSS).

Appendix Table A2. **Descriptive Statistics for Waged Workers**

	Mean	SD
Monthly employment income (renminbi)	1,631.37	2,283.98
Personal characteristics		
Years of experience	27.86	10.06
Female*	0.43	0.49
Minority*	0.09	0.29
Nonagricultural *hukou**	0.40	0.49
Currently married*	0.89	0.31
Schooling and cognitive skills		
Years of education (years of schooling)	9.70	4.45
Level of education:		
*Bachelor and above**	0.11	0.31
*Semibachelor**	0.11	0.31
*Senior secondary**	0.19	0.49
*Junior secondary**	0.30	0.46
*Primary and below (base group)**	0.29	0.45
Good English skills*	0.11	0.32
Health capital		
Height (centimeters)	165.38	7.49
Self-reported health status:		
*Bad**	0.12	0.32
*Normal (base group)**	0.21	0.40
*Good**	0.67	0.47
Body mass index (BMI):		
*BMI < 18.5, underweight**	0.07	0.25
*18.5 ≤ BMI < 25, normal (base group)**	0.72	0.45
*25 ≤ BMI < 30, overweight**	0.19	0.39
*BMI ≥ 30, obese**	0.02	0.14
Excluded instruments (IV model)		
$\text{Education}_{Father}$ (in years)	5.27	4.61
$\text{Education}_{Mother}$ (in years)	3.38	4.30
Parent died when respondent was 14 years old*	0.03	0.18
Labor force participation identifying variable (Heckman model)		
Nonlabor income received from bequest (renminbi)	30.15	707.22

Continued.

Appendix Table A2. *Continued.*

	Mean	SD
Geographic location		
Rural*	0.46	0.50
Eastern region*	0.38	0.48
Central region*	0.34	0.47
Western region*	0.28	0.45

IV = instrumental variable, SD = standard deviation.
Note: *indicates dummy variables equal to 1 if true, and otherwise equal to 0.
Sources: Chinese General Social Survey (CGSS) and authors' calculations.

Appendix Table A3. **First Stage Regression of Instrumental Variable and Heckman Models (full sample estimates only)**

	IV First Stage (individual's schooling)	Heckman First Stage (labor force participation)
Personal characteristics		
Age	0.035	0.044***
	(0.72)	(12.90)
Age squared	−0.001	−0.001***
	(1.50)	(14.01)
Female	−0.801***	−0.181***
	(5.84)	(15.89)
Minority	−0.109	−0.001
	(0.66)	(0.01)
Nonagricultural *hukou*	2.241***	−0.016*
	(16.34)	(1.81)
Currently married	0.315*	−0.005
	(1.93)	(0.48)
Schooling and cognitive skills		
Years of education		0.005***
		(5.07)
Good English skills	2.454***	0.061***
	(14.62)	(5.09)
Health capital		
Height (centimeters)	0.024***	−0.001
	(2.64)	(0.30)
Self-reported health status:		
Bad	−0.827***	−0.039***
	(4.67)	(3.33)
Good	0.108	0.029***
	(0.89)	(3.38)
Body mass index (BMI):		
BMI < 18.5, underweight	−0.203	0.001
	(1.05)	(0.07)
25 ≤ BMI < 30, overweight	0.130	−0.023**
	(1.06)	(2.49)
BMI ≥ 30, obese	−0.379	−0.021
	(1.12)	(0.79)

Continued.

Appendix Table A3. *Continued.*

	IV First Stage (individual's schooling)	Heckman First Stage (labor force participation)
Family background (instruments)		
Parent died when respondent was 14 years old (yes = 1)	−0.857***	
	(3.00)	
Education$_{Father}$(years)	0.138***	
	(9.60)	
Education$_{Mother}$ (years)	0.122***	
	(7.71)	
Labor force participation identifying variable		
Nonlabor income received from bequest (renminbi)		−0.012***
		(3.93)
Geographic location		
Rural	−1.682***	0.106***
	(12.19)	(11.98)
Eastern region	0.535***	0.005
	(4.43)	(0.54)
Western region	−0.497***	0.026***
	(3.98)	(2.85)
Constant	4.394**	
	(2.38)	
Adjusted R-squared/Pseudo R-squared	0.54	0.17
Number of observations	4,223	6,618
F-test of significance: parental death only	19.03***	
F-test of significance: parental education variables only	151.61***	

IV = instrumental variable.

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Early parental death along with father's and mother's education are used as excluded instruments in the IV model. Nonlabor income received from bequest is used as an excluded identifying variable in the Heckman model.

Sources: Chinese General Social Survey (CGSS) and authors' calculations.