Changing Returns to Vocational and Regular Education in China

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Motivation

- Emerging markets challenged to provide appropriate skill training to enable supply of skills to meet changing demand for skills during the process of structural change
- Longstanding debates over the appropriate mix of vocational versus general education
- China decided to aggressively expand vocational high school education since mid-2000s
  - 6.6 million secondary vocational school graduates compared to 8.1 million regular high graduates in 2011
- To date, almost no evidence on the returns to vocational versus regular education in China
  - Challenge: most surveys do not distinguish between regular and vocational high school

Contribution

- Provide evidence from 3 new data sources on returns to vocational versus regular education in China
- Employ research designs that provide causal estimates of the relative returns to vocational versus regular education
  - Use expansion of vocational education in 2000s as an exogenous supply shock (e.g., Duflo, 2001)
  - Employ an RD-design based on high school exam entrance cutoff scores

Previous Studies

- The World Bank generally recommends that countries invest in general education, citing early survey papers suggesting lower rates of return to vocational schooling (Psacharopoulos, 1987).
- However, more recently, some have questioned this interpretation of the existing empirical evidence (Bennell, 1996). Recent studies find mixed results
  - Moenjak and Worswick (2003) find a higher return to vocational schooling compared to general schooling in Thailand
  - Munich, Svejnar, and Terrell (2005) finds no statistically significant difference in transition economies.
  - Malamud and Pop-Eleches (2008) employ a regression discontinuity approach to exploit a policy change in Romania in 1973 that increased the years of general schooling required to pursue vocational training from 8 years to 10 years, and find no significant impact of reduced vocational education on employment or wage outcomes
- Relative returns to vocational and regular change may vary over the life cycle.
  - Hanushek, Woessman, and Zhang (2011) analyze data from 18 countries and find that initial advantages from vocational education diminishes over time and is surpassed by the returns to regular education. But this study does not distinguish between age and cohort effects.

China Background

- Educational expansions
  - College expansion since 2000
  - Vocational high school expansion since 2005
- Academic progression
  - Local competitive exams for entry into general high school
  - General high school necessary to qualify for college entrance
  - Competitive college entry examinations (for both general and vocational colleges)
  - *Exams may create selection bias in estimating returns to education
- Criticism of vocational high school quality
  - REAP studies
  - Multiple models, including general education content, and internship arrangements

New Data Sources

- China Urban Labor Survey (2001, 2005, 2010)
  - 5 large cities in China
  - Migrant and local resident samples
  - Distinguish between vocational and regular high school in all waves
- NBS rural household survey subsample (2011)
  - 8 provinces
  - Includes rural migrant workers in cities
  - Added question on year completed middle school
- Survey of young adults in rural county in Yunnan (2013)
  - Data on all high school entrance exam scores for 2001, 2005-7
  - Focus sample on those with scores near the cutoff line (10%)
  - Spring festival survey with phone calling protocol

China Urban Labor Survey (CULS)

- Three waves: 2001, 2005, 2010
- Surveys directed by Institute of Population and Labor Economics (CASS), working with international collaborators
- Five cities: Shanghai and Fuzhou (coast), Shenyang (NE), Wuhan (central), Xian (west)
- Local residents and migrants sampled independently using PPS sampling of neighborhoods and detailed enumeration of dwellings in sampled neighborhoods
- Sample includes all wage employees aged 16 to 59
  - 21,860 observations

Descriptive statistics on educational level of local residents and migrants

Variable	2001		2005		2010	
	Local	Migrant	Local	Migrant	Local	Migrant
Middle school and below (%)	41.3	74.8	29.8	70.3	32.3	57.0
Regular high school (%)	29.4	17.0	36.2	19.8	29.7	18.7
Vocational high school (%)	10.4	4.34	11.2	3.31	9.23	5.67
Vocational higher education (%)	11.4	2.69	13.5	3.52	16.7	9.48
College and above (%)	7.47	1.19	9.43	3.10	12.1	9.15
Schooling years	11.0	8.62	11.6	9.3	11.9	10.4

China Urban Labor Survey Estimates

- Returns to vocational and regular education by year
- Returns to vocational and regular education for local and migrant workers by year
- Returns to regular and vocational education by age-group controlling for birth cohort

Returns to education by year

	2001CULS	2005CULS	2010CULS
Gender	0.202***	0.251***	0.234***
	[0.017]	[0.018]	[0.014]
Regular high school	**0.289*** **	**0.285*** **	**0.216*** **
	[0.021]	[0.022]	[0.018]
Vocational high school	**0.513*** **	**0.589*** **	**0.417*** **
	[0.029]	[0.032]	[0.026]
Vocational higher education	0.752***	0.781***	0.696***
	[0.026]	[0.029]	[0.021]
College and above	1.029***	1.092***	0.958***
	[0.031]	[0.032]	[0.022]
Age	0.050***	0.036***	0.049***
	[0.005]	[0.006]	[0.005]
Age square	-0.0005***	-0.0004***	-0.006***
	[0.000]	[0.000]	[0.000]
Rural migrant (Yes=1)	**-0.303*** **	**-0.247*** **	**-0.198*** **
	[0.026]	[0.025]	[0.018]
Urban migrant (Yes=1)	**-0.148*** **	**-0.121*** **	**-0.096*** **
	[0.035]	[0.036]	[0.021]
City dummy variable	Yes	Yes	Yes
R^2	0.36	0.41	
N	4733	4236	6540

Returns to education for local residents and migrants by year

	2001 Local	2001 migrant	2005 Local	2005 migrant	2010 Local	2010 migrant
Gender	0.204***	0.153***	0.275***	0.237***	0.215***	0.248***
	[0.020]	[0.029]	[0.022]	[0.021]	[0.018]	[0.018]
Regular high school	0.202***	0.250***	0.129***	0.236***	0.242***	0.190***
	[0.025]	[0.038]	[0.029]	[0.028]	[0.024]	[0.024]
Vocational high school	**0.374*** **	**0.524*** **	**0.441*** **	**0.449*** **	**0.450*** **	**0.239*** **
	[0.035]	[0.061]	[0.040]	[0.055]	[0.033]	[0.039]
Vocational higher education	0.642***	0.836***	0.635***	0.785***	0.677***	0.498***
	[0.031]	[0.083]	[0.036]	[0.067]	[0.028]	[0.034]
College and above	0.923***	1.241***	0.932***	1.226***	0.956***	0.857***
	[0.034]	[0.121]	[0.040]	[0.073]	[0.029]	[0.038]
Age	0.016**	0.065***	0.020**	0.054***	0.060***	0.036***
	[0.008]	[0.010]	[0.009]	[0.007]	[0.006]	[0.006]
Age square	-0.000*	-0.001***	-0.000**	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
City dummy	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.295	0.231	0.388	0.242	0.345	0.329
N	3799	2445	3156	3764	4345	4237

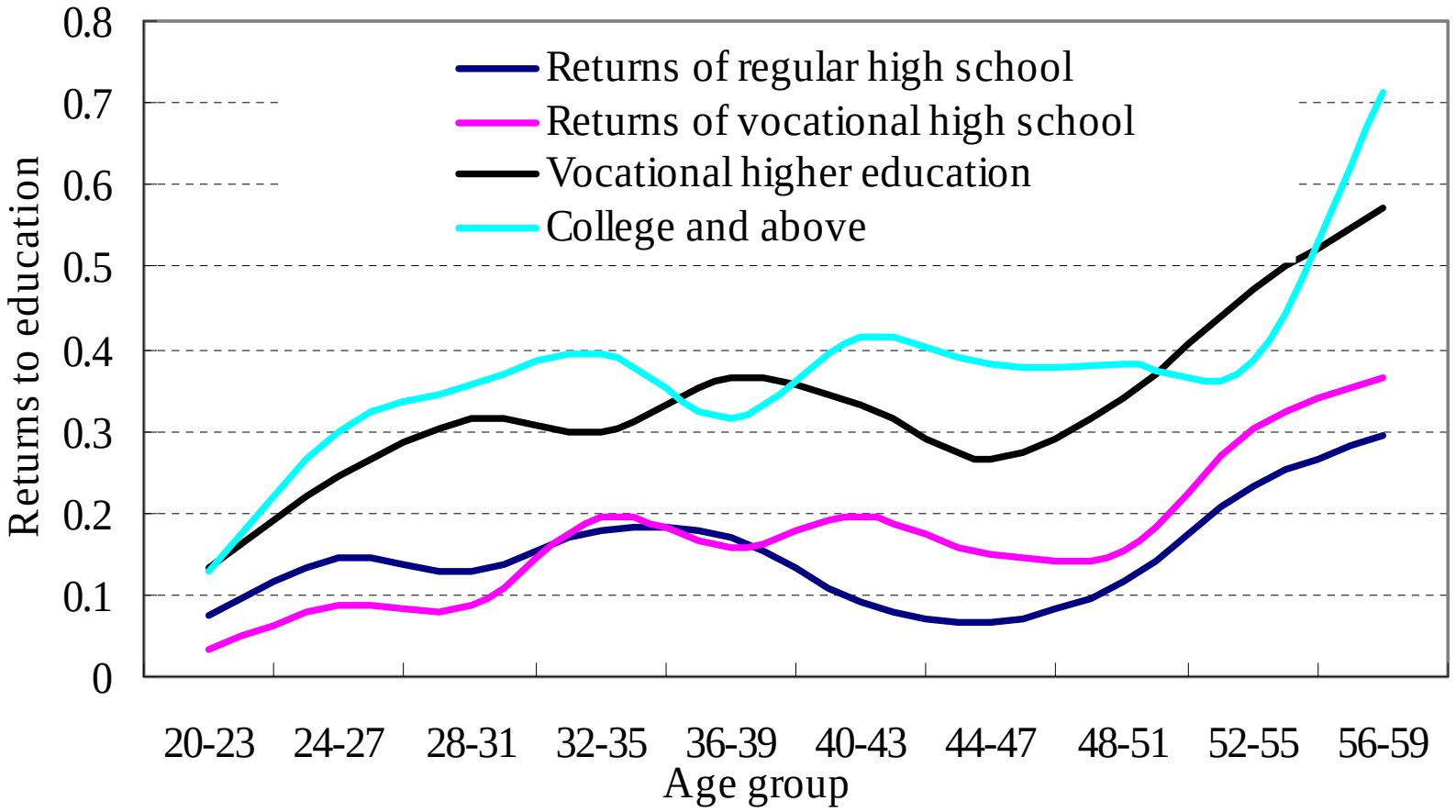
Mean of Log hourly-wage of graduates of regular and vocational high school by age group

Age group	Log hourly-wage	
	Regular high school	Vocational high school
16-19	1.569	1.711
20-23	1.665	1.778
24-27	1.747	1.866
28-31	1.749	1.904
32-35	**1.754**	**2.007**
36-39	1.655	1.884
40-43	1.608	1.950
54-47	1.615	1.875
48-51	1.749	1.899
52-55	1.781	1.821
56-59	1.598	1.782

Estimating the returns to education over the life cycle

- **use pooled data for all three years (2001, 2005, 2010)**
- **control for birth cohort**

$$Lnhourly\_wage_{ict} = \beta_0 + \beta_1 gender_{ict} + \beta_2 i.brith\_group + \beta_3 edu_{ict} +$$
$$\beta_4 i.edu * i.age\_group_{ict} + \beta_5 i.age\_group_{ict} + \beta_6 i.year + \beta_7 i.city + \varepsilon_{ict}$$


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Returns to education
Returns of regular high school
Returns of vocational high school
Vocational higher education
College and above
20-23
24-27
28-31
32-35
36-39
40-43
44-47
48-51
52-55
56-59
Age group

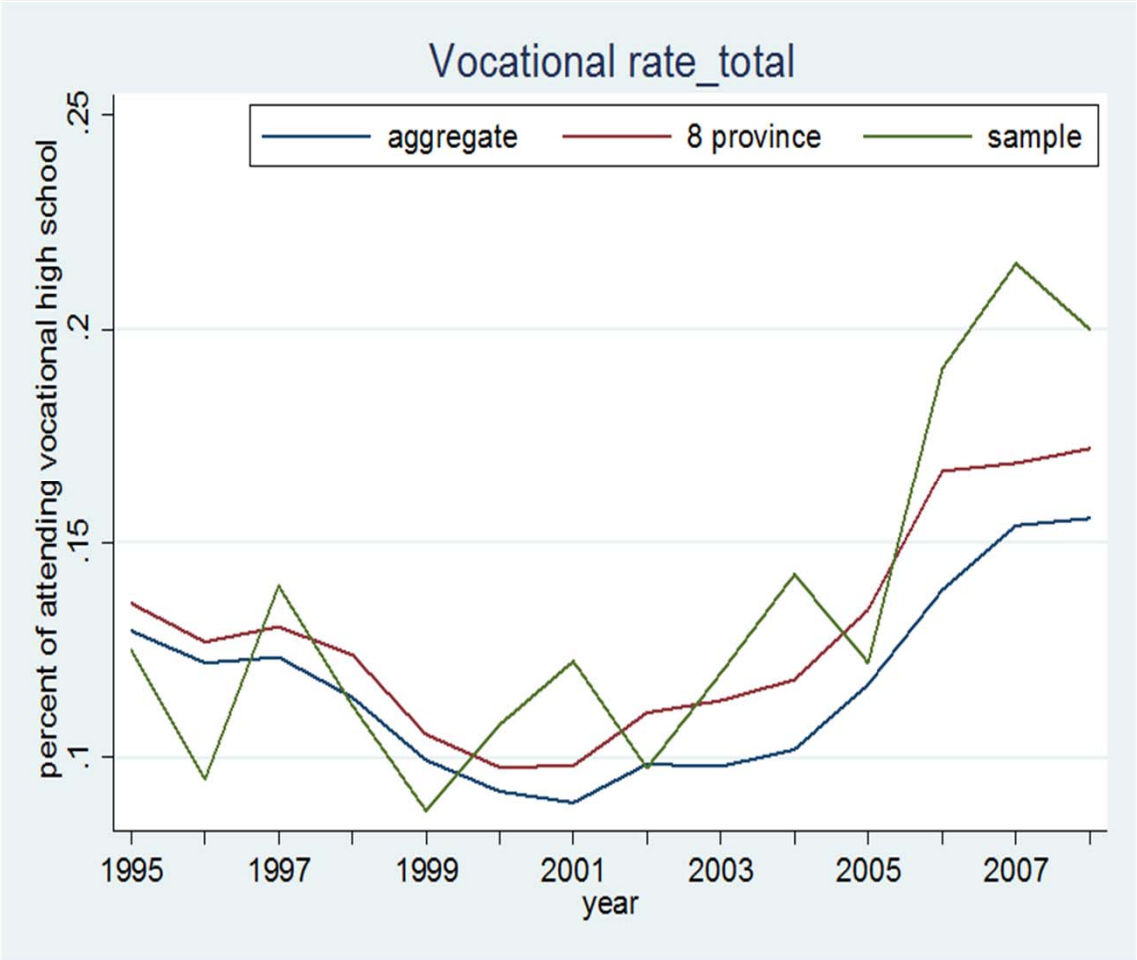
Summary of Findings from CULS

- The returns to all levels of education declined from 2005 to 2010, especially for vocational high school
- Returns to vocational high school have decreased over time for migrants but increased over time for local residents
- Relative return to vocational versus general high school does not decline with age, but relative return to college versus high school (both vocational and general) education increases with age to mid-30s then is stable

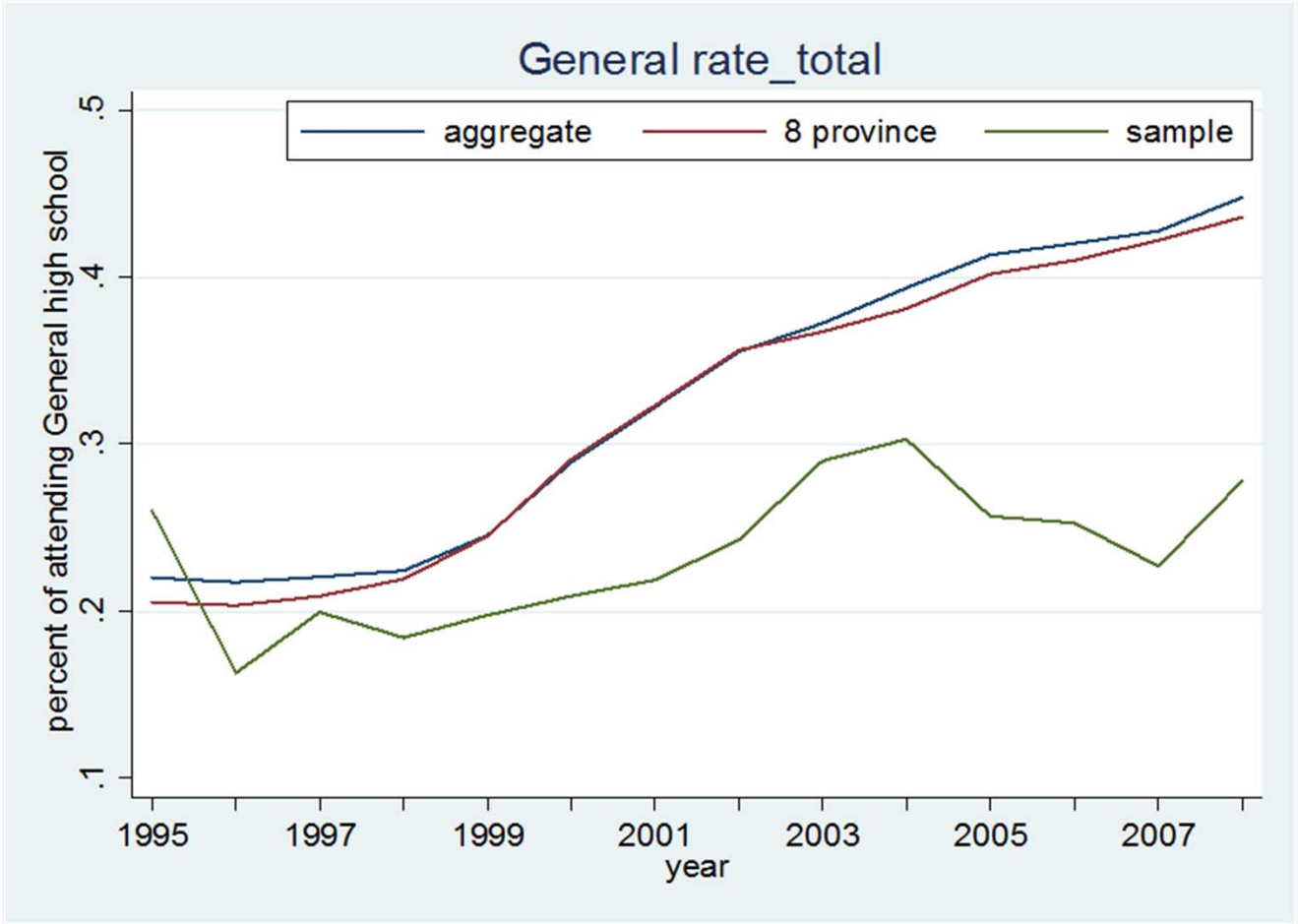
Evidence from NBS Survey Data

- 2011 NBS Rural Household Survey data for 8 provinces
- China vocational education expansion since 2005
  - Initial goal: 1 to 1 ratio of vocational and general high school students
  - Includes subsidized tuition
- IV approach assumes that provincial enrolment changes are supply-driven

Vocational High School Enrolment Rate by Middle School Graduation Year



General High School Enrolment Rate by Middle School Graduation Year



OLS Wage Regressions (NBS Data)

VARIABLES	(1) lnwage	(2) lnwage	(3) lnwage	(4) lnwage	(5) lnwage	(6) lnwage
Cohort controls	None	Cohort trend	Cohort trend x province dummies	None	Cohort trend	Cohort trend x province dummies
Vocational high	0.0638*	0.0539	0.0607	0.0978***	0.0849**	0.0902**
	(1.696)	(1.445)	(1.622)	(2.594)	(2.247)	(2.378)
General high	0.127***	0.0747**	0.0799**	0.0697**	0.0443	0.0495
	(3.670)	(2.084)	(2.220)	(1.974)	(1.229)	(1.365)
Voc. college				0.256***	0.219***	0.209***
				(5.606)	(4.663)	(4.433)
University				0.201***	0.158**	0.153**
				(3.252)	(2.498)	(2.421)
Male	0.116***	0.113***	0.114***	0.115***	0.114***	0.116***
	(4.679)	(4.596)	(4.638)	(4.676)	(4.645)	(4.715)
Experience	-0.000166	-0.0236**	-0.0256**	0.0198*	0.00105	-0.00164
	(-0.0164)	(-2.138)	(-2.316)	(1.899)	(0.0882)	(-0.137)
Exp2	0.000416	0.000996*	0.00111*	-0.000361	0.000133	0.000262
	(0.741)	(1.755)	(1.951)	(-0.638)	(0.228)	(0.446)
Year graduated		-0.0363***			-0.0242***	
middle school		(-5.080)			(-3.187)	
Observations	1,440	1,440	1,440	1,427	1,427	1,427
R-squared	0.156	0.172	0.177	0.183	0.189	0.194

- Returns to general high school higher than vocational high school
- Value of general high school is mainly option value of attending college

IV Wage Regressions (Provincial Enrolment Shares as IVs)

VARIABLES	(1) lnwage	(2) lnwage	(3) lnwage
Cohort controls	None	Cohort trend	Cohort trend x province dummies
Vocational high	-0.922	-0.538	-0.346
	(-1.241)	(-0.992)	(-0.918)
General high	0.675***	0.563***	0.511*
	(3.659)	(5.123)	(1.891)
Male	0.116***	0.121***	0.125***
	(4.028)	(4.976)	(4.951)
Experience	0.0270*	0.0293**	0.0270
	(1.723)	(2.168)	(1.237)
Exp2	-0.000711	-0.000749*	-0.000668
	(-1.408)	(-1.708)	(-1.267)
Year graduated middle school		0.000723***	
		(8.716)	
Observations	2,327	2,327	2,327
First-stage F-stats			
Vocational high	23.65	6.57	2.79
General high	35.29	9.55	1.47

IV Wage Regressions for High School Attendees (Provincial Enrolment Shares as IVs)

VARIABLES	(1) lnwage	(2) lnwage	(3) lnwage
Cohort controls	None	Cohort trend	Cohort trend x province dummies
Vocational high	-0.380	-0.498	-0.106
	(-0.462)	(-0.971)	(-0.340)
Male	0.116*	0.107**	0.139***
	(1.702)	(2.101)	(3.543)
Experience	0.00870	0.00622	-0.0154
	(0.435)	(0.230)	(-0.812)
Exp2	0.000170	0.000184	0.000605
	(0.254)	(0.259)	(0.955)
Year of middle school graduation		-0.00710	
		(-0.334)	
Observations	803	803	803
R-squared	0.110	0.042	0.206

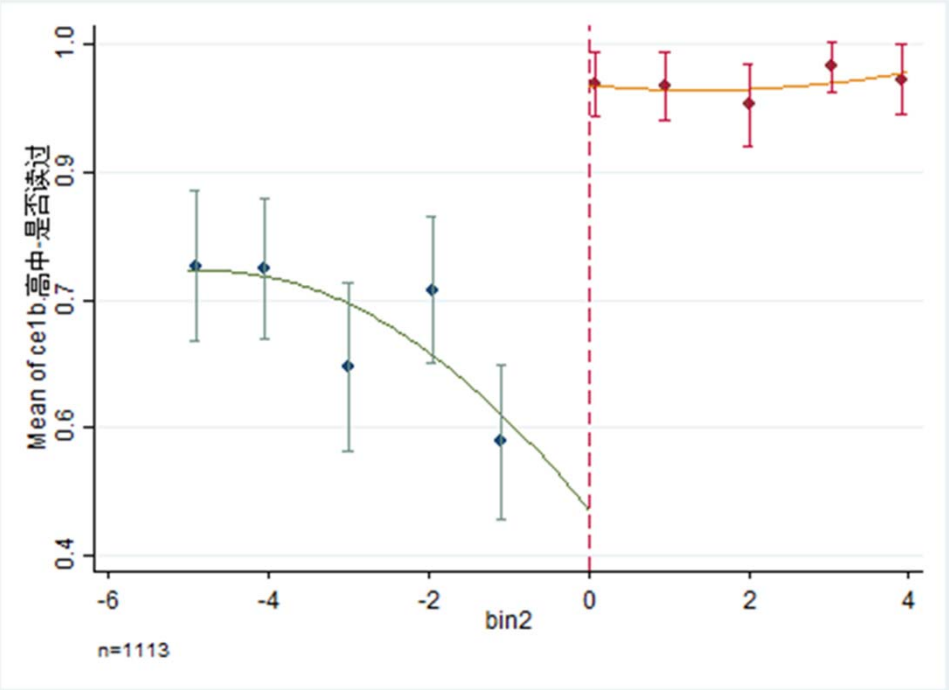
IV Wage Regressions for High School Attendees (Year Spline as Instrument)

VARIABLES	(1) lnwage	(2) lnwage	(3) Vocational high
Vocational high	-0.964***	-1.422***	
	(-3.985)	(-2.986)	
Male	0.0672	0.0361	-0.0461
	(1.231)	(0.510)	(-1.473)
Experience	0.0168		
	(0.610)		
Exp2	0.000764		
	(0.375)		
Year graduated middle school	0.000991***	0.00110***	
	(9.794)	(8.468)	
Year graduated (to 2005)			0.0148
			(1.077)
Year graduated (after 2005)			0.0521**
			(2.457)
F-stat			3.90
Observations	518	521	521

Evidence from Yunnan

- 2013 spring festival survey of young adults from one county in Yunnan who took high school entrance exams in 2001, 2005-7
  - 2001 (2005) cohort should have graduated from college in 2008 (2012)
- Test how having high school entrance score just above the cutoff affects college and high school graduation probability, wages, whether working
  - Interpretation: impacts on marginal HS students
  - Those not getting into high school may work directly or go to vocational high school

First stage: Impact on General High School Attendance



Regression with linear control for test score percentile above and below cutoff finds that passing the entrance exam increases probability of attending high school by 15 to 18 percent (significant, but lower than expected.

Impact on College Attendance

Dependent variable: ever attend college						
	(1)	(2)	(4)	(5)	(6)	(8)
	Reduced form	IV 2nd state	OLS	Reduced form	IV 2nd state	OLS
ever attend high school		0.275	0.230***		0.447	0.209***
		(0.316)	(0.033)		(0.377)	(0.048)
above cutoff score	0.042		0.007	0.081		0.043
	(0.049)		(0.048)	(0.068)		(0.068)
s	0.127	-0.101	-0.063	-0.419	-0.769	-0.583
	(0.212)	(0.427)	(0.209)	(0.534)	(0.763)	(0.527)
s*above cutoff score	0.054	0.265	0.230	0.748	1.238	0.977
	(0.303)	(0.393)	(0.298)	(0.788)	(0.903)	(0.778)
2005	0.015	-0.009	-0.005	0.038	-0.008	0.016
	(0.037)	(0.047)	(0.036)	(0.053)	(0.069)	(0.053)
2006	0.037	0.000	0.006	0.068	-0.006	0.033
	(0.037)	(0.057)	(0.037)	(0.052)	(0.085)	(0.052)
2007	0.006	-0.020	-0.015	0.027	-0.027	0.002
	(0.037)	(0.047)	(0.036)	(0.052)	(0.069)	(0.052)
Constant	0.169***	-0.026	0.006	0.107*	-0.196	-0.035
	(0.044)	(0.252)	(0.049)	(0.061)	(0.296)	(0.069)
Observations	1,112	1,112	1,112	572	572	572
	Discontinuity sample -10>=d>=10			Discontinuity sample -5>=d>=5		
F stat		.			.	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.10						
deviations from the cutoff score.						

Positive but insignificant effect on attending college.

Impact on Employment

Dependent variable: working = 1 (subsample of those either working or not going to school nor						
	(1)	(2)	(4)	(5)	(6)	(8)
	Reduced form	IV 2nd state	OLS	Reduced form	IV 2nd state	OLS
ever attend high school		-0.152	0.116***		-0.195	0.171***
		(0.234)	(0.039)		(0.288)	(0.052)
above cutoff score	-0.042		-0.074	-0.058		-0.109
	(0.063)		(0.064)	(0.082)		(0.083)
s	0.605**	0.711*	0.523*	0.260	0.452	0.091
	(0.267)	(0.401)	(0.267)	(0.638)	(0.886)	(0.632)
s*above cutoff score	-0.680*	-0.780*	-0.603	0.002	-0.325	0.288
	(0.387)	(0.434)	(0.386)	(0.926)	(1.113)	(0.918)
2005	-0.039	-0.031	-0.045	-0.082	-0.069	-0.093*
	(0.039)	(0.043)	(0.039)	(0.053)	(0.061)	(0.052)
2006	-0.114***	-0.112**	-0.115***	-0.044	-0.032	-0.055
	(0.044)	(0.045)	(0.044)	(0.058)	(0.065)	(0.057)
2007	-0.046	-0.070	-0.028	-0.065	-0.101	-0.033
	(0.050)	(0.063)	(0.050)	(0.069)	(0.092)	(0.069)
Constant	0.899***	0.996***	0.825***	0.900***	1.025***	0.791***
	(0.052)	(0.189)	(0.057)	(0.068)	(0.237)	(0.075)
Observations	723	723	723	360	360	360
	Discontinuity sample -10>=d>=10			Discontinuity sample -5>=d>=5		
F stat		.			.	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.10						

Impact on Wages

Dependent variable: log hourly wages; sample of wage workers						
	(1)	(2)	(4)	(5)	(6)	(8)
	Reduced form	IV 2nd state	OLS	Reduced form	IV 2nd state	OLS
ever attend high school		-0.744	0.062		-0.849	0.008
		(0.846)	(0.079)		(0.720)	(0.110)
above cutoff score	-0.096		-0.104	-0.179		-0.180
	(0.099)		(0.099)	(0.138)		(0.140)
s	0.188	0.815	0.135	-0.403	-0.672	-0.400
	(0.437)	(1.092)	(0.443)	(1.050)	(1.015)	(1.053)
s*above cutoff score	-0.229	-0.684	-0.191	3.000*	3.173*	2.998*
	(0.612)	(0.885)	(0.615)	(1.565)	(1.722)	(1.569)
exp	-0.007	-0.074	-0.001	0.026	-0.049	0.027
	(0.029)	(0.086)	(0.030)	(0.040)	(0.083)	(0.041)
exp2	-0.002	-0.001	-0.002	-0.005	-0.003	-0.005
	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.004)
female	-0.188***	-0.244***	-0.183***	-0.220***	-0.262***	-0.220***
	(0.049)	(0.084)	(0.050)	(0.068)	(0.086)	(0.069)
mealsyes	-0.059	-0.111	-0.055	-0.137*	-0.220*	-0.136*
	(0.059)	(0.087)	(0.059)	(0.080)	(0.114)	(0.081)
mealsmiss	-0.088	-0.065	-0.090	0.096	0.427	0.093
	(0.366)	(0.402)	(0.366)	(0.515)	(0.621)	(0.518)
roomyes	0.071	0.083	0.070	0.092	0.087	0.092
	(0.059)	(0.065)	(0.059)	(0.080)	(0.087)	(0.080)
2005	-0.204***	-0.381*	-0.189**	-0.151	-0.366*	-0.149
	(0.073)	(0.217)	(0.075)	(0.101)	(0.205)	(0.105)
2006	-0.300***	-0.523*	-0.281***	-0.331***	-0.562**	-0.329***
	(0.083)	(0.271)	(0.087)	(0.112)	(0.226)	(0.116)
2007	-0.393***	-0.677**	-0.369***	-0.424***	-0.792**	-0.421***
	(0.090)	(0.342)	(0.095)	(0.128)	(0.349)	(0.137)
Constant						

Estimates based on RD design suggest no significant impact of attending general high school on attending college, working, or earning higher wages

- Caveat: surveyed workers may be too young to see true returns to education.

Expected wages in mid-30s by level of education

variable	mean	median	sd	N	Missing N
middle	2818	2500	1745	1160	57
vocational	3483	3000	1938	1160	60
high	3280	3000	1968	1160	66
college	4406	4000	3217	1160	71

Based on questions asking respondents to estimate monthly wages of persons of similar age when they reach their mid-30s.

Conclusions

- No strong empirical evidence of high returns to vocational high school education
  - Expansion of vocational education in China has reduced its economic returns
  - Questions about quality of vocational high schools and how quality can be improved
- Returns to general high school significantly higher than vocational high school, mainly by providing an option value for attending college
  - But expanding high school access will not necessarily produce more successful college students

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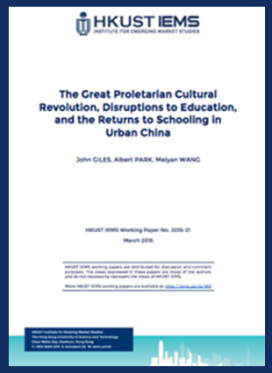

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SEMINARS AND CONFERENCES