FDI and Urban Inequality: Evidence from Chinese Cities

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(Very preliminary, please don't circulate)

Abstract

In this paper we examine the relationship between FDI and city-level income inequality. We calculate the measures of within-city income inequality for 227 Chinese cities. It is found that FDI penetration is positively and significantly correlated with within city inequality, which is mainly due to the strong and positive correlation between skill premium and FDI penetration. We identify the causal relationship between college premium and FDI penetration using foreign culture influence in the history as instrument variable. Furthermore, we provide individual-level and firm-level evidence to support our main findings. Also, we explore the potential channels through which FDI can affect skill premium, and find that both composition and agglomeration effects exist.

Keywords: FDI; inequality; China

JEL classification: F21; R12; O18

1. Introduction

It has been over three decades since the People's Republic of China (PRC) implemented the reforms and opening-up policy. Figure 1 shows that there is a strikingly increasing trend in FDI inflows since the 1980s. In 2012, China has surpassed the United States for the first time since 2003 to be the world's largest recipient of global foreign direct investment. Since the 1990s, foreign direct investments have been playing a more and more important role in China's economic development.

Meanwhile, inequality is a serious problem and urgent to tackle in China's development. China was a fairly equal society at the beginning of the economic reform in the early 1980s, when the Gini coefficient was less than 0.3 (Wan, Ye and Zhuang, 2012). Although the recent 5 years see a slight decline in overall Gini, the Gini coefficient reached a high level of 0.474 in 2012. The interregional convergence of per capita income narrows the overall country inequality (Gustafsson, Li and Sicular, 2008), while the inequality of urban people has kept rising significantly (Ravallion and Chen, 2007; Lin et al., 2010). However, there is no literature to study how within-city inequality is affected by FDI inflows in China, which is the gap this paper fills. In particular, as the urbanization process is going deeper over time, the policy relevance of analyzing within-city inequality should become increasingly significant.

There have been a large number of studies on this issue in the literature, but most of them examine country-level variation or cross-region inequality. Lessnann (2013)

finds that FDI increases regional inequality depending on economic development, and expands regional inequality in poor countries, which has no significant effect in high-income countries with higher mobility and better policies. Wei, Yao and Liu (2009) argue that it is not FDI, but the uneven distribution of FDI that contributes to the increase in regional inequality. Lin, Kim and Wu (2013) examine the distributional effects of FDI using a cross-country panel data. It is found that there is a non-monotonic impact of FDI on income inequality, depending on the level of human capital. Basu and Guariglia (2007) find that FDI promotes both growth and inequality using country-level data. Pica and Mora (2011) establish a theoretic model on FDI and income. The model predicts that FDI benefits the high- and low-income workers, but makes the middle-income workers worse off. This implies that the relationship between FDI and total income inequality could be ambiguous or non-monotonic.

A number of studies have analyzed the relationship between FDI and inter-provincial inequality in China. Sun and Chai (1998) investigate the effect of FDI on growth in the eastern and western province from 1986 to 1992. They find a growing effect of FDI in the east, but only weak effects in the west and conclude that FDI has contributed to the rise of regional inequality in China. Wan, Lu and Chen (2007) investigate the impacts of FDI on regional income inequality in China, and find that FDI contributes to the rising of income inequality across regions. This paper complements to these literature by investigating within-city inequality and FDI penetration.

In this paper, we focus on the impacts of FDI on local income inequality at city level. We first construct the measures of income inequality for each city using individual information from 2005 min census and then investigate the relationship between FDI penetration and within city inequality. The main difficulty is to establish the causal impact of FDI due to the endogeneity issue. We adopt a novel instrumental variable by exploiting the historical distribution pattern of converts in China. The fact that the spread of church activities was not only determined by geographic or economic reasons, but also exogenous natural disasters, such as floods, draughts or diseases makes it an valid instrument variable for FDI. In addition to the IV approach, we also provide evidence using individual level information to further support our main findings.

After the causal impact of FDI on inequality is established, we explore the potential mechanisms based on the existing literatures using both individual and firm level information. First, consistent with Feenstra and Hanson (1997), which find that growth in FDI is positively correlated with the relative demand for skilled labor in Mexico, we find that FDI firms on average employ relative more skilled workers. Also, our results show that FDI has wage spillover effects on both FDI firms and domestic firms, and the impact on FDI firms is much higher than domestic firms. Second, we find that the agglomeration effect of FDI on individual wages exists and skilled workers benefit more from it. This is consistent with Hale and Long (2011), which documents the presence of FDI in the same industry and region has an indirect effect on wage of skilled workers in private firms.

In addition, this paper is also inspired by the recent literature on globalization and local labor markets. Autor, Dorn and Hanson (2013) study the impact of import competition from China exports on local employment in the U.S. Autor, Dorn, Hanson and Song (2014) examine how workers adjust to trade from China. While this line of researches focus on the impacts of international trade, little attention has been paid to how FDI can affect local labor market outcomes. This paper focus on how FDI penetration affects local inequality.

The following sections are organized as below: Section 2 describes the data sets used in the paper and provides some preliminary patterns. Section 3 shows the main empirical results. In the section 4, we explore the potential mechanisms. Section 5 concludes the paper.

2. Data and Measures of Inequality

2.1 Data

Our data comes from China's population survey in 2005 conducted by National Bureau of Statistics (NBS)，which is the largest Chinese dataset available with individual income information. The survey is nationally representative, whose respondents are randomly selected from each of China 2,861 counties using a three-stage cluster sampling method (Zhang et al. 2005). Our sample is a subset of the original survey, which contains 2,585,481 observations that is randomly drawn from NBS dataset.

In this paper, we use cities in 2005 as our geographic units and Theil Index as the main measure of inequality. For the whole paper, we focus on the observations older

than 15 and younger than retiring ages, 55 for women and 60 for men. Also, we consider the persons who had a job at the time when he/she was interviewed. Moreover, since our main interest is within city wage inequality, we conclude all local people living in the city when calculating inequality measures. The Hukou or household registration system is a system under which each Chinese got an identity according to his/her birthplace.[1] The very strict hukou system separates people into two groups, those with urban hukou identity and those with rural hukou identity. Only people with rural hukou have been assigned farmland. For people living in city with rural hukou, it's more likely that workers usually work in urban area since they are separated from their farmland. However, another part of city population work in the city has not local urban houkou, but other urban houkou. We call both these people as migrants. In this paper, all the measures of within city wage inequality are calculated using information of individuals with local urban hukou or migrants[2] in each city.

There are 339 cities in the Census data, including four municipalities and 335 prefecture-level cities. The data of city size, measured by number of residents in the city, comes from China City Statistical Yearbooks. There are 227 cities left after merging census data with city data, as population size is missing for some small cities[3].

2.2 Measure of inequality

[1] Please refer to Liu (2005), Chan and Buckingh (2008), Chan (2009), and Lu *et al.* (2013) for introduction of both the history and the reform of the Hukou system.

[2] We also constructed inequality measures only considering people with urban hukou, and the results are similar.

[3] The cities with missing population size data are not 'real cities' in economic sense, as their population size are too small. Instead, they are administrative units, which are named as *Zizhizhou* or *Meng* rather than cities in Chinese. Based on 2005 census data, the average sample size of the cities with missing population size is 389, while the average sample size of the cities with non-missing population size is 1299.

We use Theil Index as the measure of inequality mainly because it is a commonly used measure in the literature, and it suits for decomposition. Theil index is defined as

$$T = \frac{1}{N\bar{y}} \sum_{i=1}^{N} y_i \ln\left(\frac{y_i}{\bar{y}}\right)$$

where $\bar{y}$ is the mean income in the sample, y_i represents individual's income and *N* is the number of people in the population. It is invariant with respect to scale, which means that it would not change for a proportional increase in income for everyone or a change in population. Additionally, it can be decomposed into inequality within some subgroups and inequality across these subgroups. These characteristics make it attractive for our main focus on city size and inequality.

Overall inequality can be decomposed into two aspects: between-group inequality and within-group inequality. Between-group inequality describes the difference in income between people with different characteristics, such as education, age, race and gender, while within-group inequality describes the difference in income between people with similar observable characteristics. Residual income inequality is commonly used as a measure of within-group inequality in the literature. A Mincer regression is always employed to calculate residual inequality. Specifically, residual wage inequality is calculated from the residuals of a regression of log wages on a set of age, squared age, education dummies, race dummy, sex dummy and marriage status dummy. Mincer regression is run for each city, and then, city-level residual wage inequality is calculated by taking the average of the square of residuals for all workers within each city.

Regarding between-group inequality, we focus on the income difference arising from education. There are three reasons for emphasizing education: first, education accounts for a significant part in income inequality, around 18% of the variation in income comes from human capital; second, it can be shown that the variation in education compositions across cities is relatively bigger than other aspects; third, human capital is more relevant in terms of policy implications.

2.3 Measures of FDI penetration

Two sources of FDI information are explored in this paper: one is City Statistics Yearbooks, and the other is the Annual Surveys of Manufacturing. With both sources, we combine foreign investment with Hong Kong, Macao and Taiwan (HKMT) investment and use the sum of these two as our definition of FDI in this paper. In City Statistics Yearbooks, there is information on the number of foreign/HKMT firms and revenues from foreign/HKMT firms. We construct two measures of FDI penetration from this: the share of the number of FDI firms in total number of firms and the share of FDI revenues in total outputs. In addition, we calculate the share of FDI in total capital and the share of FDI employment in total employment from Annual Surveys of Manufacturing. We use the share of FDI in total capital as our main measure of FDI penetration.

3. FDI and urban inequality

3.1 Empirical specification

The equation we estimate is straightforward:

$$inequality_i = \alpha + \beta FDI\ penetration_i + \gamma X_i + \varepsilon_i$$

where $inequality_i$ is the degree of income inequality in city i. We use Theil index as the measure of overall inequality.[4] FDI penetration is the degree of influence of foreign capital in city economy. X_i represents city-level control variables, such as city size, average income and regional fixed effects.

Our goal is to identify the causal effect of FDI on city inequality and the main concern is the endogeneity issue. There are three potential reasons for endogeneity here: First, measurement errors in inequality that are correlated with city characteristics, such as city size and per capita income, can lead to endogeneity. Our main measures of inequality are calculated from census data. As in any other census, there is an upper bound in income which could cause underestimation of inequality, and the magnitude of this error could be bigger in larger or richer cities. The literature has shown that market size is one of the main determinants of FDI location choice. This would lead to an overestimate of the effect of FDI on inequality. Second, FDI and inequality could be simultaneously determined by some underlying city characteristics, such as geographic location, city size, human capital endowment and so on. Third, inequality itself could affect FDI location.

To deal with these issues, we first control for city characteristics that can determine FDI location choice. Cheng and Kwan (2000) study the location pattern of FDI firms in China and find that market size, infrastructure, wage cost and education are the main determinants of FDI inflows. Therefore, we control for city size, average income, infrastructure and education. Furthermore, we also control for government

[4] It can be shown that our basic results still exist if we use alternative measures of inequality.

policy, industry compositions and regional fixed effects. This will also help minimize the possibility that these characteristics can affect FDI and some other aspects of the economy at the same time and thus lead to a positive correlation between FDI and inequality. One consideration here is that the effect of FDI and international trade could be mixed together. Here, we could not separate the impact of FDI and international trade completely since FDI could affect inequality through its role on promoting international trade.

Moreover, we adopt an instrument-variable approach to further deal with the endogeneity issue caused by measurement errors and reversed causality. Our instrument variable is the degree of foreign culture influence in the history. This is inspired by the literature on history and economic development as reviewed thoroughly by Nunn (2009). We use the share of primary students from missionary schools in total population in the 1920s as the exclusive instrument variable for FDI penetration. The information comes from The Christian Occupation of China, which contains detail county-level data on the numbers of Protestant converts, missionaries, and churches in 1920s. We match these data with current city-level data. As can be seen from Figure 3, missionary school penetration is significantly and positively correlation with FDI penetration in 2005. The first stage regression in Table A.1 further confirms this correlation. Figure 4 shows the geographic pattern of missionary school penetration. As expected the degree of Christian penetration is relatively high along the coastal regions since these areas were more open to foreigners in the history due to treaty ports and being occupied by foreign countries. However, some inland

regions also experienced very high level of Christian penetration because missionaries targeted some regions on purpose to help local residents through natural disasters, such as floods, draughts and pestilence. This pattern can work like exogenous shocks and make this variable valid as an instrument variable. In addition, the Christian distribution in 1920s, which is more than half a century prior to the beginning of reform and openness, should not have any direct effects on the local income inequality in the 2000s. One concern on its validation as IV is that foreign culture influence can have long-run impacts on inequality through other aspects, such as institution and migration. However, since we have controlled institution, city size and average income. This issue could be minimized already.

3.2 OLS results

Table 1 reports the OLS results on overall inequality, within inequality and between inequality. Regional fixed effects are controlled for in all regressions. The first three columns show the results for overall inequality measured by Theil Index. In column 1, it can be seen that the correlation between FDI and inequality is positive and significant. Column 2 shows that when market size and average wage are controlled for, the coefficient on FDI penetration decreases by almost a half but still significant. In column 3, other city characteristics are further controlled for and FDI penetration is still significant correlated with inequality. Column 4 shows that this positive correlation is not due to the connection between within-group inequality, measured by residual inequality, and FDI. In the last two columns, high-school premium and college premium are examined. It can be seen that the correlation

between college premium and FDI is much stronger and significant than that between high-school premium and FDI. This implies that FDI is more likely to affect overall inequality through its impact on college premium. Therefore, in the following analysis, we focus on establish the causal effect of FDI on college premium.

3.3 2SLS results on college premium

Table 2 reports the results on college premium and FDI. The first four columns show the step-by-step results from OLS regressions. The purpose is to show how the coefficient on FDI changes as more variables are controlled for. Column 2 shows that when city size and wage are controlled for, the coefficient on FDI drops by about 25%. This implies that our consideration that market size and wage level can determine both college premium and FDI at the same time is reasonable. In column 3, it can be seen that the coefficient further decreases by 20% when policy, infrastructure and industrial compositions are controlled for. In column 4, education composition, measured by the share of workers with some college education, is added into the regression. The coefficient on FDI becomes only a half of that in column 3, but it is still significant at 10% level. Since relative supply of skilled labor is one crucial determinant of college premium, this result is not surprising. Especially, FDI can affect skill premium by changing the relative demand of skilled labor. Therefore, the result in column 4 actually underestimates the impact of FDI on skill premium.

In the last column, result from IV regression is reported. As expected, the coefficient on FDI becomes bigger than in Column 4. This means that FDI penetration does contribute to expanding college premium. The first-stage F-statistics is 20.82,

which indicates that weak instrument variable problem is not a big issue here. One thing that should be noted that the historical date is only available for 190 cities, which means that the very small cities are not included in the analysis. In Table 3, three alternative measures of FDI penetration are used and the analysis in Table 2 is repeated using each of these measures. Both OLS and IV results are provided. It can be seen that the results are consistent with our earlier findings.

Moreover, we construct a panel data set and control for city fixed effects to avoid the potential issues of simultaneity and missing variables caused by city characteristics that don't change over time, such as geographic location and so on. We calculate city-level college premiums using information from Urban Household Surveys for 16 provinces from 2000 to 2009. FDI penetration is measured by the ratio of revenues from FDI firms to GDP from City Statistic Year Books. It can be seen that the results are quite similar.

3.4 Micro-level evidence

The city-level evidence in the previous subsection suggests that overall income inequality in areas with more FDI generally is higher, especially college premium. As discussed above, one limitation of this analysis is the measurement error in inequality and the exclusion of small cities in the analysis. To further establish our results, we provide some more evidence in this section using both individual level and firm level data.

The advantage of using individual level information is that we can control for wage inequality caused by other individual characteristics better. Also, we could deal

with industry and occupation variation better. We explore the augmented Mincer wage equation as below:

$$ln\ wage_{ic} = \alpha + \beta college_i + \gamma share\ of\ FDI_c + \mu college_i * share\ of\ FDI_c + \lambda X_i + \mu_C + \varepsilon_{ic}$$

where $ln\ wage_{ic}$ is the log of wage income for individual i in city c. $college_i$ is an indicator variable equal to 1 if worker i has some college or above. $share\ of\ FDI_c$ is measured by the share of workers of FDI firms in industrial firms in city c.[5] X_i is a set of individual characteristics, including age, squared age, sex dummy and marriage status dummy, μ_C is city fixed effect. Moreover, we control for industrial dummies and occupation dummies. ε_{ic} is the random error term.

The results from both the OLS and the 2SLS estimations are presented in Table 5. Column 1 shows that income of workers with college education is about 41% higher than those without any college education, after controlling for individual characteristics and city fixed effects. After adding the FDI penetration and the interaction term into the regression, the coefficient of the interaction term suggests, given the same education level, FDI penetration in city significantly increases the college premium. The results are robust after the city-level characteristics controlled for and using instrumental strategy.

4. Discussion on Mechanisms

We focus on mainly three potential channels through which FDI can affect skill premium: first, FDI can increase skill premium by simply offering relatively more

[5] We first regress FDI share on other city level controls used in Table 2, and then use the residuals in the Mincer regression to avoid simultaneity and missing variable issues.

jobs for skilled workers and thus increase relative demand for skilled workers; second FDI firms themselves offering relatively higher wages for skilled workers and the indirect wage effect of FDI firms on domestic firms; third, skilled workers benefit more from the agglomeration effects of FDI.

4.1 Labor demand and wage effects

First, we analyze differences in college ratio between FDI firms and domestic firms from firm-level data. We use the following specification:

$$college\ ratio_i = \alpha + \beta_1(FDI\ firms = 1) + \gamma X_i + \varepsilon_i$$

where $college\ ratio_i$ is the share who workers having college or above education degree account for in firm i, X_i are city and industry dummies, FDI firms is whether the firm is foreign investment, we define domestic firms including all private firms and SOE firms, X_i is a set of firm-level control variables specific to the outcome variable, such as exported/output ratio, employment numbers, profit, the life span of firm i, while ε_i is a random error term, the coefficient β_1 measures differences in college ratio between FDI firms and domestic firms.

Table 6 shows results from our study of differences in college ratio between FDI firms and domestic firms in each city. Column 1 shows that FDI firms employ relatively more skilled workers on average. This pattern exists even after firm size, profitability and industry are controlled for, as shown in column 2&3. This implies that the direct job creation effects of FDI can increase relative demand for skilled labor and thus help promote college premium. We also examine if there is an indirect impact of FDI on relative labor demand through the spillover effect on domestic firms

and no significant spillover effect on labor employment is found.

Next, we investigate the wage effect of FDI penetration. Ideally, it would be interesting to see how within-firm skill premium is related to FDI penetration. Unfortunately, it's not feasible with the available data. Here, we focus on the connection of average firm wage is affected by FDI penetration and how it is related to firm skill intensity. We employ the estimation model as follows:

$$ln\ average\ wage_{jc} = \alpha + \beta college\ ratio_j + \gamma share\ of\ FDI_c + \mu college\ ratio_j * share\ of\ FDI_c + \lambda X_j + \rho_C + \varepsilon_{jc}$$

where average wage_{jc} is average wage of firm j in the city c. Share of FDI_c is still measured by the share of worker number of FDI firms in industrial firms in city c. $college\ ratio_{jc}$ is an indicator variable for the ratio of workers with college degree and above in firm j. We add the interaction term of Share of FDI_c and $college\ ratio_{jc}$. X_j is a set of firm characteristics, including firm size and firm profitability, which is the ratio of operating profit to total operating income of firm j , ρ_C is city fixed effect controlling for the average effect of city characteristics on income. We also control for industrial dummies.

The results are reported in Table 7. The first three columns show the results from OLS for all firms, FDI firms and domestic firms respectively, and the last three columns show the results from 2SLS estimations. It can be seen from column (1) that FDI penetration has positive impact on average wage, and the impact is bigger for more skill intensive firms. Column (2) and (3) show that, the influence of FDI

penetration exists for both FDI firms and domestic firms, but the effect is bigger among FDI firms. This implies that it's not only that FDI penetration increases the relative demand for skilled workers. It's likely that skill premium is higher among FDI firms and there is also a spillover effect on domestic firms. This is consistent with the existed literatures (Feenstra and Hanson, 1997; Hale and Long, 2011).

4.2 Agglomeration effects

In this subsection, we discuss the agglomeration effects of FDI penetration on individual wage using individual level data. Specifically, we use the following specification:

$$ln(wage)_{ic} = \alpha_0 + \beta_4 share\ of\ FDI_c + \mu X_i + \eta Z_c + \varepsilon_i$$

where $wage_{ic}$ is wage of individual i. $share\ of\ FDI_c$ is still measured by the share of worker number of FDI firms in industrial firms in city c. X_i is a set of characteristics of individual i, including gender, experience, experience square and minority, Z_c is a vector capturing city-level features for city c, which includes city size, average income, government policy, road density and so on. We also control for province dummies and industrial dummies, while ε_i is the random error term.

The results are reported in the Table 8. The first three columns are OLS results and the last three columns are 2SLS results. We separate the whole sample into skilled workers and unskilled workers according to whether they received some college education or not. All coefficients are positive and statistically significant at a 1% confidence level. This means that not only skilled workers, but also unskilled workers benefit from higher degree of FDI penetration. Comparing Column (2) to Column (3),

we find that, skilled workers benefit more from FDI penetration than unskilled workers, which can cause higher skill premium within a city. The instrument variable results further confirm this finding.

5. Concluding remarks

In this paper, we focus on the impacts of FDI on local income inequality on city-level. First, we find that FDI penetration is positively and significantly correlated with within city inequality after controlling for city characteristics. Also, the connection between FDI penetration and skill premium is much stronger than that with residual inequality. Second, we establish a causal relationship between FDI penetration and college premium using a novel instrument variable approach. Finally, we explore the potential mechanisms and find that not only the direct impact on job creation matters. FDI actually has positive wage spillover effect on domestic firms and agglomeration effect on both skilled workers and unskilled workers.

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Table 1: FDI and City Inequality, OLS

	(1)theil	(2)theil	(3)theil	(4)within	(5)high	(6)college
fdi_share	0.124***	0.065**	0.071**	0.031	0.083	0.324***
	[0.030]	[0.028]	[0.034]	[0.034]	[0.071]	[0.093]
Ln(pop)		0.024***	0.021***	0.014**	0.010	0.039**
		[0.005]	[0.006]	[0.006]	[0.016]	[0.018]
Ln(wage)		0.036*	0.051**	0.029	0.246***	0.062
		[0.022]	[0.023]	[0.020]	[0.061]	[0.068]
ETDZ	No	No	Yes	Yes	Yes	Yes
Road	No	No	Yes	Yes	Yes	Yes
Industry	No	No	Yes	Yes	Yes	Yes
region	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.153***	-0.122*	99.842	94.657**	197.720	193.601
	[0.006]	[0.064]	[65.852]	[47.623]	[159.957]	[209.377]
R^2	0.19	0.29	0.34	0.08	0.42	0.50
N	252	252	225	225	225	225

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. Share of FDI is the share of FDI firms in total capital. Ln(pop) is the log of total population in urban area. Ln(wage) is the log of average individual income. Road density and industry come from China City Statistical Yearbook, which represent city development level. Education composition is college ratio in total population. ETDZ dummy is whether has economic and technological development zone.

Table 2: FDI and College Premium-baseline

	(1)OLS	(2)OLS	(3)OLS	(4)OLS	(5)IV
fdi_share	0.490***	0.365***	0.294***	0.153*	0.760**
	[0.077]	[0.078]	[0.088]	[0.093]	[0.306]
Ln(pop)		0.053***	0.041**	0.037**	0.018
		[0.017]	[0.018]	[0.018]	[0.021]
Ln(wage)		0.062	0.041	0.106	0.136
		[0.067]	[0.070]	[0.075]	[0.094]
ETDZ	No	No	Yes	Yes	Yes
Road	No	No	Yes	Yes	Yes
Industry	No	No	Yes	Yes	Yes
education	No	No	No	Yes	Yes
region	Yes	Yes	Yes	Yes	Yes
_cons	0.468***	-0.091	0.042	0.073	-0.173
	[0.024]	[0.197]	[0.211]	[0.214]	[0.291]
First-stage F	-	-	-	-	20.82
R^2	0.35	0.40	0.49	0.52	0.47
N	252	252	225	225	190

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. Share of FDI is the share of FDI in total capital. Ln(pop) is the log of total population in urban area. Ln(wage) is the log of average individual income. Road density and industry come from China City Statistical Yearbook, which represent city development level. Education composition is college ratio in total population. ETDZ dummy is whether has economic and technological development zone.

Table 3: FDI and College Premium, robustness checks

	(1)OLS	(2)IV	(3)OLS	(4)IV	(5)OLS	(6)IV
fdi_emp	0.147**	1.011**				
	[0.061]	[0.483]				
fdi_rev			0.118*	0.737**		
			[0.066]	[0.310]		
fdi_num					0.280**	0.876**
					[0.112]	[0.358]
Ln(pop)	0.029	-0.012	0.023	0.007	0.031*	0.031
	[0.018]	[0.029]	[0.018]	[0.025]	[0.017]	[0.021]
Ln(wage)	0.117	0.040	0.203***	0.144	0.147**	0.112
	[0.071]	[0.134]	[0.077]	[0.109]	[0.071]	[0.094]
ETDZ	Yes	Yes	Yes	Yes	Yes	Yes
Road	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
education	Yes	Yes	Yes	Yes	Yes	Yes
region	Yes	Yes	Yes	Yes	Yes	Yes
_cons	232.597	200.393	160.254	0.000	83.710	35.142
	[206.243]	[316.651]	[237.502]	[0.000]	[218.313]	[254.425]
First-stage F	-	20.02	-	10.47	-	15.71
R^2	0.54	0.23	0.56	0.34	0.57	0.52
N	225	190	190	170	212	184

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. fdi_emp is the share of workers of FDI firms in industrial firms. fdi_rev is the share of FDI revenues in GDP. Fdi_num is the share of the number of FDI firms in total number of firms. Ln(pop) is the log of total population in urban area. Ln(wage) is the log of average individual income. Road density and industry come from China City Statistical Yearbook, which represent city development level. Education composition is college ratio in total population. ETDZ dummy is whether it has economic and technological development zone.

Table 4: Panel Results

	(1)	(2)	(3)
fdi_rev	0.486**	0.363*	0.402*
	[0.203]	[0.197]	[0.213]
Ln(pop)		0.057	0.033
		[0.289]	[0.295]
Ln(wage)		-0.128	-0.139
		[0.103]	[0.107]
ETDZ	No	Yes	Yes
Road	No	Yes	Yes
Industry	No	Yes	Yes
Education	No	No	Yes
City FE	Yes	Yes	Yes
R^2	0.11	0.12	0.12
N	1,027	957	903

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. fdi_rev is the share of FDI revenue in GDP. Ln(pop) is the log of total population in urban area. Ln(wage) is the log of average individual income. Road density and industry come from China City Statistical Yearbook, which represent city development level. Education composition is college ratio in total population. ETDZ dummy is whether it has economic and technological development zone.

Table 5: Individual-level Evidence

	(1)OLS	(2)OLS	(3)IV	(4)OLS	(5)IV
College degree (Yes=1)	0.410***	0.111***	0.119***	0.108***	0.109***
	(0.004)	(0.007)	(0.013)	(0.007)	(0.013)
College degree *FDI penetration		0.763***	0.755***	0.759***	0.765***
		(0.015)	(0.029)	(0.015)	(0.029)
Individual controls	Yes	Yes	Yes	Yes	Yes
City dummy	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes
Occupation dummy	Yes	No	No	Yes	Yes
First stage F value			5971		1489
Observation	66912	66912	66912	66912	66912
R-squared	0.254	0.285	0.283	0.293	0.293

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at city level. College degree represents individual whether have college degree or above. FDI penetration is the share of workers of FDI firms in industrial firms. Individual controls include age, squared age, sex and marital status. Share of FDI is the share of workers employed by FDI firms.

Table 6: Difference in college ratio between FDI firms and domestic firms

VARIABLES	OLS	OLS	OLS
FIE (Yes=1)	0.027***	0.031***	0.039***
	(0.001)	(0.001)	(0.001)
Profitability		-0.026***	-0.014***
		(0.002)	(0.002)
Ln (firm size)		-0.015***	-0.014***
		(0.000)	(0.000)
City dummy	N	N	Y
Industry dummy	N	N	Y
Constant	0.120***	0.197***	0.134
	(0.000)	(0.002)	(0.145)
Observation	175,591	175,591	175,591
R-squared	0.005	0.014	0.207

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. FIE represent foreign firms. Profitability is the profit of firm. Ln (firm size) is the log of total population in firm. We only control city dummies and industry dummies because we consider at the firm level.

Table 7: Firm-level evidence: the dependent variable is ln(average wage)

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
	All firms	FIEs	Non-FIEs	All firms	FIEs	Non-FIEs
College ratio of firms*FDI penetration	0.897***	0.869***	0.244***	0.329***	0.610***	0.254***
	(0.034)	(0.066)	(0.042)	(0.068)	(0.142)	(0.080)
College ratio of firms	0.676***	0.881***	0.638***	0.849***	0.918***	0.631***
	(0.013)	(0.031)	(0.015)	(0.024)	(0.062)	(0.024)
Profitability	0.100***	0.074***	0.122***	0.094***	0.060***	0.117***
	(0.007)	(0.011)	(0.009)	(0.007)	(0.012)	(0.009)
ln(firm size)	0.027***	0.009***	0.026***	0.027***	0.015***	0.025***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Industry dummy	YES	YES	YES	YES	YES	YES
City dummy	YES	YES	YES	YES	YES	YES
Observation	164,383	45,541	118,842	159,861	45,120	114,741
R-squared	0.276	0.331	0.222	0.268	0.287	0.225

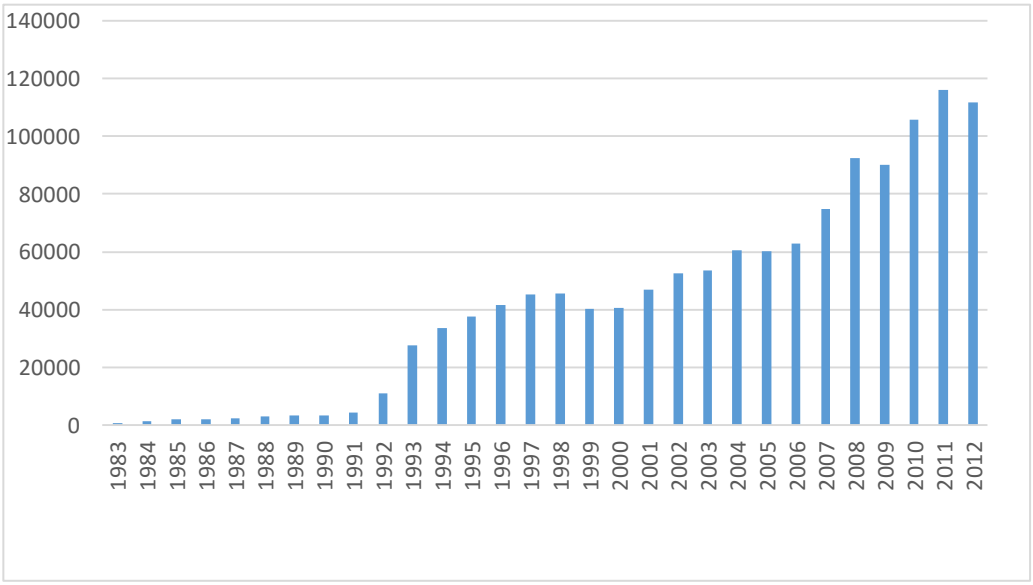
Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at city level. College ratio is the ratio of workers with college degree or above in firm. FDI penetration is the share of workers of FDI firms in industrial firms. Profitability is the profit of firm. Ln (firm size) is the log of total population in firm.

Table 8: Agglomeration effects

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	OLS	OLS	2SLS	2SLS	2SLS
	All sample	High-skilled	Low-skilled	All sample	High-skilled	Low-skilled
FDI						
Penetration	0.206***	0.432***	0.144***	0.221***	0.555***	0.153***
	(0.005)	(0.010)	(0.006)	(0.018)	(0.034)	(0.019)
Individual						
controls	Yes	Yes	Yes	Yes	Yes	Yes
City controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Observation	199,362	66,317	133,045	185,631	59,793	125,838
R-squared	0.355	0.377	0.269	0.362	0.378	0.273

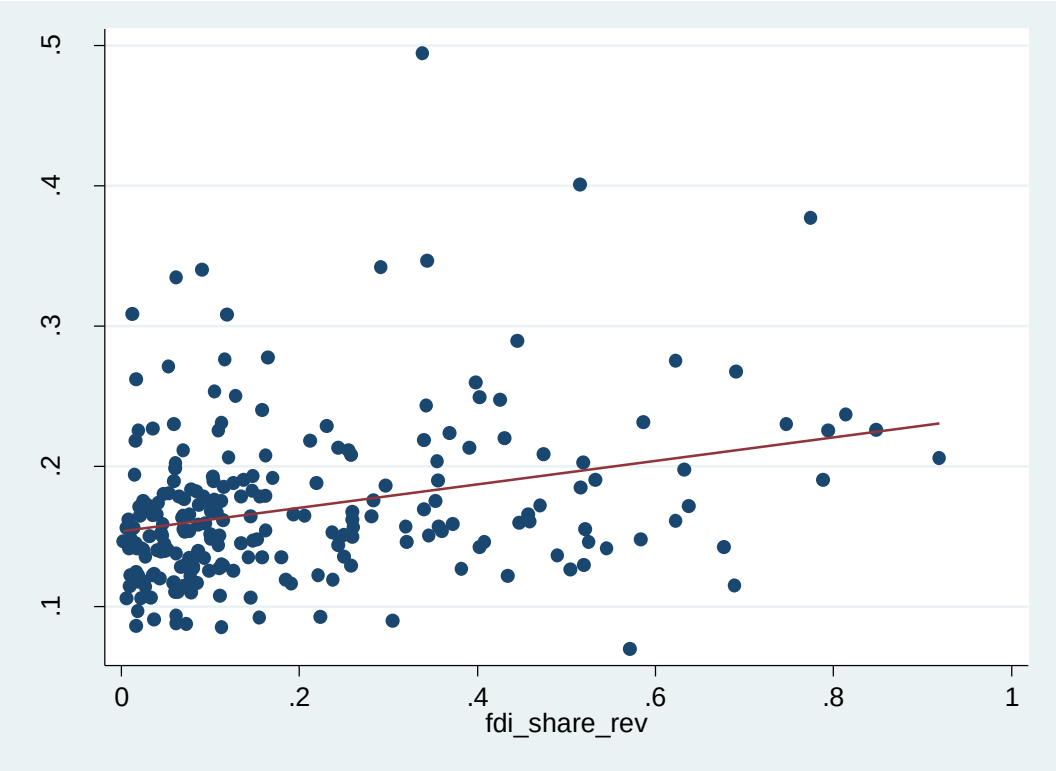
Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level; standard errors are in parentheses and clustered at province level. FDI Penetration is the share of workers employed by FDI firms. Individual controls include age, squared age, education, sex and marital status. City control variables are the same as in Table 2. We also control for industry dummies and occupation dummies in all regressions.

Figure 1: Foreign Direct Investment in the PRC($, million)



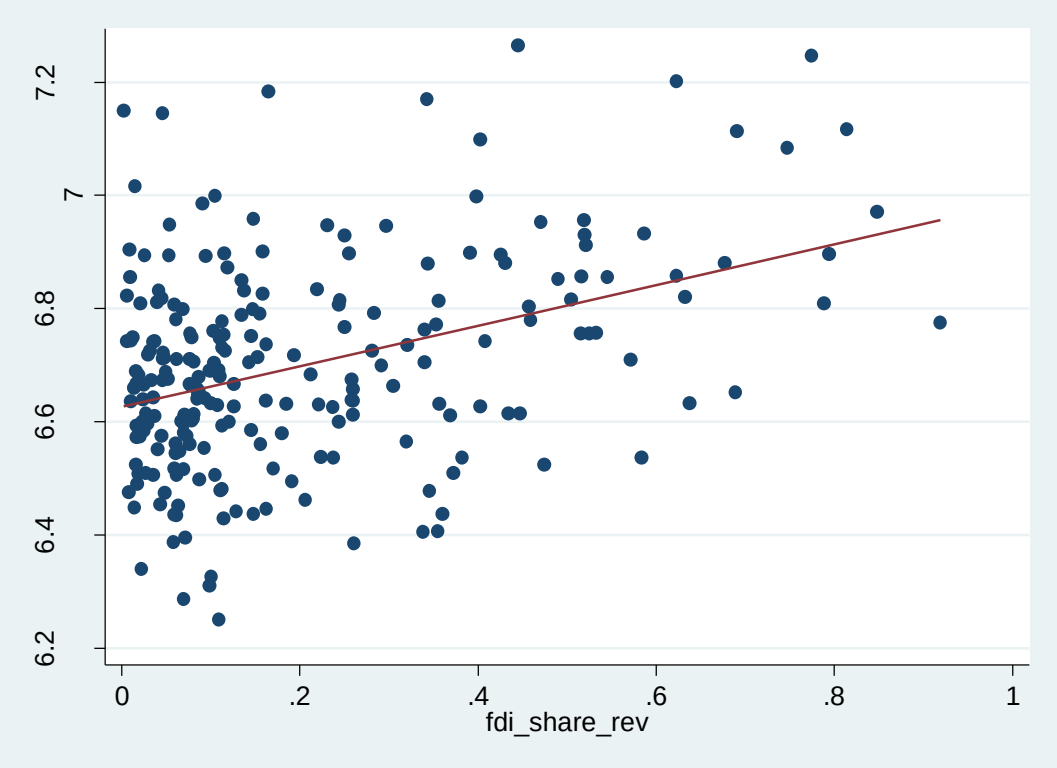
Source: China Statistical Yearbook (1984–2013), National Bureau of Statistics of China.

Figure 2: FDI penetration and city inequality



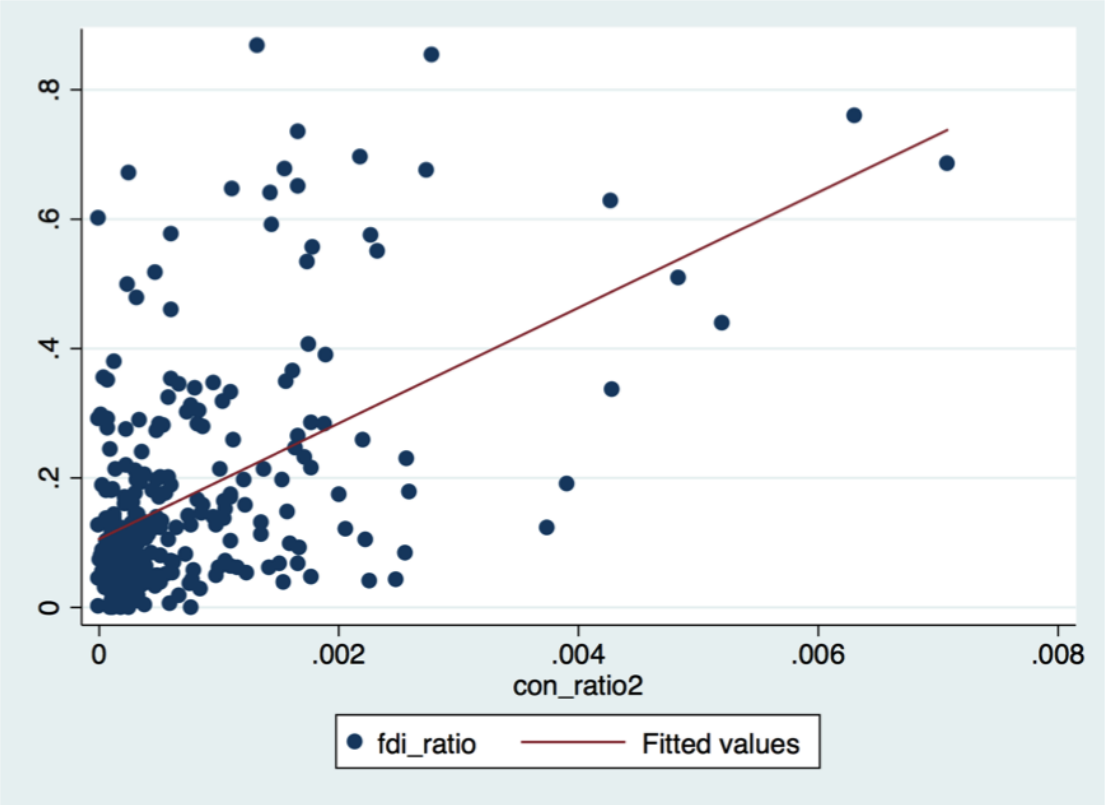
Notes: Each dot represents a city. The vertical axis is the log of theil index. The horizontal axis is the share of FDI revenue in total industrial revenue.

Figure 3: FDI and average income



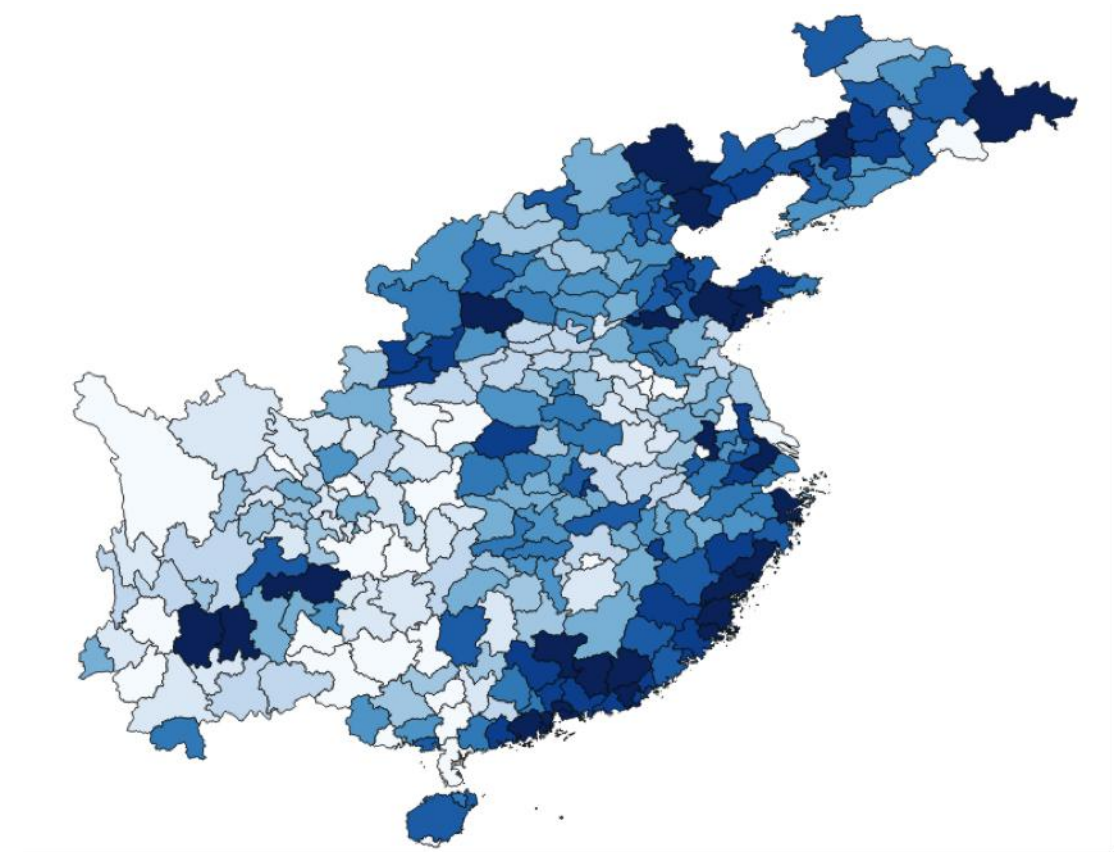
Notes: Each dot represents a city. The vertical axis is the log of mean income in urban area. The horizontal axis is the share of FDI firm revenue in total industrial revenue in each city.

Figure 4: The ratio of converts and share of FDI



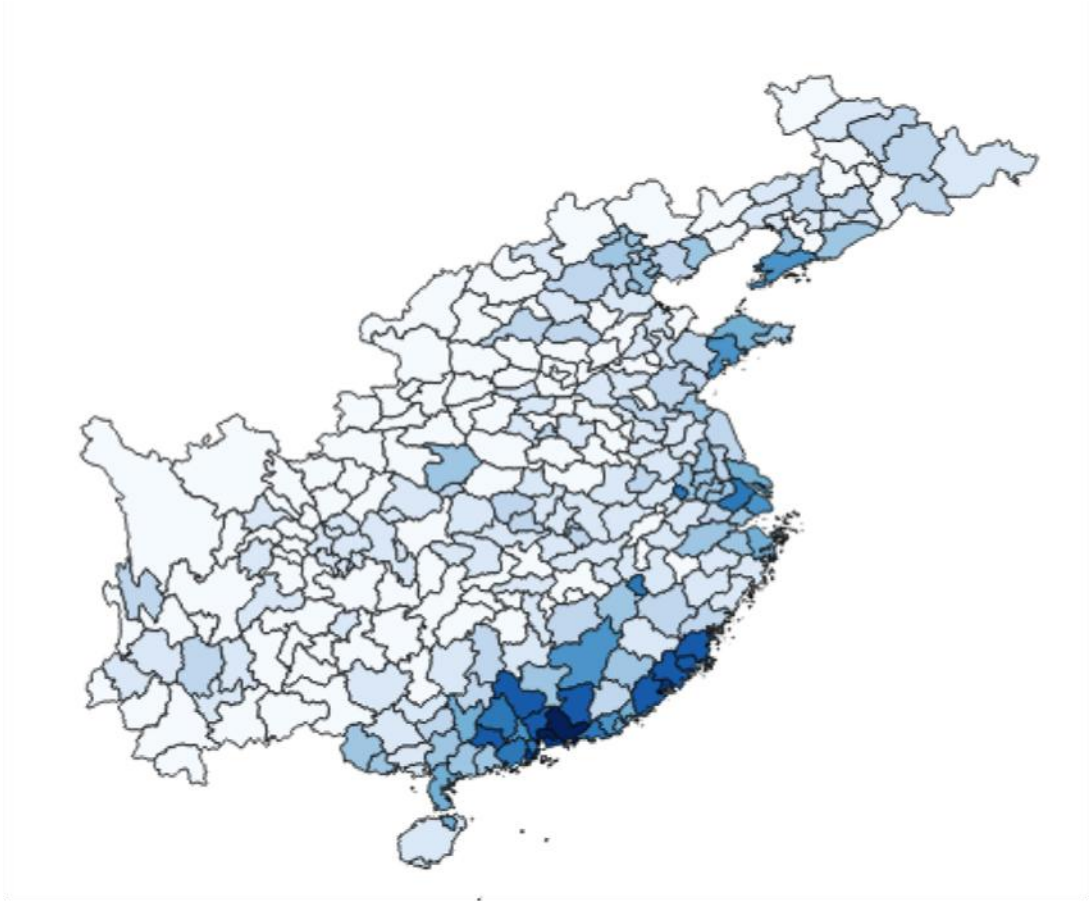
Note: The horizontal axis represents the share of FDI employment, and the vertical axis is the ratio of converts.

Figure 5: The distribution of ratio of converts (GIS)



Notes: we color all cities according to the value of ratio of converts all over china. The darker area represents higher ratio of convert numbers.

Figure 6: The distribution in the share of FDI employment, 2004



Notes: Cities are colored according to the share of FDI employment. The darker area represents higher degree of FDI penetration.

Appendix

Table A.1: The first stage result

	(1)	(2)	(3)
VARIABLES	OLS	OLS	OLS
Ratio of converts	0.0111***	0.00848***	0.00565***
	(0.00197)	(0.00173)	(0.00159)
ln(pop)		0.118***	0.0710***
		(0.0182)	(0.019)
ln(wage)		0.083	0.140*
		(0.0852)	(0.0845)
ETDZ	No	No	Yes
Road	No	No	Yes
Industry	No	No	Yes
education	No	No	Yes
region	No	Yes	Yes
Constant	0.166***	-0.958***	-0.513**
	(0.0184)	(0.208)	(0.238)
Observation	192	192	192
R-squared	0.143	0.37	0.517

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1\% level; standard errors are in parentheses and clustered at province level. Ratio of convents is the ratio of students from mission primary school. Ln (city size) is the log of total population in urban area. Ln (average wage) is the log of average individual income. Road density and fiscal power come from China City Statistical Yearbook, which represent city development level. Education composition is college ratio in total population. ETDZ dummy is whether it has economic and technological development zone.