The Research on Relationship between Task Biased Technical Change and Inequality of Wage across Regions in South Korea

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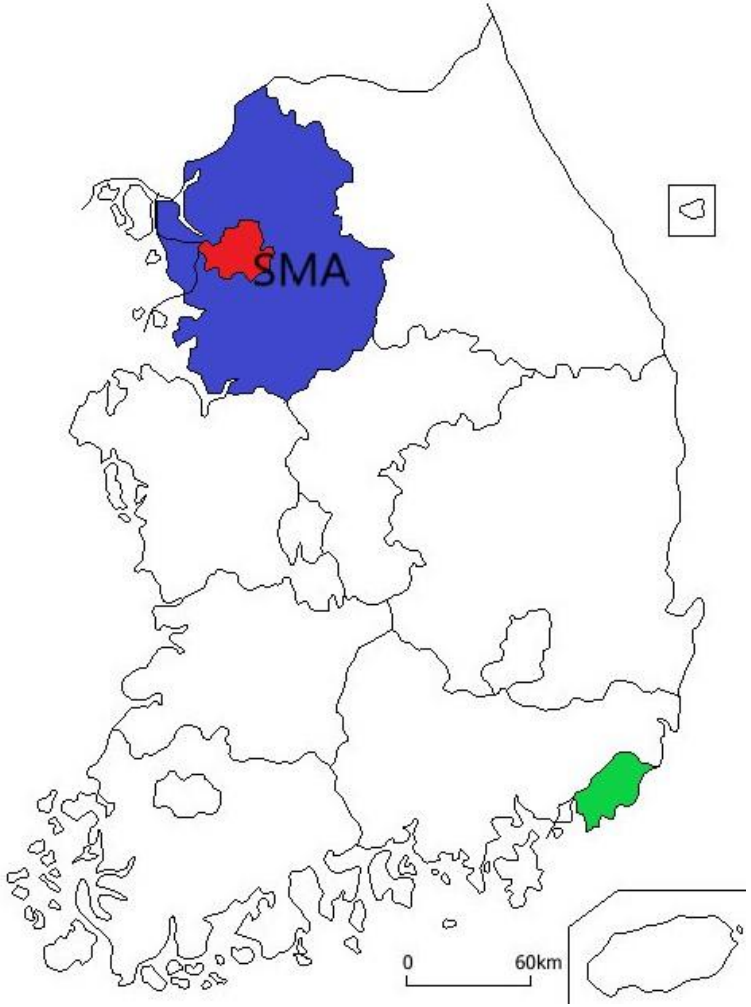
Contents

I. Introduction

1.1. Background



- **Seoul Metropolitan area called SMA is primate metropolitan area in South Korea**
  - The area of SMA is only about 12% of South Korea.
  - About 50% of the population is concentrated in SMA.
  - About 55% of worker who graduated university is concentrated in SMA.
  - Many younger workers want to start their career or learn in SMA

1.1. Background

- **Regional disparities between SMA and NSMA is deepened.**
  - Income growth and Local labor market is to become inequality
- **Why does the inequality between two regions persist?**
  - **Agglomeration effect and Sorting to larger cities** ➔ Larger city has more productivity than the others (Davis and Dingel, 2012; Roca and Puga, 2017)
  - **Directed technical Change** ➔ professional tasks vs routine/medium tasks (Hornstein et al., 2004; Acemoglu and Autor, 2011; Acemoglu, 2015)

1.2. Goal of paper

- **Link between DTC and income inequality among regions**
  - DTC may affect on slope of relative labor demand
    ➔ wage elasticity: degree of substitution of tasks across regions
  - DTC may affect on shift of relative labor demand
    ➔ biased agglomeration effects
- **To analyze relative labor demand for task**
  - To provide on evidence **difference in wage elasticity** of relative labor demand between **SMA** and **NSMA**
  - To estimate impact **agglomeration effect** and **ICT development** on relative labor demand in regions.

II. Methodology

2.1. Task biased technical change across regions

2.1.1. Assumptions

1. Intermediate input consist of **Professional tasks** and **Routine tasks** as CES function
2. Task-biased agglomeration effect
    1. Productivity growth **only** affects on **the professional tasks** (Acemoglu and Autor, 2011; Hug, 2017)
    2. Productivity growth depends on **agglomeration effect** of big firms (Behrens and Robert-Nicoud, 2014; Galiani et al., 2017; Roca and Puga, 2017)

2.1. Task biased technical change across regions

2.1.2. Model: relative labor demand between tasks

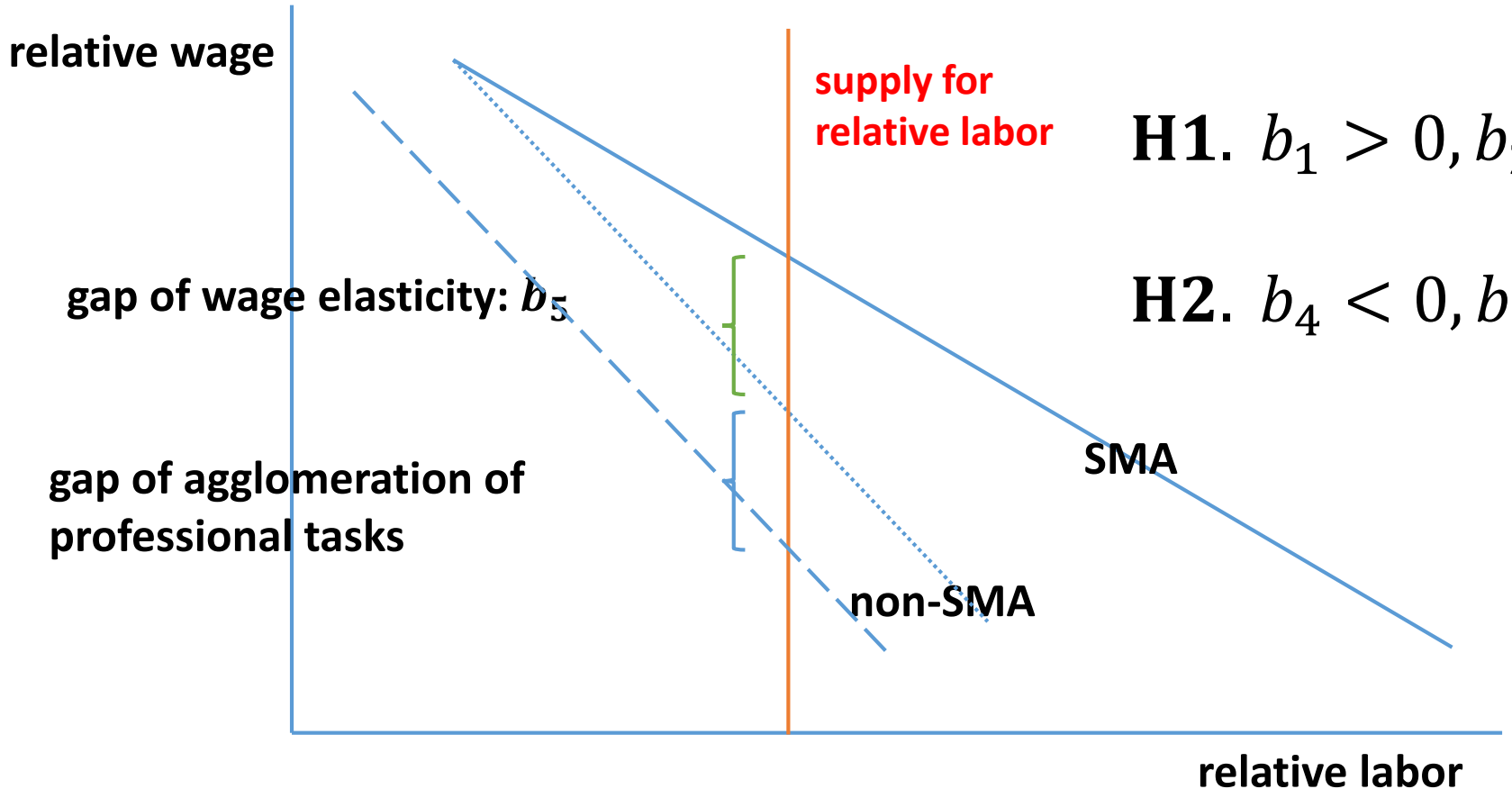
- **Our empirical analysis (eq 1)**

$$lnl_{i,t} = b_1 d_{i,t} + b_2 s_{i,t} + b_3 ICTd_t + b_4\, lnw_{i,t} + b_5\left(lnw_{i,t} \times I\right) + \mu_i, + \epsilon_{i,t} \quad \text{(eq 1)}$$

Variables	definition	note
• $\boldsymbol{lnl_{i,t}}$	Relative labor between two tasks	
• $\boldsymbol{d_{i,t}}$	Degree of density for big firms(tightness)	Agglomeration effect
• $\boldsymbol{s_{i,t}}$	Relative size of big firms(scale effect)	
• $\boldsymbol{ICTd_t}$	ICT development	Trend effect
• **I**	Non SMA dummy variables	NSMA=1, SMA=0
• $\boldsymbol{lnw_{i,t}}$	Relative wage between two tasks	Slope of relative demand

2.1. Task biased technical change across regions

Fig 1. Relative labor demand across regions: SMA and Non-SMA



H1. $b_1 > 0, b_2 > 0, b_3 > 0$

H2. $b_4 < 0, b_5 > 0, b_4 + b_5 < 0$

2.2. Empirical issues

2.2.1. Issues of estimation: Endogenous problem 1

- **Choosing to instrumental variables**
  - Identified problem in aggregated data: weak IV problem.
  - We need to show stability of results using IV : IV test, and robustness
- **Two types IV**
  - **Location cost:** rent for house such as apartment and single house (Behrens, Duranton and Puga, 2011; Puga, 2016)
  - **Sorting to city:** competition of education and net migration (D'Costa, 2014; Ahlin et al., 2017; Roca, 2017).

2.2. Empirical issues

2.2.2. Issues of estimation: Endogenous problem 2

- **Test of instrumental variables**
  1. **Hansen J test** ➔ H0: $cov(z, \varepsilon) = 0$
  2. **To detect weak IV** ➔ $cov(z, x) \neq 0$: First stage of F stat. ≥10 and Stock and Yogo test
  3. **Weak-IV robust inference** (①AR F test and ②chi2 test ③Wald test)
- **Our empirical methods are 4 types**

➔2step-GMM, and CU-GMM: efficient and finite problem

III. Data and Variables

3.1 Data

- Main Source of Data: KOSIS, Regional Panel data from 1999 to 2015

Variables		Source	Note
Wage, Employment		KOSIS, Report on the Service Industry Survey	
Data of firms in regions		KOSIS, Report of the census on establishments	• The number of big firms • The employees of big firms
ICT development		KOSIS, Information and Communication account	• The number of Kr domain
IV	Education variables	Korea Education Statistics Service(KESS)	• Applicants of university • Enrollees of university
	Net migration	KOSIS, Population account	• From 20 to 29
	Housing cost	R-ONE(http://www.r-one.co.kr/rone/)	• Lease cost(Total, SH, SAPT) • Rent cost

3.2 Variables and Summary statistics

- **Tasks and industries**
  - Problem of proxy variables such as two tasks
    - limitation of data in regional panel ➔ absence of occupations
  - We use classification of service industry to proxy occupations.
  - Professional services and the industrial structure within cities(Henderson, 2003; 2010)
  - Professional task ➔ professional service industry
  - routine task ➔ service industry close to the repeated job.

3.2 Variables and Summary statistics

[Table 1] Variables definition

Variable	definition	Obs
R	Routine service	Cleaning Services
		Security and Guard Services
		Office Support Services
		Telemarketing Services
		Exhibition and Trade Fair Organization Agencies
		Packaging and Filling Activities
		Credit Reporting and Collection Agency Services
		All Other Business Support Services
A1	Professional Services	Legal Services
		Accounting and Tax Preparation Services
		Advertising
		Market Research
		Activities of Head Offices and Management Consultancy
A2	Architectural, Engineering and Scientific Technical Services	Architectural, Engineering and Related Technical Services
		Technical Testing and Analysis
		Surface Surveying, Geological Services and Cartographing
A3	Finance	Finance

source: Kosis

IV. Results

4.1.1 Demand for relative labor (1)

[Table 2] results of equation (1) : Coefficients

VARIABLES	IV: Housing cost		IV: sorting to cities	
	(1) FEGMM	(2) FECUE	(3) FEGMM	(4) FECUE
b_4: *wage*	-2.969***	-3.618***	-2.801***	-3.235***
	(0.623)	(1.057)	(0.749)	(0.551)
b_5: *wage* X *Non-SMA*	2.761***	3.435***	2.491***	2.855***
	(0.589)	(1.016)	(0.696)	(0.545)
b_1: *density of firms*	0.133***	0.167***	0.168***	0.147***
	(0.027)	(0.043)	(0.025)	(0.017)
b_2: *relative size of firms*	0.403	0.711***	0.061	0.141
	(0.235)	(0.153)	(0.275)	(0.293)
b_3: ICT development	0.734***	0.207	0.700***	0.589***
	(0.221)	(0.188)	(0.177)	(0.152)
Obs	208	208	208	208
region FE	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1

4.1.2 Demand for relative labor (2)

Fig 3. Fitting value of relative labor

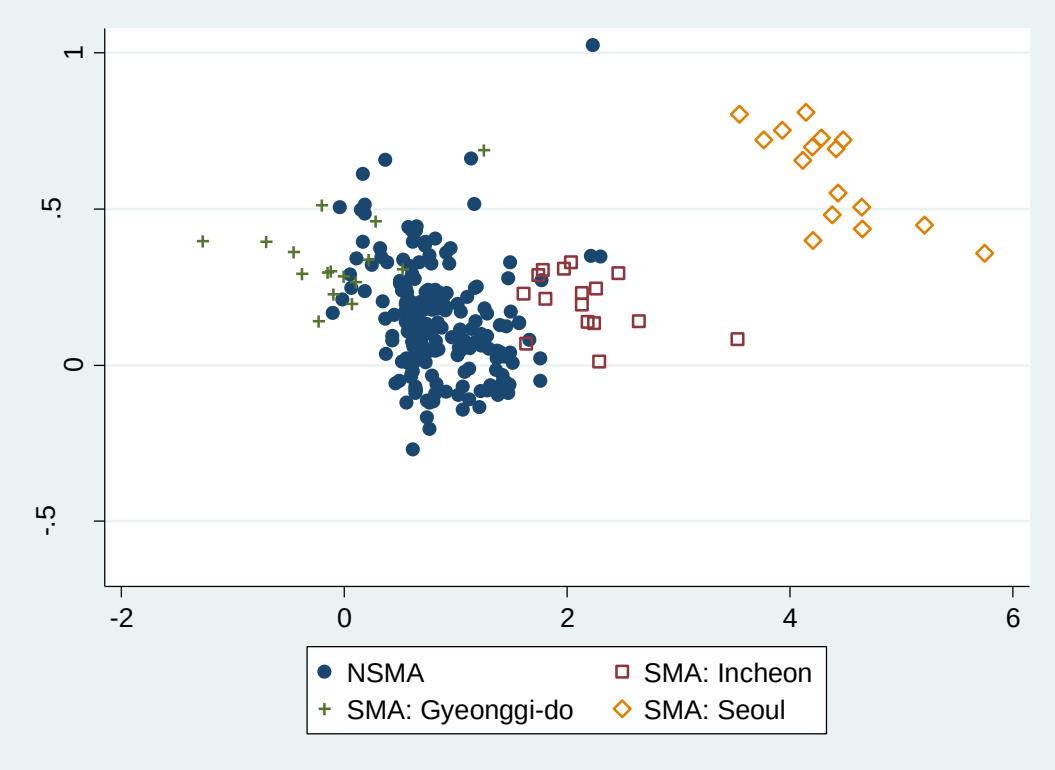
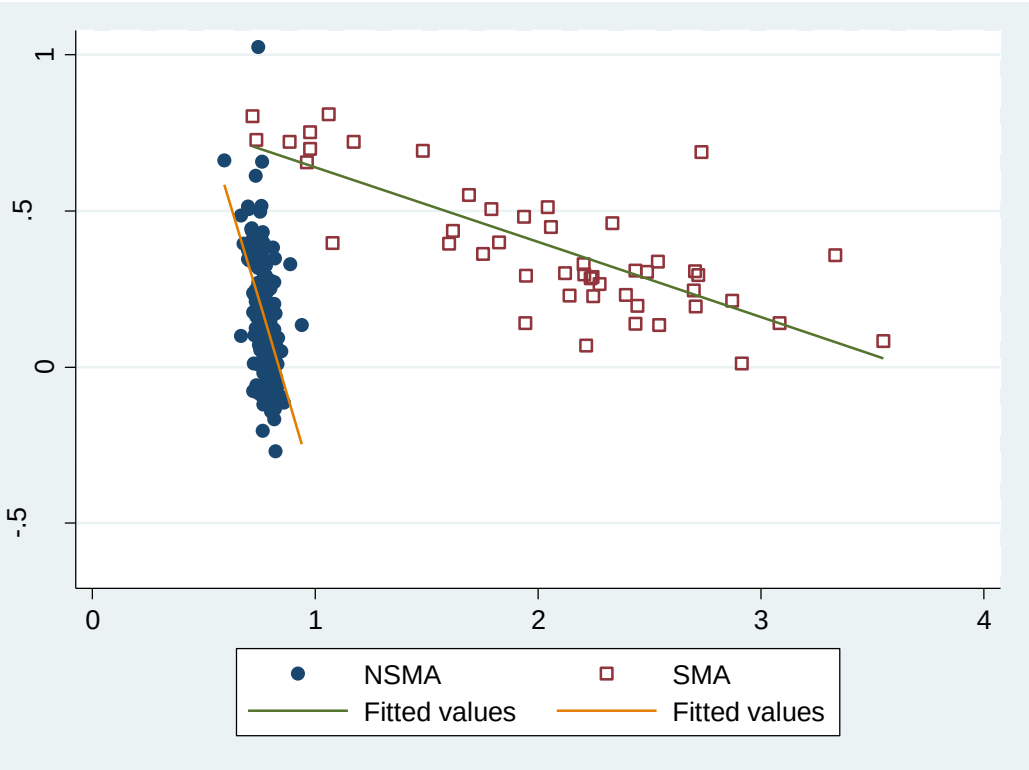


Fig 4. Marginal effect of relative wage on relative labor



4.1.1 Demand for relative labor (1)

[Table 3] results of equation (1) : Test for IV

VARIABLES	IV: Housing cost		IV: sorting to cities	
	(1) FEGMM	(2) FECUE	(3) FEGMM	(4) FECUE
Hansen J test (p-value)	0.162	0.288	0.455	0.387
KP’s F value	1455	1455	16.960	16.960
weak iv. test: AR F-test	0.003	0.003	0.000	0.000
weak iv. test: AR chi-test	0.000	0.000	0.000	0.000
weak iv. test: Wald test	0.000	0.000	0.000	0.000
C test(p-value)	0.883	0.634	0.808	0.249

Note: *** p<0.01, ** p<0.05, * p<0.1

4.3.1 Relevance of Instruments: housing cost

Fig 5. relative wage – housing cost

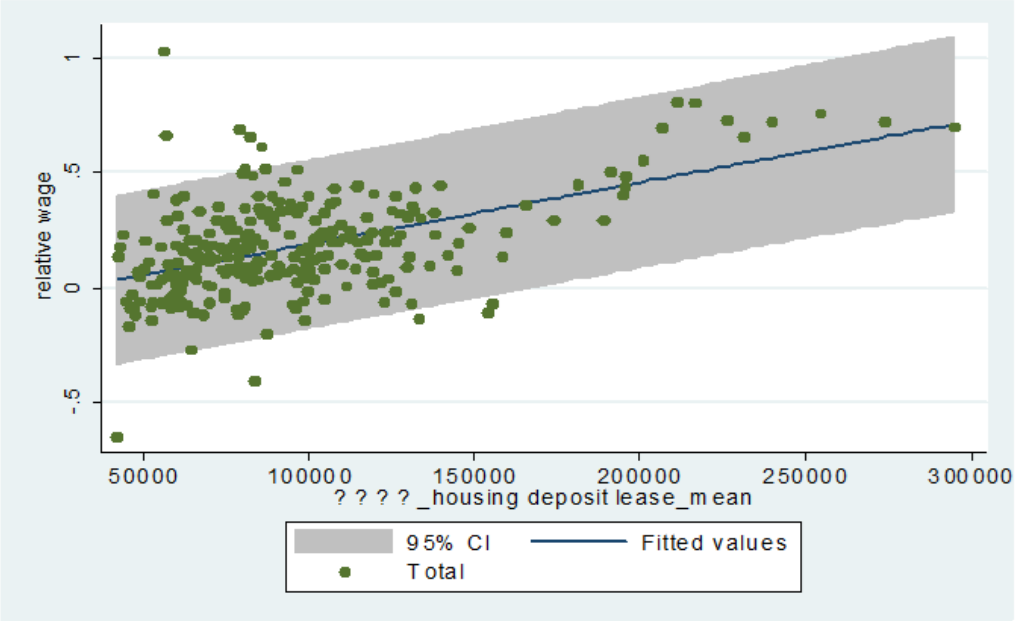
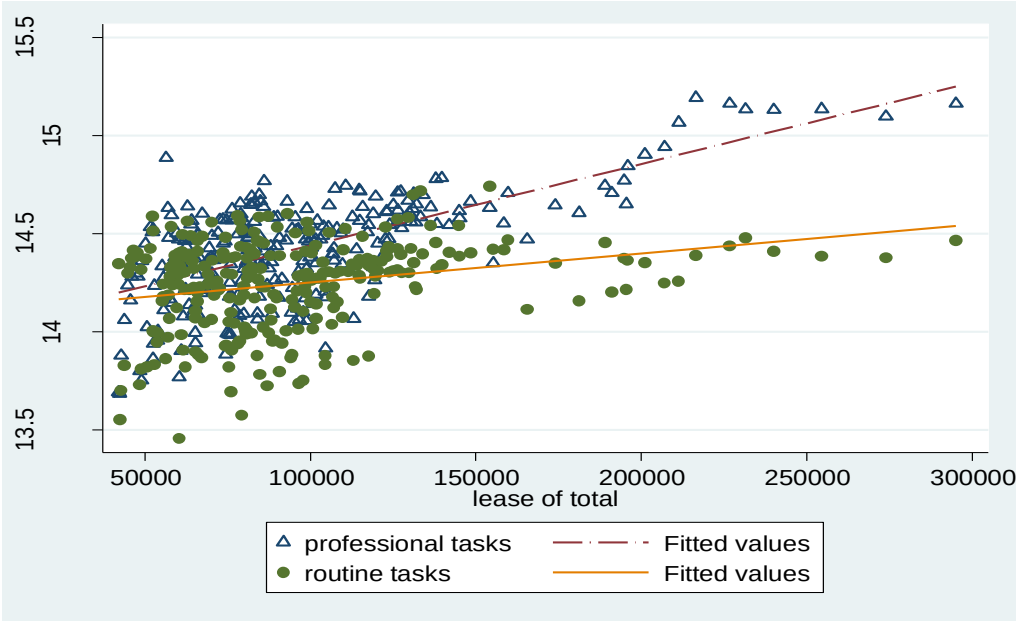


Fig 6. two types wage – housing cost



- Relative wage and instruments are positive relationship
- Professional task is more related to instruments.

4.3.1 Relevance of Instruments: housing cost

Fig 7. relative wage – education cost

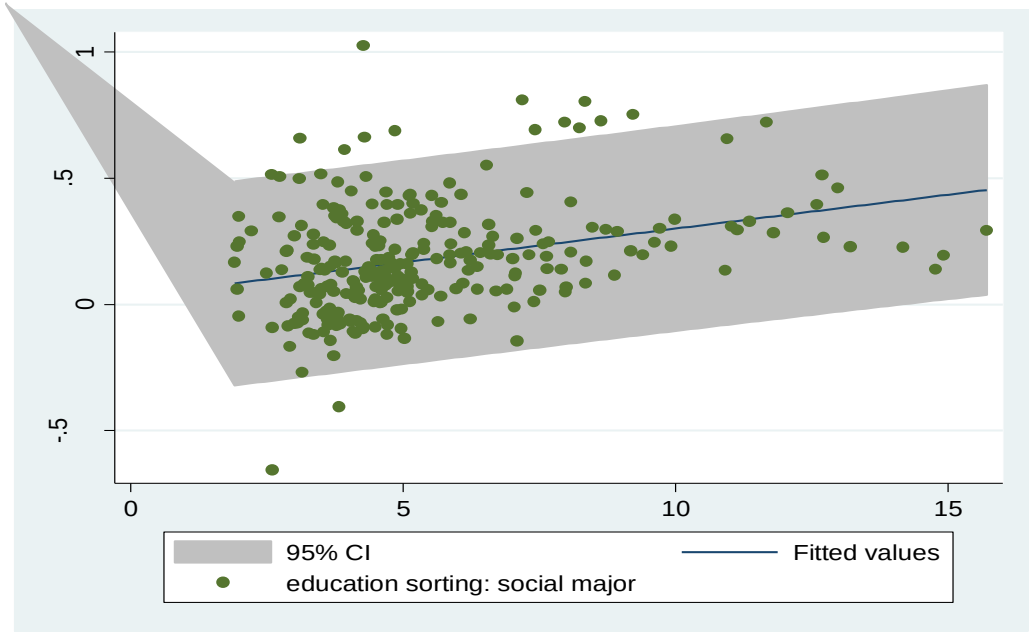
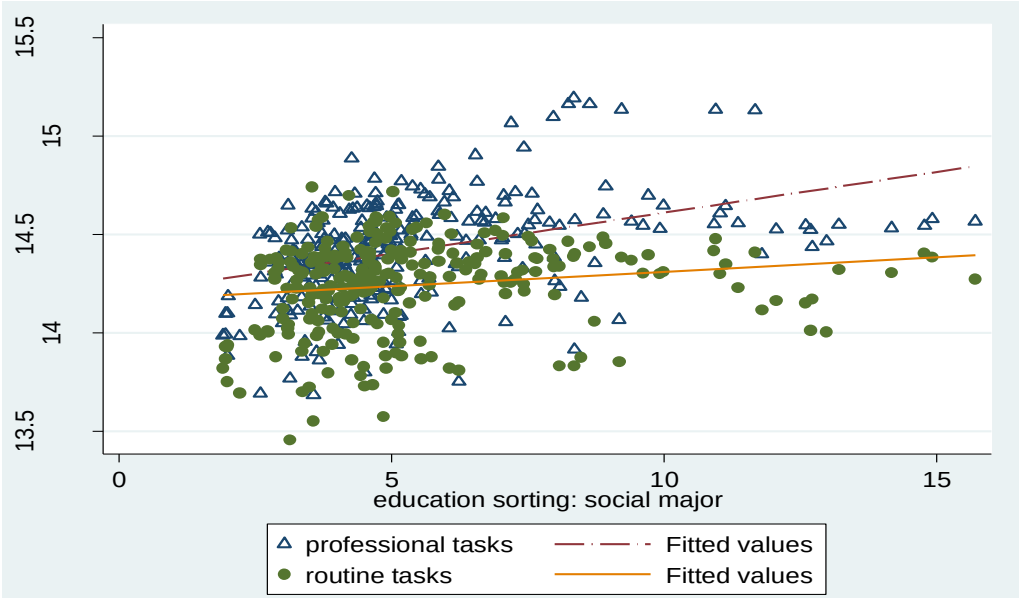


Fig 8. two types wage – education cost



- Relative wage and instruments are positive relationship
- Professional task is more related to instruments.

V. Conclusion

5.2. Conclusion

1. Agglomeration effect and ICT development

- Positive effect of ICT development on local labor demand
- Agglomeration effect for density of big firms increased workers of abstract task.
- SMA, which has a large number of big firms, is concentrated to workers of abstract task.

2. Wage elasticity between SMA and NSMA

- The elasticity of substitution between two tasks in SMA is larger than in NSMA.
- Growth of supply for abstract task(or higher-skilled workers) may potentially be deepening gap of local labor market, which lead to regional disparities between SMA and NSMA
- We can argue that job polarization due to DTC is accompanied by wage inequality across regions.

Thank you