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## **Abstract**

# **Decomposition Method of Gender Pay Gap By using Quantile Regression Analysis on Counterfactual Inference**

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Wage distribution of both female and male labor force in Korea show apparently heterogeneous features between different quantile groups. For this reason, ordinary regression methods which is based on conditional expectation cannot explain the data effectively. Censored quantile regression (CQR) which considers also the minimum wage as well as quantile issue could be plausible alternative in this case. By implementing CQR procedure of Chernozhukov and Hong (2002), Korean Labor and Income Panel Study (KLIPS) of year 2000 and 2008 were analyzed. Furthermore, the effect of higher education level for women and men were derived from the total change of wage from 2000 to 2008 based on counterfactual distribution theory and through the decomposition method. The final results imply that policy which can guarantee higher education level for the destitute poor female workers could be efficient policy to reduce the gap between men and women, and between the rich and the poor simultaneously.

**Key Words:** Counterfactual analysis, Censored quantile regression, Decomposition method, Gender pay gap

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# 1 Introduction

Most policy questions concerning wage or wealth ask for the effects of those policies on distribution between subgroups or classes, as the term ‘equality’ is considered one of the important social values. Unequal distribution of wealth based on unfair and unjust practice of law or tradition increases the potential risk of a social crisis and, therefore, does harm the social welfare. Studies on gender wage inequality, in this respect, deserve attention because, traditionally, social norm was unfavorable against the working women in many societies. Furthermore, pregnancy and parenting cause career discontinuity for female workers and this contributes to a gender pay gap.

Simply put, this study is on the gender wage gap. However, our focus is not only restricted to the wage gap between the genders, but also within the genders. Such extension of the scope of this study is a natural consequence of current changes in job market environment; as society develops, more lucrative job opportunities are open to the highly educated and motivated female workers even if average female workers suffer from low wage and unfavorable work environment. Specifically, the primary subject matter of this paper is to analyze the effect of higher education on hourly wage of male and female worker respectively. Based on the analysis, we try to decompose the change in wage and provide the policy implication.

The secondary subject matter is the new statistical framework of a policy analysis that is applicable to the case what we face. The usual statistical techniques, based on the least square estimation, are unsatisfactory and distortive to be directly applied to the case we are considering because of two

reasons: loss of distributional information, and distortion from censored data. The first problem is caused by the characteristics of the least square estimator. Least square estimator usually estimates conditional expectations, and not distribution itself. For example, OLS estimation  $X\beta$  is the estimation on  $E(Y|X)$  therefore we have no clue for the conditional distribution  $F(Y|X)$ . To solve this problem, conditional quantile regression is a good technical alternative. Quantile regression (QR) estimates the conditional quantile value  $Q(\tau|X)$  for each given probability  $\tau$  and covariate value  $X$ . Since quantile is merely the inverse function of the distribution function it allows us to recover the information about the conditional distribution function  $F(Y|X)$ . The second problem, distortion from the censored data, is expected to present at the case we face since a minimum wage is enforced by law. The more the data are subject to censoring, the more we can expect distortion in estimation. The censored regression technique can alleviate such distortion. In this study, censored quantile regression (CQR) has been adopted.

The contents of this study are summarized as follows. First of all, both of QR and CQR analysis have been performed to compute the result of the estimation at 2000 male, 2000 female, 2008 male, 2008 female respectively. Here, we can conjecture that discrepancy between QR and CQR estimations is expected to be severe at lower quantile and in female groups due to law enforced minimum wage which is more likely to affect the lower wage workers. Secondly, conditional distribution estimation is done by using CQR estimation result. Finally, based on the estimated conditional distribution, wage change from 2000 to 2008 has been decomposed into wage effect and composition effect and counterfactual distributions are derived. Also we evaluate the hypothetical policy.

This paper is organized as follows. Section 2 reviews the theoretical background of study and provides underlying settings. Section 3 is about the data set and variable description and presents the result of analysis including regression analysis, decomposition analysis, and the counterfactual analysis. Section 4 concludes this study.

## 2 Theoretical background

### 2.1 General idea

The wage distribution among different subgroups attracts interest from researchers. The observed difference in distribution, however, is the consequence of social process, not the cause. Decomposition methods, in this context, deserve a massive attention since it allows researchers to recognize the source of change. For instance, the increase in sales of a company can be caused by increase in quantity of good sold or increase in market price. By the same token, the change in wage distribution could be the consequence of change in wage structure or change in covariate.

Oaxaca (1973) is one of such endeavors to find the source of such change. Denote  $Y, X, i$  be wage, covariate, and index of subgroup of interest that is 1 or 0. OB idea can be described as follows.

$$\begin{aligned} & E[Y | i = 1] - E[Y | i = 0] \\ &= E[ E[Y|X, 1]|1] - E[ E[Y|X, 1]|0] + E[ E[Y|X, 1]|0] - E[ E[Y|X, 0]|0] \end{aligned}$$

And by assuming the linear model, i.e.

$$E[Y|X = x, i] = x \beta_i$$

,

We can rewrite above equation into

$$\begin{aligned} E[Y | i = 1] - E[Y | i = 0] &= E[X\beta_1|1] - E[X\beta_1|0] + E[X\beta_1|0] - E[X\beta_0|0] \\ &= E[X|1]\beta_1 - E[X|0]\beta_1 + E[X|0]\beta_1 - E[X|0]\beta_0 \\ &= (E[X|1] - E[X|0])\beta_1 + E[X|0](\beta_1 - \beta_0) \end{aligned}$$

First part is called composition effect that is the change caused by the change in covariate. Second part is called wage effect that is the change caused by change in wage structure itself. Above decomposition is easily calculated and estimated by substitute  $E[X|i] = \bar{X}_i$  that is the conditional average of covariate within  $i$  th subgroup and  $\beta_i = \hat{\beta}_i$  that is the nice estimator of  $\beta_i$ . It is easily implementable since least squares estimation is straight forward. However, it suffers from the fundamental limitation that the information on wage distribution is not preserved. Such decomposition method cannot answer the question concerning the distribution of wage since it only takes the conditional expectation into account.

Triggered by DiNardo et al. (1996), current studies such as Firpo et al. (2007), Fortin et al. (2010), Gosling et al. (2000), Machado et al. (2005), and Melly (2005) try to overcome this problem by using conditional quantile not conditional mean. Write  $Q_\tau(X, i)$  be the conditional quantile of the random

variable  $Y|X, i$ . Then, we put the decomposition of quantile given  $\tau$  as follows.

$$\begin{aligned} & E[Q_\tau(X, 1) | 0] - E[Q_\tau(X, 0) | 0] \\ &= E[Q_\tau(X, 1) | i = 1] - E[Q_\tau(X, 1) | 0] + E[Q_\tau(X, 1) | 0] - E[Q_\tau(X, 0) | 0] \end{aligned}$$

Assume the linear structure for the conditional quantile for all  $\tau$ . That is  $Q_\tau(X = x, i) = x\beta_i^\tau$ . Then,

$$\begin{aligned} & E[Q_\tau(X, 1) | 1] - E[Q_\tau(X, 1) | 0] \\ &= E[X|1]\beta_1^\tau - E[X|0]\beta_1^\tau + E[X|0]\beta_1^\tau - E[X|0]\beta_0^\tau \end{aligned}$$

By the same token to the Oaxaca (1973) if  $\hat{\beta}_i^\tau$  is the nice estimator of  $\beta_i^\tau$ , we can estimate the decomposition as follows.

$$(\bar{X}_1 - \bar{X}_0)\hat{\beta}_1^\tau - \bar{X}_0(\hat{\beta}_1^\tau - \hat{\beta}_0^\tau)$$

Actually, its usefulness comes at the cost of computational complexity. In this study, we use the CQR estimator for  $\hat{\beta}_i^\tau$  and it is not the simple task to calculate it. We will discuss about the computational strategy in more detail in next part.

## 2.2 Censored quantile regression

Previous studies based on mean regression have obvious limitations in that they cannot capture the precise effects of each variable. Quantile regression which considers the entire shape of the distribution first appeared in the 1970s by Koenker and Bassett (1978). In this study, CQR is implemented because of



the minimum wage problem. The censored model can be described as follows where  $\underline{Y}$  is the minimum wage.

$$Y_i = \max(X_i\beta, \underline{Y}) + \varepsilon_i$$

It also can be expressed by using latent variable. Specifically, consider the regression model below.

$$Y_i = \delta_i X_i \beta + (1 - \delta_i) \underline{Y} + \varepsilon$$

Where  $\delta_i \in \{0, 1\}$  which is 1 if the observation is uncensored, 0 otherwise. The fair estimation of  $\beta$  must be based on the set of uncensored observation  $\{i \mid \delta_i = 1\}$  not the whole sample. Here, two different estimation strategies are viable: EM algorithm type that considers  $\delta_i$  as a latent variable, and estimates uncensored observation set. In the case of CQR problem, we can write the two different strategies formally as below.

i) EM algorithm type

Do

$$\begin{aligned} \beta_{\tau}^{(n+1)} &= \operatorname{argmin}_{\beta} \sum_{i \in I} \rho_{\tau}(Y_i - \Pr(X_i = 1; \beta^{(n)})X_i\beta - \Pr(X_i \\ &= 0; \beta^{(n)})\underline{Y}) \end{aligned}$$

Until

$$|\beta_{\tau}^{(n+1)} - \beta^{(n)}| < \epsilon$$

It solves the problem by i) updating the probability of censoring, and ii) minimizing objective function. Here  $I$  is the index set of sample.

ii) Estimated uncensored observation set based regression

$$\beta_{\tau}^{(n+1)} = \operatorname{argmin}_{\beta} \sum_{i \in C(\beta_{\tau}^{(n)})} \rho_{\tau}(Y_i - X_i \beta)$$

Here  $C(\beta^{(n)})$  is the index of estimated uncensored set.

The calculation of CQR in this study is based on the methods of the second strategy. Actually, it is a sort of iterative algorithm that tries to improve the accuracy of the estimation on  $C$ . In this context, this algorithm shares a lot in common with EM algorithm. The detailed procedures are as below. More comprehensive reference is available in Three-step censored quantile regression and extramarital affairs (2002) by Chernozhukov and Hong.<sup>1</sup>

#### Step 1 :

Decide whether  $i$  in  $C$  based on the estimated probability by logit regression. Specifically,  $i \in C$  if  $\hat{p}(X_i) - \tau + c$  where  $\hat{p}(X_i)$  is the estimated probability which is a result of logit regression.  $c$  is an arbitrary positive constant that is smaller than  $\tau$ . In this study, we assumed  $c = 0.001$

#### Step 2 :

Update  $C$  based on the result of QR on  $C$ . Specifically  $i$  in  $C$  if  $X_i \hat{\beta} > \underline{Y} + \delta_n$  where  $\hat{\beta}$  is the result of quantile regression. Chernozhukov and Hong (2002) provides the guideline for  $\delta_n$  that  $\delta_n \rightarrow 0, \delta_n \sqrt{n} \rightarrow \infty$ . In this

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<sup>1</sup> Koenker's matlab code is adopted for quantile regression analysis.

study,  $\delta_n$  is assumed to be  $n^{-1/4}$ .

#### Step 3 :

Update  $C$  based on the result of QR on  $C$  which is the result from step 2. We can continue to iterate this step until some bound is achieved or just stop the iteration at this point. By numerical simulation, two iterations generated satisfactory convergent results. Therefore, because of the cost of computation, two iterations on Step3 have been performed in this study.

## **3 Data description and Analysis**

### **3.1 Data description**

Korean Labor and Income Panel Study (KLIPS) data is applied in this study. KLIPS is longitudinal data of labor force supply and mobility of individuals and households. Main focus is on the 3<sup>rd</sup> year data (2000) and the 11<sup>th</sup> year data (2008). This seems reasonable since otherwise, it is impossible to distinguish the extraordinary influence of financial crisis of South Korea in 1997. From available observation, we selected the workers who are older than 15 years and younger than 65 years. Also to remove the outlier, we used the observation which monthly wage is smaller than 100 million won. Total number of samples used in 2000 is 1867 and 1154 for men and women respectively. 2169 and 1433 for men and women respectively in year 2008.

	10%	20%	30%	40%	50%	60%	70%	80%	90%
<b>1999</b>	0.77	0.71	0.68	0.62	0.6	0.58	0.59	0.63	0.68
<b>2000</b>	0.79	0.71	0.64	0.63	0.62	0.59	0.59	0.61	0.66
<b>2001</b>	0.8	0.71	0.67	0.65	0.62	0.59	0.62	0.62	0.7
<b>2002</b>	0.76	0.69	0.64	0.62	0.58	0.6	0.58	0.63	0.67
<b>2003</b>	0.77	0.68	0.64	0.62	0.63	0.62	0.64	0.7	0.73
<b>2004</b>	0.73	0.67	0.63	0.59	0.58	0.59	0.59	0.64	0.63
<b>2005</b>	0.69	0.63	0.57	0.57	0.57	0.59	0.58	0.61	0.61
<b>2006</b>	0.71	0.67	0.61	0.59	0.59	0.56	0.58	0.59	0.64
<b>2007</b>	0.7	0.62	0.59	0.58	0.57	0.6	0.56	0.6	0.6
<b>2008</b>	0.69	0.61	0.59	0.57	0.58	0.56	0.57	0.6	0.63

Table1. Hourly wage ratio (female wage / male wage) by quantile

As the ratio of highly educated female workers rises, gender pay gap has become smaller. However, there still exist signs of wage inequality in Korea, as women's average income hardly reaches 70% of that of men's. Main reasons for this wage difference can be found in traditional women's role of taking charge of house duty, much of which leads to women's resignation, and women's tendency to avoid overloaded task. In addition, considering women's time investment in laboring and parenting, women's work hour is absolutely shorter than that of men's and the fact can contribute to the wage difference between men and women. Table1 shows U-shaped wage ratio trend for each year as quantile changes. In other words, wage ratio of female over male labor force is obviously different depending on the quantiles. This stands as the main reason why quantile regression analysis is required.

Variable	Description
Hourly wage	Hourly real wage before taxation
Minimum wage	Hourly real minimum wage adjusted by CPI
Seoul	Reside within capital city or not
Potential experience	Potential experience = age - education year - 5
Potential experience <sup>2</sup>	Potential experience <sup>2</sup>
Marital status	Married or not
Union	Existence of union or not
Education	Under high school
	High school
	College(2 year)
	College(4 year) or post graduate
Industry	Manufacturing, Construction,
	Wholesale and retail trade,
	Lodging, Transportation, Networking, Finance·Insurance,
	Business service, Public administration·Military service,
	Education, Social welfare, Entertainment·Personal service,
	Etc(Infrastructure, Lease)
Job class	Professional, Semiprofessional, Clerical, Service, Sales, Skilled, Unskilled

Table 2. Variable Description

Table2 provides description for variables adopted in this study. First, hourly real wage is derived from monthly wage divided by weekly work hour multiplied by weeks per month. Both of hourly real wage and minimum real

wage<sup>2</sup> are adjusted by consumer price index<sup>3</sup>. For male labor workers, hourly wage is 8.46 in 2000 and 13.31 in 2008 which records 36.44% of increasing. For female, it has changed from 5.4 to 7.85 from 2000 to 2008, 31.21% of increasing. The ratio of people who reside within capital city is about 25% for both men and women and doesn't report dramatic change over time. Potential experience, which was derived as (age - education year - 5) has increased for women but still was lower than men's until 2008. Ratio of married female workers has increased while married men have decreased.

Education variable is categorized into 4 subsectors based on education year. Under high school represents whose education year is shorter than 12 years. High school which is set as omitted dummy variable is for longer or equal to 12 and shorter than 14. College (2 year) represents whose education year is longer than 14 shorter than 16. Above 16 years are named as College (4 year) or post graduate. Since omitted variable is high school level, coefficients following in section 4.2 represent the effect of each education level as it piles up serially. Education level has arisen for both men and women. The ratio of education level higher than university graduates was 24.96% for men and 17.76% for women in 2000. In 2008, data show the ratio has changed to 35.22% for men and 25.61% for women.

Industry is categorized into 14 subsectors. Agriculture and mining are excluded due to too small portion of individuals included. Subsector which contains at least one part of which proportion is lower than 1% is all summed

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<sup>2</sup> The Ministry of Employment and Labor

<sup>3</sup> The Bank of Korea

up as etc. Manufacturing takes around 30% of whole industry for male and about 20% for female labor workers which takes the highest proportion. Hence, manufacturing is taken as omitted dummy variable among industry subsectors.

Job class is divided into 7 categories. More than 20% and 15% of male and female workers are classified into unskilled respectively and therefore, it is considered as an omitted dummy variable of job class sector.

Recall that the wage ratio showed U-shaped distribution over the quantile. From this observation, we can conjecture that the usual least squares method will fail to capture the important information about the distribution we have. Secondly, from table 3, we can see that the ratio of women who get wage below minimum threshold is obviously higher than that of men labor force. This phenomenon has been aggravated as time goes. CQR can be reasonable alternative to QR in this case since QR might underestimate the effects of dependent variables on female workers especially those that lie on the lower quantile.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Male</b>	3.8%	4.0%	4.8%	4.6%	6.2%	5.6%	6.4%	6.0%	6.2%	5.8%
<b>Female</b>	7.2%	8.7%	7.8%	10.8%	13.6%	14.3%	19.8%	18.1%	22.8%	19.3%

Table3. Below minimum wage proportion

### 3.2 Regression Analysis

Both QR and CQR result shows that the workers who reside in capital city tends to be paid more but not as much as significant. Furthermore, such tendency is weakened in 2008 compared to that in 2000. In case of potential experience we can observe interesting phenomenon. First of all, the result of estimation shows the consistent result to the theoretical speculation that wage will increase with job experience but the marginal effect will decrease in year of experience. However, in case of lowest 10% quantile female worker, such effect is not statistically significant. The possible explanations are i) potential experience is not a good proxy for the experience for the low income female workers. ii) low income female workers are engaging in jobs of which experience is not rewarded. More interesting observation comes from the comparison between QR and CQR result. Figure shows that QR is underestimating the slope of the potential experience while overestimating the coefficient of potential experience square. It means, if we describe the wage premium of experience as a function, CQ tends to estimate such function be less curvy. The source of such distortion is from the censored data. Roughly speaking, censored data will gravitate the medium part of the fitting function to the center and consequently, the fitting function will be flatter.



There exist significant differences between male and female workers when it comes to marital status. While seemingly wage does not look very much related to marital status of female workers, marital status is positively correlated with wage level in the case of male workers. However, we cannot be sure of the direction of the casualty. Both explanations are equally likely: i) marriage may enhance the productivity of male labor force since their spouses serve hospitality, ii) there exists selection bias since there is a possibility that only affluent male workers may get married.

Theoretically, labor union enhances the bargaining power of workers and, therefore, it is expected to lift the hourly wage level up. Both of QR and CQR results support such speculation, but for the lower income female case, QR underestimates the wage premium caused by labor union. It supports our conjecture that distortion caused by directly applying QR is severe in case of low income female workers.

Recall that we assigned the omitted dummy variable to the high school education. If high school education uplifts the productivity of the workers, coefficients are supposed to have a negative sign. i.e. the gap between zero and coefficient represents the wage premium of high school graduation. In this respect, QR consistently underestimates the education premium for low income worker except for 03<sup>rd</sup> year female. The wage premium of 2 years college education is not significant enough in 03<sup>rd</sup> year data. However, in 11<sup>th</sup> year data, except for the lowest 10% quantile, wage premium is significant. We can also observe here that QR keeps underestimate the wage premium of education for the female labor. In case of higher education, such tendency is obvious. Here we can see here that the result of QR and CQR almost coincide for the male labor while QR estimation suffers from the censored data.

Most regression result is constituent to the theoretical speculation. Important implication of this study is that the QR clearly underestimates the wage premium of low income female workers from education, and labor union. Hence, policy evaluation by using the result of QR can be potentially misleading.

### **3.3 Decomposition and counterfactual analysis**

Based on the decomposition method introduced in section 2.1, the change in wage distribution from 2000 to 2008 is decomposed. Decomposition is conditioned to each gender respectively, and change in total amount of wage and change caused by higher education are observed separately. Table 4 is the result of the decomposition analysis. 1.

According to A. figure.18, male labor is more rewarded than the female labor and wage has been raised from 2000 to 2008 except for low income female labor. That is, the job market for low income female labor is getting more and more unfavorable. According to the result decomposition, composition effect is positive for all quantile and gender. The problem is on the wage effect. The wage effect of lowest 10% and 20% quantile is negative. In contrary, the wage effect of higher education is positive and dominates the wage effect of male over whole quantile. It implies that the female labor tends to be undervalued compared to the male labor, but the demands for the highly educated female labor is increasing.

		10%	20%	30%	40%	50%	60%	70%	80%	90%
<b>Male</b>	Total change of wage	2.427	2.835	3.579	4.007	4.403	4.887	5.64	6.409	7.692
	Wage structure (Total)	2.15	2.424	3.026	3.4	3.754	4.126	4.729	5.335	6.304
	Composition effect (Total)	0.277	0.411	0.553	0.607	0.65	0.761	0.911	1.075	1.388
	Total change caused by higher education	0.241	0.387	0.466	0.595	0.752	0.896	0.892	1.164	1.344
	Wage structure (caused by higher education)	0.049	0.142	0.197	0.266	0.368	0.459	0.42	0.583	0.688
	Composition effect (caused by higher education)	0.191	0.245	0.268	0.329	0.384	0.437	0.472	0.581	0.657
<b>Female</b>	Total change of wage	-0.473	0.107	0.926	1.399	2.2	2.416	2.671	3.195	4.165
	Wage structure (Total)	-1.46	-0.61	0.067	0.303	1.115	1.137	1.327	1.767	2.634
	Composition effect (Total)	0.986	0.717	0.86	1.096	1.085	1.279	1.344	1.428	1.531
	Total change caused by higher education	0.876	0.726	0.735	0.901	0.942	1.25	1.291	1.22	1.255
	Wage structure (caused by higher education)	0.721	0.579	0.587	0.731	0.757	1.087	1.103	1.022	1.061
	Composition effect (caused by higher education)	0.155	0.147	0.148	0.17	0.184	0.162	0.188	0.197	0.194

Table4. Decomposition of wage distribution between 2000 and 2008

The possible cause of undervaluation of female labor is career discontinuity. Female workers, in many cases, have to leave their work place because of pregnancy, and parenting burden. As a result, on the employee side, the learning curve of female workers is flatter than that of male workers and, therefore, less productive in the long run. On the other hand, from the employer side, employers expect female workers to leave the work place, and for this reason, they are reluctant to employ the female labor. In this respect, it is the natural consequence that the female labor is undervalued in job market.

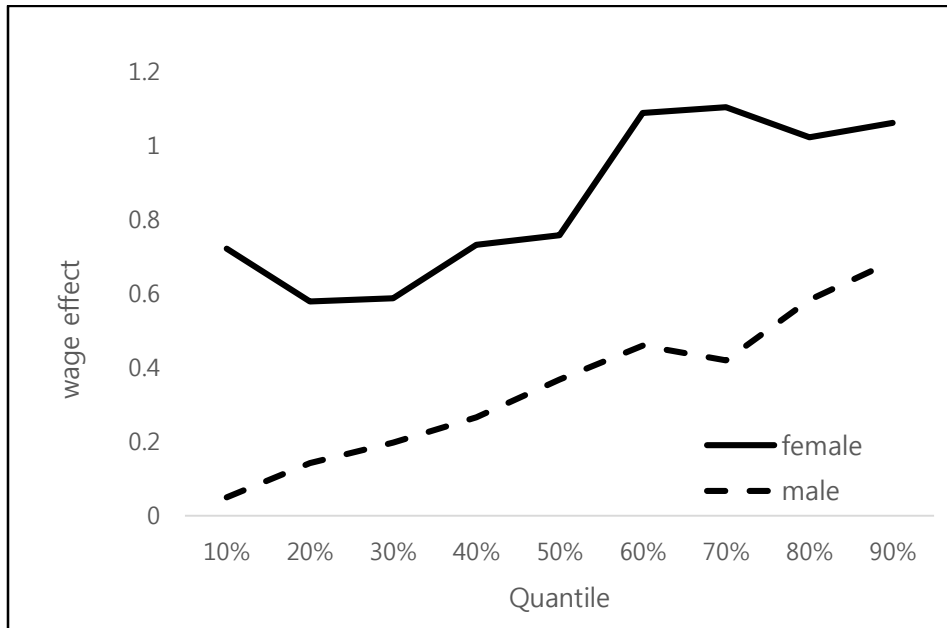


Figure 1. Wage effect of higher education

Considering the above observation, to alleviate such inequality between, and within the gender group, we can think of two policies. First is social support for the working mom. If female workers do not have to leave their job, undervaluation problem can partly resolved. Second is to support the higher education of female worker. As we can see from figure 1, higher education is more valued for female than for male. It means that the demand for highly educated female labor is not met. Therefore, it is clear that such policy can alleviate the inequality problem between the genders. The vision of labor policy is not only to solve the between group inequality, but to narrow the within group gap. Therefore, in order to evaluate labor policy, it is necessary to take the both aspects into account.

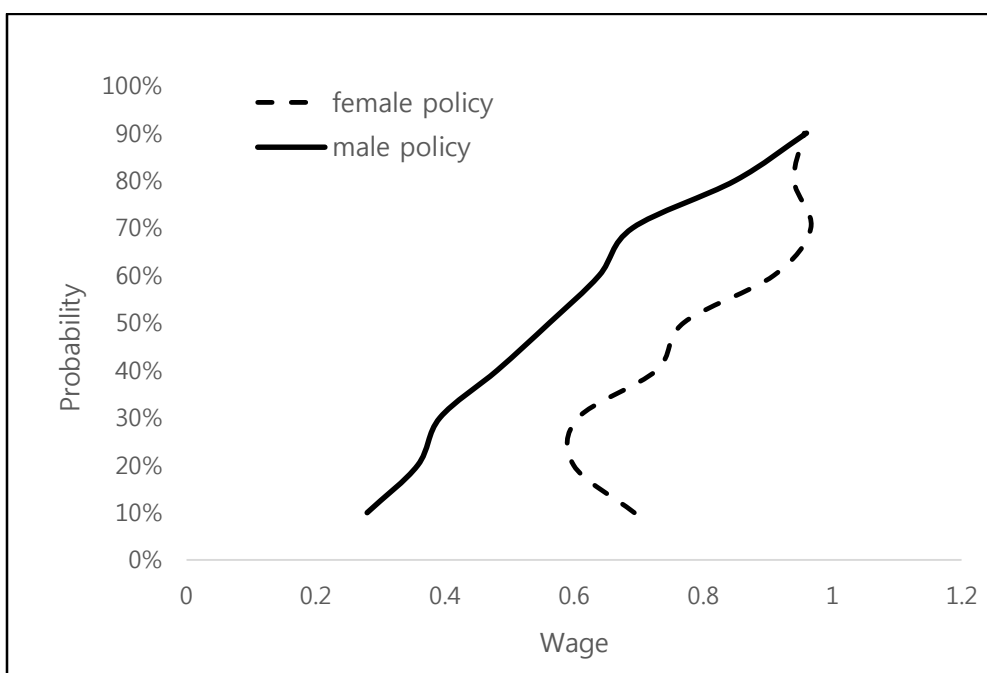


Figure 2. Marginal effect of policy implementation on wage distribution

Here, we can justify the dominance of policy that supports higher education of female over the policy that supports higher education of male.

Let there be a policy maker who is reviewing several policy proposals to enhance labor income level and alleviate the income polarization. Suppose that two proposals are under review: increasing 15% of highly educated male labor, increasing 15% of highly educated female labor ( $P_{\text{female}}$ ). Denote two proposals as  $P_{\text{male}}$  and  $P_{\text{female}}$  respectively. What is supposed to be done before making a choice between them is to order  $P_{\text{male}}$  and  $P_{\text{female}}$  according to the policy maker's preference. Recall the policy objectives i) enhancement of overall labor income ii) alleviation of income polarization. The resulting marginal effect is presented in figure 2. At first glance, an

evident characteristic is the dominance of wage effect of female over the wage effect of male. This implies that the marginal increment in the proportion of highly educated female labor will cause bigger effect in overall income level compared to the case when such changes are made to the male labor. From this observation, we can derive the ordering  $P_{\text{male}} < P_{\text{female}}$ , in accordance to the first policy objective.

Secondly, the wage effect of high education of male labor tends to increase in the quantile value. i.e. higher the income, higher the premium of high education. On the other hand, the wage effect for the female labor tends to uniform over whole quantile. From this observation, we can induce that  $P_{\text{male}}$  can possibly worsen the income polarization while  $P_{\text{female}}$  does not. Therefore, we can conclude that  $P_{\text{male}} < P_{\text{female}}$ .

Furthermore, we can take into account the effect of externality that uplift the gross projection of economy; increased in female wage attract more female labor to the labor market.

## 4 Conclusion

So far, we have gone through statistical analysis on inequality between and within the genders by using KLIPS data and derived policy implication from female's higher education. As mentioned in the first section of this paper, however, such policy implication is not the only subject matter of this study. The statistical and analytical framework itself deserves attention. We can summarize the finding and implication into three keywords: counterfactual analysis, decomposition of effect, and CQR.

Counterfactual and decomposition analysis based on QR allows us to answer the policy question on the distribution of wage or wealth. However, by using KLIPS data, we found that the counterfactual and decomposition analysis based on QR is distortive if censoring structure is present in the model. Eventually, because of such distortion, QR underestimates the wage effect of productivity enhancement caused by education and experience. Also, we found that such distortion is severe at the lower quantile. As for the solution to this problem, this study suggests using the CQR based analysis.

The limitation of this study is the limited scope in the alternative regression method that is contrasted to CQR. For example, distribution regression technique is an alternative way of formulating this problem. However, since the cost of computation of CQR is far smaller than the distribution regression method, and the difference is reported to be not that significant<sup>4</sup> the result of this study can be practically useful to the researchers in the field of gender study.

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<sup>4</sup> Refer Chernozhukov et al. 2013

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## Appendix A: Tables

	Year 2000		Year 2008	
	Male	Female	Male	Female
Number of obs.	1867	1154	2169	1433
Hourly wage <sup>1</sup>	8.46 (6.39)	5.4 (3.47)	13.31 (12.35)	7.85 (5.06)
Capital	26.62%	27.64%	22.64%	24.84%
Potential experience	20.78 (11.52)	17.92 (13.82)	21.27 (11.37)	20.26 (13.16)
Marital status	72.68%	52.77%	71.23%	59.94%
Labor union	28.55%	17.59%	24.71%	15.56%
Under high school	19.34%	27.99%	11.43%	19.26%
High school	43.06%	40.12%	33.84%	33.85%
College(2yrs)	12.64%	14.12%	19.5%	21.28%
College(4yrs) or post graduate	24.96%	17.76%	35.22%	25.61%
Manufacturing	32.78%	27.12%	30.71%	20.24%
Construction	12.32%	1.91%	8.58%	1.61%
Wholesale and retail trade	8.89%	13.08%	10.97%	14.38%
Lodging	2.95%	9.62%	2.72%	10.26%
Transportation	7.23%	1.65%	6.32%	1.61%
Networking	2.04%	1.56%	2.12%	1.54%
Finance-Insurance	4.07%	6.41%	3.78%	4.19%
Business service	7.61%	6.24%	12.45%	8.03%
Public administration-Military service.	7.23%	4.68%	5.76%	3.28%
Education	6.48%	13.34%	6.04%	15.56%
Social welfare	1.23%	6.59%	1.57%	9.63%
Entertainment-Personal service	4.93%	6.93%	6.09%	7.96%
Etc(Infrastructure, Lease)	2.25%	0.87%	2.9%	1.74%
Unskilled	29.03%	19.06%	24.02%	15.14%
Professional	8.25%	14.56%	13.69%	16.26%
Semiprofessional	18.53%	9.97%	18.67%	15.63%
Clerical	13.66%	24.18%	15.68%	23.73%
Service	5.03%	13.34%	5.12%	14.17%
Sales	4.18%	8.32%	4.24%	9%
Skilled	21.32%	10.57%	18.58%	6.07%

A.Table. 1. Summary Statistics

<sup>1</sup> Unit : 1,000 won

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	1.188 (0.322)	1.328 (0.313)	1.521 (0.355)	1.668 (0.31)	1.54 (0.338)	1.987 (0.367)	2.572 (0.381)	2.501 (0.337)	3.102 (0.592)
	Seoul	0.243*** (0.171)	0.28*** (0.201)	0.367* (0.184)	0.333** (0.181)	0.342*** (0.221)	0.318*** (0.239)	0.399*** (0.271)	0.259*** (0.338)	0.407*** (0.53)
	Potential experience	0.174 (0.031)	0.224 (0.028)	0.25 (0.032)	0.278 (0.032)	0.322 (0.034)	0.34 (0.033)	0.342 (0.039)	0.435 (0.042)	0.399 (0.07)
	Potential experience^2	-0.003*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.007*** (0.001)	-0.006*** (0.001)
	Marital status	0.671 (0.188)	0.988 (0.201)	1.028 (0.205)	1.095 (0.219)	0.931 (0.249)	0.777 (0.25)	0.967 (0.287)	0.817* (0.352)	1.314* (0.519)
	Labor union	0.744 (0.209)	0.792 (0.212)	0.848 (0.227)	1.087 (0.247)	1.31 (0.249)	1.29 (0.263)	1.409 (0.298)	1.672 (0.338)	2.318 (0.556)
Education	Below high school	-0.671*** (0.246)	-0.761*** (0.176)	-0.807*** (0.195)	-1.035*** (0.205)	-1.18*** (0.206)	-1.603*** (0.268)	-1.741*** (0.307)	-1.797*** (0.407)	-1.277*** (0.656)
	High school									
	College(2yrs)	-0.139*** (0.232)	0.444*** (0.294)	0.44** (0.227)	0.418** (0.237)	0.534* (0.27)	0.503*** (0.32)	0.607** (0.354)	0.654*** (0.38)	0.491*** (0.723)
	College(4yrs) or post graduate	1.484 (0.289)	1.513 (0.296)	1.883 (0.282)	1.969 (0.339)	2.273 (0.344)	2.386 (0.36)	2.856 (0.394)	3.265 (0.581)	3.641 (0.778)
Industry	Manufacturing									
	Construction	-0.675*** (0.208)	-0.679*** (0.204)	-1.053*** (0.22)	-0.981*** (0.227)	-0.883*** (0.205)	-1.048*** (0.264)	-1.093*** (0.367)	-0.967*** (0.369)	-1.217*** (0.559)
	Wholesale and retail trade	-0.028*** (0.341)	-0.274*** (0.306)	-0.627*** (0.25)	-0.859*** (0.276)	-0.583*** (0.308)	-0.881*** (0.329)	-1.129*** (0.462)	-1.189*** (0.56)	0.261*** (1.409)
	Lodging	-0.658*** (0.377)	-0.921*** (0.467)	-1.433*** (0.545)	-1.006*** (0.693)	-0.755*** (0.707)	-1.232*** (0.666)	-0.968*** (0.589)	-1.299*** (0.785)	-1.554*** (1.516)
	Transportation	-1.332*** (0.447)	-1.247*** (0.331)	-1.508*** (0.294)	-1.456*** (0.304)	-1.449*** (0.325)	-1.512*** (0.388)	-1.474*** (0.411)	-1.92*** (0.594)	-1.403*** (0.879)
	Networking	-0.185*** (0.614)	-0.54*** (0.533)	-0.755*** (0.746)	0.077*** (0.744)	-0.371*** (0.65)	-0.839*** (0.788)	-0.413*** (1.111)	0.319*** (1.397)	-0.664*** (1.213)
	Finance-Insurance	0.535*** (0.768)	1.13* (0.569)	0.572*** (0.409)	0.786*** (0.668)	1.533** (0.833)	2.056* (0.815)	2.308 (0.833)	1.884 (0.726)	1.246*** (1.071)
	Business service	-0.587*** (0.392)	-0.879*** (0.355)	-1.009*** (0.351)	-0.863*** (0.349)	-0.616*** (0.414)	-0.492*** (0.483)	-0.008*** (0.518)	-0.248*** (0.573)	0.257*** (0.895)
	Public admin-Military service.	-0.085*** (0.415)	0.02*** (0.291)	-0.312*** (0.329)	0.084*** (0.424)	0.487*** (0.465)	0.365*** (0.444)	0.285*** (0.474)	-0.25*** (0.629)	-0.053*** (1.136)
	Education	-0.148*** (0.351)	-0.421*** (0.575)	-0.468*** (0.708)	-0.177*** (0.759)	-0.331*** (0.831)	-0.123*** (0.697)	-0.025*** (0.72)	0.098*** (1.17)	0.169*** (1.285)
	Social welfare	0.097*** (0.929)	-0.844*** (0.548)	-1.13*** (0.6)	-0.693*** (0.862)	-1.092*** (1.171)	-1.035*** (1.625)	0.447*** (1.68)	0.81*** (2.25)	0.116*** (9.124)
	Entertainment-Personal service	-1.024*** (0.286)	-1.035*** (0.287)	-1.177*** (0.319)	-1.065*** (0.283)	-1.024*** (0.349)	-1.108*** (0.397)	-1.221*** (0.457)	-1.054*** (0.571)	-1.164*** (0.871)
	Etc(Infrastructure, Lease)	-0.735*** (0.639)	-0.5*** (0.654)	-0.477*** (0.492)	-0.342*** (0.505)	-0.087*** (0.705)	0.264*** (0.906)	0.274*** (0.874)	0.687*** (0.989)	0.856*** (1.262)
Job	Unskilled									
	Professional	2.378 (0.446)	3.387 (0.61)	3.63 (0.572)	3.623 (0.667)	4.148 (0.625)	4.072 (0.532)	3.502 (0.641)	5.182 (1.166)	7.438 (1.868)
	Semiprofessional	1.278 (0.3)	1.91 (0.358)	2.2 (0.293)	2.208 (0.295)	2.43 (0.331)	2.827 (0.329)	2.693 (0.395)	3.292 (0.542)	4.648 (0.907)
	Clerical	1.268 (0.315)	1.177 (0.251)	1.295 (0.281)	1.311 (0.3)	1.381 (0.354)	1.679 (0.394)	1.556 (0.448)	1.829 (0.443)	2.319 (0.737)
	Service	1.069 (0.379)	0.815** (0.442)	1.082* (0.47)	1.271* (0.618)	1.162** (0.701)	1.59* (0.641)	1.396* (0.638)	1.893* (0.842)	2.937*** (1.85)
	Sales	-0.094*** (0.596)	0.386*** (0.437)	0.331*** (0.344)	0.813* (0.36)	0.696** (0.396)	0.783* (0.398)	0.68*** (0.52)	0.71*** (0.635)	0.281*** (1.368)
	Skilled	0.919 (0.22)	0.679 (0.189)	0.809 (0.204)	0.776 (0.182)	1.103 (0.204)	1.14 (0.235)	1.302 (0.269)	1.298 (0.328)	1.718 (0.421)

Note: \*, \*\*, \*\*\* means p value of 90%,95%,99% respectively, and the value in () is standard deviation computed by using bootstrap.

A.Table. 2. Result of estimation Male 03<sup>rd</sup> (2000) QR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	-0.535*** (0.756)	-0.665*** (0.673)	0.433*** (0.648)	1.245* (0.519)	0.968** (0.5)	1.552 (0.486)	2.351 (0.536)	2.307 (0.514)	3.1 (0.652)
	Seoul	0.469* (0.239)	0.313*** (0.25)	0.419* (0.209)	0.299*** (0.201)	0.379** (0.221)	0.254*** (0.256)	0.402*** (0.279)	0.155*** (0.36)	0.409*** (0.556)
	Potential experience	0.276 (0.061)	0.365 (0.06)	0.353 (0.051)	0.324 (0.045)	0.378 (0.05)	0.365 (0.045)	0.353 (0.047)	0.441 (0.054)	0.399 (0.075)
	Potential experience^2	-0.005*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.006*** (0.001)	-0.007*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.007*** (0.001)	-0.006*** (0.002)
	Marital status	0.882 (0.286)	1.064 (0.259)	0.98 (0.231)	1.076 (0.242)	0.864 (0.289)	0.816 (0.276)	0.945 (0.289)	0.882* (0.347)	1.312* (0.516)
	Labor union	0.869 (0.23)	0.87 (0.272)	0.918 (0.247)	0.984 (0.261)	1.417 (0.265)	1.384 (0.261)	1.445 (0.297)	1.607 (0.333)	2.318 (0.545)
Education	Below high school	-1.296*** (0.325)	-0.866*** (0.234)	-0.963*** (0.199)	-1.165*** (0.192)	-1.289*** (0.208)	-1.712*** (0.259)	-1.994*** (0.321)	-2.157*** (0.495)	-1.275*** (0.713)
	High school									
	College(2yrs)	-0.13*** (0.353)	0.666** (0.373)	0.44** (0.267)	0.539** (0.294)	0.691* (0.296)	0.481*** (0.317)	0.507*** (0.372)	0.769* (0.392)	0.491*** (0.713)
	College(4yrs) or post graduate	1.667 (0.304)	1.819 (0.308)	1.825 (0.276)	2.142 (0.346)	2.273 (0.355)	2.418 (0.352)	2.922 (0.418)	3.326 (0.581)	3.643 (0.778)
Industry	Manufacturing									
	Construction	-1.024*** (0.314)	-0.794*** (0.273)	-1.216*** (0.246)	-1.368*** (0.257)	-1.041*** (0.221)	-1.105*** (0.281)	-0.938*** (0.39)	-1.042*** (0.383)	-1.215*** (0.591)
	Wholesale and retail trade	0.255*** (0.475)	0.046*** (0.365)	-0.578*** (0.317)	-0.856*** (0.321)	-0.441*** (0.353)	-0.843*** (0.36)	-1.004*** (0.499)	-1.187*** (0.548)	0.263*** (1.437)
	Lodging	-1.114*** (0.69)	-1.235*** (0.551)	-1.703*** (0.578)	-2.284*** (0.799)	-1.161*** (0.891)	-1.356*** (0.718)	-1.308*** (0.691)	-1.962*** (0.929)	-1.697*** (1.851)
	Transportation	-2.125*** (0.814)	-1.268*** (0.692)	-1.335*** (0.383)	-1.469*** (0.333)	-1.638*** (0.348)	-1.49*** (0.396)	-1.443*** (0.412)	-1.931*** (0.578)	-1.401*** (0.879)
	Networking	-0.12*** (0.911)	-0.067*** (0.7)	-0.428*** (0.723)	0.106*** (0.712)	-0.349*** (0.674)	-0.679*** (0.751)	-0.532*** (1.119)	0.195*** (1.376)	-0.66*** (1.184)
	Finance-Insurance	1.014*** (0.857)	1.285* (0.554)	0.836** (0.455)	0.785*** (0.688)	1.371** (0.784)	1.946* (0.843)	2.294 (0.856)	1.867 (0.714)	1.25*** (1.039)
	Business service	-0.464*** (0.517)	-0.541*** (0.452)	-0.808*** (0.434)	-0.828*** (0.423)	-0.401*** (0.405)	-0.499*** (0.487)	0.166*** (0.558)	-0.213*** (0.59)	0.26*** (0.862)
	Public admin-Military service.	-0.271*** (0.484)	0.173*** (0.446)	-0.152*** (0.369)	-0.149*** (0.412)	0.513*** (0.497)	0.322*** (0.445)	0.131*** (0.503)	-0.627*** (0.627)	-0.051*** (1.113)
	Education	0.253*** (0.465)	-0.199*** (0.677)	-0.278*** (0.687)	-0.547*** (0.822)	-0.715*** (0.898)	-0.02*** (0.733)	-0.008*** (0.748)	-0.184*** (1.186)	0.172*** (1.322)
	Social welfare	0.537*** (1.227)	-0.326*** (0.567)	-0.891*** (0.639)	-1.553*** (0.895)	-1.112*** (1.16)	-0.882*** (1.615)	0.348*** (1.731)	0.772*** (2.258)	0.116*** (9.128)
	Entertainment-Personal service	-0.926*** (0.498)	-0.663*** (0.357)	-1.201*** (0.419)	-1.183*** (0.357)	-0.931*** (0.346)	-1.231*** (0.4)	-1.162*** (0.495)	-0.851*** (0.603)	-1.162*** (0.862)
	Etc(Infrastructure, Lease)	-0.364*** (0.924)	-0.355*** (0.642)	-0.473*** (0.571)	-0.448*** (0.598)	-0.3*** (0.761)	-0.395*** (0.945)	0.494*** (1.025)	0.629*** (1.07)	0.858*** (1.296)
Job	Unskilled									
	Professional	2.62 (0.555)	3.063 (0.623)	3.695 (0.57)	3.716 (0.692)	4.425 (0.678)	3.993 (0.545)	3.574 (0.607)	5.118 (1.114)	7.434 (1.843)
	Semiprofessional	1.791 (0.447)	2.144 (0.414)	2.27 (0.349)	2.177 (0.316)	2.352 (0.342)	2.927 (0.325)	2.738 (0.433)	3.32 (0.508)	4.644 (0.903)
	Clerical	1.766 (0.393)	1.265 (0.356)	1.524 (0.358)	1.366 (0.308)	1.392 (0.364)	1.828 (0.4)	1.678 (0.471)	2.021 (0.436)	2.319 (0.739)
	Service	1.317* (0.598)	0.819*** (0.506)	1.063** (0.575)	1.494* (0.626)	1.425** (0.744)	1.967 (0.652)	1.545* (0.705)	2.526* (0.984)	2.939*** (1.978)
	Sales	-0.387*** (1.534)	0.414*** (0.68)	0.553*** (0.448)	0.816* (0.384)	0.534*** (0.452)	0.964* (0.457)	0.776*** (0.555)	0.523*** (0.65)	0.279*** (1.432)
	Skilled	1.449 (0.375)	0.875 (0.283)	1.073 (0.282)	0.811 (0.214)	1.101 (0.204)	1.234 (0.243)	1.395 (0.294)	1.514 (0.347)	1.717 (0.431)

A.Table. 3. Result of estimation Male 03<sup>rd</sup> (2000) CQR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	1.852 (0.273)	2.051 (0.228)	1.898 (0.206)	2.075 (0.243)	2.407 (0.262)	2.462 (0.283)	2.431 (0.349)	2.864 (0.36)	3.485 (0.392)
	Seoul	0.352* (0.175)	0.496 (0.136)	0.535 (0.108)	0.491 (0.116)	0.461 (0.117)	0.634 (0.128)	0.721 (0.191)	1.086 (0.232)	1.406 (0.445)
	Potential experience	0.066 (0.024)	0.064 (0.018)	0.084 (0.015)	0.094 (0.017)	0.102 (0.02)	0.101 (0.022)	0.123 (0.024)	0.125 (0.026)	0.138 (0.043)
	Potential experience^2	-0.001*** (0)	-0.001*** (0)	-0.001*** (0)	-0.001*** (0)	-0.002*** (0)	-0.002*** (0)	-0.002*** (0)	-0.002*** (0)	-0.002*** (0.001)
	Marital status	0.029*** (0.208)	0.224** (0.127)	0.19*** (0.118)	0.168*** (0.12)	0.242** (0.129)	0.446 (0.158)	0.499 (0.155)	0.709 (0.213)	0.88* (0.345)
	Labor union	0.514 (0.167)	0.604 (0.149)	0.559 (0.157)	0.69 (0.181)	0.735 (0.164)	0.732 (0.188)	0.881 (0.237)	1.184* (0.463)	1.299* (0.525)
Education	Below high school	-0.256*** (0.203)	-0.37*** (0.164)	-0.368*** (0.146)	-0.488*** (0.18)	-0.814*** (0.179)	-0.969*** (0.253)	-1.338*** (0.296)	-1.607*** (0.396)	-1.891*** (0.782)
	High school									
	College(2yrs)	0.359** (0.197)	0.225*** (0.181)	0.479* (0.204)	0.368** (0.204)	0.344*** (0.233)	0.501** (0.26)	0.758* (0.355)	0.998* (0.391)	0.853** (0.505)
	College(4yrs) or post graduate	1.318 (0.397)	1.44 (0.227)	1.435 (0.21)	1.825 (0.255)	1.854 (0.294)	1.697 (0.399)	1.827 (0.511)	2.256 (0.535)	2.181* (0.903)
Industry	Manufacturing									
	Construction	0.561*** (0.439)	0.468** (0.249)	0.233*** (0.278)	0.143*** (0.293)	0.142*** (0.302)	0.065*** (0.459)	0.445*** (0.574)	0.229*** (0.729)	1.127*** (0.738)
	Wholesale and retail trade	-0.38*** (0.236)	-0.59*** (0.231)	-0.642*** (0.231)	-0.765*** (0.234)	-0.949*** (0.271)	-0.629*** (0.289)	-0.78*** (0.362)	-0.99*** (0.499)	-0.113*** (1.13)
	Lodging	-0.128*** (0.23)	-0.359*** (0.169)	-0.376*** (0.139)	-0.498*** (0.193)	-0.52*** (0.226)	-0.513*** (0.249)	-0.636*** (0.32)	-0.664*** (0.438)	-0.032*** (0.711)
	Transportation	-0.566*** (0.504)	-0.953*** (0.469)	-0.287*** (0.514)	-0.286*** (0.645)	-0.14*** (0.857)	0.902*** (0.874)	0.805*** (0.736)	0.388*** (2.064)	0.818*** (3.712)
	Networking	-1.009*** (0.869)	0.109*** (0.75)	-0.026*** (0.799)	0.839*** (0.76)	0.644*** (0.636)	0.603*** (0.814)	0.99*** (1.271)	1.598*** (1.837)	3.078*** (3.705)
	Finance-Insurance	0.691** (0.363)	0.768* (0.331)	0.857 (0.317)	0.789* (0.325)	0.781 (0.29)	0.888** (0.507)	1.219*** (0.912)	2.717 (0.842)	2.381 (0.775)
	Business service	-0.162*** (0.326)	-0.2*** (0.25)	-0.02*** (0.319)	-0.003*** (0.263)	-0.035*** (0.202)	-0.05*** (0.25)	-0.212*** (0.287)	-0.546*** (0.403)	-0.469*** (0.56)
	Public admin-Military service.	-0.17*** (0.512)	0.228*** (0.364)	0.399*** (0.261)	0.406*** (0.283)	0.479*** (0.318)	0.84* (0.352)	0.681*** (0.481)	0.45*** (0.811)	1.499*** (1.248)
	Education	0.844* (0.359)	0.566* (0.225)	0.488** (0.262)	0.239*** (0.341)	0.245*** (0.384)	0.599*** (0.417)	0.109*** (0.489)	0.243*** (0.594)	0.152*** (0.965)
	Social welfare	0.157*** (0.375)	0.16*** (0.356)	0.036*** (0.36)	-0.058*** (0.349)	0.114*** (0.322)	0.019*** (0.36)	0.194*** (0.462)	-0.021*** (0.499)	0.269*** (0.767)
	Entertainment-Personal service	-0.479*** (0.346)	-0.431*** (0.259)	-0.143*** (0.21)	-0.18*** (0.211)	-0.149*** (0.231)	-0.133*** (0.267)	-0.036*** (0.332)	0.003*** (0.473)	0.473*** (1.06)
	Etc(Infrastructure, Lease)	-1.212*** (0.591)	-1.132*** (0.799)	-1.01*** (1.042)	-0.125*** (1.171)	0.358*** (1.121)	0.476*** (1.032)	0.824*** (0.912)	0.6*** (0.757)	0.204*** (0.655)
Job	Unskilled									
	Professional	0.567*** (0.391)	1.182 (0.325)	1.879 (0.361)	2.397 (0.375)	2.445 (0.438)	2.811 (0.579)	3.85 (0.791)	4.008 (0.789)	5.172 (1.279)
	Semiprofessional	0.205*** (0.317)	0.715 (0.253)	1.146 (0.308)	1.474 (0.349)	1.576 (0.336)	1.578 (0.345)	2.04 (0.505)	2.09* (0.815)	3.458 (1.037)
	Clerical	0.654 (0.234)	0.76 (0.177)	1.115 (0.223)	1.231 (0.217)	1.178 (0.22)	1.234 (0.23)	1.574 (0.306)	1.624 (0.355)	1.324 (0.409)
	Service	-0.063*** (0.229)	0.228*** (0.174)	0.341* (0.17)	0.375* (0.183)	0.297*** (0.216)	0.407*** (0.249)	0.551*** (0.31)	0.333*** (0.423)	-0.202*** (0.637)
	Sales	0.564** (0.293)	0.906 (0.279)	1.185 (0.254)	1.235 (0.244)	1.259 (0.336)	1.22 (0.374)	1.377 (0.412)	1.393 (0.538)	0.665*** (1.025)
	Skilled	0.049*** (0.209)	0.165*** (0.182)	0.403 (0.145)	0.24*** (0.163)	0.271*** (0.181)	0.465* (0.192)	0.686 (0.227)	0.509*** (0.372)	1.118*** (0.765)

A.Table. 4. Result of estimation Female 03<sup>rd</sup> (2000) QR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	-0.192*** (1.084)	0.915*** (0.589)	1.125* (0.52)	1.27* (0.542)	1.909 (0.524)	2.007 (0.556)	1.668 (0.604)	2.382 (0.579)	3.346 (0.468)
	Seoul	0.459*** (0.367)	0.536* (0.217)	0.626 (0.158)	0.648 (0.156)	0.485 (0.141)	0.613 (0.15)	0.817 (0.2)	1.16 (0.255)	1.391 (0.443)
	Potential experience	0.107*** (0.07)	0.13 (0.044)	0.139 (0.038)	0.145 (0.034)	0.147 (0.035)	0.147 (0.036)	0.17 (0.035)	0.162 (0.035)	0.148 (0.051)
	Potential experience^2	-0.002*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.003*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
	Marital status	0.696*** (0.429)	0.593* (0.274)	0.291*** (0.229)	0.242*** (0.181)	0.136*** (0.186)	0.341*** (0.221)	0.583 (0.215)	0.732 (0.247)	1.004 (0.374)
	Labor union	1 (0.364)	0.758 (0.227)	0.614 (0.188)	0.901 (0.207)	0.836 (0.191)	0.874 (0.245)	1.043 (0.274)	0.919* (0.444)	1.314* (0.528)
Education	Below high school	-0.505*** (0.591)	-0.206*** (0.324)	-0.288*** (0.214)	-0.379*** (0.231)	-0.814*** (0.235)	-1.048*** (0.285)	-1.268*** (0.345)	-1.903*** (0.453)	-2.027*** (0.95)
	High school									
	College(2yrs)	0.805** (0.463)	0.676* (0.3)	0.676* (0.298)	0.661* (0.293)	0.523** (0.287)	0.512*** (0.311)	0.903* (0.375)	1.047 (0.399)	0.867** (0.526)
	College(4yrs) or post graduate	1.733 (0.572)	1.677 (0.332)	1.69 (0.283)	1.921 (0.25)	2.096 (0.318)	1.706 (0.417)	2.026 (0.48)	2.175 (0.539)	2.126* (0.88)
Industry	Manufacturing									
	Construction	0.841*** (0.746)	0.397*** (0.431)	0.201*** (0.348)	0.287*** (0.351)	0.089*** (0.415)	-0.138*** (0.534)	0.27*** (0.683)	0.461*** (0.864)	1.333** (0.788)
	Wholesale and retail trade	-0.415*** (0.728)	-0.596*** (0.417)	-0.703*** (0.33)	-0.561*** (0.286)	-0.998*** (0.312)	-0.739*** (0.332)	-0.737*** (0.401)	-0.447*** (0.576)	-0.052*** (1.111)
	Lodging	0.108*** (1.113)	-1.148*** (0.638)	-0.576*** (0.42)	-0.559*** (0.27)	-0.479*** (0.327)	-0.457*** (0.351)	-0.549*** (0.383)	-0.358*** (0.527)	0.145*** (0.814)
	Transportation	0.02*** (2.108)	-0.535*** (0.916)	-0.403*** (0.547)	-0.414*** (0.855)	0.361*** (1.019)	1.012*** (0.956)	1.081*** (0.825)	0.914*** (1.992)	0.875*** (3.787)
	Networking	0.408*** (1.534)	0.34*** (0.71)	-0.113*** (0.732)	0.509*** (0.68)	0.465*** (0.65)	0.349*** (0.845)	0.685*** (1.223)	1.708*** (1.786)	2.992*** (3.711)
	Finance-Insurance	0.964*** (0.645)	0.872* (0.399)	0.899 (0.298)	0.812* (0.317)	0.827* (0.327)	0.892** (0.49)	1.248*** (0.864)	3.055 (0.859)	2.457 (0.785)
	Business service	0.903*** (0.659)	-0.248*** (0.395)	0.077*** (0.397)	0.387*** (0.318)	0.035*** (0.254)	0.099*** (0.296)	-0.093*** (0.346)	-0.126*** (0.496)	-0.365*** (0.584)
	Public admin-Military service.	-0.194*** (1.024)	-0.32*** (0.728)	0.576*** (0.479)	0.482*** (0.352)	0.561*** (0.37)	0.887* (0.403)	0.95* (0.481)	0.967*** (0.774)	1.575*** (1.157)
	Education	1.293* (0.615)	0.421*** (0.38)	0.385*** (0.319)	0.443*** (0.332)	0.204*** (0.372)	0.665*** (0.432)	0.347*** (0.517)	0.357*** (0.607)	0.161*** (0.989)
	Social welfare	0.653*** (0.929)	0.101*** (0.419)	0.246*** (0.389)	0.065*** (0.4)	0.083*** (0.391)	0.169*** (0.427)	0.327*** (0.487)	0.267*** (0.54)	0.492*** (0.796)
	Entertainment-Personal service	-0.045*** (1.138)	-0.482*** (0.562)	-0.355*** (0.383)	-0.162*** (0.338)	-0.254*** (0.308)	-0.08*** (0.321)	0.043*** (0.408)	0.417*** (0.56)	0.348*** (1.067)
	Etc(Infrastructure, Lease)	-0.625*** (1.719)	-1.717*** (1.64)	-1.966*** (1.769)	-0.785*** (1.627)	0.384*** (1.227)	0.591*** (0.935)	1.014*** (0.968)	0.776*** (0.749)	0.058*** (0.707)
Job	Unskilled									
	Professional	1.084*** (0.929)	1.651 (0.497)	2.081 (0.436)	2.413 (0.432)	2.511 (0.442)	2.879 (0.612)	3.822 (0.755)	4.093 (0.812)	5.063 (1.284)
	Semiprofessional	0.777*** (0.745)	1.031* (0.477)	1.508 (0.418)	1.471 (0.412)	1.568 (0.354)	1.699 (0.387)	2.106 (0.543)	1.85* (0.838)	3.262 (1.042)
	Clerical	1.436** (0.826)	1.34 (0.397)	1.415 (0.359)	1.426 (0.386)	1.302 (0.338)	1.429 (0.337)	1.911 (0.398)	1.469 (0.431)	1.369 (0.445)
	Service	-0.857*** (1.284)	0.302*** (0.584)	0.61*** (0.377)	0.475** (0.282)	0.274*** (0.318)	0.351*** (0.364)	0.46*** (0.347)	0.229*** (0.498)	-0.482*** (0.721)
	Sales	1.391*** (0.969)	1.093* (0.464)	1.317 (0.365)	1.325 (0.328)	1.482 (0.397)	1.503 (0.431)	1.747 (0.461)	0.985** (0.566)	0.57*** (1.03)
	Skilled	0.602*** (0.692)	0.227*** (0.342)	0.466* (0.211)	0.408** (0.213)	0.364** (0.212)	0.649 (0.214)	0.601* (0.251)	1.002* (0.431)	1.109*** (0.755)

A.Table. 5. Result of estimation Female 03<sup>rd</sup> (2000) CQR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	1.49 (0.493)	1.638 (0.57)	1.863 (0.545)	1.662 (0.487)	2.195 (0.574)	2.015 (0.654)	2.355 (0.629)	2.074 (0.649)	2.512 (0.945)
	Seoul	-0.075*** (0.29)	0.053*** (0.296)	-0.096*** (0.341)	0.177*** (0.33)	0.335*** (0.316)	0.426*** (0.337)	0.293*** (0.379)	0.574*** (0.448)	0.073*** (0.625)
	Potential experience	0.234 (0.042)	0.315 (0.043)	0.356 (0.038)	0.43 (0.035)	0.433 (0.044)	0.497 (0.053)	0.574 (0.061)	0.705 (0.075)	0.824 (0.091)
	Potential experience^2	-0.005*** (0.001)	-0.006*** (0.001)	-0.007*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)	-0.011*** (0.001)	-0.013*** (0.002)
	Marital status	1.63 (0.284)	1.867 (0.318)	2.095 (0.259)	2.249 (0.218)	2.181 (0.292)	2.286 (0.349)	2.408 (0.401)	2.625 (0.466)	3.19 (0.652)
	Labor union	3.548 (0.371)	3.596 (0.401)	3.821 (0.375)	4.009 (0.451)	4.395 (0.436)	5.021 (0.528)	5.359 (0.643)	5.771 (0.621)	7.081 (0.895)
Education	Below high school	0.042*** (0.335)	-0.479*** (0.375)	-0.51*** (0.392)	-0.788*** (0.338)	-1.37*** (0.364)	-1.809*** (0.517)	-2.676*** (0.604)	-3.547*** (0.516)	-4.124*** (0.773)
	High school									
	College(2yrs)	0.851* (0.389)	1.245 (0.371)	1.039 (0.31)	1.105 (0.267)	0.974 (0.318)	1.238 (0.384)	0.873* (0.382)	0.944* (0.406)	1.431* (0.663)
	College(4yrs) or post graduate	1.708 (0.265)	2.285 (0.39)	2.282 (0.378)	2.943 (0.436)	3.412 (0.456)	4.148 (0.468)	4.166 (0.499)	5.181 (0.652)	6.164 (0.956)
Industry	Manufacturing									
	Construction	-0.221*** (0.386)	-0.356*** (0.396)	-0.52*** (0.343)	-0.653*** (0.37)	-0.566*** (0.352)	-0.891*** (0.418)	-1.043*** (0.494)	-1.421*** (0.479)	-2.327*** (0.665)
	Wholesale and retail trade	-1.094*** (0.562)	-1.46*** (0.524)	-1.052*** (0.504)	-1.176*** (0.448)	-0.943*** (0.444)	-1*** (0.504)	-0.973*** (0.714)	-0.923*** (0.727)	-0.265*** (0.968)
	Lodging	-1.776*** (0.576)	-2.389*** (0.735)	-3.042*** (0.924)	-3.197*** (0.707)	-3.763*** (0.945)	-4.038*** (1.181)	-3.86*** (1.264)	-3.182*** (1.636)	-2.26*** (1.41)
	Transportation	-3.538*** (0.833)	-3.597*** (0.513)	-3.206*** (0.579)	-3.355*** (0.534)	-3.255*** (0.544)	-3.158*** (0.584)	-3.561*** (0.921)	-2.699*** (0.837)	-2.076*** (1.193)
	Networking	-1.989*** (0.675)	-2.581*** (0.582)	-2.952*** (0.713)	-2.377*** (0.925)	-2.308*** (1.083)	-2.524*** (1.494)	-1.498*** (1.776)	-0.672*** (2.605)	1.831*** (4.538)
	Finance-Insurance	-0.087*** (0.932)	1.339*** (1.575)	4.638* (2.138)	5.199 (1.141)	4.766 (1.003)	4.893 (1.233)	4.606 (1.683)	6.997 (2.351)	7.656 (2.026)
	Business service	-0.713*** (0.465)	-1.087*** (0.489)	-1.113*** (0.418)	-1.357*** (0.34)	-1.509*** (0.419)	-1.299*** (0.517)	-1.669*** (0.502)	-1.729*** (0.6)	-1.772*** (0.957)
	Public admin-Military service.	0.34*** (0.654)	0.457*** (0.765)	0.807*** (0.7)	0.777*** (0.458)	0.384*** (0.665)	0.525*** (0.761)	-0.209*** (0.912)	-0.943*** (1.049)	-1.582*** (1.163)
	Education	-0.596*** (0.8)	-0.659*** (0.548)	-1.312*** (0.476)	-1.37*** (0.788)	-0.569*** (0.729)	-1.241*** (1.093)	-1.163*** (1.429)	-0.224*** (1.698)	2.361*** (2.852)
	Social welfare	-0.822*** (0.734)	-1.345*** (0.883)	-1.019*** (0.999)	-1.084*** (0.9)	-1.071*** (0.886)	-1.491*** (0.867)	-2.395*** (1.183)	-1.602*** (2.016)	-2.174*** (3.355)
	Entertainment-Personal service	-2.217*** (0.446)	-2.525*** (0.553)	-2.348*** (0.442)	-2.516*** (0.382)	-2.393*** (0.415)	-2.753*** (0.44)	-2.667*** (0.643)	-2.589*** (0.593)	-2.981*** (0.918)
	Etc(Infrastructure, Lease)	-1.015*** (0.785)	-1.297*** (0.698)	-1.931*** (0.79)	-1.007*** (0.858)	-0.869*** (0.908)	-0.932*** (1.049)	-0.26*** (1.257)	-0.019*** (1.251)	-0.597*** (1.277)
Job	Unskilled									
	Professional	2.796 (0.548)	3.241 (0.536)	4.252 (0.545)	4.618 (0.474)	4.649 (0.595)	4.654 (0.785)	5.827 (0.881)	5.557 (0.932)	7.017 (1.487)
	Semiprofessional	2.685 (0.369)	2.629 (0.366)	3.12 (0.41)	3.042 (0.39)	3.323 (0.449)	3.77 (0.545)	4.423 (0.698)	4.164 (0.763)	3.735 (1.055)
	Clerical	1.216 (0.358)	1.266 (0.428)	1.654 (0.414)	1.613 (0.387)	1.657 (0.393)	1.882 (0.439)	2.037 (0.601)	2.056 (0.686)	1.794* (0.767)
	Service	0.726*** (0.646)	0.973*** (0.708)	2.036* (0.859)	1.826 (0.669)	2.137* (0.879)	2.597 (0.971)	2.93 (0.967)	3.62* (1.569)	4.105 (1.431)
	Sales	1.051*** (0.659)	0.881*** (0.56)	0.565*** (0.543)	0.323*** (0.478)	0.421*** (0.627)	0.77*** (0.654)	0.708*** (0.764)	0.328*** (0.862)	0.198*** (1.72)
	Skilled	1.522 (0.322)	1.24 (0.351)	1.498 (0.307)	1.313 (0.327)	1.491 (0.317)	1.843 (0.375)	1.559 (0.391)	1.435 (0.422)	1.207*** (0.786)

A.Table. 6. Result of estimation Male 11<sup>th</sup> (2008) QR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	-0.255*** (1.163)	0.161*** (0.812)	-0.506*** (1.002)	-0.527*** (0.85)	-0.116*** (0.868)	-0.027*** (0.91)	0.555*** (0.89)	0.346*** (0.808)	1.369*** (1.071)
	Seoul	-0.153*** (0.509)	0.141*** (0.404)	0.057*** (0.414)	0.308*** (0.378)	0.438*** (0.403)	0.556*** (0.388)	0.337*** (0.375)	0.583*** (0.436)	-0.431*** (0.564)
	Potential experience	0.331 (0.096)	0.398 (0.062)	0.498 (0.066)	0.552 (0.052)	0.614 (0.057)	0.66 (0.071)	0.721 (0.08)	0.856 (0.083)	0.978 (0.105)
	Potential experience^2	-0.007*** (0.002)	-0.008*** (0.001)	-0.009*** (0.001)	-0.01*** (0.001)	-0.011*** (0.001)	-0.012*** (0.001)	-0.012*** (0.002)	-0.014*** (0.002)	-0.016*** (0.002)
	Marital status	2.208 (0.507)	2.058 (0.385)	2.189 (0.325)	2.631 (0.286)	2.382 (0.372)	2.384 (0.411)	2.397 (0.421)	2.358 (0.55)	2.572 (0.665)
	Labor union	3.959 (0.408)	3.764 (0.432)	3.933 (0.417)	4.329 (0.463)	4.499 (0.479)	4.841 (0.54)	5.592 (0.614)	5.894 (0.602)	6.924 (0.847)
Education	Below high school	-0.859*** (0.593)	-1.042*** (0.446)	-1.214*** (0.47)	-1.303*** (0.495)	-1.316*** (0.415)	-1.663*** (0.513)	-2.339*** (0.747)	-3.012*** (0.544)	-4.771*** (0.765)
	High school									
	College(2yrs)	0.623*** (0.59)	1.428 (0.531)	1.419 (0.372)	1.491 (0.349)	1.305 (0.415)	1.436 (0.442)	1.37 (0.421)	1.563 (0.449)	1.412* (0.681)
	College(4yrs) or post graduate	1.865 (0.368)	2.387 (0.458)	2.615 (0.468)	3.207 (0.447)	3.746 (0.511)	4.259 (0.488)	4.603 (0.534)	5.662 (0.665)	6.397 (0.929)
Industry	Manufacturing									
	Construction	-0.398*** (0.518)	-0.547*** (0.51)	-0.747*** (0.45)	-0.899*** (0.408)	-0.841*** (0.412)	-1.041*** (0.428)	-1.156*** (0.491)	-1.533*** (0.508)	-2.388*** (0.638)
	Wholesale and retail trade	-1.953*** (0.777)	-1.864*** (0.787)	-1.578*** (0.615)	-1.45*** (0.581)	-1.155*** (0.602)	-1.159*** (0.589)	-1.119*** (0.777)	-0.76*** (0.746)	-0.431*** (0.979)
	Lodging	-2.641*** (0.917)	-4.068*** (1.1)	-4.9*** (1.351)	-5.323*** (1.345)	-5.165*** (1.391)	-5.723*** (1.431)	-6.261*** (1.554)	-6.549*** (2.136)	-4.3*** (2.141)
	Transportation	-4.524*** (1.789)	-4.043*** (1.074)	-3.426*** (0.788)	-3.723*** (0.64)	-3.982*** (0.699)	-3.921*** (0.766)	-4.308*** (1.067)	-2.784*** (1.138)	-1.681*** (1.352)
	Networking	-2.36*** (1)	-2.266*** (0.705)	-2.948*** (0.768)	-2.411*** (0.944)	-2.304*** (1.138)	-2.481*** (1.463)	-1.551*** (1.655)	-1.138*** (2.548)	0.943*** (4.504)
	Finance-Insurance	0.015*** (1.188)	0.949*** (1.398)	4.029* (1.877)	4.099 (1.125)	4.365 (1.144)	4.483 (1.244)	4.784 (1.713)	6.919 (2.252)	7.731 (1.981)
	Business service	-0.563*** (0.658)	-0.976*** (0.596)	-1.063*** (0.429)	-1.486*** (0.366)	-1.577*** (0.501)	-1.303*** (0.587)	-1.493*** (0.582)	-1.273*** (0.634)	-1.391*** (0.972)
	Public admin-Military service.	0.179*** (0.79)	0.119*** (0.834)	0.802*** (0.759)	0.523*** (0.563)	0.544*** (0.695)	0.161*** (0.741)	-0.487*** (0.896)	-0.822*** (0.989)	-1.821*** (1.217)
	Education	-1.233*** (1.04)	-0.729*** (0.651)	-1.162*** (0.612)	-1.442*** (0.663)	-1.173*** (0.696)	-1.599*** (1.069)	-1.403*** (1.545)	0.076*** (1.691)	2.511*** (2.763)
	Social welfare	-0.856*** (1.018)	-1.475*** (1.188)	-0.911*** (1.188)	-0.965*** (1.116)	-1.042*** (1.018)	-1.415*** (0.972)	-2.093*** (1.243)	-0.91*** (2.074)	-1.346*** (3.259)
	Entertainment-Personal service	-3.298*** (2.079)	-3.542*** (0.968)	-3.041*** (0.737)	-3.086*** (0.562)	-3.028*** (0.548)	-2.815*** (0.584)	-2.437*** (0.723)	-2.388*** (0.615)	-3.385*** (0.808)
	Etc(Infrastructure, Lease)	-0.799*** (0.828)	-1.404*** (0.909)	-0.485*** (1.107)	-1.059*** (0.907)	-0.684*** (0.97)	-1.066*** (1.126)	-0.306*** (1.209)	0.16*** (1.156)	-1.003*** (1.204)
Job	Unskilled									
	Professional	3.187 (0.76)	3.443 (0.649)	5.024 (0.616)	5.158 (0.574)	5.014 (0.646)	5.078 (0.829)	5.816 (0.818)	5.084 (0.949)	6.434 (1.466)
	Semiprofessional	3.399 (0.561)	3.116 (0.525)	3.807 (0.563)	3.791 (0.51)	3.483 (0.533)	4.007 (0.565)	4.22 (0.659)	4.067 (0.783)	3.92 (1.023)
	Clerical	1.532 (0.57)	1.752 (0.597)	2.34 (0.543)	2.157 (0.511)	1.934 (0.452)	2.056 (0.452)	1.944 (0.618)	1.716 (0.659)	1.523* (0.736)
	Service	1.068*** (1.131)	1.423*** (1.131)	2.699 (1.03)	2.28* (1.004)	2.986 (1.157)	3.647 (1.18)	3.193* (1.274)	3.681* (1.735)	4.29* (1.72)
	Sales	1.797*** (1.53)	1.252*** (0.852)	1.21*** (0.737)	1.073*** (0.724)	0.322*** (0.796)	1.168*** (0.982)	0.989*** (1.014)	0.306*** (0.873)	0.114*** (1.783)
	Skilled	1.856 (0.501)	1.749 (0.49)	2.193 (0.48)	2.044 (0.478)	1.873 (0.425)	2.113 (0.411)	1.69 (0.462)	1.548 (0.434)	1.338** (0.742)

A.Table. 7. Result of estimation Male 11<sup>th</sup> (2008) CQR



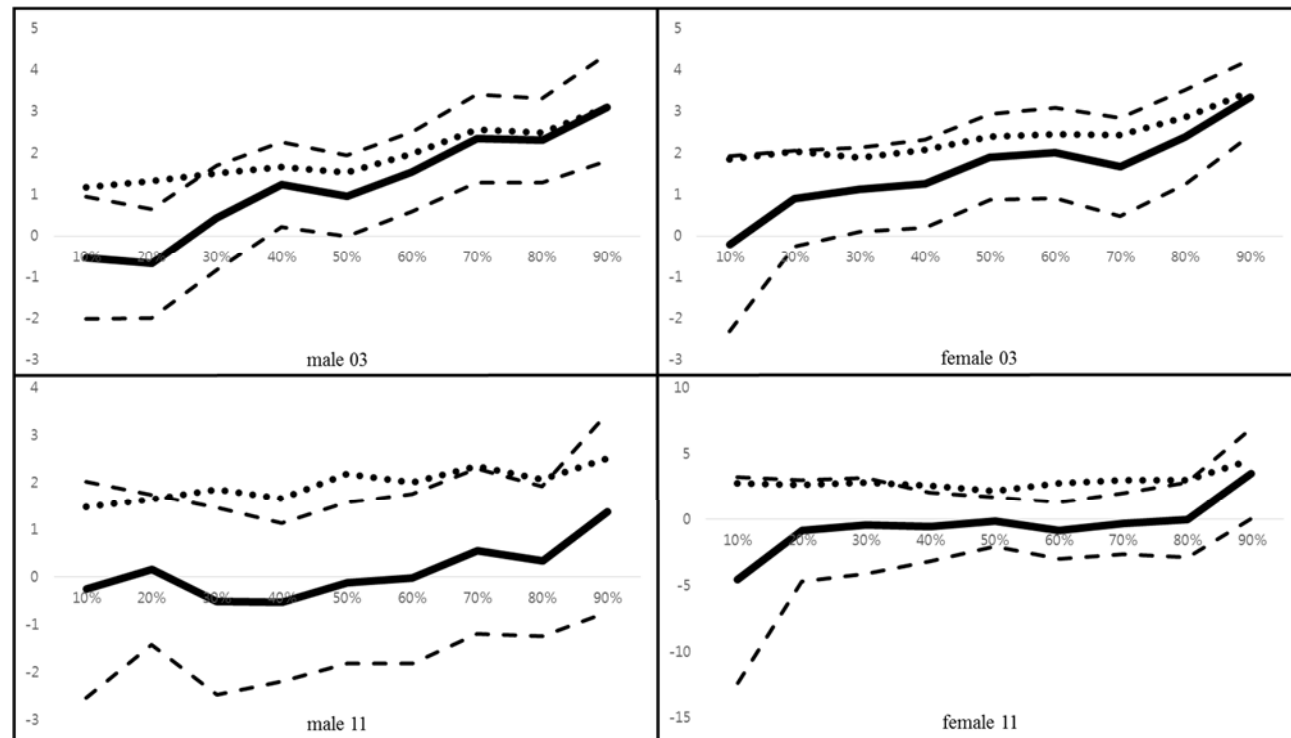
		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	2.805 (0.423)	2.661 (0.47)	2.869 (0.462)	2.595 (0.513)	2.22 (0.505)	2.762 (0.574)	3.02 (0.687)	3.034 (0.825)	4.564 (1.097)
	Seoul	0.223*** (0.16)	0.244*** (0.179)	0.312* (0.159)	0.267*** (0.202)	0.476* (0.189)	0.514* (0.226)	0.762 (0.258)	0.58** (0.352)	1.182* (0.582)
	Potential experience	0.054* (0.027)	0.086 (0.03)	0.095 (0.029)	0.135 (0.032)	0.17 (0.034)	0.17 (0.038)	0.2 (0.052)	0.256 (0.062)	0.327 (0.081)
	Potential experience^2	-0.001*** (0.001)	-0.002*** (0)	-0.002*** (0)	-0.002*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
	Marital status	0.184*** (0.191)	0.173*** (0.15)	0.262** (0.149)	0.226*** (0.154)	0.257*** (0.177)	0.217*** (0.189)	0.095*** (0.287)	-0.171*** (0.361)	-0.736*** (0.56)
	Labor union	2.046 (0.375)	2.749 (0.321)	3.069 (0.276)	3.025 (0.355)	3.069 (0.415)	3.209 (0.467)	3.224 (0.457)	3.563 (0.61)	3.851 (1.074)
Education	Below high school	-0.278*** (0.265)	-0.158*** (0.202)	-0.284*** (0.224)	-0.479*** (0.216)	-0.667*** (0.257)	-0.674*** (0.274)	-0.923*** (0.328)	-1.621*** (0.478)	-3.359*** (0.919)
	High school									
	College(2yrs)	0.421* (0.21)	0.402*** (0.257)	0.567 (0.199)	1.107 (0.357)	1.711 (0.318)	1.496 (0.325)	1.652 (0.422)	1.802 (0.52)	2.472 (0.773)
	College(4yrs) or post graduate	1.861 (0.319)	2.54 (0.294)	2.863 (0.277)	3.411 (0.398)	4.391 (0.415)	4.582 (0.421)	5.247 (0.533)	5.575 (0.643)	6.195 (0.718)
Industry	Manufacturing									
	Construction	0.411*** (0.563)	0.715*** (0.687)	0.608*** (0.839)	1.241*** (0.813)	1.582** (0.811)	1.262*** (1.037)	1.511*** (1.403)	2.983* (1.34)	2.227*** (1.721)
	Wholesale and retail trade	-0.68*** (0.348)	-0.229*** (0.332)	-0.518*** (0.304)	-0.638*** (0.34)	-0.725*** (0.319)	-1.233*** (0.303)	-1.659*** (0.414)	-1.431*** (0.618)	-2.18*** (0.671)
	Lodging	-0.483*** (0.327)	-0.237*** (0.233)	-0.544*** (0.232)	-0.694*** (0.255)	-0.735*** (0.3)	-1.112*** (0.368)	-1.537*** (0.493)	-1.106*** (0.588)	-0.919*** (0.878)
	Transportation	-0.034*** (1.126)	0.954*** (1.017)	0.841*** (0.858)	0.841*** (0.873)	0.865*** (1.087)	0.711*** (1.206)	1.397*** (1.087)	1.28*** (1.155)	0.627*** (1.541)
	Networking	-0.244*** (0.608)	0.045*** (0.774)	0.142*** (0.867)	-0.063*** (0.914)	0.548*** (0.9)	-0.346*** (0.873)	0.069*** (0.999)	-0.774*** (1.276)	0.183*** (1.275)
	Finance-Insurance	0.123*** (0.642)	0.984*** (0.778)	0.785*** (0.795)	2.125** (1.141)	2.47 (0.811)	2.362 (0.823)	3.564 (1.009)	3.837 (1.368)	5.704* (2.713)
	Business service	-0.292*** (0.304)	-0.122*** (0.287)	-0.179*** (0.354)	0.325*** (0.418)	0.281*** (0.347)	-0.107*** (0.374)	-0.006*** (0.467)	-0.099*** (0.526)	-1.127*** (0.706)
	Public admin-Military service.	-0.264*** (0.369)	-0.368*** (0.405)	-0.768*** (0.415)	-0.94*** (0.573)	-0.634*** (0.714)	-0.35*** (0.7)	-1.132*** (0.79)	-0.584*** (1.707)	1.814*** (2.092)
	Education	-1.01*** (0.275)	-0.9*** (0.299)	-0.823*** (0.393)	-0.434*** (0.434)	-0.62*** (0.473)	-0.685*** (0.478)	-0.81*** (0.64)	-0.479*** (0.842)	0.807*** (1.416)
	Social welfare	-0.176*** (0.3)	-0.234*** (0.3)	-0.566*** (0.304)	-0.501*** (0.38)	-0.3*** (0.57)	0.061*** (0.57)	0.023*** (0.564)	0.072*** (0.788)	0.839*** (1.258)
	Entertainment-Personal service	-0.93*** (0.326)	-0.74*** (0.299)	-0.852*** (0.29)	-0.956*** (0.266)	-1.021*** (0.294)	-1.336*** (0.406)	-1.371*** (0.677)	-0.484*** (0.771)	0.041*** (1.43)
	Etc(Infrastructure, Lease)	-0.975*** (0.62)	-1.278*** (0.681)	-1.315*** (0.896)	-1.235*** (1.275)	-0.097*** (1.083)	-0.238*** (0.896)	-0.159*** (0.807)	-0.356*** (1.122)	-1.175*** (3.058)
Job	Unskilled									
	Professional	1.644 (0.303)	2.073 (0.33)	2.206 (0.4)	2.18 (0.47)	2.243 (0.514)	2.42 (0.613)	3.368 (0.72)	4.319 (0.749)	3.374 (1.288)
	Semiprofessional	0.723* (0.344)	1.364 (0.317)	1.562 (0.314)	1.726 (0.379)	1.97 (0.402)	2.277 (0.43)	2.365 (0.53)	2.876 (0.719)	2.702** (1.478)
	Clerical	0.867 (0.288)	0.962 (0.285)	1.256 (0.291)	1.664 (0.331)	1.826 (0.327)	2.344 (0.369)	2.425 (0.458)	2.842 (0.535)	2.102** (1.094)
	Service	0.169*** (0.321)	0.038*** (0.234)	0.131*** (0.225)	0.302*** (0.228)	0.344*** (0.266)	0.485*** (0.325)	0.58*** (0.435)	0.548*** (0.518)	-0.264*** (0.918)
	Sales	0.124*** (0.428)	-0.128*** (0.414)	0.042*** (0.347)	0.004*** (0.374)	0.201*** (0.335)	0.52*** (0.344)	0.634*** (0.498)	0.699*** (0.636)	0.652*** (0.934)
	Skilled	-0.583*** (0.304)	-0.243*** (0.284)	-0.281*** (0.281)	-0.133*** (0.277)	-0.081*** (0.329)	-0.089*** (0.388)	-0.129*** (0.379)	-0.018*** (0.445)	-0.614*** (0.746)

A.Table. 8. Result of estimation Female 11<sup>th</sup> (2008) QR

		Quantile								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	Intersection	-4.533*** (3.982)	-0.812*** (1.968)	-0.43*** (1.866)	-0.552*** (1.328)	-0.151*** (0.972)	-0.837*** (1.11)	-0.326*** (1.188)	-0.016*** (1.45)	3.508* (1.751)
	Seoul	0.598*** (0.649)	0.661** (0.4)	0.759* (0.362)	0.45*** (0.33)	0.434*** (0.277)	0.56** (0.322)	0.832* (0.331)	0.845* (0.396)	1.181** (0.641)
	Potential experience	0.175*** (0.144)	0.32 (0.093)	0.293 (0.091)	0.392 (0.081)	0.301 (0.079)	0.415 (0.083)	0.446 (0.09)	0.484 (0.101)	0.423 (0.108)
	Potential experience^2	-0.002*** (0.004)	-0.007*** (0.003)	-0.006*** (0.002)	-0.007*** (0.002)	-0.005*** (0.002)	-0.007*** (0.001)	-0.007*** (0.002)	-0.007*** (0.002)	-0.005*** (0.002)
	Marital status	0.464*** (0.784)	0.328*** (0.419)	0.134*** (0.381)	-0.145*** (0.363)	0.421*** (0.356)	0.297*** (0.389)	-0.175*** (0.412)	-0.37*** (0.412)	-0.648*** (0.587)
	Labor union	4.101 (0.649)	3.721 (0.348)	3.659 (0.359)	3.43 (0.356)	3.093 (0.354)	3.041 (0.359)	3.16 (0.417)	3.481 (0.628)	3.767 (1.044)
Education	Below high school	-2.828*** (1.796)	-2.109*** (1.457)	-1.752*** (1.195)	-1.454*** (0.948)	-0.877*** (0.555)	-0.461*** (0.393)	-0.948*** (0.434)	-1.419*** (0.594)	-4.084*** (1.089)
	High school									
	College(2yrs)	1.393*** (1.057)	1.312* (0.611)	1.381 (0.516)	2.181 (0.509)	2.382 (0.471)	2.999 (0.518)	3.054 (0.59)	2.947 (0.754)	2.646 (0.862)
	College(4yrs) or post graduate	4.623 (0.97)	3.996 (0.667)	4.042 (0.583)	4.851 (0.594)	5.13 (0.514)	6.062 (0.635)	6.445 (0.665)	6.271 (0.666)	6.376 (0.77)
Industry	Manufacturing									
	Construction	-0.037*** (1.759)	1.382*** (1.699)	1.316*** (1.376)	1.032*** (1.247)	1.587*** (1.155)	1.677*** (1.135)	2.04*** (1.288)	3.075* (1.266)	1.795*** (1.676)
	Wholesale and retail trade	-1.828*** (1.504)	-0.639*** (0.898)	-0.801*** (0.64)	-1.279*** (0.538)	-1.646*** (0.504)	-1.928*** (0.526)	-2.149*** (0.588)	-1.907*** (0.849)	-2.047*** (0.821)
	Lodging	-1.782*** (1.738)	-0.69*** (1.428)	-0.744*** (1.205)	-1.181*** (0.681)	-1.047*** (0.595)	-1.673*** (0.725)	-1.966*** (0.854)	-2.211*** (1.152)	-1.111*** (1.049)
	Transportation	1.265*** (1.868)	1.743*** (1.244)	0.931*** (1.009)	0.817*** (0.981)	-0.046*** (0.927)	0.085*** (1.124)	-0.542*** (1.392)	0.615*** (1.286)	0.358*** (1.707)
	Networking	0.742*** (1.314)	0.925*** (1.123)	-0.641*** (1.11)	-1.081*** (1.22)	-0.305*** (1.06)	-0.935*** (1.053)	-1.291*** (1.395)	-1.046*** (1.549)	0.005*** (1.267)
	Finance-Insurance	0.705*** (1.667)	1.719*** (1.356)	1.199*** (1.155)	2.513 (0.93)	2.074 (0.628)	1.765* (0.774)	3.224 (1.232)	3.844 (1.35)	5.235* (2.607)
	Business service	0.837*** (1.093)	0.93*** (0.775)	0.482*** (0.662)	0.518*** (0.547)	0.117*** (0.443)	-0.037*** (0.5)	-0.382*** (0.468)	-0.393*** (0.539)	-1.444*** (0.814)
	Public admin-Military service.	-0.164*** (1.043)	-0.903*** (0.761)	-1.647*** (0.763)	-1.684*** (1.044)	-1.419*** (1.122)	-1.328*** (1.044)	-1.503*** (1.076)	-0.874*** (1.694)	1.749*** (2.231)
	Education	-1.293*** (0.827)	-1.228*** (0.519)	-1.016*** (0.5)	-0.737*** (0.561)	-0.654*** (0.558)	-0.95*** (0.624)	-1.163*** (0.699)	-1.14*** (0.825)	0.176*** (1.343)
	Social welfare	0.219*** (0.661)	-0.232*** (0.511)	-0.99*** (0.492)	-0.561*** (0.645)	-0.364*** (0.629)	0.01*** (0.648)	-0.226*** (0.6)	-0.638*** (0.773)	0.01*** (1.168)
	Entertainment-Personal service	-2.94*** (1.561)	-1.832*** (1.164)	-1.653*** (0.828)	-1.971*** (0.705)	-2.413*** (0.624)	-2.633*** (0.76)	-2.478*** (1.089)	-0.474*** (1.108)	0.188*** (1.536)
	Etc(Infrastructure, Lease)	-2.702*** (1.532)	-3.462*** (1.196)	-4.567*** (2.209)	-1.797*** (2.596)	-1.254*** (2.11)	-0.084*** (1.5)	-0.794*** (1.079)	-0.895*** (1.322)	-1.238*** (2.931)
Job	Unskilled									
	Professional	5.498*** (3.547)	2.524*** (1.549)	3.058* (1.31)	2.543 (0.795)	3.052 (0.62)	3.129 (0.752)	3.646 (0.839)	4.613 (0.908)	3.487* (1.367)
	Semiprofessional	4.552*** (3.577)	1.863*** (1.477)	2.459** (1.284)	2.093 (0.771)	3.019 (0.558)	3.17 (0.672)	3.449 (0.757)	4.03 (0.847)	3.135* (1.49)
	Clerical	3.46*** (3.623)	1.094*** (1.583)	2.28** (1.343)	2.2 (0.816)	3.005 (0.525)	3.068 (0.609)	3.124 (0.643)	3.622 (0.704)	2.142** (1.221)
	Service	2.997*** (3.731)	-0.469*** (1.798)	0.832*** (1.421)	0.791*** (0.812)	0.859*** (0.559)	1.079*** (0.718)	0.694*** (0.801)	1.237*** (0.986)	-0.707*** (1.043)
	Sales	2.564*** (3.744)	-0.618*** (1.543)	0.014*** (1.327)	-0.822*** (1.062)	1.158*** (0.866)	1.15** (0.635)	0.865*** (0.68)	0.879*** (0.939)	-0.076*** (1.135)
	Skilled	3.795*** (3.531)	0.947*** (1.745)	-0.714*** (1.725)	-1.907*** (1.401)	0.041*** (0.915)	0.027*** (0.626)	-0.204*** (0.43)	-0.046*** (0.524)	-0.684*** (0.841)

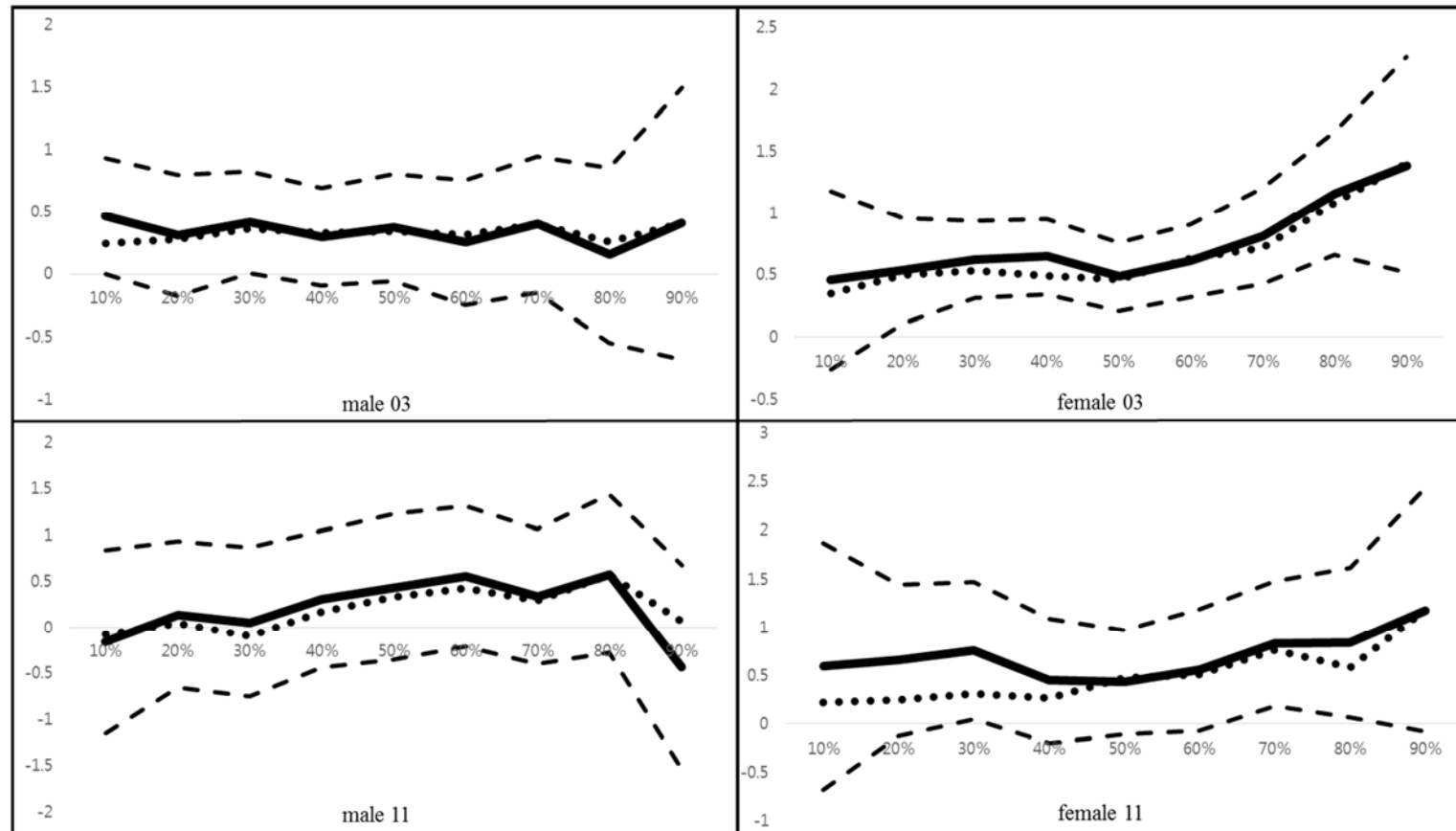
A.Table. 9. Result of estimation Female 11<sup>th</sup> (2008) CQR

## Appendix B: Figures

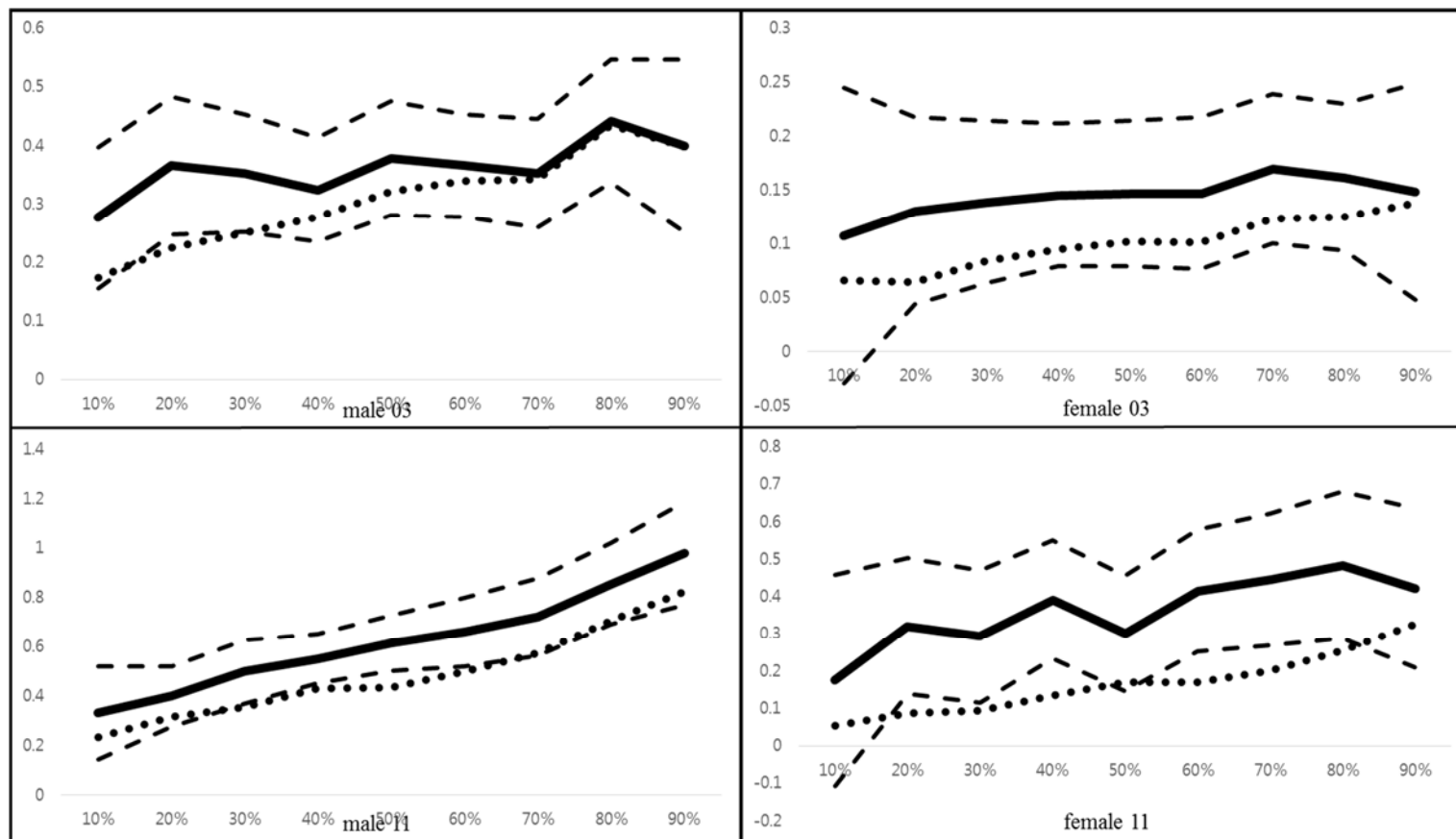


Note: Solid line, and round dot line represent the result of CQR and QR respectively and dashed line represent the 95% confidence band of CQR estimation.

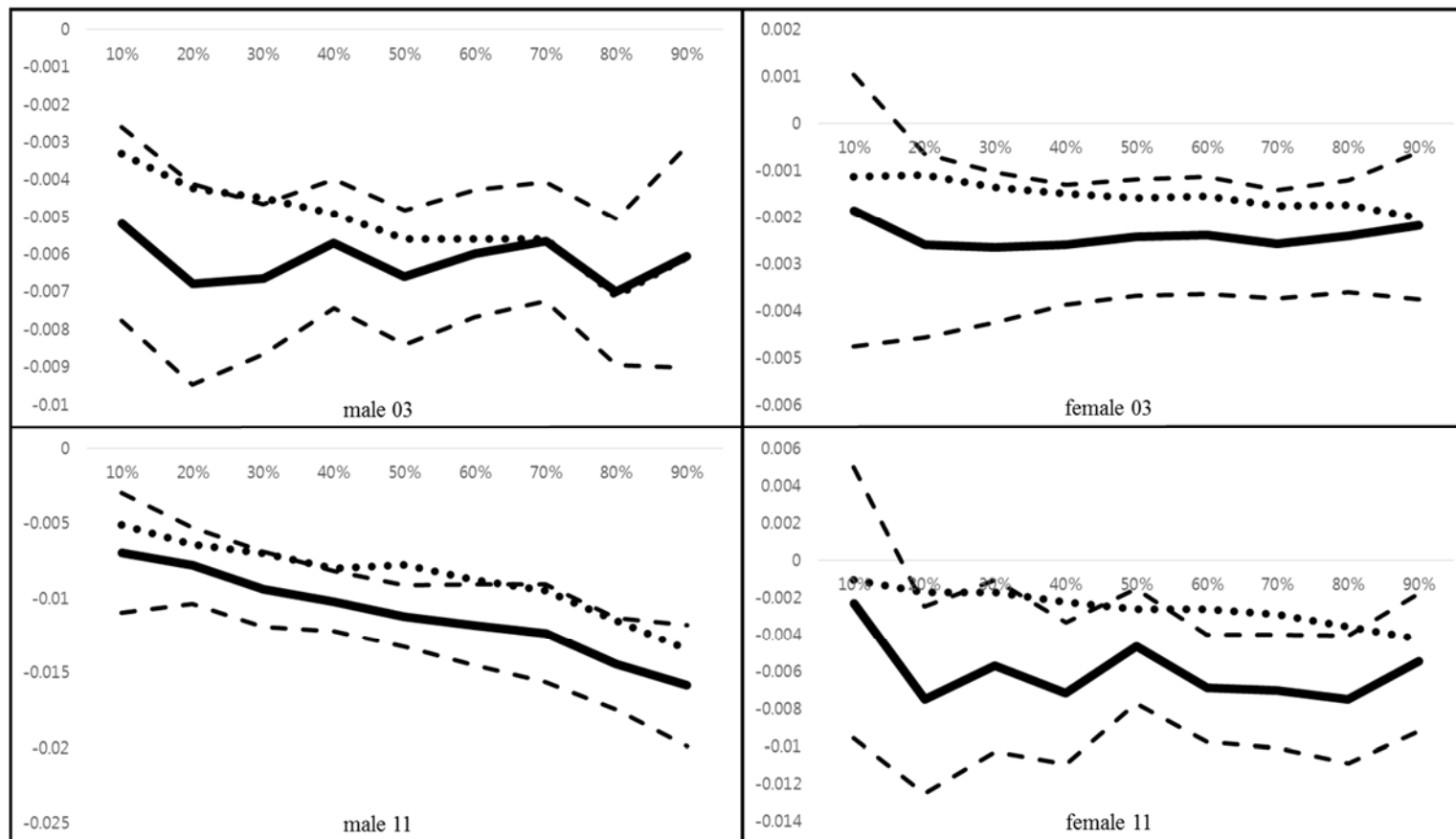
A. Figure 1. Estimation result of intersection.



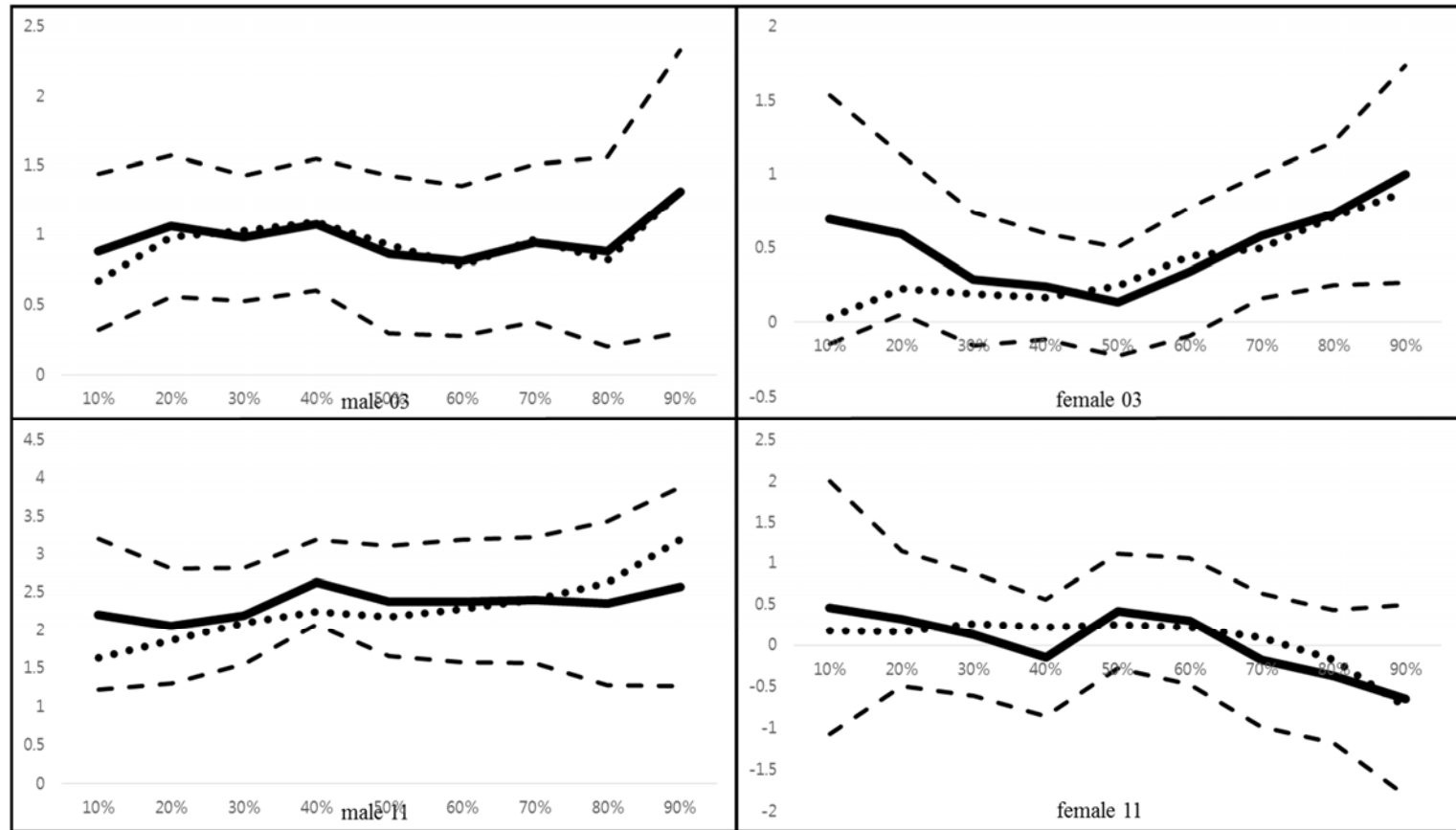
A. Figure 2. Estimation result of seoul



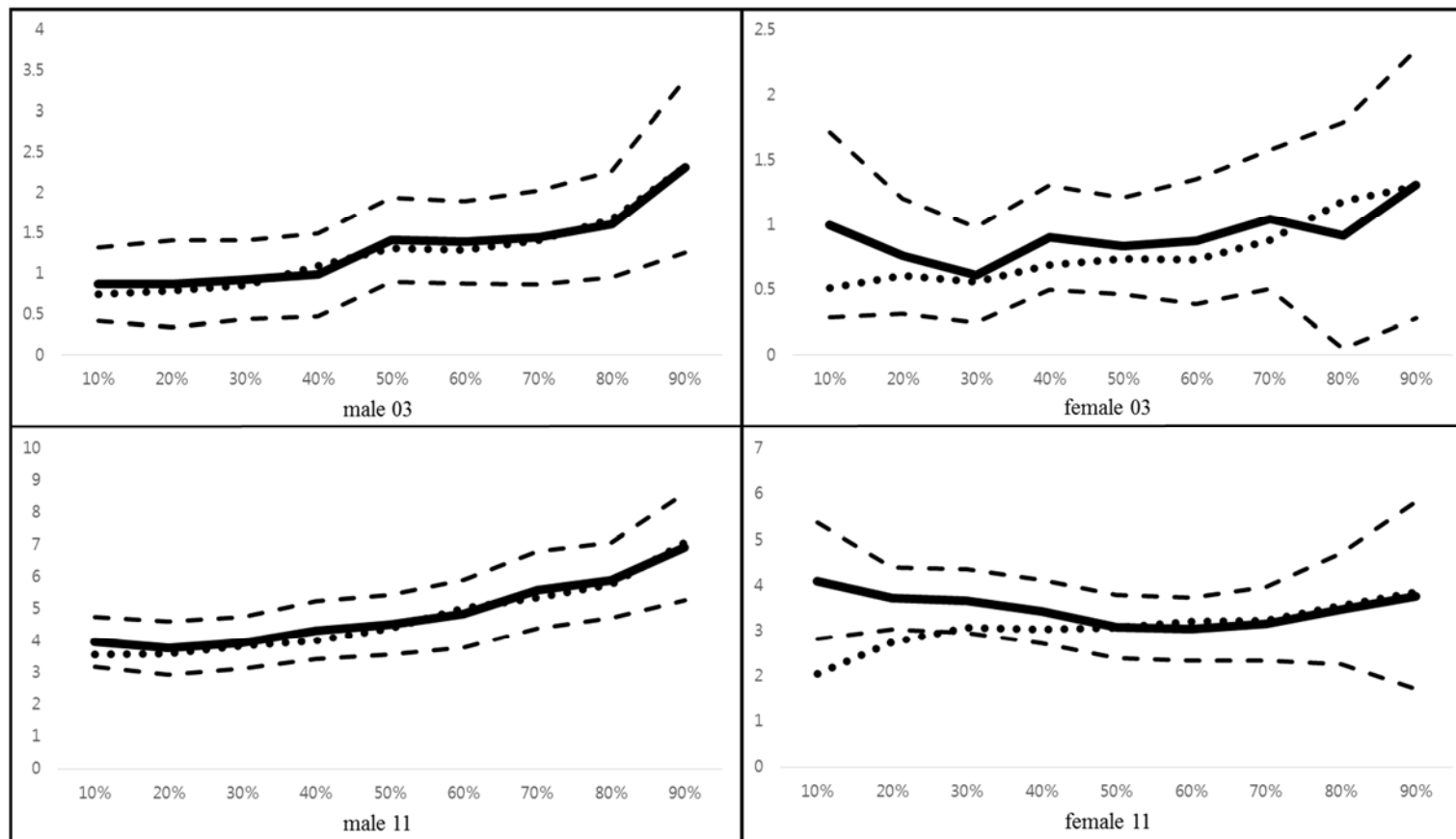
A. Figure 3. Estimation result of potential experience



A. Figure 4. Estimation result of potential experience<sup>2</sup>

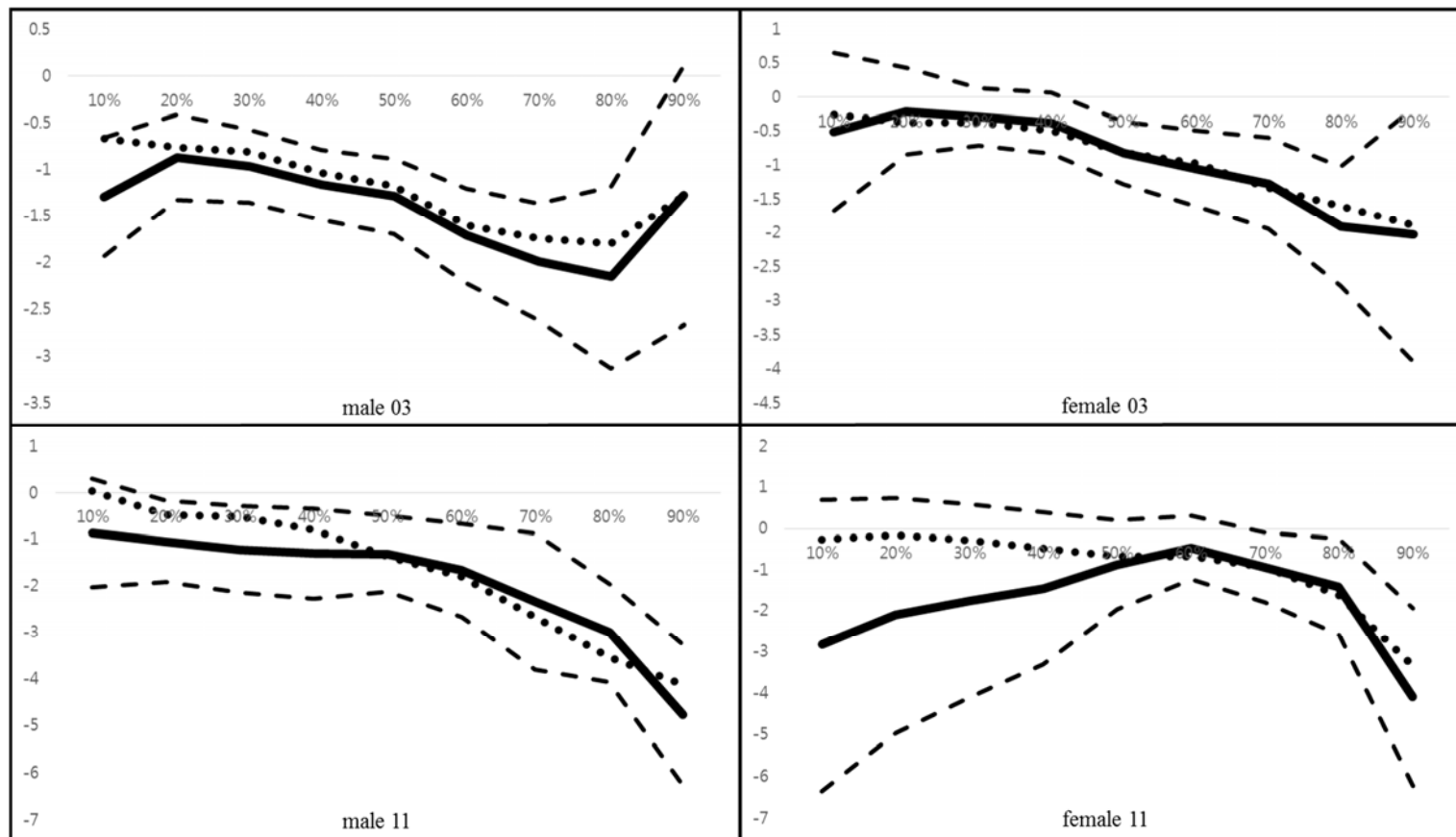


A. Figure 5. Estimation result of marital status

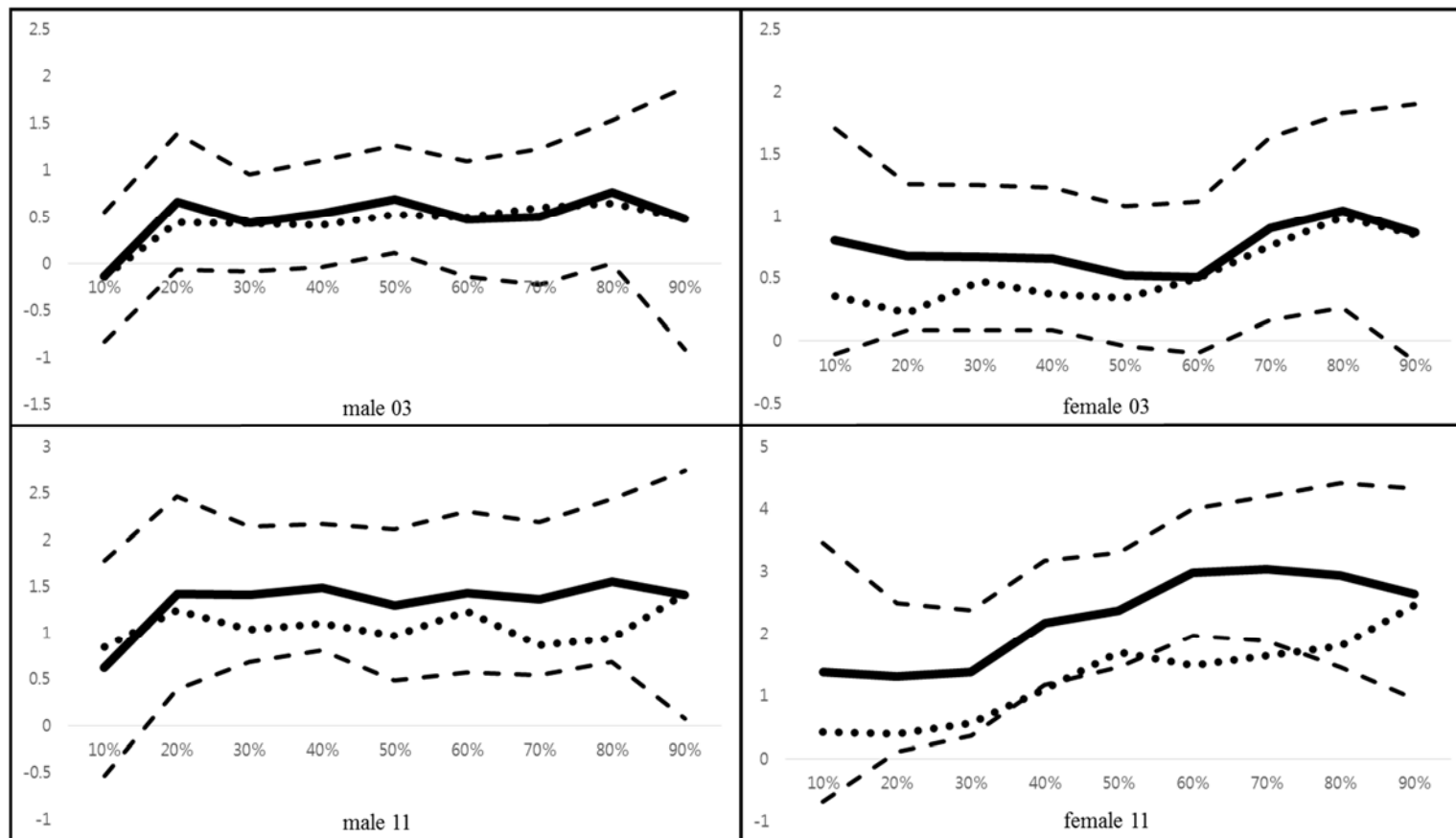


A. Figure 6. Estimation result of labor union

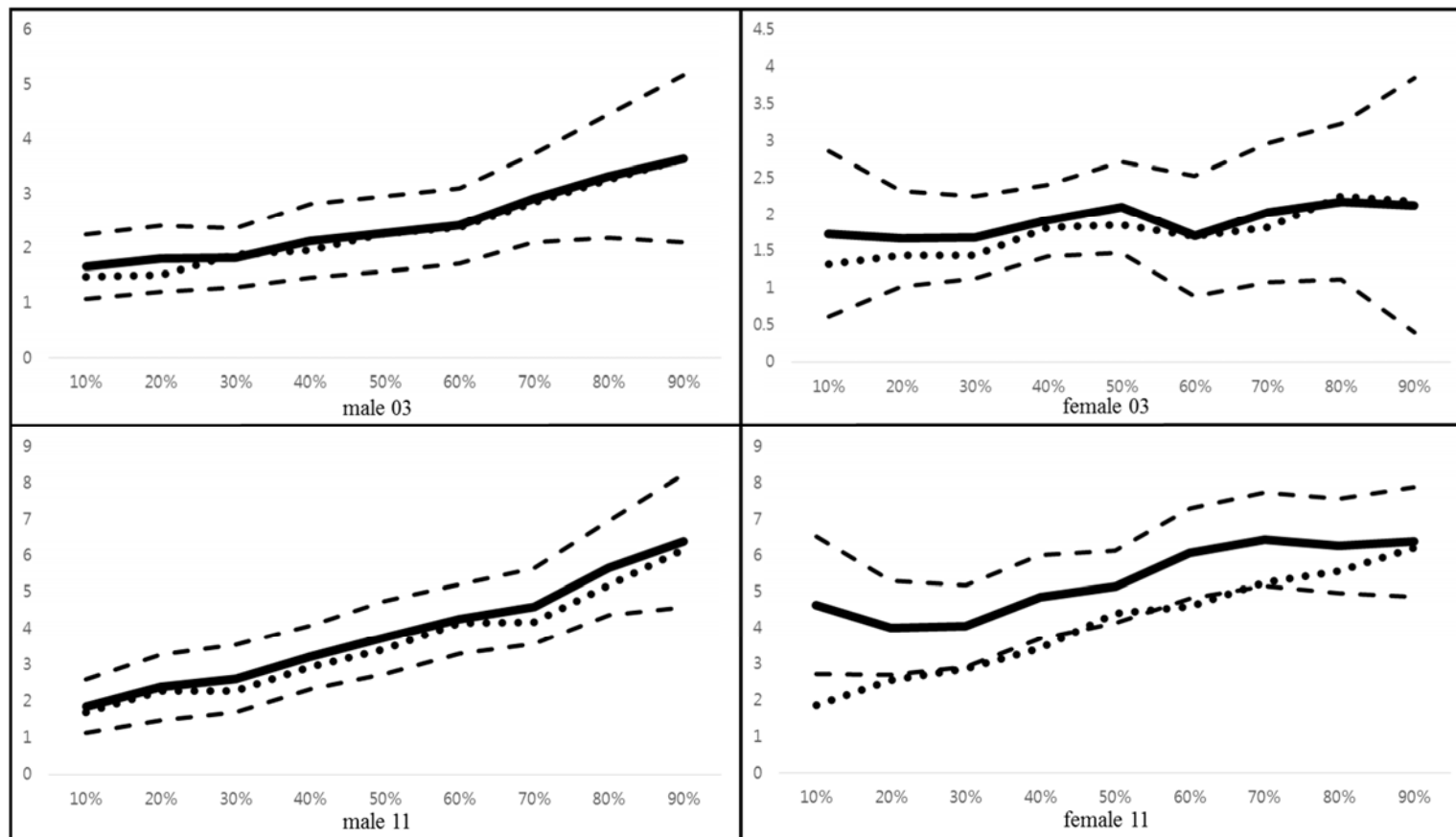




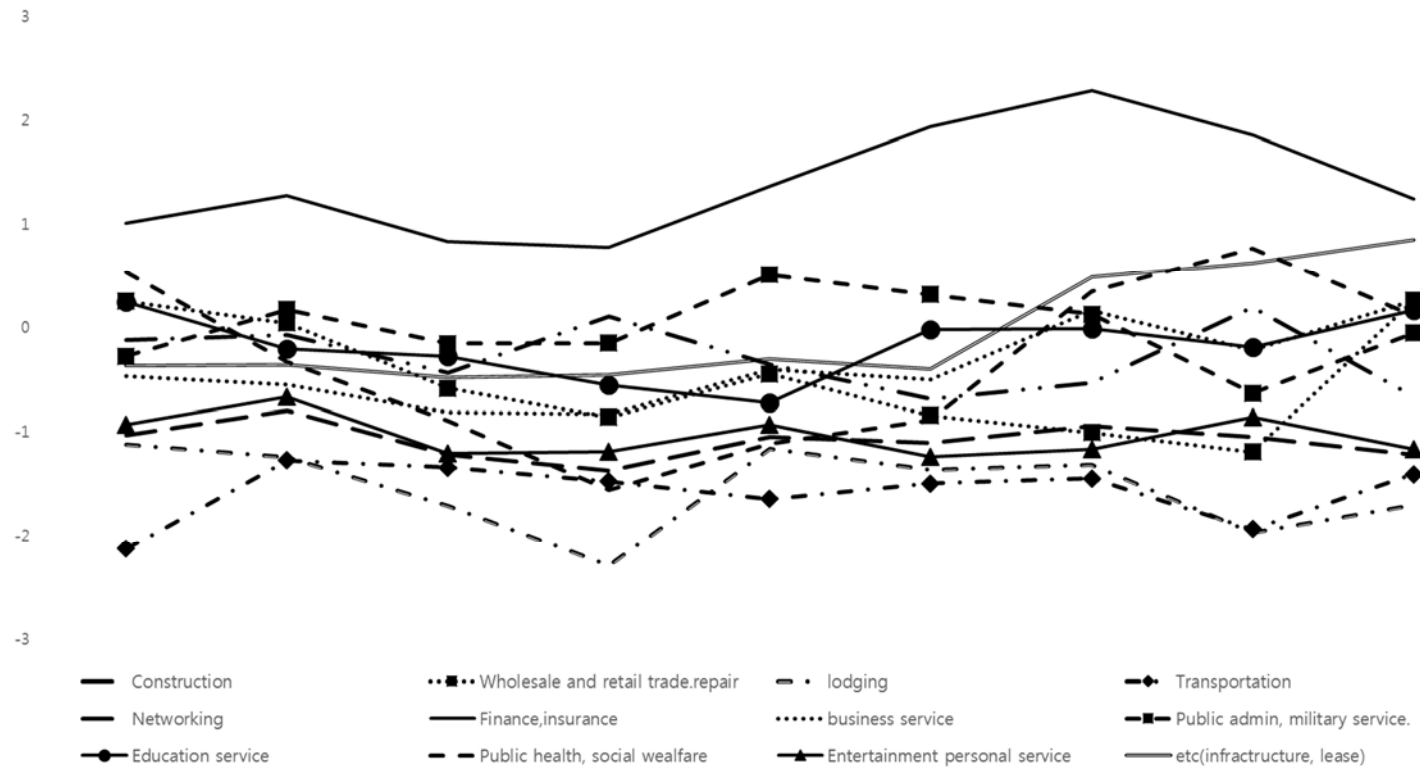
A. Figure 7. Estimation result of below high school education



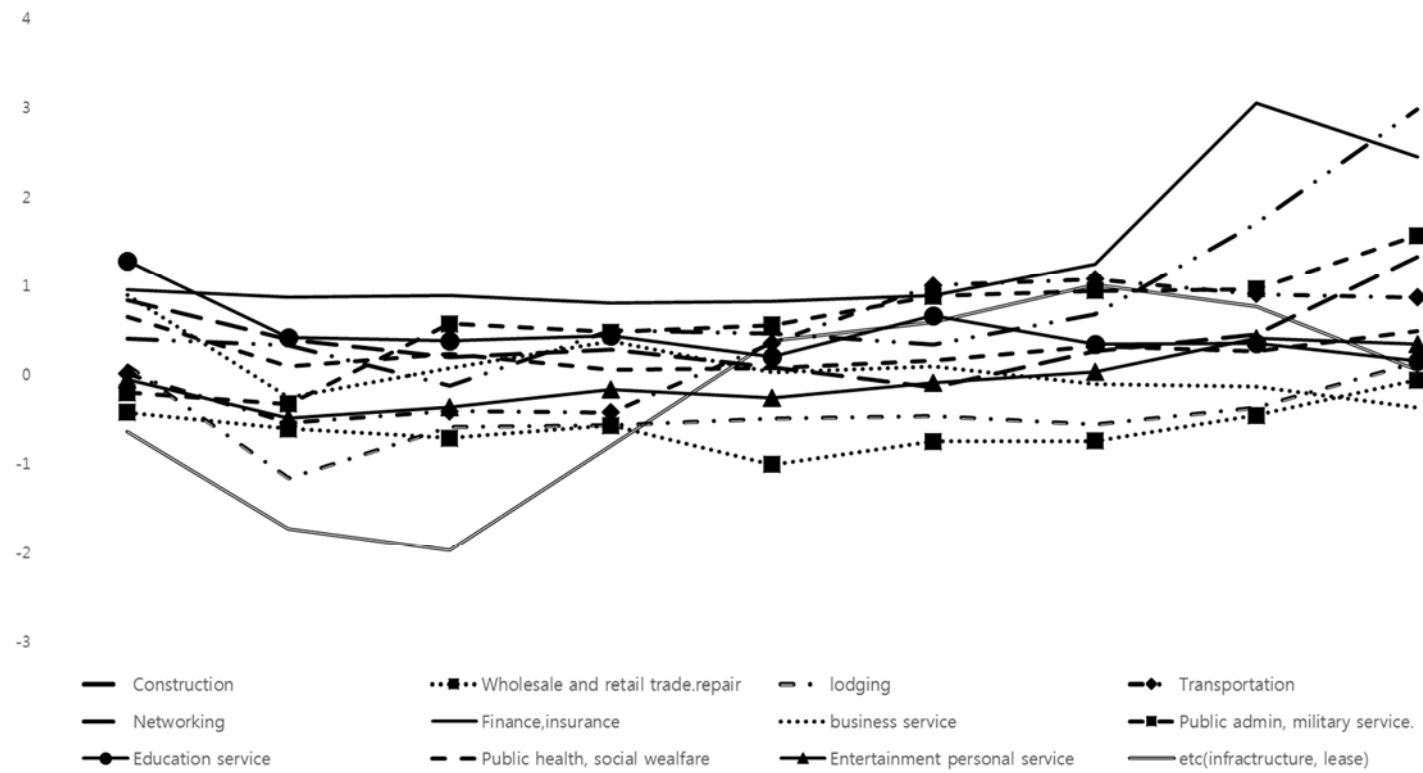
A. Figure 8. Estimation result of 2 year college education



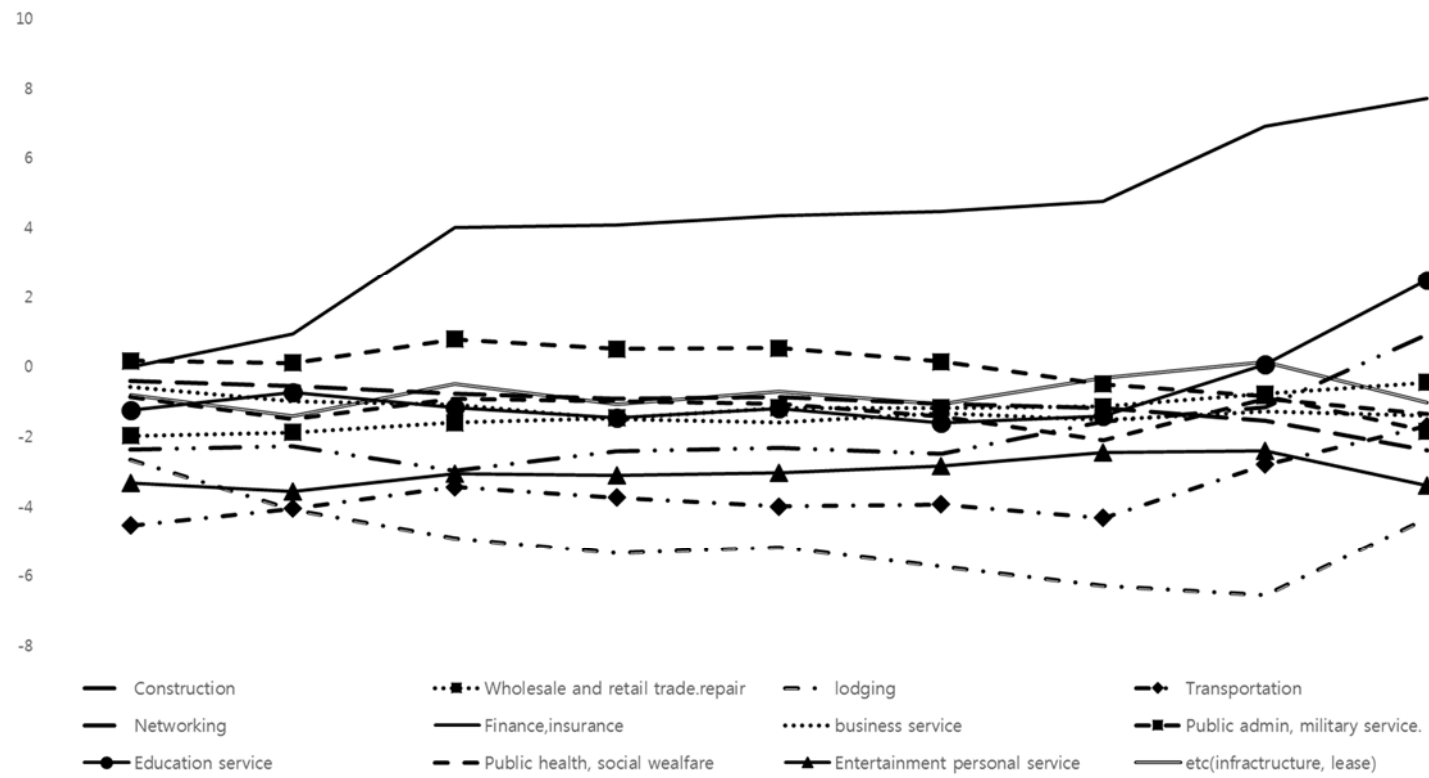
A. Figure 9. Estimation result of 4 year college or post graduate education



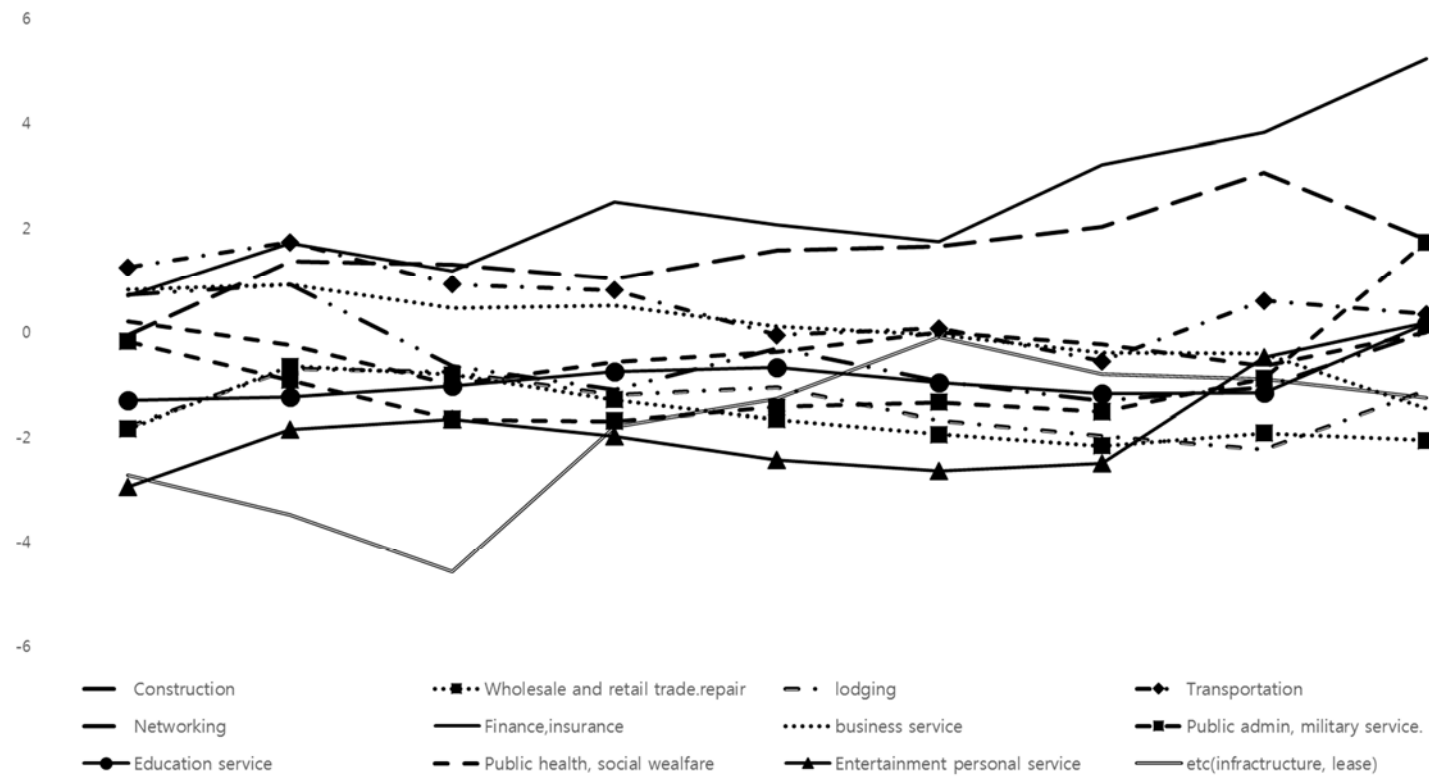
A. Figure 10. CQR estimation results of industry dummies for 03 male



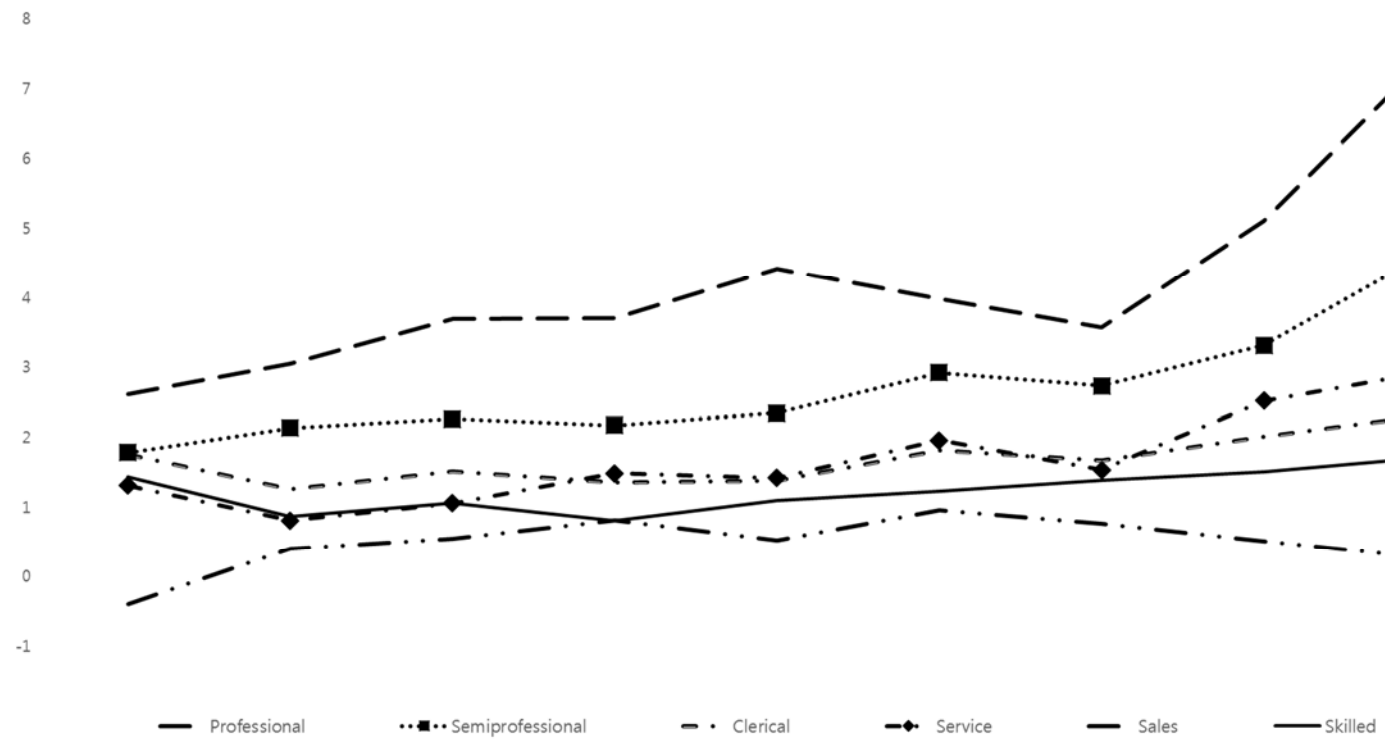
A.Figure 11. CQR estimation results of industry dummies for 03 female



A. Figure 12. CQR estimation results of industry dummies for 11 male

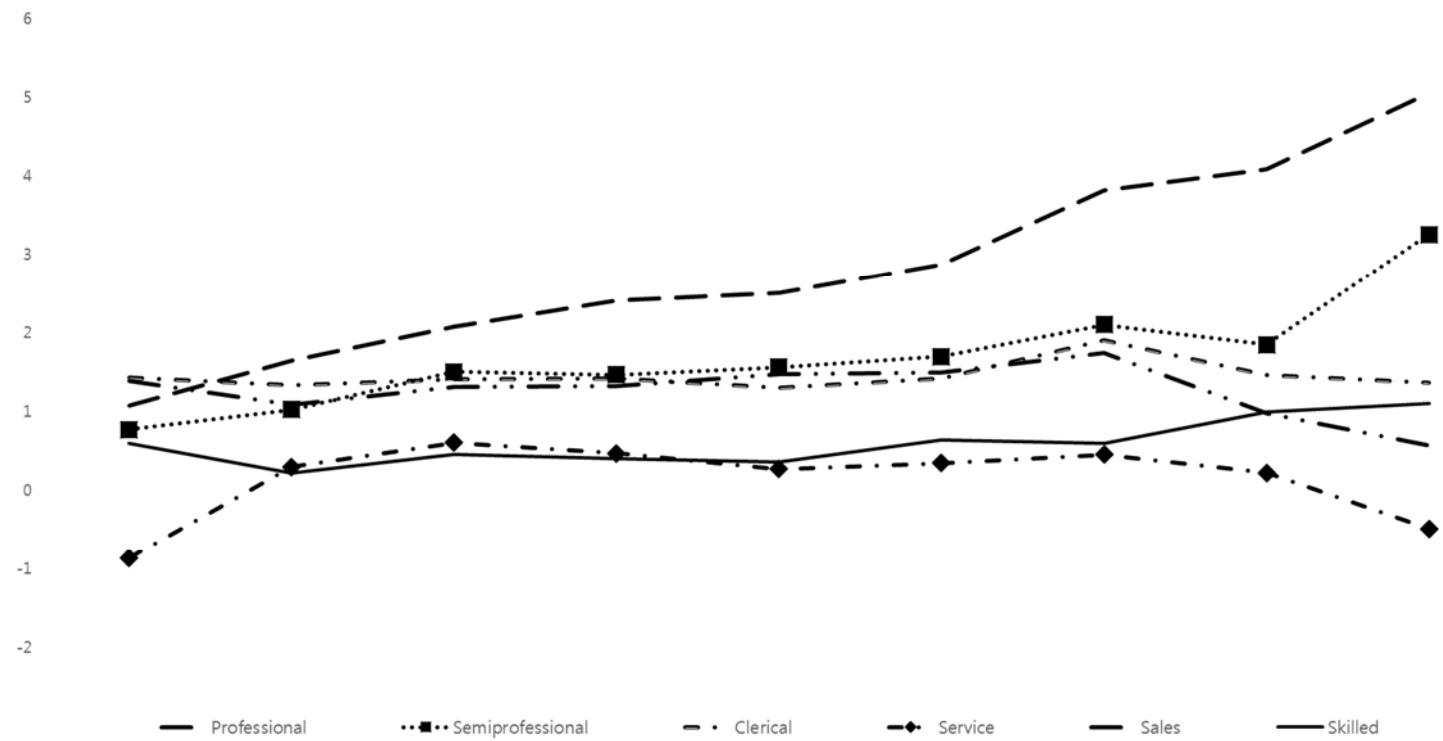


A. Figure 13. CQR estimation results of industry dummies for 11 female

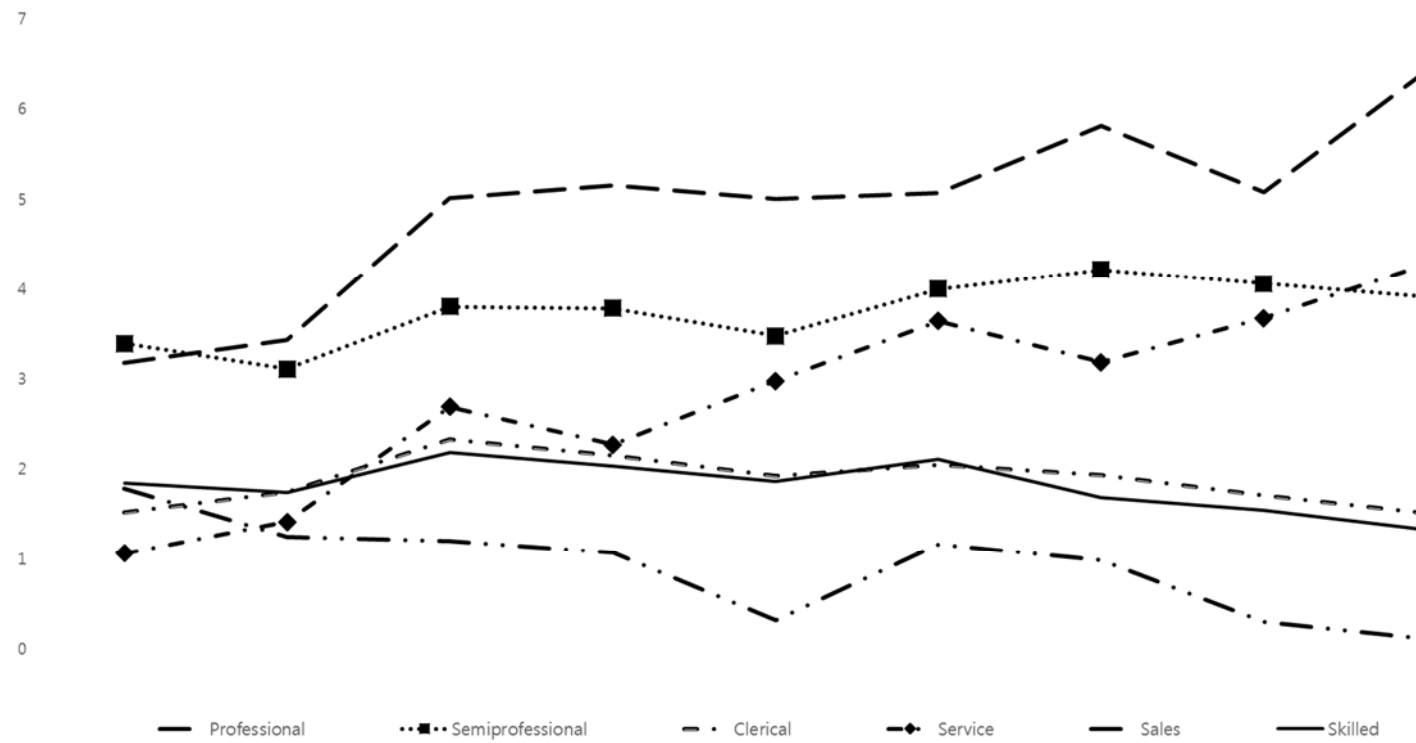


A. Figure 14. CQR estimation results of job classification dummies for 03 male

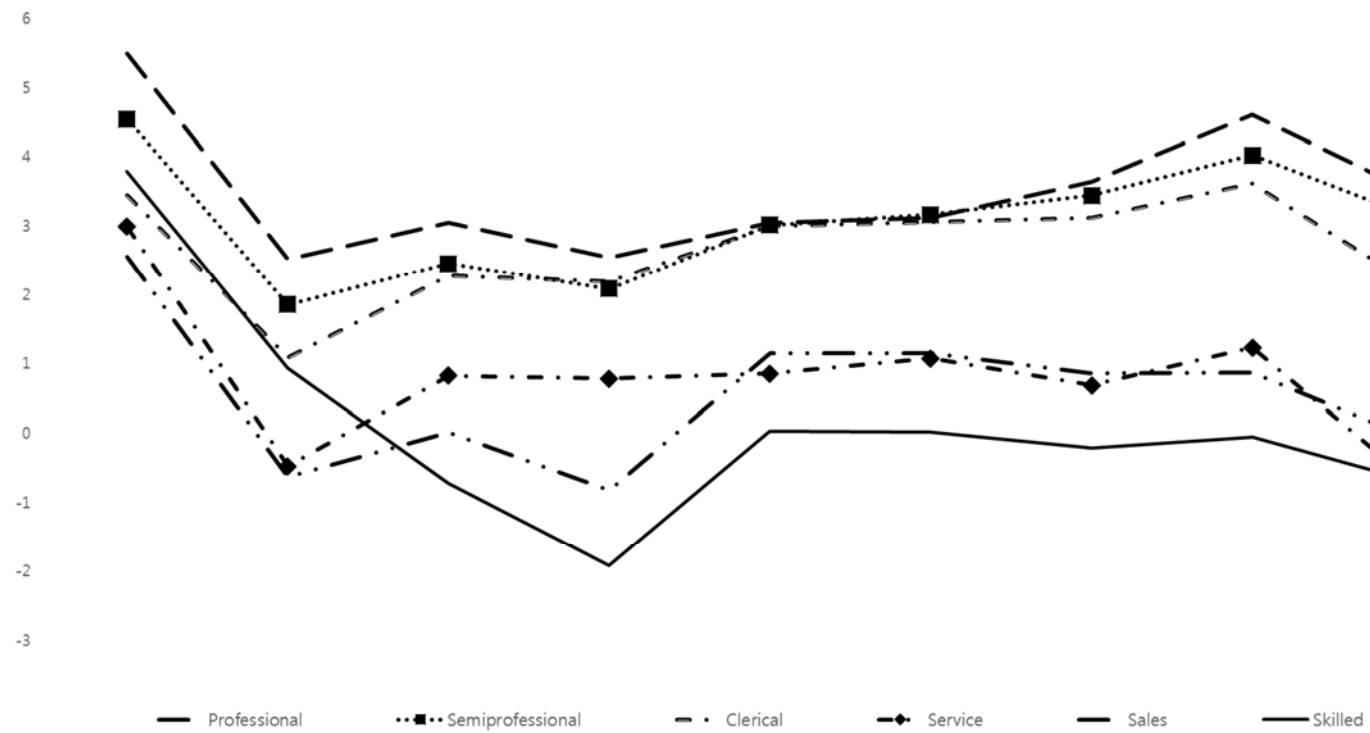




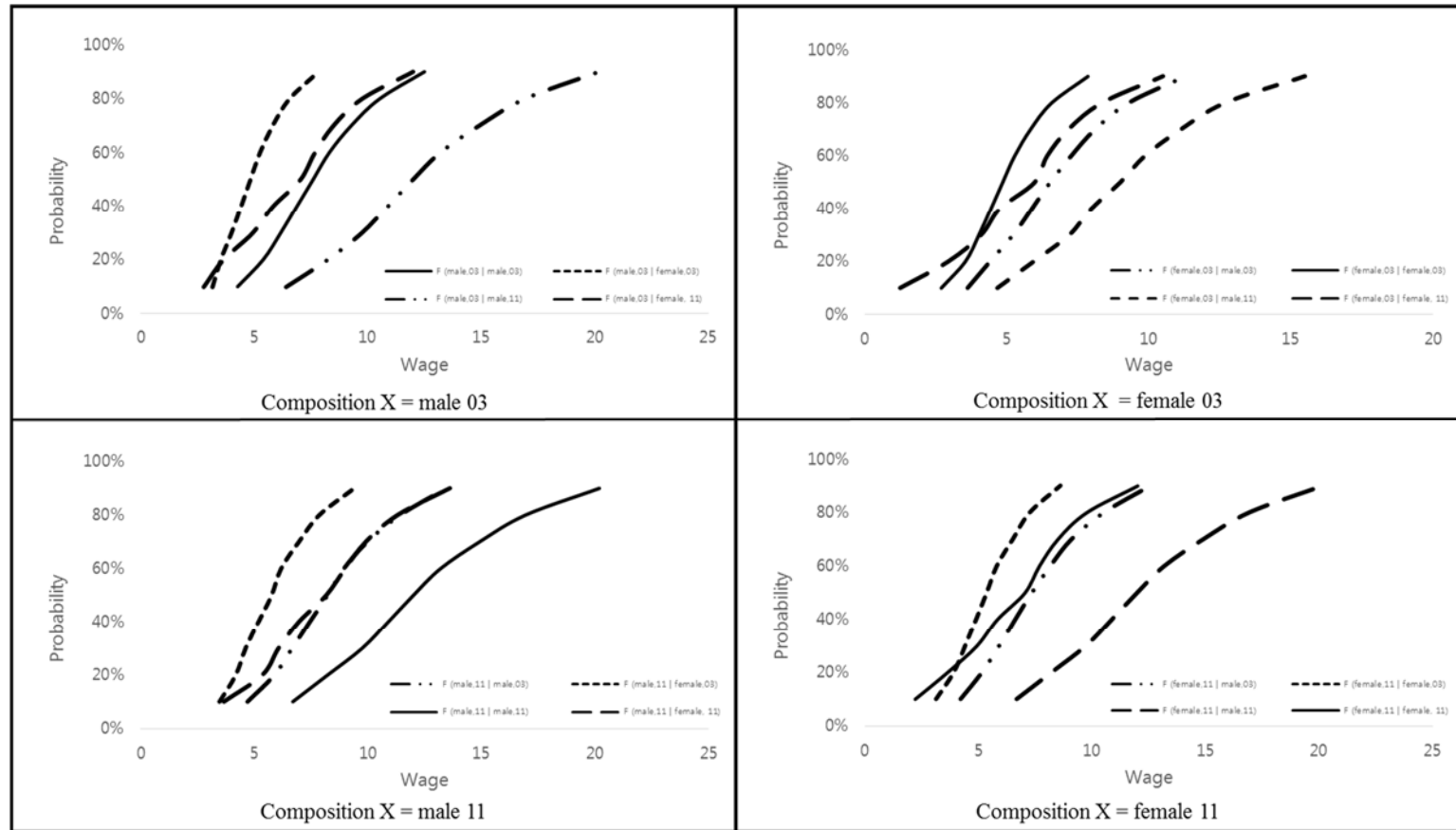
A. Figure 15. CQR estimation results of job classification dummies for 03 female



A. Figure 16. CQR estimation results of job classification dummies for 11 male



A. Figure 17. CQR estimation results of job classification dummies for 11 female



A.Figure 18. Counterfactual distributions

## 국 문 초 록

한국사회에서 남녀임금분포는 각 분위별로 매우 이질적인 양상을 보인다. 따라서 기존의 조건부 기대값에 기반한 회귀분석을 통해서만 실제 임금분포를 효과적으로 분석해낼 수 없다. 검열 분위 회귀분석(CQR)은 조건부 분위에 대한 회귀분석을 통해 분포전체에 대한 정보를 보존할 뿐 아니라, 검열값으로써 최저임금을 고려하므로 위와 같은 경우에 효과적인 방법론적 대안으로 고려될 수 있다. 본 연구는 Chernozhukov와 Hong의 2002년 논문에서 제시된 모형을 적용하여 2000년과 2008년 두 해의 한국노동패널(KLIPS) 자료를 분석하였다. 또한, 반사실 분석 및 분해 분석법을 통해 임금변화와 고등교육이 임금에 미치는 영향을 관찰하였다. 분석의 결과로, 여성 고등교육 지원정책이 빈부격차해소와 성별임금격차 완화에 기여할 수 있음을 경험적으로 논증한다.

**주요어:** 반사실 분석, 검열 분위 회귀, 분해 분석법, 성별 임금 격차

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