구직기간에 대한 실증분석
An Empirical Analysis for Duration of Job Search

김 병 우*

Kim (2016) applied hazard model for estimation of job search duration to KLIP survey. Gender characteristics and the participation in unemployment insurance affect job search. Results show that, in general, hazard rate is low for female workers and non-participants in unemployment insurance.

In this study, we analyze the duration of job search applying hazard model to most recent 2020 KLIPS(Korean Labor and Income Panel Survey) data. These data is panel, but in this study we used only 2020 cross-section data. We applied Tobit to estimation of log of job search duartion. The estimated coefficient for job duration on wage is smaller than that of (truncated) LS in Tobit model. These results show that workers with higher wages, in general, have long period of job search. 1 unit of increase in wage and education increases duration by 0.2% and 5.1%, respectively. We also applied parametric approach to hazard model explaining the probability of job finding, and derived significant parameter estimates in exponential, log-normal and Weibull models.

Key Words : job search, duration, hazard function.

I. Introduction

The importance of analysis for duration of job search is very important in viewpoint of theoretical and empirical implication.

In econometrics, the difference between unemployment and job search duration is important. Econometricians use reduced-form approach that use search duration data only. This is contrasted with structural approach, which is mentioned later in this study.

We applied hazard model for estimation of job search duration to KLIP survey. We can see that hazard(failure) rate is low for ones who have much leisure-related activity. Also, gender characteristics and the participation in unemployment insurance affect job search. Results show that, in general, hazard rate is low for female workers and non-participants in unemployment

* 한국교통대학교 교수

insurance. This calls for the revision of the implementation of labor policy.

Kim (2016) applied hazard model for estimation of job search duration to KLIP survey. Gender characteristics and the participation in unemployment insurance affect job search. Results show that, in general, hazard rate is low for female workers and non-participants in unemployment insurance. In this study, we conversely analyze the duration of job occupancy rather than vacancy and search.

II. Econometric Analysis

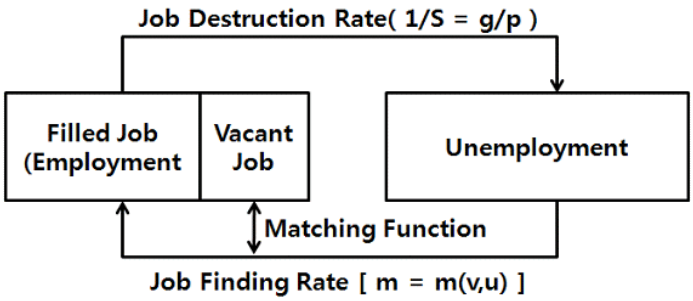
The analysis for duration of job occupancy is very important from the viewpoint of theoretical and empirical implication.

We apply sophisticated hazard model for estimation of job occupancy duration to KLIP survey(1998-2020). We examine whether that hazard(failure) rate is low for ones who have much leisure-related activity. Also, gender characteristics and the participation in unemployment insurance affect job occupancy. We derive results show that, for example, hazard rate is low for female workers and non-participants in unemployment insurance. This may call for the revision of the implementation of labor policy.

1. The Econometrics of Job Search

The basic search model with regard to economic growth was presented by Mortensen (1986). The time period during which unemployed worker find a matched new vacancy.

<Fig. 1> Search Model



[Employment(E)]	→ (Job Separation, b=1/S) ← (Job Finding, m)	[Unemployment(U)]

but, b=1/S: job separation rate, m: job finding rate

Natural rate of unemp;yment is:

U/(U+E) = 1/[1+(mb)]= 1/[1+(m/S)]

A distribution whose hazard function slopes upward is said to have positive duration dependence. The likelihood of failure at time t, conditional upon duration up to time t, is increasing in t, in that case. The opposite case is that of decreasing hazard or negative duration dependence. Our question in the introduction about whether the job occupancy is more or less likely to end at time t given that it has lasted until time t can be framed in terms of positive or negative duration dependence.

(2-1)

$$h(t) = "Pr(T = t|T \geq t)" = \frac{f(t)}{1 - F(t)}$$

At t or earlier, the probability(distribution function) of failure(job search duration ends) is:

(2-2)

$$F(t) = \int_0^t f(s)ds$$

For the period of t, probability of survival(job search continues) is:

(2-3)

$$S(t) = 1 - F(t) = \int_t^\infty f(s)ds$$

Our empirical research may be used in the future research and policy recommendation. This work can give high incentive for implementing labor policies for workers and give implications for labor policy. Second, we can estimate the marginal (partial) effect of a change, for example, in the probability that an individual firm success in product innovation on employment duration.

Finally, in this study, we use panel data from 1998-2020. This can control individual heterogeneity of workers in estimation.

A. Data and Estimation

This study analyzes the duration of job searcher who lost job or continued to search after 2020.

The number of sample is 22,964.

<Tab 1> Summary Statistics

	SEARCH WEEK Duration of Job Search(weeks)	CONTRACT Existence of Work Contract	WAGE Monthly(10 Thausand Won)	DURATION Existence of Job Search
Mean	0.163125	0.724395	104.8303	59.17275
Std. Dev.	1.519645	0.931170	168.4180	340.5563
Observations	22964	22964	22964	22964

Data: KLIPS 23rd, ('20).

Then, we estimate hazard model for job search duration. We use Weibull distribution, and in this case hazard rate is a function of v.

$$\lambda_i = e^{-\beta vi}$$

The effect of explanatory variable make us have to estimate β. So, we need duration model.

B. Previous Literature

Hong et al. (2002) used KLIPS panel and considered unempolyed period, experience of part-time job, etc. as explanatory variables. They contolled individual heterogeneity. Ji (2007) argued that social insurance such as unemployment insurance cannot increase unemplyment.

Parametric hazard model not considering unobserved heterogeneity was criticized by Heckmann and Singer (1984) as the problem of overparameterization. So, in this stidy, we used semi-parametric approach.

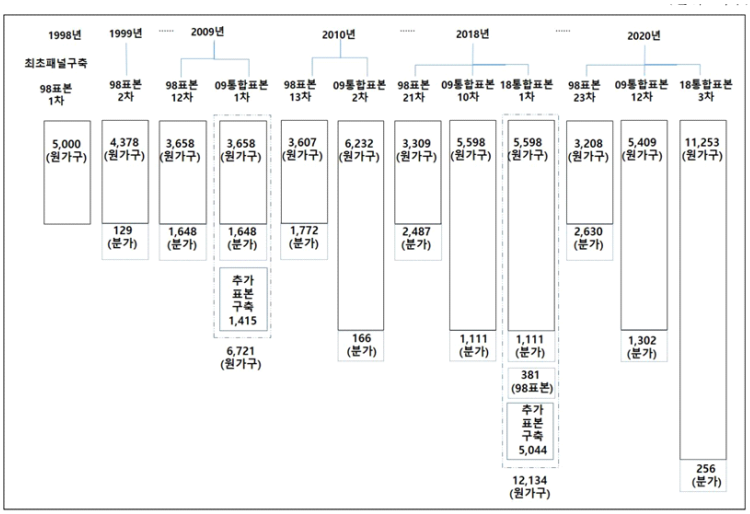
2. Empirical Analysis: KLPIS

In microeconomics, they use mainly panel data which consist of cross-section and time-series. For example, we can use (1968-, about 8,000 households) PSID and (1979-, 14-22 aged youths 12,686) NLS(NLSY79; BEA).

In this stidy, we used 『KLIPS, 한국노동패널』23th data (2020 survey). This data have characteristics of longitudinal survey data.

We postpone panel hazard function estimation in future research.

<Tab 2> Number of Observation



A. Econometric Model

This study examines the effects of wages on the duration of job search of workers. Duration (spell) data are as follows: t_1, t_2, t_3... t_n. The probability of exit(failure) from job search conditioned that duration T has lapsed at least t.

<Tab 3> shows basic statistics and questionnaire.

<Tab 3> Variables and Data(23th survey, Korean)

	WAGE	EDU
Mean	104.8303	5.250348
Std. Dev.	168.4180	1.515438
Observations	22964	22964

변수설명	통합변수명	응답항목_통합
가구번호(22차, 2019)	hhid22	
(가구정보)학력(전공계열) EDU	p_0113	고등학교의 경우
(주된일자리)근로계약기간 유무 CONTRACT	p_0501	(1) 정해져 있다
1차-2차는 (3)모른다 조사되지 않음.		(2) 정해져 있지 않다
(3)모른다는 3차-9차에만 해당		(3) 모른다
(주된일자리)임금수준(월급액) WAGE	p_1612	
(주된일자리) 사회보험 관련 문항	SET NO. : 21	
(주된일자리)국민연금가입여부	p_2101	(1) 가입되어 있다
		(2) 가입되어 있지 않다
		(3) 잘 모르겠다
(주된일자리)구직활동기간유무	p_2701	(1) 없었다
		(2) 있었다
(주된일자리)구직활동기간㈜ SEARCHWEEK	p_2706	

B. Log-normal Distribution

First, we apply lognormal distribution to model without covariates. That is, log vale of duration is assumed to have normal distribution. In this case, E[$e^{\ln t}$] is not equal to e^{μ}, in which t is duration.

$f(t)=(p/t)\phi[p\ \ln(\lambda t)]$
$S(t)=\ \Phi[-p\ \ln(\lambda t)]$ (2-1)

Maximum likelihood use method of BFGS. Considering right censoring of duration data, we use the following likelihood function.[2)]

$\ln L(\Theta)\ =\ \Sigma(\text{uncensored})\ \ln f(t|\Theta)\ +\ \Sigma(\text{censored})\ \ln S(t|\Theta)$ (2-2)

First, we examine LS estimation for finding basic relationships between variables. As an candidate of causal relationship, individual workers with long duration of job search had higher wages on average. Existence of bilateral causation need to be tested strictly. We focused on the determination of job search duration(SEARCHWEEK). This variable is related with censored regression model, since duration variable is left censored at zero.

Recent development in econometrics made it possible to control heterogeneity of individual worker. We can apply random effects or random parameters models. Most previous literature applied fixed effects to censored data.

Tobit model comprises of participation and intensity equations.

Cragg(1971) presented other model, in which the probability of observing limit value is independent from intensity equation. This is called two-part model.

Lin and Schumidt(1984) presented the method of testing restictions by likelihood ratio in Tobit equation. If LR statistics exceed CV, we reject the null restriction of Tobit.

Amemiya(1985) provided mechanism (a), that is, type II Tobit.(<Tab 4>, Greene, 2012)

---

2) If survival funcstion is expressed as conditional function, this is $S(t_i|v_i)$.

Then, consitional expectation is:

$S(t)\ =\ E_v[S(t|v)]=\int_v S(t|v)f(v)dv$

Hazard function is:

$\lambda(t)\ =\lambda p(\lambda t)^{p-1}[S(t)]^{\theta}$

<Tab 4> Type II Tobit

1. Participation Equation

$di^* = zi'\gamma + ui$ $\quad ui \sim N(0,1)$

$di = 1$ if $di^* > 0$ $\quad 0$ otherwise

2. Intensity Equation

$yi^* = xi' \beta + \varepsilon i$ $\quad \varepsilon i \sim N(0,\sigma 2)$

3 Observation Equation

(a) $yi^* = 0$ if $di = 0$

and $yi = yi^*$ if $di = 1$

(b) $yi = yi^*$ if $di = 1$

and yi unobserved if $di = 0$

4 Endogeneity

$ui \sim$ bivariate Normal with correlation ρ

5 Conditional Expectation(Type II)

$E(yi|di = 1,xi) = xi' \beta + E(\varepsilon i|di = 1,xi) = xi' \beta + \rho\sigma\lambda i$

When $d_i = 0$, we get sample selection model of Heckman(1984), if we cannot observe explanatory variables.

We tested Tobit vs. Probit and Truncated Model by LR statistics. The null hypothesis is the restriction that tobit is correct, that is, coefficients in probit and truncated model is equal.

We get the following value, and we donot reject the null.

LR = -4663

<Tab 4> Wage Determination

Dependent Variable: LOG(WAGE)			
Method: Least Squares			
Included observations: 643			
Variable	Coefficient		Prob.
C	3.191434		0.0000**
SEARCHWEEK	0.011881		0.0002**
EDU	0.194022		0.0000**
CONTRACT2	0.422683		0.0000**
		Durbin-	
F-statistic	79.81657	Watson stat	1.360448
Prob(F-statistic)	0.000000**		

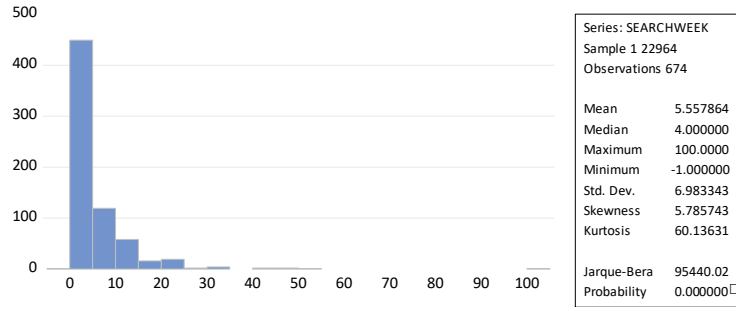
<Tab 5> Duaration for Job Search Determination

Dependent Variable: LOG(SEARCHWEEK)				
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)				
Left censoring (value) at zero				
Variable	Coefficient			Prob.
C	0.838566			0.0000**
CONTRACT2	-0.208837			0.0039**
WAGE2	0.002479			0.0000**
EDU	0.051134			0.0956*
Error Distribution				
SCALE:C(5)	0.918993	0.028005	32.81556	0.0000**
		Right		
Left censored obs	92	censored obs		0
		Total		
Uncensored obs	581	obs		673

Dependent Variable: LOG(SEARCHWEEK)			
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)			
Truncated sample			
Variable	Coefficient		Prob.
C	1.177185		0.0000**
CONTRACT2	-0.074926		0.2598
WAGE2	0.001185		0.0008**
EDU	0.033708		0.2363
Error Distribution			
SCALE:C(5)	0.743026		0.0000**
	Right		
Left censored obs	0	censored obs	0
	Total		
Uncensored obs	581	obs	581

Dependent Variable: SEARCH_C2			
Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)			
Variable	Coefficient		Prob.
C	-2.950783		0.0000**
CONTRACT2	0.738264		0.0000**
WAGE2	-0.001924		0.0000**
EDU	0.088442		0.0000**
	Total		
Obs with Dep=0	22291	obs	22964
Obs with Dep=1	673		

<Fig. 2> Histogram of Job Search Duration



Then, we estimated hazard model for examining the probability of job finding conditioning a certain duration of job search.

The significantly estimated hazard rate(location parameter) λ is 6.13. If we assume log-normal, λ means that E[ln t] = -ln λ. Scale parameter in survival function is estimated as 0.96. In this case, p means that σ[ln t] is 1/p.

<Tab 6> Duaration Model for Job Search Determination

Variable	Coeff	Signif
Exponential		
λ	6.13	0.00**
Variable	Coeff	Signif
Weibull		
λ	0.17	0.00**
p	1.08	0.00**
Variable	Coeff	Signif
Log Normal		
λ	0.15	0.00**
p	0.96	0.00**
Function Value -2201		
Weibull with Covariate		
b	-1.58	0.000**
p	-0.001	0.000**
a	1.098	0.000**
Function Value -1812		

C. Weibull Model with Covariates

In this section, we estimate marginal effect in Weibull distribution with covariates. Wage level x affects the probability of finding job.

$\lambda(i)=\exp(-x(i)\beta)$ (2-3)

x(i) is assumed to be constant from T=0 to failure time(T=t_i). If we set hazard probability λ(i) as a function of covariates , then we call this accelerated failure time model.

In this Weibull model, p is estimated 1.09.

<표 3> Weibull with Covariates

$\ln t(i) = \sigma w(i)+x(i)\beta$
$f(\ln t(i))=1/\sigma\ f([\ln t(i)-\exp(-x(i)\beta)]/\sigma)$
$S(\ln t(i))= S([\ln t(i)-\exp(-x(i)\beta)]/\sigma)$

Ⅲ. Summary

We applied hazrd model to KLIPS(Korean Labor and Income Panel Survey) data. These data is panel, but in this study we used only 2020 cross-section data.

We applied Tobit to estimation of log of job search duartion. The estimated coefficient for job duration on wage is smaller than that of (truncated) LS in Tobit model. These results show that workers with higher wages, in general, have long period of job search.

1 unit of increase in wage and education increases duration by 0.2% and 5.1%, respectively.

We also applied parametric approach to hazard model explaining the probability of job finding, and derived significant parameter estimates in exponential, log-normal and Weibull models.

References

김병우(2007), 「Innovation, Job Creation and Economic Growth」, 『한국혁신학회지』, 제2권 1호. 한국혁신학회.

김병우(2016), 「근로자특성과 구직기간 : 지속기간모형」, 『여성경제연구』, 제13권 1호. 여성경제학회.

문성배・전현배(2008), 「기술혁신활동의 고용효과에 대한 실증분석: ICT기업과 비ICT기업의 비교를 중심으로」, 『산업조직연구』, 제16권 1호. 한국산업조직학회.

지은숙(2007), 「사회보장에서의 도덕적 해이」, 『보건과 복지』, 제9집. 한국보건복지학회.

홍서연・안주엽(2002), 「청년의 학교졸업후 구직기간의 분석」, 『노동정책연구』, 제2권 1호. 한국노동연구원.

Aghion P. and P. Howitt (1998) *Endogeneous Growth Theory*, MIT Press.

Aghion P. and P. Howitt (1994) "Growth and Unemployment", *Review of Economic Studies* 61: 477-494.

Blanchard O. (2006), *Macroeconomics,* 4th Ed., Pearson: Prentice Hall.

Bonnal L., Cazals C., Favard P and Kamionka T. (1998) "Unemployment Duration Econometrics", *WP,* U of Toulouse.

Cahuc P. and A Zylberberg(2004) *Labor Economics*, The MIT Press.

Chang Y., J. Nam and C. Rhee (2004) "Trends in unemployment rates in Korea: A Search-Matching Model Interpretation ", *Journal of the Japanese and International Economies*, Vol.18(2):241-263.

Chang Y. and J. Hong (2006) "Do Technological Improvements in the Manufacturing Sector Raise or Lower Employment?", *American Economic Journal*, Vol.96(1): 352-368.

Eckstein, G. J. and van den Berg(2007) "Empirical labor search: A survey" *Journal of Econometrics,* Volume 136, Issue 2, February, Pages 531-564

Hansen G.(1985), "Indivisible Labor and the Business Cycle", *Journal of Monetary Economics* 16: 309-327.

Hausman and Han (1990) “Flexible Parametric Estimation of Duration Competing Risk Models”, *Journal of Applied Econometrics*, Vol.5. 1-28.

Heckman and Singer (1984) “Econometric Duration Analysis”, *Journal of Econometrics*, Vol.24. 271-320.

Hornstein A. P. Krusell and G. Violante (2005a) "The Effects of Technical Change on Labor Market Inequalities", *Handbook of Economics Growth* 1B: 1275-1370.

Hornstein A. P. Krusell and G. Violante (2005b) "The Replacement Problem in Frictional Economies: An "Equivalence Results", *Journal of European Economic Association* 3:

1007-1057.

Jones C. (2008), *MacroEconomics,* Norton & Company.

Kiefer and Neumann (1989) *Search Models and Applied Labor Economics*, The Cambridge Univ. Press.

Kim H.(2006) "Job Flow and Unemployment in Korea: A Search Theoretic Approach", *Economic Analysis*, July 2007: Vol. 12, BOK.(Korean)

Kim B.(2010) "R&D Investment, Job Creation, and Job Destruction in Korea: Technological Progress and Labor Market Equilibrium", 노동정책연구, 67, 제10권 제2호.

Lilien D. (1982) "Sectoral-Shifts and Cyclical Unemployment", *Journal of Political Economy*, Vol.90. 777-93.

Mortensen D. and Pissarides C. (1994) "Job Creation and Job Destruction in the Theory of Unemployment", *Review of Economic Studies*, Vol.61. 397-415.

Mortensen D. and Pissarides C. (1998) "Technological Progress, Job Creation and Job Destruction", *Review of Economic Dynamics*, Vol.1. 733-53.

Mortensen D. and Pissarides C. (1999) "Unemployment Responses to "Skill-Biased Shocks: The Role of Labor Market Policy", *Economic Journal*, Vol.109. 242-65.

Nam J. (1997) "Research on the Trend in the Unemployment rate of Korea", *PhD Dissertation,* SNU.

Neuman G. and R. Topel (1991) "Employment Risk, Diversification and Unemployment", *Quarterly Journal of Economics*, Vol.106. 1341-1365.

Pissarides C. (1985) "Short-Run Dynamics of Unemployment, Vacancies and Real Wages", *American Economic Review,* Vol.12. No.3.

Pissarides C.(1990) *Equilibrium Unemployment Theory*, Oxford: Basil Blackwell.

Pissarides C.(2000) *Equilibrium Unemployment Theory*, 2nd Ed., The MIT Press.

Rogerson R. (1997) "Theory Ahead of Language in the Economics of Unemployment", *Journal of Economic Perspectives,* 11.

Romer D.(2006), *Advanced Macroeconomics*, 3rd Ed., International Edition.

Ryu K. (1994) "Group Duration Analysis of Proportional Hazard Model: Minimum Chi-square Estimators and Specification Tests," Journal of the American Statistical Association, 89, 1386-1397.

Stock J, and M. Watson (2005) *Introduction to Econometrics,* 3rd Ed., Addison-Wesley.