

A Consideration on the Theoretical Features of Job Search Modeling and an Experimental Approach to Decide the Reservation Price of Employees

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Abstract

This paper analysis the theoretical programmatic features of dynamic search theory to construct an experimental approach to measure the reservation price of searching for jobs. We found that two factors are entangled in each decision maker's choice in dynamic search theory. We cannot isolate the risk attitude towards search activities from discount factors of futures because the trade off problem in dynamic job research is always given as either constant unemployment insurance or future probabilistic cash flows. We pointed out that the dynamic search theory always assumes that the size of discounting future and the preference toward risk is equal. This assumption means a myopic person as always risk averse, vise versa. We view this assumption is too strong and we should establish a dynamic theory to distinguish them axiomatically in the future.

Though the assumption of risk neutrality in dynamic the job search model is not considered to be crucial to solving dynamic problems, it was determined that the assumption of risk neutrality causes the timing of stopping of search activities to be correlated exactly to the magnitude of the reservation price.

Search theory theoretically excludes the multiple chances to search through the idea of a reservation price, however, the

actual serious problem we face is the more frequent chances to search opportunities for jobs. We examined via experiment our hypothesis that the multiple recruitment made applicants accept a lower reservation price.

The reservation prices to accept wages with known uniform distributions were measured in the first step to investigate the reservation price that is provided in standard search models under different lengths of employment. We observed that subjects rationally confess their reservation price in our experimental settings, but we could not judge how the reservation price of subjects was affected by the structural differences introduced by differing lengths of employment periods except for the cost of decision making.

1 Introduction

Daring recession, the systematic problems of the labor market appear easily in contrast to the normal economic times, when systematic problems are tend to hide. After 1998, when the Japanese economy experienced its worst period with negative substantial growth rates of GDP, the Obuchi cabinet, eased the Worker Dispatch Law. In 2004, Worker Dispatch Law was erased again and the duration of time of the acceptance of the dispatch was extended one year to three year at most. Through this deregulation, contracts of dispatch workers were introduced to the manufacturing sector to match the demand and supply in the labor market quickly. This deregulation makes easy for employes to employ workers without subsidizing employee's social securities and welfare. Therefore, companies of auto-mobile manufacture could decrease their labor costs to increase their profits. This deregulation first creates temporal extra demand for labor that resulted in the large layoff of part-time employees in the manufacture sectors in 2008 after worldwide financial crisis triggered by the default of Reaman-Brothers.

Since 2008, the French government once deregulated the conditions of layoffs to active labor market because the fact that elder employees kept their positions made companies refrain from hiring new employees. However, the young graduates held strong demonstrations against this deregulation and the initiative is abandoned.

In Japan, they discuss the necessity of activating the labor market in educational area: teachers of under high school should renew their licences periodically in order to keep up with changes in teaching materials and techniques. However, the strong resistance are expressed by teachers who have already confirmed their tenure. The main reason for this is the idea that introducing reexamine their licences discourage the people who have high abilities and refrain them from applying to be teachers. Although this opinion is logically doubtful, we need empirical proof.

Though the length and conditions of contracts of employment are important from the viewpoint of the dynamic structures of demand and supply in the labor market, thorough main theoretical framework to analyze labor market, we cannot distinguish differences of quality and length of contracts. Search theory provides various extension of basic models and succeeds in explaining actual labor market problems and employees behaviors, however, it cannot distinguish between the consecutive short term contracts and one long contract. Matching and bargaining theories give understandings of under which conditions the powers of employers and employees reach equilibrium. Especially the wage-tenure contracts are considered by Margaret Stevens [6] that company can avoid turn-over of workers. However, the previous literatures are focus on how to avoid voluntary retirements and do not describe situations under recession. During recession, companies always focus on the employees who will retire soon. This shows companies need adjust labors with business cycle.

We need an appropriate definition of quality of labor contract to

differentiate temporal job worker and regular full-time employee and reconstruct the models.

Next, an important problems caused by structural change is now being debated in Japan : whether or not we need to introduce the work sharing between the temporal workers and full time workers. If work sharing is introduced by a company, the company needs to keep the maximum number of employed people and now adjustment is done not through the numbers of employee but through the hours of each employee. No employee can evade fluctuations of income caused by their labor hours under this system. The Netherland has introduced work sharing and does not distinguish wages per hour between regular full time employees, non regular full-time employees and part-time employees. Under such a complete work sharing system, the choice of labor contracts by households are strongly affected by their preference for leisure: the marginal utility from leisure time become crucial to deciding working hours.

Then we should back to discuss the quality of employment because the quality of contracts are related with the quality of workers. Workers who graduated from universities are usually considered more intelligent and/or patient enough to acquire necessary units to graduate. The correlation of workers' characteristics and the motivation how to work is considered to be positive in asymmetric information theory. Resent trends show, however, the opposite results. : the higher rate of turnover is observed within high educated workers.

Therefore, we investigate the employees' preference over the duration of contract. Consecutive temporal contracts and long term contracts are theoretically identical when we ignore the social securities and welfare, however, we doubt these are identical when we consider the risk attitude and time discounting.

Prior to the analysis of above of conditions, we study whether or not the behavior of employees is affected by structure of employment

periods: the difference between consecutive short period contracts and a long contract. This is one of purposes of this paper.

1.1 Standard Job Search Model

The prominent survey of the labor market theory is written by Richard Rogerson, Robert Shimer and Randall Wright [5]. They survey and build equilibrium models up from the decision problem, focusing on search theory and related bargaining theory and matching theory. They explicitly distinguish between the random search and directed search, and the role of bargaining and wage posting. We start the most simple job search model described by them :random search and wage posting without bargaining.

The basic model of job search theory presented by them is that the decision maker confronted a known objective distribution $F(w)$ of offers each period. If an offer is rejected, the agent remains unemployed during that period. It is assumed that previously rejected offers cannot be recalled. They implicitly assume that the problem is stationary, because this condition is necessary to solve dynamic problem using Bellman Equations.

$$W(w) = w + \beta W(u),$$

w shows wage, and β shows discount rate.

$$U = b + \beta \int_0^{\infty} \max\{U, W(w)\} dF(w),$$

where $W(w)$ is the payoff from accepting a wage w (W stands for working) and U is the payoff from rejecting a wage offer, earning b , and sampling again next period. b is payoff from unemployment insurance (UI) or social insurance¹⁾. Since $W(w)=w/(1-\beta)$ is strictly increasing, there is a unique w_R , called the reservation price wage, satisfying $W(w_R)=U$ with the property that the worker should reject if $w < w_R$ and accept if $w \geq w_R$. Through subscribing to the above conditions, the

contraction condition function $T(w_R)$ is shown as

$$T(w_R) = (1 - \beta)b + \beta \int_0^\infty \max\{w, w_R\} dF(w),$$

This equation characterizes optimal search strategy. There is a period T-N when N periods of search remain, after which the worker receives either b , or the accepted wage w for the remaining periods. The standard reservation wage equation as a solution of the dynamic problem is written as

$$w_R = b + \frac{\beta}{1 - \beta} \int_0^\infty \{1 - F(w)\} dw,$$

Reservation price depends on the level of the unemployment insurance, the objective distribution of w , and the discount value of the future. If $b = 0$, the problem becomes simple, and the decision maker's problem is only dependent on β and $F(w)$

2 Relation of Theory and Experiment

When testing search model via a static experiment in the laboratory, there are several difficulties.

The essence of the job search problem is that the decision maker faces a dynamic problem whether to accept smaller payoff b given today or larger payoff w given in future. Therefore, the equation of reservation wage can be solved using $0 < \beta < 1$. However, we cannot measure the size of β of each individual in the static choice problem.

Moreover, the problem when decision maker stops his job search is entangled with the problem of which level of reservation price is optimal for them :the problem of how long continue to search and the choice of reservation price is solved simultaneously.

In addition the difficulties we mentioned above, w such that satisfying $w \geq w_R$ is given probabilistically, whilst, the unemployment insurance is certain. The job search problem can divided into two factors : the attitude toward risk and discount future. However, in

behavioral aspects, these two factors are distinguishable features of decision makers.

This problem is crucial when we try to measure the size of reservation wage via experimental settings in which decision maker confront the choice problem whether they accept w or not when he has successive probable chances.

Consider a job searcher who discounts future a little and has a strong aversion to uncertainty. His choice of reservation price becomes lower because of his aversion to uncertainty, therefore, the length of job search period may be short in one day experiment. The result of any static experiment cannot reflect the size of discount factor. However, as for the interpretation of the result, if we get a comparatively lower reservation price than the other subjects under common known distribution in one day experiment, we can see the subject risk averse but impatient.

This theoretical structure is similar to the expected utility theory which doesn't distinguish between the risk attitude and the intertemporal substitution rate due to Epstein and Zin [2]. They pointed out that the utility theory implicitly assumes the magnitude of intertemporal substitution is identical to that of the risk attitude: the more risk allowance always means large substitution of dynamic utility²⁾. It is not clear where the smaller declaration of reservation wage is coming from, either from the lower confidence of the decision maker or from smaller risk allowance or higher preference for rewards. They are mutually entangled.

Moreover, the the reservation wage is dependent on the worker's own preference for higher rewards for search activities even in a static case. To illustrate, consider two decision makers who are facing the same distribution of w . It is intuitive that they may exhibit different degrees of risk aversion.

We should establish a dynamic model to distinguish the preferences

for higher reward for search activity and the risk allowance and the discount factor. We start with the static search model to eliminate the discount factor, or some substitutional novel experimental method should be developed. After the established facts are collected and analyzed, the dynamic experiment should be considered in the forward paper.

The primary objective of this paper is to provide an experimental support of the separation of decision factors of reservation wage. We concentrate on the measurement of the reservation price when they are given simple stopping problem. We start with the most simple stopping problems without dynamic choices. Instead of making subject choice between probabilistic w and constant b , we induce all subjects to accept probabilistic stopping problem with trivial cost. Our aim is to make subjects confess their optimal reservation wage under known uniform distribution of w .

2.1 Key Questions and Our Experimental Settings

The first question we are interested in is:

1: Do subjects exhibit rational search activity under known distribution ?

The extreme attitude toward risk allowance of search activity of decision makers is they hold the optimistic strategy and stick to their inner reservation point that they commit in advance to start job search. If we give the subject five opportunities to do search activities, such subjects will declare the highest reservation point, and then, continue to search until he gets the point that he have declared. The other simple attitude is to give up any job search because extreme risk averse.

We view that these are too extreme and decision makers search to maximize their payoffs. We consider the following basic search

model, that can capture the search behaviors by unemployed householders.

Our experiment is static in meanings of the rewards are given on the same day of the experiment, therefore, we could not consider the effect of personal magnitude of β . Furthermore, we do not create infinite settings in this experiment. We give discrete time and finite search model. Therefore, the utility expressed by the expected payoffs that each subject confront is,

$$U(w_R, n) = 0 + \max w(n), w_R \times m - (n-1)$$

$$F(w) = 1, 2, 3, \dots, 10, p(1) = p(2) = \dots = p(10) = 0.1, M = 5, 10, 20$$

There is no dilemma for of each time choice to when selecting whether a constant payoff or to bet probabilistic payoffs because $b = 0$.

The standard setting of job search theory is realistic when we consider job search activities in whole life. However, our experimental settings are more realistic when you consider the Japanese new graduates job researching activities during their 3rd and 4th year activities. For someone who cannot find their first job until graduation time, they will continue job searching. The m denotes how many periods they receive by their accepted offered wage of each period. M has crucial role for our experiment.

The n denotes how many time each subject do search. N is dependent on the distribution of wages and reservation price, therefore, theoretically, selecting n is identical to the selection of reservation price. However, behaviorally, to see them identical is too strong. We view these parameter have independency to some extent for the reasons describe below. The reservation price decides n approximately by calculating the possibility to reach the reservation point. However, when the search times are limited, n is also dependent how fortunate each decision maker's. If a subject

happens to be very unfortunate, he may become pessimistic and he reduce his reservation price from the first one. Given the above models and experiment, we are interested in the question,

2: Are subjects sensitive to the structure of another chances? If so, how? Or does behavior of subjects satisfy certain 'consistency' between their choices under different m ?

We gave structural difference to subjects by adjusting the time of periods m , not by adjusting the time of n . The total payoff in each session is uniformed to 20 periods. If $m=20$, the session has one chance to job search. If $m=10$, the session has two chances to job search. The same structure is held, when $m=5$.

Theoretically, the decision makers do not care structural differences, effect their reservation level and not care about how their opportunities are given. However, from the viewpoint of behaviorally economy, we cannot view these sessions identically for subjects.

We consider the level of reservation wage depends both on their confidence, and structural parameter m . This structure is similar to that between holding long term bonds and holding short terms consecutively, until the maturity of the long term bond. Holding these two securities are theoretically identical but realistic meanings in the market and behavioral problems that decision makers are facing are not identical. Someone prefers holding long term bond to holding short term bonds, and someone are indifferent. Someone prefers holding consecutive short term bonds.

The last question we are interested in is:

3: Do subjects affected their past result of each search activities? *across* identical information?

Decision maker may become pessimistic after they experienced

bad lucky. This is important if such things happen to actual job searchers. We observed many students of Keiai university completely lose their motivation when they could not find attractive jobs. After search activities, and gave up search activities to become a regular worker and became a part time workers in so-called 'ice age of recruit' : from 1994 to 2003³⁾.

We start measuring the reservation price for the model above under different periods of one session. Next we investigate how the difference of frequency of sessions are recognized and differentiated via revealed choices of decision makers. And we proceed to compare their performances and examine whether the differences are significant or not.

3 The Experiments

3.1 Procedure of Experiment

Instructions are given as below.

- We divide subjects two groups. One groups is faced with search problems with $m=20$ first, and $m=10$ secondly. The other groups is faced with search problems with $m=10$ first, and $m=5$ secondly.
- Subjects are given first card to scratch without any cost in each phase.
- The cost to scratch one new additional is losing 1 point each time.
- Subjects are told that after scratching one circle, they should never scratch one additional circle. If a subject happens to scratch two silver circles on one scratch, he/she will get nothing. If they would like to continue the search, they should raise their right hand and one additional scratch is given. However, they must abandon the number they got before, and they must attempt the new scratch.
- Subjects are told they have at the most 4 voluntarily trials beside first given trial without any cost.
- Subjects declare reservation point as a their inner commitment,

however, braking this commitment is never permitted. They are recommended to confess honestly.

- Subjects are told that the experimenter in the end determines which results out of two sessions is applied and linked to actual reward throwing a dice.

The difficulty here is that it is hard to make the subjects declare the reservation number for stopping search. Our purpose is to know the reservation price of subjects, however, the declaration is possible to be too much of commitment for them. Suppose for example that the subject who declares the reservation price $x = 8$ for his stopping search problem. His expectation is he can get the number 8, 9 or 10 in the third trials. He assumes that his losing points are at most 3, and after getting at least 8, he stops the search. If the subject scratches an '8' in the third attempt, and if the period for getting payoff is 10, total payoff becomes $8 \times 10 - 3 = 73$. Even if the subject declares 8 as his reservation point, unfortunately he cannot find the number 8 and he becomes pessimistic, and the last number he got at the third trial was 7, we may change his mind to accept 7 and give up 8.

3.2 Specific Devise in Experiment Designing—How to Make i.i.d Distribution

We mimic the situation that the decision maker samples one independently identically distributed (i.i.d.) distribution of offer each period from a known distribution $F(w)$. We give subjects $F(w)$ through using scratches. Under the silver circle of scratch, the numbers from 1 to 10 are hidden. the domain of w is (1,10) with average 6. Therefore, the numbers on one scratch card have uniform distribution. The numbers of every card are randomized by at least 3 peoples. We carefully investigate scratch sheets to certain the numbers of 10 are discovered by some transparency. We prohibit see the scratch sheets thought light. The problem is significant

when rewards are paid according to the actual choices made by the subjects, though it is absent in thought experiments.

| | |
|----------------------------|-----------------------|
| Day | Dec. 20, 2008 |
| Subjects | 30 at Keio Univ. |
| Rewards from their choices | 300 yen for one point |
| Reward for participation | No reward |
| Effective samples | 30 |

Table 1: basic data

| group | treatment 1 (search session) | treatment 2 (search session) |
|---------------------|---------------------------------|---------------------------------|
| group A sessions | m=20 (once) | m=10 (twice) |
| group B sessions | m=10 (twice) | m=5 (fourth) |

Table 2: treatment and sessions

4 Result

4.1 Overview of Results

Our results can be summarized as follows: (i) Almost all subjects decided their reservation point non-trivially rather than two extremes to bet max payoff or become too pessimistic (ii) Regarding incorporating different structure of opportunities of job searching and leaving their former job, the results partially differentiate two structures. (iii) Our observations were not enough to judge the different information did not match the predictions of existing theories. (iv) Few subjects broke their declaration of reservation value.

4.2 Choice Experiment

We conducted the choice experiment at Keio University on December 20, with 30 subjects. The subjects were asked to make choices by answering questionnaires to determine reservation points, and actual rewards were provided as explained below. After the questionnaires, the subjects were required to scratch their card and to raise their hands when if needed to scratch an additional card. Then they are given one scratch to write down the number they find and post it on the paper. They are told when they are given the 3rd additional card, 'it is the penultimate one'. to evade their regret by sticking to their reservation point.

Payment determination

After all the choices are made, payments are determined in the following way: All of them are given 20 points at first. The point subjects accepted and stopped to scratching, we call it the last point, they will get the last point multiplied by m periods. Next, the search cost n , the additional card they required is eliminated. The points of each session is calculated by $w(n) \times m - n$. If there are 4 phases in one session are 4, that means $m=4$, the all points in each session they get will sum up.

4.3 Rationality of Answers

Subjects behave rational when they were not too over confident nor too pessimistic, and we can judge subjects decide their reservation point seriously.

2 out of 30 subjects became pessimistic and gave up continuing scratching until they found their reservation point because the number of their 1st and 2nd draws were consecutively equal or low number under 2.

The mode for all sessions of any groups were 6. This number is considered pessimistic rather than optimistic when we consider that the

reservation point that gave subjects the highest expected payoff was 8 in all sessions for both treatments for any groups. (see table 4)

The maximum point of each session is shown in the table 3. The probability of reservation point 6 appearing in the 2nd draw is 0.95, therefore, strategy of subjects were pretty diligent.

In group A, 8 subjects out of 16 perfectly gave consistent answers to all sessions. In group B, only 2 subjects answers consistently even in 1st and 2nd sessions of the treatment 1. In group B, no subject was

| the point will appears in the | 1st card | 2nd card | 3rd card | 4th card | last card |
|-------------------------------|----------|----------|----------|----------|-----------|
| 10 | 0.1 | 0.19 | 0.271 | 0.3439 | 0.40951 |
| 9 | 0.2 | 0.38 | 0.542 | 0.6878 | 0.81902 |
| 8 | 0.3 | 0.57 | 0.813 | 1 | |
| 7 | 0.4 | 0.76 | 1 | | |
| 6 | 0.5 | 0.95 | 1 | | |
| 5 | 0.6 | 1 | | | |

Table 3: the cumulative probability distribution of reservation point

| reservation point | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------------|----|-----|-----|-----|----------|--------|
| the expected payoffs with m=20 | 96 | 114 | 134 | 152 | 137.4 | 71.9 |
| the expected payoff with m=10 | 92 | 108 | 128 | 144 | 127.4 | 61.9 |
| the expected payoff with m=5 | 84 | 96 | 116 | 128 | 107.4236 | 41.902 |

Table 4: the expected payoffs after the expected search cost is omitted

| treatment | 1st, m=20 | 2nd, m=10 | 1st, m=10 | 2nd, m=5 |
|--------------|-----------|-----------|-----------|-------------------------|
| | group A | group A | | group B |
| session | 1st | 1st | 2nd | group B |
| average of w | 6.375 | 6.594 | 6.781 | 6.214 6.385 6.179 6.407 |
| maximum of w | 9 | 9 or 10 | 9 or 10 | 7 8 7 8 |

Table 5: Average of reservation point

| | | | | | | |
|---------------------|--------------------------------|----------|----------|-------------------------------|----------|----------|
| group A | treatment s1 vs treatment 2 s1 | | | treatment 1 vs treatment 2 s2 | | |
| t-value | 0.4170 | | | 0.1086 | | |
| group A treatment 2 | s1 vs s2 | | | | | |
| t-value | 0.5489 | | | | | |
| group B treatment 1 | s1 vs2 | | | | | |
| t-value | 0.8069 | | | | | |
| group B treatment 2 | s1 vs s2 | s1 vs s3 | s1 vs s4 | s2 vs s3 | s2 vs s4 | s3 vs s4 |
| t-value | 0.5830 | 0.7929 | 0.4248 | 0.3356 | 0.5543 | 0.1612 |

Table 6: The results of statistical test between reservation points of different sessions within the same groups

consistent from the 1st session to the last session. We cannot explain why such prominent differences occur. We doubt this result comes from our methodology and suspect it is due to the characteristics of subjects. The subjects of group B knew that they would have 6 phases for search activity in contrast to the subjects of group A were facing only 3 phases for search activity. Each decision making to scratch in each session require them some kind of mental cost to decide, therefore, the subjects who were frequently forced to make decisions were not consistent. They randomized their answers. We consider these strategies were not irrational and serious because they knew they would be given their payoffs as a sum of each sessions payoffs in one treatment. The monetary incentive made subjects of the group free from resolute choices.

4.4 Observation of Behavioral Differences Within Groups

We compare the average within groups and between different treatments or different sessions. First, we compare the averages between treatment 1 and 2 of each group. As for the results group A, when search opportunity increases, the average reservation price became higher. This may be a reasonable result when we consider less

opportunity makes the expected value of the payoff smaller because if subjects target their reservation point equally the expected payoff will decrease due to additional search cost. However, as for the results of group B, the data are adverse : the increase of opportunity makes reservation point smaller. This result cannot be explained by the search cost. However, the differences between them were not significant.

Any comparison of average of each group was not significant. The observations do not support the inconstancy of rationality of search activities.

5 Concluding Remarks

We conducted an experiment to measure the reservation point of decision makers under different opportunities the search activities. The key contribution is we find the rationality of their strategies. Under stopping problem of each session with known cumulative function satisfying i.i.d distribution, most subjects decide their reservation point according to the expectation value. Our findings so far can be summarized as follows: (i) almost all the subjects exhibited non-trivial attitudes; they were not too optimistic nor too pessimistic (ii) the subjects answers with frequent opportunities to search are were not constant across the sessions; (iii) we cannot judge the reservation points of subjects were affected by the structural differences except for the cost of decision making. (iv) some subjects became pessimistic because of their unlucky draw.

Several interpretations of the results are possible. One is that the results are possibly robust when we conduct the experiment via same method Another possible interpretation is that the methodology was does not account for the dynamic nature of a job search and therefore the results do not represent real behavior. Therefore, we need more progress in experimental settings.

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Note

- 1) In Japan, the unemployment insurance payoff is decided by the length of employment periods and last income of employed period. The social insurance is thirteen thousands yen. Note that this payment is higher than average payoff of public pension funds.
- 2) One of the experimental approach to divide two factors and time discount factors via experimental approach is Wada and Oda (2005) [?]
- 3) in the ice age of recruit, the ration of active job openings to active job applicants are very low. Especially, in the 1998, when the bottom of the economy, the ratio decrease under 0.5. The unemployment rate was sharply increase from under 3 per cent in 1994 up to beyond 5 per cent in 2003.