Changing Job: A Real Option Analysis

Fouad K. Moussa
Department of Business
Gallaudet University
Washington, DC 20002, USA.

Hung Nguyen
College of Business
University of North Carolina
Charlotte, NC 28223, USA.

Anh Duc Ngo
College of Business
Wright State University
Dayton, OH 45435, USA.

Abstract

Changing job is the strategy for a worker to maximize his earnings during the life time. To optimally implement this strategy, he has to spend an amount of searching costs, scans over the labor market, and eventually makes an optimal decision on when and at which searching costs he is willing to move his current job to a new one. Dominated by the traditional net present value approach, the existing literature suggests that a worker accepts a new job offer if the net potential earnings exceed the current earnings. However, this decision rule is not applicable if we consider the decision to change jobs as an option. So, the decision rule must be based on pricing this option. This paper concerns with developing a theoretical option based model of job changing, and validating this model with an empirical application. It came up with three main findings: (i) real option approach works well as modeling job changing decision; (ii) the optimal solution of the model sensitively responds to the changes in parameters; and (iii) the within industry mobility demands higher critical earnings gap the cross industry mobility does.

1. Introduction

As an "economic man", a worker always wants to maximize his earnings during his working life. His good strategy is to spend substantial searching costs and scan over the labor market for a suitable job at each period in the working life[1]. Recently, a report by the US Bureau of Labor Statistics stated that younger baby boomers average 10.2 jobs between ages 18 and 38 (cited in Miller, 2005). In fact, there are many reasons for a worker to change the current job such as wage/salary, benefits, promotion, working condition, or bad feelings. Of which, wage/salary is the most important driving factor. Worker can quit the current job with relatively low earnings to a new offer with the potential for salary or career advancement. According to a recent survey by the Society of Human Resource Management, 89 percent of the respondents cited salary as a reason for employees' leaving. While, 85 and 79 percent of the sample responded that potential career advancement and satisfied feelings are the key points to accept a new offer.

The key question raised here is that what is the decision rule for him to leave the current job, and thus accept a new offer? Specifically, a worker has to decide when he optimally change his job and at which searching costs[2].

---

[1] As estimated, a typical worker spends from 4 to 6 months for active searching of a new job and spends over $500,000 for job searching costs in terms of lost wages, lost benefits, and lost investment returns during his lifetime (Miller, 2005)

[2] There are two types of job searching costs including job acceptance cost (e.g. cost of purchasing new clothing or equipment, and the costs of adjusting to the new environment, tasks and colleagues, and training cost), and job leaving costs (e.g. loss of firm specific pension entitlements) (Burgess, 1992)

Widely using the traditional net present value (NPV) methodology, the existing literature suggests that a worker should accept a new job offer if the net potential earnings is higher than the current earnings (Johnson, 1978; Burdett, 1978; Burgess, 1992). Because offer information is gradually revealed, a worker will lose opportunities for other new offers in the future if he decides to accept a new job right now. In other words, he can have more offers if he waits for a specific time. Considering the decision of changing jobs as a call option with a strike price equal to the searching costs, a worker's optimal solution must take into account the opportunity costs. However, the traditional NPV rule is not applicable here because it absolutely neglects this time value. In stead, we can use real option approach to value the option of changing jobs.

This study has two main following purposes:

1. To use the real option approach to model how a worker decides to change the current job to a new one as facing the uncertainty of potential earnings gap. And,
2. To apply a real data set into the theoretical model in order to analyze a worker's decision of changing jobs cross two industries and within an industry. Findings from this application will validate the model.

The paper is structured as follows. The next section describes the research methodology. Section 3 reviews the literature. Based on the methodology supposed by Dixit and Pindyck (1994), Section 4 develops a theoretical real option model of job changing. Next, Section 5 provides an application of the model to analyze a worker's decision to change the current job between two industries and within an industry. The final one is the conclusion section.

2. Research methodology

The paper considers the workers' decisions to change their jobs under the uncertainty of the earnings as a call option and then uses the model developed by Dixit and Pindyck (1994) to model to the worker's decision to change his job. Furthermore, the sensitivity of the model's solution will be examined by varying the parameters.
An empirical application of the model will be based on the data of workers' annual earnings obtained from the US Department of Labor during the period 1968-2007. The dataset (N=40 observations) provides information on annual earnings for workers working in Construction and Manufacturing industries, and Durable and Non-durable goods manufacturing. The earnings gaps will be constructed and used to estimate the model's parameters (α and σ^2). These estimates of parameters and variables will be used to calculate the options to change jobs between two industries (Construction and Manufacturing) and within the industry (Durable and Non-durable goods manufacturing). The results will validate the theoretical model.

3. Literature review

Changing job is a typical decision of a worker to deal with the dynamics of the labor market[3]. Specific issues of this topic such as why and when a worker change his jobs are dealt with in the theories of job searching or job shopping. In general, the literature makes some critical assumptions. Researchers always assume that a worker is risk- neutral and wants to maximize his income during the lifetime (Johnson, 1978; Burdett, 1978; Burgess, 1992). This assumption implies that a worker has to make the optimal decisions on his employments in order to address the income maximization problem. Researchers also assume that the labor market is so perfect that an employee can freely change his career and offer information is available to workers (Burgess, 1992; Lee and Choi, 2007). However, the assumptions on the dynamics of the earnings stream were almost neglected. A recent option- based study on when employees apply for a MBA course by Lee and Choi's (2007) assumes that the potential earnings flow is risky and follows a geometric Brownian motion. In the real world, a worker may leave the current job and look for a new offer for some main reasons such as relatively lower earnings, bad working conditions, or no potential promotions. A job shopping theory developed by Johnson (1978) states that:

> "A worker has two reasons to move to another job after trying a job and finding out the total return for that job. He may feel unlucky in picking a particular job that was either unsuitable or profitable. Alternatively he may feel that he knows more about his general ability and want to move to a job that requires his relatively high ability. He will move at the end of the first period if his expected earnings in job two exceed his current earnings."

[3] According to a recent poll by Louis Harris & Associates, 53 percent of American workers expect to leave their jobs voluntarily within the next five years.

In specific researches on quit rates, the literature finds that wage, age, gender, working experience, education, and searching costs are the common determinants of quit rates (Burdett, 1978; Burgess, 1992; John, 1967-8; Pencavel, 1968). Specifically, Burdett (1978) commented that wage rate and age of a worker determine the probability of quitting and job tenure. High wage induces a worker to change their current job, thus higher quit rate. While, high age discourages a worker to quit the current job. Because of the negative relationship between age and job tenure, long job tenure reduces the quit rate. Study by Pencavel (1968) strongly supports this argument. He found that an increase of annual wage income will reduce the number of quits about 2.7 in every 100 of employees working in the American manufacturing industries. While, workers under 30 years old have higher rate of mobility, and the proportion of female employees in the work force increases the quit rate. In regards to experience and education Johnson (1978) strengthened the literature when arguing that the quit rate of job change should be high among low experience workers, but low among highly educated ones. Additionally, according to Burgess (1992), searching costs include job acceptance costs and job leaving/quitting costs (JAC and JLC). Research findings support the hypothesis that these costs will reduce the probability of quitting jobs (Burgess, 1992; John 1978). Job changing costs tie workers into their current job, so unemployed workers will more choosy in selecting their first job. Also by making on the job search less profitable, these costs reduce the number of employed workers engaging in search (Burgess, 1992).

Furthermore, macroeconomic indicators such as GDP growth and unemployment rate also have effects on quit rate. An increase of unemployment rate will reduce the quit rate (John, 1968). In fact, less new offers in high unemployment situation explain for low quit rates in bad time. As usual, it is rational to assume that offer information is gradually revealed in the future. Therefore, a worker may have a better offer if he waits for a specific time in stead of quitting, thus accepting a new offer right now. Leaving the current job costs a worker an opportunity cost equal to the gap between the current and potential earnings. This argument implies that the traditional net present value method is not applicable in this situation because it ignores the opportunity costs. Unfortunately, this approach has been dominated in the literature. Researchers argue that a worker accepts a new offer if the net discounted potential earnings exceeds the current earnings (Burdett, 1978; Burgess, 1992; John, 1968). Specifically, John (1968) cited that:

> "…According to the classical theory of labor mobility, workers allocate their employment between industries so as to maximize their net rates of return over costs over their lifetime. In state of perfect information where all employment opportunities are known to him and if his employability is not restricted by lack of skills, economic man will move out of one employment into another if the latter offers him higher discounted real net returns."

As mentioned above, net present value approach is widely used in the literature. So, the application of real option concepts to the labor market has been almost neglected. There has been a study using real option approach by Lee & Choi's (2007) study on the employees' decision on MBA course application. Considering the decision to apply as an American call option with the exercise price equal the MBA cost, they found that the employee applies for the course just before the overall cost exceeds the potential benefit. They also took a simulation to see how the optimal solution responds to the changes in parameters and found that the option value of MBA application is very sensitive to parameter changes. These findings strengthen the validation of the model developed by Dixit and Pindyck (1994).

In short, theories in job changing have been developed under the critical assumptions and net present value approach. The literature come up with an important finding that earning is the most important factor triggering a worker to change the current job to another one. However, the NPV method is criticized for not taking into account the time value of waiting. Thus, there must be a room for further research using real option approach to study job-changing decisions.

4. A general model of job changing

The model will be based on the following assumptions:

(i) Workers always search for a suitable job in attempt to maximize their income during working life. In other words, we argue that workers are always proactive to the changes in the labor market which is affected by the economy's situations. This is the common assumption in the literature of job searching theories. However, as exceptions, Burdett (1978) and Mortensen (1986) who both assume permanent jobs and costless mobility (cited in Burgess, 1992).

(ii) The labor market is completely competitive and offer information is available and is gradually revealed in the future. It is also assumed that, except for searching costs, no barriers in terms of regulations or legal issues hindering the workers' mobility among jobs exist. For simplicity, the searching costs (i.e. job acceptance cost and job leaving cost) are assumed to be constant overtime.

(iii) Workers do not accumulate firm- specific capital and know all about the job before starting working. Thus, better offers will induce workers to leave the current jobs between industries or within an industry.

(iv) After scanning the labor market, workers can have some potential offers better than the current job to consider. For simplicity, we assume that workers have to decide whether they quit the current career or accept a new one only. Denote X and Y as the workers' earnings stream from the current job and from the new one, respectively[4]. The difference between the earnings is uncertain and defined as *V= X- Y*. As usual, *V* is supposed to follow a geometric Brownian motion, that is:

$$dV = \alpha V dt + \sigma V dz \tag{1}$$

where *dz* is the increment of a standard Wiener process; α is the expected growth of the earnings gap; σ is the standard deviation of the earnings gap's growth. Equation (1) implies that the current value of the earnings gap is known, however the future values are lognormally distributed with a variance growing linearly with the time horizon. Thus, the value of the earnings gap is uncertain.

As mentioned in the introduction, a worker wonders what is the optimal solution to pay an amount of searching costs (i.e. sunk costs, denoted as C) to accept a new offer which generates higher earnings than the current job does. We consider this decision as a European call option with the strike price at C. We denote the value of new job opportunity by F(V). The payoff from accepting a new offer at time t is V_T – C. Thus, the problem is to maximize the expected present value of the payoff:

$$F(V) = \max E\left[(V_T - C)e^{-\rho T}\right] \tag{2}$$

where ρ is the discount factor and T is time of searching for a new offer. As noted in Dixit and Pindyck (1994), ρ equals the free risk interest rate under risk- neutrality situation.

As supposed by Dixit and Pindyck (1994), we can use the contingent claim or dynamic programming approach to solve equation (2). This study will use the second one to derive the optimal solution.

The change in the expected return from new job opportunity is described by the Bellman equation:

$$\rho F dt = E(dF) \tag{3}$$

Expanding F (V) by Ito's lemma to obtain:

$$dF = \frac{\partial F}{\partial t}dt + \frac{\partial F}{\partial V}dV + \frac{1}{2}\frac{\partial^2 F}{\partial V^2}(dV)^2 \tag{4}$$

where

$$\frac{\partial F}{\partial t} = 0 \qquad \frac{\partial F}{\partial V} = F_V \qquad \frac{\partial^2 F}{\partial V^2} = F_{VV} \qquad (dV)^2 = \sigma^2 V^2 dt \tag{5}$$

By substituting equation (1) and (5) into (4) and taking the expectation, we have the result:

$$E(dF) = \alpha V F_V dt + \frac{1}{2}\sigma^2 V^2 F_{VV} dt \tag{6}$$

Finally, from equation (3) and (6), we end up with a partial differentiate equation (PDE):

$$\frac{1}{2}\sigma^2 V^2 F_{VV} + \alpha V F_V - \rho F(V) = 0 \tag{7}$$

F(V) must satisfy the three following boundary conditions:

- Option existing condition: F (0) = 0 (8)
- Value matching condition: $F(V^*) = V^* - C$ (9)
- Smooth pasting condition: $F_{V*} = 1$ (10)

[4] Earnings are the gross income described in the payroll.

Condition (8) means that the option to change the current job will be zero when no gap between the current and potential earnings exists. In this case, a worker is indifferent between the current job and the new one. V* is the earning gap at which it is optimal for a worker to accept a new offer. Condition (9) shows the net payoff from accepting a new job. Moreover, this condition can be modified as:

$$C = V^* - F(V^*) \tag{9'}$$

$$V^* = C + F(V^*) \tag{9''}$$

In general, equation (9') says that when a worker spends an amount of the searching costs, C, to accept a new offer (no wait), he gets an additional earnings, V, but has to give up the opportunity of other new offers in the future. The optimal earning gap, V*, triggering a job change is where the net gain equals the searching costs. Similarly, equation (9'') implies that the earnings gap must equal the sum of searching costs and opportunity costs as a worker made decision to leave the current job.

Technically, condition (10) guarantees the continuation and smooth of F (V) curve at the critical point, V*.
As usual, the optimal solution to equation (7) has the affine form:

$$F(V) = A_1 V^{\beta_1} + A_2 V^{\beta_2} \tag{11}$$

where $\beta_{1,2}$ are the roots of the quadratic equation:

$$Q = \frac{1}{2}\sigma^2 \beta(\beta - 1) + \alpha\beta - \rho = 0 \tag{12}$$

and are derived as follows:

$$\beta_1 = \frac{1}{2} - \alpha/\sigma^2 + \sqrt{\left(\alpha/\sigma^2 - \tfrac{1}{2}\right)^2 + \tfrac{2\rho}{\sigma^2}} > 1 \tag{13}$$

$$\beta_2 = \frac{1}{2} - \alpha/\sigma^2 - \sqrt{\left(\alpha/\sigma^2 - \tfrac{1}{2}\right)^2 + \tfrac{2\rho}{\sigma^2}} < 0 \tag{14}$$

Because $\beta_2 < 0$, F (V) goes to infinity as V goes to zero, thus violates condition (8). To satisfy this condition, the factor A_2 of the second term must be zero ($A_2 = 0$). Therefore, equation (11) becomes:

$$F(V) = A_1 V^{\beta_1} \tag{15}$$

where

$$A_1 = \frac{(V^* - C)}{(V^*)^{\beta_1}} = \frac{(\beta_1 - 1)^{\beta_1 - 1} C^{1-\beta_1}}{(\beta_1)^{\beta_1}} \tag{16}$$

Finally, we come up with the optimal earnings gap that triggers workers to quit the current job and accept a new one.

$$V^* = \frac{\beta_1}{\beta_1 - 1} C \tag{17}$$

The next step is to examine how the optimal solution responds to the changes in parameters. Differentiating the quadratic expression, Q, yields:

$$\frac{\partial Q}{\partial \beta}\frac{\partial \beta_1}{\partial \sigma} + \frac{\partial Q}{\partial \sigma} = 0 \tag{18}$$

where $\frac{\partial Q}{\partial \beta} = \sigma^2\left(\beta - \tfrac{1}{2}\right) + \alpha > 0$ and $\frac{\partial Q}{\partial \sigma} = \sigma\beta(\beta - 1) > 0$. Thus, equation (18) implies $\frac{\partial \beta_1}{\partial \sigma} < 0$. In other words, as σ goes up, β_1 goes down, then $\frac{\beta_1}{\beta_1 - 1}$ and the critical value of V increase. This result means that the more uncertain is the earnings gap, the higher is the net earnings gain a worker asks for changing his current job.
The literature of real option also pays attention on the effect of the excess return, $\delta = \rho - \alpha$, on the optimal solution. In the labor market, we can consider δ as the spread of the average earnings in dominating industries during the time a worker is looking for new job opportunities.

Substituting $\alpha = \rho - \delta$ into equation (12), this quadratic expression becomes:

$$Q = \frac{1}{2}\sigma^2 \beta(\beta - 1) + (\rho - \delta)\beta - \rho = 0 \qquad (12')$$

and the root β_1 is:

$$\beta_1 = \frac{1}{2} - (\rho - \delta)/\sigma^2 + \sqrt{\left((\rho - \delta)/\sigma^2 - \frac{1}{2}\right)^2 + \frac{2\rho}{\sigma^2}} > 1 \qquad (13')$$

In a similar way, the differentiation of equation (12') is:

$$\frac{\partial Q}{\partial \beta}\frac{\partial \beta_1}{\partial \delta} + \frac{\partial Q}{\partial \delta} = 0 \qquad (18')$$

where $\frac{\partial Q}{\partial \beta} = \sigma^2\left(\beta - \frac{1}{2}\right) + \alpha > 0$ and $\frac{\partial Q}{\partial \delta} = -\beta < 0$. So, it must be that $\frac{\partial \beta_1}{\partial \delta} > 0$. This means as □□increases, β_1 increases and *V** decreases so that the greater the excess return, the smaller the net gain a worker will demand in order to accept a new job offer.

5. A Real Application

The validation of the model requires the ideal data for an individual worker's earnings streams of both the current job and potential offers during his working life. Unfortunately, it is not possible to get such a data.

Instead, this section uses the data collected from the US Department of Labor (USDL) to validate the model. The sample includes 40 observations of Construction and Manufacturing workers' annual earnings[5] during the period 1968-2007. Explicitly, a worker can get the average annual earnings as he works in an industry during his life.

There are several steps to fit the real data into the model:

1. To construct the earnings gaps between Construction and Manufacturing, and Durable goods and Non-durable goods within Manufacturing.
2. To estimate the parameters: the expected growth of earnings gaps (α) and the variance (σ^2). This paper uses the approach proposed by Hull (2007) to estimate the variance of the earning gaps. The statistic $u_t = \ln\left(\frac{V_t}{V_{t-1}}\right)$ was calculated and used to calculate the variance (σ^2). The formula is defined as $\sigma^2 = \frac{1}{m-1}\sum_{i=1}^{m}\left(u_{n-i} - \bar{u}\right)^2$, where *m* is the number of observations of *u*.
3. To estimate searching costs: Burgess (1992) suggested that these costs include job acceptance costs (JAC) and job leaving costs (JLC). However, data of JAC is not available. Hence, we assume that only JLC is searching costs. JLCs are the lost benefits from leaving the current job, including insurance, retirement and savings and legally required benefits. These benefits are supposed to be constant over time. Estimated from USDL data, these lost benefits account for 31 percent and 29 percent of the earnings gaps for Construction and Manufacturing workers, respectively. The corresponding costs are estimated to be $78.9 and $84.5.
4. To plug the estimated parameters and variables to the model and calculate the optimal solution

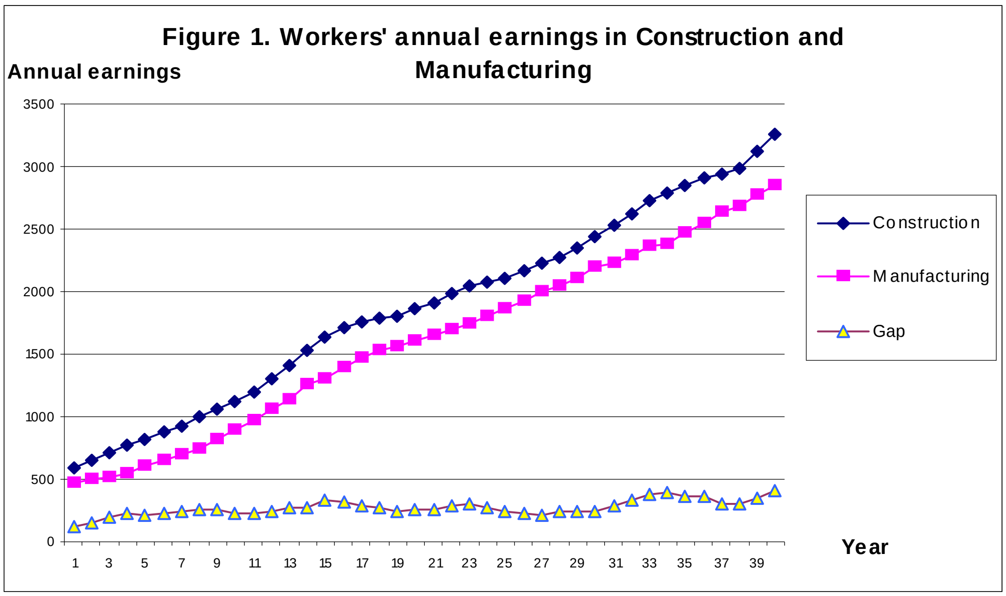
Table 1 shows the descriptive summary of the data and the earnings gaps between Construction and Manufacturing industries, and within Manufacturing. The mean of annual earnings in Construction is substantially higher than that of manufacturing ($1,870.2 vs. $1,598.2). This gap has the mean $272 and standard deviation of $61.65. Similarly, the earning gap within Manufacturing or between Durable goods and Nondurable goods manufacturing exists ($1,715.7 vs. $1,424.3), with the mean and standard deviation of $291.4 and $93.08, respectively. All of these differences are statistically significant at 5% level (p-value= 0). Intuitively, these gaps will trigger workers to move from Manufacturing to Construction (i.e. cross-industry mobility) and from Non-durable goods to Durable goods manufacturing (i.e. within industry mobility).

[5] These earnings are inflation adjusted and are measured at the constant price as of 1982.

Table 1: Descriptive statistics of the sample (N=40)

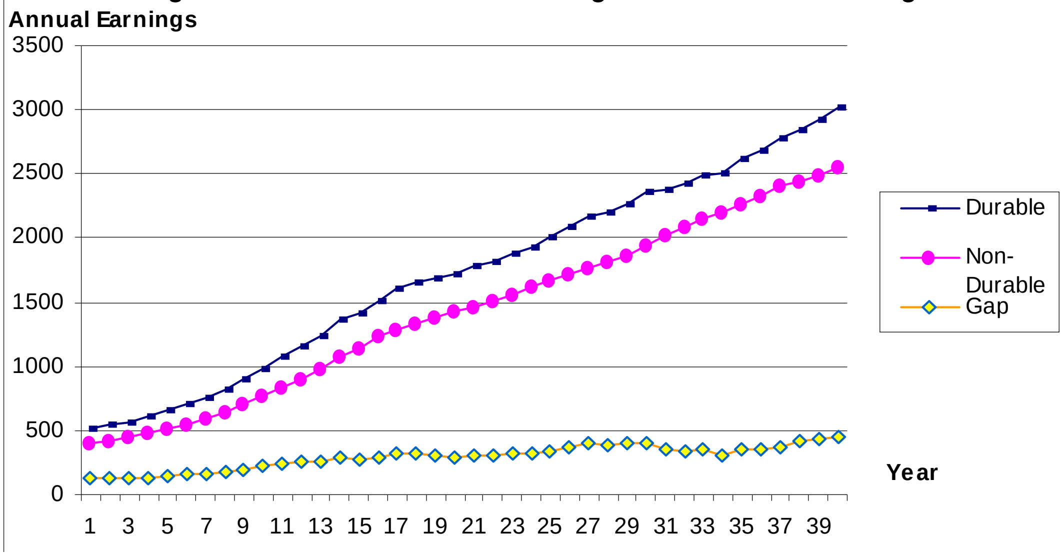
Industries	Mean	Paired t-test	Standard Deviation	Minimum	Maximum
Construction	1,870.22		773.39	590.74	3,256.16
Manufacturing	1,598.22	P-value=0.0	727.06	470.64	2,842.56
Cross- Gap	272.00		61.65	120.10	413.60
Manufacturing					
Durable Goods	1,715.74		760.17	519.66	3,012.31
Nondurable Goods	1,424.31	P-value=0.0	673.00	398.67	2,557.33
Within Gap	291.43		93.08	120.66	454.98

Figure 1 describes the increasing trend of Construction and Manufacturing workers' annual earnings during 1968-2007. The cross gap exits and possibly follows a stochastic evolution. This fact supports the geometric Brownian motion (GBM) assumption on the earnings gap.



Similarly, Figure 2 reveals the increasing trend of the annual earnings for workers working within manufacturing industry. Again, there is a gap of the annual earnings between Durable and Nondurable goods producing sectors. Also, the gap curve implies the possibility of GBM property.

Figure 2. Workers' annual earnings within Manufacturing



Theoretically, the drift of a GBM series can be estimated from the empirical data. Tauer (2004) used the real prices to estimate the expected growth and variance of milk prices to calculate the option value of getting in and out the diary milk market. Following the same procedure, the earnings gaps' expected growths and variances will be estimated from the USDL's data set. As shown in Table 2, the estimated parameters are slightly different. The expected growth of the earning gaps between construction and manufacturing, and between durable and non durable goods manufacturing are 1.37 and 3.4 percent, respectively. Their corresponding standard deviations are 0.106 and 0.065. Explicitly, the expected growth of the within gap is higher than that of the cross gap. Whereas, the cross gap has higher standard deviation.

Table 2: The estimates of parameters

Earnings Gap	Expected growth (α)	Variance (σ^2)	Std. Deviation (σ)
Construction- Manufacturing	0.0137	0.0113	0.106
Durable – Nondurable Goods Manufacturing	0.034	0.004	0.065

It is assumed that the discount rate is 10 percent annually. By substituting all of these parameters and searching cost into equation (13), (15), (16) and (17), we find the main results described in Table 3.

Table 3: The optional solution

Job mobility	Factors		Optimal solution	
	A_1	β_1	V*	F(V*)
Manufacturing =>> Construction	0.0000017	3.56	109.85	30.85
Nondurable Goods =>> Durable Goods Manufacturing	0.00011	2.67	135.24	50.74

Table 3 shows the critical values of the earnings gaps encouraging a worker to accept a new offer. By graph, these trigger points are defined as the tangency of the option value curve, F(V), and the curve of the net earnings gap, V-C (See Figure 3 & 4). Thus, a worker changes his job from Construction to Manufacturing or from Durable goods to Nondurable goods manufacturing if only if the earning difference exceeds \$109.85 and \$135.24, respectively.

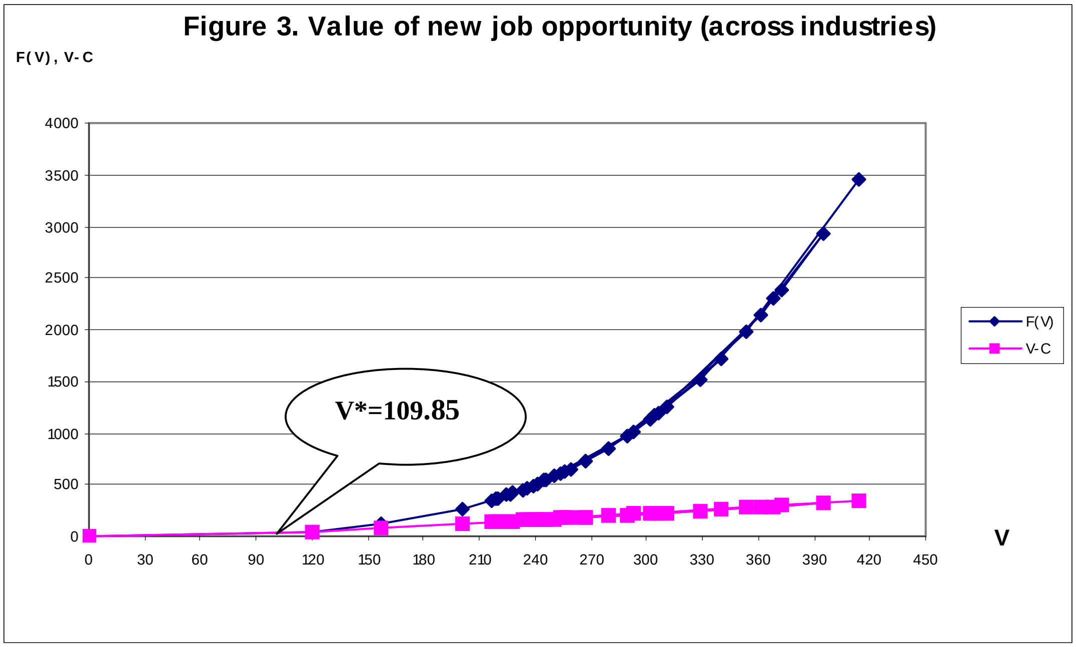
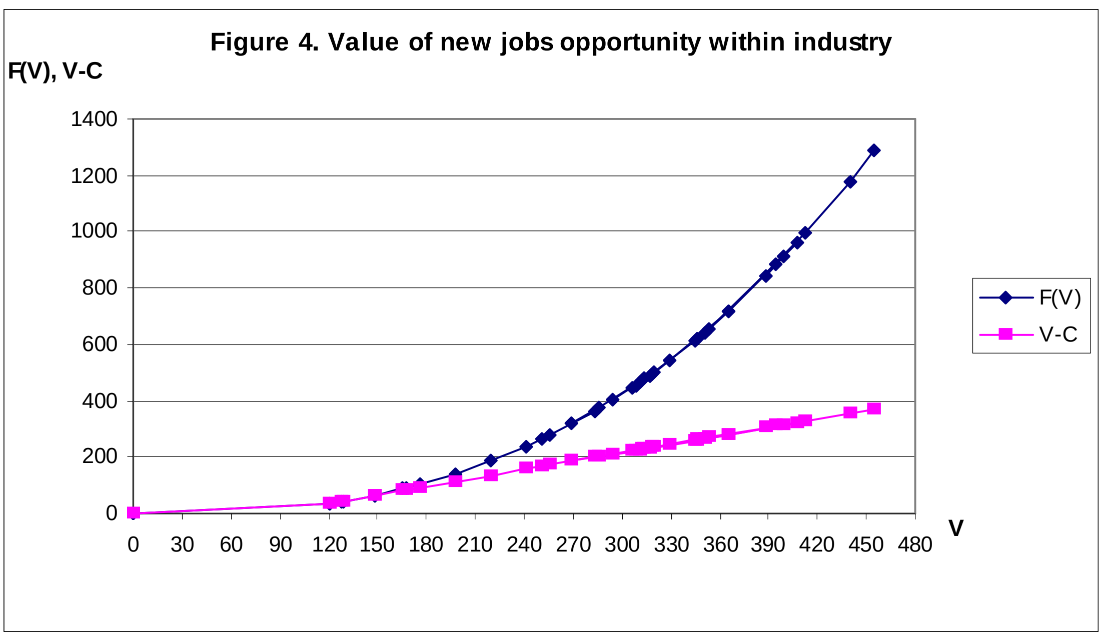


Figure 3 & 4 show the evolution of the option value over time for a job change from Manufacturing to Construction and from Non-durable goods to Durable goods manufacturing. Clearly, the option values are exponential to value of earning gaps. The implication is that higher earning gaps require more time to wait, thus higher value of the option.



An interesting finding comes up here. The within industry mobility (within Manufacturing) requires higher critical value of the earnings gap (1.23 times) than the value demanded for a job mobility among industries (Construction and Manufacturing). At the critical values, the option value of within job mobility is also larger than that of cross industry mobility ($50.74 vs. $30.85). This means that the waiting time for the within industry mobility must be higher than that of cross industry mobility. The question here is why? As stated in Table 1 & 2, except for variance, the mean, standard deviation, and expected growth of cross earnings gap are lower than those of within earnings gap. So this finding can be explained by the more flexibility of mobility within an industry. In fact, the structure of different industries results in less job mobility among them.

Table 4: Sensitivity of the optimal solution

Change in parameters	V*	F(V*)
Increase in discount rate	-	-
Increase in the expected growth rate of the earning gaps	+	+
Increase in variance	+	+
Increase in searching costs	+	+
Increase in all parameters	+	+

As analyzed in Section 4, the optimal solution sensitively responds to the changes in parameters. So, it is interesting to examine this argument using the real data. Table 4 reveals the summary of the effects of parameter changes on the optimal solution. The critical value of earning gaps and option values increase as the expected growth rate of the earnings gap, variance, and searching costs increase. This implies that if a job with high expectations of the earnings gap growth, more uncertainty, and high searching costs will discourage a worker to accept a new offer right now. In other words, he has to wait for a specific time. By contrast, the optimal solution goes down as the discount rate goes up. Totally, an increase in all parameters results in an increase in the optimal solution. These findings are consistent with Section 4.

6. Conclusion

This paper has studied the job changing problem under the real option approach. The analysis proved that the traditional NPV decision rule is not applicable when a worker has options to wait for more offer information in the labor market. In general, to make the optimal decision, a worker has to take into account the opportunity costs of giving up the potential offers if he decides to change the current job now. However, the traditional decision rule is applicable when job offers are scare, especially in high unemployment situation.

The theoretical optimal solution is very sensitive to the changes in parameters including the expected growth rate of earnings gaps, variance rate, discount rate, and searching costs. These parameters affect the decision on when a worker changes his jobs. The empirical analysis strengthens this argument.

The optimal solution of changing jobs among industries (cross industry mobility) significantly differs from that of changing jobs within industry (within industry mobility). Within mobility demands higher critical earnings gap than cross mobility does. Basically, the structure differences explain for this finding.

The study has several limitations. First, the analysis strictly supposed that the earnings gaps follow a geometric Brownian motion. Plausibly, the earnings gaps would be a jump process because potential promotions can results in a jump in the earnings. Further researches must take into account this issue to comprehensively model the job changing problem. Second, the data set used in this paper is not ideal enough to exactly value the job changing options. Hence, future empirical researches require longitudinal data on current and potential earnings of individual workers during their lifetime. The analysis also fails to consider the issue of age as developing the theoretical model. Older workers likely tie to the first offer, thus waiting is worthless to them.

References

Burgess, S M., “A search model with job changing costs: Euro sclerosis and unemployment,” *Oxford Economic Papers,* 44 (1992), 75-88

Burdett K., “A theory of employee job search and quit rates,” *The American Economics Review*, 1, 68 (1978), 212-220

Dixit and Pindyck, *Investment under Uncertainty*, Princeton University Press, 1994

Hull J C., Options*, Futures and other Derivatives,* Prentice Hall, Sixth Ed., 2007

Johnson, W R., “A theory of job shopping,” *The Quarterly Journal of Economics,* Vol.92 (May, 1978), 261-278

Lee J R. & Choi K H., “When to apply for an MBA course: the real options approach,” *Applied Mathematical Sciences,* 1, 55 (2007), 2707-2714

Pencavel J., “An analysis of the quit rate in American manufacturing industry,” Industrial Relation sections, Dec 1968

Tauer, L W., “When to get in and out of diary farming: A real option analysis,” Working Paper, Department of Applied Economics and Management, Cornell University, Oct. 2004, http://hotjobs.yahoo.com/career-articles-should_i_stay_or_should_i_go-461, http://mediaserver.prweb.com/pdfdownload/289818/pr.pdf