Human Resources

Asymmetric Information in Labour Markets

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Traditional assessment of economic performance has been based upon traditional production factors such as land, labour and capital but the importance of the knowledge-based assets' role in firm's performance increase undeniably. Knowledge assets or intellectual capital may be mentioned as the "hidden" assets of a firm which is based on Human capital. According to this statement selection of the human resource becomes a much more important case that has to be achieved for firms and other agents.

The development of internet in 1990's has caused a kind of revolution in labour market which provides significant cost advantage forming a candidate pool. For a Human Resources Manager (HRM), choosing an appropriate candidate for the suitable position is just as difficult as to click his/her PC's mouse button. However, efficiency requires all labour forces to be employed under the assumption that the supplier (candidate) knows the true quality of him/herself whereas the HRMs (dealer) are unable to find the true quality of a specific candidate and adverse selection effect may cause the labour market to collapse entirely.

My paper is trying to introduce these selection process problems by combining different methods, Lemon Markets, Bayesian Signalling Games, Moral Hazard, Adverse Selection and Principal-Agent problems. The term lemon will refer to the candidates who apply for any kind of job while the interviews form the signals between the candidate (sender) and the HRMs (receptor). Using these tools, the paper is basing all these microeconomic problems on factors such as immigration and/or gender. Although Akerlof showed that informational asymmetries can cause adverse selection on markets. Inspiring by Spence's theory under certain conditions, well informed job applicants can improve their probability of taking the job by signalling their private information to poorly informed HRMs.

In the first part of the paper, I will give a very brief explanation about theoretical background of these tools and establish the link between those theoretical explanations and candidate selection process. In this framework, the labour force is dividing into two group: one group belongs to the well educated-white/blue collar labour force and the other group belongs to unskilled-ordinary labour force. This distinction helps us to interpret the signals from our model much more correctly.

Second part of the paper includes information about the selection and the real Human Resources Management examples. In this context, this part gives different selection problem cases. For instance, those inefficient choice techniques usually find the right CVs but wrong person. So choosing the good lemon among the others becomes more and more difficult when HRMs look at the wrong basket. Finally the last part gives a summary.

Introduction

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My paper is trying to introduce these selection process problems by combining different methods, Lemon Markets, Bayesian Signalling Games, Moral Hazard and Principal-Agent problems. (Aliprantis and Chakrabarti, 2000)

In his Nobel prize winner lecture Akerlof[1] showed that informational asymmetries can cause adverse selection on markets. Akerlof studied on markets with the informational problem known as adverse selection where the seller has more information than the buyer regarding the quality of the product. According to imperfect information on the prospective car buyers, borrowers with weak repayment prospects or sellers of low-quality cars crowd out everyone else from the market. Spence demonstrated that under certain conditions, well-informed agents can improve their market outcome by signaling their private information to poorly informed agents. (Akerlof, 2001 and Spence, 2001)

But the other side of the medal is that the firms can also have superior information than the workers exactly opposing from my paper. The asymmetry of information introduces unemployment fluctuations and dynamic wage sluggishness as Acemoğlu mentions. As the information of the firm, whom has superior information, reveals gradually wages fall slowly in response to a negative shock and unemployment exhibits additional persistence. Dynamic bargains and asymmetric information in the wage determination process can be an additional source of persistence in unemployment fluctuations as in non-competitive labour markets, both workers and firms receive rents from the unemployment relation. (Acemoğlu, 2003)

Models

First Part of the Candidate Selection Process

Signaling Games: Perfect Bayesian Equilibrium[2]

A signaling game is dynamic game of incomplete information. There are two players in a signaling game; we will call them player 1(Sender) and player 2 (Receiver). Nature moves first and draws among a number of different types.

1. For every type if i=1,2,....., n; Nature draws a type t_i for the Sender from a set of feasible types $T=\{t_1, ... t_n\}$ according to the probability distribution $P(t_i)$ where $P(t_i)>0$ for every i and $P(t_1)+..... P(t_n)=1$.

2. If j=1,2,....., n; The Sender observes t_i and then chooses a message m_j form a set of feasible messages $M=\{m_1, ... m_j\}$.

3. Receiver observes the m_j message but can not observe the *ti* type and chooses an a_k action from a set of feasible actions $A=\{a_1, ..., a_k\}$.

4. Payoffs are determined by $U_S(t_i, m_j, a_k)$ and $U_R(t_i, m_j, a_k)$.

[1] Akerlof shared first rank in Nobel Prizes 2001with Michael Spence and Joseph E. Stiglitz

[2] See Gibbons, Robert, Game Theory For Applied Economics for the original text.

Signaling games have been applied extremely widely in economics as they can be used to simulate many real life situations. In Spence's (1973) model of-marketing signaling, the Sender is a worker, the Receiver is the market of prospective employers, the type is the worker's education choice, and the action is the wage paid by the market.

In our model the Sender will refer to the candidate who applies for the job while Receiver will refer to the HRM. The set of feasible messages M={mı, ... mj} will be composed by candidates' CVs. We will assume that m1 will refer to qualified CVs while m2 refers to unqualified CVs. Message m1 may be consist of graduating from a good university, having a high TOEFL score, internships, seminars attended etc.

The set of feasible actions A={aı, ..., ak } will be consist of only two actions which are whether to call the candidate for an interview (I) or reject the application (R).

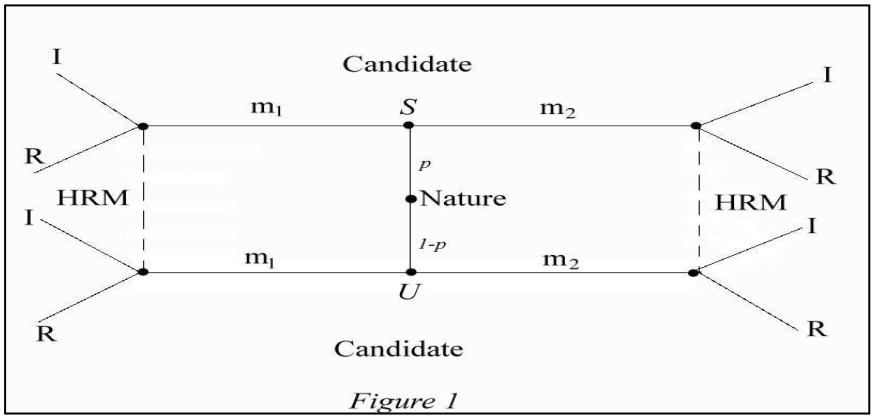


Figure 1

Signaling game, which is a game of imperfect information with no subgames in shown in Figure 1. Here the most important thing is that the game does not begin at a starting point. The action that will start the game is revealed by nature from the middle of the tree to the terminal points. Strategy of a player in any kind of game is a complete plan of his available actions. According to the chosen messages candidate's pure strategy function is m(ti) for every type that nature can reveal while HRM's pure strategy is a function of a(mj) for every message which can be sent by the sender.

So both HRM and a candidate have four pure strategies in the game.

Candidate's strategies:

1. If nature draws a skilled worker, than the worker will play m_1 or he will play m_1 again if nature draws an unskilled worker.
2. If nature draws a skilled worker candidate will play m_2 or he will play m_2 if nature draws an unskilled worker.
3. If nature draws a skilled worker candidate will m_2 or he will play m_1 if nature draws an unskilled worker.
4. Finally if nature draws a skilled worker candidate will play m_2 or he will play m_2 again if nature draws an unskilled worker.

HRM' s strategies:

1. If candidate chooses m_1, the HRM will play I or if candidate chooses m_2 he will play I.
2. If candidate chooses m_1, the HRM will play I or if candidate chooses m_2 he will play R.
3. If candidate chooses m_1, the HRM will play I or if candidate chooses m_2 he will play I again.
4. If candidate chooses m_1 the HRM will play I or if candidate chooses m_2 he will play R.

We call the candidate's first and fourth strategies pooling as each type sends the same message while the second and third separating because each type sends a different message. In a model with more than two types there are also *semi-separating* strategies in which all the types in a given set of types send the same message but different sets of types send different messages. (Gibbons, 1992)

In fact a Bayesian Signaling Game is a conflict of impressions. The game is constructed on making the other player behave as you want rather then maximizing your payoffs although it is obvious that if he behaves as you like your utility will be maximized. Strategies are a little bit more complicated than the "*prisoners dilemma*" . If you think about the Human Resources newspapers which are given as pull-outs at weekends you will realize that the set of candidates' messages is being conditioned before the game starts. Candidates do not compose their CVs according to their qualifications. Especially in developing countries, even the football team that you are a fan of, your high school or your religious beliefs may be a stronger reason than your academic achievements; a catalyst for being chosen among others.

Most of the HRMs discovered that having only skill and knowledge does not guarantee success. It is the deeper and invisible competencies that are often vital to success. So not only the messages occurred by the impressions of candidates' CVs on HRMs identify whether to hire a candidate but also the interviews are very important.

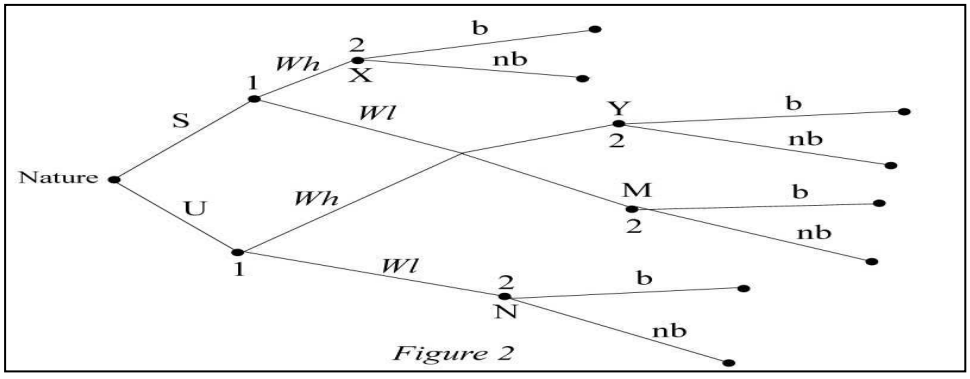
Second Part of the Candidate Selection Process
The Market for Lemons

The game is a type of two-player game in which one of the players has superior information than the other. The example is a highly stylized version of the market for lemons which was analyzed by George Akerlof in his seminal piece "The Market for Lemons: Quality Uncertainty and the Market Mechanism. In this market there are two types of workers and seller will refer to the workers who supply their labor will.

In such a market the seller usually has a reservation wage W_h if he is a skilled worker. (the lowest wage he is willing to supply his labor). On the other hand buyer, who refers to the Human Resources Manager, has his own reservation wage: a reservation wage of H YTL for a skilled worker(the highest wage he is willing to pay for a skilled worker) and a reservation wage of L YTL for an unskilled worker (the highest wage he is willing to pay for an unskilled worker). For the viability of the market transaction we will assume that $H>W_h$ and $L>W_l$

Another important point is that all reservation wages H ,W_h, L, W_l are known by all players. It is also assumed that $W_h>W_l$ and H>L. Finally in this market the seller has superior information than the HRM.

Now let's look at the sequential game that results when a worker supplies his labor in a market which the wages are too low for such a qualified candidate. First nature reveals the quality of the worker whether he is skilled or unskilled (S for skilled and U for unskilled) to the candidate (player1) who decides whether he should ask a high wage, W_h or a low wage, W_l for his labor. The HRM (player2) does not know the quality of the worker but sees the W asked by the worker. Player 2 then has to decide whether to hire player 1 or not. The process is described in Figure 2.



Clearly the sequential game with imperfect information does not have any subgames but once an information set of player 2 is reached it is unclear what player 2 will do as he does not know whether the worker is skilled or unskilled. Which way is rational for player 2 depends on his beliefs about the quality of the worker. The question is what beliefs should a rational player have at

player 2's information sets. The rationality of the player's beliefs depends on the consistency with his choices.

Under these circumstances it may "seem" sensible to believe that

- If player 2 (HRM) observes the listed wage W to be close to W_h, then he should believe that the worker is skilled.
- If he observes the wage W to be close to W_l, then he should believe that the worker is unskilled.

But what if player 1 knows this? Should player 1 charge a high wage if he is skilled and a low wage if he is unskilled. As the game theory is based on the both player's ability of guessing each other's actions and constructing strategies according to these estimations the answer is of course to charge a high wage whether he is skilled or not. It is obvious that the beliefs of player 2 are not consistent with the choices of player 1 given player 2's beliefs. So high wage should lead player 2 to believe that not only skilled labor is supplied but also unskilled labor is supplied at the high wage. Hence the probability of the worker being skilled and unskilled is equal for the HRM. In such a case the HRM will hire the candidate only if the expected value of hiring the worker exceeds the expected value of not hiring him.

$\frac{1}{2}$ (H-W)+ $\frac{1}{2}$ (L-W)$\geq$0 or W$\leq \frac{1}{2}$ (H+L) which means that the HRM believes that he is at node X with a probability of $\frac{1}{2}$ and at node Y with a probability of $\frac{1}{2}$.

In this situation according to player 2's information sets rational points I_1=X, Y are P({X})=P({Y})=$\frac{1}{2}$. If however W_h>W>W_l the HRM will believe that skilled workers do not supply their labor in the market. Thus when the HRM sees a wage W less than W_h should believe that he is at node N with certainty. In this case according to the player 2's information sets I_2=M, N rational points are given as P({M})=0 and P({N})=1.

Case 1: If $\frac{1}{2}$(H+L)>Wh

In this case since the wage W=$\frac{1}{2}$ (H+L) is greater or equal to the reservation wage W_h which skilled workers will ask for both quality of workers will supply their labor.

Case 2: W_h>$\frac{1}{2}$ (H+L)

In this case, since W=$\frac{1}{2}$ (H+L) will be offered as the wage, skilled workers will not supply their labor. Therefore only unskilled workers will supply their labor and the wages will settle somewhere between W_l and W.

In 1990s in the golden ages of banks, qualified workers were being transferred with too high wages according to their marginal productivity of labor.(MPL) So in such a competitive sector transfers were implemented not only to have qualified workers but also to build prestige, banks spent lots of money for human resources. But after the 2001 crisis everything changed.

Today a three years experienced bank employee's net rate is 450YTL. (BusinessWeek Turkiye, 2006) Although wages are so low for even candidates whom graduates from economics and business departments of universities, also lots of engineers and other people from various disciplines apply for being a bank employee. Even tough high possibility of being promoted, not being sought for experience(especially in call-centers), premiums, social opportunities make this sector attractive it is not something easily understandable of a candidate's application for a job offering such a low rate level if he has graduated from a respected university. Excluding the private life conditions of individuals why a candidate supplies his labor in such a low rate offering market if he is so skilled?

It seems quite reasonable of a HRM having a confused mind in the candidate selection process. So choosing the right CV but the wrong candidate is a problem that HRMs usually have to face. Finally we may mention that this kind of uncertainty causes problems for not only HRMs but also the candidates such as over-qualification.

Third Part of the Candidate Selection Process
Principal-Agent Problems:

We have seen how difficult is choosing the proper candidate for a job. But more difficult than this is encouraging this worker work hard as he may choose being lazy rather than working hard.

Optimal Contracts: The Perfect Information Case:

This is a two-player sequential game in which the Principal P is considering about making a contract with Agent A who will either accept the contract or reject it. If he accepts the contract again he will have two choices as either working hard (H) or being lazy (L). We assume that H and L are measured as YTL. If the agent works hard he will make the principal earn 1000 YTL with a probability of 0,8 and 100 YTL with a probability of 0,2. If he is lazy than principal will get 1000YTL with a probability of 0,2 or he will receive 100 YTL with a probability of 0,8. It is also assumed that principal can observe whether the agent works hard or is lazy. The game is a game with perfect information.

The contract that is offered will be denoted by the wage function *W*(.) where this function takes two values *W*(H) and *W*(L). Here our next assumption will be H>L. In Figure 3 the resulting Principal-Agent game is shown. The payoff to the principal in case the worker works hard is 1000YTL-*W*(H) and agent receives *W*(H)-H.

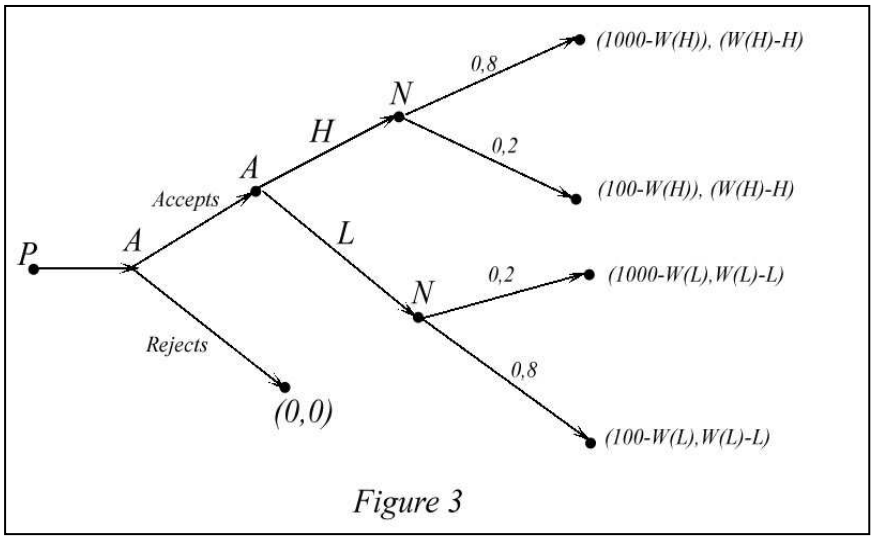


Figure 3

The aim of the principal is to offer a contract to the agent that will induce him to work hard or to be lazy according to his profit for both situations.

If the principal wants the worker to work hard conditions have to be as shown below:
$W(H)-H \geq W(L)-L$ and $W(H)-H \geq 0$
The condition $W(H)-H \geq W(L)-L$ guarantees that the worker will choose to work hard. So expected payoff of the principal is as:
$0,8 \times [1000-W(H)] + 0,2 \times [100-W(H)] = 780 - W(H)$, (1)
If the principal wants the worker to be lazy conditions have to be as shown below:
$W(L)-L \geq W(H)-L$ and $W(L)-L \geq 0$ (2)

The condition $W(L)-L \geq W(H)-H$ guarantees that the worker will choose to be lazy. So expected payoff of the principal is as:

$0,8\times [100-W(L)] + 0,2\times [1000-W(H)] = 280- W(L),$ (3)

Finally if we solve (1) and (2) simultaneously where $780 - W(H) > 280- W(L)$ the principal will prefer the worker to work hard.

As you may realize easily principal-agent problem with perfect information is just a simple cost accounting calculation rather than constructing a production strategy. Whole strategy is based up on a simple equation which is: π>MC to make profit for the principal and for the agent gaining a wage which is greater than his reservation wage H or L. H which may be minimum wage, is the cost of working hard for agent while L which can be unemployment insurance, is the cost of being lazy. But with the presence of imperfect information we shall see that the game will become substantially complicated.

Optimal Contracts: Imperfect Information Case:

Here we will assume that the principal is able to observe the outcome only. Now the principal-agent is a game of imperfect information. Game tree is shown in Figure 4.

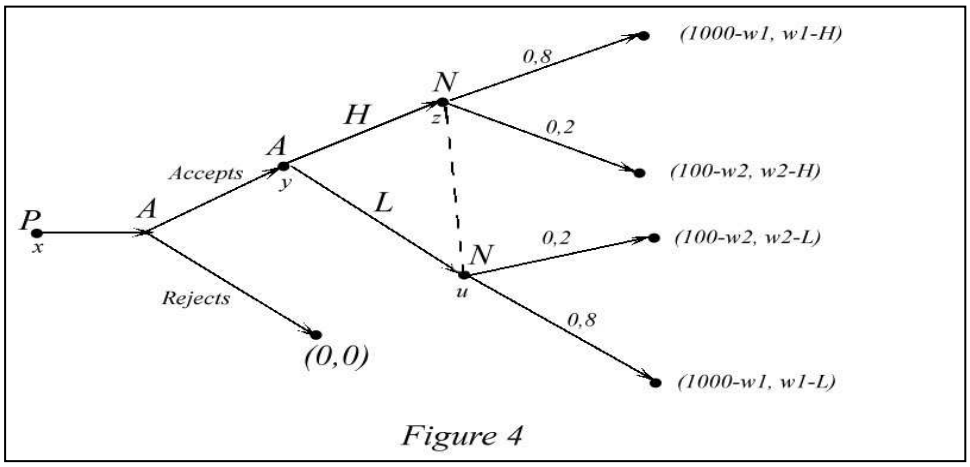


Figure 4

In this case since the principal can only observe the outcome the wage contract $W(.)$ depends on the level of output. So $W(.)$ is now a function of the output's level instead of the level of effort.

$w_1=W$(high output) and $w_2=W$(low output) while $w_1 \geq 0$ and $w_2 \geq 0$

In this game a strategy of the principal consists of making a wage offer (w_1,w_2), and a strategy of the agent consists of a plan whether to accept the wage contract or reject it at node X.

If we try to solve the principal maximization problem with an assumption as both the principal and agent are risk-averse by *Lagrange Multiplier Method* [3]*:*

The *incentive constraint* which will make the agent accept the contract is $0,8w_1+0,2\ w_2-H \geq 0$ while the *individual rationality constraint* is $0,8w_1+0,2w_2-H>0,2w_1+0,8w_2-L$ which will induce the agent work hard.

$$L = 0,8w_1^2+0,2w_2^2+\lambda(0,6w_1-0,6w_2-H+L)$$

$$\frac{\partial L}{\partial w_1} = 1,6w_1+0,6\lambda = 0 \qquad (1)$$

$$\frac{\partial L}{\partial w_2} = 0,4w_2-0,6\lambda = 0 \qquad (2)$$

[3] see for Lagrange Multipliers Method Thomas/Finney, Calculus 8th Edition Part 2, page: 891

$\frac{\partial L}{\partial \lambda} = 0{,}6w_1\text{-}0{,}6w_2\text{-}H+L = 0$ (3)

From equation (3) we can find $w_1 = w_2 + 1{,}66(H-L)$

If we solve (1) and (2) simultaneously we will find $w_1 = -\frac{1}{4} w_2$

When we put w_2 in (3) the solution is $w_1 = \frac{H-L}{3}$ and $w_2 = -\frac{4(H-L)}{3}$

Conclusion

Principal-agent problem shall be both player's individual maximization problem but in long run it will have negative effects on macroeconomics. For example in a dynamic bargaining framework, agreements often take time so the information reveals gradually. Thus when a bad shock hits the economy, the impact of this shock reveals slowly which is called *'dynamic wage sluggishness'*. Wages are not only high now but also in the future as with dynamic bargaining information about the impact of the shock reveals immediately. As a result the destruction in employment spreads over time. (Acemoğlu, 2003)

So we see that Adam Smith is wrong as the sum of the individuals utility does not equal to the whole society's welfare.

In fact the problem is even the candidate himself knows whether he is suitable or he/she wants to work on that job really although whom we assume that has superior information than the HRM. At that point universities can be mentioned as a mind bending factor as they even can not decide themselves whether to educate students for private sector or being academicians. These confusions effect the set of candidate's feasible messages and the candidate selection process fail at the beginning of the game. Conditioned set of messages misleads the set of HRM's set of feasible actions and results as wrong candidate selection which cause great amounts of selection costs. "*In a global research study - conducted jointly by SHL and the Future Foundation - it was found that the hidden cost of selecting the wrong candidate for a position equals an annual sum of US$23 billion in the UK and US$105 billion in the United States. Translating these findings to a South African context, the cost of managing poor performance is estimated to be R29 billion or 2.26% of GDP.* "[4]

Finally undergraduate programs and courses shall be revised in order to innovate this procedure. As a short term solution even transcripts can be used to understand the specialization of the candidates according to the courses they studies in their undergraduate program. Labor has to be educated and may be oriented in to the right sectors according to individuals skills, intellectual capital and wishes as well.

[4] http://www.onrec.com/content2/news.asp?ID=9676

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