Problem Set 8: Search Theory

Exercise 1. Fallick and Fleischman (2004) report that 5 million people left employment in the U.S. in 1999. Meanwhile, 120,000 new jobs were created on net each month. How many people entered employment? What does this finding suggest about the U.S. labour market?

Solution 1 (Labour Market Flows)**.** There were $120,000 \times 12 = 1,440,000$ net new jobs created in 1999 and since $5,000,000$ people left employment, $6,440,000$ entered employment in the US during 1999. Lots of people are leaving and even more are entering so the US labour market is quite dynamic.

Exercise 2. In the flow model of the labour market, the job finding rate was $xa(\theta)$, where x represented the efficiency of the matching process and θ denoted the labor market tightness, $\frac{v}{u}$. What is the sign of $a'(\theta)$? What is the average time to find a job? Does a high θ facilitate workers or firms?

Solution 2 (Labour Market Tightness)**.** Note that the job finding rate was $xa(\theta) = x\theta^{1-\alpha}$ so $a'(\theta) = (1-\alpha)\theta^{-\alpha} > 0$ for $\alpha < 1$, i.e. job finding rate increases with looser labour markets (higher $\frac{v}{u}$). This makes sense since with more vacancies per unemployed person, it would be easier to find jobs. The average time to find a job is the inverse of the job finding rate: $\frac{1}{xa(\theta)}$. A high θ reduces the average time it takes to find a job (raises the job finding rate) so though it may hinder firms to the extent that there are more vacancies relative to unemployment, it actually facilitates both firms and workers since a looser labour market raises the job-finding rate and lowers the average time to find a job.

Exercise 3. In the model, the evolution of unemployment was

$$\dot{U} = \phi(1-u)L - xauL$$

How would this change if workers could find jobs, but turn them down with probability β. How would this change equilibrium unemployment? What might determine β?

Solution 3 (Rejecting Job Offers)**.** With the ability to reject a job offer and turning one down with probability β, the evolution of unemployment becomes

$$\dot{U} = \phi(1-u)L - (1-\beta)(xauL)$$

where the first term are the number of people fired and the second term are the number of people who accept job offers. Labour market equilibrium is still given by $\dot{U} = 0$:

$$\phi(1-u)L = (1-\beta)(xauL) \Longrightarrow u = \frac{\phi}{\phi + (1-\beta)xa(\theta)}$$

So equilibrium employment is now lower, which makes sense since now workers are more 'picky' about whether to take a job offer up. Regarding what might determine β, let us imagine that there are unemployment benefits, so the value of working needs to be at least as high as the value of not working and waiting. There could be a minimum wage a worker is prepared to work for that would be determined by the current wage offer, the expectation that a future wage offer might be higher that this wage and also the chance of getting an offer in the future and of course the length of time an agent might expect to wait before getting a sufficiently high wage offer.

Exercise 4. How would the internet affect the efficiency of job matching and the Beveridge curve?

Solution 4 (Beveridge Curve & the Internet)**.** The internet would improve the efficiency of job matching (probably boost the vacancy-filling rate $\frac{M}{V} = x\left(\frac{u}{v}\right)^{\alpha}$ and the job-finding rate $\frac{M}{U} = x\left(\frac{v}{u}\right)^{1-\alpha}$) and shift the Beveridge curve inwards (for any given level of unemployment there would be less vacancies – they would be filled). When there is a lot of unemployment, internet helps to match workers so more vacancies would be filled than before and unemployment would drop relative to without the internet.

Exercise 5. Paul Krugman recently wrote about a new paper by the Boston FED

> '...it looks at the recent deterioration of the Beveridge curve the apparent worsening of the tradeoff between vacancies and unemployment. Many people have argued that this is evidence of structural unemployment, of workers not having the right skills or something like that. But the authors show that the worsening of the tradeoff seems to apply to all skill groups, all types of work, and so on.'

What are the implications of this finding?

Solution 5 (Beveridge Curve)**.** Krugman essentially says that the Beveridge curve has shifted outwards. Rather than pin this on not matching skills possessed by workers and those required by jobs, the idea has more to do with a problem of matching any skills, so it could be to do with low job-finding rates and low vacancy-filling rates. More frictions such as employment protection (active / passive policies affecting productivity) can reduce matching efficiency. Even though there may be lots of recruiting activity, there are still no matches. Employers may have become more selective. There may have been a structural shift, which was delayed by the housing boom. Search intensity must rise in order to improve efficiency. There are still plenty of jobs available in the Great Recession even though the number of hires drops in recessions – it is more the case that the efficiency of the labour market declines. This could be due to a fall in x (exogenous RBC shock) that would reduce the number of matches, thereby reducing the job-finding $\frac{M}{U} = x\left(\frac{v}{u}\right)A^{1-\alpha}$ and vacancy-filling $\frac{M}{V} = x\left(\frac{u}{v}\right)^{\alpha}$ rates together with raising equilibruim unemployment $u = \frac{\phi}{\phi + xa(\theta)}$.

Exercise 6. Suppose cost of a vacancy is k (in terms of advertizing, recruitment costs etc.) The present discounted value of a new worker to firm is J. Then in equilibrium, explain why $xq(\theta)J = k$.

Solution 6 (Search Model Equilibrium)**.** Firms will equate costs with benefits when choosing whether to create vacancies. The cost of a vacancy is k and is incurred whether or not the vacancy is filled. The benefit of a filled vacancy is J and unfilled vacancies give no benefit. Since a vacancy is filled with probability $xq(\theta)$ (vacancy-filling rate), the benefit of a vacancy (whether filled or not) is $xq(\theta)J + (1 - xq(\theta))0 = xq(\theta)J$. The cost of one additional vacancy (marginal cost of vacancies) must be equated with the benefit of one additional vacancy (marginal benefit of vacancies), by standard arguments ($MC < MB$ means firm could undergoe more advertising etc. to attract workers so push up MC or $MC > MB$ means firm would be more reluctant to post vacancies so vacancy-filling rate would go up and thereby raise MB), so in equilibrium MB=MC: $xq(\theta)J = k$.