

Problem Set #1

Econ 366-Markets with Frictions
Prof. Guido Menzio
New York University

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Instructions: There are four questions. Each question is worth 25 points. You are encouraged to work in groups of up to 3 members.

The problem set is due by midnight of March 1. Please submit your solutions through NYU Classes using the Assignments tab, where you can find more detailed instructions about the submission itself.

Any questions or concerns about submissions can be sent to the TA Felipe Camelo (felipe.camelo@nyu.edu). Good Luck!

1. Unemployment and wages as workers' discipline devices. Consider the labor market model of Shapiro and Stiglitz (1984). Suppose that a firm can discipline shirking workers by firing them and by withholding part of their paycheck. In particular, suppose that if a firm catches a worker shirking, it fires the worker and withholds c dollars from his paycheck, $c \in (0, e)$.

a. Write down an expression for the lifetime utility of a worker employed at the wage w . In this expression, make sure to identify the periodical utility of a worker who chooses effort $a \in \{0, 1\}$, and the continuation utility of a worker who chooses effort $a \in \{0, 1\}$.

b. Derive a condition under which the worker chooses to exert effort.

c. The equilibrium employment N^* and the equilibrium wage w^* satisfy the following labor supply and the no-shirking conditions

$$F'(N^*) = w^*, \quad (\text{LD})$$

$$w^* = e + b + \frac{e - qc}{\beta q} \left[\frac{1 - (1 - \delta)N^*}{1 - N^*} - \beta(1 - \delta) \right]. \quad (\text{NS})$$

Draw the locus of (w^*, N^*) that satisfies the labor supply and no-shirking conditions and identify the equilibrium of the economy.

d. What happens to equilibrium wages and unemployment if the performance-based component of the wage increases? Interpret your findings.

e. What happens to welfare if the performance-based component of the wage increases? Interpret your findings.

2. Monitoring technology with false positives. Consider the labor market model of Shapiro and Stiglitz (1984). Suppose that the firm's monitoring technology returns both false negatives and false positives. Specifically, the monitoring technology correctly identifies a shirking worker with probability q and mistakes him for a diligent worker with probability $1 - q$, $q \in (0, 1)$. Moreover, the monitoring technology correctly identifies a diligent worker with probability $1 - m$, and mistakes him for a shirking worker with probability m , $m \in (0, q)$. The firm fires all workers identified (correctly or not) as shirkers.

a. Write down an expression for the lifetime utility of a worker employed at the wage w . Explain the meaning of each term in the expression.

b. Derive a condition under which the worker chooses to exert effort.

c. Given the monitoring technology described above, the equilibrium employment N^* and the equilibrium wage w^* satisfy the following labor supply and the no-shirking conditions

$$F'(N^*) = w^*, \quad (\text{LD})$$

$$w^* = (e + b) + \frac{e}{\beta(q - m)} \left[\frac{1 - (1 - \delta)N^*}{1 - N^*} - \beta(1 - \delta) \right]. \quad (\text{NS})$$

Draw the locus of (w^*, N^*) that satisfies the labor supply and no-shirking conditions and identify the equilibrium of the economy.

d. What happens to equilibrium wages and employment if the probability m of firing a diligent worker increases?

e. What happens to equilibrium wages and employment if the probability m of firing a diligent worker approaches q ?

3. Quantifying the effect of unemployment benefits on unemployment. Consider a version of the labor market model of Pissarides (1985) in which the matching function $M(u, v)$ is $uv/(u + v)$ and the discount factor β is 1.

a. Derive an expression for the worker's job-finding probability, $p(\theta)$, and for the firm's job-filling probability, $q(\theta)$.

b. Express the equilibrium market tightness θ in terms of the parameters of the model, k , δ and η .

c. Express the equilibrium unemployment u in terms of the parameters of the model.

d. Let $y = 1$, $b = 0.75$, $\delta = 0.025$, $\eta = 0.5$ and $k = 0.5$. Compute the equilibrium market tightness θ and the equilibrium unemployment u .

e. If the unemployment benefit decreases from $b = 0.75$ to 0.5 , what happens to the equilibrium market tightness θ and to the equilibrium unemployment u ? Explain your findings.

4. **Vacancy costs and the labor market.** Consider the search-theoretic model of the labor market of Diamond (1982), Mortensen (1982) and Pissarides (1985).

a. The equilibrium tightness of the labor market, θ^* , solves the following equation

$$k = q(\theta) \frac{(1 - \eta)(y - b)}{1 - \beta [1 - \delta - \eta p(\theta)]}.$$

Plot the left and the right hand side of the above equation as functions of θ and identify θ^* .

b. Using the same graph as before, identify the effect of an increase in the vacancy cost k on the equilibrium tightness of the labor market. Interpret your finding.

c. The equilibrium unemployment, u^* , and the equilibrium vacancies, v^* , solve simultaneously the following system of equations

$$u = \frac{\delta}{\delta + p(v/u)}, \quad v = \theta^* u.$$

Plot the solutions to these two equations in a graph that has u on the horizontal axis and v on the vertical axis (i.e. plot the Beveridge curve and the market tightness curve). Identify u^* and v^* .

d. Using the same graph as before, illustrate the effect of an increase in the vacancy cost k on the equilibrium unemployment and vacancies. Interpret your findings.

e. Should the government intervene to lower unemployment in response to an increase in k ?