

2. Consider the following model of employer-employee relations. Firms maximize expected profits given by:

$$\int [pg(l(p)) - w^e(p)l(p) - w^u(p)(m - l(p))]f(p)dp$$

subject to:

$$\int \left[ \frac{l(p)}{m} U(w^e(p)) + \left(1 - \frac{l(p)}{m}\right) U(Y + w^u(p)) \right] f(p) dp \geq U(V)$$

and

$$m \geq l(p)$$

where  $p$  is the realized price,  $l(p)$  is employment when the realized price is  $p$ ,  $w^e(p)$  is the wage when the realized price is  $p$  for employed workers,  $w^u(p)$  is the wage when the realized price is  $p$  for laid off workers,  $f(p)$  is the probability density function for the distribution of prices,  $m$  is the number of workers the firm attaches ex ante,  $Y$  is the income equivalent of the leisure and income the worker receives if laid off,  $V$  is determined exogenously ex ante,  $g$  is strictly concave and  $U$  is strictly concave. Firms take prices as given but must come to terms with workers (including the number of workers the firm attaches) before the state of the world is realized. Please answer the following questions:

- (i) Derive optimal  $l(p)$ ,  $w^e(p)$ ,  $w^u(p)$  and  $m$ . Using your optimal contract, discuss the following issues: (a) Is this the first best contract? (b) Does this model "explain" wage rigidity?
- (ii) Use your partial equilibrium optimal solution for  $m$  to derive the aggregate demand for contracts. Specify an aggregate supply curve of contracts and motivate your supply curve from first principles. Given your aggregate demand and supply curve, discuss the factors that will impact the equilibrium determination of  $V$ .
- (iii) Suppose that the state of the world " $p$ " is imperfectly observed by the worker ex post. Does this imply that the optimal contract you derived in (i) is no longer incentive compatible? Discuss formally in the context of your optimal contract solution..
- (iv) Suppose that the effort of workers is imperfectly observed by firms. Modify the *above* model *formally* to reflect this alternative assumption. Without necessarily deriving the optimal contract for this more complex specification, discuss the likely differences between the contract that you derived in (i) and the optimal contract in an environment with imperfectly observed effort.