

Asymmetric Learning Model With Wage Rigidity and Costly Firings

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Introduction

- ▶ Analyze an asymmetric learning model as it relates to wages and tenure
- ▶ Incorporate sticky wages
- ▶ Incorporate fixed firing costs
- ▶ Basic model set up is similar to Acemoglu and Pischke
- ▶ Scaled back to focus on wage evolution
- ▶ Simplifying in certain ways allows adding other unexplored complexity

Outline

- ▶ Outline of basic model structure
- ▶ Equilibrium under flexible wages
- ▶ Equilibrium under sticky wages
- ▶ Equilibrium under sticky wages and various firing costs
- ▶ Implications
- ▶ Thoughts moving forward

Model Environment

My Model

- ▶ Workers have ability $\theta \in [0, 1]$
 - ▶ Produce θ per period
- ▶ Workers supply labor inelastically
- ▶ exogenously separate at rate δ
- ▶ Employers receive a good signal g w.p. θ and a bad signal b w.p. $1 - \theta$
- ▶ Employers offer wages each period (no long term contracts).
 - ▶ All firms can condition on employment status
 - ▶ Current employer can also condition wage on signal
- ▶ Outside firms see employment status and history (resume)
- ▶ There are many identical firms
 - ▶ Zero profit condition
- ▶ Downward wage rigidity
- ▶ Fixed cost to fire employee

Variable Definitions

Variable	Meaning
θ	Ability
g	Good Signal
b	Bad Signal
e	Employed Signal
f	Fired Signal
F_C	Fixed Cost to Firing
δ	Exogenous separation rate
w_1	Period 1 Wage
w_g	Wage After Good Signal
w_b	Wage After Bad Signal
w_u	Wage for unemployed worker
π	Profits

Time Line

- ▶ period 1 wage offers
- ▶ Workers produce output
- ▶ workers exogenously separate
- ▶ Workers send signal of ability
- ▶ Employers decide who to fire
- ▶ Employers offer period 2 wages conditional on signals
- ▶ Outside Firms offer wages conditional on resume
- ▶ Workers take the best offer and work for one more period
- ▶ Workers retire

Flexible Wages

- ▶ Let Q denote the fraction of workers that don't separate but then quit.

$$w_u(Q) = (\delta E[\theta] + QE[\theta|\text{worker quit}]) / (\delta + Q)$$

- ▶ Employers will not pay more than the expected output of a worker, giving

$$w_b = E[\theta|b]$$

- ▶ This implies that all bad signal employees quit since if $\delta > 0$

$$E[\theta|b] < \frac{\delta E[\theta] + (1 - \delta)p(b)(E[\theta|b])}{\delta + (1 - \delta)p(b)} = \min w_u(Q)$$

- ▶ Where the Right hand side is the lowest possible w_u since here $Q = (1 - \delta)p(b)$

Flexible Wages

- ▶ If all bad signal employees quit than anyone still employed is identified as high ability. Giving

$$w_g = E[\theta|g]$$

- ▶ This gives

$$w_u = \frac{\delta E[\theta] + (1 - \delta)p(b)(E[\theta|b])}{\delta + (1 - \delta)p(b)}$$

- ▶ And a first period wage

$$w_1 = E[\theta]$$

Sticky Wages

- ▶ Now employers can't cut their low signal worker's wages.
- ▶ We know $w_1 > E[\theta|b]$ because if it weren't profits would be positive
- ▶ This implies employers fire bad signal workers
- ▶ Wage outcomes are identical to flexible model but with workers fired rather than quitting

Sticky Wages and fixed firing costs

Low firing costs

- ▶ A low firing cost will not alter firms decision to fire bad signal employees
- ▶ Now that hiring an employee means I may have to pay a cost to fire them, their marginal benefit is decreased and so their wage offer is lower

$$w_1 = E[\theta] + (1 - \delta)p(b)F_C$$

- ▶ Firms continue to do this as long as

$$w_1 - E[\theta|b] > F_C$$

$$\implies E[\theta] + (1 - \delta)p(b)F_C - E[\theta|b] > F_C$$

$$\implies f_C < \frac{E[\theta] - E[\theta|b]}{1 + p(b)(1 - \delta)}$$

Clarifying Equilibrium wages

An Aside

To clarify the wage offers in the next section, first consider this numerical example:

► $w_u = 1$

$E[\theta]$	EQ Wage offer
3	2.5
2	2

- If the "raiding" firm offers $w = 2 + \epsilon$ to all employed workers, they get only those with $E[\theta] = 2$ for a loss
- If they offer $w = 2.5 + \epsilon$ they get workers with average $E[\theta] = 2.5$ for a loss
- These are the lowest wages the firm can offer and still retain their employees
- In general, it means employers pay a worker the expected ability of all workers less than and equal to their own ability

Sticky Wages and fixed firing costs

High firing costs

- ▶ If the fixed costs become sufficiently large, it is clear that firms will not fire any employees
- ▶ Firms must pay their employees enough to keep them from getting "raided"

$$w_g = E[\theta|e] = E[\theta]$$

$$w_b = w_1$$

- ▶ Unemployed workers get their expected output

$$w_u = E[\theta]$$

Sticky Wages and fixed firing costs

High firing costs

- ▶ This gives a first period wage through the zero profit condition

$$w_1 = E[\theta] + (1 - \delta)(p(g)(E[\theta|g] - E[\theta]) + p(b)(E[\theta|b] - w_1))$$

- ▶ using the following fact: $p(g)E[\theta|g] + p(b)E[\theta|b] = E[\theta]$

$$\implies w_1 = E[\theta] + (1 - \delta)(E[\theta] - p(g)E[\theta] - p(b)w_1)$$

- ▶ Next, using

$$E[\theta] - p(g)E[\theta] = p(b)E[\theta]$$

$$\implies w_1 = E[\theta] + (1 - \delta)p(b)(E[\theta] - w_1)$$

$$\implies w_1 + (1 - \delta)p(b)w_1 = E[\theta] + (1 - \delta)p(b)E[\theta]$$

$$\implies w_1 = E[\theta]$$

- ▶ all workers get paid $E[\theta]$

Sticky Wages and fixed firing costs

High firing costs: stability

This equilibrium will be stable whenever it is more costly to fire an employee than to keep them at this wage.

$$F_C > w_1 - E[\theta|b] = E[\theta] - E[\theta|b]$$

Sticky Wages and fixed firing costs

Mixed Equilibrium

- ▶ Now consider the case between the two extremes.

$$F_C \in \left[\frac{E[\theta] - E[\theta|b]}{1 + p(b)(1 - \delta)}, E[\theta] - E[\theta|b] \right]$$

- ▶ In this case employers will fire a fraction of their bad signal workers δ_F until they are indifferent between firing and keeping them

$$F_C = w_1 - E[\theta|b]$$

- ▶ Good signal employees need to be paid the expected output of an average worker employee in period 2

$$w_g(\delta_F) = \frac{p(g)E[\theta|g] + p(b)(1 - \delta_F)E[\theta|b]}{p(g) + p(b)(1 - \delta_F)}$$

Sticky Wages and fixed firing costs

Mixed Equilibrium

- ▶ bad signal employees are paid the lowest wage possible
 $w_b = w_1$ and unemployed get their expected output

$$w_u = \frac{\delta E[\theta] + (1 - \delta)\delta_F E[\theta|b]}{\delta + (1 - \delta)\delta_F}$$

- ▶ by the zero profit condition we get the first period wages

$$w_1 = E[\theta] + (1 - \delta) \left(p(g) \left(E[\theta|g] - w_g(\delta_F) \right) - p(b) F_C \right)$$

Sticky Wages and fixed firing costs

Mixed Equilibrium

- ▶ We have two equations for w_1 with the only unknown being δ_F
- ▶ I have solved for it, but it not very intuitive or generally helpful. Can use it to solve numeric examples.

$$\delta_F = \frac{p(g) \left[\frac{E[\theta] - F_C - (1-\delta)p(b)F_C - E[\theta|b]}{(1-\delta)p(g)} \right]}{p(b) \left[E[\theta|b] - \frac{E[\theta] - F_C - (1-\delta)p(b)F_C - E[\theta|b]}{(1-\delta)p(g)} + E[\theta|g] \right]}$$

What Next

- ▶ Three period version is not intuitive.
- ▶ I have made progress solving general numeric examples, but unsure how useful this is
- ▶ More than two signal levels seems promising
 - ▶ I expect I will also need to resort to numeric examples
- ▶ A continuous signal or just employers fully learning workers continuous ability measure
 - ▶ I started this and do not think there is a general solution.
(Depends on θ distribution)
- ▶ Promotions
- ▶ An Acemoglu and Pischke type utility shock

Questions and Concerns

- ▶ How to apply model to data?
- ▶ Are numerical examples and graphs useful?
- ▶ Trouble fitting this into literature
- ▶ Are the assumptions reasonable?

The End

Thank You