

# Asymmetric Learning Model of Resume Building With Wage Rigidity and Costly Firings

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# Introduction

## Current Asymmetric Learning Models

- ▶ Asymmetric Learning seems to match intuition for labor market
- ▶ Current models' set up seems odd
- ▶ Schönberg (2007)
  - ▶ Employer learns workers true ability
  - ▶ Outside firms receive noisy signal about each specific workers ability

# Model Environment

## My Model

- ▶ Workers have ability  $\theta \in [0, 1]$ 
  - ▶ Produce  $\theta$  per period
- ▶ Workers supply labor inelastically
- ▶ Employers receive a good signal  $g$  w.p.  $\theta$  and a bad signal  $b$  w.p.  $1 - \theta$
- ▶ Employers offer wages each period (no long term contracts).
- ▶ Outside firms see length of employment (resume)
  - ▶ i.e. receive a signal  $e$  or  $f$
- ▶ There are many identical firms
  - ▶ Zero profit condition
- ▶ Downward wage rigidity
- ▶ Fixed cost to fire employee

## Variable Definitions

Variable	Meaning
$\theta$	Ability
$g$	Good Signal
$b$	Bad Signal
$e$	Employed Signal
$f$	Fired Signal
$F_C$	Fixed Cost to Firing
$w_1$	Period 1 Wage
$w_g$	Wage After Good Signal
$w_b$	Wage After Bad Signal
$w_f$	Wage for Fired Worker
$\pi$	Profits

# Time Line

- ▶ period 1 wage offers
- ▶ Workers produce output
- ▶ 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

# Outline

- ▶ Start simple and build up model
- ▶ First consider two period model with flexible wages
- ▶ Second, add in wage rigidity, but with high fixed costs to firing
- ▶ Finally, solve the complete model with wage rigidity and moderate firing costs

# Two Period Flexible Wage Model

## Optimal Second Period Wage Offers

- ▶ With flexible wages there is no reason to fire workers
- ▶ Outside firms will not offer more than expected output given 1 year of employment  $E[\theta|e] = p(g)E[\theta|g] + p(b)E[\theta|b] = E[\theta]$ 
  - ▶ Employers can pay their good signal employees  $w_g = E[\theta]$
- ▶ An outside offer below  $w_g$  would only attract bad signal employees
  - ▶ Employer can offer  $w_b = E[\theta|b]$
- ▶ In equilibrium workers stay where they are

# Two Period Flexible Wage Model

## Optimal First Period Wage Offers

- ▶ Zero profit condition means that first period wages should give expected profit of zero
- ▶ In other words, pay period 1 worker their expected profits

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

or

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



# Two Period Flexible Wage Model

## Result

- ▶  $w_1 > w_g > w_b$
- ▶ Employers pay a premium for period 1 workers so that they can earn a profit with inside knowledge in period 2.
- ▶ This does not seem to reflect reality

# Two Period Sticky Wage, High Firing Cost

- ▶ Next introduce wage rigidity
- ▶ For now, assume the fixed cost of firing is so high it is never optimal to fire

# Two Period Sticky Wage, High Firing Cost

## Lemma 1

**Lemma 1:** With sticky wages  $w_1 \in (E[\theta|b], E[\theta|g])$

**Proof:** If  $w_1 \geq E[\theta|g]$  employers will make negative profits. If  $w_1 \leq E[\theta|b]$  employers make positive profits.

**Corollary**  $w_b = w_1$  because  $w_b$  will be "stuck"

# Two Period Sticky Wage, High Firing Cost

## Equilibrium wages

- ▶ Given Lemma 1,  $w_b = w_1$
- ▶ By the same logic as in the flexible model we get  $w_g = E[\theta|e] = E[\theta]$
- ▶ The period one wage to give zero profits is  $w_1 = E[\theta] + p(g)(E[\theta|g] - E[\theta]) + p(b)(E[\theta|b] - w_1)$
- ▶ Solving this gives  $w_1 = E[\theta]$
- ▶  $w_1 = w_g = w_b = E[\theta]$

# Two Period Sticky Wages

Not firing is not an equilibrium

- ▶ Let the fixed cost  $F_C < E[\theta] - E[\theta|b]$
- ▶ NOT firing workers is NOT an equilibrium.
- ▶ If a firm unilaterally deviates and fires workers after a bad signal they receive positive profits

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

$$> p(g)(E[\theta|g] - E[\theta]) + p(b)(E[\theta|b] - E[\theta]) = 0$$

- ▶ Given this, all firms have an incentive to deviate and fire bad signal employees

# Two Period Sticky Wages

When is firing bad workers an equilibrium

- ▶ If all firms are firing, I could try to unilaterally deviate and keep bad signal employees
- ▶ Need to pay them at least  $w_1$
- ▶ Bad signal workers accept  $w_1$  since leaving to another firm would expose them as bad signal worker
- ▶ Unilaterally keeping low wage workers would change profits by

$$\Delta\pi = p(b)(F_C + E[\theta|b] - w_1)$$

- ▶ If  $F_C < w_1 - E[\theta|b]$  firing bad signal employees is an equilibrium outcome

# Two Period Sticky Wages

## Equilibrium Wages

- ▶ Assume  $F_C < w_1 - E[\theta|b]$  so all employers fire low signal workers
- ▶ Since only good signal workers are employed  
 $w_g = E[\theta|e] = E[\theta|g]$
- ▶ Need to offer a period one wage to get zero profits

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

or

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

- ▶ Fired workers are identified as low signal so they get re-hired for  $w_f = E[\theta|b]$
- ▶ So we get  $w_f < w_1 < E[\theta] < w_g$

# Two Period Sticky Wages

## Equilibria

- ▶ If  $F_C > E[\theta] - E[\theta|b]$ 
  - ▶ No one is fired
- ▶ If  $F_C < E[\theta] - p(b)F_C - E[\theta|b] \implies F_C < \frac{E[\theta] - E[\theta|b]}{1+p(b)}$ 
  - ▶ Bad signal employees are fired
- ▶ If  $F_C \in \left( \frac{E[\theta] - E[\theta|b]}{1+p(b)}, E[\theta] - E[\theta|b] \right)$ 
  - ▶ I believe there will be a mixed equilibrium where some bad signal workers are fired.
  - ▶ Not proven yet



# Numerical Example

- ▶  $\theta \in \{0, \frac{1}{3}, \frac{2}{3}, 1\}$  with equal probability
- ▶  $F_C = 0.1$
- ▶  $E[\theta] = \frac{1}{2}$
- ▶  $E[\theta|g] = \frac{7}{9}$
- ▶  $E[\theta|b] = \frac{2}{9}$
- ▶ Flexible wages
  - ▶  $w_1 = 0.6388$
  - ▶  $w_b = \frac{2}{9}$
  - ▶  $w_g = \frac{1}{2}$
- ▶ Sticky wages
  - ▶  $w_1 = 0.407$
  - ▶  $w_f = \frac{2}{9}$
  - ▶  $w_g = \frac{7}{9}$

# What Next

- ▶ Three period version
- ▶ Promotions
- ▶ Initial education signal correlated with ability
- ▶ Exogenous separations
- ▶ An Acemoglu and Pischke type utility shock

# Questions and Concerns

- ▶ How to apply model to data?
- ▶ What aspects of labor market should it explain?
- ▶ Are the assumptions reasonable?
- ▶ Is game theory approach useful?