Dynamic Models Of Labor Demand

Handbook of Labor Economics, Chapter 9,

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Plan of the presentation

1. Why do we need dynamic models?
2. Hiring and firing costs
3. Theoretical frameworks
4. Empirical framework
5. Conclusion

Why do we need dynamic models?

- Firms do not hire labor force anew each day
- Hiring and firing generates costs above average weekly wage payments
- Implications for dynamic demand for workers
- This chapter: models of dynamic labor demand based on adjustment costs

Examine theoretical explanations of these facts and investigate extent to which these explanations are consistent with empirical data

Size and structure of adjustment costs: Hiring costs

- Expenditures on advertising, time spent on interviewing, testing etc.
- Expenditures on training, lost output while in training
- **Costs of hiring:**
  1. Oi (1962) average costs of hiring and training of a new employee amounts to 142 hours' pay with substantial differences between skilled and unskilled workers(unskilled only 22 hours pay)
  2. Barron et. al. (1983) unskilled 8.11 hours recruiting and 34 hours training
  3. Rees (1973) confirms enormous differential between skilled and unskilled with costs of skilled being 5 times as large as costs for unskilled

Size and structure of adjustment costs: Firing costs

- Minimal loss if mutual agreement
- Compensation for breach of contract, loss of output, legally enforced compensations
- **Costs of firing:**
  1. Oi (1962) estimates firing costs excluding unemployment benefits as 16 hours' pay (per new employee, i.e. underestimates real costs)
  2. According to other studies payments may amounts to as much as 3 weeks' pay, in Britain 5 weeks' pay or more

Size and structure of adjustment costs

- Voluntary quits cost less
- Gross number of new employees matter rather that net additions
- Average costs of hiring decline at first(as we have increasing returns to hiring technology) but eventually costs are increasing at the margin
- Firing costs behave similarly but more in a linear fashion (compensation is same per employee)
- Possible asymmetries
- It is also possible to use current wages to facilitate labor force adjustment (one model)

Size and structure of adjustment costs: Structure

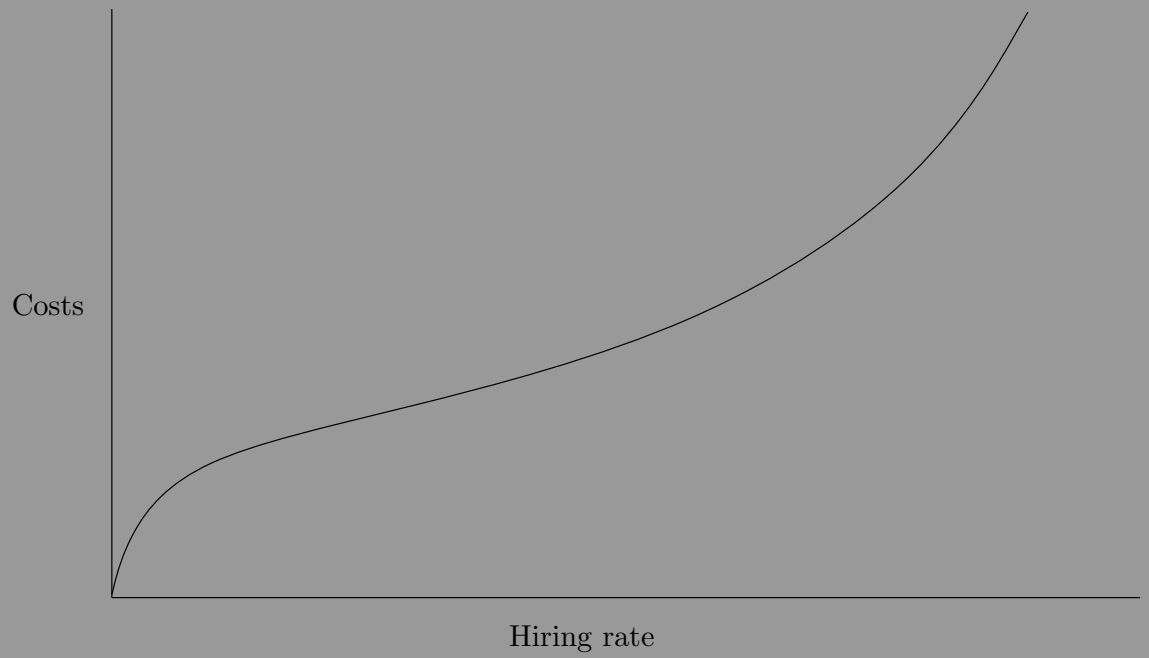

Figure: The relationship between hiring costs and rate of hiring

Dynamic theories of labor markets

Gross output production function

$$y(t) = f(N(t), z(t), t),$$

where $y(t)$ is output, $N(t)$ is employment and $z(t)$ is a vector of completely flexible inputs.
Real net revenue function of a price taking firm

$$p(t)R(N(t), t) = \max_{z(t)} \{p(t)f(N(t), z(t), t) - p_z(t)z(t)\},$$

where $p(t)$ is price of output and $p_z(t)$ is the vector of input prices. As the right hand side expression is homogeneous of degree one, R is a function of the price ratios $p_z(t)/p(t)$.
$p(t)R(N(t), t)$ is then revenue accruing to the firm for any given level of employment under the assumption that the capital stock is exogenous/predetermined and other factors optimally deployed.

Strictly convex adjustment costs

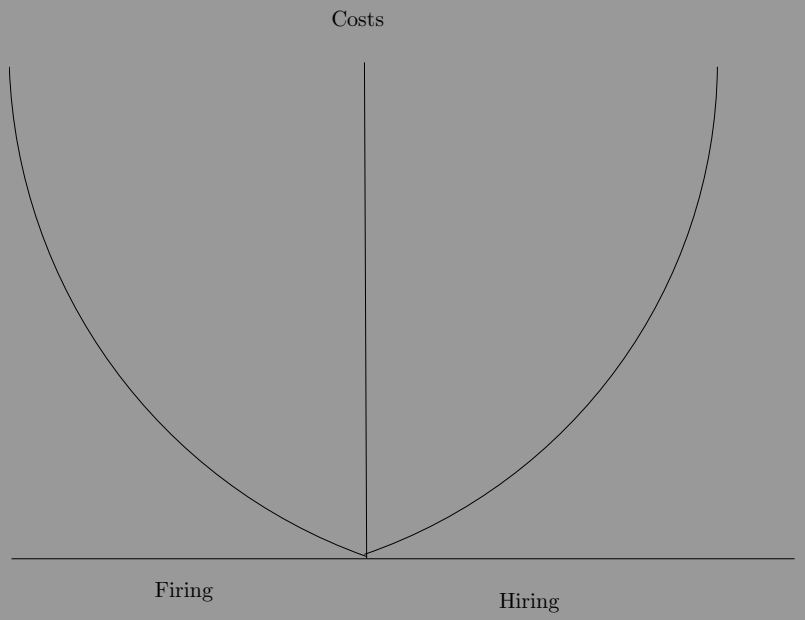

Figure: Strictly convex adjustment costs

- Voluntary quitting induces no direct costs and takes place mechanically at proportional rate δ
- Adjustment costs as a function of $\dot{N}(t) + \delta N(t)$
- Hiring if positive, firing if negative
- Assume point expectations

Strictly convex adjustment costs

Firm maximizes

$$\int_0^\infty e^{-\phi(t)}\{p(t)R(N(t),t) - w(t)N(t) - C(x(t))\}dt,$$

where $w(t)$ is exogenously given wage and C is adjustment cost function and $x(t)$ satisfies

$$\dot{N}(t) = x(t) - \delta N(t)$$

and discount factor

$$\phi(t) = \int_0^t r(\tau)d\tau.$$

In such case, the only thing that limits the size of firm in the equilibrium is the fact that the cost of replacing the quits is increasing at the margin as employment rises.

Strictly convex adjustment costs

Assume that all exogenous variables are expected to remain constant. Stationary equilibrium level of employment, N^*, satisfies

$$pR_N(N^*) = w + (r + \delta)C'(\delta N^*).$$

The last term differentiates dynamic from static model and captures the costs associated with replacing voluntary quits.

Employment will always exhibit a partial adjustment style of behavior which implies that current employment will be some convex combination of a target level and employment of last period.

Dynamic monopsony

Firm maximizes

$$\int_0^{\infty} e^{-\phi(t)}\{p(t)R(N(t),t) - w(t)N(t)\}dt,$$

where $w(t)$ is firm's wage and

$$\dot{N}(t) = x(w(t), w^*(t))N(t),$$

where x determines the proportional rate at which employees join or leave the firm and this is increasing in the firm's wage w and decreasing in the given outside level of wages $w^*$and discount factor

$$pR_N(N^*) = w^* + \frac{r}{x_1(w^*, w^*)}.$$

Both convex adjustment costs model and monopsony model generate long-run employment which is lower than tat implied by purely static models

Linear adjustment costs

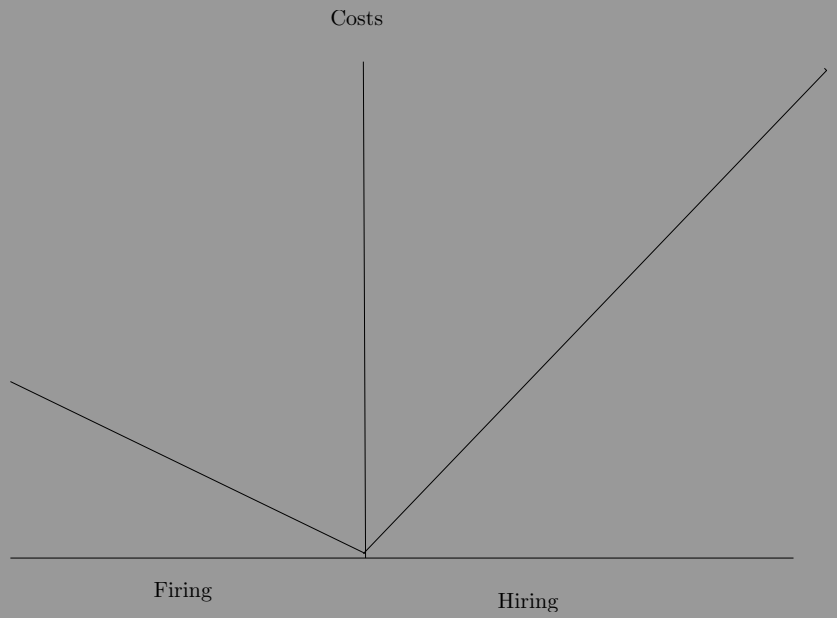

Figure: Strictly convex adjustment costs

- Same as convex, but with linear adjustment costs
- Adjustment costs as a function of $\dot{N}(t) + \delta N(t)$
- Proportional hiring rate, $a(t)$, with unit costs α
- Proportional firing rate, $f(t)$, with unit costs β

Linear adjustment costs

Firm maximizes

$$\int_0^\infty e^{-\phi(t)}\{p(t)R(N(t),t) - w(t)N(t) - \alpha a(t)N(t) - \beta f(t)N(t))\}dt,$$

s.t.

$$\dot{N}(t) = (a(t) - f(t) - \delta)N(t).$$

There is never simultaneous hiring and firing(waste of money).

$$pR_N(N(t),t) = w(t) + (r(t) + \delta)\alpha$$

Assume fixed exogenous variables, if we are below equilibrium level of employment, hire $N^* - N$ and thereafter hire at rate δN^* to replace voluntary quits.

$$pR_N(N(t),t) = w(t) - (r(t) + \delta)\beta$$

This cannot happen in steady state as st.st must involve replacement of voluntary quits. If we start from $N > N^*$, optimal strategy is to fire a group of workers, let the rest drop by voluntary quits and then start replacing them by hires again.

Linear adjustment costs

- Appealing properties, instantaneous hiring after firing of groups of workers
- Interesting predictions about employment behavior of the firm in response to foreseen cyclical fluctuations
- However, for empirical work the only tractable model is with strictly convex adjustment costs.

From theory to practice

- Discrete time version of strictly convex adjustment costs model
- Start from general model and successively approximate to generate linear equation

Fundamental employment equation

$$N(t) = \mu N(t-1) + (1-\mu)(1-\alpha\mu)\sum_{s=0}^{\infty}(\alpha\mu)^s N^*(t+s)$$

$$N(t) - N(t-1) = (1-\mu)\left[(1-\alpha\mu)\sum_{s=0}^{\infty}(\alpha\mu)^s N^*(t+s) - N(t-1)\right],$$

i.e. N follows a partial adjustment process where the target is a convex combination of all future expected values of N^* with the weights forming a geometric progression. Speed of adjustment, $(1-\mu)$, is decreasing in in the level of adjustment costs.

Issues

1. Specification of N^* - depends on revenue function form. Assume Cobb-Douglas.
2. Expectations - point vs. rational expectations
3. Stochastic structure - additional errors from inaccurate descriptions of the employment process
4. Aggregation - different types of labor and different firms

General problems

- **Missing variables** - other factor prices (materials and energy), taxes on labor paid, shifts in length of work week, overtime premia. Capital stock predetermined in the short run, in the long run should be included
- **Dynamic structure** - no justification for imposing simple dynamic structure without testing
- **Specification of the technology** - assumption of constrained demand and exogenous output
- **Specification of expectations**

Conclusions

- Different structures of hiring and firing costs (have implications for time path of employment)
- Empirical work: quadratic turnover costs
- Disaggregation of labor at least into 2 categories (low and high skilled workers) as the associated costs differ significantly
- Question of moving from quadratic framework

Thank you for the attention!
Questions? Comments?