Job Turnover and Policy Evaluation: A General Equilibrium Analysis

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Motivation

- Study the implications of government policies that make it costly for firms to adjust their employment level.
- Characterize the stationary equilibrium of an economy with firing costs.
- Main result: It is costly to distort job creation/destruction process.

The Model

- $\pi_t = p_t f\left(n_t, s_t\right) - n_t - p_t c_f - g\left(n_t, n_{t-1}\right)$
- s follows Markov process $F\left(s' s\right)$
- $g\left(n_t, n_{t-1}\right) = \tau max\left(0, n_{t-1} - n_t\right)$
- All the rest is as in Hopenhayn (92)

Timing of decisions

Incumbent begins period t with (s_{t-1}, n_{t-1})

Exit Decision

/ \

Exit / Stay

/ \

Exit	Stay
receive $-g(0, n_{t-1})$ this period	find out value of s_t
zero in all future periods	make employment decision n_t
	receive $p_t f(n_t, s_t) - n_t - g(n_t, n_{t-1}$
	↓
	repeat next period

FIG. 1.—Timing of decisions

The firm's decision problem

$$W(s,n;p) = \max_{n'\geq 0}\{p_t f(n',s) - n' - pc_f - g(n',n) + \quad (1)$$

$$+\beta \max[E_s W(s',n';p), -g(0,n')]\} \quad (2)$$

The problem for the potential entrants is simply given by:

$$W^e(p) = \int W(s,0;p)dv(s) \leq c_e \quad (3)$$

- Let (s,n) be the state of an individual firm, then the state of the economy is defined as the distribution of the state variables for all individual firms $\mu(s,n)$
- The transition from μ to μ' is $\mu' = T(\mu, M; p)$. The operator T has a fixed point: $\mu^* = T(\mu^*, M; p)$

Preferences and Endowments

- There is a continuous of identical agents with utility function:

$$\sum_{t=1}^{\infty} \beta^t [u(c_t) - \kappa(n_t)] \tag{4}$$

- Labor supply $\in \{0, 1\} \Rightarrow$ individual choose employment lotteries $\Rightarrow$ representative agent with preferences $\sum_{t=1}^{\infty} \beta^t [u(c_t) - aN_t]$
- The problem of the household is:

$$\max u(c) - aN \qquad s.t. \qquad pc \leq N + \Pi + R \tag{5}$$

- Π are the profits equally distributed among households and R is the lump–sum transfer from taxation of job destruction
- $L^s(p, \Pi + R)$ is the labor supply. **It is assumed that the income effect on labor supply is negative**

Equilibrium

$$
\begin{aligned}
L^{d}(\mu, M; p) &= \int N(s, n; p)\, d\mu(s, n) + M \int N(s, 0; p)\, d\nu(s) \\
Y(\mu, M; p) &= \int \left[f(N(s, n; p), s) - c_f \right] d\mu(s, n) + \\
&\quad + M \int f(N(s, 0; p), s)\, d\nu(s) \\
\Pi(\mu, M; p) &= pY(\mu, M; p) - L^{d}(\mu, M; p) - R(\mu, M; p) - Mpc_e \\
R(s, n; p) &= \left[1 - X(s, n; p)\right] \int g(N(s', n; p), n)\, dF(s's) \\
&\quad + X(s, n; p)\, g(0, n)
\end{aligned}
$$

Equilibrium definition

A stationary equilibrium consists of an output price p, a mass of entrants M, a measure of incumbent firms μ decision rules $N(s, n; p)$ and $X(s, n; p)$ and labor supply function for households $L^s(p, W)$such that:

1. Decision rules are optimal for firms and households
2. $L^d(\mu, M, p) = L^s(p, \Pi(\mu, M, p) + R(\mu, M, p))$
3. $\mu = T(\mu, M; p)$
4. $W^e(p) \leq pc_e$ with equality if $M > 0$.

Parametrization

- $f(n, s) = sn^{\theta}$ with $\theta \in [0, 1]$
- $g(n_t, n_{t-1}) = 0$ in the benchmark model otherwise $g(n_t, n_{t-1}) = \tau \max(0, n_{t-1} - n_t)$
- $\log(s_t) = a + \rho \log(s_{t-1}) + \varepsilon_t$ with $\varepsilon \; N(0, \sigma_{\varepsilon}^2)$ $a \geq 0$ and $\rho \in [0, 1)$
- $u(c) = \log(c)$, $\kappa(n) = An$ with $A > 0$
- in the benchmark model the problem of the firm is static and it implies:

$$\log(n_t) = \frac{1-\rho}{1-\theta}\left(\log\theta + \log\rho + \frac{a}{1-\rho}\right) + \rho\log(n_{t-1}) + (\frac{1}{1-\theta})\varepsilon_t$$

Calibration with 5 years as a unit of time using LRD

- $p^* = 1 \Rightarrow c_e$ is pinned down by the entry condition
- $\theta = 0.64$, $\beta = 0.8$ and A s.t. $\frac{employment}{population} = 0.6$
- ρ and σ_ε^2 are recovered from the regression of $\log(n_t)$ on a constant and $\log(n_{t-1})$
- c_f and a are chosen to match the cross–sectional average of log employment and the 5–years exit rate
- The distribution of v is chosen to match the actual size distribution of firms aged 0-6 years in their first and second periods

LRD Statistics

A. ESTIMATES DERIVED FROM THE LRD

Serial correlation in log employment (5-year interval, survivors)	.93
Variance in growth rates (log difference, 5-year interval, survivors)	.53
Mean employment	61.7
Exit rate (5-year interval)	37%

B. SIZE DISTRIBUTION FOR FIRMS AGED 0–6 YEARS

Employees	Share of Total Firms
1–19	.74
20–99	.18
100–499	.08
500+	.01

Statistics from Benchmark Model

A. Summary Statistics for Benchmark Model

Average firm size	61.2
Co-worker mean	747
Variance of growth rates (survivors)	.55
Serial correlation in log n (survivors)	.92
Exit rate of firms	.39
Turnover rate of jobs	.30
Fraction of hiring by new firms	.15
Average size of new firm	7.5
Average size of existing firm	4.9

B. Size Distribution

	1–19	20–99	100–499	500+
Firms	.52	.37	.10	.01

The effect of a tax on job destruction

Effect of Changes in τ (Benchmark Model)

	$\tau = 0$	$\tau = .1$	$\tau = .2$
Price	1.00	1.026	1.048
Consumption (output)	100	97.5	95.4
Average productivity	100	99.2	97.9
Total employment	100	98.3	97.5
Utility-adjusted consumption	100	98.7	97.2
Average firm size	61.2	61.8	65.1
Layoff costs/wage bill	0	.026	.044
Job turnover rate	.30	.26	.22
Serial correlation in log(n)	.92	.94	.94
Variance in growth rates	.55	.45	.39

- A tax on job destruction reduces long–run employment, reduces average productivity and, as a consequence of this reduction, produces welfare losses

TABLE 4

Effect of τ on Decision Rules

	$\tau = .1$		$\tau = .2$	
$\log s$	n_l	n_u	n_l	n_u
1.83	1.36	1.78	1.18	1.98
4.75	21.7	26.7	21.0	32.8
10.5	194	238	181	282
19.9	1,110	1,410	1,036	1,617
27.3	2,610	3,316	2,522	3,935

TABLE 5

Absolute Deviations from MPL = $1/p$

	Fraction of Firms within Interval	
Size of Deviation (%)	$\tau = .1$	$\tau = .2$
0–3	.30	.00
3–5	.45	.12
5–10	.15	.78
10–15	.00	.05
>15	.00	.05