Job creators, job creation and the tax code

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MOTIVATION

Lowering marginal tax rates on high income individuals is associated with:

1. Increasing (before-tax) income dispersion (Occupy Wall Street)
2. Job creation (Tea Party)

**Objective:** To understand when either or both can be true?

**Requires:**

1. Income dispersion (Lucas [1978] span-of-control)
2. Matching frictions (DMP)
Piketty et al [2011]: Across OECD negative relationship between top marginal tax rates and the before-tax earnings of high income individuals.
EMPIRICAL WORK

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They rule out a

- Supply-side effect
- Tax evasion effect

In favor of a “bargaining effect”

Bivens and Mishel [2013]: High incomes largely come from corporate profits or capital gains
ENVIRONMENT: Time and Demography

- **Time:**
  - Continuous, Infinite horizon

- **Demography:**
  - Mass 1 of individuals indexed by $p \in [p, \bar{p}]$
  - $p \sim H(.)$ is their (ex ante) ability as firm owner
  - The density, $h(.)$, is the population of each type
  - Infinite lives
  - Everyone has the same ability as a worker
  - Individuals decide (at no cost) to be a worker or to set up a firm
ENVIRONMENT: Preferences

- Individuals are risk neutral
- They discount the future at rate $r$
- Workers experience disutility of work, $z$
Employers establish a firm and can hire any number of workers.
When a worker is hired, capital is acquired from competitive market.
The $i$th worker hired by a firm type $p$ associated with $k_i$ units of capital produces $pf(k_i)$ units of the consumption good.
$f(.)$ is increasing, concave, Inada conditions.
Depreciation rate of capital is $\delta$.
Separation occurs at rate $\lambda$ (irreconcilable tiff).
Undepreciated capital returned to market.
Firms are always in the market

Workers direct their search based on the ability of the employers

Employers, firms and markets are indexed by $p \in P_A \subset [\underline{p}, \bar{p}]$

$\theta(p) = h(p) / u(p)$ is ratio of firms to job seekers in market $p$
Workers meet firms at rate $m(\theta)$

$m(.)$ is
- increasing,
- concave,
- passes through origin,
- $m'(0) = \infty$,
- $\eta(\theta) \equiv \theta m'(\theta)/m(\theta) < 1$

Firms meet workers at rate $q(\theta) = m(\theta)u/h = m(\theta)/\theta$

So $q'(\theta) < 0$
Wage formation is by generalized Nash bargaining

$\beta$ is the bargaining power of the firm
Tax code is exogenous for analytical part

- Tax on capital, $\tau_k$
- User cost, $\rho$, solves $\rho(1 - \tau_k) = r + \delta$
- Tax on wages, $\tau_w$
- Tax on profits, $\tau_f$
- Revenues thrown away
ANALYSIS: Firm size

- $\gamma_n$ is the probability that the firm has $n = 0, 1, 2...$ workers.
\( \gamma_n \) is the probability that the firm has \( n = 0, 1, 2 \ldots \) workers.

In steady state firms transition rates between any two levels of employment will be equalized

\[
q(\theta)\gamma_0 = \lambda \gamma_1, \quad q(\theta)\gamma_1 = 2\lambda \gamma_2 \quad \text{and} \quad q(\theta)\gamma_n = (n+1)\lambda \gamma_{n+1}
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- Solving,

$$\gamma_n = \left(\frac{q(\theta)}{\lambda}\right)^n \frac{\gamma_0}{n!}.$$
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- Solving,

$$\gamma_n = \left(\frac{q(\theta)}{\lambda}\right)^n \frac{\gamma_0}{n!}.$$

- Given $\sum_n \gamma_n = 1$ firm’s number of workers is distributed Poisson with parameter $q(\theta)/\lambda$.
- The matching rate of the firm, $q(\theta)$, is proportional to its expected size (balanced matching).
For the unemployed

\[ rV_u = m(\theta)E_n (V_e^n - V_u) \]
ANALYSIS: Worker Value functions

- For the unemployed

\[ rV_u = m(\theta)E_n (V^n_e - V_u) \]

- For the employed

\[ rV^n_e = w_n(1 - \tau_w) - z + \lambda(V_u - V^n_e) \]
ANALYSIS: Firm Value functions

With $n$ employees

$$rV_f^n = \sum_{i=1}^{n} y_i + q(\theta) (V_f^{n+1} - V_f^n) + n\lambda (V_f^{n-1} - V_f^n) \quad \text{for } n = 0, 1, 2, ..$$

$$y_i = (1 - \tau_f) (pf(k_i) - w_i - \rho k_i)$$
ANALYSIS: Firm Value functions

- With \( n \) employees
  \[
  rV_f^n = \sum_{i=1}^{n} y_i + q(\theta) (V_f^{n+1} - V_f^n) + n\lambda (V_f^{n-1} - V_f^n) \quad \text{for } n = 0, 1, 2, \ldots
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y_i = (1 - \tau_f)(pf(k_i) - w_i - \rho k_i)
  \]
- If \( \Delta_f^n = V_f^n - V_f^{n-1} \),
  \[
  (r + q(\theta) + n\lambda) \Delta_f^n = q(\theta) \Delta_f^{n+1} + (n - 1)\lambda \Delta_f^{n-1} + y_n
  \]
ANALYSIS: Firm Value functions

- With $n$ employees
  \[ rV^n_f = \sum_{i=1}^{n} y_i + q(\theta) (V^{n+1}_f - V^n_f) + n\lambda (V^{n-1}_f - V^n_f) \quad \text{for } n = 0, 1, 2, .. \]

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- Example: $y_n = y$ for all $n$ (ruling out non-fundamental paths)
  \[ \Delta^n_f = \Delta_f \equiv \frac{y}{r + \lambda}. \]
ANALYSIS: Firm Value functions

- With $n$ employees

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- Example: $y_n = y$ for all $n$ (ruling out non-fundamental paths)

$$\Delta^n_f = \Delta_f \equiv \frac{y}{r + \lambda}.$$

$$V^0_f = \frac{q(\theta)y}{r (r + \lambda)}$$

$$V^n_f = \left(\frac{q(\theta) + nr}{r}\right) \left(\frac{y}{r + \lambda}\right).$$
On meeting a worker, a type $p$ employer with $n-1$ workers solves

$$\max_{k_n} (1 - \tau_f)[pf(k_n) - w_n - \rho k_n]$$

where:

$$w_n = \arg \max_w (\Delta^n_f)^\beta (V_e - V_u)^{1-\beta}$$
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Dependence of $k_n$ and $w_n$ on $n$ comes from $\Delta^n_f$ which comes from $y_n$
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where:

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- Dependence of $k_n$ and $w_n$ on $n$ comes from $\Delta_f^n$ which comes from $y_n$
- Symmetry implies $y_n = y$ for all $n$ is a solution
ANALYSIS: Bargaining and Capital stock

- On meeting a worker, a type \( p \) employer with \( n - 1 \) workers solves

\[
\max_{k_n} (1 - \tau_f)[pf(k_n) - w_n - \rho k_n] 
\]

where:

\[
w_n = \arg \max_w (\Delta_f^n)\beta (V_e - V_u)^{1-\beta}
\]

- Dependence of \( k_n \) and \( w_n \) on \( n \) comes from \( \Delta_f^n \) which comes from \( y_n \)
- Symmetry implies \( y_n = y \) for all \( n \) is a solution
- \( k = k(p) \), which solves \( pf'(k) = \rho \), for all \( n \)
On meeting a worker, a type \( p \) employer with \( n - 1 \) workers solves

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w_n = \arg \max_w (\Delta^n_f) \beta (V_e - V_u)^{1-\beta}
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- Symmetry implies \( y_n = y \) for all \( n \) is a solution
- \( k = k(p) \), which solves \( pf'(k) = \rho \), for all \( n \)
- \( w = w(p, \theta) \), for all \( n \) solves

\[
\max_w \left( \frac{(1 - \tau_f) [pf(k) - w - \rho k]}{r + \lambda} \right)^\beta \left( \frac{w(1 - \tau_w) - z + \lambda V_u}{r + \lambda} - V_u \right)^{1-\beta}
\]
For each $p \in P_A \subseteq [\underline{p}, \bar{p}]$, tightness, $\theta(p)$, solves

$$V_u(p, \theta) \equiv \frac{m(\theta) [(1 - \tau_w)w(p, \theta) - z]}{r (r + \lambda + m(\theta))} = \bar{V}_u.$$ 

$\bar{V}_u$ is the common value to unemployment.
For each $p \in P_A \subseteq [\underline{p}, \bar{p}]$, tightness, $\theta(p)$, solves

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$\bar{V}_u$ is the common value to unemployment.

The value to establishing a type $p$ firm is

$$V_f^0(p) \equiv \frac{q(\theta(p))(1 - \tau_f) [pf(k(p)) - w(p, \theta(p)) - \rho k(p)]}{r \left( r + \lambda \right)}$$
Lemma

For any given value of $\bar{V}_u$ such that

$$(1 - \tau_w) (\bar{p} f(\bar{k}) - \rho \bar{k}) > z + r \bar{V}_u,$$

where $\bar{k} = k(\bar{p})$, $\theta(p)$ is unique and $V_f^0$ is strictly increasing in $p$.

So,

1. $\theta(p)$ is a well defined decreasing function of $p$.
2. $w(p, \theta(p))$ is a well defined increasing function of $p$.
3. For any given value of $\bar{V}_u$, $P_A = [\bar{p}, \bar{\bar{p}}]$. 
ANALYSIS: Steady State

\( e(p) \) is the population of workers employed at type \( p \) firms
\( u(p) \) is the population of workers looking for employment at type \( p \) firms
\( j(p) = e(p) + u(p) \) is the total population of workers associated with market \( p \)

- The total workforce is given by

\[
J(\tilde{p}) = \int_{\tilde{p}}^{\bar{p}} j(p) dp.
\]
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- In steady state,

\[
m(\theta(p)) u(p) = \lambda e(p)
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- So,

\[ j(p) = \frac{\lambda + m(\theta(p))}{\lambda} u(p). \]
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- So,

$$j(p) = \frac{\lambda + m(\theta(p))}{\lambda} u(p).$$

- As $\theta(p) = h(p)/u(p)$

$$j(p) = \frac{[\lambda + m(\theta(p))]}{\lambda\theta(p)} h(p).$$
A steady state directed search equilibrium is a threshold value of entrepreneurial ability, \( \tilde{p} \), and a market tightness function \( \tilde{\theta}(p) \) such that:

1. All individuals with \( p < \tilde{p} \) are workers while those with \( p \geq \tilde{p} \) are employers.
2. Type \( \tilde{p} \) individuals are indifferent between being a worker and starting a firm, \( V_f^0(\tilde{p}) = \tilde{V}_u \).
3. \( \tilde{V}_u = V_u(p, \tilde{\theta}(p)) \) for all \( p \geq \tilde{p} \).
4. The population of workers equals the labor force: \( H(\tilde{p}) = J(\tilde{p}) \).
Result 1:

\[ H(\tilde{p}) = \int_{\tilde{p}}^{\bar{p}} \left( \frac{\lambda + m(\tilde{\theta}(p))}{\lambda \tilde{\theta}(p)} \right) dH(p). \]

\( \tilde{p} \) is unique.
Result 1:

\[ H(\tilde{p}) = \int_{\tilde{p}}^{\bar{p}} \left( \frac{\lambda + m(\tilde{\theta}(p))}{\lambda \tilde{\theta}(p)} \right) dH(p). \]

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Result 2:

\[ \tilde{\theta} \equiv \tilde{\theta}(\tilde{p}) = \frac{\beta(1 - \tau_f)}{(1 - \beta)(1 - \tau_w)}. \]
Result 1:

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Result 2:

\[ \tilde{\theta} \equiv \tilde{\theta}(\tilde{p}) = \frac{\beta(1 - \tau_f)}{(1 - \beta)(1 - \tau_w)} \]

Result 3: For any \( p, p' \in [\tilde{p}, \bar{p}] \),

\[ \frac{V_f^0(p')}{V_f^0(p)} = \frac{\tilde{\theta}(p)}{\tilde{\theta}(p')} \]
Focus on steady states and constant government spending without discounting

\[
\max_{k(p), \theta(p), \bar{p}} \int_{\bar{p}}^{\bar{p}} \left( pf(p) - \delta k(p) - z \right) \frac{m(\theta(p))}{\lambda \theta(p)} dH(p) - G
\]

subject to \( H(\bar{p}) = \int_{\bar{p}}^{\bar{p}} \left( \frac{\lambda + m(\bar{\theta}(p))}{\lambda \bar{\theta}(p)} \right) dH(p) \).
Focus on steady states and constant government spending without discounting

\[
\max_{k(p), \theta(p), \tilde{p}} \int_{\tilde{p}}^p (pf(p) - \delta k(p) - z) \frac{m(\theta(p))}{\lambda \theta(p)} dH(p) - G
\]

subject to \( H(\tilde{p}) = \int_{\tilde{p}}^p \left( \frac{\lambda + m(\tilde{\theta}(p))}{\lambda \tilde{\theta}(p)} \right) dH(p) \).

**Results:**

\[
\tilde{\theta}_p = \frac{\eta(\tilde{\theta}_p)}{1 - \eta(\tilde{\theta}_p)}
\]

If \( \eta(\tilde{\theta}_p) = \beta \) and \( \tau_w = \tau_f \), the market economy will choose \( \tilde{\theta} \) optimally.
Focus on steady states and constant government spending without discounting

$$\max_{k(p), \theta(p), \tilde{p}} \int_{\tilde{p}} (p f(p) - \delta k(p) - z) \frac{m(\theta(p))}{\lambda \theta(p)} dH(p) - G$$

subject to $H(\tilde{p}) = \int_{\tilde{p}} \left( \frac{\lambda + m(\tilde{\theta}(p))}{\lambda \tilde{\theta}(p)} \right) dH(p)$. 

Results:

$$\tilde{\theta}_p = \frac{\eta(\tilde{\theta}_p)}{1 - \eta(\tilde{\theta}_p)}$$

If $\eta(\tilde{\theta}_p) = \beta$ and $\tau_w = \tau_f$, the market economy will choose $\tilde{\theta}$ optimally.

If $m(.)$ isoeslastic with $\eta = \beta$ and $G = 0$ (no taxes) market economy coincides with constrained efficient allocation.
\[ G = \int_{\bar{p}}^{\tilde{p}} \left\{ [pf(k(p)) - w(p, \theta(p)) - \rho k(p)] \tau_f + \rho k(p) \tau_k + w(p, \theta(p)) \tau_w \right\} e(p) dp \]
Production: $f(k) = k^\phi$

Matching: $m(\theta) = \bar{m}\theta^\eta$

Distribution of $p$ is Pareto:

$$H(p) = 1 - \left(\frac{p}{\bar{p}}\right)^\sigma$$

So

$$\tilde{H}(p) = \frac{H(p) - H(\bar{p})}{1 - H(\bar{p})} = 1 - \left(\frac{\bar{p}}{p}\right)^\sigma$$
SIMULATIONS: Parameters for leading example

- **Time unit:** 1 Year
- **Normalization:** $p = 1$
- **External:** $r = 0.04$, $\lambda = 0.2$, $\eta = 0.5$, $\phi = 0.33$, $\beta = 0.96$, $\delta = 0.1$, $\tau_f = 0.15$, ($\tau_k = 0$)
- **Quantitative Targets:**
  - unemployment rate, 6%
  - share of employers in the economy at 5%
  - government spending 18.6% of GDP
  - A share of before-tax income going to top 1% of earners at 20%
- **Internal parameters:** $\bar{m} = 4.52$, $z = 0.748$, $\sigma = 7.65$, $\tau_w = 35.5$
- **Implied value of** $G = 0.6954$. 
RESULTS: Leading example

Equal: $\tau_w = \tau_f = 28.2\% \ (\tau_k = 0)$; Unequal: $\tau_w = 35.5\%$, $\tau_f = 15\%$

<table>
<thead>
<tr>
<th>Metric</th>
<th>Equal tax</th>
<th>Lower $\tau_f$</th>
<th>Unequal tax</th>
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<tbody>
<tr>
<td>Unemployment (%)</td>
<td>5.38</td>
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<td>Welfare</td>
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<td>% Employers</td>
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<td>25.67</td>
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<td>25.27</td>
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<td>Top 1% of population</td>
<td>19.49</td>
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<td>1.696</td>
<td>1.749</td>
<td></td>
</tr>
</tbody>
</table>
SIMULATIONS: Alternative (Hosios) Parameters

- **External:** \( r = 0.04, \lambda = 0.2, \eta = 0.5, \phi = 0.33, \beta = 0.5, \delta = 0.1, \tau_f = 0.15, \tau_k = 0 \)

- **Quantitative Targets:**
  - unemployment rate, 6%
  - share of employers in the economy at 5%
  - government spending 18.6% of GDP

- 20% of income going to top 1% of earners now not achievable

- **Internal parameters:** \( \bar{m} = 3.3, z = 0, \sigma = 69.4, \tau_w = 28.70\% \)

- **Implied value of** \( G = 0.2763 \).
RESULTS: Alternative (Hosios) Parameters

Unequal: $\tau_w = 28.7\%, \tau_f = 15\%, (\tau_k = 0)$; Equal $\tau_w = \tau_f = 27.8\%$

<table>
<thead>
<tr>
<th>Metric</th>
<th>Equal tax</th>
<th>Lower $\tau_f$</th>
<th>Unequal tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment (%)</td>
<td>6.46</td>
<td>6.05</td>
<td>6.01</td>
</tr>
<tr>
<td>GDP</td>
<td>1.486</td>
<td>1.486</td>
<td>1.486</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.720</td>
<td>(0.728)</td>
<td>0.719</td>
</tr>
<tr>
<td>% Employers</td>
<td>4.60</td>
<td>4.94</td>
<td>4.97</td>
</tr>
<tr>
<td>Before-tax income shares:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employers</td>
<td>4.97</td>
<td>4.69</td>
<td>4.67</td>
</tr>
<tr>
<td>1% share</td>
<td>1.621</td>
<td>1.482</td>
<td>1.472</td>
</tr>
<tr>
<td>0.1% share</td>
<td>0.267</td>
<td>0.248</td>
<td>0.248</td>
</tr>
<tr>
<td>0.01% share</td>
<td>0.040</td>
<td>0.036</td>
<td>0.036</td>
</tr>
<tr>
<td>Before-tax incomes:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.002% income</td>
<td>7.634</td>
<td>7.149</td>
<td>7.112</td>
</tr>
<tr>
<td>Average worker wage</td>
<td>1.037</td>
<td>1.040</td>
<td>1.040</td>
</tr>
</tbody>
</table>
RESULTs: Leading example, tax on capital

Unequal: $\tau_k = 15\%, \tau_w = 35.39\%, (\tau_f = 0)$; Equal: $\tau_k = \tau_w = 28.89\%$

<table>
<thead>
<tr>
<th>Metric</th>
<th>Equal tax</th>
<th>Unequal tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment (%)</td>
<td>6.60</td>
<td>6.65</td>
</tr>
<tr>
<td>GDP</td>
<td>3.208</td>
<td>3.506</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.791</td>
<td>0.992</td>
</tr>
<tr>
<td>% Entrepreneurs</td>
<td>4.65</td>
<td>4.66</td>
</tr>
<tr>
<td>Before-tax income shares:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurs' share (%)</td>
<td>25.12</td>
<td>25.06</td>
</tr>
<tr>
<td>1% share (%)</td>
<td>20.46</td>
<td>20.49</td>
</tr>
<tr>
<td>0.1% share (%)</td>
<td>8.80</td>
<td>8.85</td>
</tr>
<tr>
<td>0.01% share (%)</td>
<td>2.27</td>
<td>2.28</td>
</tr>
<tr>
<td>Before-tax incomes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.002% income</td>
<td>1,787</td>
<td>1,963</td>
</tr>
<tr>
<td>Average worker wage</td>
<td>1.514</td>
<td>1.658</td>
</tr>
</tbody>
</table>
In a span-of-control model with labor market frictions:

- Lowering taxes on profits decreases unemployment and decreases inequality.
- Effects of budget-balancing increases in the wage tax depend on firm bargaining power:
  - With high power, tax is borne by the firms with a disproportionate effect on small ones.
  - With low power, more is borne by workers incentivizing entrepreneurship.
- Taxes on capital off-set distributional effects of wage taxes but have a strong impact on investment and output.
- **Issue:** how to distinguish between payments to capital and excess profits.