Simple Labor Income Tax Systems with Endogenous Employment Contracts

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Motivation

Welfare policy design: implement efficient outcomes with simple policies

Tension between efficiency and simplicity:
- Varying types of skill shocks: transient, persistent
- Shocks are private information
⇒ Personalized and time-varying welfare systems

Real-world policies are simpler: anonymous, history-independent

Question: Can we implement the constrained social optimum with simple welfare policies?
Mechanism

Highlight firms’ contractual responses to labor income tax system

Progressive labor income tax system:

- Direct effect: redistribution
  - Against persistent shocks
- Indirect effect: consumption-smoothing, by firms’ efficiency wage contracts
  - Absorb transient shocks

Policy maker and firms specialize in different shocks
Agenda

1. Transient shocks
   - Firm’s contractual response to progressive income taxes

2. Transient and persistent shocks
   - Planner’s problem
   - Implementation with firms

3. Discussion
Firm’s Problem: Set Up

Fix a progressive labor income tax system \( \{\tau(\cdot)\} \); Consider the problem between a firm and a worker on \([0, 1]\)

At each \( t \in [0, 1] \), the worker exerts a flow effort \( l_t \in \mathbb{R}_+ \) and generates a random output \( \tilde{y}_t \in \{H, L\} \):

- \( \mathbb{P}(\tilde{y}_t = H|l_t) = p(l_t) \):
  - \( p(\cdot) \in (0, 1), p'(\cdot) > 0, p''(\cdot) < 0 \)
- Worker’s flow payoff: \( u(c_t) - v(l_t) \):
  - \( u' > 0, u'' < 0, v' > 0, v'' > 0 \)
- Firm’s flow profit: \( y_t - w_t \)
- \( c_t = w_t(1 - \tau(w_t)) \)

Effort is private; output is public

No discounting; No saving
Progressive Labor Income Taxes

- As the pre-tax income increases, a larger fraction of it is taxed away and the after-tax consumption is increasing.
Firm’s Contractual Choice

Fix the effort $l$ that the firm wants to elicit

Compare two contracts:
- Bonus contract
- Efficiency wage contract
A bonus contract = a series of identical static contracts

At each $t$, pay $\bar{c}$ if $y_t = H$ and $c$ if $y_t = L$

Two constraints: incentive compatibility; participation
Bonus Contract: Constraints

Incentive compatibility.

\[ c \]
\[ w \]
\[ \bar{c} \]
\[ \bar{w} \]
Incentive compatibility and Participation.

\[ \bar{c} = \nu \]

\[ Ec = \nu \quad (IR) \]

\[ \underline{w} \quad \overline{w} \]
"Tax premium" = $\mathbb{E}[w] - \hat{w}$; cost of providing incentives through consumption variation when labor income taxes are progressive.
Bonus Contract: Incentive Costs

Remark: Risk-averse agent

Sources of concavity of $u(c(w))$: progressiveness, risk aversion
Incentive cost: tax premium, risk premium
Efficiency wage contract \((c, \mathbb{E}[\tilde{y}|l], B)\):

- Pay a fixed consumption \(c = v(l)\) (or wage \(\hat{w}\)) at each \(t \in [0, 1]\)
- At \(t = 1\), compute the sample mean of outputs
  \[
  \hat{\mu} = \int_{0}^{1} y_t dt
  \]
- Pass if \(\hat{\mu} \geq \mathbb{E}[\tilde{y}|l]\); Fail otherwise
- If fail, charge a penalty \(B > v(l)\)
Proposition

Take an arbitrary \( l \). Under the efficiency wage contract \((c, \mathbb{E}[^\gamma|l], B_T)\), there exists a Bayesian Nash equilibrium where the worker exerts \( l \) all the time.

Proof sketch:

- **Exert \( l \) all the time:**
  - Pass with prob. 1;
  - Curvature of \( p(\cdot), v(\cdot) \): the cheapest way to pass
- \( B > v(l) \): the worker prefers to pass than to fail

Consequence: avoid tax premium all together!
Pool information over time to obtain a precise measure of the worker’s long-term performance

Incentive provision without consumption variation; Eliminate the tax premium
Robustness Check: Discrete-Time Finite Horizon

**Proposition**

*Compare to the complete information benchmark,*

- *The per-period profit loss of the efficiency wage contract is of $O(T^{-0.5+\varepsilon})$ for some arbitrary $\varepsilon > 0$;*
- *The per-period profit loss of the bonus contract is of $O(1)$."

As horizon becomes long enough, the efficiency wage contract

- Outperforms bonus contracts
- Becomes asymptotically optimal
- Absorbs transient shocks
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2. Transient and persistent shocks
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Persistent and Transient Shocks: Set Up

At $t = 0$, the worker draws a private ability shock $\theta \sim F(\cdot)$ (Mirrless 1971)

At each $t \in [0, 1]$:

- Exert a flow effort $l_t \in \mathbb{R}_+$ and generate a random public output $\tilde{y}_t \in \{H, L\}$
- Flow payoff: $u(c_t) - v(l_t, \theta)$:
  - $u' > 0$, $u'' < 0$
  - $v_l > 0$, $v_{ll} > 0$, $v_\theta < 0$, $v_{l\theta} < 0$, $v(0, \theta) = 0$ for all $\theta$
Planner’s Problem

The social planner who observes the effort, the output but not the ability type:

\[
\max_{\{c(\theta),l(\theta)\}} \int \lambda(\theta)(u(c(\theta)) - \nu(l(\theta), \theta))dF(\theta)
\]

s.t. \( u(c(\theta)) - \nu(l(\theta), \theta) \geq u(c(\theta')) - \nu(l(\theta'), \theta) \) \( \forall \theta, \theta' \) (IC\(\theta\))

and \( \int \mathbb{E}[\tilde{y} | l(\theta)] - c(\theta)dF(\theta) \geq R \)

Denote the solution by \( \{c^*(\theta), l^*(\theta)\} \) and let the planner implement it with labor income taxes:

- Personalized and time-varying tax system: two workers \( \theta, \theta' \) are taxed at different rates \( \frac{y - c^*(\theta)}{y}, \frac{y - c^*(\theta')}{y} \)
- Possible, but very complicated
Implementation with Firms

Players: planner, firms $i \in [0, 1]$ and workers with $\theta \sim F(\cdot)$

At $t = 0$,
- The planner proposes $\{\tau^*(\cdot)\}$ where
  \[(1 - \tau^*(w)) \cdot w = c^*(\theta), \text{ if } w = \mathbb{E}[\tilde{y} | l^*(\theta)]\]
- Competitive firms offer menus of contracts
- Workers choose contracts; Contracts become binding

Production takes place on $[0, 1]$. 
Proposition

Suppose certain regularity conditions are satisfied. Then $\{\tau^*(\cdot)\}$ is progressive and induces a Bayesian Nash equilibrium where

- Each firm $i$ effectively targets a single ability type $\theta$ by offering an efficiency wage contract $(c^*(\theta), \mathbb{E}[\tilde{y} | l^*(\theta)], B(\theta))$;
- Type $\theta$ worker chooses the contract that matches his ability and exerts $l^*(\theta)$ at each $t$;
- All firms earn zero flow profit.
Proof Sketch

\[ \begin{align*}
\mathbf{c}_0 & \mathbf{l} \\
\mathbf{c}^*(\theta) & (IC_{\theta'}) \\
(l^*(\theta)) & (ICFOC)
\end{align*} \]
Proof Sketch

\[ c_0 \]

\[ l(I_{CFOC}) = 0 \]

\[ c(\theta) \]

\[ l(\theta) \]

\[ c^*(\theta) \]

\[ (IC_{\theta}) \]

\[ (IC_{\theta'} \]

\[ (IS_{\Pi=0}) \]
Sufficient Conditions for Progressiveness

When is \( u(c_T(w)) \) concave in \( w \)?

Regularity condition (the case of risk-neutral worker)

\[
\frac{\mathbb{E}[\tilde{y}|l(\theta)]}{\nu(I(\theta),\theta) - \int_\theta^\infty \nu(l(s),s)ds} < 1 + \frac{\int_\theta^\infty \mu - \lambda(s) dF(s)}{\mu f(\theta)} \frac{|v_l(l(\theta),\theta)|}{v_l(l(\theta),\theta)}
\]

- Planner does not care much about the high ability type
- Complementarity between ability and effort is strong
Conclusion

Interaction between two mechanism design problems:
- Government: labor income tax
- Firms: employment contract (given the tax system)

Dichotomous result:
- The employment contract absorbs transient productivity shocks
- The tax system handles persistent ability shocks

Emphasize the firm’s endogenous contractual response; Justify simple redistribution policies
Discussion

- Contractual friction: discounting, limited liability, ... 
- Saving; capital income tax 
- Other aggregate shocks: handicap, structural unemployment
Discussion: Discounting and Limited Liability

Linkage mechanism:
- Hinge on the ability to collect many data points and perform powerful statistical tests;
- Work well when shocks are frequent and transient.

Discounting, limited liability:
- Undermine the performance of linkage mechanism;
- Partial remedy: shorten the review block; weaken the power of the statistical test.
Discussion: Saving and Capital Income Tax

Private productivity shock vs. capital accumulation:
- Workers cannot be fully insured against these shocks;
- Inefficient capital hoarding; gives room to capital income tax.

Our analysis: the persistency of shocks matters for their macro implication.
- Transient shocks are insured by firms
- Saving only needed to insure the persistent shocks (disabilities, unemployment, etc.)
Discrete-Time Finite Horizon: Performance Threshold