Optimal Income Taxation and Commitment on the Labor Market

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Firms and personal income taxation

People differ in initial ability and face productivity shocks along the life cycle.

We want to redistribute income and insure risk. Typically with income tax.

What is the role of firms?

Can firms insure their workers?

How does insurance within firm affect income redistribution?

Important clues:

- Firms and workers can (partially) commit to maintain employment.
  Michelacci and Quadrini (2005, 2009); Guiso, Pistaferri, and Schivardi (2012); Brandt and Hosios (1996)
- Firms insure employees against productivity shocks.
  Guiso, Pistaferri, and Schivardi (2005); Lagakos and Ordonez (2011)
- Firms help their employees avoid taxes.
  Kreiner, Leth-Petersen, and Skov (2014, 2015)

I extend the theory of optimal income taxation to incorporate the above.

This paper

Key assumptions

Heterogeneity:	Every worker has an idiosyncratic, stochastic productivity.
Information:	Workers' productivities are observed by firms, but neither by the government nor financial markets.
Commitment:	Firms can fire workers subject to the **firing cost** ϕ, workers can quit jobs subject to the **quiting cost** κ.

Main results

Two-sided commitment on the labor market ($\phi = \kappa = \infty$)

1. All efficient allocations involve full consumption insurance.
2. Incentive-compatible tax schedules cannot be 'too regressive'
   - Local regressivity encourages tax avoidance via **income randomization**.

Partial commitment on the labor market ($\phi < \infty$ or $\kappa < \infty$)

1. Insurance within firm depends only on $\phi + \kappa$.
2. When $\phi = 0$ or $\kappa = 0$, agents cannot randomize income initially
   $\rightarrow$ more redistribution is possible.

Take away: Some labor market commitment benefits insurance, too much commitment restricts redistribution.

Related literature

Insurance with limited commitment

Thomas and Worrall (1988); Kocherlakota (1996); Harris and Holmstrom (1982); Krueger and Uhlig (2006); Thomas and Worrall (2007); Lamadon (2014); Abrahám, Alvarez-Parra, and Forstner (2017)

Optimal non-linear taxation

static: Mirrlees (1971); Diamond (1998); Saez (2001)

dynamic: Golosov, Kocherlakota, and Tsyvinski (2003); Golosov, Tsyvinski, and Werning (2007); Kocherlakota (2010); Farhi and Werning (2013); Golosov, Troshkin, and Tsyvinski (2016)

Optimal taxation with firms / private insurance markets

Golosov and Tsyvinski (2007); Chetty and Saez (2010); Attanasio and Rıos-Rull (2000); Krueger and Perri (2011); Ábrahám, Koehne, and Pavoni (2016); Stantcheva (2014); da Costa and Maestri (2017)

Plan of the presentation

Workers

A continuum of agents live for T periods and have a per-period utility function

$$u(c) - v(n),$$

where $u'' \leq 0$ and $v'' > 0$. They discount future with β.

Take some history of consumption $c = (c_1, ..., c_T) \in \mathbb{R}_+^T$ and labor supply $n = (n_1, ..., n_T) \in \mathbb{R}_+^T$. The implied lifetime utility of agent is

$$U(c, n) \equiv \sum_{t=1}^{T} \beta^{t-1} (u(c_t) - v(n_t)).$$

In each period each agent draws labor productivity from $\Theta \subseteq \mathbb{R}_+$.

Productivity histories $\theta^T = (\theta_1^T, ..., \theta_T^T) \in \Theta^T$ are distributed according to probability measure μ_{Θ^T}. No restrictions on the productivity process.

Firms

A continuum of risk-neutral firms that collect output and pay labor income.

No information assymetry between an employee and and an employer.
Each employer observes productivity, labour supply and output of his employee.

Take some history of labor income $y = (y_1, ..., y_T) \in \mathbb{R}^T$, labor supply $n = (n_1, ..., n_T) \in \mathbb{R}_+^T$ and labor productivity $\theta^T \in \Theta^T$.

The continuation profits in period t are

$$\pi_t\left(y, n, \theta^T\right) \equiv \sum_{s=t}^{T} \beta^{s-1}\left(\theta_s^T n_s - y_s\right).$$

Labor market

1. Workers enter the labor market **after the initial productivity is drawn**.
2. Firms make job offers dependent on the initial productivity.
3. Workers observe all offers: a Bertrand competition among firms,
   $\Longrightarrow$ firms maximize workers expected utility subject to making zero profits in expectations. Intuitively:

$$\mathbb{E}\{\pi_1(y, n, \theta^T) \mid \theta\} = 0 \text{ for all } \theta \in \Theta.$$

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Assumptions on commitment:

- Firms can fire a worker subject to a firing cost $\phi \geq 0$.
- Workers can quit (and join another firm) subject to a quiting cost $\kappa \geq 0$.

In equilibrium neither a firm nor a worker has incentives to terminate the contract at any history. Intuitively:

$$\kappa \geq \mathbb{E}\{\pi_t(y, n, \theta^T) \mid \theta^t\} \geq -\phi \text{ for all } t \leq T \text{ and all } \theta^t \in \Theta^t.$$

Social planner

In each period

the planner observes: consumption c, labor income y;

the planner does not observe: productivity θ, hours worked n, output θn.

Timing:

First, the planner commits to a mechanism.

Then in each period

1. Agents observe their productivity and send reports to the planner.
2. Planner assigns consumption and labor income.
3. Agents choose their labor supply.

A mechanism

Define an outcome as $x = (c, y) \in X = \mathbb{R}_+ \times \mathbb{R}$.

The planner chooses a mechanism Ψ which specifies

- a message space M,
- a randomization device R_x,
- an outcome function $x : M^T \times R_x^T \to X^T$.
  - For any report history the outcome function implies a lottery over the histories of consumption and income.
  - x_t is $(m^t \times r_x^t)-$measurable: current outcomes do not depend on the future.

Equilibrium of a mechanisms

The agent chooses

1. reporting strategy ρ which specifies a randomization device R_m and a reporting function $m : \Theta^T \times R_m^T \times X^T \to M^T$
   - m_t is $\left(\theta^t \times r_m^t \times x^{t-1}\right)$ −measurable.
2. labor strategy n, where $n : \Theta^T \times R_m^T \times X^T \to \mathbb{R}_+^T$
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Given mechanism Ψ strategies $(\hat{\rho}, \hat{n})$ satisfy

1. zero profit constraints (ZPC) if

$$\mathbb{E}_{\Psi,\hat{\rho}}\{\pi_1(y, \hat{n}, \theta^T) \mid \theta\} = 0 \text{ for all } \theta \in \Theta,$$

2. and limited commitment constraints (LCC) if

$$\kappa \geq \mathbb{E}_{\Psi,\hat{\rho}}\{\pi_t(y, \hat{n}, \theta^T) \mid \theta^t, r_m^t, x^{t-1}\} \geq -\phi \text{ for all } t \leq T \text{ and all } (\theta^t, r_m^t, x^{t-1}).$$

Definition

Strategies (ρ, n) are an equilibrium of a mechanism Ψ if

$$(\rho, n) \in \arg\max_{(\hat{\rho},\hat{n})} \mathbb{E}_{\Psi,\hat{\rho}}\{U(c, \hat{n})\} \text{ s.t. ZPC and LCC.}$$

Revelation principle

A mechanism Ψ with an associated equilibrium (ρ, n) is feasible if

$$\mathbb{E}_{\Psi,\rho}\left\{\sum_{t=1}^{T}\beta^{t-1}\left(\theta_t^T n_t - c_t\right)\right\} \geq 0.$$

A direct mechanism has a message space $M = \Theta$.

A truthful reporting strategy ρ^* has a reporting function $m(\theta^T) = \theta^T$.

A direct mechanism is incentive-compatible (incentive-feasible) if it has a truthful equilibrium (and is feasible).

Lemma (Revelation principle)

For any feasible mechanism there exists a direct, incentive-feasible mechanism which provides the agent with the same expected utility.

Myerson (1979) - revelation principle in 'hidden info' setting.
Myerson (1982) - revelation principle in 'hidden info + hidden action' setting, considering only pure reporting strategies.

This lemma extends Myerson (1982) to mixed reporting strategies, which are relevant in 'hidden info + hidden action' setting.

Planner's problem

The planner maximizes the expected utility weighted with Pareto weights λ

$$\max_{\Psi,n} \mathbb{E}_{\Psi,\rho^*}\{\lambda(\theta_1^T)U(c,n)\}$$

subject to the resource constraint

$$\mathbb{E}_{\Psi,\rho^*}\left\{\sum_{t=1}^{T}\beta^{t-1}(\theta_t n_t - c_t)\right\} \geq 0$$

and the incentive-compatibility constraint

$$(\rho^*, n) \in \arg\max_{\hat{\rho},\hat{n}} \mathbb{E}_{\Psi,\hat{\rho}}\{U(c,\hat{n})\}$$

subject to zero profit constraints

$$\mathbb{E}_{\Psi,\hat{\rho}}\{\pi_1(y,\hat{n},\theta^T) \mid \theta\} = 0 \text{ for all } \theta \in \Theta$$

and limited commitment constraints

$$\kappa \geq \mathbb{E}_{\Psi,\hat{\rho}}\{\pi_t(y,\hat{n},\theta^T) \mid \theta^t, r_m^t, x^{t-1}\} \geq -\phi$$

$$\text{for all } T \geq t \geq 1 \text{ and all } (\theta^t, r_m^t, x^{t-1}) \in \Theta^t \times R_m^t \times X^{t-1}.$$

A mechanism is incentive-efficient if it solves the planner's problem for some non-negative Pareto weights.

No labor market commitment

Suppose that $\phi = \kappa = 0$: neither a worker nor a firm can commit.

Further suppose that the planner chooses a deterministic mechanism.

Limited commitment constraints become

$$\mathbb{E}_{\Psi,\hat{\rho}}\{\pi_t(y, \hat{n}, \theta^T) \mid \theta^t, r_m^t, x^{t-1}\} = 0 \implies y_t = \theta_t \hat{n}_t.$$

Firms pay workers their output in every period
$\rightarrow$ no insurance within firm,
$\rightarrow$ dynamic Mirrlees model of Golosov, Kocherlakota, and Tsyvinski (2003).

Incentive-efficient allocations balance insurance and labor efficiency and involve:

- partial consumption insurance,
- history dependent labor distortions.

Plan of the presentation

Introduction

Framework

Two-sided commitment

Partial commitment

Full consumption insurance

Suppose that $\phi = \infty$ and $\kappa = \infty$ - workers and firms can commit fully and we can drop the limited commitment constraints.

Theorem

Suppose that $\phi = \kappa = \infty$. All incentive-efficient mechanisms are deterministic and involve full consumption insurance.

Full consumption insurance

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Intuition:

Without commitment, labor supply follows income in each period: $\theta_t n_t = y_t$.

With two-sided commitment, labor supply follows income only in expectation over the lifetime bc of the zero profit constraint

$$\mathbb{E}_{\Psi,\rho}\left\{\sum_{t=1}^{T}\beta^{t-1}\theta_t^T n_t \mid \theta\right\} = \mathbb{E}_{\Psi,\rho}\left\{\sum_{t=1}^{T}\beta^{t-1}y_t \mid \theta\right\}.$$

$\implies$ labor strategy depends only on initial type and expected lifetime income.

We can make income process independent of stochastic productivity without distorting labor $\rightarrow$ full insurance without labor distortions.

When $\phi = \kappa = \infty$, there is no trade-off between insurance and labor efficiency.

Mixed reporting strategies are relevant

Lemma

Suppose that $\phi = \kappa = \infty$. The incentive constraints with respect to pure reporting strategies are slack.

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Proof for $T = 1$: Suppose that some initial type θ is indifferent between truthful reporting and reporting some other type θ' with certainty

$$u(c(\theta)) - v\left(\frac{y(\theta)}{\theta}\right) = u\left(c\left(\theta'\right)\right) - v\left(\frac{y\left(\theta'\right)}{\theta}\right) = U.$$

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Then for any $\sigma \in (0,1)$

$$U = \sigma\left[u(c(\theta)) - v\left(\frac{y(\theta)}{\theta}\right)\right] + (1-\sigma)\left[u\left(c\left(\theta'\right)\right) - v\left(\frac{y\left(\theta'\right)}{\theta}\right)\right]$$

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Then for any $\sigma \in (0, 1)$

$$\begin{aligned} U &= \sigma\left[u(c(\theta)) - v\left(\frac{y(\theta)}{\theta}\right)\right] + (1-\sigma)\left[u\left(c\left(\theta'\right)\right) - v\left(\frac{y\left(\theta'\right)}{\theta}\right)\right] \\ &= \sigma u(c(\theta)) + (1-\sigma)u\left(c\left(\theta'\right)\right) - \left[\sigma v\left(\frac{y(\theta)}{\theta}\right) + (1-\sigma)v\left(\frac{y\left(\theta'\right)}{\theta}\right)\right] \end{aligned}$$

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When $y(\theta') \neq y(\theta)$, it is strictly better to randomize reports and **keep the labor supply constant across reports**.

Equivalent static taxation problem

Lemma

Suppose that $\phi = \kappa = \infty$. The incentive-efficient mechanism allocates to the agent with initial report θ consumption $c(\theta)$ and income $y(\theta)$ in each period, where $c(\cdot), y(\cdot)$ solve

$$\max_{\{c\theta, y(\theta)\}_{\theta \in \Theta}} \mathbb{E}\{\lambda(\theta)(u(c(\theta) - \tilde{v}(y(\theta), \theta))\}$$

subject to the resource constraint

$$\mathbb{E}\{y(\theta) - c(\theta)\} \geq 0$$

and the incentive constraints in mixed reporting strategies

$$u\left(c\left(\theta'\right)\right) - u(c(\theta)) - \left(y\left(\theta'\right) - y(\theta)\right)\tilde{v}_y(y(\theta), \theta) \leq 0 \text{ for all } \theta, \theta'.$$

where $\tilde{v}(y, \theta)$ is increasing, concave and differentiable with respect to y.

The modified IC constraints ensure that agents cannot gain by marginally increasing the probability of misreporting type, starting from truthtelling.

Similar to standard Mirrlees model, but with tighter incentive constraints.

No-randomization condition

For any allocation $(c(\cdot), y(\cdot))$ define the income tax schedule

$$\mathcal{T}(y(\theta)) \equiv y(\theta) - c(\theta).$$

Proposition

Suppose that income tax schedule is twice differentiable at y. Any incentive-compatible allocation satisfies the no-randomization condition:

$$-\frac{u''(y - \mathcal{T}(y))}{u'(y - \mathcal{T}(y))} \geq \frac{-\mathcal{T}''(y)}{(1 - \mathcal{T}'(y))^2}.$$

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Proof: Introduce a small variation ϵ around income y. Since the expected income does not change, **labor supply does not change**. The utility gain is

$$\begin{aligned} &\frac{1}{2}u(y + \epsilon - \mathcal{T}(y+\epsilon)) + \frac{1}{2}u(y - \epsilon - \mathcal{T}(y - \epsilon)) - u(y - \mathcal{T}(y)) \\ &\qquad \approx \frac{1}{2}\epsilon^2 \left[(1 - \mathcal{T}'(y))^2 u''(y - \mathcal{T}(y)) - \mathcal{T}''(y)u'(y - \mathcal{T}(y))\right]. \end{aligned}$$

The second-order term is non-positive when the no-randomization cnd holds.

Sufficiency of the no-randomization condition

Assumption (Single crossing)

Θ is convex. $\tilde{v}(y,\theta)$ is differentiable with respect to θ. The single crossing property holds: $\tilde{v}_{y\theta}(y,\theta) < 0$ for all $\theta \in \Theta$ and $y \in \mathbb{R}_+$.

Proposition

Under the single crossing assumption, an allocation $(c(\cdot), y(\cdot))$ is incentive compatible if and only if

1. *$y(\cdot)$ is nondecreasing (monotonicity),*
2. *$u(c(\theta')) - \tilde{v}(y(\theta'),\theta') - (u(c(\theta)) - \tilde{v}(y(\theta),\theta)) = -\int_{\theta}^{\theta'} \tilde{v}_\theta(y(\tilde{\theta}),\tilde{\theta})d\tilde{\theta}$ for all $\theta, \theta' \in \Theta$ (local incentive constraints),*
3. *$\tilde{v}_y(y(\theta),\theta)$ is nonincreasing in θ (no-randomization condition).*

Conditions 1-2 are standard.
Condition 3 (a general form of the no-randomization condition) fully characterises the impact of mixed reporting strategies.

Restriction on tax regressivity

No-randomization condition:

$$\underbrace{-\frac{u''(y-\mathcal{T}(y))}{u'(y-\mathcal{T}(y))}}_{\text{absolute risk aversion}} \geq \underbrace{\frac{-\mathcal{T}''(y)}{(1-\mathcal{T}'(y))^2}}_{\text{a measure of tax regressivity}}$$

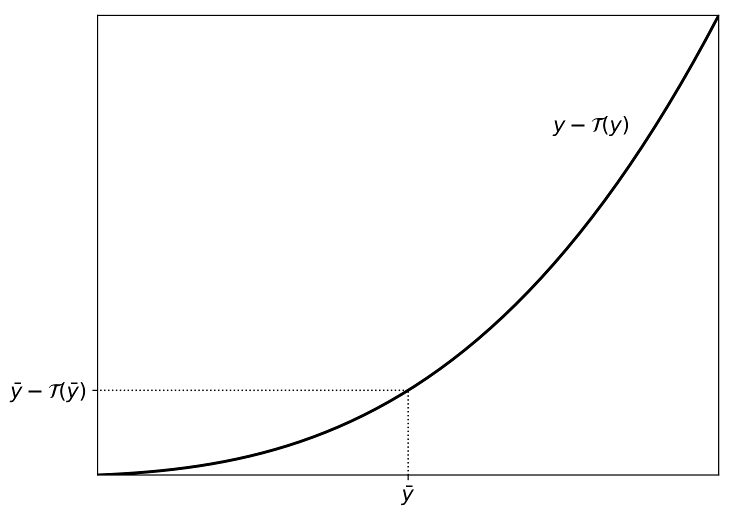
Agents' aversion to consumption risk is determined by preferences.

Agents' aversion to income risk is determined both by preferences and by a tax schedule.

A regressive tax schedule ($\mathcal{T}''(y) < 0$) reduces workers' aversion to income risk, since income lotteries reduce the expected tax payment.

Tax regressivity and incentives for income randomization

Regressive tax $\rightarrow$ consumption convex in income $\rightarrow$ gains from randomness.



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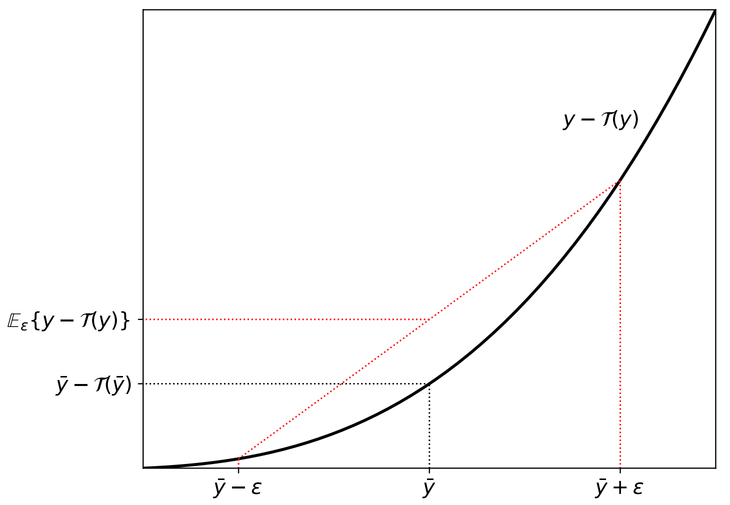

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No-randomization condition bounds the tax regressivity and ensures that the absolute aversion to income risk is non-negative.

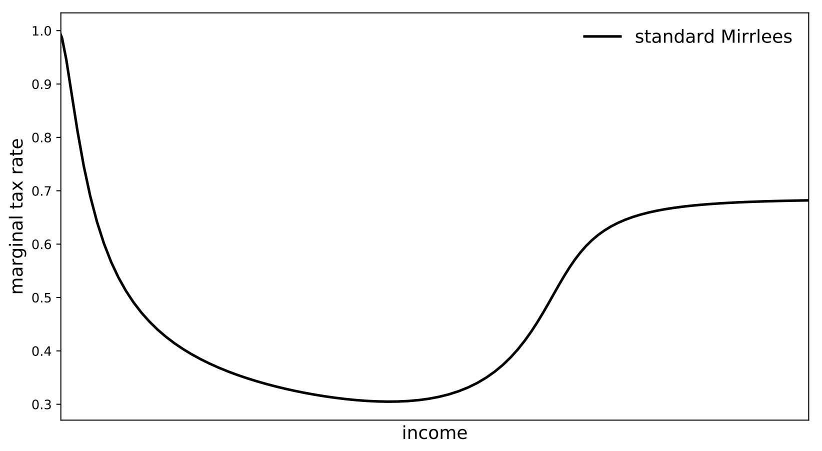
Special cases of no-randomization cnd:

- risk neutrality: $T''(Y) \geq 0$.
- CRRA σ & HSV taxes with progressivity parameter p: $\sigma \geq \frac{p}{p-1}$.

Rawls and risk neutral agents

Rawlsian planner, risk neutral agents, lognormal distribution with a Pareto tail.

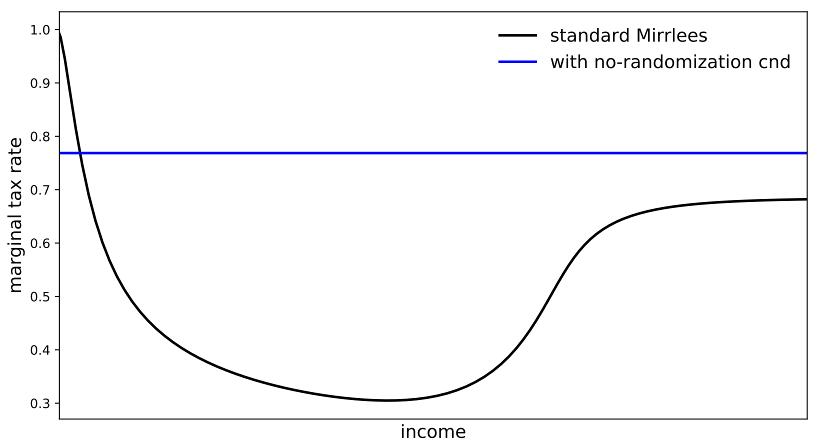
A typical U-shape of optimal tax rates (Diamond (1998)).



Rawls and risk neutral agents

Imposing no-randomization cnd leads to the optimal tax being linear if

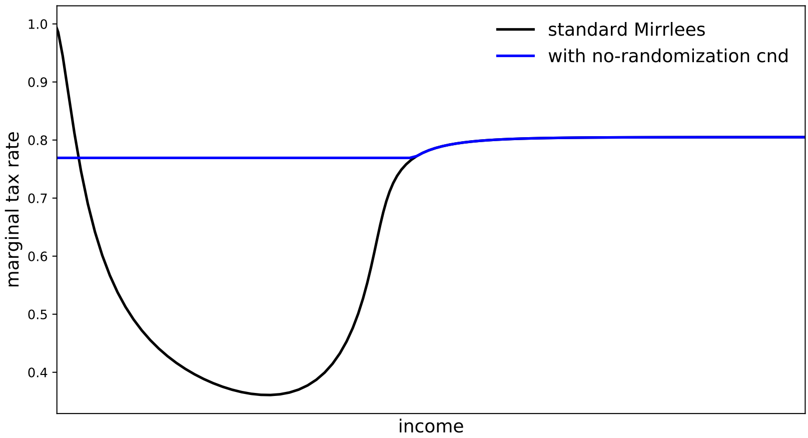
$$\underbrace{\frac{1}{1+\varepsilon}}_{\text{optimal linear tax rate}} \geq \underbrace{\frac{1}{1+\frac{\varepsilon}{1+\varepsilon}\alpha}}_{\text{optimal top tax rate}}$$



Rawls and risk neutral agents

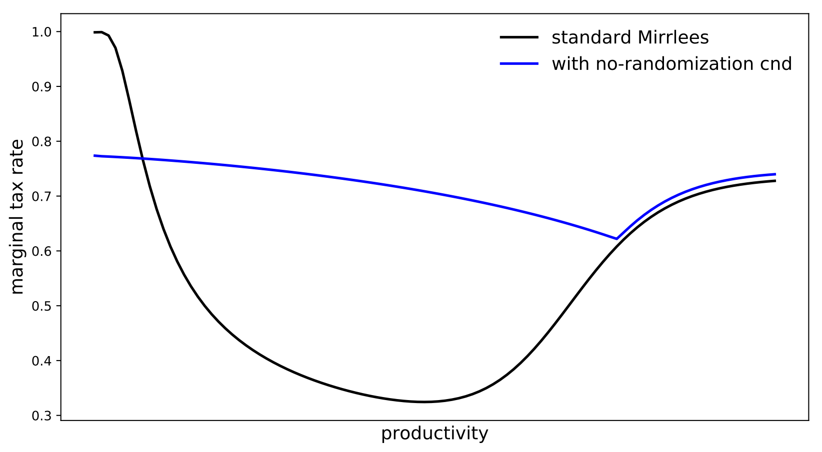
Imposing no-randomization cnd leads to the optimal tax being nonlinear if

$$\underbrace{\frac{1}{1+\varepsilon}}_{\text{optimal linear tax rate}} < \underbrace{\frac{1}{1+\frac{\varepsilon}{1+\varepsilon}\alpha}}_{\text{optimal top tax rate}} \implies \alpha - \varepsilon < 1 \implies \mathbb{E}\{y\} = \infty$$



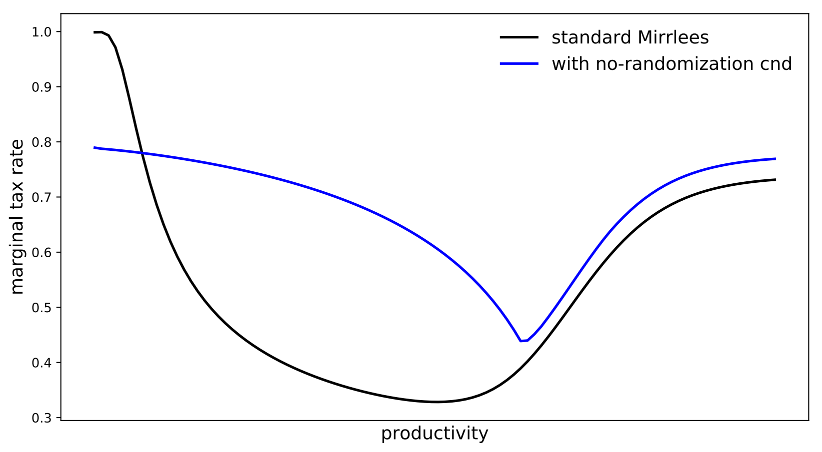
Rawls and CARA agents ("low risk aversion")

Suppose instead agents have constant absolute risk aversion γ.



Rawls and CARA agents (”high risk aversion”)

Suppose instead agents have constant absolute risk aversion γ.



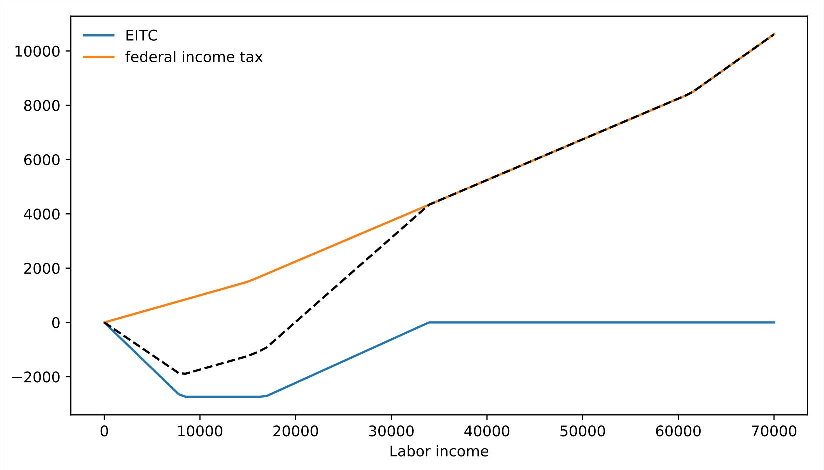
Tax regressivity in practice

Statutory income taxes are typically progressive.

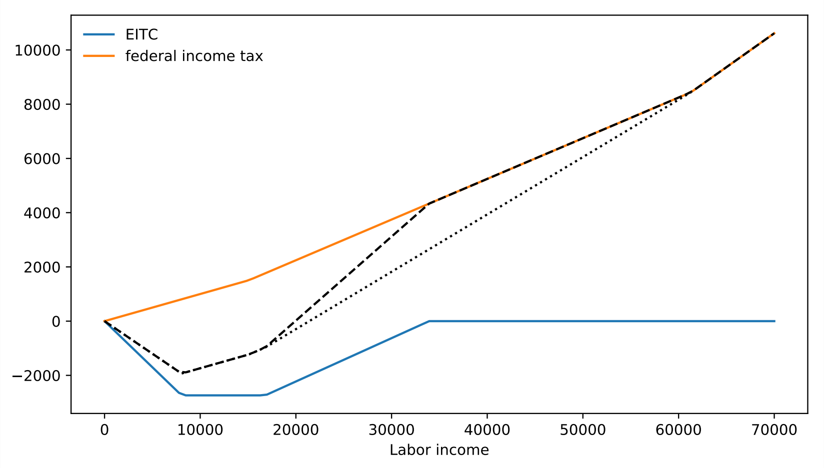
However, statutory income taxes + social transfers are often regressive where transfers are phased-out.

Consider Earned Income Tax Credit for a couple with one child in 2006.

Earned income tax credit



Earned income tax credit



Max expected gain from randomization: $1680 ≈ 60% of max EITC.

Plan of the presentation

Partial commitment

Consider arbitrary $\phi \geq 0$ and $\kappa \geq 0$.

Insurance without initial differences

Assumption ("no initial differences")

$T \geq 2$ and there exists $\theta_1 \in \Theta$ such that $\mu_{\Theta^T}(\theta_1 \times \Theta^{T-1}) = 1$.

Proposition

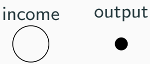
Under "no initial differences" assumption, if a consumption allocation and a labor policy are implementable with ϕ and κ, then they are also implementable with ϕ' and κ' where $\phi' + \kappa' = \phi + \kappa$.

What matters for labor market insurance is only the combined commitment power $\phi + \kappa$.

Any imbalance in commitment power can be accomodated by shifting income forward or backwards

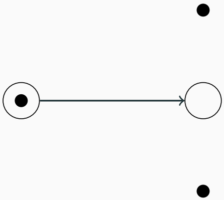
- $\phi >> \kappa$: income is backloaded (paid later)
- $\phi << \kappa$: income is frontloaded (paid earlier).

Insurance without initial differences

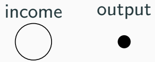


firing cost $\phi > 0$

quiting cost $\kappa > 0$



Insurance without initial differences



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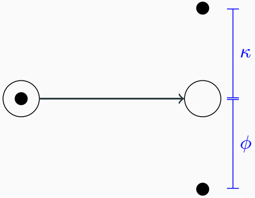
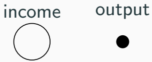
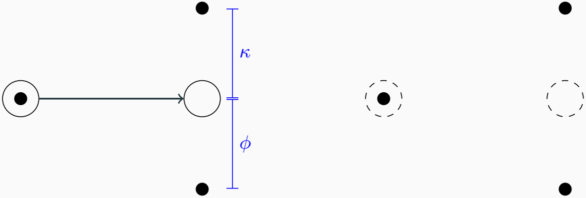


Insurance without initial differences



firing cost $\phi > 0$
quiting cost $\kappa > 0$

firing cost $\phi' = \phi + \kappa - \kappa'$
quiting cost $\kappa' < \kappa$



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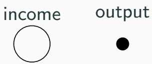

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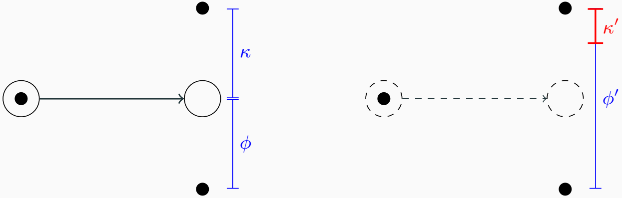

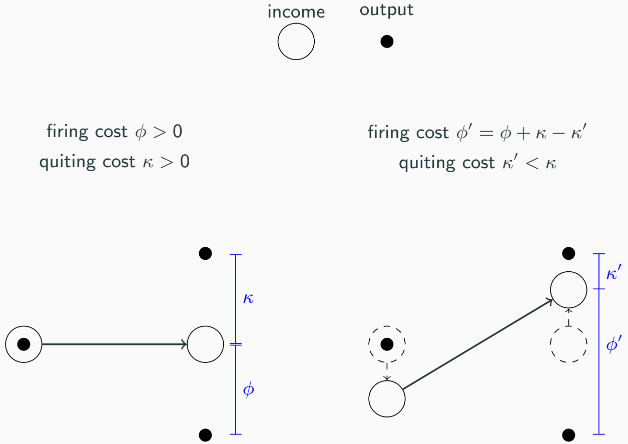
income
output
firing cost $\phi > 0$
quiting cost $\kappa > 0$
firing cost $\phi' = \phi + \kappa - \kappa'$
quiting cost $\kappa' < \kappa$
κ
ϕ
κ'
ϕ'

Insurance and redistribution

Let's reintroduce the redistributive motive.

Proposition

If a consumption allocation and a labor policy are implementable with ϕ and κ, then they are also implementable with ϕ' and κ' where $\phi' + \kappa' = \phi + \kappa$ and $\phi' \cdot \kappa' = 0$. The coverse is not true.

Suppose $\kappa' = 0$.

LCC in $t = 1$

$$0 \geq \mathbb{E}_{\Psi,\rho,\nu}\{\pi_1(y, n) \mid \theta, r_m\} \geq -\phi'.$$

and ZPC

$$\mathbb{E}_{\Psi,\rho,\nu}\{\pi_1(y, n) \mid \theta\} = 0$$

imply

$$\mathbb{E}_{\Psi,\rho,\nu}\{\pi_1(y, n) \mid \theta, r_m\} = 0.$$

The firm needs to break even conditional on every initial report.

Income randomization not possible in the initial period $\rightarrow$ initial IC constraints are relaxed $\rightarrow$ more redistribution is possible.

Insurance and redistribution under one-sided commitment

Corollary

Suppose Θ is bounded. Any consumption allocation and labor policy which are implementable under two-sided commitment ($\phi = \kappa = \infty$) can be implemented under one-sided commitment ($\phi = \infty, \kappa = 0$ or vice versa).

Two sided commitment:

- full consumption insurance,
- but limits on tax regressivity.

One-sided commitment:

- full consumption insurance still available,
- but (under full insurance) the limits on tax regressivity no longer apply.

$\rightarrow$ When the full insurance is optimal, the Mirrleesian tax schedule is optimal.

Conclusions

1. Labor market commitment enables insurance within firm.
    - Insurance depends on total commitment power $\phi + \kappa$.

2. Two-sided commitment limits redistribution by restricting tax regressivity
    - Local tax regressivity can be exploited with income randomization.
    - Big impact on the optimal policy: optimal tax schedules with risk neutral agents and Rawlsian planner become linear.

3. Restrictions on tax regressivity apply also in models with more complex worker-firm relationships
    - search frictions: Golosov, Maziero, and Menzio (2013),
    - monopolistic screening: da Costa and Maestri (2017),
    - moral hazard and on-the-job search: Abrahám, Doligalski, and Forstner (2017).