Efficient Labor and Capital Income Taxation over the Life Cycle

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Motivation: Tax Policy Practice and Theory

- **Tax policy practice in most countries**
  - Labor income: non-linear schedules with changing marginal tax rates
  - Based on current, annual earnings
  - Tax capital income in addition (capital income tax revenue/total tax revenue $\approx 15-30\%$ USA and EU)

- **Approaches to optimal income taxation in public economics**
  1. Labor income taxation: Diamond (AER ‘98), Saez (ReStud ‘01)
  2. Life cycle model: Atkinson and Stiglitz (JpubE ‘76)
  3. NDPF: Farhi and Werning (ReStud ‘13), Kocherlakota (Ecma ‘05)
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- Approaches to optimal income taxation in public economics
  1. Labor income taxation: Diamond (AER ‘98), Saez (ReStud ‘01)
     - Builds on Mirrlees (71)
     - Link to data (where possible) – sufficient statistics.
     - No explicit capital income taxation, however.
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- Approaches to optimal income taxation in public economics
  1. Labor income taxation: Diamond (AER ‘98), Saez (ReStud ‘01)
  2. Life cycle model: Atkinson and Stiglitz (JpubE ’76)
    - Influential benchmark. Plausible case for zero capital tax.
    - One dimension of heterogeneity, labor tax sufficient
    - Data $\neq$ A-S model: changes in (within cohort) inequality over life cycle
Motivation: Tax Policy Practice and Theory

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  - Risk and changes in inequality
  - Do not characterize taxes (only wedges)
  - Tax interpretation would require arbitrary amount of sophistication in tax systems
  - $n^{t-1}$ tax schedules. $\neq$ current practice of taxing on annual current earnings
Motivation: Goals

- Tractable life cycle model, government uses policy instruments as is current practice (surprisingly little work)

- Key ingredients:
  - Government has "realistic" policy instruments at disposal: **linear taxes on current capital income and non-linear taxes on current labor income**
  - **Wages change over the life cycle**
  - **Key question I:** does government want to tax capital income?
  - **Key question II:** what shapes optimal labor income taxation in dynamic environments?
  - Also explore age-dependency as potential middle ground
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- Key ingredients:
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  - Key question II: what shapes optimal labor income taxation in dynamic environments?
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Motivation: Key Results

Key question I: does government want to tax capital income?
- Yes.
  - Derive new formula: very simple and intuitive equity-efficiency relationship.
  - Quantitative exercises: 15% tax rate on capital income
  - \( \tau_k \neq 0 \), conventional Atkinson-Stiglitz-Chamely-Judd wisdom of \( \tau_k = 0 \)

Key question II: optimal labor income taxation in dynamic environments versus static environments?

Key difference:
- Redistribution and insurance can be separated in dynamic framework
- Taxes serve two roles
  1. Redistributing income between individuals to keep inequality in check
  2. Insurance against idiosyncratic wage risk
- Insurance puts (Pareto) lower bound on taxes
**Relationship to previous work**

- Atkinson-Stiglitz (JPubE ‘76) and generalization afterwards: optimal zero capital tax in life cycle model
- NDPF: Farhi and Werning (ReStud ‘13), Kocherlakota (Ecma ‘05), Kocherlakota-Golosov-Tsyvinski (ReStud ‘03)
- Inheritance Taxation: Piketty and Saez (Ecma ‘13)
Atkinson-Stiglitz (JPubE ‘76) and generalization afterwards: optimal zero capital tax in life cycle model

- Only one source of heterogeneity in their model, so one instrument (labor tax) sufficient, here multiple sources as inequality changes over life cycle $\rightarrow \tau^k > 0$ as additional instrument

- NDPF: Farhi and Werning (ReStud ‘13), Kocherlakota (Ecma ‘05), Kocherlakota-Golosov-Tsyvinski (ReStud ‘03)

- Inheritance Taxation: Piketty and Saez (Ecma ‘13)
Relationship to Previous Work

- Atkinson-Stiglitz (JPubE ‘76) and generalization afterwards: optimal zero capital tax in life cycle model
- **NDPF**: Farhi and Werning (ReStud ‘13), Kocherlakota (Ecma ‘05), Kocherlakota-Golosov-Tsyvinski (ReStud ‘03)
  - Arbitrarily complex tax systems → concerns about implementability. Here taxes on current income as common practice
  - Tax savings when income effects reduce labor supply (evidence?), but not because of wealth inequality/concentration; in general wealth inequality not well defined
  - Here: no income effects, capital tax to insure and redistribute
- Inheritance Taxation: Piketty and Saez (Ecma ‘13)
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- NDPF: Farhi and Werning (ReStud ‘13), Kocherlakota (Ecma ‘05), Kocherlakota-Golosov-Tsyvinski (ReStud ‘03)
- **Inheritance Taxation:** Piketty and Saez (Ecma ‘13)
  - Also feature breakdown of conventional Atkinson-Stiglitz-Chamely-Judd wisdom of $\tau^k = 0$
  - Two dimensional heterogeneity in their model: parental preferences and income
Outline for Rest of Talk

1. Model and Notation

2. Optimal Labor and Capital Income Taxation

3. Numerical Simulations
Individuals live for $T$ periods and are characterized by $\theta_t$ in each period

Labor income: $y_t = \theta_t l_t$

No income effects: $U (c_t - \nu (l_t))$

→ empirical literature has typically not rejected a zero income elasticity on labor supply or found very small effects (Gruber and Saez (2002), Kleven and Schultz (2013))

→ two simplifications

1. $y_t(\theta_t)$ instead of $y_t(\theta_t, a_t)$
The Model Individual Problem Given Taxes

- **Value function of individual**

\[
V_t(\theta_t, a_t(\theta^{t-1})) = \max_{a_{t+1}, y_t} U \left( c_t - v \left( \frac{y_t}{\theta_t} \right) \right) \\
+ \int_{\theta_{t+1}} V_{t+1}(\theta_{t+1}, a_t) dF_{t+1}(\theta_{t+1}|\theta_t)
\]

- **subject to budget constraint:**

\[
c_t + a_{t+1} = y_t - T(y_t) + (1 + r)(1 - \tau)a_t(\theta^{t-1})
\]
The Model Individual Problem Given Taxes

- Value function of individual

\[ V_t(\theta_t, a_t(\theta_{t-1})) = \max_{a_{t+1}, y_t} U \left( c_t - v \left( \frac{y_t}{\theta_t} \right) \right) \]

\[ + \int_{\theta_{t+1}} V_{t+1}(\theta_{t+1}, a_t) dF_{t+1}(\theta_{t+1}|\theta_t) \]

- subject to budget contraint:

\[ c_t + a_{t+1} = y_t - T_t(y_t) + (1 + r)(1 - \tau_t)a_t(\theta^{t-1}) \]

\[ \Rightarrow \text{Taxes possibly age-dependent} \]
\textbf{THE MODEL} \hspace{1em} \textbf{GOVERNMENT’S PROBLEM}

- The government solves

\[ \max_{\tau, T} \int_{\theta_1} V_1(\theta_1, 0) d\tilde{F}(\theta_1) \]

- subject to present value budget constraint

- where
  - \( \tilde{F}(\theta_1) \) are Pareto weights
  - and \( \tau = \{\tau_2, \tau_3, \ldots, \tau_T\} \)
  - and \( \mathcal{T} = \{\mathcal{T}_1, \mathcal{T}_2, \ldots, \mathcal{T}_T\} \)
The Model Government’s Problem

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\max_{\tau, T} \int_{\theta_1} V_1(\theta_1, 0) d\tilde{F}(\theta_1)
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- where
  - \( \tilde{F}(\theta_1) \) are Pareto weights
  - and \( \tau = \{\tau_2, \tau_3, ..., \tau_T\} \)
  - and \( T = \{T_1, T_2, ..., T_T\} \)

- Static model (Mirrlees-Diamond-Saez): anything goes (Werning 2007), can justify zero taxes for some weights

- Dynamic model: no longer true...
The Model  Government's Problem

- Two solution methods

1. Optimal control (first-order approach, mechanism design)
2. Tax perturbation

- This talk:
  - Two period model now
  - Just age-independent taxes
The Model  Government’s Problem

- Optimal \( T'(y) = F(M, LS, S) \)

1. \( M \): mechanical effect depends on
   - Taste for redistribution
   - Income distribution
   - Insurance motives: risk-aversion, income risk

2. \( LS \): labor supply distortion
   - Elasticity

3. \( S \): savings effect
   - Non-zero savings taxes create fiscal externalities

\[
S_1(\theta_1) = \tau \int_{\theta_1}^{\bar{\theta}_1} \frac{\partial a_2(\bar{\theta}_1)}{\partial T'(y_1(\bar{\theta}_1))} dF_1(\bar{\theta}_1)
\]
**Proposition**

*Optimal labor taxes:*

\[
\frac{T'(y(\theta))}{1 - T'(y(\theta))} = \left(1 + \frac{1}{\varepsilon(\theta)}\right) \frac{1}{\lambda \theta \times f^*} \times \left[\sum_{i=1}^{2} M_i(\theta) + S_i(\theta)\right].
\]

\[
f^* = f_1(\theta) + \frac{1}{1 + r} \int_{\Theta} f_2(\theta|\theta_1) dF_1(\theta_1)
\]

- Can decompose

  \[M_i = M_i^l + M_i^R\]

- \(M_i^R\): redistribution between \(\theta_1\) types
  - Governed by welfare weights \(\tilde{f}\)

- \(M_i^l\): insurance for \(\theta_2\) types.
  - Governed by income risk and risk aversion
Consider small $d\tau^k > 0$.

- Behavioral Responses (lowers wealth accumulation – efficiency cost),
  Mechanical and Welfare effect (redistribution, insurance)
Consider small $d\tau^k > 0$.

Behavioral Responses (lowers wealth accumulation – efficiency cost), Mechanical and Welfare effect (redistribution, insurance)

**Proposition**

\[
\frac{\tau^k}{1 - \tau^k} = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{u' \tilde{f}_1}{\lambda} f_2 | 1 \right]}{\int_{\theta_1} a \epsilon_{a, 1 - \tau^k}}
\]
Consider small $d\tau^k > 0$.

Behavioral Responses (lowers wealth accumulation – efficiency cost), Mechanical and Welfare effect (redistribution, insurance)

**Proposition**

$$\tau^k \frac{1}{1 - \tau^k} = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{u'\tilde{f}_1}{\lambda} f_2 \right]_1}{\int_{\theta_1} a\epsilon_{a,1-\tau^k}}$$
Consider small $d\tau^k > 0$.

Behavioral Responses (lowers wealth accumulation – efficiency cost), Mechanical and Welfare effect (redistribution, insurance)

**Proposition**

$$\tau^k = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{u'\tilde{f}_1}{\lambda} f_2 | 1 \right]}{1 - \tau^k}$$

$$= \frac{\int_{\theta_1} a e_{a,1-\tau^k}}{\int_{\theta_1} a e_{a,1-\tau^k}}$$
Consider small $d\tau^k > 0$.

Behavioral Responses (lowers wealth accumulation – efficiency cost), Mechanical and Welfare effect (redistribution, insurance)

**Proposition**

$$\frac{\tau^k}{1 - \tau^k} = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{U^* f}{\lambda} f_2|1 \right]}{\int_{\theta_1} a\epsilon_{a,1 - \tau^k}} \geq 0$$

If redistributive

$\tau^k > 0$ likely, for commonly used social welfare criteria

$\tau^k$ increasing in wealth inequality
Proposition

\[ \frac{\tau^k}{1 - \tau^k} = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{U_{f_1}^{f_1}}{\lambda} f_2 | 1 \right] \right] \int_{\theta_1} a e_{a,1-\tau^k} }{\geq 0} \]

If redistributive

- **Breakdown of A-S (1976)?**
- A-S looks at case where individuals retire in second period. Savings taxes superfluous and harmful.
- Suppose, labor income constant across two periods: \( \tau^k = 0 \).
- With non-constant labor income: multiple source of heterogeneity, multiple instruments beneficial
**Proposition**

\[
\frac{\tau^k}{1 - \tau^k} = \frac{\int_{\theta_1} a \left[ f_1 - \int_{\theta_2} \frac{U^{\tilde{f}_1}}{\lambda} f_2|1 \right]}{\int_{\theta_1} a \epsilon_{a,1-\tau^k}} \geq 0
\]

*If redistributive*

- **Comparison to NDPF**: capital wedge > 0 because of income effects, here no income effects.
- With realistic tax instruments wealth inequality drives capital taxation (wealth distribution not well defined in NDPF model).
Numerical Exploration
Numerical Simulation: Risk over the Life Cycle

- Karahan and Ozkan (2013)

\[ y_a^i = f(X_a^i) + \tilde{y}_a^i \]

\[ \tilde{y}_a^i = \alpha_i + z_a^i + \phi \epsilon_a^i \]

\[ z_a^i = \rho_a z_{a-1}^i + \pi \eta_a^i \]

- \( \alpha_i \): permanent fixed-effect
- \( \epsilon_a^i \) transitory: measurement error, bonuses, overtime
- \( \eta_a^i \) permanent: layoff, promotion
- \( \rho_a \) persistence of permanent events
We use parameters from Karahan and Ozkan (2013) who find two structural breaks in parameters.

Simulate millions of earnings histories given parameter estimates.

We consider three period model with age classes 24-36, 37-49 and 50-62.

CRRA utility (=1.5) and constant labor supply elasticity (=1/3)
Motivation Model Numerical Exploration

Calibration Cross Section Distribution

Sebastian Findeisen (Mannheim)
If age-dependent: taxes on the young the lowest

Reason: higher insurance value of taxation on the old
SIMULATION  Optimal Marginal Labor Income Taxes

(a) Risk-Aversion and Capital Taxes  (b) Welfare Gains of Capital Taxation

Figure: Capital Income Taxes

- Baseline capital income tax around 15%
- Highly increasing in risk aversion
(a) Risk-Aversion and Capital Taxes  (b) Welfare Gains of Capital Taxation

**Figure**: Capital Income Taxes

- Driven by desire to tax wealth of the old (like to leave young untaxed)
- Higher wealth inequality at old age
In a framework with heterogeneous agents, there is no correct or incorrect normative objective.

To what extent can redistributive taxation be grounded on the idea of social insurance?

We therefore make the following thought experiment: We consider a static economy where productivities are distributed as in the first period of our dynamic economy. We then consider a static Mirrlees problem and back out the Pareto weights that would yield the laissez-faire equilibrium as the optimum.
Simulate Optimal Marginal Labor Income Taxes

- Social insurance tax rate around 10% >> 0
- If age-dependent insurance value increasing
- Negative marginal tax rates on the young to counteract later distortions
**Conclusion**  
**Bottom Line**

- Capital income taxes are not superfluous in simple life cycle model ($\neq$ Atkinson-Stiglitz)
  - Robust theoretical results
  - Numerical exercises: 15% on savings income
- Redistribution versus insurance distinction becomes meaningful in dynamic model
  - Puts lower bound on tax rates (around 10% in our exercises)
  - In static model, in contrast, anything goes
- Age-dependent: if feasible, suggest lowest taxes on the young
  - Main driver: insurance value increases over the life cycle