Optimal Taxation of Paid- and Self-Employment

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Conventional Approaches to Optimal Taxation

- Mirrlees:
  - Few restrictions on fiscal system
  - Many modeling shortcuts (eg, heterogeneity, dynamics, GE)
  - Wide range of shapes for marginal tax rates
- Ramsey:
  - Tight restrictions on fiscal system
  - Few modeling shortcuts
  - Wide range of magnitudes for marginal tax rates

This paper: Bridge between the two

Two headaches

- Rich fiscal systems

  $\Rightarrow$ high-dimensional choice vector for planner

- Rich GE models

  $\Rightarrow$ hard-to-compute but welfare-relevant transitions

Two contributions

- Methodological
  - Fast method to compute transition
- Application
  - Find optimal shape of labor wedge in Aiyagari model
  - Find implementation with income and consumption taxes

Findings

- Shape of the labor wedge
  - approximately constant
  - ignoring transition, optimal wedge is smaller and regressive
- Welfare gains
  - Result: gains large when tax on consumption large
  - Intuition: consumption tax effectively taxes capital distributions

Model: Households

Continuum of households consume, supply labor, and save:

$$V_t(a,\epsilon) = \max_{c,n,a'} u(c,\ell) + \beta \mathbb{E}_{\epsilon'|\epsilon}\left[V_{t+1}(a',\epsilon')|\epsilon\right]$$

subject to

$$(1+\tau_c)c + (1+\gamma)a' = (1+\bar{r}_t)a + w_t\epsilon n - T_t^n(w\epsilon n)$$

$$a', \ell = 1-n, \geq 0 \quad n \in [0,1]$$

Labor wedge $\equiv 1 - \left(\frac{u_l/u_c}{w_t\epsilon}\right)$

Model: Corporate-sector Firms

Representative firm maximizes a sum of discounted after-dividend tax dividend flows

$$v_{c,t}(k) = \max_{n,k}(1-\tau_d)d + \frac{1+\gamma}{1+\bar{r}}_t v_{c,t+1}(k')$$

subject to

$$(1+\gamma)k' = (1-\delta_c)k + x$$

$$y = AF(k,n)$$

$$d = y - w_t n - x - \tau_p(y - w_t n - \delta k)$$

Model: Government

Government

- Spends g
- Borrows b
- Pays interest at rate $\bar{r}$
- Collects consumption taxes at rate τ_c
- Collects labor income taxes with schedule $T^n(\cdot)$
- Collects profit taxes with rate τ_p
- Collects dividend taxes with rate τ_d

To satisfy

$$g + (\bar{r}_t - \gamma)b = \tau_c \int c_{it} di + \int T_t^n(w_t \epsilon_{it} n_{it}) di + \tau_{p,t}(y_t - w_t n_t - \delta k_t) \\ + \tau_d \left(y_t - w_t n_t - (\gamma + \delta_k)k - \tau_p(y_t - w_t n_t - \delta k_t)\right)$$

Planning problem

From hh optimality, labor wedge depends $\{T^n(\cdot), \tau_c\}$

- Choices:
$$\Upsilon \equiv \{T^n(\cdot), \tau_c\}$$
ensuring revenue neutrality
- Welfare criteria:
$$W(\Omega_0; \Upsilon) \equiv \int V_0(a, \epsilon; \Upsilon) d\Omega_0$$

Note:

- Utilitarian weights over individual welfare include transitions

Fast Method to Compute Transition

- Want to approximate
$$W(\Omega_0;\Upsilon) \equiv \int V_0(a,\epsilon;\Upsilon)d\Omega_0$$

- Idea:
  - Take Taylor expansion
  $$W(\Omega) = W(\overline{\Omega}) + W_\Omega(\overline{\Omega}) \cdot (\Omega - \overline{\Omega}) + \frac{1}{2}W_{\Omega\Omega}(\overline{\Omega}) \cdot \left(\Omega - \overline{\Omega}, \Omega - \overline{\Omega}\right) + \dots$$
  - Need to compute Frechet derivatives W_Ω, $W_{\Omega\Omega}, \dots$

Computing Transitions: Frechet Derivatives

$$W(\Omega_0; \Upsilon) \equiv \int V_0(a, \epsilon; \Upsilon) d\Omega_0$$

How to proceed?

1. Set $\overline{\Omega}$ to the new steady state for reform Υ
2. Define direction $\Delta_0 \equiv \Omega_0 - \overline{\Omega}$

Differentiate once

$$W_\Omega(\overline{\Omega}) \cdot \Delta_0 = \int V_0(a, \epsilon; \Upsilon) d\Delta_0 + \int V_{0,\Omega}(a, \epsilon; \Upsilon) \cdot \Delta_0 d\overline{\Omega}$$

where $V_{0,\Omega}$ depends on policy function derivatives

$$\{c_{t,\Omega}(a, \epsilon) \cdot \Delta_0, n_{t,\Omega}(a, \epsilon) \cdot \Delta_0\}_{t=0}^{\infty}$$

Length of transition x number of nodes to store policy functions x number of points to store the distribution!

Three mappings to represent equilibria

Cast of characters

- $z = (a, \epsilon)$ individual states, Ω distribution over z
- $\tilde{x}(z, \Omega)$ individual policies
- $\tilde{X}(\Omega)$ aggregate variables

Equilibrium

Optimality

$$0 = F\left(z, \tilde{x}(z,\Omega), \tilde{X}(\Omega), \mathbb{E}\left[\tilde{x}\left(\mathrm{p}\tilde{x}(z,\Omega) + \epsilon', \tilde{\Omega}(\Omega)\right)\right]\right)$$

Law of motion

$$\tilde{\Omega}(\Omega)(y) = \int\int \iota\left(\mathrm{p}\tilde{x}(z,\Omega) + \epsilon \le y\right) dPr(\epsilon) d\Omega(z)$$

Market clearing

$$0 = R\left(\int \tilde{x}(z,\Omega) d\Omega(z), \tilde{X}(\Omega)\right)$$

Equilibirum summarized by three mappings: $\{F, R, \tilde{\Omega}\}$

Computing Policy Function Derivatives: $\{x_{t,\Omega}(z) \cdot \Delta_0\}$

- Express policy function derivatives in terms of $\{X_{t,\Omega} \cdot \Delta_0\}_t$

  Differentiate individual optimality conditions for $\{x_{t,\Omega} \cdot \Delta_0, n_{t,\Omega} \cdot \Delta_0\}_t$

  $$0 = F\left(z, \tilde{x}(z_t, \Omega_t), \tilde{X}(\Omega_t), \mathbb{E}_t\left[\tilde{x}\left(\mathrm{p}\tilde{x}(z_t, \Omega_t) + \epsilon_{t+1}, \tilde{\Omega}(\Omega_t)\right)\right]\right)$$

  Differentiate law of motion of distribution for $\{\Omega_{t,\Omega} \cdot \Delta_0\}_t$

  $$\tilde{\Omega}\left(\Omega_t\right)(y) = \int\int \iota\left(\mathrm{p}\tilde{x}(z, \Omega_t) + \epsilon \leq y\right) dPr(\epsilon) d\Omega_t(z)$$

- With some work, the previous two steps can be done in closed-form (i.e., no numerical/symbolic/automatic differentiation)
- Solve a much smaller *linear system* in $\{X_{t,\Omega} \cdot \Delta_0\}_t$ with market clearing conditions

  $$0 = R\left(\int \tilde{x}(z, \Omega_t) d\Omega_t(z), \tilde{X}(\Omega_t)\right)$$

- Same logic extends to higher order derivatives

Functional Forms

- Period utility: $u(c, \ell) = \dfrac{\left(c^{\eta} \ell^{1-\eta}\right)^{1-\mu}}{1-\mu}$
- Production: $F(k, n) = Ak^{\theta} n^{1-\theta}$
- Skills: $\ln \epsilon_t = \text{Persistent} + \text{iid}$
- Labor tax schedule:

$$T^n(y) = \begin{cases} \tau_1^n y - \psi_1^n & \text{if } y \in [0, y_1^n] \\ \tau_2^n y - \psi_2^n & \text{if } y \in [y_1^n, y_2^n] \\ \vdots & \vdots \\ \tau_{N-1}^n y - \psi_{N-1}^n & \text{if } y \in [y_{N-2}^n, y_{N-1}^n] \\ \tau_N^n y - \psi_N^n & \text{if } y \in [y_{N-1}^n, \infty), \end{cases}$$

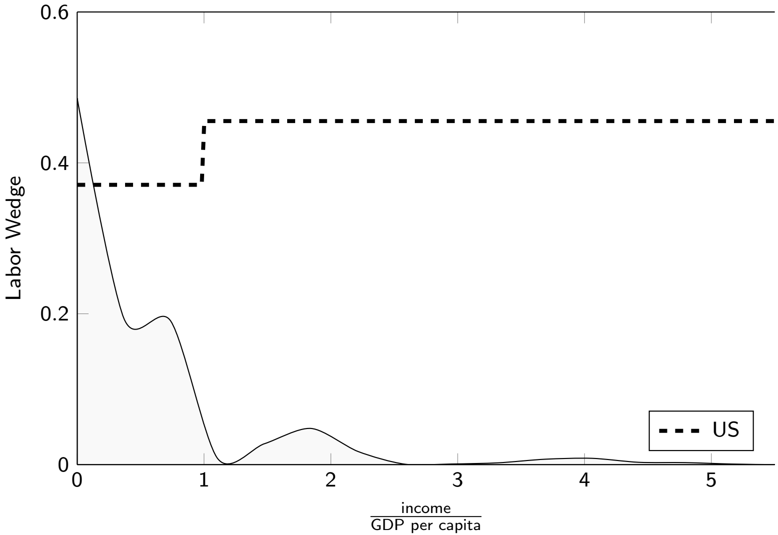
where $\{\psi_i^n\}$ chosen so T^n is continuous

Implied Moments for US Parameterization

Moments	Value
After-tax return on capital	4%
Business Capital / GDP	3.5
Government Debt /GDP	1
Hours	28%
Labor income /GDP	64%
Average Labor wedge	34%
Government Consumption/ GDP	13%
Labor income Gini	62%
Wealth Gini	72%

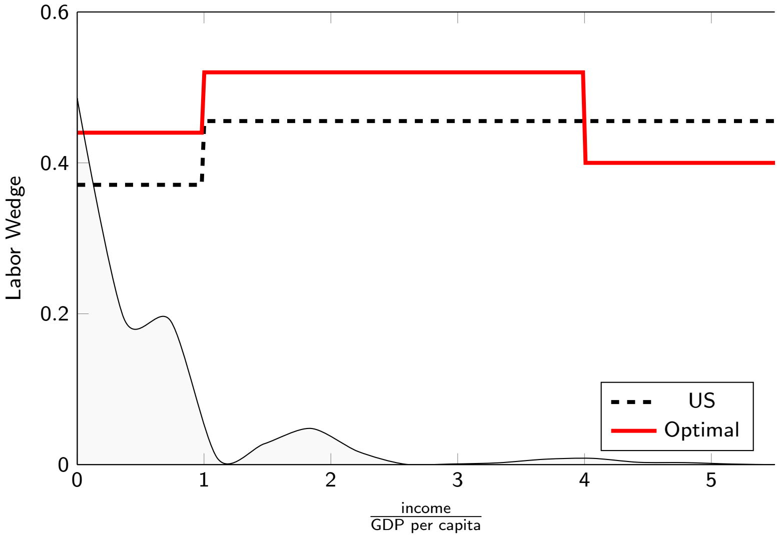
Optimal labor wedge

Labor Wedge $= 1 - \left(\frac{1-\tau^n}{1+\tau_c}\right)$



Optimal labor wedge

$$\text{Labor Wedge} = 1 - \left(\frac{1-\tau^n}{1+\tau_c}\right)$$



Optimal labor wedge

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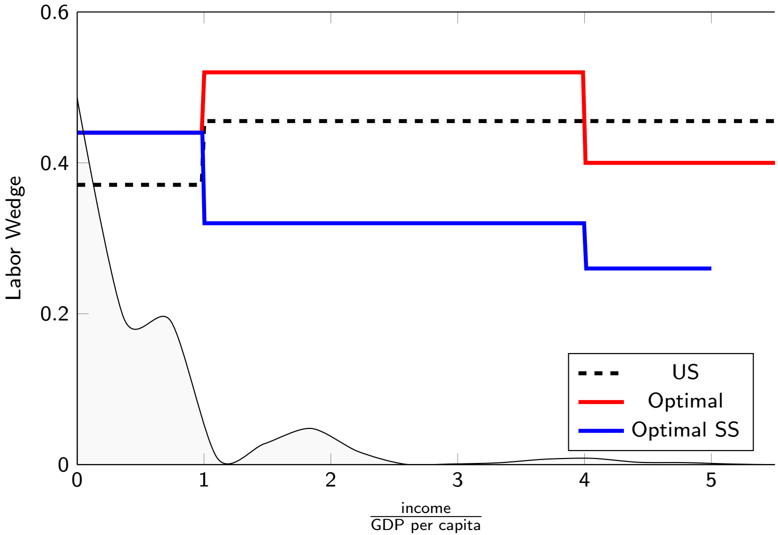


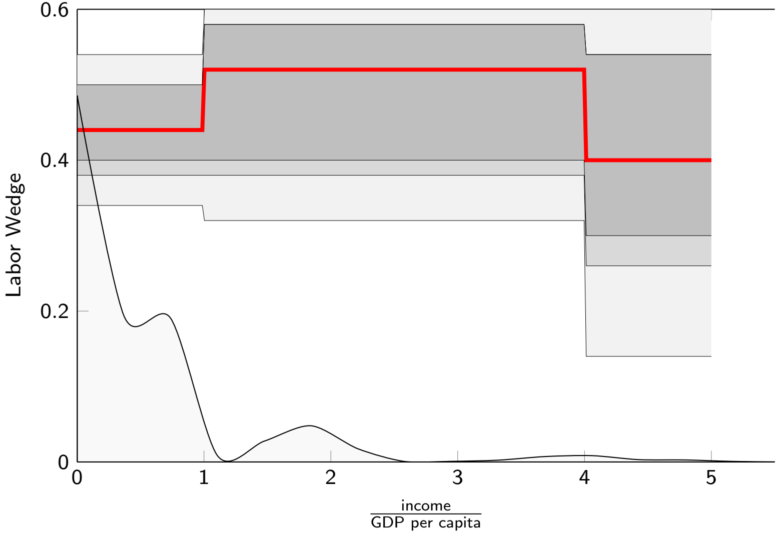
How tightly is the optimum pinned down?

Let $\omega(\Upsilon)$ be the consumption eq. welfare gains relative to Υ^{US}. For some $\delta \in (0,1)$ define

$$\mathcal{C}(\delta) \equiv \left\{ \Upsilon : \omega(\Upsilon) \geq \delta\omega(\Upsilon^{OPT}) \right\}$$

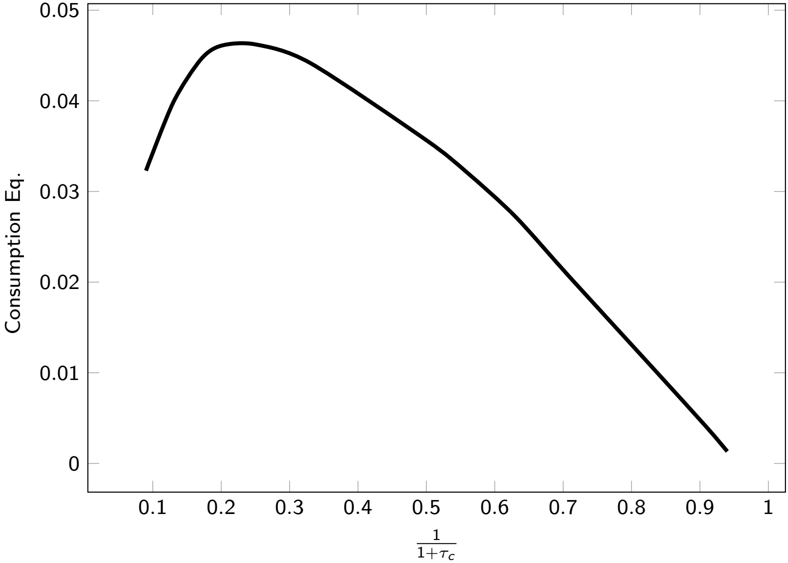
Shape of $\mathcal{C}(\delta)$ informative about welfare sensitivity

Welfare Sensitivity



Darker shades represent tighter welfare bands by setting $\delta \in \{0.75, 0.9, 0.95\}$

Welfare Gains from Consumption Tax



Sources of Welfare Gains

- Recall household budget constraint

$$a_t \left(\frac{1+\bar{r}}{1+\tau_c} \right) = \sum_j \left(\frac{1+\gamma}{1+\bar{r}} \right)^j \left\{ c_{t+j} - \text{Labor wedge} \times (w\epsilon_t n_t) + \text{Transfers} \right\}$$

- Taxing consumption like taxing capital income distributions
  - Pros: valuable for planner who cares about redistribution
  - Cons: households lose ability to smooth and need to cut consumption after the reform to increase savings

Lessons

- Optimal labor wedge in baseline Aiyagari is approximately constant
- Consumption taxes a powerful tool for redistribution
- More discussion needed about consumption taxes
  - Why not tax wealth directly?
  - Will there be shifts towards non-market transactions?
  - Will there be shifts towards consumption on the job?