Book-Value Wealth Taxation, Capital Income Taxation, and Innovation

Fatih Guvenen, Gueorgui Kambourov, Burhan Kuruscu, Sergio Ocampo

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Taxing Capital

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This paper: Theoretical analysis of optimal combination of taxes

- Characterize ***(i)*** innovation + productivity ***(ii)*** welfare ***(iii)***optimal taxes

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   - Return heterogeneity $\longrightarrow$ concentration at very top $+$ Pareto tail $+$ fast wealth growth

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3. **Practical:** Wealth taxation widely used by governments $\longrightarrow$ Need better guidance

4. **Theoretical:** Interesting **new economic mechanisms**

   Allais (1977), Guvenen, Kambourov, Kuruscu, Ocampo, Chen (2023)

Outline

1. **Benchmark model with endogenous entrepreneurial productivity distribution**
2. Innovation and efficiency gains from wealth taxation
3. Welfare and optimal taxation
4. Extension to managerial effort (time allowing!)

Perpetual Youth Model with Workers and Entrepreneurs

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Common Preferences: Discount $\beta < 1$ and conditional survival probability $\delta < 1$

$$E_0 \sum_{t=0}^{\infty} (\beta\delta)^t \log(c_t)$$

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3. **Government:** Finances exogenous expenditure G and transfers T with τ_k and τ_a

$$G + T = \tau_k \alpha Y + \tau_a K$$

Entrepreneurial Productivity and Technology

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$$\Pr(z = z_h) = p(e) \qquad \Pr(z = z_\ell) = 1 - p(e), \qquad \text{where } z_h > z_\ell \geq 0$$

- Endogenous fraction μ of entrepreneurs have $z_i = z_h$, $1 - \mu$ have $z_i = z_\ell$
- Productivity constant over lifetime *(results robust to Markov productivity process)*

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$$y_i = (z_i k_i)^\alpha n_i^{1-\alpha} \longrightarrow Y = \int y_i di$$

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$$y_i = (z_i k_i)^\alpha n_i^{1-\alpha} \longrightarrow Y = \int y_i di$$

- Equivalent: Add corporate sector with $Y_c = (z_c K_c)^\alpha N_c^{1-\alpha}$ and $z_\ell \leq z_c < z_h$

Financial Markets & Entrepreneurs' Problem

Financial markets:

- Collateral constraint: $k \leq \lambda a$, where a is entrepreneur's wealth and $\lambda \geq 1$
- Bonds are in zero net supply $\longrightarrow$ rate r determined endogenously

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Entrepreneurs' production decision:

details

$$\Pi^{\star}(z, a) = \max_{\mathbf{k} \leq \lambda \mathbf{a}, n} \left\{ (zk)^{\alpha} n^{1-\alpha} - rk - wn \right\} \quad \longrightarrow \quad \Pi^{\star}(z, a) = \underbrace{\pi^{\star}(z)}_{\text{Excess return above } r} \times a$$

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Unique equilibrium with return heterogeneity, capital misallocation + Empirically relevant

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$$\text{If} \quad \underbrace{(\lambda-1)\,\mu A_h}_{K \text{ Demand from H-Type}} < \underbrace{(1-\mu)\,A_\ell}_{K \text{ Supply from L-Type}} \longleftrightarrow \underbrace{\lambda < \overline{\lambda}}_{\text{Bound on Leverage}} \longleftrightarrow \tau_a < \overline{\tau}_a$$

Entrepreneur's Dynamic Problem

$$
\begin{aligned}
V(a,z) &= \max_{c,a'} \log(c) + \beta\delta V(a',z) \\
\texttt{s.t.} \quad c + a' &= \underbrace{(1-\tau_a)\,a + (1-\tau_k)\,(r+\pi^\star(z))\,a}_{\texttt{After-tax Wealth}}.
\end{aligned}
$$

- Define (after-tax) gross return as:

$$
R_i \equiv (1-\tau_a) + (1-\tau_k)\,(r+\pi^\star(z_i)) \quad \text{for } i \in \{\ell, h\}
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- The savings decision (CRS + Log Utility):

$$a' = \beta\delta R_i a \quad \longrightarrow \quad \text{linearity allows aggregation}$$

  - No behavioral response to taxes *(conservative lower bound)*

Entrepreneur's Innovation Effort Choice

Innovator's problem:

$$\max_{e}\; p(e)\, V_h(\overline{a}) + (1 - p(e))\, V_\ell(\overline{a}) - \frac{1}{(1-\beta\delta)^2}\Lambda(e)$$

- Simplification: $p(e) = e \longrightarrow \mu = e$

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Optimal innovation effort:

$$\underbrace{\Lambda'(e)}_{\text{Mrg. Cost of Effort}} = (1-\beta\delta)^2 \left(V_h(\bar{a}) - V_\ell(\bar{a}) \right) = \underbrace{\log R_h - \log R_\ell}_{\text{Mrg. Benefit: Return Gap}}$$

- Return dispersion incentivizes effort $\longrightarrow$ Return dispersion necessary for innovation!

Equilibrium Values: Aggregation

Key variables:

- $s_h = \frac{\mu A_h}{\mu A_h + (1-\mu) A_\ell}$: wealth share of high-productivity entrepreneurs.
- $z_\lambda \equiv z_h + (\lambda - 1)(z_h - z_\ell)$: effective productivity of high-productivity entrepreneurs.

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Lemma: Aggregate output can be written as:

$$Y = (Z K)^\alpha \, L^{1-\alpha} \qquad (Z^\alpha \text{ is measured TFP})$$

where

$$K \equiv \mu\, A_h + (1-\mu)\; A_\ell \qquad K = \text{Aggregate capital}$$

$$Z \equiv s_h\, z_\lambda \; + \; (1 - s_h)\; z_\ell \qquad Z = \text{Wealth-weighted productivity}$$

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Note: Use it or lose it effect increases efficiency if $s_h \uparrow (\longrightarrow Z \uparrow)$

Steady State: Capital, Returns, and Taxes

Steady State K: Same as Neoclassical Growth Model... but endogenous Z (Moll, 2014)

$$(1-\tau_a) + (1-\tau_k)\overbrace{\alpha Z^{\alpha}\left({}^{K}/_{L}\right)^{\alpha-1}}^{\text{MPK}} = \frac{1}{\beta\delta}$$

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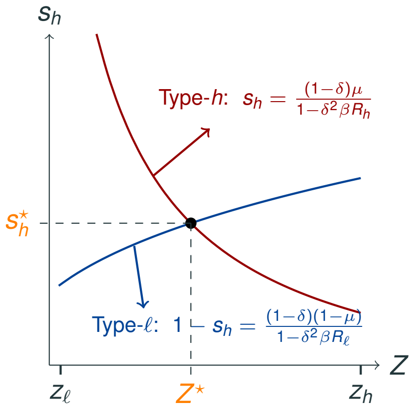
Steady State R: Returns reflect MPK + effective entrepreneurial productivity $z_i \in \{z_\ell, z_\lambda\}$

$$R_i = (1-\tau_a) + (1-\tau_k)\overbrace{\left(\alpha Z^{\alpha}\left({}^{K}/_{L}\right)^{\alpha-1}\right)}^{\text{MPK}}\frac{z_i}{Z} \quad \longrightarrow \quad R_i = (1-\tau_a) + \left(\frac{1}{\beta\delta} - (1-\tau_a)\right)\frac{z_i}{Z}$$

Steady State: Productivity and Returns



- Z consistent with wealth accumulation

$$Z = s_h z_\lambda + (1 - s_h)\, z_c$$

- Wealth distribution reflects returns

$$A_i' = \delta^2 \beta R_i A_i + (1-\delta)\,\overline{a} \longrightarrow \frac{A_i}{\overline{a}} = \frac{1-\delta}{1-\delta^2\beta R_i}$$

- Equilibrium: $Z \rightarrow \{R_h, R_\ell\} \rightarrow s_h \rightarrow Z$
  - Solution is quadratic!

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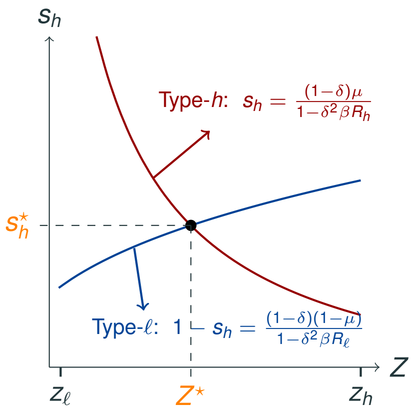

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- Wealth tax affects returns, productivity, and innovation. Capital income tax does not.
- Both taxes affect capital, output, wages...

Steady State: Innovation and Productivity Distribution

The stationary equilibrium share high-productivity entrepreneurs, μ, solves fixed point:

$$\begin{tikzcd} & \text{Innovation: } \mu \arrow[dr, bend left, "+"] & \\ \text{Effort: } e(R_h, R_\ell) \arrow[ur, bend left, "+"] & & \text{Productivity: } Z(\mu) \arrow[dl, bend left, "-"] \\ & \text{Returns: } R_i(Z) \arrow[ul, bend left, "+"] & \end{tikzcd}$$

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We show: Existence and uniqueness of equilibrium with innovation.

(Cellina's fixed point theorem + Monotonicity)

Outline

1. Benchmark model with endogenous entrepreneurial productivity distribution
2. **Innovation and efficiency gains from wealth taxation**
3. Welfare and optimal taxation
4. Extension to managerial effort (time allowing!)

Wealth Taxation and Returns

- Returns (R_h, R_ℓ) control ***(i)*** incentives for innovation, and ***(ii)*** distribution of wealth

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Lemma: Partial response of returns to productivity and innovation

$$\xi_Z^{R_h} \equiv \frac{d\log R_h}{d\log Z} > 0, \qquad \xi_Z^{R_\ell} \equiv \frac{d\log R_\ell}{d\log Z} < 0, \quad \& \quad \mu\xi_Z^{R_h} + (1-\mu)\,\xi_Z^{R_\ell} < 0$$

(use-it-or-lose-it)

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$$\xi_\mu^{R_h} \equiv \frac{d\log R_h}{d\mu} < 0, \qquad \xi_\mu^{R_\ell} \equiv \frac{d\log R_\ell}{d\mu} > 0, \quad \& \quad \mu\xi_\mu^{R_h} + (1-\mu)\,\xi_\mu^{R_\ell} > 0 \qquad \text{(innovation effect)}$$

Main Result 1: Innovation & Efficiency Gains from Wealth Taxation

Proposition:

Proof

For all $\tau_a < \overline{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ **increases** $\boldsymbol{\mu}$ and **Z**

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- Result from fixed-point comparative statics $\longrightarrow$ Partial responses are key

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- Result from fixed-point comparative statics $\longrightarrow$ Partial responses are key
- Dispersion of after-tax returns rises (given μ)

$$\frac{dR_h}{d\tau_a} > \mathbf{0} \qquad \& \qquad \frac{dR_\ell}{d\tau_a} < \mathbf{0}$$

$\rightarrow$ Wealth concentration rises, $s_h \uparrow$, therefore $Z \uparrow$ $(= s_h z_\lambda + (1 - s_h)\, z_\ell)$

Distribution

$\rightarrow$ Higher incentives for innovation effort $\left(\Lambda^{'}(e) = \log R_h - \log R_\ell\right)$

- Innovation, on its own, increases productivity: $\frac{dZ}{d\mu} > 0$

Government Budget and Aggregate Variables

$$G + T = \tau_k \alpha Y + \tau_a K.$$

- In what follows, τ_k adjusts in the background when $\tau_a \uparrow$ so that $G + T = \theta \alpha Y$

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For all $\tau_a < \overline{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ has the following effects on aggregates:

- **Increases** capital (K), output (Y), wage (w), & high-type wealth (A_h)

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- **Increases** capital (K), output (Y), wage (w), & high-type wealth (A_h)
- **Key:** Higher $\alpha \longrightarrow$ Larger pass-through of productivity to K, Y, w

$$\xi_Z^K = \xi_Z^Y = \xi_Z^w = \frac{\alpha}{1-\alpha} \qquad \xi_Z^x = \frac{d\log x}{d\log Z}$$

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2. Innovation and efficiency gains from wealth taxation
3. **Welfare and optimal taxation**
4. Extension to managerial effort (time allowing!)

Main Result 3: Optimal Taxes

α thresholds

Objective: Choose taxes (τ_a, τ_k) to max newborn welfare ($n_w = {}^{L}/_{(1+L)}$ pop. share of workers)

$$\mathcal{W} \equiv n_w V_w(w) + (1 - n_w)\left(\mu V_h(\overline{a}) + (1-\mu) V_\ell(\overline{a}) - \frac{\Lambda(\mu)}{(1-\beta\delta)^2}\right)$$

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- An interior solution satisfies $d\mathcal{W}/d\tau_a = 0$.

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Key trade-off:

Welfare by type

1. Higher *levels* of worker income $(w+T)$ and wealth $(\bar{a} = K)$ — Depends on α!

   (higher welfare for workers and high-z entrepreneurs)

2. Lower *wealth growth* over lifetime from lower average return — Depends on τ_a

   (lower welfare for low-z entrepreneurs and entrepreneurs as a group)

Main Result 3: Optimal Taxes

▸ α thresholds ▸ $\tau_a^\star$ level ▸ Diagram

Proposition: There exists a unique optimal tax combination $(\tau_a^\star, \tau_k^\star)$ that maximizes $\mathcal{W}$.

An interior optimum $(\tau_a^\star < \bar{\tau}_a)$ is solution to:

$$0 = \Bigg(\underbrace{n_w \xi_Z^{w+T} + (1-n_w)\,\xi_Z^K}_{\text{Level Effect} = \frac{\alpha}{1-\alpha}(+)} + (1-n_w) \underbrace{\xi_Z^g}_{\text{Growth Effect }(-)} \Bigg) \frac{d \log Z}{d\tau_a} + (1-n_w) \underbrace{\xi_\mu^g}_{\text{Innovation Effect }(+)} \frac{d\mu}{d\tau_a}$$

where $\xi_Z^x \equiv \frac{d \log x}{d \log Z}$ is the elasticity of x with respect to Z.

Main Result 3: Optimal Taxes

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where $\xi_Z^x \equiv \frac{d \log x}{d \log Z}$ is the elasticity of x with respect to Z. **Furthermore,**

Low Pass-Through: $\alpha < \underline{\alpha}$		High Pass-Through: $\alpha > \overline{\alpha}$
$\tau_a^\star < 0$, $\tau_k^\star > 0$	$\tau_a^\star > 0$, $\tau_k^\star > 0$	$\tau_a^\star > 0$, $\tau_k^\star < 0$

$0 \qquad \underline{\alpha} \qquad \overline{\alpha} \qquad 1$

Outline

1. Benchmark model with endogenous entrepreneurial productivity distribution
2. Innovation and efficiency gains from wealth taxation
3. Welfare and optimal taxation
4. **Extension to managerial effort** (Is there any time left? Yes No)

Conclusions

Increasing τ_a (& reducing τ_k):

- Innovation Effect: Provides incentives for innovation shaping productivity distribution
- Use it or Lose it Effect: Reallocates capital from less to more productive agents.
  - Higher innovation, productivity, output, and wages;
  - Higher dispersion in returns and wealth and lower average returns

Optimal tax mix:

- Combination of taxes depends on pass-through of TFP to wages and wealth

Extra

Entrepreneur's Problem

Financial Markets & Entrepreneurs' Production Problem

back

Entrepreneurs' Production Decision:

$$\Pi^{\star}(z,a) = \max_{\mathbf{k}\leq\lambda\mathbf{a},n} (zk)^{\alpha} n^{1-\alpha} - rk - wn.$$

Financial Markets & Entrepreneurs' Production Problem

back

Entrepreneurs' Production Decision:

$$\textbf{Solution:} \quad \Pi^{\star}(z,a) = \underbrace{\pi^{\star}(z)}_{\text{Excess return above } r} \times a$$

$$\pi^{\star}(z) = \begin{cases} (MPK(z) - r)\,\lambda & \text{if } MPK(z) > r \\ 0 & \text{otherwise.} \end{cases} \qquad k^{\star}(z) \begin{cases} = \lambda a & \text{if } MPK(z) > r \\ \in [0, \lambda a] & \text{if } MPK(z) = r \\ = 0 & \text{if } MPK(z) < r \end{cases}$$

- $(\lambda - 1)\,a$: amount of external funds used by type-z if $MPK(z) > r$.

Financial Market Equilibrium with Heterogenous Returns

back

Three types of equilibria can arise depending on parameter values.

Financial Market Equilibrium with Heterogenous Returns

back

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We focus on "interesting one": if $\underbrace{(\lambda - 1)\,\mu A_h}_{K \text{ Demand from H-Type}} < \underbrace{(1-\mu)\,A_\ell}_{K \text{ Supply from L-Type}} \longleftrightarrow \underbrace{\lambda < \overline{\lambda}}_{\text{Bound on Leverage}}$

Financial Market Equilibrium with Heterogenous Returns

back

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- Low-productivity entrepreneurs bid down interest rate, $r = \text{MPK}\,(z_\ell)$
- **Unique steady state** with:
  return heterogeneity, capital misallocation, wealth tax $\neq$ capital inc tax
- **Empirically relevant:** $R_h > R_l$ and $\frac{\text{Debt}}{\text{GDP}} \gg 1.5$ when $\lambda = \bar{\lambda}$

details

Financial Market Equilibrium with Heterogenous Returns

back

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details

Condition implies an upper bound on wealth taxes:

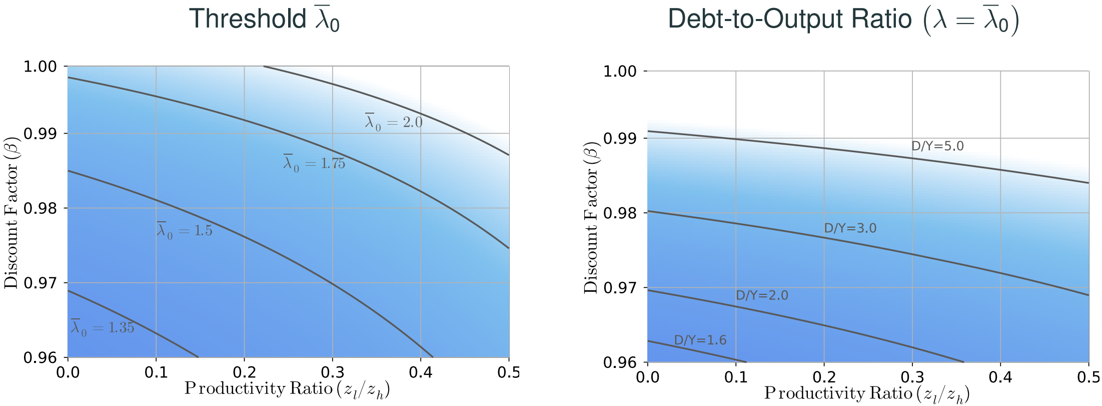
Upper Bound on τ_a

$$(\lambda - 1)\,\mu A_h < (1-\mu)\,A_\ell \longleftrightarrow \tau_a < \overline{\tau}_a = 1 - \frac{1}{\beta\delta}\left(1 - \frac{1-\delta}{\delta}\,\frac{1-\lambda\mu}{(\lambda-1)\left(1-\frac{z_\ell}{z_h}\right)}\right)$$

FIGURES

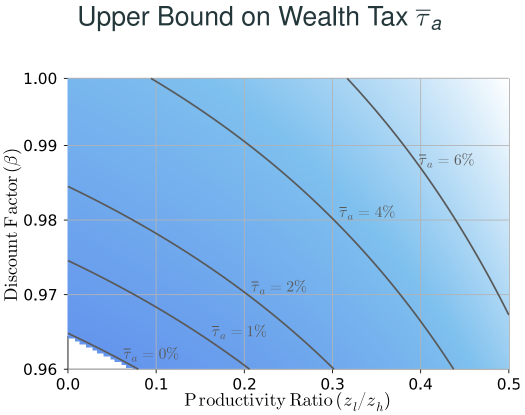
Conditions for Steady State with Heterogeneous Returns

Returns back



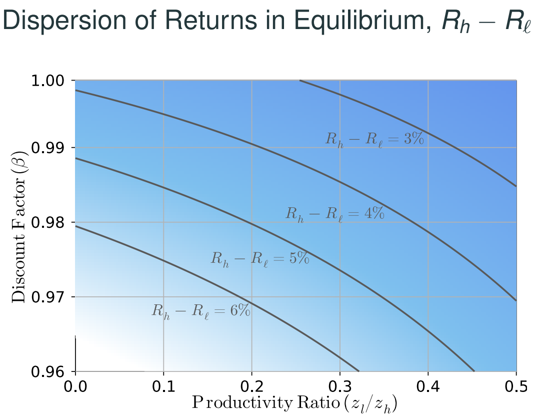
Condition for Steady State with Heterogeneous Returns

Returns back



Return Dispersion in Steady State of the Benchmark Economy

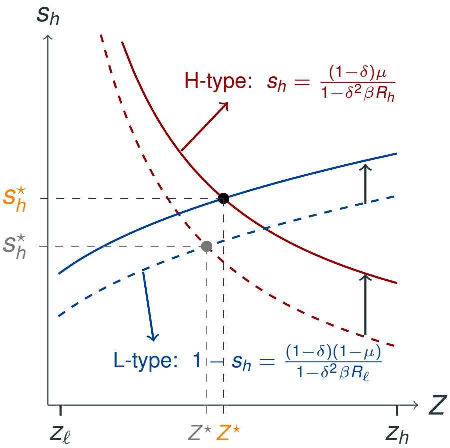
back



Note: *The figure reports the value return dispersion in steady state for combinations of the discount factor* (β) *and productivity dispersion* (z_ℓ/z_h)*. We set the remaining parameters as follows:* $\delta = 49/50$, $\beta\delta = 0.96$, $\mu = 0.10$, $z_h = 1$, $\tau_k = 25\%$, *and* $\alpha = 0.4$.

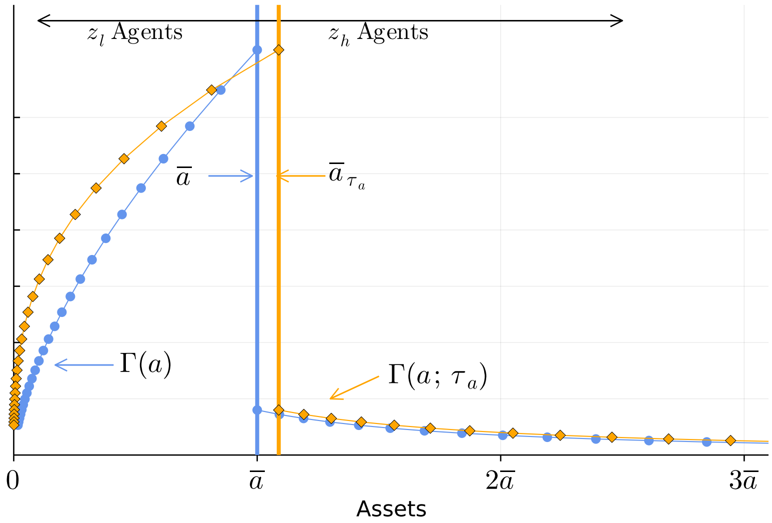
What happens to Z if $\tau_a \uparrow$?

Back to eff. gain



Stationary wealth distribution and wealth taxes

back



Welfare Gains

Main Result 2: Welfare Gains by Type

back

Proposition:

α Thresholds

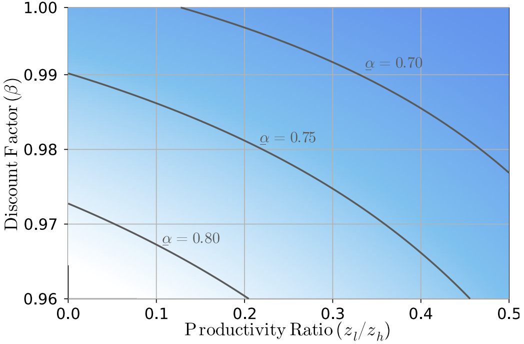
For all $\tau_a < \overline{\tau}_a$, a higher $\boldsymbol{\tau_a}$ changes welfare as follows:

- Workers: Higher welfare: $\frac{dV_{workers}}{d\tau_a} > 0$
- High-z entrepreneurs: Higher welfare $\left(\frac{dV_h(\bar{a})}{d\tau_a} > 0\right)$ because $\xi_Z^K + \frac{1}{1-\beta\delta}\xi_Z^{R_h} > 0$
- Low-z entrepreneurs: Lower welfare $\left(\frac{dV_\ell(\bar{a})}{d\tau_a} < 0\right)$ iff $\xi_Z^K + \frac{1}{1-\beta\delta}\xi_Z^{R_\ell} < 0; \alpha < \underline{\alpha}_\ell$
- Entrepreneurs: Lower average welfare iff $\xi_Z^K + \frac{1}{1-\beta\delta}\left(\mu\xi_Z^{R_h} + (1-\mu)\,\xi_Z^{R_\ell}\right) < 0; \alpha < \underline{\alpha}_E$

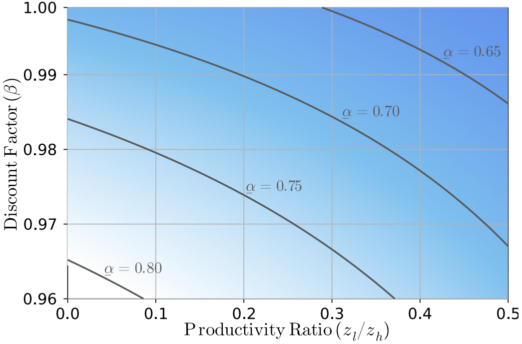
Conditions for Entrepreneurial Welfare Gain

back

Low-Productivity Entrepreneurs: ${}^{dV_\ell}/_{d\tau_a} > 0$



Average Entrepreneur: ${}^{dV_E}/_{d\tau_a} > 0$

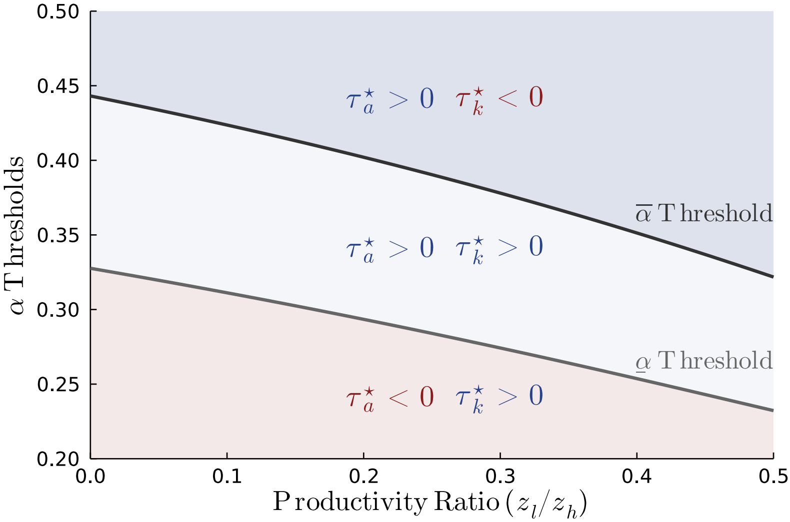


Note: *The figures report the threshold value of α above which entrepreneurial welfare increases after an increase in wealth taxes for combinations of the discount factor (β) and productivity dispersion (${}^{z_\ell}/_{z_h}$). We set the remaining parameters as follows:* $\delta = {}^{49}/_{50}$, $\beta\delta = 0.96$, $\mu = 0.10$, $z_h = 1$, $\tau_k = 25\%$, *and* $\alpha = 0.4$.

Optimal Taxes

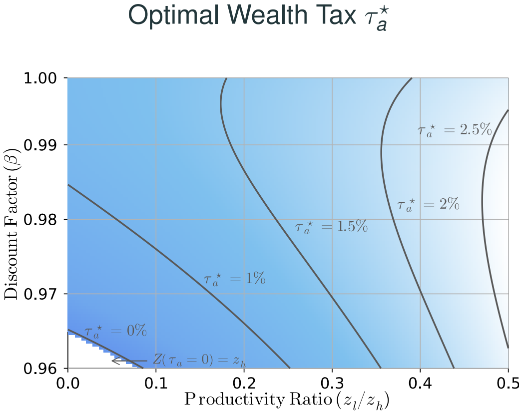
α Thresholds

back



Optimal Wealth Tax: β & Productivity Dispersion

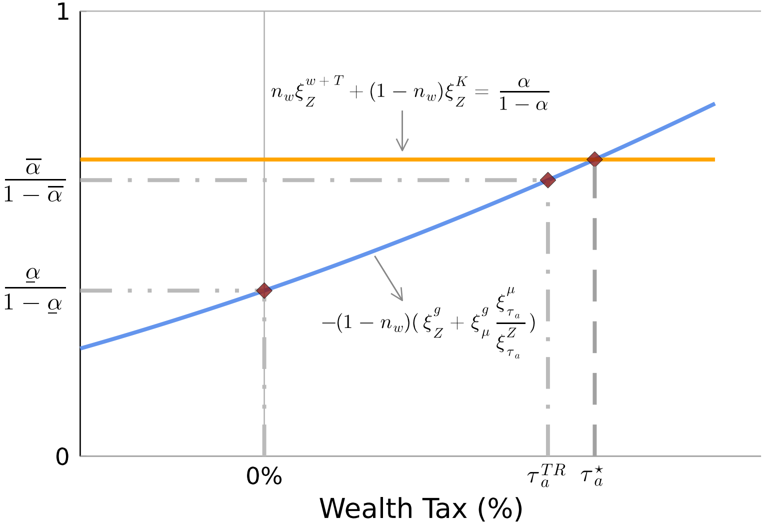
back



Note: *The figure reports the value of the optimal wealth tax for combinations of the discount factor* (β) *and productivity dispersion* (z_ℓ/z_h)*. We set the remaining parameters as follows:* $\delta = 49/50$, $\beta\delta = 0.96$, $\mu = 0.10$, $z_h = 1$, $\tau_k = 25\%$, *and* $\alpha = 0.4$.

Optimal Tax and $\underline{\alpha}$ and $\overline{\alpha}$ Thresholds

back



Extensions

Managerial Effort

back

- Managerial effort in production: (maintain CRS)

$$y = (zk)^{\alpha}\, m^{\gamma} n^{1-\alpha-\gamma} \quad \longrightarrow \quad m : \text{managerial effort}$$

- Entrepreneurial preferences: (avoid income effects)

$$u(c, e) = \log(c - \psi m) \qquad \psi > 0$$

Managerial Effort

back

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Entrepreneurial problem becomes:

$$\hat{\pi}(z,k) = \max_{n,e} \left\{ y - wn - rk - \underbrace{\frac{\psi}{\mathbf{1} - \boldsymbol{\tau_k}}}_{\text{Effective Cost of Effort}} m \right\}$$

- **Key:** Effective cost of effort *increases* with capital income tax τ_k but not with τ_a!

Managerial Effort: Results

back

1. Efficiency gains from wealth taxation go through
   - Neutrality holds $\Big((1-\tau_k)\,\text{MPK} = \frac{1}{\beta\delta} - (1-\tau_a) \Big) \longrightarrow Z$, R_h, R_ℓ depend only on τ_a!

Managerial Effort: Results

back

1. Efficiency gains from wealth taxation go through
   - Neutrality holds $\left((1-\tau_k)\,\text{MPK} = \frac{1}{\beta\delta} - (1-\tau_a) \right) \longrightarrow Z, R_h, R_\ell$ depend only on τ_a!
2. Effect on aggregates is stronger if capital income taxes go down
   - Aggregate effort increases, increasing output, capital, wages, etc.

$$E = \left(\frac{(1-\tau_k)\,\gamma}{\psi} \right)^{\frac{1}{1-\gamma}} (ZK)^{\frac{\alpha}{1-\gamma}} L^{\frac{1-\alpha-\gamma}{1-\gamma}}$$

Managerial Effort: Results

back

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3. Optimal taxes: higher wealth tax and lower capital income tax

Pareto Tail of Wealth Distribution: Model vs. Data

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