Taxing Wealth and Capital Income When Returns are Heterogeneous

Guvenen, Kambourov, Kuruscu, Ocampo

Lisbon Macro Workshop

Taxing Capital

What is the optimal way to tax capital income *(flow)* and wealth *(stock)* when returns are heterogeneous?

Taxing Capital

What is the optimal way to tax capital income *(flow)* and wealth *(stock)* when returns are heterogeneous?

- If the return, r, is the same for all individuals, the two taxes are equivalent with $\tau_a = r\tau_k$.

Taxing Capital

What is the optimal way to tax capital income *(flow)* and wealth *(stock)* when returns are heterogeneous?

- If the return, r, is the same for all individuals, the two taxes are equivalent with $\tau_a = r\tau_k$.

Our earlier work: Quantitative analysis of optimal capital income versus wealth tax
(Guvenen, Kambourov, Kuruscu, Ocampo, Chen, QJE 2023)

- Rich OLG model with return heterogeneity, bells & whistles
- **Find:** Large efficiency & welfare gains from replacing capital income tax with wealth tax

Taxing Capital

What is the optimal way to tax capital income *(flow)* and wealth *(stock)* when returns are heterogeneous?

- If the return, r, is the same for all individuals, the two taxes are equivalent with $\tau_a = r\tau_k$.

Our earlier work: Quantitative analysis of optimal capital income versus wealth tax

(Guvenen, Kambourov, Kuruscu, Ocampo, Chen, QJE 2023)

- Rich OLG model with return heterogeneity, bells & whistles
- **Find:** Large efficiency & welfare gains from replacing capital income tax with wealth tax

This paper: Theoretical analysis of optimal combination of taxes

- Analytical model with workers, heterogeneous entrepreneurs, and innovation
- **Find:** conditions for **(i)** efficiency gains **(ii)** welfare effects **(iii)** optimal taxes **(iv)** effects on innovation

Why Study Capital Taxation with Heterogeneous Returns?

At least 4 reasons:

Why Study Capital Taxation with Heterogeneous Returns?

At least 4 reasons:

1. **Empirical:** A growing literature documents persistent return heterogeneity.
   Bach, Calvet and Sodini 2020; Fagereng, Guiso, Malacrino, Pistaferri 2020; Smith, Yagan, Zidar, Zwick 2023

Why Study Capital Taxation with Heterogeneous Returns?

At least 4 reasons:

1. **Empirical:** A growing literature documents persistent return heterogeneity.

   Bach, Calvet and Sodini 2020; Fagereng, Guiso, Malacrino, Pistaferri 2020; Smith, Yagan, Zidar, Zwick 2023

2. **Technical:** Capital taxes paid by the very wealthy.

   - Models struggle to generate plausible wealth inequality.
   - Return heterogeneity generates concentration at the very top, Pareto tail, and fast wealth growth

     Benhabib, Bisin, et al, 2011–2018; Gabaix, Lasry, Lions, Moll et al 2016; Jones, Kim 2018; Guvenen, Kambourov, Kuruscu, Ocampo, Chen 2023

Pareto Tail vs. Models

Why Study Capital Taxation with Heterogeneous Returns?

At least 4 reasons:

1. **Empirical:** A growing literature documents persistent return heterogeneity.
   Bach, Calvet and Sodini 2020; Fagereng, Guiso, Malacrino, Pistaferri 2020; Smith, Yagan, Zidar, Zwick 2023

2. **Technical:** Capital taxes paid by the very wealthy.
   - Models struggle to generate plausible wealth inequality.
   - Return heterogeneity generates concentration at the very top, Pareto tail, and fast wealth growth
     Benhabib, Bisin, et al, 2011–2018; Gabaix, Lasry, Lions, Moll et al 2016; Jones, Kim 2018;
     Guvenen, Kambourov, Kuruscu, Ocampo, Chen 2023

   Pareto Tail vs. Models

3. **Practical:** Wealth taxation has been used by governments
   - We need to provide better guidance to policy makers.

Why Study Capital Taxation with Heterogeneous Returns?

At least 4 reasons:

1. **Empirical:** A growing literature documents persistent return heterogeneity.

   Bach, Calvet and Sodini 2020; Fagereng, Guiso, Malacrino, Pistaferri 2020; Smith, Yagan, Zidar, Zwick 2023

2. **Technical:** Capital taxes paid by the very wealthy.

   - Models struggle to generate plausible wealth inequality.
   - Return heterogeneity generates concentration at the very top, Pareto tail, and fast wealth growth

     Benhabib, Bisin, et al, 2011–2018; Gabaix, Lasry, Lions, Moll et al 2016; Jones, Kim 2018; Guvenen, Kambourov, Kuruscu, Ocampo, Chen 2023

Pareto Tail vs. Models

3. **Practical:** Wealth taxation has been used by governments

   - We need to provide better guidance to policy makers.

4. **Theoretical:** Interesting **new economic mechanisms** $\longrightarrow$ Example next.

   Allais 1977, Piketty 2014, Guvenen, Kambourov, Kuruscu, Ocampo, Chen 2023

Return Heterogeneity: A Simple Example

- One-period model.
- Government taxes to finance $G = \$50K$.
- Two brothers, Fredo and Mike, each with \$1M of wealth.

Return Heterogeneity: A Simple Example

- One-period model.
- Government taxes to finance $G = \$50K$.
- Two brothers, Fredo and Mike, each with \$1M of wealth.
- **Key heterogeneity:** investment/entrepreneurial ability.
  - (Fredo) Low ability: earns $r_f = 0\%$ rate of return.
  - (Mike) High ability: earns $r_m = 20\%$ rate of return.

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax
	$a_{i,\text{after-tax}} = a_i + (1 - \tau_k) r_i a_i$		
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	
Wealth	\$1M	\$1M	
Before-tax Income	**\$0**	**\$200K**	
Tax liability			
After-tax return			
After-tax wealth ratio			

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax
	$a_{i,\text{after-tax}} = a_i + (1 - \tau_k) r_i a_i$		
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	
Wealth	\$1M	\$1M	
Before-tax Income	**\$0**	**\$200K**	
	$\tau_k = 25\% \; (= \frac{50}{200})$		
Tax liability	0	\$50K ($= 200\tau_k$)	
After-tax return			
After-tax wealth ratio			

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k)r_i a_i$		
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	
Wealth	\$1M	\$1M	
Before-tax Income	\$**0**	\$**200K**	
	$\tau_k = 25\%$ $(= \frac{50}{200})$		
Tax liability	0	\$50K $(= 200\tau_k)$	
After-tax return	0%	15% $(= \frac{200-50}{1000})$	
After-tax wealth ratio	1.15 $(= {}^{1150}/_{1000})$		

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax (on book value)
	$a_{i,\text{after-tax}} = a_i + (1 - \tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1 - \tau_a) a_i + r_i a_i$
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	
Wealth	\$1M	\$1M	
Before-tax Income	**\$0**	**\$200K**	
	$\tau_k = 25\%$ $\left(= \frac{50}{200}\right)$		
Tax liability	0	\$50K ($= 200\tau_k$)	
After-tax return	0%	15% $\left(= \frac{200-50}{1000}\right)$	
After-tax wealth ratio	1.15 ($= {}^{1150}/_{1000}$)		

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		**Wealth tax (on book value)**	
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1-\tau_a) a_i + r_i a_i$	
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)
Wealth	\$1M	\$1M	**\$1M**	**\$1M**
Before-tax Income	**\$0**	**\$200K**	0	\$200K
	$\tau_k = 25\%$ $(= \frac{50}{200})$			
Tax liability	0	\$50K $(= 200\tau_k)$		
After-tax return	0%	15% $(= \frac{200-50}{1000})$		
After-tax wealth ratio	1.15 $(= 1150/1000)$			

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		**Wealth tax (on book value)**	
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1-\tau_a) a_i + r_i a_i$	
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)
Wealth	\$1M	\$1M	**\$1M**	**\$1M**
Before-tax Income	**\$0**	**\$200K**	0	\$200K
	$\tau_k = 25\% \left(= \frac{50}{200}\right)$		$\tau_a = 2.5\% \left(= \frac{50}{2000}\right)$	
Tax liability	0	\$50K $(= 200\tau_k)$	\$25K $(= 1000\tau_a)$	\$25K $(= 1000\tau_a)$
After-tax return	0%	15% $\left(= \frac{200-50}{1000}\right)$		
After-tax wealth ratio	$1.15\ (= 1150/1000)$			

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax (on book value)	
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1-\tau_a) a_i + r_i a_i$	
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)
Wealth	\$1M	\$1M	**\$1M**	**\$1M**
Before-tax Income	**\$0**	**\$200K**	0	\$200K
	$\tau_k = 25\%$ $(= \frac{50}{200})$		$\tau_a = 2.5\%$ $(= \frac{50}{2000})$	
Tax liability	0	\$50K $(= 200\tau_k)$	\$25K $(= 1000\tau_a)$	\$25K $(= 1000\tau_a)$
After-tax return	0%	15% $(= \frac{200-50}{1000})$	-2.5% $(= \frac{0-25}{1000})$	17.5% $(= \frac{200-25}{1000})$
After-tax wealth ratio	1.15 $(= 1150/1000)$		1.20 $(\approx 1175/975)$	

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		**Wealth tax (on book value)**	
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1-\tau_a) a_i + r_i a_i$	
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)
Wealth	\$1M	\$1M	**\$1M**	**\$1M**
Before-tax Income	**\$0**	**\$200K**	0	\$200K
	$\tau_k = 25\%$ $(= \frac{50}{200})$		$\tau_a = 2.5\%$ $(= \frac{50}{2000})$	
Tax liability	0	\$50K $(= 200\tau_k)$	\$25K $(= 1000\tau_a)$	\$25K $(= 1000\tau_a)$
After-tax return	0%	15% $(= \frac{200-50}{1000})$	-2.5% $(= \frac{0-25}{1000})$	17.5% $(= \frac{200-25}{1000})$
After-tax wealth ratio	1.15 $(= {}^{1150}/_{1000})$		1.20 $(\approx {}^{1175}/_{975})$	

- Replacing $\boldsymbol{\tau_k}$ with $\boldsymbol{\tau_a} \rightarrow$ reallocates assets to more productive agent (**use it or lose it**)

Capital Income (τ_k) vs. Wealth Tax (τ_a)

	Capital income tax		Wealth tax (on book value)	
	$a_{i,\text{after-tax}} = a_i + (1-\tau_k) r_i a_i$		$a_{i,\text{after-tax}} = (1-\tau_a) a_i + r_i a_i$	
	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)	Fredo ($r_f = 0\%$)	Mike ($r_m = 20\%$)
Wealth	\$1M	\$1M	**\$1M**	**\$1M**
Before-tax Income	**\$0**	**\$200K**	0	\$200K
	$\tau_k = 25\%$ $(= \frac{50}{200})$		$\tau_a = 2.5\%$ $(= \frac{50}{2000})$	
Tax liability	0	\$50K $(= 200\tau_k)$	\$25K $(= 1000\tau_a)$	\$25K $(= 1000\tau_a)$
After-tax return	0%	15% $(= \frac{200-50}{1000})$	-2.5% $(= \frac{0-25}{1000})$	17.5% $(= \frac{200-25}{1000})$
After-tax wealth ratio	1.15 $(= 1150/1000)$		1.20 $(\approx 1175/975)$	

- Replacing τ_k with $\tau_a \rightarrow$ reallocates assets to more productive agent (**use it or lose it**) + increases dispersion in after-tax returns & wealth.

Baseline Model with Exogenous Entrepreneurial Productivity

Perpetual Youth Model with Exogenous Entrepreneurial Productivity

Perpetual Youth Model with Exogenous Entrepreneurial Productivity

1. Homogenous **workers** (size L)
   - Supply labor inelastically + consume wage income *(hand-to-mouth)*

Perpetual Youth Model with Exogenous Entrepreneurial Productivity

1. Homogenous **workers** (size L)
   - Supply labor inelastically + consume wage income *(hand-to-mouth)*
2. Heterogenous **entrepreneurs** (size 1)
   - Produce final goods using capital and labor ($y_i = (z_i k_i)^{\alpha} \, n_i^{1-\alpha}$) + consume/save
   - Heterogeneity in
     - productivity ($z_i \in \{z_\ell, z_h\}$) determined at birth: μ $(1-\mu)$ fraction w/ permanent z_h (z_ℓ)
     - wealth (a)
   - Initial (inherited) wealth $\overline{a}$ common across entrepreneurs *($\overline{a}$ determined endogenously later)*

Perpetual Youth Model with Exogenous Entrepreneurial Productivity

1. Homogenous **workers** (size L)
   - Supply labor inelastically + consume wage income *(hand-to-mouth)*
2. Heterogenous **entrepreneurs** (size 1)
   - Produce final goods using capital and labor ($y_i = (z_i k_i)^{\alpha} n_i^{1-\alpha}$) + consume/save
   - Heterogeneity in
     - productivity ($z_i \in \{z_\ell, z_h\}$) determined at birth: μ $(1-\mu)$ fraction w/ permanent z_h (z_ℓ)
     - wealth (a)
   - Initial (inherited) wealth $\overline{a}$ common across entrepreneurs *($\overline{a}$ determined endogenously later)*

Preferences (of workers and entrepreneurs): $E_0 \sum_{t=0}^{\infty} (\beta\delta)^t \log(c_t)$

where $\beta < 1$ and $\delta < 1$ is the conditional survival probability.

Perpetual Youth Model with Exogenous Entrepreneurial Productivity

1. Homogenous **workers** (size L)
   - Supply labor inelastically + consume wage income *(hand-to-mouth)*
2. Heterogenous **entrepreneurs** (size 1)
   - Produce final goods using capital and labor ($y_i = (z_i k_i)^{\alpha} \, n_i^{1-\alpha}$) + consume/save
   - Heterogeneity in
     - productivity ($z_i \in \{z_\ell, z_h\}$) determined at birth: μ $(1-\mu)$ fraction w/ permanent z_h (z_ℓ)
     - wealth (a)
   - Initial (inherited) wealth $\overline{a}$ common across entrepreneurs *($\overline{a}$ determined endogenously later)*

Preferences (of workers and entrepreneurs): $E_0 \sum_{t=0}^{\infty} (\beta\delta)^t \log(c_t)$

where $\beta < 1$ and $\delta < 1$ is the conditional survival probability.

Aggregate output: $Y = \int y_i di = \int (z_i k_i)^{\alpha} \, n_i^{1-\alpha} di$

Government: Finances exogenous expenditure G with τ_k and τ_a

Financial Markets & Equilibrium with Heterogenous Returns

Financial markets:

- Collateral constraint ($\lambda \geq 1$): $k \leq \lambda a$, where a is entrepreneur's wealth.
- Bonds are in zero net supply.

Financial Markets & Equilibrium with Heterogenous Returns

Financial markets:

- Collateral constraint ($\lambda \geq 1$): $k \leq \lambda a$, where a is entrepreneur's wealth.
- Bonds are in zero net supply.

Equilibrium with Heterogenous Returns:

- If $(\lambda - 1)\,\mu A_h < (1 - \mu)\,A_\ell$:
  - low-type entrepreneurs bid down interest rate, $r = \text{MPK}\,(z_\ell)$.
  - **Unique steady state** with: return heterogeneity, misallocation of capital, wealth tax $\neq$ capital income tax.
  - **Empirically relevant:** $R_h > R_l$ and $\frac{\text{Debt}}{\text{GDP}} \gg 1.5$ when $\lambda = \overline{\lambda}$.

Financial Markets & Equilibrium with Heterogenous Returns

Financial markets:

- Collateral constraint ($\lambda \geq 1$): $k \leq \lambda a$, where a is entrepreneur's wealth.
- Bonds are in zero net supply.

Equilibrium with Heterogenous Returns:

- If $(\lambda - 1)\,\mu A_h < (1-\mu)\,A_\ell$:
  - low-type entrepreneurs bid down interest rate, $r = \text{MPK}\,(z_\ell)$.
  - **Unique steady state** with: return heterogeneity, misallocation of capital, wealth tax $\neq$ capital income tax.
  - **Empirically relevant:** $R_h > R_l$ and $\frac{\text{Debt}}{\text{GDP}} \gg 1.5$ when $\lambda = \overline{\lambda}$.
- $(\lambda - 1)\,\mu A_h < (1-\mu)\,A_\ell \longleftrightarrow \tau_a < \overline{\tau}_a = 1 - \frac{1}{\beta\delta}\left(1 - \frac{1-\delta}{\delta}\frac{1-\lambda\mu}{(\lambda-1)\left(1-\frac{z_\ell}{z_h}\right)}\right)$

Upper Bound on τ_a

Equilibrium Values: Aggregation

Lemma: Aggregate output is

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

where

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

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

Equilibrium Values: Aggregation

Lemma: Aggregate output is

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

where

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

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

Key variables:

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

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 in Neoclassical Growth Model... but with endogenous Z (Moll, 2014)

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

Steady State: Capital, Returns, and Taxes

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

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

- τ_k does not affect steady state after-tax MPK; τ_a does.

Steady State: Capital, Returns, and Taxes

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

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

- τ_k does not affect steady state after-tax MPK; τ_a does.

Steady State Z: Returns and evolution of assets imply this quadratic equation:

$$\begin{aligned}\left(1-\delta^2\beta\left(1-\tau_a\right)\right) Z^2 - \left[\left(1-\delta\right)\left(\mu z_\lambda + \left(1-\mu\right) z_\ell\right) + \delta\left(1-\delta\beta\left(1-\tau_a\right)\right)\left(z_\lambda + z_\ell\right)\right] Z \\ +\delta\left(1-\delta\beta\left(1-\tau_a\right)\right) z_\ell z_\lambda = 0.\end{aligned}$$

- Z only depends on τ_a.

Steady State: Capital, Returns, and Taxes

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

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

- τ_k does not affect steady state after-tax MPK; τ_a does.

Steady State Z: Returns and evolution of assets imply this quadratic equation:

$$\left(1-\delta^2\beta\left(1-\tau_a\right)\right)Z^2 - \left[\left(1-\delta\right)\left(\mu z_\lambda + \left(1-\mu\right)z_\ell\right) + \delta\left(1-\delta\beta\left(1-\tau_a\right)\right)\left(z_\lambda + z_\ell\right)\right]Z$$
$$+\delta\left(1-\delta\beta\left(1-\tau_a\right)\right)z_\ell z_\lambda = 0.$$

- Z only depends on τ_a.
- Wealth tax affects returns, wealth shares, and productivity. Capital income tax does not.

Main Result 1: Efficiency Gains from Wealth Taxation

Proposition:

Proof

For all $\mu \in (0, 1)$ and $\tau_a < \bar{\tau}_a$, an increase in τ_a **increases Z**

Main Result 1: Efficiency Gains from Wealth Taxation

Proposition: Proof

For all $\mu \in (0,1)$ and $\tau_a < \bar{\tau}_a$, an increase in τ_a **increases Z**

Corollary: For all $\mu \in (0,1)$ and $\tau_a < \bar{\tau}_a$, an increase in τ_a **increases**

- Wealth concentration: $s_h \uparrow \; (Z \uparrow = s_h z_\lambda + (1 - s_h) z_\ell)$

Main Result 1: Efficiency Gains from Wealth Taxation

Proposition: Proof

For all $\mu \in (0, 1)$ and $\tau_a < \bar{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ **increases Z**

Corollary: For all $\mu \in (0, 1)$ and $\tau_a < \bar{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ **increases**

- Wealth concentration: $s_h \uparrow \left(Z \uparrow = s_h z_\lambda + (1 - s_h)\, z_\ell\right)$
- Dispersion of after-tax returns rises:

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

Government Budget and Aggregate Variables

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

- In what follows, τ_k adjusts in the background when $\tau_a \uparrow$

Government Budget and Aggregate Variables

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

- In what follows, τ_k adjusts in the background when $\tau_a \uparrow$

Lemma:

For all $\mu \in (0, 1)$ and $\tau_a < \overline{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ has the following effect on aggregates:

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

Government Budget and Aggregate Variables

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

- In what follows, τ_k adjusts in the background when $\tau_a \uparrow$

Lemma:

For all $\mu \in (0,1)$ and $\tau_a < \overline{\tau}_a$, an increase in $\boldsymbol{\tau_a}$ has the following effect on aggregates:

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

$$\xi_K = \xi_Y = \xi_w = {}^{\alpha}/_{1-\alpha} \qquad \xi_x = \frac{d \log x}{d \log Z}$$

Main Result 2: Welfare Gains by Type

Proposition:

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: $\frac{dV_h(\overline{a})}{d\tau_a} > 0$ (since $\xi_K + \frac{1}{1-\beta\delta}\xi_{R_h} > 0$)
- Low-z entrepreneurs: Lower welfare ($\frac{dV_\ell(\overline{a})}{d\tau_a} < 0$) iff $\xi_K + \frac{1}{1-\beta\delta}\xi_{R_\ell} < 0$
- Entrepreneurs: Lower average welfare iff $\xi_K + \frac{1}{1-\beta\delta}\left(\mu\xi_{R_h} + (1-\mu)\,\xi_{R_\ell}\right) < 0$

Main Result 2: Welfare Gains by Type

Proposition:

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: $\frac{dV_h(\bar{a})}{d\tau_a} > 0$ (since $\xi_K + \frac{1}{1-\beta\delta}\xi_{R_h} > 0$)
- Low-z entrepreneurs: Lower welfare ($\frac{dV_\ell(\bar{a})}{d\tau_a} < 0$) iff $\xi_K + \frac{1}{1-\beta\delta}\xi_{R_\ell} < 0$
- Entrepreneurs: Lower average welfare iff $\xi_K + \frac{1}{1-\beta\delta}\left(\mu\xi_{R_h} + (1-\mu)\xi_{R_\ell}\right) < 0$

Note: The last two conditions imply a threshold on α for welfare gains that are high in practice, so average entrepreneur welfare is typically lowered when τ_a increases.

α Thresholds

Main Result 3: Optimal Taxes

α thresholds

Objective: Choose taxes (τ_a, τ_k) to maximize newborn welfare

$$\mathcal{W} \equiv n_w V_w(w) + (1 - n_w)\left(\mu V_h(\bar{a}) + (1-\mu) V_\ell(\bar{a})\right)$$

Main Result 3: Optimal Taxes

α thresholds

Objective: Choose taxes (τ_a, τ_k) to maximize newborn welfare

$$\mathcal{W} = \frac{1}{1-\beta\delta}\left\{n_w \log w + (1-n_w)\left(\log \bar{a} + \frac{\mu \log R_h + (1-\mu)\log R_\ell}{1-\beta\delta}\right)\right\} + \text{Constant}$$

Main Result 3: Optimal Taxes

α thresholds

Objective: Choose taxes (τ_a, τ_k) to maximize newborn welfare

$$\mathcal{W} = \frac{1}{1-\beta\delta}\left\{n_w \log w + (1-n_w)\left(\log \bar{a} + \frac{\mu \log R_h + (1-\mu)\log R_\ell}{1-\beta\delta}\right)\right\} + \text{Constant}$$

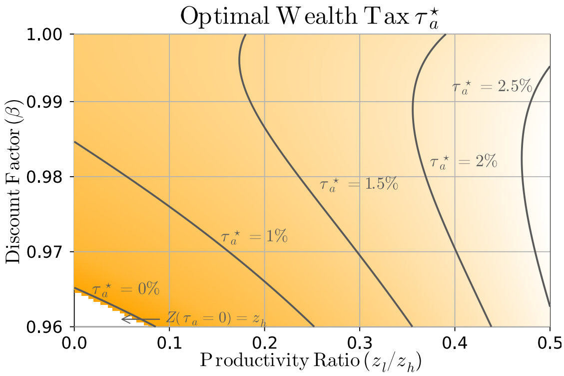
Proposition: There exists a unique optimal tax combination $(\tau_a^\star, \tau_k^\star)$ that maximizes $\mathcal{W}$. An interior optimum $(\tau_a^\star < \bar{\tau}_a)$ is the solution to:

$$0 = \left(\underbrace{n_w \xi_w^Z + (1-n_w)\,\xi_K^Z}_{\text{Level Effect }(+)} + \underbrace{\frac{1-n_w}{1-\beta\delta}\left(\mu \xi_{R_h}^Z + (1-\mu)\,\xi_{R_\ell}^Z\right)}_{\text{Return Productivity Effect (-)}}\right)\frac{d\log Z}{d\tau_a}$$

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

$$\begin{aligned}
&\tau_a^\star < 0 \text{ and } \tau_k^\star > 0 && \text{if } \alpha < \underline{\alpha} \\
&\tau_a^\star > 0 \text{ and } \tau_k^\star > 0 && \text{if } \underline{\alpha} \le \alpha \le \bar{\alpha} \\
&\tau_a^\star > 0 \text{ and } \tau_k^\star < 0 && \text{if } \alpha > \bar{\alpha}
\end{aligned}$$

Figure 1: Optimal Wealth Tax



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 $\alpha = 0.4$.*

Baseline Model with Innovation and Endogenous Entrepreneurial Productivity

Innovation Effort and Productivity

- We interpret productivity z_i as the outcome of a risky innovation process
- Innovation requires costly effort, e, and can end with a high- or low-productivity idea

Innovator's problem:

$$\max_{e} \; \mu(e) V_h(\bar{a}) + (1-\mu(e))\, V_\ell(\bar{a}) - \frac{1}{(1-\beta\delta)^2}\Lambda(e); \quad \Lambda(e) \text{ convex}+C^2; \; \mu(e) = e$$

Innovation Effort and Productivity

- We interpret productivity z_i as the outcome of a risky innovation process
- Innovation requires costly effort, e, and can end with a high- or low-productivity idea

Innovator's problem:

$$\max_{e} \mu(e) V_h(\bar{a}) + (1 - \mu(e)) V_\ell(\bar{a}) - \frac{1}{(1-\beta\delta)^2} \Lambda(e); \quad \Lambda(e) \text{ convex} + C^2; \mu(e) = e$$

We can show:

- Unique equilibrium with innovation.
- Efficiency gains with wealth tax.
- Wealth tax increases innovation, hence fraction of high-type entrepreneurs.
- Optimal wealth tax is higher.

Equilibrium with Innovation

Steady State $\mu^\star$: For a given wealth tax level $\tau_a \leq \overline{\tau}_a$, the steady state share of high-productivity entrepreneurs, $\mu^\star$, is determined by the solution to

$$\mu^\star = e(Z(\mu^\star)), \text{ where}$$

i. $Z(\mu)$ gives the steady state productivity given μ.
ii. $e(Z)$ gives the optimal innovation effort given steady state productivity Z.

Equilibrium with Innovation

Steady State $\mu^\star$: For a given wealth tax level $\tau_a \leq \overline{\tau}_a$, the steady state share of high-productivity entrepreneurs, $\mu^\star$, is determined by the solution to

$$\mu^\star = e(Z(\mu^\star)), \text{ where}$$

i. $Z(\mu)$ gives the steady state productivity given μ.
ii. $e(Z)$ gives the optimal innovation effort given steady state productivity Z.

Proposition (existence and uniqueness):

There exists a unique innovation equilibrium.

Equilibrium with Innovation

Steady State $\mu^\star$: For a given wealth tax level $\tau_a \leq \overline{\tau}_a$, the steady state share of high-productivity entrepreneurs, $\mu^\star$, is determined by the solution to

$$\mu^\star = e(Z(\mu^\star)), \text{ where}$$

i. $Z(\mu)$ gives the steady state productivity given μ.
ii. $e(Z)$ gives the optimal innovation effort given steady state productivity Z.

Proposition (existence and uniqueness):

There exists a unique innovation equilibrium.

Proposition (innovation gains from wealth taxation):

The equilibrium $\mu^\star$ is increasing in wealth taxes, τ_a.

Equilibrium with Innovation

Steady State $\mu^\star$: For a given wealth tax level $\tau_a \leq \overline{\tau}_a$, the steady state share of high-productivity entrepreneurs, $\mu^\star$, is determined by the solution to

$$\mu^\star = e\left(Z\left(\mu^\star\right)\right), \text{ where}$$

i. $Z(\mu)$ gives the steady state productivity given μ.
ii. $e(Z)$ gives the optimal innovation effort given steady state productivity Z.

Proposition (existence and uniqueness):

There exists a unique innovation equilibrium.

Proposition (innovation gains from wealth taxation):

The equilibrium $\mu^\star$ is increasing in wealth taxes, τ_a.

Corollary (efficiency gains from wealth taxation):

The equilibrium $Z^\star$ is increasing in τ_a (+ Both $\mu^\star$ and $Z^\star$ are independent of τ_k).

Optimal taxes with innovation

Objective: Choose $(\tau_a^\star, \tau_k^\star)$ to maximize newborn welfare net of innovation costs

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

Optimal taxes with innovation

Objective: Choose $(\tau_a^\star, \tau_k^\star)$ to maximize newborn welfare net of innovation costs

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

Proposition:

The optimal tax combination $(\tau_a^\star, \tau_k^\star)$ that maximizes $\mathcal{W}$ is the solution to:

$$0 = \left(\underbrace{n_w \xi_w^Z + (1-n_w)\xi_K^Z}_{\text{Level Effect }(+)} + \underbrace{\frac{1-n_w}{1-\beta\delta}\left(\mu \xi_{R_h}^Z + (1-\mu)\xi_{R_\ell}^Z\right)}_{\text{Return Productivity Effect (-)}}\right)\frac{d\log Z}{d\tau_a} + \underbrace{\frac{1-n_w}{1-\beta\delta}\left(\mu \xi_{R_h}^\mu + (1-\mu)\xi_{R_\ell}^\mu\right)\frac{d\mu}{d\tau_a}}_{\textbf{New! }\text{Return Innovation Effect }(+)}$$

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

Extensions

Extension: Infinite-Horizon Model with Mean-Reverting Productivity

- Entrepreneurial productivity follows Markov process with persistence ρ (first-order autocorrelation)
- All results hold as long as entrepreneurial productivity is persistent ($\rho > 0$).

We further considered the following three extensions:

- Corporate sector that faces no borrowing constraint Details
  - If $z_\ell < z_C < z_h$, then low-productivity agents invest in the corporate sector.
- Rents: Return $\neq$ marginal productivity. Details
  - Introduce zero-sum return wedges so that $R_h <> R_\ell$.
  - Efficiency gains from $\tau_a \uparrow$ if $R_h > R_\ell$.
- Per-period entrepreneurial effort in production (still exogenous z): Details
  - With GHH preferences, aggregate entrepreneurial effort increases with wealth tax.

Conclusions

Increasing τ_a (& reducing τ_k):

- Reallocates capital: less productive $\rightarrow$ more productive agents.
  - Higher TFP, output, and wages;
  - Higher dispersion in returns and wealth
- Workers gain
- Entrepreneurs: High-productivity gain, low-productivity (typically) lose.
- Equilibrium innovation increases (when innovation is endogenous)

Optimal taxes:

- Optimal tax combination depends on elasticity of output with respect to capital.
- Optimal wealth tax increases with capital share.
- Optimal wealth tax is higher with endogenous innovation.

Extra

Outline

1. Benchmark model with exogenous entrepreneurial productivity process
2. Efficiency gains from wealth taxation
3. Welfare effects of wealth taxation
4. Optimal taxation
5. Model with endogenous entrepreneurial productivity
6. Extensions
7. Quantitative Analysis

Entrepreneur's Problem

Financial Markets & Entrepreneurs' Production Problem

Entrepreneurs' Production Decision:

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

Financial Markets & Entrepreneurs' Production Problem

Entrepreneurs' Production Decision:

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

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

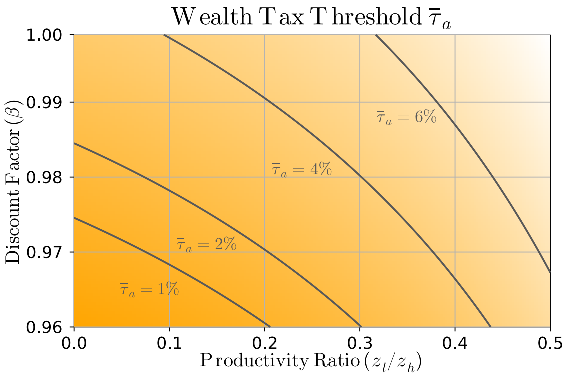
- $(\lambda - 1)\,a$: amount of external funds used by type-z if $MPK(z) > r$.

back

FIGURES

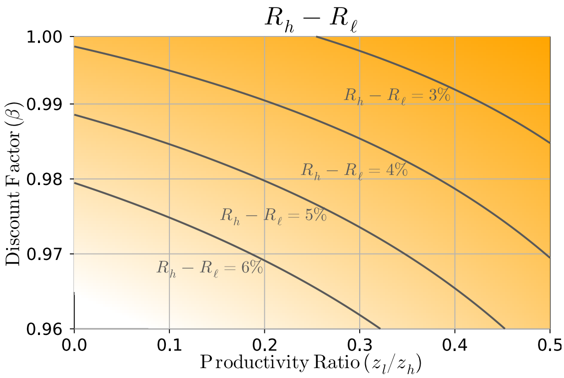
Condition for Steady State with Heterogeneous Returns

Figure 2: Upper Bound Wealth Tax



Note: *The figure reports the upper bound on wealth taxes 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 $\alpha = 0.4$. λ is such that the debt-to-output ratio in our baseline calibration is 1.5.*

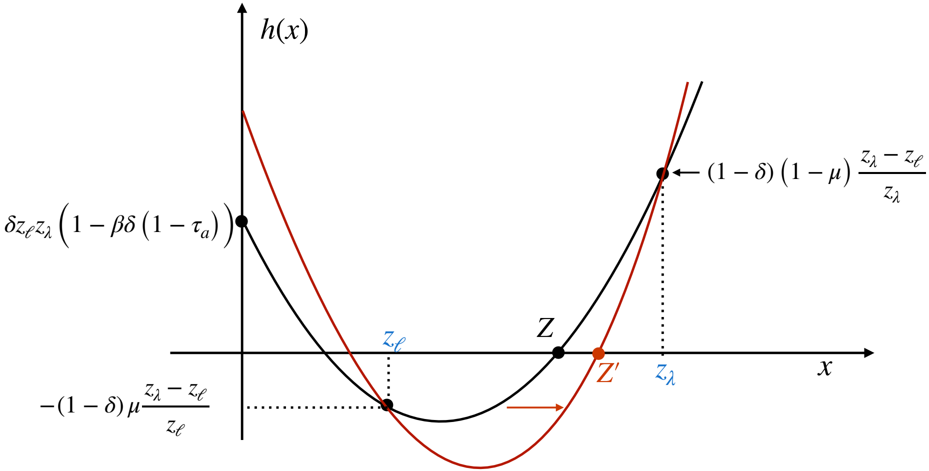
Figure 3: Dispersion of Returns in Steady State



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* $\alpha = 0.4$.

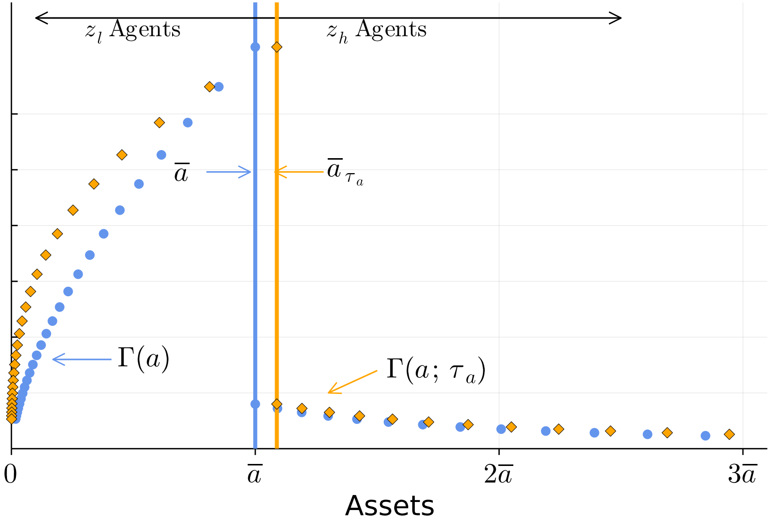
What happens to Z if $\tau_a \uparrow$?

$$\frac{dh(x)}{d\tau_a} = \beta\delta^2\left(1-\tau_a\right)\left(x-z_\ell\right)\left(z_\lambda - x\right) < 0 \text{ iff } z_\ell < x < z_\lambda$$



Stationary wealth distribution and wealth taxes

back

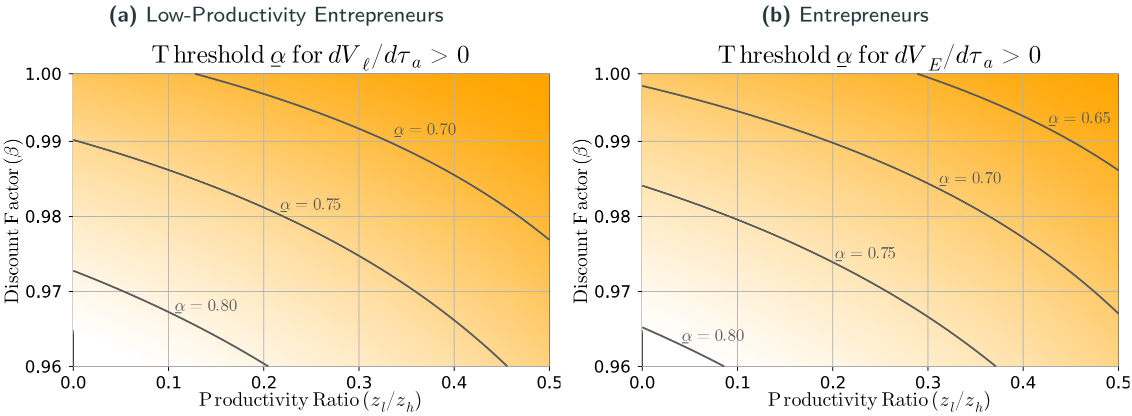


Welfare Gains

Conditions for Entrepreneurial Welfare Gain

back

Figure 4: α Thresholds for Entrepreneurial Welfare Gains



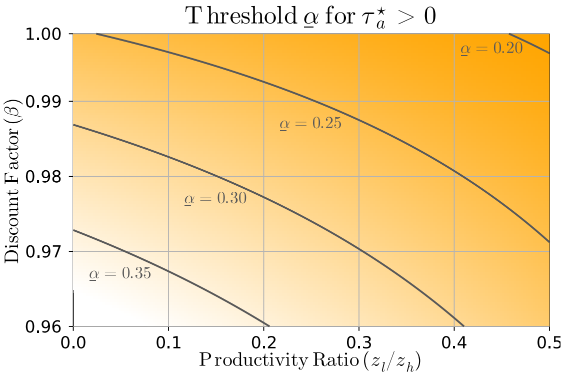
Note: *The figures report the threshold value of α above which entrepreneurial welfare increases after an increase in wealth taxes for combinations of the discount factor (β) and productivity dispersion (z_ℓ/z_h). We set the remaining parameters as follows: $\delta = 49/50$, $\beta\delta = 0.96$, $\mu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

Optimal Taxes

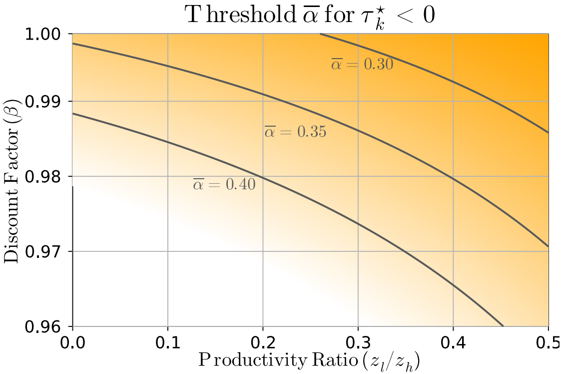
α-thresholds for Optimal Wealth Taxes

Back to opt. tax

Figure 5: α Thresholds for Optimal Wealth Taxes



(a) Lower Threshold $\underline{\alpha}$ for $\tau_a^\star > 0$



(b) Upper Threshold $\overline{\alpha}$ for $\tau_k^\star > 0$

Note: *The figures report the threshold value of α for the optimal wealth taxes to be positive (left) and capital income taxes to be positive (right) 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 $\alpha = 0.4$.*

Extensions

Extension: Corporate sector

- Corporate sector produces final goods using CRS technology:

$$Y_c = (z_c K_c)^{\alpha} L_c^{1-\alpha}$$

  - No financial constraints!

- Corporate sector imposes lower bound on r:

$$r \geq \alpha z_c \left(\frac{1-\alpha}{w} \right)^{\frac{1-\alpha}{\alpha}} .$$

Interesting case: $z_\ell < z_c < z_h$

- Corporate sector and high-productivity entrepreneurs produce
- Low-productivity entrepreneurs lend all of their funds.
- No real changes in the aggregates of the economy! z_c takes the place of z_ℓ

$$Y = (ZK)^{\alpha} L^{1-\alpha}$$

but now $Z = s_h z_\lambda + s_l \mathbf{z_c}$, where $z_\lambda = z_h + (\lambda - 1)(z_h - \mathbf{z_c})$.

Extension: Rents

Back to extensions

- Introduce wedge for returns above/below productivity:

$$R_i = (1 - \tau_a) + (1 - \tau_k) \underbrace{(1 + \omega_i)}_{\text{Return Wedge}} \alpha \left({}^{ZK}/_{L}\right)^{\alpha - 1} z_i$$

- Zero-sum condition on wedges: $\omega_l z_\ell A_\ell + \omega_h z_\lambda A_h = 0$
- Characterization of eq. in terms of "effective productivity" $\tilde{z}_i = (1 + \omega_i) z_i$

Extension: Rents

Back to extensions

- Introduce wedge for returns above/below productivity:

$$R_i = (1-\tau_a) + (1-\tau_k) \underbrace{(1+\omega_i)}_{\text{Return Wedge}} \alpha \left({}^{ZK}/_{L}\right)^{\alpha-1} z_i$$

- Zero-sum condition on wedges: $\omega_l z_\ell A_\ell + \omega_h z_\lambda A_h = 0$
- Characterization of eq. in terms of "effective productivity" $\tilde{z}_i = (1+\omega_i)\, z_i$

Proposition:

For all $\tau_a < \overline{\tau}_a$, a marginal increase in wealth taxes (τ_a) increases Z, $\frac{dZ}{d\tau_a} > 0$, **iff**

1. $\rho > 0$ and $R_h > R_\ell \longrightarrow$ Same mechanism as before
2. $\rho < 0$ and $R_h < R \longrightarrow$ Reallocates wealth to the true high types next period

Extension: Entrepreneurial Effort

Back to extensions

- Entrepreneurial production:

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

  - Production functions is CRS $\longrightarrow$ Aggregation

- Entrepreneurial preferences:

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

  - GHH preferences with no income effects $\longrightarrow$ Aggregation
  - ψ plays an important role: Cost of effort in consumption units

Extension: Entrepreneurial Effort

Back to extensions

Problem is isomorphic to having preferences

$$u(\hat{c}) = \log \hat{c} \qquad \text{where } \hat{c} = c - \psi e$$

and modifying entrepreneurial problem to:

$$\hat{\pi}(z,k) = \max_{n,e} y - wn - rk - \underbrace{\frac{\psi}{\mathbf{1 - \tau_k}}}_{\text{Effecive cost of effort}} e$$

- Solution is just as before (linear policy functions a', n, **and e**)
- **Key:** Effective cost of effort depends on capital income tax $\boldsymbol{\tau_k}$!
  - Effort affects entrepreneurial income
  - Income subject to capital income taxes but not to **book value** wealth taxes

- Aggregate effort:

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

  - Comparative statics: $K \uparrow$, $Z \uparrow$, and $\tau_k \downarrow$

- New wedge from capital income taxes on aggregate output and wages!
- Effort affects marginal product of capital $\longrightarrow$ Affects K_{ss}

A neutrality result:

- **No changes to steady state productivity!**
- Steady state capital adjusts in background to satisfy:

$$(1-\tau_k)\,\mathrm{MPK} - \tau_a = \frac{1}{\beta} - 1$$

Extension: Entrepreneurial Effort

Back to extensions

Results:

1. Efficiency gains from wealth taxation remain
2. Effect on aggregates is stronger if capital income taxes go down
   - **Effort increases with wealth taxes** (if $\rho > 0$)**!**
3. Characterization of optimal taxes is similar but
   higher wealth taxes and lower capital incomes taxes are optimal

Quantitative Framework with New Results

Model: Households

Back

- **OLG** demographic structure.
- **Uncertain lifetimes:** individuals face mortality risk every period.
- **Bequest motive**, inheritance goes to (newborn) offspring.

Model: Households

Back

- **OLG** demographic structure.
- **Uncertain lifetimes:** individuals face mortality risk every period.
- **Bequest motive**, inheritance goes to (newborn) offspring.

Individuals:

- Have preferences over consumption, **leisure** and bequests
- Make three decisions:

  consumption-savings ‖ **labor supply** ‖ portfolio choice

- Two exogenous characteristics:

  y_{ih} (**labor market productivity**) ‖ z_{ih} (entrepreneurial productivity)

Model: Households

Back

- **OLG** demographic structure.
- **Uncertain lifetimes:** individuals face mortality risk every period.
- **Bequest motive**, inheritance goes to (newborn) offspring.

Individuals:

- Have preferences over consumption, **leisure** and bequests
- Make three decisions:

consumption-savings ‖ **labor supply** ‖ portfolio choice

- Two exogenous characteristics:

y_{ih} (**labor market productivity**) ‖ z_{ih} (entrepreneurial productivity)

Entrepreneurs: monopolistic competition → **decreasing returns to scale**

Entrepreneurial Productivity z_{ih}: Key Source of Heterogeneity

Back

- Idiosyncratic wage risk :
  - Modeled in a rich way, but does not turn out to be critical. Details

Entrepreneurial Productivity z_{ih}: Key Source of Heterogeneity

Back

- Idiosyncratic wage risk :
  - Modeled in a rich way, but does not turn out to be critical. Details
- Entrepreneurial productivity, z_{ih}, varies
  1. permanently across individuals
     - imperfectly correlated across generations
  2. stochastically over the life cycle

Government

Back

Government budget balances:

- **Outlays:** Expenditure (G) $+$ Social Security pensions
- **Revenues:** tax on consumption (τ_c), labor income (τ_ℓ), bequests (τ_b) plus:

1. tax on capital income (τ_k), or
2. tax on wealth (τ_a).

Calibration summary

Back

Choose parameters of

- Bequest motive $\rightarrow$
  - level and concentration of bequests

Calibration summary

Back

Choose parameters of

- Bequest motive $\rightarrow$
  - level and concentration of bequests
- Entrepreneurial productivity $\rightarrow$
  - top wealth concentration (overall and in the hands of entrepreneurs)
  - shares of entrepreneurs and self-made billionaires

Calibration summary

Back

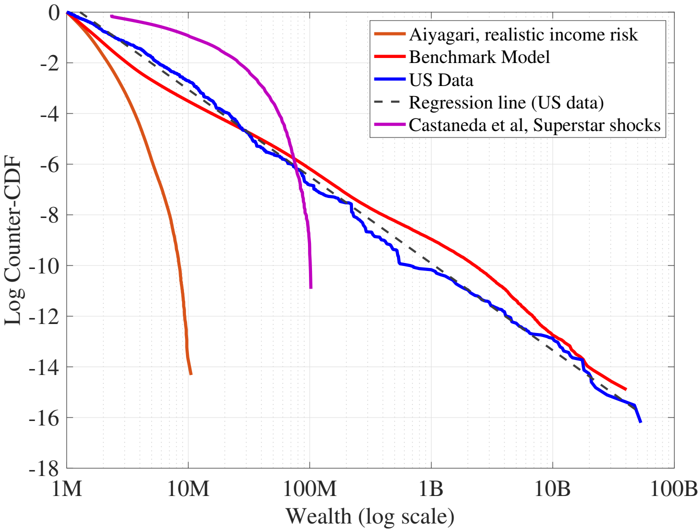
Choose parameters of

- Bequest motive $\rightarrow$
  - level and concentration of bequests
- Entrepreneurial productivity $\rightarrow$
  - top wealth concentration (overall and in the hands of entrepreneurs)
  - shares of entrepreneurs and self-made billionaires
- Entrepreneurs' collateral constraint $\rightarrow$
  - Business debt plus external funds/GDP

Details

Pareto Tail of Wealth Distribution: Model vs. Data

Back



Note: Both axes are in natural logs.

Back

Table 1: Distribution of Rates of Return (Untargeted) in the Model and the Data

	Annual Returns			Persistent Component of Returns					
	Std dev	P90-P10	Kurtosis	Std dev	P90-P10	Kurtosis	P90	P99	P99.9
Data (Norway)	8.6	14.2	47.8	6.0	7.7	78.4	4.3	11.6*	23.4*
Data (Norway, bus. own.)	–	–	–	4.8	10.9	14.2	10.1	–	–
Data (US, private firms)	17.7	33.8	8.3	–	–	–	–	–	–
Benchmark Model	8.4	17.1	7.6	4.1	9.2	6.1	5.8	13.9	19.7
L-INEQ Calibration	6.7	13.1	9.2	3.8	9.2	4.3	5.6	11.2	15.8

*Notes: Returns on wealth in percentage points. All cross-sectional returns are value weighted. *The statistics for Norway are for individual returns on wealth (net worth) taken from Fagereng, Guiso, Malacrino, and Pistaferri (2020). The US statistics are from Smith, Zidar, and Zwick (2021) and are for S-corps' returns on investment; they also report statistics for partnerships, which are very similar (std dev of 17.8% and P90-P10 of 27.9). For each individual, the persistent component of returns is calculated following Fagereng et al as the unweighted average of annual, before-tax, returns between ages 25 and 75, after taking out the average return by age.*

Tax Reform and Optimal Taxes

Back

	τ_k	τ_ℓ	τ_a	ΔWelfare
Benchmark	25%	22.4%	–	–
RN Tax reform	–	22.4%	1.19%	7.2
Opt. $\boldsymbol{\tau_a}$				
Opt. $\boldsymbol{\tau_k}$				

Change in aggregate variables

Back

% change	K	Q	TFP	L	Y	w	w (net)
Tax reform	16.4	22.6	2.1	1.2	9.2	8.0	8.0
Optimal τ_a		.		.	.	.	.
Optimal τ_k		.		.	.	.	.

Tax Reform: Who Gains? Who Loses?

Back

Average (consumption equivalent) **welfare gain** by age-productivity groups:

	Productivity group (Percentile)					
Age	0-40	40-80	80-90	90-99	99-99.9	99.9+
20	**6.7**	**6.3**	**6.8**	**8.5**	**11.5**	**13.4**
21-34						
35-49						
50-64						
65+						

Tax Reform: Who Gains? Who Loses?

Back

Average (consumption equivalent) **welfare gain** by age-productivity groups:

	Productivity group (Percentile)					
Age	0-40	40-80	80-90	90-99	99-99.9	99.9+
20	**6.7**	**6.3**	**6.8**	**8.5**	**11.5**	**13.4**
21-34	6.3	5.5	5.5	6.5	8.5	9.7
35-49	4.9	3.8	3.3	3.3	3.1	2.8
50-64	2.2	1.5	1.1	0.9	0.4	-0.2
65+	-0.2	-0.3	-0.4	-0.4	-0.7	-1.0

Tax Reform: Who Gains? Who Loses?

Back

Average (consumption equivalent) **welfare gain** by age-productivity groups:

	Productivity group (Percentile)					
Age	0-40	40-80	80-90	90-99	99-99.9	99.9+
20	**6.7**	**6.3**	**6.8**	**8.5**	**11.5**	**13.4**
21-34	6.3	5.5	5.5	6.5	8.5	9.7
35-49	4.9	3.8	3.3	3.3	3.1	2.8
50-64	2.2	1.5	1.1	0.9	0.4	-0.2
65+	-0.2	-0.3	-0.4	-0.4	-0.7	-1.0

BB tax reform turns welfare losses of retirees to gains, ranging from 2.3% to 6.5%.

Tax Reform and Optimal Taxes

Back

	τ_k	τ_ℓ	τ_a	ΔWelfare
Benchmark	25%	22.4%	–	–
RN Tax reform	–	22.4%	1.19%	7.2
Opt. $\boldsymbol{\tau_a}$				
Opt. $\boldsymbol{\tau_k}$				

Tax Reform and Optimal Taxes

Back

	τ_k	τ_ℓ	τ_a	ΔWelfare
Benchmark	25%	22.4%	–	–
RN Tax reform	–	22.4%	1.19%	7.2
Opt. τ_a	–	**15.4%**	**3.03%**	8.7
Opt. τ_k				

	τ_k	τ_ℓ	τ_a	ΔWelfare
Benchmark	25%	22.4%	–	–
RN Tax reform	–	22.4%	1.19%	7.2
Opt. τ_a	–	**15.4%**	**3.03%**	8.7
Opt. τ_k	**–13.6%**	**31.2%**	–	5.1

Change in aggregate variables

Back

% change	K	Q	TFP	L	Y	w	w (net)
Tax reform	16.4	22.6	2.1	1.2	9.2	8.0	8.0
Optimal τ_a	**2.6**	10.5	3.1	3.3	6.1	2.8	**12.0**
Optimal τ_k							

Change in aggregate variables

Back

% change	K	Q	TFP	L	Y	w	w (net)
Tax reform	16.4	22.6	2.1	1.2	9.2	8.0	8.0
Optimal τ_a	**2.6**	10.5	3.1	3.3	6.1	2.8	**12.0**
Optimal τ_k	**38.6**	46.1	2.2	–1.0	15.7	16.8	**3.6**

Welfare: Levels vs Redistribution

Back

Welfare gain comes from changes in consumption (c) and leisure(ℓ).

- How much comes from changes in the **level** vs **distribution** of c and ℓ?

Welfare: Levels vs Redistribution

Back

Welfare gain comes from changes in consumption (c) and leisure(ℓ).

- How much comes from changes in the **level** vs **distribution** of c and ℓ?

	Tax Reform	Opt.τ_k	Opt.τ_a
CE_2 (NB)	7.2	5.1	8.7
Level $\left(\overline{c}, \overline{\ell}\right)$	8.9		
Dist. (c, ℓ)	-1.5		

Welfare: Levels vs Redistribution

Back

Welfare gain comes from changes in consumption (c) and leisure(ℓ).

- How much comes from changes in the **level** vs **distribution** of c and ℓ?

	Tax Reform	Opt.τ_k	Opt.τ_a
CE_2 (NB)	7.2	5.1	8.7
Level $\left(\bar{c}, \bar{\ell}\right)$	8.9	14.7	
Dist. (c, ℓ)	-1.5	**−8.3**	

Welfare: Levels vs Redistribution

Back

Welfare gain comes from changes in consumption (c) and leisure(ℓ).

- How much comes from changes in the **level** vs **distribution** of c and ℓ?

	Tax Reform	Opt.τ_k	Opt.τ_a
CE_2 (NB)	7.2	5.1	8.7
Level $(\bar{c}, \bar{\ell})$	8.9	14.7	5.9
Dist. (c, ℓ)	-1.5	**–8.3**	**2.6**

Optimal taxes with transition

Optimal Tax Equilibrium with Transition

Back

- Fix opt. tax level (τ_k or τ_a) and solve transition to new steady state
- Use labor income tax (τ_ℓ) to finance debt from deficits during transition

Optimal Tax Equilibrium with Transition

Back

- Fix opt. tax level (τ_k or τ_a) and solve transition to new steady state
- Use labor income tax (τ_ℓ) to finance debt from deficits during transition

	τ_k Transition	τ_a Transition
τ_k	-13.6^*	0.00
τ_a	0.00	3.03^*
τ_ℓ	39.90	17.01
$\overline{CE}_2$ (newborn)	**–8.4** (5.1)	**6.0** (8.7)
$\overline{CE}_2$ (all)	–6.1 (4.5)	3.5 (4.3)