Entrepreneurship, Agency Frictions and Redistributive Capital Taxation

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Motivation

- Equity-efficiency tradeoff for capital taxation.
  - Still no consensus in literature.
- Literature focuses on effect of taxes on level of investment.
  - What about allocation of capital/efficiency of use.
- How should you tax capital? Capital income taxes? Wealth taxes?
- What about entrepreneurship?
  - Capital concentrated among poorly diversified business owners.
  - Do capital taxes discourage entrepreneurial activity/risk taking?

Outline

- Analytically tractable framework to look at these issues.
- Optimal linear capital taxation in a setting with...
  - Entrepreneurs (who own capital).
  - Workers (who do not own capital).
- Government seeks to redistribute from entrepreneurs to workers.
  - Sets taxes on: capital income; labour income; wealth; consumption.
- Financial markets are frictional:
  - Due to asymmetric information.
  - Entrepreneurs bear idiosyncratic risk.
  - Entrepreneurs must fund investment partly from own assets.

Preview of Results

- Capital taxes affect capital allocation and (therefore) TFP.
  - Affect entrepreneurs' choices to put capital into 'risky' versus 'risk free' sector.
  - Affect degree to which capital is used by high productivity entrepreneurs.
- Compared to wealth taxes:
  - Capital income taxes relatively more distortionary.
    - Intuition: capital income taxes distort relative return of different choices. Wealth taxes don't.
  - Consumption taxes relatively less distortionary.
    - Similar to existing results in literature.
    - Intuition: consumption taxes do not distort saving decisions.

Preview of Results

- Optimal taxes can be expressed as functions of pre-tax prices.
- Consumption taxes set at highest level consistent with no evasion.
- In (very rough) calibration:
  - Consumption tax $\simeq$ 35%.
  - Capital income tax $\simeq$ -33%.
  - Wealth tax $\simeq$ 2 % (per year).
  - Results very dependent on max. level of consumption tax consistent with no evasion.

Related Literature

- **Taxation of entrepreneurial capital:** Albanesi (2011), Shourideh (2014), Cagetti and di Nardi (2009), Kitao (2008).
- **Optimal taxation with financial market imperfections:** Biljanovska and Vardoulakis (2017), Abo-Zaid (2014), Itskhoki and Moll (2015).
- **Optimal capital taxation with high wealth inequality:** Piketty and Saez (2013), Straub and Werning (2014), Panousi and Reis (2014).

Agents

Continuum of four types of agent:

- **Households:**
  - **Entrepreneurs:** Own capital and produce intermediate goods. Measure π.
  - **Workers:** Live hand to mouth. Supply labour. Measure 1.
- **Competitive Firms:**
  - **Final goods producers:** Produce output using labour and intermediate goods.
  - **Financial intermediaries:** Allocate finance between entrepreneurs.

Government levies taxes on agents and funds government spending G.

Production Technology

- Each period $t = 1, ...,$ each entrepreneur i:
  - uses some capital (k_{it}^E) to produce Y_t^E intermediate goods (risky)
  - uses remainder (k_{it}^F) to produce Y_t^F intermediate goods (risk-free)
- Each worker j supplies labour $n_{jt} = 1$ to final goods producers.
- Representative final goods producer produces output according to:

$$Y_t = F(Y_t^E, Y_t^F, N_t)$$

- We assume $F' > 0$, $F'' < 0$, $\lim_{i \to 0} F_i' = \infty$, $\lim_{i \to \infty} F_i' \in (0, \delta)$.

Production Technology

- Entrepreneurs vary in their ability. At start of each period, entrepreneur i draws publicly observable ability $\theta_{it} \sim G(\theta_{it})$, with pdf:

$$g(\theta) = \frac{A_1}{\theta^2} \quad \text{for } \theta \in [\underline{\theta}, \overline{\theta}]$$

- Entrepreneur i starts period with k_{it} units of capital. Chooses k_{it}^E, k_{it}^F. Publicly observable.
- Capital k_{it}^F used to produce $y_t^F = k_t^F$ intermediate goods.

Idiosyncratic Shock

- After choosing k_{it}^E, k_{it}^F, entrepreneur i draws a stochastic shock $\epsilon_{it} \sim H(\epsilon)$, with pdf $h(\epsilon)$. i.i.d. across time and entrepreneurs.
- We assume that $E[\epsilon] = 1$, that $h(\epsilon) > 0$ for $\epsilon \geq 0$ and that, for $q \geq 0, x \geq 0$:

$$\frac{\partial^2}{\partial x^2}\left(\frac{\int_\epsilon (1+x\epsilon)^{1+q} dH(\epsilon)}{\int_\epsilon \epsilon(1+x\epsilon)^{1+q} dH(\epsilon)}\right) \geq 0$$

(appears to be true for most non-negative distributions)

Intermediate Goods

- After choosing k_{it}^E, k_{it}^F, entrepreneur i draws $\epsilon_{it} \sim H(\epsilon)$.
- Entrepreneur's risky output of y_{it}^E intermediate goods given by: $y_{it}^E = \theta_{it}\epsilon_{it}k_{it}^E$.
- Intermediate goods y_{it}^E sold to final goods producer at price r_t^E.
- Intermediate goods y_{it}^F sold to final goods producer at price r_t^F.

Budget Constraints

- Entrepreneur i may choose to borrow some b_{it} from the financial intermediary at the start of each period.

- At the end of each period, entrepreneur i
  - Agrees to repay $\hat{b}_{it}$ to the intermediary (state contingent).
  - Pays taxes τ_K, τ_C, τ_W.
  - Divides remaining resources between consumption and investment.

- Entrepreneur i faces the following budget constraints:

$$
\begin{aligned}
k_{it}^E + k_{it}^F \leq & k_{it} + b_{it} \\
\hat{b}_{it} + c_{it}(1 + \tau_C) + I_{it} \leq & r_t^E y_{it}^E (1 - \tau_K) + r_t^F k_{it}^F (1 - \tau_K) \\
& - (\tau_W - \tau_K \delta)(k_{it}^E + k_{it}^F)
\end{aligned}
$$

Laws of Motion

- Entrepreneur's capital from one period to next evolves according to:

$$k_{i,t+1} = I_{it} + (1-\delta)(k_{it}^{E} + k_{it}^{F})$$

- Fraction γ of entrepreneurs and workers die at end of period.
    - Replaced by newborn entrepreneurs and workers.
    - Capital of dead entrepreneurs redistributed equally between newborn entrepreneurs.

Budget Constraints and Preferences

- Each worker faces the budget constraint:

$$c_t(1+\tau_C) = w_t(1-\tau_{Nt})$$

- All agents value consumption according to:

$$U = \sum_t \beta^t (1-\gamma)^t u(c)$$
$$u(c) = \log(c)$$

Financial Contract

- State contingent: $\hat{b}_{it} = \hat{b}_{it}(\epsilon_{it})$. Independent of history.
- Intermediaries break even in expectation each period:

$$\int_{\epsilon} \hat{b}_{it}(\epsilon) dH(\epsilon) = b_{it}(1 + r_t)$$

However:

- Entrepreneur's realisation of ϵ_{it} is private information.
- Entrepreneur can falsely under-report ϵ_{it} and can secretly hide intermediate goods and convert into units of consumption.

Agency Frictions

- For each unit of intermediate goods the entrepreneur hides, she can convert this into $\rho_E \in (0, F'_{k_E}(\infty))$ units of consumption.

- As a consequence, financial contract must satisfy the following incentive compatibility constraint:

$$\frac{\partial \hat{b}_{it}(\epsilon_{it})}{\partial \epsilon_{it}} \leq (1+\tau_C)\rho_E \frac{\partial y_{it}(\epsilon_{it})}{\partial \epsilon_{it}}$$

or, equivalently,

$$\frac{\partial c_{it}(\epsilon_{it})}{\partial \epsilon_{it}} + \left(\frac{1}{1+\tau_C}\right)\frac{\partial I_{it}(\epsilon_{it})}{\partial \epsilon_{it}} \geq \rho_E \frac{\partial y_{it}(\epsilon_{it})}{\partial \epsilon_{it}}$$

Tax Evasion

- Furthermore, at start of period, entrepreneur can convert one unit of capital directly into $\rho_F < 1 - \delta$ units of consumption .
  - Unobserved by government.
  - Allows entrepreneur to evade taxes.
  - Has no effect on decisions provided taxes are not too high.
- Effective upper bound on taxes:

$$\frac{(1 + r_F - \delta)(1 - \tau_K) + \tau_K - \tau_W}{1 + \tau_C} \geq \rho_F$$

Entrepreneur's Problem

Entrepreneur chooses $c_{it}(\epsilon), b_{it}, \hat{b}_{it}(\epsilon), k_{it}^{E}, k_{it}^{F}$ to solve:

$$\sup \mathbf{E} \sum_{t} \beta^{t}(1-\gamma)^{t} u(c)$$

subject to:

- Budget constraints.
- Capital law of motion.
- Intermediary breaks even in expectation.
- Incentive compatibility constraint.

Entrepreneur's Optimal Decisions

- Optimal decisions can (almost) be written in closed form.

- For $\theta_{it} \leq \tilde{\theta}_t$, entrepreneur only participates in risk-free sector:
  - puts capital in risk-free sector and lends to intermediaries.

- For $\theta_{it} > \tilde{\theta}_t$, entrepreneur participates in risky sector:
  - $k_{it}^E = k_{it}\tilde{k}_t^E(\theta_{it})$, where $\tilde{k}_t^{E\prime}(\theta_{it}) > 0$.
  - $c(k_{it}) = \underline{c}_{it} + \rho_E y_{it}$

- Interpretation: equity and debt.
  - Entrepreneur sells fraction $1 - \frac{\rho_E(1+\tau_C)}{(1-\tau_K)r_t^E}$ 'equity' of her output.
  - keeps fraction $\frac{\rho_E(1+\tau_C)}{(1-\tau_K)r_t^E}$ for herself.
  - takes out a (risk-free) loan from the intermediary.

Effect of Agency Frictions

- Agency friction $\Rightarrow$ entrepreneur cannot fully diversify risk:
  $\Rightarrow$ discourages from choosing high k_{it}^E.

- Entrepreneurs must receive fraction ρ_E of return to k_{it}^E
  - So entrepreneurs must contribute to cost of k_{it}^E.

  $\Rightarrow$ Entrepreneurs' k_{it}^E constrained by their wealth.

- Taxes affect k_{it}^E by affecting rate of return **and wealth**.
  - Substitution and wealth effects of taxation on capital allocation.

Factor Prices

- Final goods producers maximise profits:

$$r_t^E = F_1'(Y_t^E, Y_t^F, N)$$

$$r_t^F = F_2'(Y_t^E, Y_t^F, N)$$

$$w_t = F_3'(Y_t^E, Y_t^F, N)$$

Equilibrium

An equilibrium is a sequence of prices and allocations such that:

- Entrepreneurs' choices solve their optimisation problems.
- K_E, K_t^F, Y_t^E, Y_t^F represent aggregate of entrepreneur decisions.
- Final goods producers maximise profits.
- Financial Markets Clear: $\int_i b_{it} = 0$.
- Government budget balances:

$$G = \tau_N wN + \tau_K(r_E Y_E + r_F K_F + (1-\delta)K) + (\tau_W - \tau_K)K + \tau_C C$$

Effects of Taxes

- Taxes affect both level and allocation of capital stock.
- In particular, taxes affect:
  - How much entrepreneurs save.
  - How much entrepreneurs allocate capital to the risky sector, K_E, versus the risk-free sector, K_F.
  - How much capital in the risky sector is held by high θ entrepreneurs.
- From growth accounting perspective:
  - Taxes affect aggregate TFP and K.

Effects of Taxes: Comparative Statics

- Effects of tax changes on aggregate TFP depend entirely on the elasticity of Y_E and K_E with respect to tax changes, holding fixed K.

- For example

$$\frac{(1-\tau_K)}{Y_E}\frac{\partial Y_E}{\partial(1-\tau_K)} \equiv e_K^\star$$
$$\frac{(1-\tau_K)}{K_E}\frac{\partial K_E}{\partial(1-\tau_K)} \equiv e_K$$
$$\frac{(1-\tau_W)}{Y_E}\frac{\partial Y_E}{\partial(1-\tau_W)} \equiv e_W^\star$$

- $e_W, e_C^\star, e_C$ can be defined analogously.

Effects of Taxes: Comparative Statics

- These elasticities can be partially characterised using:

$$K_E = \int_\theta K \tilde{k}_E(\theta) dG(\theta)$$

$$Y_E = \int_\theta K \theta \tilde{k}_E(\theta) dG(\theta)$$

- $e_K^\star, e_K$ are large (in absolute value).
- $e_W^\star, e_W, e_C^\star, e_C$ are smaller. Always < 1.

Government's Problem

- Government chooses:
  - tax rates $\tau_C, \tau_K, \tau_W, \tau_N$.
  - an equilibrium $\mathcal{E}$ consistent with these tax rates.
- Government seeks to maximise steady state value of:

$$\mathcal{W} = (1 - \Gamma)U(c_N) + \Gamma \int_i u(c_i)di$$

- Focus on $\Gamma = 0$ (Rawlsian) case. Results are similar for small enough $\Gamma > 0$.

Optimal Tax Scheme without Financial Frictions

- **Proposition:** *If $\rho_E = 0$, then the government's optimal tax policy satisfies:*
  - τ_C at highest possible level consistent with no tax evasion.
  - Any $\tau_K < 1, \tau_W$ is optimal if:

$$\tau_W = (\bar{r} - \delta)(1 - \tau_K) - \left(\frac{1}{\beta(1-\gamma)} - 1 \right)$$

- **Intuition:** In the absence of financial frictions, no allocative inefficiency so:
  - Taxing capital income and wealth are equivalent.
  - Taxing consumption is non-distortionary.

Optimal Tax Scheme with Financial Frictions

- **Proposition:** *Suppose that* $\rho_E > 0$ *and that in the steady state* $r_F < \rho_F$ *and at least some entrepreneurs do not participate in the risky sector. Then the government's optimal tax policy satisfies:*
  - τ_C at highest possible level consistent with no tax evasion.
  - $\tau_K = 1 - (1 - \xi)(1 + \tau_C)$
  - $\xi \in \left(0; \frac{(1-\beta(1-\gamma))r_F}{\overline{r}_E - \beta(1-\gamma)r_F}\right)$
  - $\tau_W = (\overline{r} - \delta)(1 - \tau_K) - \left(\frac{1}{\beta(1-\gamma)} - 1\right)$

- Restrictions on the steady state can presumably be relaxed.

Properties of Optimal Tax Scheme

- High consumption taxes are optimal.
  - Provided they are consistent with no tax evasion.

- **Intuition for Result:**
  - $\tau_C \uparrow$ raises a large amount of revenue.
  - $\tau_C \uparrow$ has small effect on both allocation and aggregate K.
  - Entrepreneurs respond much more to changes in τ_K.

    $\Rightarrow$ big increase in τ_C & small cut in τ_K leaves Y unchanged.
  - This generates a lot of revenue, which funds cuts in τ_N
    $\Rightarrow$ optimal.

Rough Calibration

- Based on post-war returns to equity, capital and risk-free rate and taxes in US, set:

$$\begin{aligned} \delta = 7\%; &\quad \bar{r}_E = 5\% + \delta \\ r_F = \delta; &\quad \bar{r} = 4\% + \delta \\ \beta = 0.97; &\quad \rho_F = 0.7(??) \end{aligned}$$

- Calibration implies that:
    - Consumption tax $\simeq$ 35%.
    - Capital income tax $\simeq$ -33%.
    - Wealth tax $\simeq$ 2 % (per year).
    - Results very dependent on ρ_F.

Conclusion

- Study redistributive capital taxation with frictional financial markets.
  - Government seeks to redistribute from entrepreneurs to workers.
- Taxes affect capital allocation and capital stock.
  - Both aggregate TFP and K
- Consumption and wealth taxes preferable to capital income taxes.