Optimal Taxation of Risky Entrepreneurial Capital

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April 12, 2022

Motivation

- Optimal 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?
  - Wealth concentrated among poorly diversified business owners.
  - Do capital taxes discourage entrepreneurial activity/risk taking?

This Paper

- Analytically tractable framework to look at these issues.
- Optimal linear capital taxation in a setting with...
  - Workers (who supply labor).
  - Entrepreneurs (who use capital and labor to produce output).
- Government maximizes steady state utility of newborn agent.
  - Chooses tax rates on: capital income; labor income; wealth.
- Financial markets are frictional:
  - Due to asymmetric information.
  - Entrepreneurs bear idiosyncratic risk.
  - Entrepreneurs must fund investment partly from own assets.

Preview of Results

- Taxes affect capital allocation, capital stock and entry.
- Optimal taxes in steady state can be expressed as functions of 'sufficient statistics'.
- Capital income and wealth taxes are not equivalent
  $\because$ Different agents earn different returns to capital.
- Calibrated model:
  - Capital income tax $= 3.7\%$.
  - Wealth tax $= 0.2\%$.
  - Labor income tax $= 28.0\%$.
- Negligible (0.4% CEQ) welfare gains from moving from status quo.

Related Literature

- **Taxation of entrepreneurial capital:** Albanesi (2011), Shourideh (2014), Panousi (2015), Cagetti and di Nardi (2009), Guvenen, Kambourov, Kuruscu, Ocampu-Diaz & Chen (2018).

- **Optimal taxation with financial market imperfections:** Biljanovska and Vardoulakis (2017), Abo-Zaid (2014), Itskhoki and Moll (2018).

- **Optimal capital taxation – sufficient statistics approach:** Piketty and Saez (2013), Saez and Stantcheva (2018).

Agents

Continuum of three types of agent:

- **Households:**
  - **Entrepreneurs:** Own capital and produce intermediate goods.
  - **Workers:** Supply labour.
- **Competitive Firms:**
  - **Financial intermediaries:** Allocate finance between entrepreneurs.

Government levies taxes on agents and funds government spending G.

Demographics and Preferences

- Fraction γ of entrepreneurs and workers die at end of period.
  - Replaced by newborn agents who choose occupation for life.
- Agent i's lifetime utility : $\sum_{t=0}^{\infty}(1-\rho)^t(\log(c_{i,t}) + z_{i,j})$.
  - $z_{i,j}$: i's disutility of working in occupation j.
    - Normalize $z_{i,N} = 0$ for being a worker.
    - $z_{i,E}$ drawn at birth from distribution H_z.
      $\Rightarrow$ determines occupational choice.
- Agents can hold annuities, paying return $\frac{1}{1-\gamma}$ between periods.

Production Technology

- In each period $t = 1, ...,$ each entrepreneur i:
  - uses some capital (k_{it}^E) to produce $y_{i,t}^E$ intermediate goods (risky)
  - uses remainder (k_{it}^F) to produce $y_{i,t}^F$ intermediate goods (risk-free)
  - Produce final goods according to $y_t = f(y_t^{E,d}, y_t^{F,d}, n_t^d)$.
    - $f(\cdot)$ displays CRS.
  - Pay each factor its marginal product, $r_{E,t}, r_{F,t}, w_t$ (profit maximization).

Workers

- Each worker supplies 1 unit of labor to entrepreneurs.
- Workers maximize lifetime utility.
- Subject to: the following budget constraint:

$$c_{i,t}^N + (1-\gamma)a_{i,t+1}^N = w_t(1-\tau_{N,t}) + R_{F,t}a_{i,t}^N.$$

Entrepreneurs

- Entrepreneurs vary in ability $\theta_{i,t}$.
  - Publicly observable. Drawn at birth from $U(0,1)$.
  - Draws new $\theta_{i,t}$ each period with prob. λ_θ.
- Entrepreneur i starts period with k_{it} units of capital. Chooses k_{it}^E, k_{it}^F.
- After choosing k_{it}^E, k_{it}^F, entrepreneur i draws shock $\xi_{it} \sim N(0,1)$.
  - Shock changes stock $k_{i,t}^E \to \tilde{k}_{E,i,,t} = q(\theta_{i,t}, \xi_{i,t}, k_{E,i,t})$.
- Entrepreneur's output of intermediate goods given by:
  $$y_{it}^E = \tilde{k}_{i,t}^E, \quad y_{it}^F = k_{it}^F.$$

Entrepreneurial Risk

$$\tilde{k}_{E,i,t} = k_{E,i,t} + (1-\underline{\epsilon})\left(\exp\left(\frac{\varphi\xi_{i,t}}{\sqrt{\theta_{i,t}}} - \frac{\varphi^2}{2\theta_{i,t}}\right) - 1\right)\max\left\{k_{E,i,t} - \underline{k}_E; 0\right\}$$

- Functional form implies:
  - $\frac{\partial \tilde{k}_{E,i,t}}{\partial \xi_{i,t}} > 0; \quad E[\tilde{k}_{E,i,t}] = k_{E,i,t}.$
  - Variance increases more than proportionately in scale.
    - Limits size of risky projects.
  - Variance decreasing in $\theta_{i,t}$.
    - High θ entrepreneurs can run larger risky projects for given risk. $\Rightarrow$ earn higher average return to capital in equilibrium.

Entrepreneur Budget Constraints (I)

- 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_W.
  - Divides remaining resources between consumption and investment.

Entrepreneur Budget Constraints (II)

- Entrepreneur i faces the following budget constraints:

$$\begin{aligned} k_{E,i,t} + k_{F,i,t} = k_{i,t} = & \quad a_{i,t} + b_{i,t}. \\ c_{i,t} + (1-\gamma) a_{i,t+1} + \hat{b}_{i,t} = & \quad (1-\delta)\left(\tilde{k}_{E,i,t} + k_{F,i,t}\right) \\ & \quad + \pi_{i,t} - T_{i,t}, \end{aligned}$$

where

$$\pi_{i,t} = r_{E,t}\tilde{k}_{E,i,t} + r_{F,t}k_{F,i,t},$$

$$T_{i,t} = \tau_{K,t}\pi_{i,t} - \tau_{K,t}\delta k_{i,t} + \tau_{W,t}k_{i,t},$$

Financial Contract

- Entrepreneur writes one-period contract with intermediary.
  - Contract specifies b_{it} & state contingent $\hat{b}_{it}$.
  - Maximizes entrepreneur's expected present discounted utility subject to constraint that intermediary breaks even.

However:

- Entrepreneur's realization of ξ_{it} is private information.
- Entrepreneur can falsely under-report ξ_{it} and can secretly hide capital and convert into units of final output.

Agency Frictions

- For each unit of capital the entrepreneur hides, she can convert this into $\phi \in (0, 1)$ units of consumption.

$\therefore$ Financial contract must satisfy incentive compatibility constraint:

$$\frac{\partial \hat{b}_{it}}{\partial \xi_{it}} + \frac{\partial T_{i,t}}{\partial \xi_{it}} \leq (1 - \phi) \cdot \frac{\partial}{\partial \xi_{it}} \left(\pi_{it}(\xi_{it}) + \xi_{i,t}(1 - \delta) k_{it}^{E} \right)$$

Equilibrium Optimal Contract

- Entrepreneur's optimal contract with intermediary is equity and debt:
  - Entrepreneur sells fraction $1 - \frac{\phi}{r_E(1-\tau_K)+(1-\delta)}$ 'equity' in her k_E.
  - Takes out risk-free loan from intermediary of value $R_F^{-1}\underline{\epsilon}k_{it}^E$.

- Agency friction $\Rightarrow$ entrepreneur cannot fully diversify risk:

  $\Rightarrow$ discourages from choosing high k_{it}^E.
  - Entrepreneur's k_{it}^E depends on initial wealth.
  - Taxes affect k_{it}^E by affecting rate of return and wealth.

Aggregate Effects of Taxes

- Taxes affect both level and allocation of capital stock.
- In particular, taxes affect:
  - How much entrepreneurs save.
  - Fraction of wealth held by high ability entrepreneurs.
  - How much these entrepreneurs allocate capital to the risky technology, K_E, versus the risk-free technology, K_F.
  - How many agents become entrepreneurs.
- From growth accounting perspective:
  - Taxes affect aggregate K, N and TFP.
    - These effects can be characterized analytically.

Optimal Tax Scheme

- Assume govt. maximizes SS newborn expected lifetime utility.
- Optimal taxes can be written as a function of:
  - Tax base of each tax,
  - How much tax is paid by workers.
  - Elasticities of tax base with respect to taxes.
- Formula does not directly depend on:
  - Details of production function, utility function, entrepreneur ability distribution, agency friction.
  - But these specific assumptions allow us to characterize elasticities.

Optimal Tax Formula

$$\mathcal{T} = \left(I - g_1 + B^{-1}\left(-\mathcal{E} + \mathbf{e}^N \mathbf{1}^T\right) B\right)^{-1} \left(\mathbf{1} - \mathbf{g}_2 + B^{-1}\overline{G}\mathbf{e}^N\right),$$

$$\begin{aligned}
B &= \begin{pmatrix} B_{\tau_K} & 0 \\ 0 & B_{\tau_W} \end{pmatrix}, \quad B^N = \begin{pmatrix} B^N_{\tau_K} & 0 \\ 0 & B^N_{\tau_W} \end{pmatrix}, \quad \mathcal{E} = \begin{pmatrix} \overline{e}^{B_{\tau_K}}_{\tau_K} & \overline{e}^{B_{\tau_W}}_{\tau_K} \\ \overline{e}^{B_{\tau_K}}_{\tau_W} & \overline{e}^{B_{\tau_W}}_{\tau_W} \end{pmatrix}, \\
g_1 &= I - \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} (I - B^{-1}B^N) - \left(e^N_{\tilde{w}}\right)^{-1} (1 - N)\, B^{-1}\mathbf{e}^N \mathbf{1}^T B, \\
\mathbf{g}_2 &= \left(B^{-1}B^N\right)\mathbf{1} + \left(B_{\tau_N} - \overline{G}\right)\left(e^N_{\tilde{w}}\right)^{-1} (1 - N)\, B^{-1}\mathbf{e}^N.
\end{aligned}$$

- Higher elasticities $\Rightarrow$ bigger $\mathcal{E} \Rightarrow$ smaller τ_K, τ_W.
- Elasticities are partial equilibrium (ignore price changes).
  - But include changes to SS wealth distribution.

Calibration

- Set parameters to target:
  - Standard real economy macro moments (e.g. labor share).
  - ROR of equity; risk-free rate; debt-to-asset ratio; equity issuance; small business risk; profitability autocorr.; frac. of entrepreneurs.
  - Set initial taxes on capital income, wealth and consumption to approximate current US values.

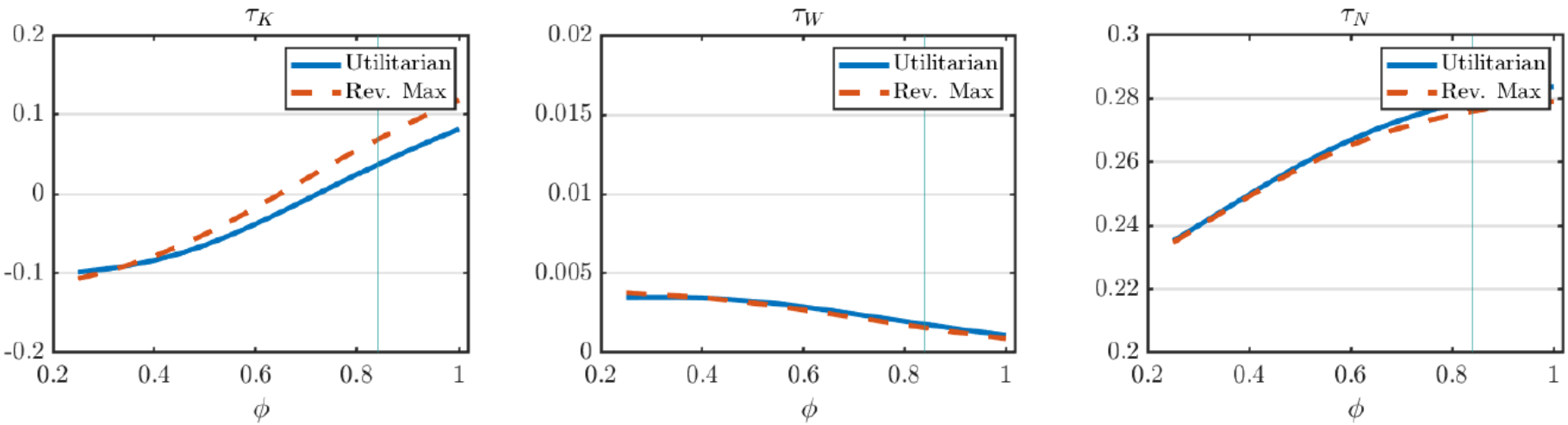
- Calibration implies optimal $\tau_K = 3.7\%$, $\tau_W = 0.2\%$, $\tau_N = 28.0\%$.
  - If govt. only cares about workers, $\tau_K = 20\%$, $\tau_W = 0\%$, $\tau_N = 26.2\%$.

  - Intuition: Much tax on capital income falls on low θ entrepreneurs.
    - $\Rightarrow$ reduces negative effect of these taxes on capital accumulation.
    - Capital accumulation is more sensitive to wealth taxes.
    - BUT, capital taxes hurt poorer entrepreneurs.

Calibration Table

Optimal Taxes

Figure 1: Optimal Taxes and Financial Frictions



- ROS ↑: opt. τ_K ↑.
- Entry elasticity ↑: opt. τ_K ↑, opt. τ_W ↓.
- Opt. taxes not strongly affected by ability persistence.

Conclusion

- First analytically tractable framework combining:
  - Inequality between heterogeneous capital owners and workers.
  - Misallocation of capital due to endogenous financial frictions.
- Taxes affect capital allocation, capital stock and entry.
  - Nevertheless, optimal taxes are a function of sufficient statistics.
- Capital income and wealth taxes are not equivalent.
- Optimal capital income tax positive, lower than labor tax.
  - Elasticity of cap. income to tax lower than in Chamley-Judd.

Calibration

Parameter	Value used	Target moment
γ	0.010	Lifespan 100 Years
ρ	0.009	Average net return to capital 4%
δ	0.070	Depreciation
λ_θ	0.115	Profitability autocor. (Cooper and Haltiwanger, 2006)
φ	0.150	Small Bus. Risk (Panousi, 2012)
$\underline{\epsilon}$	0.350	Debt-to-asset ratio (Boar and Midrigan, 2019)
α_E	0.193	Labor share 2/3
α_F	0.137	Risk-free rate
α_N	0.602	Fraction of entrepreneurs (Boar and Midrigan, 2020)
π	0.016	Return to Equity
τ_K	0.200	Corp. tax rate small businesses (OECD Tax Database)
τ_W	0	Current US level
$\bar{G}$	0.200	Govt. spending/GDP
ϕ	0.840	Small Bus. Owner Equity Share (SSBF)

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