On the Optimality of Differential Asset Taxation[1]

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[1] The views stated herein are those of the author and are not necessarily those of the Federal Reserve Bank of Cleveland or the Board of Governors of the Federal Reserve System.

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Motivation

Income in optimal taxation studies typically:

- labor (wage, salaries, etc); or
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This paper studies optimal taxation of savings and business income where:

1. business income risky, undiversifiable, and subject to misreporting.
2. only some individuals have ability to run businesses.

Results and overview

Findings:

1. optimal taxes on profits and savings *linear*;
2. savings tax on entrepreneurs > savings tax on workers.
3. sign of savings tax *ambiguous*.
4. profits tax depends only on agency friction.

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Outline:

1. Principal-agent model.
2. Stationary efficient allocations.
3. Decentralization with taxes on savings and business income.
4. Numerical examples.

Environment

Time is continuous and extends indefinitely.

Risk-neutral principal contracts with risk-averse entrepreneur.

Both discount at $\rho > 0$ and live forever.

Preferences of entrepreneur over consumption c:

$$U^A(c) := \mathbb{E}\left[\rho \int_0^\infty e^{-\rho t} \ln c_t dt\right].$$

Preferences of principal over consumption c and output Y:

$$U^P(k, c) := \mathbb{E}\left[\int_0^\infty e^{-\rho t}[dY_t - c_t dt]\right].$$

Technology

CRS function of capital with MPK Π.

Two agency frictions. Agent can:

1. misreport output $s_t k_t dt$ and consume fraction $\phi \in (0,1)$ every instant;
2. abscond with fraction $\iota \in (0,1)$ of k_t thereafter trading bond with price ρ.

Output net of borrowing costs $\rho + \tau_I$ evolves according to

$$dY_t = (\Pi - \rho - \tau_I - s_t)k_t dt + \sigma k_t dB_t \tag{1}$$

Both Π and τ_I exogenous:

- later determined by resource constraints and welfare weights.

Allocations and Incentive compatibility

Consumption and capital can depend on whole path of output.

(formal: path space $(C[0,\infty), (\mathcal{F}_t)_{t\geq 0}, P)$ where $P =$ Wiener measure)

Definition

Allocation is a triple $(k, c, \tilde{s})$ of $\mathcal{F}$-adapted processes on $C[0,\infty)$ while a strategy is a single $\mathcal{F}$-adapted process s on $C[0,\infty)$.

Strategy unobservable so allocation must be incentive compatible.

Utility from adhering to strategy s is

$$U^A(k, c, \tilde{s}; s) := \mathbb{E}^s\left[\rho \int_0^\infty e^{-\rho t} \ln(c_t + \phi s_t k_t) dt\right].$$

Allocations and Incentive compatibility

Associated with allocation $(k, c, \tilde{s})$ and strategy s is the utility process

$$W_t := \mathbb{E}^s \left[\rho \int_t^\infty e^{-\rho(t'-t)} \ln(c_{t'} + \phi s_{t'} k_{t'}) dt' \middle| \mathcal{F}_t \right].$$

Utility from absconding with k and trading bond at ρ is $W = \ln(\rho k)$.

$\implies$ additional constraint $k_t \leq \omega e^{W_t} =: (\iota\rho)^{-1} u_t$.

Definition

An allocation $(k, c, \tilde{s})$ is incentive-compatible if

$$U^A(k, c, \tilde{s}; \tilde{s}) \geq U^A(k, c, \tilde{s}; s)$$

for all strategies s and if $k_t \leq \omega e^{W_t}$ holds for all $t \geq 0$.

Heuristic characterizations: homogeneity and perturbation

1. Homogeneity: for any $\lambda > 0$, $(k, c) \in \mathcal{A}(u)$ iff $(ke^{\lambda}, ce^{\lambda}) \in \mathcal{A}(\lambda u)$.

Objective homog. of degree 1 $\implies$ value and policy functions linear in u.

Policy functions reduce to scalars $\overline{c}$ and $\overline{k}$.

2. Perturbation argument:
   - if allocation efficient, cannot perturb in IC manner and increase profits.
   - variation of Rogerson (1985) applicable $\implies$ inverse Euler equation.

Main result from partial equilibrium setting

Two caveats:

- arbitrage possible for some parameters;
- above perturbation may violate no-absconding constraint.

Irrelevant if excess return small.

Proposition

Principal's problem finite-valued iff $S := (\Pi - \rho - \tau_I)/(\sqrt{\rho}\phi\sigma)$ *is sufficiently small. Further, consumption volatility increasing in* S *whenever well-defined.*

Wedge on bond positive; wedge on capital ambiguous, but smaller than bond.

Stationary efficient allocations

Unit mass continuum of agents who discount at ρ_S and die at ρ_D:

- preferences as above with $\rho := \rho_S + \rho_D$.

Fraction $1 - \psi \in [0, 1]$ capable of running firm. Remainder can only work.

All agents endowed with L units of labor. Supplied inelastically.

Technology now CRS in capital and labor. Agency frictions as above.

If capital k and labor l assigned to entrepreneur output is

$$dY_t = \left(Ak_t^{\alpha} l_t^{1-\alpha} - \delta k_t - s_t k_t\right) dt + \sigma k_t dB_t.$$

Feasibility

Incentive constraints:

- diversion and no-absconding as in partial equilibrium; and
- need to give entrepreneurs incentive to reveal themselves.

Definition

Allocation A is resource feasible given K if $K_0 = K$, and for all $t \geq 0$,

$$C_t(A) + \dot{K}_t(A) \leq Y_t(A)$$
$$L_t(A) \leq L.$$

Allocation is incentive feasible if resource feasible and incentive-compatible.

Planner weights only workers and values flow utility independent of date of birth.

(equiv. to welfare weight of $e^{-\rho_s T}$ on Tth generation)

Characterization of efficiency

Restrict attention to stationary solutions.

Relaxation argument:

1. suppose planner could trade intertemporally at ρ_S;
2. evolution of capital now replaced with "present value constraint";
3. if for some initial distributions:
   - planner does not wish to trade; and
   - allocation stationary; then

   the present value constraint $\implies$ resource constraints.

For fixed Π and r problem identical to principal-agent problem.

$\implies$ reduces to finding Π s.t. resources balance in steady state.

Decentralization

Market structure and taxes/transfers must respect info asymmetries.

1. Profits tax levied on *reported* profits.
2. Transfers/taxes can depend on type *if* entrepreneurs get more utility.

Asset structure:

- all agents trade risk-free bond in zero net supply.
- entrepreneurs subject to collateral constraints.
- all agents may insure away longevity risks.

Agent problems

MPK depends on wage: $\Pi(w) := \max_{l\geq 0} Al^{1-\alpha} - wl - \delta$.

Definition

Given wage w, interest rate r and collateral constraint $\hat{\omega}$, problem of entrepreneur with assets a and human wealth h_E facing taxes τ_{sE} and τ_{Π} is

$$
\begin{aligned}
V_E(a) &= \max_{(c_t,k_t,s_t)_{t\geq 0}} \mathbb{E}\left[\rho \int_0^\infty e^{-\rho t} \ln(c_t + \phi s_t k_t) dt\right] \\
da_t &= [r_E a_t - c_t + (1-\tau_{LE})wL]dt + (1-\tau_{\Pi})k_t dR(s_t)_t \\
k_t &\leq \hat{\omega}(a_t + h_E) \\
0 &\leq a_t + h_E
\end{aligned}
$$

where $dR(s_t)_t = (\Pi(w) - r - s_t)dt + \sigma dB_t$, $h_E := (1-\tau_{LE})wL/r_E$ and r_E is after-tax return on savings.

Solution to entrepreneur's problem

No diversion iff $\tau_\Pi \leq 1 - \phi$.

Standard portfolio problem $\implies$ policy functions linear in total wealth:

$$c(a) = \rho(a + h_E) \qquad\qquad k(a) = \frac{\Pi - r}{\sigma^2(1 - \tau_\Pi)}(a + h_E).$$

If collateral constraint does not bind,

$$\sigma_c = \sigma(1 - \tau_\Pi)\overline{k} = \frac{\Pi - r}{\sigma}.$$

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Intuition? Domar and Musgrave (1944) effect:

- profits tax makes government "partner in business".

$\implies$ profits tax *shares risk*.

Main results: decentralization

Proposition

Stationary efficient allocation implemented as equilibrium with:

- *profits tax* $\tau_\Pi = 1 - \phi$.
- *(after-tax) return on savings s.t. consumption is martingale:*

$$(1 - \tau_{sE})(r + \rho_D) = \rho(1 - \hat{x}^2)$$
$$(1 - \tau_{sW})(r + \rho_D) = \rho$$

  where $\sqrt{\rho}\hat{x} =$ *volatility of consumption growth.*
- *transfers chosen s.t. all agents obtain same utility.*
- *interest rate* $r = \hat{\Pi} - \sqrt{\rho}\sigma\hat{x} \implies$ *risk premia at efficient level.*

Proof sketch

Efficient and eq. allocations *completely* characterized by:

- capital stock, initial consumption levels;
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$\implies$ choose transfers/taxes to make these match.

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Interest rate: equate efficient and eq. "skin-in-the-game"

$$\frac{\Pi - r}{\sigma} = \sigma_c = \sqrt{\rho}\hat{x} = \text{efficient risk.}$$

Taxes: zero mean return on total wealth (Rogerson condition)

$$0 = \text{return on savings} - \text{consumption} + \text{profits.}$$

Example

Technological and preferences parameters:

$$(\alpha, \sigma, \rho_S, \rho_D, \delta) = (0.33, 0.2, 0.035, 0.025, 0.05) \tag{2}$$

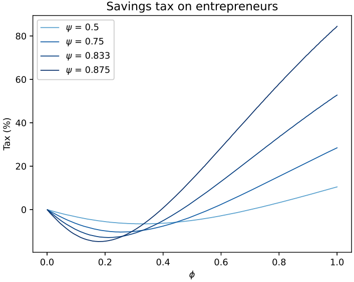
α, δ and σ standard (low end of typical ranges).

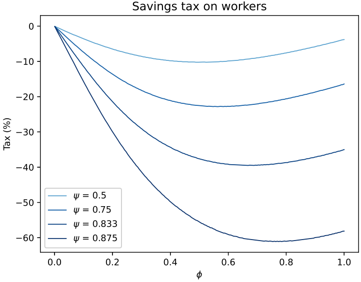
ρ_D corresponds to working lifetime $\approx$ 40 years.

I consider sensitivity with respect to:

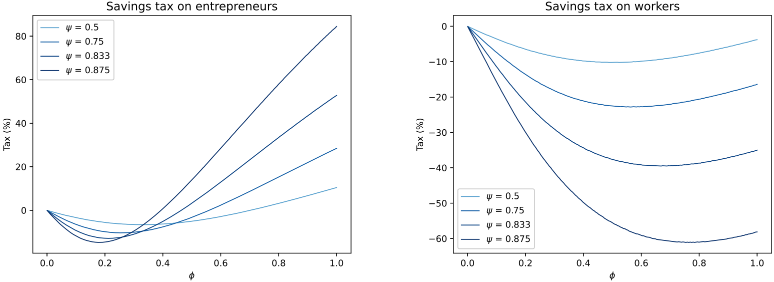
- agency frictions: ϕ (and $\iota = \phi\bar{\iota}$ for fixed $\bar{\iota}$).
- workers per entrepreneur (effectively varies MPK).

Taxes on savings





Taxes on savings



Rise in ϕ or workers/entrepreneur $\implies$ rise in MPK:

- $\implies$ higher distortions on entrepreneurs.

Incomplete markets $\implies$ $r < \rho_S$:

- worker savings subsidized; tax on entrepreneurs sometimes negative.

Taxes on savings

Why so large?

Taxes on savings

Why so large?

Key point: total return on capital $\neq$ return on savings.

Expected return on total wealth:

$$\text{return on savings} + \text{return on private business} - \text{consumption} = 0.$$

i.e. expected *total* return identical to full-information case.

As agency frictions rise:

- MPK and business income $\uparrow$;
- $\implies$ interest income $\downarrow$.

Conclusion

Model with heterogeneous sources and returns on capital income.

Key findings:

- Optimal taxes linear (but type-specific).
- Savings tax on entrepreneur $>$ savings tax on workers.
- Profits tax *shares risk* and depends only on severity of agency frictions.
- Total expected return on capital same as in full information case.
- Total return on capital $\neq$ return on savings:
  - business income greater fraction of return as frictions rise.

Perturbation details

Log preferences $\implies$ (k, c) is IC iff $(\eta k, \eta c)$ is IC for any deterministic η.

Suppose (k, c) is efficient and for any real z and positive t_0, t_1 and dt define

$$\eta_t(z) = \begin{cases} e^z & \text{if } t \in [t_0, t_0 + dt] \\ e^{-ze^{\rho(t_1 - t_0)}} & \text{if } t \in [t_1, t_1 + dt]. \end{cases}$$

Change in utility $\approx \rho[e^{-\rho t_0} - e^{-\rho t_1} e^{\rho(t_1 - t_0)}] z dt = 0.$

Change in profits $\approx (\Pi - \rho - \tau_I)[e^{-\rho t_0} k_{t_0} e^z + e^{-\rho t_1} \mathbb{E}[k_{t_1}] e^{-ze^{\rho(t_1 - t_0)}}] dt.$

Marginal change at $z = 0$ vanishes if $k_{t_0} = \mathbb{E}[k_{t_1}]$.

k/c constant by homogeneity argument $\implies$ $c_{t_0} = \mathbb{E}[c_{t_1}]$.

Distortions in partial equilibrium (wedges)

Definition

Given asset A with return R^A, wedge ν^A defined by

$$u'(c_0) = e^{-\rho t}\mathbb{E}[e^{-\nu^A t} R_t^A u'(c_t)].$$

Proposition

If no-absconding inequality strict wedges on capital ν^K and bond ν^B satisfy:

1. $\nu^B \geq 0$;
2. $\nu^B - \nu^K \geq 0$ *and increasing in* Π;
3. ν^K *may be positive or negative.*