Ramsey Asset Taxation
Under Asymmetric Information

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Asset Taxation and the Financial System

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  - US and UK are mainly *market based*;
  - Japan and Germany are more *intermediary based*. 
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- We show that the **taxation of financial assets** crucially depends on the **structure of the financial market**, and how
Asset Taxation and the Financial System

Consider competitive (Walrasian) asset/insurance markets with moral hazard (hidden effort)
- Agents can trade in markets for credit and contingent claims
- Agents’ trades are non-observable (non exclusivity)
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- Examine properties of allocations and optimal taxes, and how they vary with the structure of financial system:

  1 - Development/Richness of the Financial Market
  ⇒ whether private insurance attainable by trading in markets
  2 - Presence of Primary Insurer/‘Bank’
  ⇒ whether insurance can be provided via long-term contracts
Model
Basic Economy

- 2-period economy, only idiosyncratic risk (for exposition)
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  - $\tilde{y}_1$ independent across all consumers, with support $y_1 < \ldots < y_S$; $\pi_s(e) := \Pr\{\tilde{y}_1 = y_s \mid e\}$ for $e \in E$
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  - additive separable preferences:

\[
u(c_0) + \beta \sum_{s=1}^{S} \pi_s(e) u(c_s) - v(e)\]
Financial Market

Asset Markets are perfectly competitive, for

i) - riskless bond: price $q$
Introduction
Basic Economy
Underdeveloped Financial Market
Primary Insurers
Developed Financial Market
Conclusion

Financial Market

Asset Markets are perfectly competitive, for

i) - riskless bond: price $q$

ii) - claims contingent on each individual state $s \in S$:
     (Standardized Arrow securities)
Financial Market

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i) - riskless bond: price \( q \)

ii) - claims contingent on each individual state \( s \in S \):

(Standardized Arrow securities)

- (moral hazard) individual effort \( e \) private information to the agent, while the realization of individual state \( s \) is observable by his ‘trading partners’

- (Bid-Ask spread) prices linear in trades (non exclusivity), with different price for buying (+) and selling (-): \( q_s^+, q_s^- \)

(needed for viability of markets, Bisin-Gottardi (’99))

In the Financial Market also operate Firms:
- produce good at date 1 with technology \( F(k) \),
- trade in the asset market (for insurance and credit)
Taxes and Government Information

1. No public production or consumption (no ‘need’ to tax).
2. Linear, anonymous taxes on each of the existing assets: \( \tau_k, \tau_s \) (government only need to observe consumers’ aggregate net trades in each market)
Taxes and Government Information

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2. Linear, anonymous taxes on each of the existing assets: $\tau_k, \tau_s$ (government only need to observe consumers’ aggregate net trades in each market)
3. Lump sum taxes/transfers $T_0, T_{1,s}$

No Public Insurance: We assume Gov’t does not observe individual income realizations, hence $T_{1,s} = T_1$ for all $s$
Households’s choice problem

\[ U(T, \tau, q) := \max_{c, e, \theta^h, \{a_s^h, b_s^h\}_s} u(c_0) + \beta \sum_{s=1}^{S} \pi_s(e) u(c_s) - v(e) \]

s.t.

\[ c_0 = y_0 - (1 + \tau_k) q \theta^h - \sum_{s=1}^{S} (1 + \tau_s) \left( q_s^+ a_s^h - q_s^- b_s^h \right) + T_0 + \Pi \]

\[ c_s = y_s + \theta^h + a_s^h - b_s^h + T_1 \]
Firm’s choice problem (CE metaphor, like ‘vending machine’)

\[
\max_{k, \theta_f, \{a^f_s, b^f_s\}_s} \Pi = \sum_s \left( q^+_s a^f_s - q^-_s b^f_s \right) - k - q\theta^f
\]

s.t. \( F(k) \geq \sum_s \left( \pi_s (\hat{e}^+_s) a^f_s - \pi_s (\hat{e}^-_s) b^f_s \right) - \theta^f \)

\( \hat{e}^+_s (\hat{e}^-_s) \): firm’s conjecture over the effort level undertaken by agents whenever they buy (resp. sell) a claim contingent on \( s \)
• **Firm’s choice problem** (CE metaphor, like ‘vending machine’)

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\(\hat{e}_s^+(\hat{e}_s^-)\): firm’s conjecture over the effort level undertaken by agents whenever they buy (resp. sell) a claim contingent on \(s\)

• **Government** budget constraint:

\[
\tau q\theta^h + \sum_s \tau_s \left( q_s^+ a_s^h - q_s^- b_s^h \right) = T_0 + qT_1.
\]
Competitive Equilibrium (C.Eq.)

Definition: A symmetric C.Eq. with taxes $\tau_k, T_0, T_1, (\tau_s)_s$ is:
prices of claims, consumers’ and firms’ optimal choices such that markets clear:

$$a^f_s = a^h_s \quad \text{for all } s$$
$$b^f_s = b^h_s$$
$$\theta^f + \theta^h + T_1 = 0$$

gov’t budget constraint is satisfied, and
firms’ conjectures are correct (for traded claims):

$$q^+_s = q\pi_s (\bar{e}) \quad \text{if } \bar{a}^h_s > 0$$
$$q^-_s = q\pi_s (\bar{e}) \quad \text{if } \bar{b}^h_s > 0.$$
Competitive Equilibrium: properties

Will consider C.Eq. with 'pessimistic' conjectures for non traded claims:

\[
q_s^+ = \max_{e \in E} \pi_s(e) \quad \text{if} \quad \bar{a}_s^h = 0
\]

\[
q_s^- = \min_{e \in E} \pi_s(e) \quad \text{if} \quad \bar{b}_s^h = 0
\]

We provide sufficient conditions for existence of symmetric equil.
What we do

- We investigate the properties of **Ramsey allocations (RA)**: tax schemes such that associated competitive equilibrium maximizes $U$, the welfare of the consumer-entrepreneur.
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- **Constrained Efficient** allocations (C.Eff.): maximize $U$, subject to:
  i) resource feasibility and
  ii) effort IC constraint.
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- Constrained Efficient allocations (C.Eff.):
  maximize \( U \), subject to:
  i) resource feasibility and
  ii) effort IC constraint

- RA are typically not C.Eff.
  This is different from NDPF literature (implement C.Eff.)
Limited Financial Market
Limited Financial Market: No Trades in AS

Justifiable by high severity of moral hazard (simple production)

Definition 1 : \((\pi, E)\) displays full controllability if:
for each \(s \in S\) there is \(\hat{e} \in E\) such that \(\pi_s(\hat{e}) = 1\)
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Lemma 2: Under full controllability, if \(u(\cdot)\) is unbounded above, no contingent claim is ever traded at a competitive equilibrium, only the bond.

Proof: no arbitrage on contingent claims vs. bond requires:

for all \(s\): \((1 + \tau_s)q_s^- \leq 0\) and \((1 + \tau_s)q_s^+ \geq (1 + \tau_k)q\).
Zero Tax on Market Transactions

Proposition 1: Assume only the bond is traded (full-controllab.):

i) If a (symmetric) C.Eq. with zero taxes \((\tau, T) = 0\) exists, it is C.Eff.

ii) If \(u\) is NIARA and \(\pi(\cdot)\) has log-convex CDF, a symmetric C.E. exists for all \(\tau\).

Corollary: Under the above conditions, ‘absent distributional concerns’, the optimal tax on the bond is zero: \(\tau^*_k = 0\).

Benchmark: No pecuniary externalities
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Message: No ’endogenous’ insurance market available. Taxes cannot help sustain incentives/insurance.
Introducing Primary Insurers
Primary Insurers

- We introduce primary lender-insurers
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- They offer long term insurance contracts to consumers
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- We introduce **primary lender-insurers**

- They offer **long term insurance contracts** to consumers

- They act in a regime of **exclusivity**: the consumer cannot buy insurance from two primary insurers
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- Consumers can still (re)-trade in the financial market $\theta^h$
- Primary insurers take taxes and prices (e.g., $q$) as given
Primary Insurer’s Problem

\[ V(\tau_k, T) := \max_{c_0, \{c_s\}_{s=1}^S, \epsilon} u(c_0) + \sum_{s=1}^S \pi_s(\epsilon) \beta u(c_s) - \nu(\epsilon), \]

s.t.

\[ u(c_0) + \beta E_{\pi(\epsilon)} u(c_1) - \nu(\epsilon) \geq u(c_0 - \tilde{q}\hat{\theta}) + \beta E_{\pi(\hat{\epsilon})} u(c_1 + \hat{\theta}) - \nu(\hat{\epsilon}) \]

for all \( \hat{\epsilon} \) and \( \hat{\theta} \);

\[ y_0 + T_0 - c_0 + \Pi + \tilde{q} \sum_s \pi_s(\epsilon) (y_s + T_1 - c_s) \geq 0; \]

where \( \tilde{q} := (1 + \tau_k) q. \)
Ramsey Problem

\[
\max_{\tau_k, T_0, T_1} V(\tau_k, T)
\]
\[
\text{s.t.}
\]
\[
T_0 + qT_1 = \tau \theta(\tau_k, T)
\]

- It does not make sense to change \( q \) by distorting capital
- The level of private savings is under government’s control
- Reactions \( \theta(\tau_k, T) \) to taxes is ICC for government

\[
\theta := c_s - y_s - T_1
\]
Recall financial market is still under-developed as only the bond is traded. Agents can now get insurance via the primary insurer.

Proposition 2: Assume full controllability, and primary insurers

i) $E$ continuum: $\pi(\cdot)$ has log-convex CDF and NIARA

ii) $E$ discrete: If IC binds only wrt one effort level

then at a RA we have $\tau_k^* > 0$. 
Intuition

Positive tax on the asset makes joint deviations (to other effort levels and higher savings) less desirable; recall

\[ u(c_0) + \beta \mathbb{E}_{\pi(e)} u(c_1) - v(e) \geq u(c_0 - \tilde{q}\hat{\theta}) + \beta \mathbb{E}_{\pi(\hat{e})} u(c_1 + \hat{\theta}) - v(\hat{e}) \]
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(ii) Comparing envelope and govn’t FOC w.r.t. \( \tau_k \)

\[ \mu u'(c_0 - \tilde{q} \hat{\theta}) \hat{\theta} + V_0 \frac{\tau_k \theta_k}{1 - \tau_k \theta_0} = 0. \]

where \( \mu > 0 \) is multiplier to the IC effort

Where \( V_0, \theta_0 > 0 \) are derivatives w.r.t. \( T_0 \). And \( \theta_k < 0 \).
RA is not Constrained Efficient: Why?

1. Take the case where FOC is valid (otherwise one instrument for a joint deviation)
2. Primary insurer does not take into account the effect of taxes so wants to front-load consumption as usual
3. To do that, it distorts cross-state consumption to prevent the agent to save despite the front loading
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\[
\frac{\lambda \tilde{q}}{\beta u'(c_s)} = 1 + \mu \frac{\pi'_s(e)}{\pi_s(e)} + \phi \left[ - \frac{u''(c_s)}{u'(c_s)} \right]
\]

where \( \phi > 0 \) is multiplier to the Euler Equation
Developed Financial Market
Developed Financial Market: AS are available

Definition 2: \((\pi, E)\) displays **full-support** (NO Controllability) if for each \(e \in E\): \(1 > \pi_s(e) > 0\) for all \(s\)
Developed Financial Market: AS are available

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- Market for contingent claims may now be active
- Insurance also attainable in the market
Developed Financial Market, NO Primary Insurers

- NO primary insurers (market based financial system)
Proposition 3: Assume \( S = 2 \), two effort, and RA better than both Self-Insurance and \( e = 0 \) with full insurance.

i) If \( u \) is CARA then we always have \( \tau_k^* > 0 \) (tax);

ii) If \( u \) is CRRA with parameter \( \sigma \) then:
   - If \( \sigma < 1 \) we have \( \tau_k^* < 0 \) (subsidy),
   - If \( \sigma = 1 \) we have \( \tau_k^* = 0 \) (zero tax).
   - If \( \sigma > 1 \) we have \( \tau_k^* > 0 \) (positive tax)

iii) We always have \( \frac{1 + \tau_L^*}{1 + \tau_H^*} \geq 1 \)
Intuition

- Sign of the tax $\tau_k^*$ induced by the choice $\hat{\theta}$ vs $\theta$
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- Agent reduces effort $\Rightarrow \Delta \pi_H < 0 \Rightarrow$ buy more insurance
- If new insurance can be obtained exactly by trading $\hat{b}_H$ for $\hat{a}_L$ in period 1, than not need to tax the bond, only $\frac{1 + \tau_L^*}{1 + \tau_H^*} \geq 1$
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- Crucial condition form agents’ BC in period 0:
Intuition

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- If new insurance can be obtained exactly by trading $\hat{b}_H$ for $\hat{a}_L$ in period 1, than not need to tax the bond, only $\frac{1+\tau^*_L}{1+\tau^*_H} \geq 1$
- Crucial condition form agents’ BC in period 0:

$$\frac{\Delta \theta}{\Delta \pi_H} = \frac{1}{q_H + q_L} \left( q_H \frac{\Delta b_H}{\Delta \pi_H} + q_L \frac{\Delta a_L}{\Delta \pi_H} \right).$$

$$\frac{- \Delta b_H}{\Delta \pi_H} >? < \frac{q_L}{q_H} \frac{\Delta a_L}{\Delta \pi_H}$$
Taxes to Ease - Not Close - Financial Markets

- NO primary insurers $\Rightarrow$ insurance only attainable via market

- Optimal taxes ease trades in the markets for contingent claims: RA obtains at C.Eq. with nonzero trades
Taxes to Ease - Not Close - Financial Markets

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- Optimal **taxes ease trades** in the markets for contingent claims: RA obtains at C.Eq. with nonzero trades

*Next Slide*: Example illustrating interaction between markets and government intervention:

RA with nonzero trades and taxes
Primary Insurers in a Developed Financial Market

To avoid tax arbitrage we must set $\tau_s = \tau_k$ for all $s$.

Proposition 4: Assume two effort levels and RA with $e = e_H$

i) If $u$ is CARA or Quadratic then we always have $\tau_k^* > 0$ (tax);

ii) Examples of $\tau_k^* < 0$ (subsidy), with $u$ with high enough prudence.
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ii) Examples of \( \tau_k^* < 0 \) (subsidy), with \( u \) with high enough prudence.

Remark: Again crucial for tax sign the deviation patterns

NB: Here taxes are used to ‘close’ the credit market
Ramsey Allocation

Lemma 3: With primary insurers, and two effort levels

$$\max_{c_0, \{c_s\}_s, e} u(c_0) + \beta \mathbb{E}_\pi(e) u(c_s) - v(e),$$

s.t.

$$\tilde{q} u'(c_0) = \beta \mathbb{E}_\pi(e) u'(c_s);$$

$$u(c_0) + \beta \mathbb{E}_\pi(e) u(c_s) - v(e) \geq u(c_0 - \tilde{q} \hat{\theta}) + \beta u(\mathbb{E}_\pi(\hat{e}) c_s + \hat{\theta}) - v(\hat{e}) ;$$

$$\tilde{q} u'(c_0 - \tilde{q} \hat{\theta}) = \beta u'(\mathbb{E}_\pi(\hat{e}) c_s + \hat{\theta});$$

$$y_0 + T_0 - c_0 + \Pi + \tilde{q} \mathbb{E}_\pi(e) (y_s + T_1 - c_s) \geq 0.$$
Concluding Remarks

- We study **optimal linear taxation of assets** (Ramsey) in presence of moral hazard and limited gov’t information
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- Two main Messages:
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Two main Messages:

1. Asset taxes (distortions) are motivated by need to enhance incentives when insurance is attained at Ramsey allocations
Concluding Remarks

- We study **optimal linear taxation of assets** (Ramsey) in presence of moral hazard and limited gov’t information

- Two main Messages:
  1. **Asset taxes** (distortions) are motivated by need to enhance incentives when insurance is attained at Ramsey allocations
  2. The **sign and nature of taxes** depend on the **structure and development** of the financial system

    - With primary insurers, taxes are used to **close markets**
    - Without them **taxes facilitate incentive compatible trading**