Final presentation – Public Finance
Optimal Taxation with Behavioral Agents
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Introduction

- The literature on Optimal Taxation mostly considers rational and fully optimizing agents
- However, evidence suggest does not always hold
  - Chetty and al. 2009 show that misperception of taxes influences the behavioral responses of agents to taxes
  - Lockwood (2017) shows individual underestimate benefit of work due to present bias
  - Gerritsen (2016) shows the poor work to little and the rich too much
- This paper by Farhi and Gabaix fills this gap in the literature :
- Propose to review the main results on taxation with behavioral agents

Roadmap

1. Introduce behavioural Price Theory model
2. Optimal formula for Ramsey taxation
3. Application to misperception (Chetty, 2009)
4. Optimal formula for Mirrlees taxation
5. Applications to EITC and optimal tax rates at the top
6. If time permits : other applications

Behavioral model

- Standard setting for consumer :
  - Face prices $\boldsymbol{q} = \boldsymbol{p} + \boldsymbol{\tau}$ and income w,
  - Consume according to the demand function $\boldsymbol{c}(\boldsymbol{q}, w)$
  - Experienced utility $u(\boldsymbol{c})$
  - Restriction : need to exhaust budget : $\boldsymbol{c}(\boldsymbol{q}, w) \cdot \boldsymbol{q} = w$
- Difference : $\boldsymbol{c}(\boldsymbol{q}, w)$ does not generally maximize $u(\boldsymbol{c})$

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- Difference : $\boldsymbol{c}(\boldsymbol{q}, w)$ does not generally maximize $u(\boldsymbol{c})$
- Main sufficient statistics for behavioral agents : "behavioral wedge" $\boldsymbol{\tau}^b$

$$\boldsymbol{\tau}^b(\boldsymbol{q}, w) = \boldsymbol{q} - \frac{u_c(\boldsymbol{c}(\boldsymbol{q}, w))}{v_w(\boldsymbol{q}, w)}$$

  - Intuition : Measure of misoptimization

Behavioral model

- Different ways of justifying this ad-hoc formalism :
  - Decision vs. Experienced utility :

$$\boldsymbol{c}(\boldsymbol{q}, w) = \underset{\boldsymbol{c} \text{ s.t. } \boldsymbol{c}\cdot\boldsymbol{q}\leq w}{\operatorname{argmax}} \; u^s(\boldsymbol{c})$$

  - Misperception of prices :

$$\boldsymbol{q}^s(\boldsymbol{q}, w), \; \boldsymbol{c}(\boldsymbol{q}, w) = \boldsymbol{c}^s(\boldsymbol{q}^s, w)$$

  - Mental accounts

$$\boldsymbol{c}(\boldsymbol{q}, w) = \boldsymbol{c}^m(\boldsymbol{q}, \omega(\boldsymbol{q}, w))$$

Behavioral model

- Behavioural version of Roy's identity :

$$\frac{u_{q_j}(\boldsymbol{c}(\boldsymbol{q}, w))}{v_w(\boldsymbol{q}, w)} = -c_j(\boldsymbol{q}, w) - \boldsymbol{\tau}^b(\boldsymbol{q}, w) \cdot \boldsymbol{S}_j^C$$

- Intuition :
  - Envelope Theorem does not apply with behavioural agents
  - Slutsky matrix $\boldsymbol{S}_j^C$
  - $\boldsymbol{\tau}^b(\boldsymbol{q}, w) \cdot \boldsymbol{S}_j^C$: welfare effect of income compensated price change
  - $\boldsymbol{\tau}^b = 0$ yields standard version of Roy's identity

Optimal indirect taxation : Ramsey

- Government sets taxes to maximize social welfare :

$$\max_{\boldsymbol{\tau}} L(\boldsymbol{\tau}) = \sum_h \beta^h v^h(\boldsymbol{p} + \boldsymbol{\tau}, w) + \lambda \sum_h [\boldsymbol{\tau} \cdot \boldsymbol{c}^h(\boldsymbol{p} + \boldsymbol{\tau}, w) - w]$$

- Dual approach of taxation (cf. lecture 1)
- Important notions :
  - Social welfare weight of agent h : β^h
  - Marginal value of public funds λ

Optimal indirect taxation : Ramsey

- Optimal tax formula (Prop 2.1) :

$$\frac{\partial L(\boldsymbol{\tau})}{\partial \tau_i} = \sum_h [(\lambda - \gamma^h) c^{h_i} + \lambda(\boldsymbol{\tau} - \widetilde{\boldsymbol{\tau}}^{b,h}) \cdot \boldsymbol{S}_i^{C,h}] = 0$$

- Important notions :
    - Social marginal utility of income : $\boldsymbol{\gamma}^h = \beta^h + \lambda \boldsymbol{\tau} \cdot \boldsymbol{c}_w^h$
    - Slutsky matrix $\boldsymbol{S}_i^{C,h} = \boldsymbol{c}_{q_j}(\boldsymbol{q}, w) + \boldsymbol{c}_w(\boldsymbol{c}, w) c_j(\boldsymbol{q}, w)$

Optimal indirect taxation : Ramsey

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- Different effects :
  - Mechanical effect
  - Substitution effect
  - Behavioral effect

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- Different effects :
  - Mechanical effect : *Without change in behavior of agents*
  - Substitution effect : *Traditional change in behavior of agents*
  - Behavioral effect : *"Irrational" change in behavior*

Optimal indirect taxation : Ramsey

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- Misoptimization add this new term :
  "corrective" welfare objective of taxation
- Comes directly from Roy's identity

$$\frac{u_{q_j}(\boldsymbol{c}(\boldsymbol{q}, w))}{v_w(\boldsymbol{q}, w)} = -c_j(\boldsymbol{q}, w) - \boldsymbol{\tau}^b(\boldsymbol{q}, w) \cdot \boldsymbol{S}_j^C$$

Optimal indirect taxation : Ramsey, a simple example

- Example with specification (as in class) :
  - One agent ($h = 1$), Isoelastic preferences, Leisure is the numeraire
- Behavioral bias : Misperception
  - Salience of taxes $\tau_i^s = m_i \tau_i$, with $m_i \in [0, 1]$
  - Behavioral consumption function : $c_i(\tau_i) = (p_i + m_i \tau_i)^{-\psi_i}$
- Ramsey planning problem :

$$\max_{\{\tau_i\}} \gamma \sum_i \frac{[c_i(\tau_i)]^{1-1/\psi_i} - 1}{1 - 1/\psi_i} - (p_i + \tau_i) c_i(\tau_i) + \lambda \sum_i \tau_i \, c_i(\tau_i)$$

Optimal indirect taxation : Ramsey, a simple example

- Modified Ramsey inverse elasticity rule : Prop 3.1

$$\frac{\tau_i}{p_i} = \frac{\Lambda}{\psi_i \, m_i^2} \frac{1}{1 + \Lambda \frac{1 - m_i - 1/\psi_i}{m_i}}$$

- First-order approximation (limit of small taxes) :

$$\frac{\tau_i}{p_i} = \frac{\Lambda}{m_i^2 \psi_i}$$

- Intuition :
  - Inattention makes demand less elastic (effective elasticity : $m_i \psi_i$)
  - Benefit of raising revenues : $\Lambda = 1 - \frac{\gamma}{\lambda}$
  - Traditional Ramsey formula : $\frac{\tau_i}{p_i} = \frac{\Lambda}{\psi_i}$

Optimal indirect taxation : Ramsey – Quantitative illustration

- Heterogeneous agents : $h > 1$
  - Consider second moment $\mathbb{E}(m_i^2) = var(m_i) + \mathbb{E}(m_i)^2$ instead of m_i^2

$$\frac{\tau_i}{p_i} = \frac{\Lambda}{\psi_i \left(var(m_i) + \mathbb{E}(m_i)^2\right)}$$

- Empirical illustration :

  $\Rightarrow$ Taubinsky and Rees-Jones (2017) :
  Tax salience : $\mathbb{E}(m_i) = 0.25$ and heterogeneity : $var(m_i) = 0.13$
  Average tax rate (US) : $\tau_i = 7.3\%$

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  Average tax rate (US) : $\tau_i = 7.3\%$

  1. If taxes became fully salient : would divide tax rate by 5.7
  2. If agents would not be heterogeneous (i.e. if $var(m_i) = 0$) : would multiply tax rate by 2.8

Direct taxation : Mirrlees

- Standard setting as in Saez (2001)
  - Income distribution $h(z)$ and individual ability , n ,unobserved
  - Individual has utility $u^n(c,z)$ and welfare weight $g(z)$
- Key difference : A behavioural wedge :

$$\tau^b(z) = -\frac{(1-T'(z))u_c(c,z) + u_z(c,z)}{v_w}$$

- Intuition :
  - Again : measure of misoptimization
  - τ^b positive (resp. negative) when agents work too much (resp. little), i.e. overvalue the benefit (resp. costs) of working
- Second difference : People confuse average and marginal taxes

Direct taxation : Mirrlees

- Formula à la Saez (2001)

$$\frac{T'(z^*) - \widetilde{\tau}^b(z^*)}{1 - T'(z^*)} = \frac{1}{\zeta^c(z^*)} \frac{1 - H(z^*)}{z^* \, h^*(z^*)} \int_{z^*}^{\infty} (1 - \gamma(z)) \frac{h(z)}{1 - H(z)} dz$$

$$- \int_0^{\infty} \frac{\zeta^c_{Q_{z^*}}(z)}{\zeta^c(z^*)} \frac{T'(z) - \widetilde{\tau}^b(z)}{1 - T'(z)} \frac{z \, h^*(z)}{z^* \, h^*(z^*)} dz$$

- Notation
  - ζ^c is the compensated elasticity of labour supply
  - $\zeta^c_{Q_z}(z)$ is the elasticity of earnings at earning z w.r.t. $(1 - T'(z*))$
  - $h^*(z)$ is the virtual income density
  - $\widetilde{\tau}^b$ and $\gamma(z)$ have the same interpretation as before

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- Interpretation
  - Traditional Mirrlees
  - Tax misperception
  - Behavioural Wedge

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- Interpretation
  - Traditional Mirrlees : *Balances redistribution against distortions*
  - Tax misperception : *Tax at income z∗ also affects revenue at z*
  - Behavioural Wedge : *"Correction" motive of taxation*

Direct taxation : Mirrlees, implications for EITC

- Formula à la Saez (2001) with $\zeta^c_{Q_z}(z) = 0$

$$\frac{T'(z^*) - \widetilde{\tau}^b(z^*)}{1 - T'(z^*)} = \frac{1}{\zeta^c(z^*)} \frac{1 - H(z^*)}{z^* \, h^*(z^*)} \int_{z^*}^{\infty} (1 - \gamma(z)) \frac{h(z)}{1 - H(z)} dz$$

- Negative marginal taxes or EITC program
  - Empirical evidence from Lockwood (2017) :
    Shows that present bias leads poor individuals to underperceive benefits of working
  - So, suppose τ^b is sufficiently low for the poor agents
  - Then formula implies $T'(z^*) < 0$, which can be implemented through a EITC

Direct taxation : Mirrlees, implications for top tax rates

- Top taxes with bounded distribution with $\zeta^c_{Q_z}(z) = 0$

$$\frac{T'(z_{max}) - \widetilde{\tau}^b(z_{max})}{1 - T'(z_{max})} = 0$$

  - Gerritsen (2016) : rich work too much, $\widetilde{\tau}^b(z_{max}) > 0$ and $T'(z_{max}) > 0$
  - Intuition : Correct for misoptimization of the worker

- Top taxes with Pareto tail and $\mathbb{E}(\zeta^c_{Q_z}(z)) = 0$

$$T'(\infty) = \frac{1 - g_\infty + \zeta^c_\infty \pi \, g_\infty \, \tau^b}{1 - g_\infty + \zeta^c_\infty \pi + \eta_\infty}$$

Other extensions (1) : Pigou & externality, Nudges

- **Pigouvian taxation** :
  - Prop 2.2 : Taxation should not only correct for externality (Pigou) wedges but also behavioral wedges $\tau^{b,h}$
  - Again increase taxes if agents are inattentive
  - With heterogeneity, allows for quantity regulation rather than taxes (misallocation accross consumers)
  - Reconsider the **principle of targeting** : could taxes/subsidize goods serving as alternative for externality/internality-generating goods

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- **Nudges** : Modelling as psychological tax
  - Prop 2.3, Optimal nudge formula : nudges affects both consumption and welfare (policy tradeoff)
  - Nudges vs. Taxes : Redistribution concerns may imply the prefered use of nudges to correct internality without increasing the tax bill of specific agents

Other extensions (2) : Mental accounts, Endogenous attention

- **Mental account and vouchers** :
  - Government can provide assistance through food vouchers to correct mental accounts
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- **Endogeneous attention**
  - Link on the literature on rational inattention : agents choose how much to be attentive in function of prices and income
  - Optimal tax are usually smaller with endogenous attention as agents update their attention to the tax

Other extensions (3) : Diamond-Mirrlees & Atkinson-Stiglitz

- **Production Efficiency** : Revisit Diamond-Mirrlees (1971)
  - Production efficiency can fail with behavioural agents
  - Setting : Consumers are salient and the government levies the tax on either producers or consumers.
  - PE can fail if the government cannot levy the tax on all producers

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  - PE can fail if the government cannot levy the tax on all producers
- **Uniform Commodity Taxation** : Revisit Atkinson-Stiglitz (1976)
  - A-S Theorem says uniform commodity taxation is desirable if preferences are weakly separable and homogeneous of degree 1.
  - Prop 9.15 : If experience and decision utility are not identical, uniform commodity taxes are not optimal in general

Conclusion

- Revisited Ramsey and Mirrlees taxation with behavioural agents
- Optimal tax formulas change in an intuitive way
  - Taxes are higher if they less perceived (Salience)
  - Taxes are used to correct undervaluation of benefit of work (EITC)
- Before implementation more empirical work is necessary :
  - Measure Behavioural Wedges
  - Variance of salience
  - Elasticity of attention to taxes