Economics 2450A: Public Economics and Fiscal Policy I

Section 8: Avoidance and Evasion: Allingham-Sandmo

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Outline

1. Tax Avoidance vs. Tax Evasion
2. Evasion: Allingham-Sandmo Model
   - Setup
   - Optimal Evasion
   - Interpretation and Comparative Statics
3. Allingham-Sandmo with Automatic Reporting (Saez, Kreiner 2011)

Avoidance vs. Evasion

- Until this week, none of our discussion of optimal discussion has taken seriously tax evasion.
- Tax avoidance: Actions taken by taxpayers to lessen tax liabilities (legal)
- Tax evasion: Actions taken by taxpayers to misreport taxable income components to lessen tax liabilities
- What are examples of tax avoidance? What about tax evasion?
- Do you think evasion and avoidance are complements or substitutes?

Allingham-Sandmo: Motivation

- Allingham-Sandmo is a nice, very simple model of tax evasion. Equivalent to Gary Becker's famous crime model, where crime is modeled as a cost-benefit trade-off that depends on the probability of detection and severity of punishment.

- My personal view: tax evasion setting much nicer than crime; easier for me to imagine tax evasion as calculated economic decision.

- To model tax evasion, we'll consider models in which individuals make a choice for their income 'report', and face a penalty if they are caught (pay taxes plus a penalty on the difference).

- Goal for today: break down the Allingham-Sandmo model of tax evasion and its intuition in a slightly different way than in lecture.

Allingham-Sandmo: Setup

- Household problem: A representative household earns (exogenous) income w, chooses consumption c and reports income $\bar{w}$ to maximize utility $u(c)$. Assume utility function is concave increasing in c, twice differentiable.

- Taxes and audits: Household faces a linear tax rate of τ on **reported** income $\bar{w}$. With exogenous probability $p \in (0, 1)$ of being audited: household pays taxes evaded income $w - \bar{w}$ and a penalty parameterized by θ, $\tau(w - \bar{w})(1 + \theta)$.

- Household budget constraint is therefore piecewise (audited vs. not audited), and we can express consumption under the audit, c_A, and consumption under no audit, c_N, as:

$$c_N = w - \tau\bar{w}$$
$$c_A = w - \tau\bar{w} - \tau(w - \bar{w})(1 + \theta)$$

Allingham-Sandmo: Household Problem

- Household is choosing consumption and $\bar{w}$ to maximize expected utility:

$$\max_{c,\bar{z}} \quad p \cdot u(c_A) + (1-p) \cdot u(c_N)$$

subject to budget constraints on previous slide.

- Substituting in the budget constraints for c_A, c_N yields an unconstrained maximization problem in $\bar{w}$:

$$\max_{\bar{w}} \quad \left\{ p \cdot u\Big(w - \tau\bar{w} - \tau(w-\bar{w})(1+\theta)\Big) + (1-p) \cdot u\Big(w - \tau\bar{w}\Big) \right\}$$

- We can solve this problem with first-order conditions (as in lecture) or a perturbation approach (today) - both yield the same answer.

Allingham-Sandmo: First-Order Conditions

- Household problem from previous slide:

$$\max_{\bar{w}} \quad \left\{ p \cdot u\Big(w - \tau\bar{w} - \tau(w - \bar{w})(1+\theta)\Big) + (1-p) \cdot u\Big(w - \tau\bar{w}\Big) \right\}$$

- Taking first-order condition with respect to $\bar{w}$:

$$p \cdot u'(c_A) \cdot (-\tau + \tau(1+\theta)) + (1-p) \cdot u'(c_N) \cdot (-\tau) = 0$$

- Cancelling τ's everywhere, rearranging terms yields:

$$\frac{u'(c_A)}{u'(c_N)} = \frac{1-p}{p\theta}$$

- Implicitly characterizes optimal choice of $\bar{w}$ (LHS) - can still do comparative statics with implicit function theorem without taking stand on utility function.

Allingham-Sandmo: First-Order Conditions

- Recall the optimality condition implicitly characterizing optimal report $\bar{w}$ is:

$$\frac{u'(c_A)}{u'(c_N)} = \frac{1-p}{p\theta}$$

- Strictly concave utility $u(\cdot)$ implies that $c_A = c_N$ if and only if $\frac{1-p}{p\theta} = 1$. What about if this quantity is bigger or smaller than 1? What does this imply about the sign of $w - \bar{w}$?

- If we wanted to ensure $\bar{w} < w$ in equilibrium, could break symmetry in penalty for audit (i.e. no penalty/subsidy if $\bar{w} > w$); complicates math a tiny bit. Not in this model.

- No matter what the sign of $w - \bar{w}$ in this model is, the sign of the comparative statics $d\bar{w}/dp$ and $d\bar{w}/d\theta$ are unambiguous (and positive) – more in a few slides.

Allingham-Sandmo: Perturbation Approach

- We can also arrive at the same condition with a perturbation approach for the household.

- Consider some choice of reported income $\bar{w}$ and a perturbation $d\bar{w} > 0$ that increases the report a tiny amount (reducing evasion).

- With probability $1 - p$ (household not audited), the perturbation causes household utility to decrease by $dw \times u'(c_N) \times \tau$ (why? Interpret each term.

- With probability p (household audited), the perturbation causes household utility to increase by $dw \times u'(c_A) \times \tau\theta$.

- At an optimum report $\bar{w}$, the gains and losses from the perturbation offset and expected utility is unchanged. Imposing this and solving yields the same optimality condition obtained from FOCs.

Allingham-Sandmo: Intuition

- Optimality condition for household implies that evasion $w - \bar{w}$ is decreasing in penalty θ and audit probability p.

- What is the intuition? How do θ and p impact the cost-benefit trade-off for households in reporting their taxable income $\bar{w}$?

- Two (equivalent)approaches to make this more concrete. First, we could implicitly differentiate the FOC with respect to θ or p and compute the comparative statics $d\bar{w}/d\theta$ or $d\bar{w}/dp$. Alternatively, we can substitute in the budget constraints directly into the FOC and differentiate directly.[1]

[1] There is a third way: we could use Topkis' theorem to determine the sign of these comparative statics with no calculus at all, but we don't teach that at Harvard.

Allingham-Sandmo: Risk Aversion

- Recall from micro that risk aversion is related to the concavity of utility. It will be helpful to work through an example where we have parameterized the utility function to exhibit (for instance) constant relative risk aversion, i.e $u(c) = c^{1-\eta}/1-\eta$, for $\eta > 0$. How is η related to risk aversion?

- Note that for the CRRA utility function above, $u'(c) = c^{-\eta}$. Substituting this into the household's optimality condition yields:

$$\frac{c_A}{c_N} = \left[\frac{1-p}{p\theta}\right]^{\eta}$$

- Without taking any derivatives, how does risk aversion change the trade-offs involved in choosing reported income $\bar{w}$? How can you see this both intuitively and in the optimality condition above?

Empirical Evidence on Tax Evasion

- Huge body of empirical work on tax evasion. Topics include both estimating the amount of evaded taxes and its implications for wealth/income distributions and the determinants of evasion.

- Experimental evidence (i.e. Kleven et al. 2011) suggests that third-party reporting plays a big role in evasion.

- Third-party reporting: third party (i.e. employer) reports information on components of your tax base directly to tax authorities. Leading example is labor income as reported on form W-2.

- Easy to modify the Allingham-Sandmo model to incorporate the possibility that some component of tax base is reported by a third party (and hence is 'audited' with 100 percent probability / zero cost to the government).

Allingham-Sandmo II: Setup

- Setup is largely the same as before, except we need to distinguish between income components that are reported by third parties and that is self-reported.
- Actual income w = sum of third-party reported income w_t and self-reported income w_s:

$$w = w_t + w_s$$

- Household chooses reports for $\bar{w}_t$ and $\bar{w}_s$. However, we will simplify by assuming that $\bar{w}_t = w_t$, i.e. the household will always report w_t accurately. We assume this to simplify the math, but it will generally hold if the household is choosing $\bar{w}_t$ optimally (why?).

Allingham-Sandmo II: Third-Party Irrelevance

- Under third party reporting, we can express consumption (equivalently the budget constraints) under no audit and under an audit of self-reported income as:

$$c_N = w - \tau w_t - \tau \bar{w}_s$$
$$c_A = w - \tau w_t - \tau \bar{w}_s - \tau(w_s - \bar{w}_s)(1 + \theta)$$

- But letting $\bar{w} = w_t + \bar{w}_s$, these are the exact same budget constraints as the problem we had before: the samehousehold problem and optimal choice of $\bar{w}$ under self-reporting (third-party irrelevance).

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- To break this result, we need to extend the model further to restrict $\bar{w}_s$ (say, it can't go negative) or make p depend on $\bar{w}_s$.

Allingham-Sandmo III: Breaking Irrelevance

- Let $p(\bar(w)$ denote detection probability as a function of income report.
- Still allow for self-reported income ($w = w_t + w_s$ and $\bar{w} = \bar{w}_t + \bar{w}_s$), but we'll start by writing model in terms of report $\bar{w}$ as in pevious slide.
- Simplify model a little bit for audited individuals: assume that if audited, pay taxes on actual income w and then a penalty $\tau\theta$ on misreported amount $w - \bar{w}$.

$$\max_{\bar{w}} \quad \left\{ p(\bar{w}) \cdot u\Big((1-\tau)w - \tau\theta(w - \bar{w})\Big) + (1 - p(\bar{w})) \cdot u\Big(w - \tau\bar{w}\Big) \right\}$$

Allingham-Sandmo III: Breaking Irrelevance

- FOC for household:

$$[p(\bar{w}) - p'(\bar{w})(w - \bar{w})](1 + \theta) = 1$$

- Defining $\epsilon = -p'(\bar{w})(w - \bar{w})/p(\bar{w}) > 0$, elasticity of detection probability $p(w)$ with respect to undeclared income $w - \bar{w}$, FOC becomes:

$$1 = p(\bar{w})(1 + \theta)(1 + \epsilon)$$

- This implies full evasion is never optimal (if $\epsilon > 0$), even if $\theta = 0$, since you have to pay taxes on all income if you're caught.

- Why is this different relative to before?