Second-Best Policy

Or, What if Other Stuff is Messed Up?

Lecture 11

ARE 264

February 22, 2022

Preparing for lecture 11

- bCourses item on Goulder, Hafstead and Williams (2016)

- Note: course evals during last class
- Workload check in: OK to do the writing exercise and another problem set, or are you overwhelmed with SYP?

Some limits of the Pigouvian prescription

- The Pigouvian prescription is a useful default (reference point), but there are reasons why it needs modification:

- What if I can't tax the externality directly? (Diamond, JKSvB, sneaky first best)
- What about general equilibrium?
- What if there is another market failure?
- What if the market already fixed the problem? (Coase)
- What about equity? (Kaplow view)

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- What about equity? (Kaplow view)

- Today we discuss how fiscal interactions considerations may alter the Pigouvian prescription

Outline

1. **What is the additivity property and when is it relevant?**
2. **What is the marginal cost of public funds?**
3. **What are the tax interaction and revenue recycling effects?**
4. **What intuition should we hold regarding the double dividend?**

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General equilibrium and Pigouvian prescription: your intuition

- We derived the Pigouvian prescription in fairly simple, specific settings
- If we have a very generalized general equilibrium economy, and **an externality is the only market failure**, then do you expect the Pigouvian prescription to hold broadly?

General equilibrium and Pigouvian prescription: your intuition

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- If we have a very generalized general equilibrium economy, and **an externality is the only market failure**, then do you expect the Pigouvian prescription to hold broadly?

- Suppose now that there are other market failures. Do you expect the prescription to require modification? Why?
  - To be specific, suppose that there are **pre-existing taxes** on other factors of production or other goods in the economy. Will this change the Pigouvian prescription? Why or why not?

- Our discussion of **general equilibrium** issues and the Pigouvian prescription begins with Sandmo (1975), which sought to understand whether the existence of other markets changed the Pigouvian prescription
- Sandmo sets out a general equilibrium framework that makes some simplifying assumptions (linear production, perfect competition, etc.)

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- First shows that in general equilibrium, but with **no distortions other than the externality**, Pigouvian prescription holds. The fact that there are GE effects does not alter the Pigouvian prescription
  - E.g., if taxing alcohol reduces demand for food eaten at restaurants, this is not a reason for tax to differ from marginal damages...unless restaurant food is not priced at marginal cost

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- Second shows how second-best tax changes when there are distortions (i.e., other goods have P$\neq$MC)

Simple General Equilibrium version (Sandmo 1975)

Consumer/workers: n identical

Goods: $j = 0, ..., J$ with quantities x_j and aggregate q X_j

Good zero is labor: $x_0 =$ hours worked, $1 - x_0 =$ leisure

Good J is dirty: damages depend on aggregate X_J

Utility: $u(1 - x_0, x_1, ..., x_J, X_J)$

$\partial u / \partial x_j \equiv u_j > 0 \ (j = 0, ..., J)$

Marginal damage: $u_{J+1} < 0$

Production: $-X_0 + \sum_{j=1}^{J} a_j X_j \leq Y \quad (a_i > 0 \forall i)$

normalizes productivity of labor to 1

Utilitarian: $SWF = nu(\cdot)$

First-best allocation

Characterize first-best by choosing quantities to maximize social welfare function.

$$\mathcal{L}_P = nu(1 - x_0, x_1, ..., x_J, X_J) - \alpha \left(-X_0 + \sum_{j=1}^{J} a_i X_i \right)$$

FOCs imply:

$$\frac{u_j}{u_0} = a_j \quad (j = 1, ..., J-1)$$
$$\frac{u_J}{u_0} + n\frac{u_{J+1}}{u_0} = a_J$$

- Regular goods equate marginal utility ratio to marginal rate of technical substitution
- Dirty good has two terms: MU ratio and externality

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1. Characterize first-best allocation via SWF assuming planner chooses quantities
2. Show that first-best allocation can be decentralized via Pigouvian tax
   - Optimal tax vector is $t_j = 0$ $(j = 1, ..., J-1)$ and $t_J = -n\frac{u_{J+1}}{u_0}$
   - No need to tax inputs or complements; **general equilibrium does not seem to matter** for tax
   - This works out because there are no other distortions
3. Impose revenue requirement
   - $T \geq \sum_{j=1}^{J}(P_j - p_j)x_j = \sum_{j=1}^{J} t_j x_j$
   - Now this is a second-best problem. The other goods will be distorted in order to raise revenue, so there are **pre-existing distortions** that might be exacerbated by a tax on the dirty good

What should we expect in the second best?

- Until now, there are no other market failures or distortions
- Next we suppose the government needs to raise revenue: $T \geq \sum_{j=1}^{J} t_j x_j$
- Planner chooses taxes on each good; no lump-sum tax
- Will need to tax commodities in order to raise revenue
- How will this change the tax on the dirty good?

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- Intuition 1: **Ramsey taxation**—put higher taxes on less elastic good
- Intuition 2: **Corlett-Hague Rule (1953)**—model with no tax on labor; put higher taxes on goods that are more complementary to leisure
  - Do these tell us anything about taxing the dirty good?

Second-best result

$$t_j = \left(1 - \frac{-\mu}{\lambda}\right)\left(\frac{\sum_{k=1}^{J} x_k D_{jk}}{D}\right) \quad (j = 1, ..., J-1)$$

$$t_J = \left(1 - \frac{-\mu}{\lambda}\right)\left(\frac{\sum_{k=1}^{J} x_k D_{jk}}{D}\right) + \frac{-\mu}{\lambda}\left(-n\frac{u_{J+1}}{u_0}\right)$$

- Define D^* as the Jacobian of the demand matrix (e.g., the matrix of demand derivatives)
- D_{jk} is the cofactor; and D is the determinant of D^*

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- λ is the shadow price on the planner's revenue constraint
- μ is marginal utility of income to agent
- μ/λ is the inverse of **marginal cost of public funds**
- MCPF = ratio of value of \$1 to government over \$1 to consumer
- $\mu/\lambda < 1$ implies we scale down Pigouvian element

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  - Multiplier on government's revenue requirement λ; is dW/dR
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- E.g., in simple model with one factor L, constant productivity
  - With lump-sum taxation, government raises revenue at marginal utility of income: MCPF=1
  - With distortionary taxation on L: MCPF $= 1/(1-\varepsilon_L) > 1$

Marginal cost of public funds

- Generally, assume MCPF > 1
- Common estimates are around ≈ 1.3
- There are a lot of details debated in the literature, and competing definitions (e.g., does revenue use effect factor supply?)
- Start with Hakonsen (International Tax and Public Finance 1998)
- Will discuss a related concept: marginal value of public funds next week

- Key idea is that we have a sense of the distortion that comes from financing revenue

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- Clean goods have a Ramsey tax
- **Additivity property:** dirty good has a Ramsey tax plus the Pigouvian tax

$$\frac{t_j}{P_j} = \left(1 - \frac{-\mu}{\lambda}\right)\left(\frac{-1}{\varepsilon_j}\right) \quad (j = 1, ..., J-1)$$

$$\frac{t_J}{P_J} = \left(1 - \frac{-\mu}{\lambda}\right)\left(\frac{-1}{\varepsilon_J}\right) + \frac{-\mu}{\lambda P_J}\left(-n\frac{u_{J+1}}{u_0}\right)$$

- Suppose all cross-price derivatives are zero, with ε the own-price elasticity
- This delivers Ramsey intuition: proportional tax higher for more elastic goods

Additivity property

- This is a second best setting, but you get back some "first best properties"
- The tax on the dirty good moves with externality; scaled only by MCPF
- The tax on clean goods is independent of their relation to the dirty good; i.e., you do not tax complements more
- Dixit (1985) calls this a **Principle of Targeting**—you want to correct an externality at its source; target directly and do not worry about correlated margins of choice

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- Sandmo (1975) employs specific assumptions—representative consumer, fixed coefficients production, no nonlinear income taxation, no model of expenditures, etc.
- How general is additivity?

Generalizing additivity property (Kopczuk 2003)

- Kopczuk (2003) shows additivity (Principle of Targeting) is very general
  - Key requirement is that you be able to **tax the externality directly** (in contrast to material last class)

- You want to add a Pigouvian tax, and then optimize as if you were in a problem with no externalities; "correct the externality and then ignore it"

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Back to your intuition

- Now that you are primed to think about the marginal cost of public funds, what intuition to you have about the Pigouvian prescription in the context of **pre-existing taxes** on other factors of production or other goods in the economy. Will this change the Pigouvian prescription? Why or why not?

Simple view of dirty tax

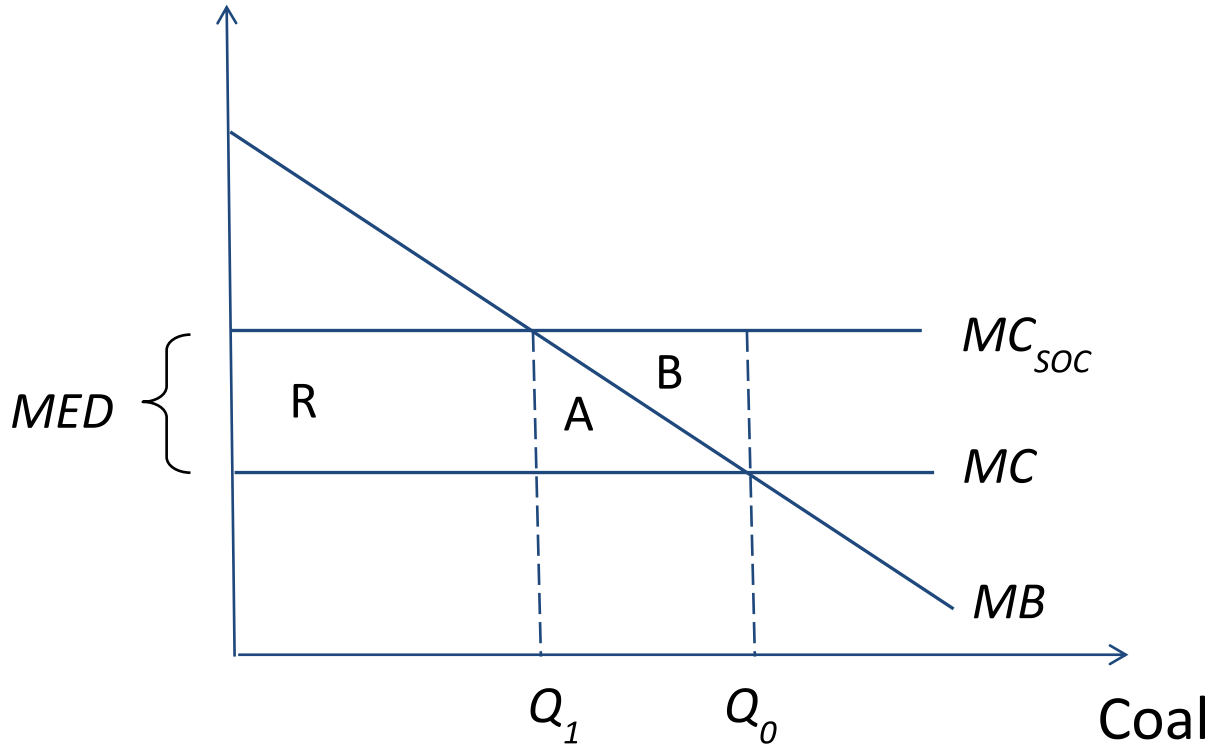

Fig. 1. Simple analysis of benefits and costs of an environmental tax.

Source: Goulder (2013)

- Environmental benefit A + B
- Lost surplus R + A
- R is transfer, lump-sum rebated or funds project with CB ratio $\approx 1 \Rightarrow$ net benefit is B

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- Since revenue is valuable, you tax coal even more than marginal damages
- Taxation yields **double dividend**: environmental benefit plus improved tax system

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- This raises cost of consumer goods
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- E.g., tax on gasoline raises price of (a) gasoline and (b) all other goods that take it as inputs
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- Implicitly, this lowers the real wage for workers
- This is the **tax-interaction effect**

Simple representation of tax-interaction effect

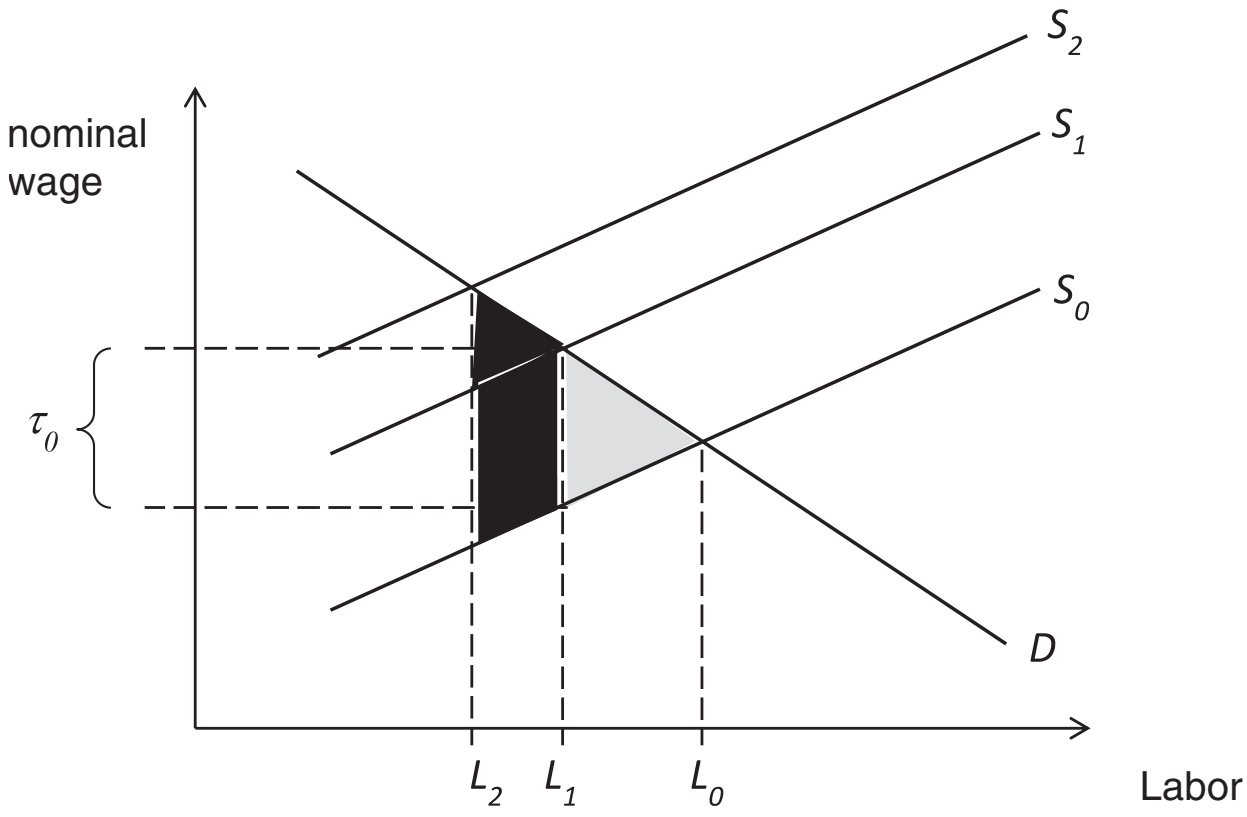

Fig. 2. The tax-interaction effect.

Source: Goulder (2013)

- Tax-interaction effect is trapezoid

Double dividend

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- Weak version generally true; implies that pollution policies with lump-sum rebates/free allocation are inefficient
- Stronger version can exist, but seems unlikely (lots of papers on this). For reviews, see:
- Goulder, 1995. "Environmental Taxation and the 'Double Dividend': A Reader's Guide". International Tax and Public Finance
- Bovenberg, 1999. "Green Tax Reforms and the Double Dividend: an Updated Reader's Guide" International Tax and Public Finance

Double dividend research idea?

- The double dividend is all about how policy impacts real factor prices through either (a) taxes or (b) the price of goods
- It seems like the conclusions might be significantly altered if there were different salience of these channels, which seems likely

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   - MCPF represents welfare loss required to raise $1 revenue
3. **What are the tax interaction and revenue recycling effects?**
   - Tax interaction effect = taxing dirty good lowers real wage, exacerbates pre-existing distortion
   - Revenue recycling = using revenue to cut distortionary taxes ameliorates pre-existing distortion
4. **What intuition should we hold regarding the double dividend?**
   - We very likely want to tax below Pigouvian prescription (strong double dividend fails), but it is very valuable to use revenue to cut distortionary taxes (weak double dividend fails)