21A: Marginal costs of public funds, and the double dividend

- Purpose/objective
  - why and when general equilibrium
  - show how general equilibrium and public finance aspects of various instruments influence optimality, and the choice of policy instruments

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Outline and introduction

- Topics
  - on public finance and general equilibrium
  - marginal costs of public funds > 1
  - double dividend
- General equilibrium
  - considers supply and demand effects
  - endogenous prices
  - "whole economy perspective
    - complicated modeling
      (= do not use unless believed to be necessary)

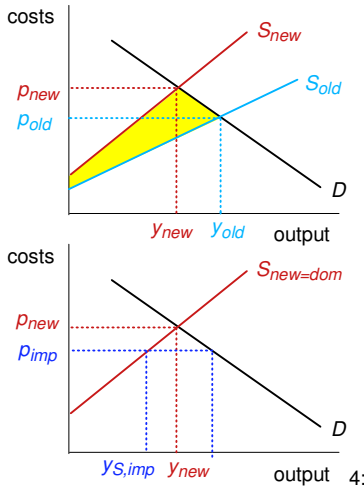
General equilibrium (1)

- Recall the general concept of a market in equilibrium: the price p^* that makes the market clear (= equates supply and demand at the margin: $q^S = q^* = q^D$)
- General equilibrium extends this equilibrium concept to the price vector **p*** that makes all market clear
  - consumer demand is influenced by relative prices and money income :: one price changes ⇒ other prices likely to change
  - producer supply influened by costs (which again depend on factor demand
  - **p*** is endogenously determined
- General equilibrium does not exist in reality, but is a gravity point that markets go towards (why?)

3:16

... general equilibrium (2)

- Ex: environmental policy that increases firms' costs
  - the costs embedded in the MACs are transformed to firms' marginal costs of producing (which make up the supply)
  - in the product market new equilibrum prices emerge
  - shaded area = welfare loss
- Impacts can be even worse under international trade
  - import price, p_{imp}, lower than p_{new} e domestic prod. falls to $y_{S,imp}$
  - + loss of employment, etc.



4:16

... general equilibrium (3)

- Modeling the "carry over" from one commodity to another or from one sector to another is complicated ... unless some tricks are done
- Computable general equilibrium (CGE) models
  - exploit the condition that all markets clear to find prices
  - are usually modeled using constant elasticity of substitution (CES) or nested CES functions
  - stylized picture of key sectors in the economy (SAM)
- Different variants of CGE models
  - while the approach is similar, CGE models are usually tailored for analyzing certain types of problems
  - international trade (example GTAP), environment
  - ⇒ the detail varies in which various sectors is modeled
  - "pre-canned" CGE models (Rutherford: *http://www.mpsge.org/*)

Public finance (1)

- Policy has two effects
  - intended effects
    (reduction of pollution, increased supply of public goods, etc.)
  - unintended effects, mostly indirect effects that affect other parts of the economy
    - "crowding out" - from macro economics
    - endogenous price effects (see general equilibrium)
- Implications of negative unintended effects:
  - the additional costs of policy implies that restraint need to be taken as the partial (single firm/single sector) optimum solution is not quite correct
- Implications of positive unintended effects:
  - there is an additional benefit from using a policy instrument (multifunctional agriculture, green tax arguments)

6:16

... public finance (2) - modeling

- How to account for these indirect effects?
  - Computable general equilibrium(CGE) models tailored to the problem/issue to be analyzed
    - entire economy approach explicitly modeling interactions between sectors to capture "carry overs" and the problem to be analyzed
    - these insights entail some (modeling) costs :: increases complexity, i.e., may have to reduce the degree of detail in other (the firm internal or environmental) parts of the model
    - there exists a trade-off *indirect effects - degree of detail* in the modeling exercise
- What to do
  - have specific models for the problem at hand
  - if any reason to fear indirect effects, CGE model afterwards

7:16

... public finance (3) - policy impl.

- Suppose CGE model results suggest large (negative) indirect effects
- How to account for these effects in policy?
  - try to correct for the most undesirable side-effects (but remember that these corrections may also have undesirable side-effects)
  - recall that not all undesirable effects need to be corrected
    - Pareto irrelevancy
    - Tinbergen: one instrument per objective
- Practical policy - "second-best" world at best
  - searching for the ultimate best situation rarely feasible
  - instead, search for improvements over status-quo

8:16

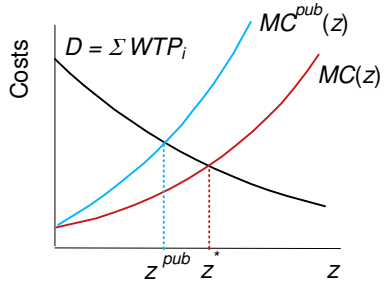
Marginal costs of public funds (1)

- Governments need to run reasonably balanced budgets over the long run
- Using public funds to pay for goods, services or environmental improvements, hence require that the government collects some revenue
- Costs of revenue collection
  - taxes onto businesses and firms have real impacts on the economy, and thus may entail some costs
  - administrative costs of collecting taxes
    - monitoring and enforcement
    - tax payers' costs of relating to the tax system (fixed and variable costs)
- There are real costs to society of using public funds: public spending "crowds out" private spending

9:16

... marginal costs of public funds (2)

- Definition : the social costs of using the last unit of public funds to a project
- Size of *Marginal Cost of Public Funds* (μ):
  - well functioning economies: μ = 1,2 - 1,5
  - in less well functioning economies: $\mu > 2$
- Example
  - assume public funds are used to provide some public good, z
  - impact: creates a wedge
- Implication
  - show restraint on using governmental funds



10:16

Double dividend (1)

- Underlying idea : environmental taxes (or auctioning off tradable permits) create revenues the government can use to reduce other distortionnary taxes
- Double dividend
  - first dividend (direct effect): improvement in environmental quality from the use of environmental policy
  - second dividend (indirect effect): welfare gains from reducing other distortionary taxes
- First dividend generally considered more important than second dividend

11:16

... double dividend (2)

- Two forms of DD:
  1. Weak double dividend: Using revenues from the environmental tax to finance reductions in marginal rates of a distortionary tax yields cost savings relative to the case where tax revenues are reduced to tax-payers in a lump sum fashion.
  2. Strong double dividend: The revenue-neutral replacement of an distortive tax with an environmental tax involves zero or negative gross costs.

12:16

... double dividend (3)

- DD is well founded theoretically, but ....
- empirical analyses have only provided support for the weak double dividend, i.e., it is not possible to have environmental policy that does not cost.
- General remark:
  - direct effects (1st dividend = the incentive effect from environmental tax) stronger than
  - indirect effects (2nd dividend = indirect effects from reducing other distortionnary taxes)

13:16

... double dividend (3)

- The optimal environmental tax rate in the absence of distortionnary taxes:

$$t = MAC(z^*) = MEC(z^*)$$

- Otimal environmental tax when distortionnary taxes present

$$t^e = MAC(z^*)\,\mu^{-1} = MEC(z^*)\,\mu^{-1}$$

where μ (> 1) is the marginal costs of public funds

- Implications:
  - $t^e < t$
  - absence of strong form DD does not invalidate environmental taxes (first dividend still there)

14:16

Summary

- Marginal costs of public funds (μ) > 1
  - reduces extent to which env. policy that use public funds (= subsidies and environmental payments) can be used
  - these impacts are particularly strong in developing countries
    - lesson: costly to be poor
    - key issue: trade-off environmental programs that work without harming econ.growth (too much)
- Double dividend
  - strong form: "non-existing"
  - weak form: some evidence (and makes sense theoretically)
- Marginal costs of public funds and double dividend imply possible large general equilibrium effects
  - ... that implies that economic analysis must be done with the possibility of endogenous prices

15:16

Concept questions

- Provide arguments in favor of the two approaches (partial or general equilibrium) to analyze climate change. Which approach would you use, and why?
- There are two elements of the "marginal cost of public funds"
  - the cost of bringing in the tax revenues needed to fund public projects, and
  - the "crowding out effect" of using public funds

  What are the possible conditions that make one or the other the largest?
- Why are the revenue impacts of an environmental tax hard to assess?

16:16