

Public Economics 14.41  
Fall 2009  
Sketch of Midterm Solutions

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- Solutions are NOT comprehensive, in that many valid solutions are omitted.

# Question One

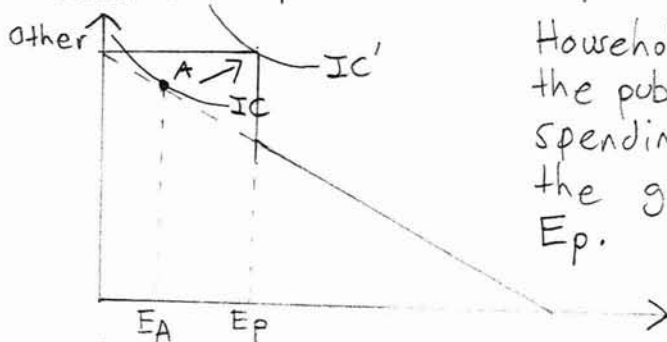
(a) False.

In terms of incentives to the polluting firm, the approaches are equivalent. That is, a \$1/unit subsidy on abatement presents a \$1/unit OC to the firm of every unit of pollution, precisely the incentive provided by a \$1/unit tax on pollution. However, from a fiscal perspective, the approaches are very different as a subsidy increases the government deficit while a tax reduces the government deficit.

(Why do we care? See chapter 4)

(b) False. (counter-example)

Consider provision of public education:

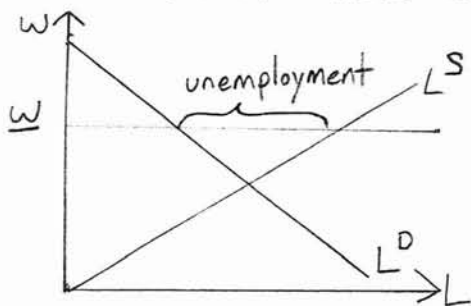


Household A, which chose  $E_A$  absent the public option, reduces private spending by  $-E_A$  ( $E_A \rightarrow 0$ ) when the government provides level  $E_P$ . Crowd-out =  $\frac{E_A}{E_P} < 1$  (less-than-full)

Although as noted in lecture private markets may 'un-do' government intervention, various constraints (such as the non-negativity constraint) may prevent full crowd-out.

(c) True.

Given a binding (effective) minimum wage, the market will not achieve clearance (excess labor supply  $\rightarrow$  unemployment).

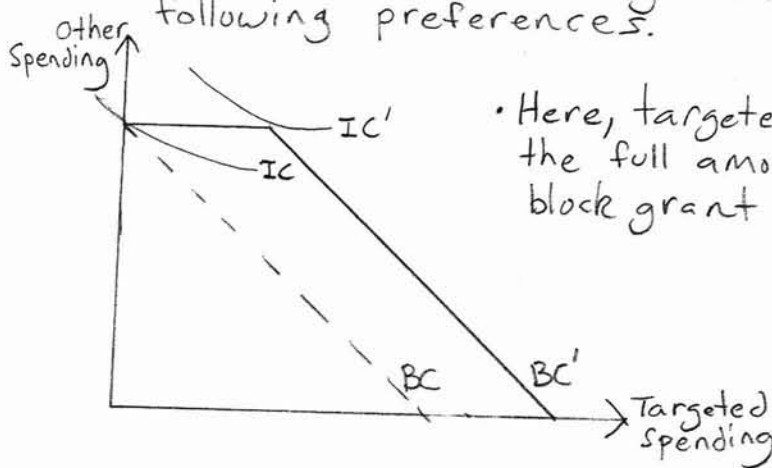


The true economic cost is the opportunity cost of labor (leisure), valued on the margin by  $L^S$ . Given unemployment, the true economic costs are less than \$6,000. The difference is a transfer to workers (rents).

### (d) Uncertain.

- A matching grant provides a (+) income and a (+) substitution effect resulting from expansion of the budget set and a distortion in relative prices.
- A conditional block grant will be less effective in terms of maximizing targeted local spending IF the 'condition' does not bind, in which case only a (+) income effect is present.
- Conversely, if the 'condition' binds, the local government faces an extreme substitution effect (trade-off 0 units of other spending for  $>0$  units of targeted spending). In this case, the conditional block grant may be more effective than the matching grant.

Example. Consider a local government with the following preferences.



- Here, targeted spending  $\uparrow$  by the full amount of the conditional block grant (0 crowd-out).

## Question Two

(a) Correct = Mississippi farms do 'suffer' to the extent that they incur direct damages  $D(W_{Total})$ .

(Note = Regardless of whether damages are 'internalized' by the restaurant chains)

Incorrect: It is not socially optimal to 'cease the extraction' (that is, full abatement), as the SMC of abatement exceeds the SMB at very high levels of abatement. (Recall = 0 pollution is unlikely to be optimal)

(b) Given that  $D = 200 \cdot W_{Total} = 200(W_M + W_{BK}) = 200W_M + 200W_{BK}$ , damages are separable. Thus we consider two parallel problems:

$R_i^*$  is achieved where  $(SMB|_{R_i^*} = SMC^i|_{R_i^*})$   
for each firm  $i$ .

Here,  $SMB = 200$  (reduced damage to farmers)  
 $SMC^i = a^i R_i$   $\hookrightarrow$  constant

$$\Rightarrow R_i^* = \frac{200}{a^i}$$

$$\text{McDonald's} = a^M = 10 \Rightarrow R_M^* = 20$$

$$\text{Burger King} = a^{BK} = 4 \Rightarrow R_{BK}^* = 50$$

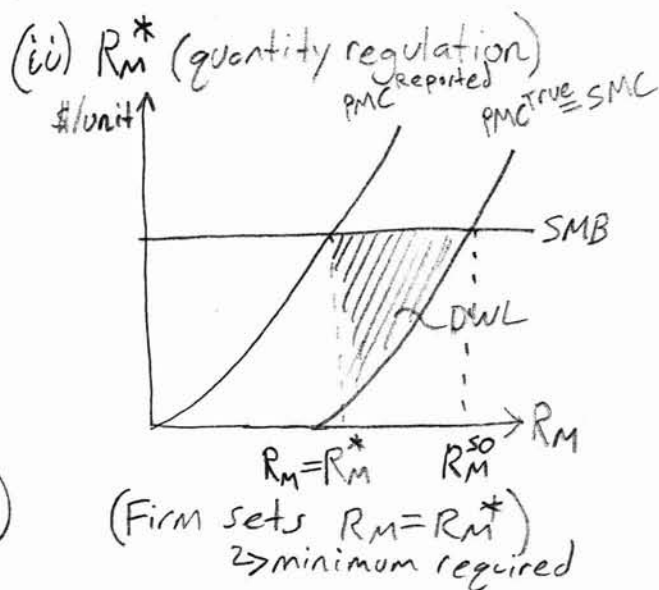
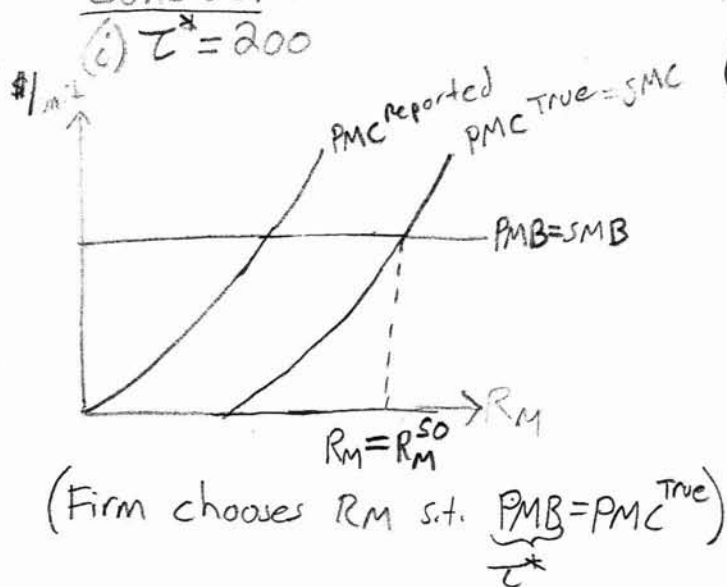
(c) Assignment (and assumed enforcement) of 'custody' (property rights over the worms) to the farmers may invoke a Coasian solution (private market solution) given costless bargaining. In this scenario, the farmers may sue the restaurant chains for damages, forcing these firms to internalize the negative production externality, thus achieving the social optimum absent direct government intervention.

However, costless bargaining may not exist given:

- Assignment problem (determining extraction levels of each firm).
- Holdout problem (last farmer holds additional bargaining power).

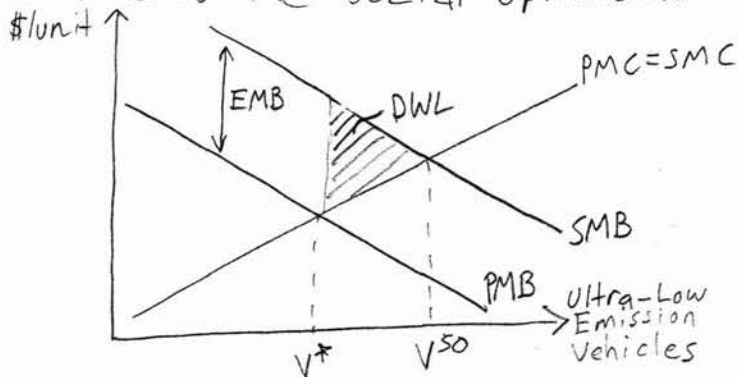
(d) Given constant external marginal damage,  $D'(W_{Total})=200$ , a corrective tax  $\tau^*=200$  will achieve the social optimum for any cost structure. Conversely,  $R_M^*$  and  $R_{BK}^*$  are partly determined by the abatement cost structures. Thus quantity regulation will result in DWL under abatement cost misreporting (either under- or over-abatement relative to the true social optimum).

Consider =



## Question Three

- (a) As the benefit of reduced emissions does not accrue entirely to the individual purchasing the vehicle, ultra-low emission vehicles pose a positive consumption externality. As in the standard externality framework, this will result in underconsumption relative to the social optimum.



Alternatively, we may consider clean air a public good. The free-rider problem, then, is that the individual faces reduced private incentive to purchase an ultra-low emission vehicle if others have already done so.

- (b) Assume additional maintenance costs begin one year from the date of the mandate, while the investment cost is incurred immediately.

$$PDV = \$100,000,000 + \frac{\$500,000}{0.10} = \$105,000,000$$

- (c) In order to control for group-specific effects and time-specific effects, I employ a standard difference-in-difference estimator:

$$\begin{aligned} \widehat{DD} &= (P_{H, 2007} - P_{H, 2003}) - (P_{O, 2007} - P_{O, 2003}) \\ &= (9.2 - 10.6) - (11.5 - 11.2) \\ &= -1.7 \end{aligned}$$

The mandate is estimated to have reduced Houston pollution level by 1.7 'Micrograms per cubic Meter of Air'

\*Note = Use of 1999 if concerned about anticipation effects.

The key assumption underlying estimator validity is the parallel trend assumption, that is absent the mandate Houston and other Major Cities would have experienced identical change in pollution levels.

I can determine plausibility of the assumption by constructing a falsification test =

$$\begin{aligned} DD_{False} &= (P_H, 2003 - P_H, 1999) - (P_O, 2003 - P_O, 1999) \\ &= (10.6 - 10.2) - (11.2 - 10.7) \\ &= -0.1 \end{aligned}$$

(Although not numerically 0, notice that the  $\widehat{DD}$  magnitude is 17 times as large)

(d) A revealed preferences approach relies upon observation of behavior to reveal valuation.

Suppose that in addition to Pollution Levels, I observe average home prices in Houston and other Major Cities.

Then constructing a DD estimator similar to (c) to evaluate impact of the mandate on home prices in Houston relative to other Major Cities would plausibly reveal individual WTP for cleaner air.

$$\frac{\Delta \text{Average Home Price}}{(-\Delta \text{Pollution})} = \text{Valuation of Reducing Pollution}$$

This methodology assumes that home prices reflect changes in valuation of amenities (here, capitalization of clean air reduction).

Notice that this estimator will under-estimate the true valuation, as the cost of the mandate is also capitalized into the home price.

## Question Four

(a) A 'pure' public good is defined by two properties =  
 • non-rival • non-excludeable

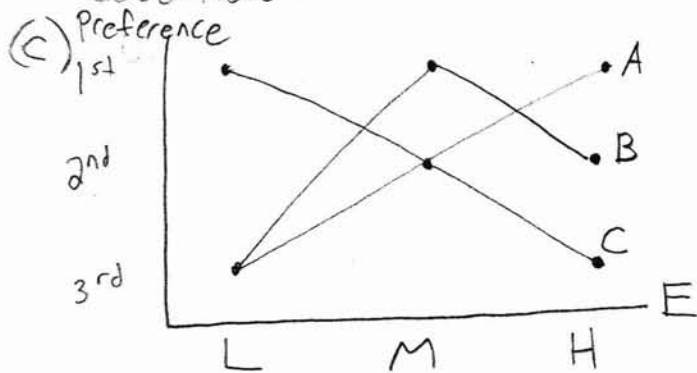
However, public education is considered an 'impure' public good as result of violations of these properties.

Rival - As classroom size increases, beyond some threshold quality falls. Thus consumption is rival, that is one student's consumption decreases the value for another.

Excludeable - Students are typically restricted to a particular school, and cannot attend any public school of one's choosing.

(b) Public goods are generally underprovided as result of the free-rider problem, that is an individual's incentive to privately provide the public good falls with the level of provision by others.

Education specifically may be underprovided in a private context as result of credit market imperfections, that is individuals may be unable to borrow against future earnings to finance education.



Consider: L vs M  $\Rightarrow$  M wins\*  
 M vs H  $\Rightarrow$  M wins  
 L vs H  $\Rightarrow$  H wins

$\Rightarrow$  Regardless of initial pair, the consistent outcome is M.

Yes.

As preferences are single-peaked, we can invoke the Median Voter Theorem, such that the consistent outcome of pair-wise voting will be the preference of the median voter, in this case household B  $\Rightarrow$   $E^* = M$

\* A voter for M  
 B voter for M  
 C voter for L } M wins (2-1)



(d) Above, I invoked the Median Voter Theorem. However, there is no reason to believe that the median voter's preferences represent the social optimum. Specifically, assigning a weight of one (per vote) to each voter ignores intensity of preferences, which will distort the median preference relative to the socially optimal level given asymmetry in the aggregate preference distribution.

(e) If the Tiebout Model applies, then lump-sum taxation and a continuum of cities will result in self-sorting ('voting with your feet') of homogeneous cities with locally optimal levels of public provision.

Two caveats:

- ① Lump-sum taxation may not be politically feasible (given desire for redistribution), thus providing an incentive for poor families to live in rich neighborhoods with high levels of public goods provision (free-rider problem).
- ② Violation of costless relocation - An individual in City A who would prefer to live in City B, but will not relocate given prohibitive moving costs (realtor fees, etc.).

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