Uncertainty with Unknown Control Costs: Section Problem
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This problem involves one regulator and one firm. The regulator has received information on the damages of emissions. Both the polluting firm and the regulator know the marginal damage of emissions MD(e), but only the firm knows the marginal savings of emissions MS(e). The regulator is unsure whether the firm has a high marginal savings of emissions MS(e)$_H$ or a low marginal savings of emissions MS(e)$_L$. The low and high MS functions average out to be $\widehat{MS(e)}$.

Suppose the regulator chooses emissions level where MD(e) is equal to $\widehat{MS(e)}$ denoted as e*. To determine the appropriate fee to achieve emissions level e*, the regulator will find the MD(e*) and set the fee to this amount (denoted as p*).

(i)   Suppose the regulator decides to implement a fee equal to p*. If the marginal damage function is more steep than the marginal savings function (absolute value of the slope is larger), what is the dead weight loss if the firm has high marginal savings of emissions MS(e)$_H$? Show graphically.

(ii)   The regulator has now decided to implement a quantity regulation setting the level of emissions at e*. If the marginal damage function is more steep than the marginal savings function (absolute value of the slope is larger), what is the dead weight loss if the firm has high marginal savings of emissions MS(e)$_H$? Show graphically.

(iii)   Repeat parts (i) and (ii) assuming the firm has a low marginal savings of emissions MS(e)$_L$.

(iv)   Now suppose the regulator decides to implement a fee equal to p*, but the marginal damage function is **less** steep than the marginal savings function (absolute value of the slope is smaller), what is the dead weight loss if the firm has high marginal savings of emissions MS(e)$_H$? Show graphically.

(v)   If the regulator sets a quantity restriction at e* and the marginal damage function is **less** steep than the marginal savings function, what is the associated DWL if the firm has high marginal savings of emissions MS(e)$_H$? Show graphically.

(vi)   If the marginal damage function is more steep than the marginal savings function, which regulatory instrument is more efficient?

(vii)   If the marginal damage function is less steep than the marginal savings function, which regulatory instrument is more efficient?