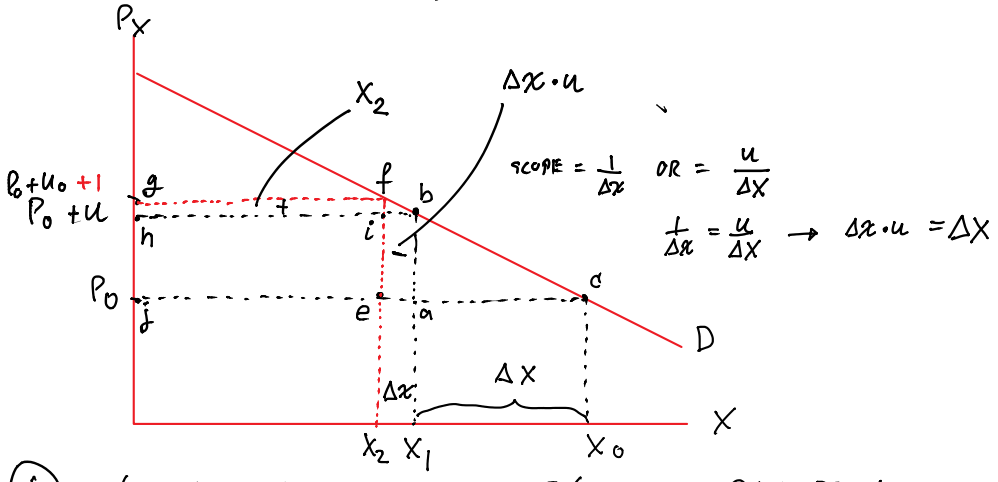
LAST ISSUE IN TAXATION: OPTIMAL TAXATION FOR COMMODITIES

GOAL: TO RAISE A CERTAIN AMOUNT OF REVENUE, HOW SHOULD WE TAX COMMODITIES SUCH THAT EXCESS BURDEN IN AT THE MINIMUM?

THE RAMSEY RULE

SUPPOSE WE HAVE TWO COMMODITIES: X AND Y, ALSO, SUPPOSE THAT BOTH ARE NEITHER COMPLEMENTS NOR Substitutes.

CONSIDER GOOD X FIRST.



SCOPE $= \frac{1}{\Delta x}$ OR $= \frac{u}{\Delta X}$

$\frac{1}{\Delta x} = \frac{u}{\Delta X} \rightarrow \Delta x \cdot u = \Delta X$

(1) W/ A UNIT TAX OF u BAHT/UNIT, QUANTITY DEMANDED FALL FROM X_0 TO X_1, OR ΔX.

EXCESS BURDEN = abc

(2) SUPPOSE GOVT INCREASES TAX BY 1 EXTRA BAHT/UNIT OF GOOD, QUANTITY DEMANDED FALLS FURTHER FROM X_1 TO X_2 OR Δx.

IT GENERATES "MARGINAL EXCESS BURDEN" = e $\square_q^f$ b f e c

(NOTE: TOTAL EXCESS BURDEN IS NOW =

LET'S CALCULATE THE SIZE OF "MARGINAL EXCESS BURDEN ($\square$ fbae)

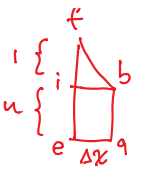
$$\square_e^f{}_q^b = \frac{1}{2} \times \Delta x \times [u + (u+1)]$$

$$= \frac{1}{2}\Delta x u + \frac{1}{2}\Delta x (u+1)$$

OR $= \Delta x \cdot u + \frac{1}{2}\Delta x$ $\therefore$ $\{ i \square^f_b$

$= \frac{1}{2}\Delta x \cdot u + \frac{1}{2}\Delta x (u+1)$

OR $= \Delta x \cdot u + \frac{1}{2}\Delta x$



WHEN $\triangle ifb$ IS RELATIVELY SMALL, WE CAN APPROXIMATELY

MARGINAL EXCESS BURDEN $= \underline{\underline{\Delta x \cdot u}}$.

SLOPE OF DEMAND CURVE $= \frac{1}{\Delta x}$ OR $= \frac{u}{\Delta X}$.

SO $\Delta x \cdot u = \Delta X$

THEREFORE MARGINAL EXCESS BURDEN $\approx \Delta X$.

③ HOW ABOUT CHANGE IN TAX REVENUE WHEN WE INCREASE A UNIT TAX FROM u TO $u+1$?

W/ u, TAX REVENUE = $abhj$

W/ $u+1$, TAX REVENUE = $fejg$

LOSS IN REVENUE = $abie$

GAIN IN REVENUE = $fghi$

SO Δ IN TAX REVENUE OR MARGINAL TAX REVENUE

$= fghi - abie$

$= X_2 - \Delta x \cdot u$

$= X_2 - (X_1 - X_2) \cdot u$

$= X_2 - X_1 u + X_2 u$

$= X_2 + u(X_2 - X_1)$

AS $X_2 = X_1 - \Delta x$, THEN

MARGINAL TAX REVENUE $= X_1 - \Delta x + u(X_2 - X_1)$

$= X_1 - \Delta x - u\Delta x$

RECALL THAT $\Delta x = \frac{\Delta X}{u}$.

SO, MTR $= X_1 - \frac{\Delta X}{u} - u\frac{\Delta X}{u}$

$= X_1 - \Delta X \left(\frac{1+u}{u}\right)$ ≈ 1

SINCE u IS RELATIVELY LARGE COMPARE TO 1, THIS MTR CAN BE APPROXIMATELY ESTIMATED AS

MTR $= X_1 - \Delta X$ → WHEN GOVT RAISES TAX FROM u TO $u+1$

SO, $\frac{\text{MARGINAL EXCESS BURDEN}}{\text{MARGINAL TAX REVENUE}} = \frac{\Delta X}{X_1 - \Delta X}$

MARGINAL EXCESS BURDEN PER BAHT OF TAX REVENUE !!!

BY THE SAME PROCESS, MARGINAL EXCESS BURDEN PER BAHT OF TAX REVENUE FOR GOOD Y. CAN BE EXPRESSED AS

$$\frac{\Delta Y}{Y_1 - \Delta Y}$$

TO MINIMIZE OVERALL EXCESS BURDEN,

$$\frac{\Delta X}{X_1 - \Delta X} = \frac{\Delta Y}{Y_1 - \Delta Y}$$ MUST BE HOLD

SAYS THAT MARGINAL EXCESS BURDEN PER LAST { BAHT / US $ / EURO } OF TAX REVENUE MUST BE THE SAME FOR EACH COMMODITY !!!

$\frac{\Delta X}{X_1 - \Delta X} = \frac{\Delta Y}{Y_1 - \Delta Y}$ IMPLIES THAT $\frac{\Delta X}{X_1} = \frac{\Delta Y}{Y_1}$

$\frac{\Delta X}{X_1}$: PERCENTAGE CHANGE IN QUANTITY DEMANDED FOR GOOD X

$\frac{\Delta Y}{Y_1}$: PERCENTAGE CHANGE IN QUANTITY DEMANDED FOR GOOD Y

RAMSEY'S RULE

TO MINIMIZE OVERALL EXCESS BURDEN, TAX RULES SHOULD BE SET SO THAT ...

PERCENTAGE "REDUCTION" IN QUANTITY DEMANDED FOR EACH COMMODITY IS THE SAME.

IN TERMS OF ELASTICITY, RAMSEY'S RULE CAN BE EXPRESSED AS FOLLOWS:

$$t_X \cdot \varepsilon^d_X = t_Y \cdot \varepsilon^d_Y$$

t_X: PERCENTAGE CHANGE IN THE PRICE (AS TAX RATE OF t INCREASE PRICE OF GOOD BY t %)

ε^d_X: PERCHANGE CHANGE IN QUANTITY DEMANDED RESULTING FROM PERCENTAGE CHANGE IN PRICE OF GOOD X

$$\frac{\%\Delta P_Y \cdot \%\Delta Q^d_Y}{\%\Delta P_Y}$$

= PERCENTAGE REDUCTION IN Q_x^d !
DUE TO TAX

$\%\Delta P \cdot \frac{\%\Delta Q}{\%\Delta P}$

REARRANGING GIVES ⇒

$$\frac{t_x}{t_y} = \frac{\varepsilon_y^d}{\varepsilon_x^d}$$

"INVERSE ELASTICITY RULE"

WHEN TWO GOODS ARE NOT RELATED, TAX RATES SHOULD BE "INVERSE PROPORTIONAL" TO PRICE ELASTICITY OF DEMAND.

i.e., IF $\varepsilon_y^d > \varepsilon_x^d$, THEN t_y SHOULD BE SMALLER THAN t_x

OR RELATIVELY HIGH TAX RATE SHOULD BE PLACED ON RELATIVELY INELASTIC GOODS !

OF COURSE, RECALL THAT WE WANT TAX TO CREATE "DISTORTIONS" AS LITTLE AS POSSIBLE AFTER ALL !!!
e.o.