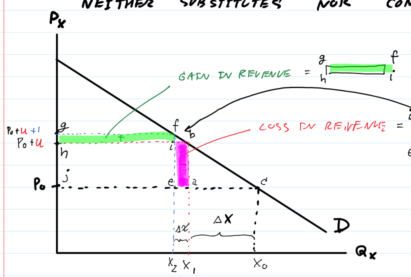
Thursday, May 12, 2016 5:30 PM

OPTIMAL TAXATION FOR COMMODITIES

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

THE RAMSEY RULE :

SUPPOSE WE HAVE 2 COMMODITIES : X & Y.
ALSO, SUPPOSE THAT THE TWO GOODS HERE ARE NEITHER SUBSTITUTES NOR COMPLEMENTS.



① W/ UNIT TAX $= u$, Q_x FALLS FROM X_0 TO X_1. EXCESS BURDEN = AREA abc
OR ΔX

② SUPPOSE GOVT. INCREASES TAX BY 1 BAHT/UNIT OF GOOD, QUANTITY DEMANDED REDUCES FURTHER TO X_2 OR Δx

MARGINAL EXCESS BURDEN = $e\,f\,b\,a$ [OF COURSE, TOTAL EXCESS BURDEN NOW IS $e\,f\,c$]

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

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

OR $$= \frac{1}{2}\Delta x\, u + \frac{1}{2}\Delta x\cdot u + \left(\frac{1}{2}\Delta x\right) \Rightarrow i\,f\,b$$

$$= \Delta x\cdot u$$

NOTE: WHEN $i\,f\,b$ IS RELATIVELY SMALL, WE CAN APPROXIMATELY SAY THAT MEB $\approx \Delta x\cdot u$.

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

SINCE $\frac{1}{\Delta x} = \frac{u}{\Delta X}$, THEN $\Delta X = \Delta x\cdot u$

THEREFORE, $\boxed{\text{MARGINAL EXCESS BURDEN} \approx \Delta X.\ \#}$ ——— ①

HOW ABOUT Δ TAX REVENUE WHEN GOVT. INCREASES TAX FROM u TO $u+1$ BAHT/UNIT ?

W/ u BAHT/UNIT : TAX REVENUE = $h\,b\,j\,a$

W/ $u+1$ BAHT/UNIT : TAX REVENUE = $g\,f\,j\,e$

SO CHANGE IN TAX REVENUE

$$= \text{GAIN} - \text{LOSS}$$

$$= g\,h\,f\,i - i\,b\,e\,a$$

$$= X_2 - \Delta x\cdot u$$

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

$$= X_2 - X_1 u + X_2 u$$

NOTE: AS $\Delta x = X_1 - X_2$, $\boxed{X_2 = X_1 - \Delta x}$

THEREFORE, MARGINAL TAX REVENUE $= X_2 - X_1 u + X_2 u$

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

$$= X_1 - \Delta x + u\,(X_2 - X_1)$$

$$= X_1 - \Delta x - u\,\Delta x \qquad (\text{NOTE: } X_2 - X_1 = -\Delta x)$$

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

THEREFORE, MARGINAL TAX REVENUE $= X_1 - \frac{\Delta X}{u} - \cancel{u}\left(\frac{\Delta X}{\cancel{u}}\right)$

$$= X_1 - \frac{\Delta X}{u} - \Delta X$$

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

WHEN u IS RELATIVELY LARGER COMPARED TO 1,

THEN $\left(\frac{1+u}{u}\right)$ CAN BE APPROXIMATELY AS 1.

- MARGINAL TAX REVENUE $= X_1 - \Delta X$ — (2)

ADDITIONAL TAX REVENUE GOVT. GET WHEN IT RAISES TAX FROM u BAHT/UNIT TO $u+1$ BAHT/UNIT

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

IS SO CALLED "MARGINAL EXCESS BURDEN PER BAHT OF TAX REVENUE FROM TAXING GOOD X"

FOR GOOD Y, WE FOLLOW THE SAME PROCESS ABOVE AND THEN WE GET

$$\frac{\Delta Y}{Y_1 - \Delta Y} \Rightarrow$$ MARGINAL EXCESS BURDEN PER BAHT OF TAX REVENUE FROM TAXING GOOD Y

TO MINIMIZE EXCESS BURDEN,

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

SAYS THAT MARGINAL EXCESS BURDEN PER BAHT OF TAX REVENUE MUST BE THE SAME FOR EACH COMMODITY!

SIMILAR TO CONSUMER CHOICE'S SPENDING RULE

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

IF $\frac{\Delta X}{X_1 - \Delta X} > \frac{\Delta Y}{Y_1 - \Delta Y}$, THEN TAX MORE ON GOOD Y AND LESS ON GOOD X.

$$\frac{\Delta X}{X_1 - \Delta X} = \frac{\Delta Y}{Y_1 - \Delta Y} \xRightarrow{\text{IMPLIES THAT}} \frac{\Delta X}{X_1} \text{ MUST BE EQUAL TO } \frac{\Delta Y}{Y_1}$$

$\frac{\Delta X}{X_1}$: % Δ IN QUANTITY DEMANDED ON GOOD X

$\frac{\Delta Y}{Y_1}$: % Δ IN QUANTITY DEMANDED ON GOOD Y

THE RAMSEY RULE: TO MINIMIZE OVERALL EXCESS BURDEN, TAX RULE SHOULD BE SET SUCH THAT ... PERCENTAGE CHANGES IN Q^d FOR EACH COMMODITY ARE THE SAME

IN TERM OF ELASTICITIES, RAMSEY'S RULE CAN BE EXPRESSED AS FOLLOWS:

$$\boxed{t_X \cdot \varepsilon_X^d = t_Y \cdot \varepsilon_Y^d} \Longrightarrow \boxed{\frac{t_X}{t_Y} = \frac{\varepsilon}{\varepsilon}}$$

t_X: % Δ IN PRICE AS TAX RATE

ε_X^d: $\frac{\% \Delta \text{ IN } Q_X^d}{\% \Delta \text{ IN } P_X}$

1927

INVERSE ELAS

$$\boxed{\frac{d\,y}{d\,x}}$$

TICITY RULE

% Δ IN PRICE — % Δ IN Q_X / % Δ IN P_X

1927

INVERSE ELAS

AS TAX RATE RAISES PRICE OF THE GOOD BY t %

$$\underbrace{\text{\% }\Delta P_X}_{}\cdot\frac{\text{\% }\Delta Q_X^d}{\text{\% }\Delta P_X}$$

WHEN THE TWO NOT RELATED, TAX RATES SHOU INVERSELY PRO TO PRICE E OF DEMAND

⇓

$\text{\% }\Delta Q_X^d$

=

PERCENTAGE REDUCTION IN Q^d DUE TO TAX!

EX: IF $\varepsilon_Y^d > \varepsilon^d$

t_Y SHOULD

THAN

OR RELATIVELY SHOULD BE RELATIVELY

FINAL EXAMS

1. EXTERNALITIES →
2. PUBLIC CHOICE
3. TAX & INCOME DISTRIBUTION
4. TAX & EFFICIENCY

TICITY RULE

GOODS ARE

ULD BE

OPORTIONAL

LASTICITY

* * *

X , THEN

BE SMALLER

t_X

HIGH TAX RATES

PLACED ON

INELASTIC GOODS !!!