

Measure of the Welfare Impact on Factors of Supply – Windfall Profits Tax: Lecture XVI

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The Oil Shock of the Late 1970s

Year	Price (\$ / Barrel)	Production (1,000 Barrels)	Imports (1,000 Barrels/Day)	Imports (1,000 Barrels)
1973	3.89	3360903	6025	1566500
1974	6.87	3202585	5892	1531920
1975	7.67	3056779	5846	1519960
1976	8.19	2976180	7090	1843400
1977	8.57	3009265	8565	2226900
1978	9.00	3178216	8002	2080520
1979	12.64	3121310	7985	2076100
1980	21.59	3146365	6365	1654900

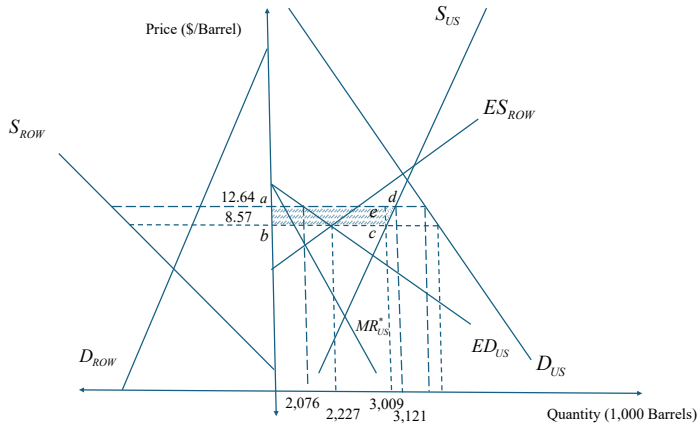
Crude Oil Windfall Profit Tax of 1980

- In 1973, the Organization of Arab Petroleum Exporting Countries initiated an oil embargo which had the effect of dramatically increasing the world-wide price of crude oil.
- In 1971, President Nixon had imposed a freeze on wages and prices to combat increasing inflation.
 - While dramatic increase in gasoline prices due to the OPEC embargo came after the initial implementation of price controls, gasoline prices were included.
 - The result was chaos – gasoline lines and even odd purchase days depending on the last number of your license plate.
- The Crude Oil Windfall Profit Tax Act of 1980 (P.L. 96-223) was a compromise which allowed for the deregulation of gasoline prices.

Structure of the Tax

- The tax was imposed on the difference between the market price for crude oil and a statutory price which was adjusted for inflation.
- The law provided for three tiers:
 - The code '[D]efines "tier one oil" as taxable crude oil other than tier two or three oil.' (70%)
 - '[D]efines "tier two oil" as stripper well oil and oil from an economic interest in a National Petroleum Reserve held by the United States.' (60%)
 - '[D]efines "tier three oil" as newly discovered oil, heavy oil, and incremental tertiary oil. (30%)

Modeling the Windfall Profit Tax

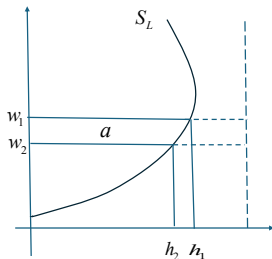


Ex Post Estimates of the Cost

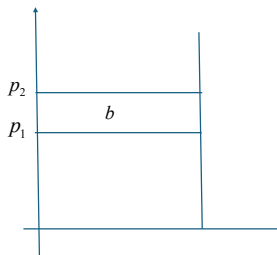
- Without the Windfall Profit Tax - the gain in domestic producer surplus would have been $abcd$ - \$ 12,474.55 million.
- However, the Windfall Profit Tax imposes a tax of τ on the area $abce$ (\$ 12.246.43). Assuming the 60 % tax rate – \$ 7,347.98 million.
- The area ecd is new production. I don't think this was taxed, but it could have been taxed at 30 %.

Factor Supply and Factor Owner Welfare

- The forgoing example highlights several questions about measuring the welfare impact of policy on factors of production.
- From one perspective, we could think of the oil wells that were producing before the imposition of the Windfall profit tax as a fixed asset (like farmland). As the price goes up, the rents to the assets simply increase.
- The question would involve the effect of new assets brought into production as the price increases.



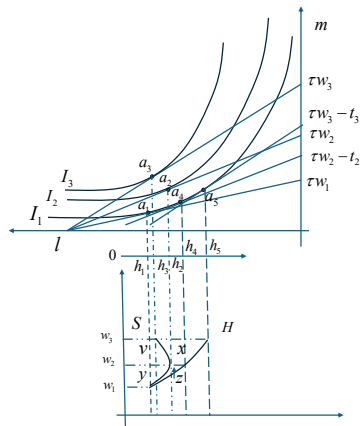
(a) Labor



(b) Land (Producing Well)

Exogenous Versus Endogeneous Income

- We will define *exogenous income* as that income which the consumer has no ability to increase or decrease in the short run.
- Similarly we define *endogenous income* as that component of income that the consumer can change – there is a response.
- Conceptually, *a factor supply curve for the consumer is determined by the exogenous income and the price of consumption commodities and other factors that influence consumer behavior.*
 - If the rents to farmland or the returns on stocks and bonds increase the consumer's income increases.
 - Further, we would recognize that increases or decreases in this exogenous income could affect the decision with regard to endogenous income. If my returns on my portfolio are higher, it could reduce the marginal value from an additional dollar of income – so I may reduce my labor supply.



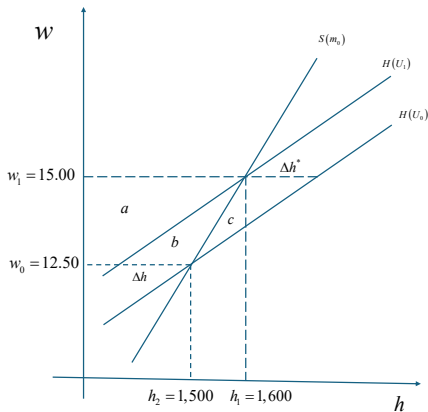
- Figure 11 is somewhat complex. The top panel is the leisure/work tradeoff with the horizontal axes depicting the amount of leisure enjoyed by the individual and the vertical axes being the amount of monetary income generated by the decision maker.
- Starting at price w_1 , the decision maker chooses point a_1 . Below the top panel is an 'inverse map' where the amount of leisure is transformed into the amount of hours worked. So point a_1 implies h_1 hours worked.
- Next, we assume that the wage rate increases to w_2 where the decision maker chooses point a_2 . Again, following the point down this means that h_2 hours are worked. The intersection of w_2 and h_2 yields a point on the uncompensated supply curve for labor.
- Envision the first segment of the supply curve for labor running from point (h_1, w_1) to point (h_2, w_2) .

- Completing the uncompensated supply curve, we increase the wage rate to w_3 resulting at the choice of point a_3 and h_3 hours supplied. The last point on the uncompensated supply curve is the (h_3, w_3) in the lower panel.
- Next, consider a “compensated” supply curve where enough tax is taken away to yield the same level of utility.
 - At wage rate w_2 the individual will earn τw_2 and be on indifference curve I_2 .
 - Consider imposing a ‘lump sum tax’ on this solution to shift the solution from a_2 to a_4 (i.e., by imposing a tax of t_2).
 - The concept is to shift the budget line so that it is parallel with the budget line at a_2 .
 - This results in h_4 units of labor being supplied. The point (h_4, w_2) is on the compensated labor supply curve.
- Finally, if we impose a “tax” of t_3 on the solution for w_3 , the decision maker supplies h_5 of labor, and the complete compensated labor supply curve of H is completed at (h_5, w_3) .

- Why this strange relationship? Basically, as wage income increases the value of leisure increases. Hence, when the marginal value of income when wages increase from w_2 to w_3 is lower than the marginal value of income when wages increase from w_1 to w_2 .
- So the compensating variation for an increase in the wage from w_1 to w_2 is either t_2 or $y + z$.

Surplus Change as an Approximation of WTP

- Since the exogeneity condition does not hold (there is an income effect), the scenario $C = \Delta S = E$ probably does not hold in general.
- The result is a similar analysis to the Hicksian/Marshallian case for consumers.
- Consider an increase in the wage rate from w_0 to w_1 .
- In general $\Delta S = a + b$, $C = a + b + c$, and $E = a$



- We begin with the effect of an increase in income on the amount of labor supplied – note that the labor supply curve does not need to bend backward, it simply needs to decrease

$$\begin{aligned}\tilde{\eta} &= \frac{\Delta h}{\Delta \tilde{m}} \frac{\tilde{m}}{h} \\ \Delta h &= \tilde{m} \times h \times \frac{\Delta \tilde{m}}{\tilde{m}}\end{aligned}\tag{1}$$

- As an approximation we set $\Delta \tilde{m} = \Delta S$, in this example 3,875.
- Substituting this result into Equation 1

$$b \doteq c \doteq \frac{1}{2} \Delta h \times |\Delta W| \doteq \frac{1}{2} \tilde{\eta} \times \Delta S \times h \times \frac{|\Delta w|}{\tilde{m}} = -38.75 \tag{2}$$

- Given the above formulation, we can define the compensating variation as

$$\tilde{C} = \Delta S - \hat{\epsilon} |\Delta S| \quad (3)$$

and the equivalent variation as

$$\tilde{E} = \Delta S + \hat{\epsilon} |\Delta S|. \quad (4)$$

- Where both are a function of an 'error' term $\hat{\epsilon}$

$$\hat{\epsilon} = \frac{\tilde{\eta} |\tilde{s}|}{2}, \quad \tilde{s} = \frac{\Delta S}{\tilde{m}} \quad (5)$$

In this case $\tilde{s} = 0.2067$, so $\hat{\epsilon} = 0.0052$. So, we would conclude that the error term is very small (less than 1%).