I. Hakan Yetkiner
http://eco.ieu.edu.tr/hyetkiner.php

Izmir Univery of Economics
Department of Economics

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Dr. Yetkiner

# Exercise III
## The Static Partial Equilibrium Model of Consumption-Leisure Tradeoff

**1**. (**No non-labor income**) Suppose that utility function $u$ of a representative agent is $u = c^{0.5} l^{0.5}$, where $c$ is consumption of physical goods and $l$ is consumption of leisure. Suppose that there is no non-labor income. Assume that real wage rate is $w = 5$ and that $h = 24$ hours.

Find the optimal values of $c$, $l$, $N^s$, and $u$ under the competitive equilibrium assumption.

**2**. (**Positive non-labor income**) Suppose that utility function $u$ of a representative agent is $u = c^{0.5} l^{1-0.5}$, where $c$ is consumption of physical goods and $l$ is consumption of leisure. Suppose that non-labor income is 60. Assume that real wage rate is $w = 5$ and that $h = 24$ hours.

(a) Find the optimal values of $c$, $l$, $N^s$, and $u$ under the competitive equilibrium assumption.
(b) Repeat the same exercise for non-labor income 120.
(c) Repeat the same exercise for non-labor income 140. Comment on the qualitative difference in results between (b) and (c).

**3**. (**Proportional labor income tax**) Suppose that utility function $u$ of a representative agent is $u = c^{0.5} l^{1-0.5}$, where $c$ is consumption of physical goods and $l$ is consumption of leisure. Suppose that non-labor income is *50*. Assume that real wage rate is $w = 5$ and that $h = 24$ hours. Suppose that the government decides to impose wage-income tax. In particular, the wage tax rate becomes $\tau = 0.20$.

(a) Find the optimal values of $c$, $l$, $N^s$, and $u$ under the competitive equilibrium assumption *before* and *after* wage income taxation.

(b) Disaggregate the total effect of taxation into substitution and income effects.

**4**. (**Production technology**) Suppose the $Y = zK^{(0.3)}N^{(0.7)}$.

(a) Derive the equation for the marginal product of capital ($MPP_K$).
(b) Derive the equation for the marginal product of labor ($MPP_N$).
(c) Suppose z = 3, K = 10, L = 20. Solve for $MPP_K$ and $MPP_N$.

**5**. (**Cost function**) Consider the following production function: $Y = AN^{\alpha}$, where $N$ is labor input, $Y$ is output, $A>0$ and $0<\alpha<1$. Let $W$ denote the price per unit of $X$.

(a) Determine whether this production function features constant, increasing or decreasing returns to scale.
(b) Show that this firm makes positive profits.
(c) Calculate and graph the Total, Average and Marginal Cost functions associated with this production technology (graph the Total Cost function separately from the Average and Marginal Cost functions).

**5**. (**Zero Profits**) Consider the following production function: $Y = K^{\alpha}N^{1-\alpha}$, where $Y$ is output, $K$ is capital, and $N$ is labor. Show that profits are zero.