Fall 2023
ECON 2152A (001)

Suggested Solutions to Practice Problems (Chapter 04)

4. When the government imposes a proportional tax on wage income, the consumer's budget constraint is now given by:

$$C = w(1-t)(h-l) + \pi - T,$$

where t is the tax rate on wage income. In Figure 4.3, the budget constraint for $t = 0$ is FGH. When $t > 0$, the budget constraint is EGH. The slope of the original budget line is $-w$, while the slope of the new budget line is $-(1 - t)w$. Initially the consumer picks point A on the original budget line. After the tax has been imposed, the consumer picks point B. The substitution effect of the imposition of the tax is to move the consumer from point A to point D on the original indifference curve. Point D is at the tangent point of indifference curve, I_1, with a line segment that is parallel to EG. The pure substitution effect induces the consumer to reduce consumption and increase leisure (work less).

The tax also makes the consumer worse off, in that he or she can no longer be on indifference curve I_1, but must move to the less preferred indifference curve, I_2. This pure income effect moves the consumer to point B, which has less consumption and less leisure than point D, because both consumption and leisure are normal goods. The net effect of the tax is to reduce consumption, but the direction of the net effect on leisure is ambiguous. Figure 4.3 shows the case in which the substitution effect on leisure dominates the income effect. In this case, leisure increases and hours worked fall. Although consumption must fall, hours worked may rise, fall, or remain the same.

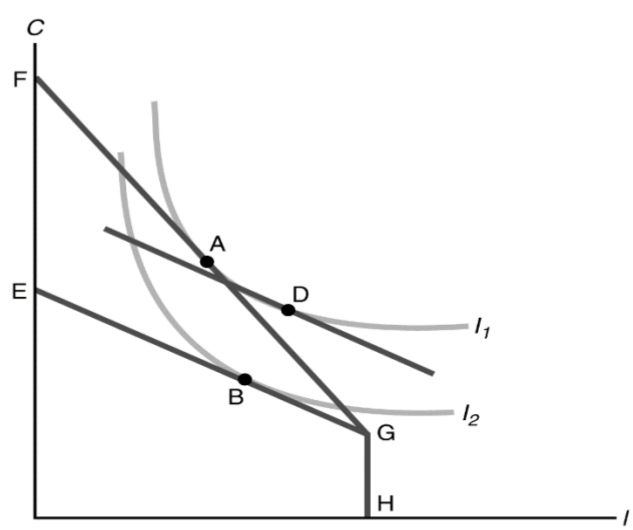

Figure 4.3

12. The firm chooses its labour input, N^d, so as to maximize profits. When there is no tax, profits for the firm are given by:

$$\pi = zF(K, N^d) - wN^d.$$

That is, profits are the difference between revenue and costs. In the top panel in Figure 4.16 the revenue function is $zF(K, N^d)$ and the cost function is the straight line wN^d. The firm maximizes profits by choosing the quantity of labour where the slope of the revenue function equals the slope of the cost function:

$$MP_N = w.$$

The firm's demand for labour curve is the marginal product of labour schedule in the bottom panel of Figure 4.16.

With a tax that is proportional to the firm's output, the firm's profits are given by:

$$\begin{aligned}\pi &= zF(K,N^d) - wN^d - tzF(K,N^d)\\ &= (1-t)zF(K,N^d) - wN^d.\end{aligned}$$

Here, the term $(1-t)zF(K,N^d)$ is the after-tax revenue function and, as before, wN^d is the cost function. In the top panel of Figure 4.16, the tax acts to shift down the revenue function for the firm and reduces the slope of the revenue function. As before, the firm will maximize profits by choosing the quantity of labour input where the slope of the revenue function is equal to the slope of the cost function, but the slope of the revenue function is $(1-t)MP_N$, so the firm chooses the quantity of labour where

$$(1-t)MP_N = w.$$

In the bottom panel of Figure 4.16, the labour demand curve is now $(1-t)MP_N$ and the labour demand curve has shifted down. The tax acts to reduce the after-tax marginal product of labour, and the firm will hire less labour at any given real wage.

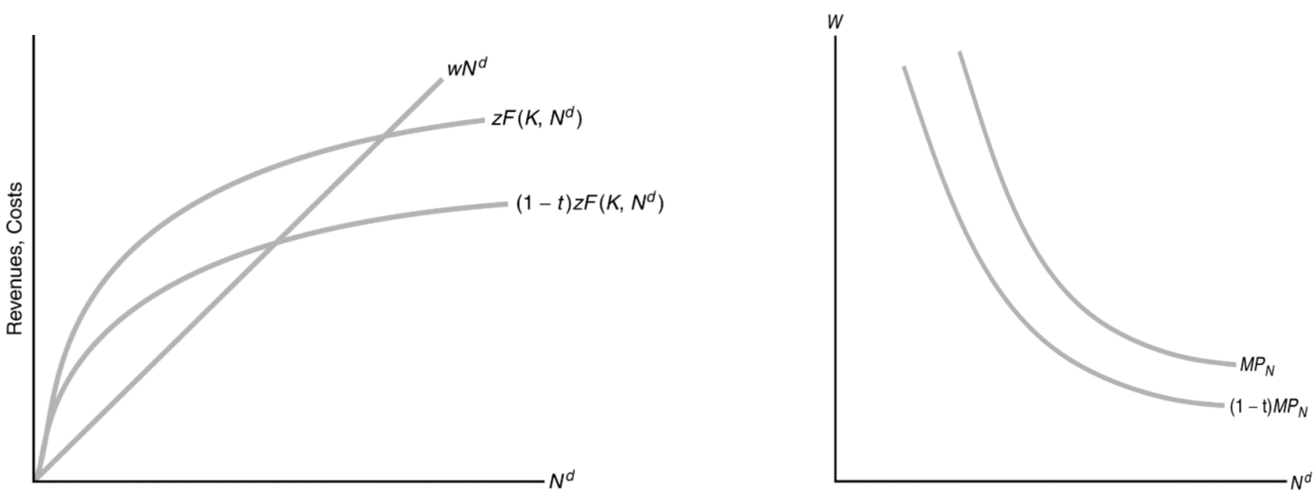

Figure 4.16

13. The firm chooses its labour input N^d so as to maximize profits. When there is no subsidy, profits for the firm are given by

$$\pi = zF(K, N^d) - wN^d.$$

That is, profits are the difference between revenue and costs. In the top panel in Figure 4.17 the revenue function is $zF(K, N^d)$ and the cost function is the straight line wN^d. The firm maximizes profits by choosing the quantity of labour where the slope of the revenue function equals the slope of the cost function:

$$MP_N = w.$$

The firm's demand for labour curve is the marginal product of labour schedule in the bottom panel of Figure 4.17.

With an employment subsidy, the firm's profits are given by

$$\pi = zF(K, N^d) - (w - s)N^d$$

where, the term $zF(K, N^d)$ is the unchanged revenue function and $(w - s)N^d$ is the cost function. The subsidy acts to reduce the cost of each unit of labour by the amount of the subsidy, s. In the top panel of Figure 4.17, the subsidy acts to shift down the cost function for the firm by reducing its slope. As before, the firm will maximize profits by choosing the quantity of labour input where the slope of the revenue function is equal to the slope of the cost function, $(t - s)$, so the firm chooses the quantity of labour where

$$MP_N = w - s.$$

In the bottom panel of Figure 4.17, the labour demand curve is now $MP_N + s$ and the labour demand curve has shifted up. The subsidy acts to reduce the marginal cost of labour, and the firm will hire more labour at any given real wage.

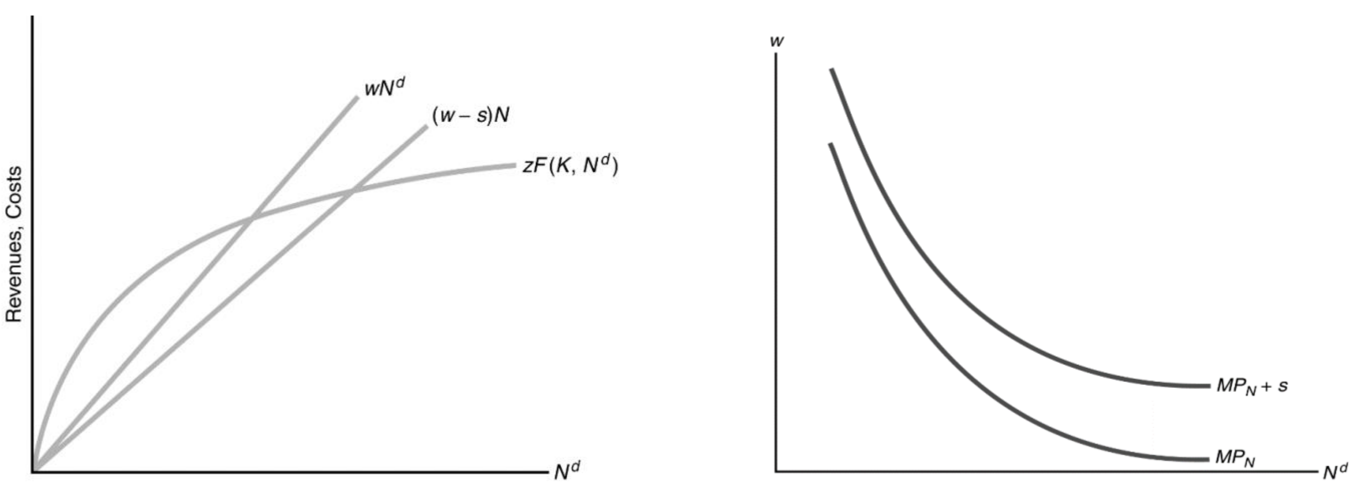

Figure 4.17