Property regimes, Transaction Costs, and Enforcement Technology

An economy is composed of two sectors: urban (or manufacturing) and rural (or agricultural). The total output function in the manufacturing and agricultural sectors are expressed as $f_M(L_M)$ and $f_R(L_R)$ respectively, where $L_M \times 10^3$ and $L_R \times 10^3$ denote the total number of workers working in each sector. Output functions take on the following specific forms:

$$f_M(L_M) = \sqrt{L_M}, \quad (1)$$

$$f_R(L_R) = \sqrt{L_R}. \quad (2)$$

This means, for instance, that if 3000 workers are working in the manufacturing sector, then total manufacturing output is $\sqrt{3} = 1.732$. The total number of workers in this economy is $\bar{L} = 5 \times 10^3$ and there is no unemployment. Let p be the unit price of agricultural goods in terms of manufactured goods and assume that it is fixed.

a) Let $p = 1$. Derive the equilibrium distribution of workers between sectors for this economy assuming *open access* in the rural sector and *exclusive ownership* (at no cost) in the urban sector . Assume that firms in the urban sector pay a wage w to hired workers and that all agents in this economy take wages and prices as given. Calculate the equilibrium values of the wage rate, total profits in the urban sector, and national income. Explain intuitively why this equilibrium is considered inefficient.

b) Assume now that there is the possibility of exclusive ownership in the rural sector but that exclusion uses up real resources in the following sense: In order to enforce exclusion in the rural sector, 2000 guards must be hired among the pool of workers and paid the same wage rate w as other workers. The labor market clearing condition is thus $L_M + L_R + 2 = 5$. Find the new equilibrium distribution of workers, the wage rate, firm net profits in both sectors, and national income. Can exclusive ownership be a sustained equilibrium for this economy?

c) Assume now that a technological innovation reduces the required number of enforcement guards to 1000. Derive the new equilibrium values for the economy and verify that exclusive ownership can be sustained as an equilibrium. Is it efficient? Who gains and who loses from this technological improvement? Interpret and comment.

SOLUTION

a) With open access in the rural sector, the equilibrium conditions in each sector are, respectively, $f'_M(L_M) = w$ and $f_R L_R/L_R = w$. Using the specific functional forms yields

$$\frac{1}{2\sqrt{L_M}} = w = \frac{1}{\sqrt{L_R}}. \tag{3}$$

Substituting in the labor endowment constraint $L_R = 5 - L_M$ leads to $L_M^{OA} = 1$, $L_R^{OA} = 4$, $w^{OA} = 0.5$, national income $Y^{OA} = \sqrt{1} + \sqrt{4} = 3$ and manufacturing sector profits $\pi_M^{OA} = \sqrt{1} - 0.5(1) = 0.5$, where superscript OA refers to the general equilibrium with open access in the resource sector.

The open access equilibrium is deemed inefficient because the marginal product of workers in the resource sector is strictly below that of a worker in the manufacturing sector, that is,

$$f'_R(L_R^{OA}) = 0.25 < f'_M(L_M^{OA}) = 0.5. \tag{4}$$

National income could thus be raised by reallocating workers from the rural to the urban sector.

b) With exclusive access in the resource sector, exclusion must be enforced with 2000 guards. Note that though the number of guards used to enforced is assumed exogenous, enforcement costs are endogenous by the fact that the wage rate is endogenous. We now have $f'_M(L_M^{RA}) = f_R(L_R^{RA}) = w$ and $L_M^{RA} + L_R^{RA} = 5 - 2$. This yields $L_M^{RA} = L_R^{RA} = 1.5$, $w^{RA} = 0.408$. Profits in the resource sector are $\pi_R^{RA} = f_R(L_R^{RA}) - w(L_R + 2) = \sqrt{1.5} - 0.408(1.5+2) = -0.203$. net profits being negative, restricted access in the resource sector cannot be sustained as an equilibrium. This is due to the fact that the wage rate paid to guards is too large to warrant exclusion from the resources. Open access is the only possible equilibrium.

c) If the number of guards necessary to enforce exclusion drops to 1000, the labor constraint becomes $L_M^{RA} + L_R^{RA} = 5 - 1$. This yields the following equilibrium values: $w^{RA} = 0.354$, $L_R^{RA} = L_M^{RA} = 2$ and $\pi_R^{RA} = \sqrt{2} - 0.354(2+1) = 0.354$. With positive net profits in the resource sector, the restricted access equilibrium can now be sustained.

The national income is $Y^{RA} = \sqrt{2} + \sqrt{2} = 2.828$, which is smaller than the national income under open access. Consequently, even though profits are large enough to cover the cost of enforcement of a restricted access following the improvement in the productivity of guards, the restricted access equilibrium is not efficient. The enforcement technological improvement is

thus good for resource owners and leads to a better use of the resource. However, it leads to inefficient property enforcement, as noted in section , and workers are made worse off since the wage rate is lower than the open access one.

As for the manufacturing sector profits, we have $\pi_M^{RA} = \sqrt{2} - 0.354(2) = 0.706 > \pi_M^{OA}$. Owners of manufacturing capital gain form a restricted access in the rural sector.