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Homework Problem Set No. 3

The economy of Lewisland is just beginning to wake up from a long period of agricultural stagnation, with the construction of some new factories in the industrial sector. The economy has relied so far entirely on production of corn. There are 100 identical families each farming their own lands. Each family has 10 siblings who participate equally in the farm work and share in the resulting output. In each farm, the land area is small: it can employ upto five full time workers, each of whom produce one unit of corn each. Beyond five full-time workers, additional workers generate no additional farm output. Hence the corn output of each farm is the smaller of 5 and x, the number of people working full time on the farm.

Each new factory produces shirts, employing labor. The marginal product of labor in each factory is $15 - y$ shirts, which is decreasing in y, the number of workers employed in the factory. Workers are free to move between the farm and industrial sector. There are no transport costs incurred by farm workers to go work in a factory.

Factories are owned by entrepreneurs who maximize profits. They save 10% of their profits and invest these to build new factories which start the following year. Each new factory requires a set up cost equivalent to 98 shirts.

Lewisland trades freely with the rest of the world, and Lewisland is small relative to the rest of the world's economy. Hence shirt and corn prices within Lewisland are fixed: the price of corn relative to shirts is 2, independent of how much shirts or corn are produced in the country. Each shirt produced can thus be sold at a fixed price equivalent to $0.5 = \frac{1}{2}$ units of corn.

(a) In year 0 before the new factories arrive, when each farm has 10 family members working on it, what is the average product of labor (i.e., corn output per worker) in

1

each farm? What is the marginal product of labor (i.e., incremental corn output if one more worker were to be employed)? What proportion of the economy's labor force is surplus labor?

(b) In year 1, 30 new factories are created. Assume (as Lewis did) that wages in the agricultural sector are going to remain fixed at their value in year 0 until such time that labor scarcity emerges in farms (i.e., the marginal product of labor exceeds the historical wage). What will the wage rate in the industrial sector be (in units of shirts)? How many workers will each factory employ in year 1?

(c) Calculate the total employment in the industrial sector in year 1.

(d) Will there be surplus labor in agriculture in year 1?

(e) Calculate the profits per factory in year 1. (Hint: remember how to calculate the area of a triangle.)

(f) How many factories will there be in year 2?

(g) Will there be surplus labor in agriculture in year 2?

(h) Calculate GDP in Lewisland in years 0, 1 and 2 respectively (in units of shirts). Describe in words the growth process experienced by Lewisland during these years.

(i) Will there be surplus labor in agriculture in year 3?