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ANSWERS TO PRACTICE MIDTERM EXAMINATION, 2014

(a) *The Solow model is based on the assumption of diminishing returns to scale, i.e., doubling capital and labor inputs will double output.*

False. It is based on constant returns to scale, with diminishing returns to capital alone.

(b) *The Harris-Todaro model of rural-urban migration predicts that government wage subsidies for the urban formal sector alone can achieve the twin goals of eliminating urban unemployment and achieving an efficient allocation of labor.*

False. Wage subsidies that ensure efficient allocation of labor will generate a higher expected wage from moving out of the rural sector to the urban sector. Hence they need to be combined with migration restrictions.

(c) *Local government revenues constituted the most important source of all government revenues in the United States during the 19th and early 20th century, in contrast to most Central and Latin American countries.*

True. Engerman and Sokoloff show that the proportion of local government revenues in the US exceeded 40% all the way from 1855 until 1927, while the shares of the national government and state governments was less than 40% during this period. The opposite was the case for Brazil, Chile, Colombia and Mexico.

(d) *The Gini coefficient is the only inequality measure that satisfies th four axioms of inequality measurement: anonymity, population replication, relative income principle, and the Dalton principle.*

False. The coefficient of variation, or the Theil measures of inequality are all consistent with these axioms as well.

(e) *It is possible for the poverty gap ratio in a given country to decline from year 1 to year 2, while the poverty head count ratio increases at the same time.*

True. Consider the following example. Suppose the poverty threshold is 100. A country has two types A,B of citizens in equal numbers in both years 1 and 2. Type A citizens' incomes go down from 95 to 50 from year 1 to 2, while Type B citizens' incomes go up from 95 to 120 at the same time. The poverty head count is 100% in the first year and 50% in the second. The poverty gap ratio goes up from 5% to 25%.

(f) *A decrease in the infant mortality rate would induce households to give birth to more children.*

False — they would want to give birth to fewer children, as children that are born are more likely to survive. If r is the risk that children born will not survive, and parents want to ensure that they have at least one surviving child with probability at least 95%, they need to give birth to at least n children, where n is the smallest integer satisfying $1 - r^n \geq .95$. A decrease in r will be associated with a decrease in n.

2. *Explain and contrast the predictions concerning the effects of a higher population growth rate on the growth rate of per capita income in each of the following theories: (i) Harrod-Domar, (ii) Solow, (iii) Lewis, for both (a) the short-run and (b) the long run.*

In the Harrod-Domar model, a higher population growth rate unambiguously reduces the rate of growth (in both the short and long run). In this model, per capita income is a linear function of capital per head (i.e. marginal productivity of capital is constant). So growth is caused by investment in capital goods which raises capital per head. The extent to which a given amount of investment increases the capital per head depends on the rate of population growth: higher population growth reduces the extent by which the amount of capital per head increases. Assuming zero depreciation, for instance, the rate of growth

g of per capita income in the Harrod-Domar model is given by

$$g = \frac{s}{\theta} - n$$

where s is the savings rate, θ is the capital output ratio, and n is the population growth rate. So the higher is n, the lower is g. Since the short run and the long run rate of growth are the same, the same effect operates on both.

In the Solow model, in the long run the amount of capital per head does not grow, owing to diminishing marginal productivity of capital. So the long-run rate of growth is always equal to the rate of technical progress, which is assumed to be exogenous, and thus independent of the savings rate. There will be no effect at all on the long-run growth rate. In the short run, however, increases in capital per head do contribute to growth, if the country happens to be below the steady state amount of capital per head. Then for exactly the same reason as in the Harrod-Domar model, the short run growth will become smaller when population grows faster.

In the Lewis model, the effect depends on which phase the economy happens to be in. If it is in the first phase, the effect on the short run growth rate is likely to be negative, as a higher population increases the demand for food, and thus drives up food prices (which in turn raises the cost of labor in the modern sector, reducing migration, industrial profits and investment). Later, however, higher population growth relieves the labor scarcity (that characterizes the second and third phases) which slows down the growth process; the effect on the long run growth rate is less adverse than on the short run growth rate, and may even be positive.

3. *Consider the following version of the Lewis model. There are two goods: corn and shirts. In Year 0, there are no factories, while there are 100 family farms. Each farm has ten adults, and a limited amount of land which produces corn as follows. If there are $x \leq 5$ adults in the family working in the farm, they collectively produce $2x$ units of corn. The land does not support gainful employment of more than five adults, so if $x > 5$, the farm produces a constant amount (10 units) of corn. Farm members share output, and value consumption only of corn (i.e., they do not have any demand for shirts).*

In Year 1, 10 factories are set up in the urban area. Each factory is owned by a capitalist who hires workers to maximize his own profits. The marginal product of labor in any factory is $12 - y$ shirts, if the factory is employing y workers. Factories export all their output at a constant relative price of 1 shirt $= \frac{1}{2}$ units of corn. Factory owners reinvest all their profits in new factories which are set up at the end of Year 1; they do not spend anything on corn. The setup cost of a factory equals 50 shirts. Workers incur no transport costs to travel between farms and the urban area.

(a) In Year 1, what is the industrial wage rate, employment and profit per factory (in units of shirts)? How much surplus labor if there in the rural sector? What is the GDP of the country (measured in units of shirts)?

The industrial wage rate will be $2 * 1 = 2$ shirts per worker. Each factory will hire y workers where $12 - y = 2$, or $y = 10$. Each factory owner will earn profits of $\frac{1}{2} * 10 * 10 = 50$. There will be 100 jobs in the urban area, so there will be 900 adults in the rural areas. Each farm needs only five adults, so the rural area can productively employ 500, and the surplus labor is 400.

Agricultural production is 1000 units of corn=2000 units of shirts. Production per factory is profits of 50 plus wage bill of $20 = 70$ shirts. Hence total industrial production is 700 shirts, and GDP in year 1 is 2700 units of shirts.

(b) How do these change in Year 2?

Each factory owner earns a profit of 50 in year 1, which is reinvested. Hence each owner builds one more factory in year 2. The number of factories will double to 20 in year 2.

The industrial wage rate will continue to equal 2 shirts per worker, since prices are unchanged and there continues to be surplus labor in rural areas. Hence employment and profit per factory will remain unchanged at 10 and 50 respectively. Employment in urban areas will equal 200, surplus labor in agriculture will be 800, and industrial production rises to 1400. Agricultural production remains unchanged. Hence GDP in year 2 is 3400 units of shirts.

(c) *Now suppose that at the beginning of Year 2, the price of shirts (relative to corn) doubled. What would be the effect on each of the above listed variables in Year 2?*

The industrial wage rate now falls to 1 shirt per worker. Hence each factory will now hire $12-1 = 11$ workers, and each factory owner's profit increases to $\frac{1}{2}*11*11 = 60.5$. Employment in urban areas will be 220 (implying lower surplus labor of 780), and production per factory will equal $60.5 + 11 = 71.5$ shirts. Industrial production will become $20*71.5 = 1430$. The value of agricultural production will now drop to 1000, so GDP will be 2430 shirts. GDP has gone down in units of shirts, but on the other hand shirts have become more valuable. In units of corn, GDP now equals 2430 units of corn (since 1 unit of corn now equals 1 shirt), as against 1700 units of corn before the price of shirts went up.

(d) *Assess the impact of the change in shirt prices in Year 2 on living standards of workers and capitalists respectively.*

Farm workers and industrial workers living standards have not changed: they earn and consume one unit of corn in both situations. Capitalists earn higher profits than before, irrespective of which units they are valued in.