Econ 1560 Second Midterm Exam

Instructions: Please answer all questions in the blue books. You may not use notes, books, or calculators. Please show your work. There are a total of six questions (some with multiple parts), for 100 points. Questions vary in their level of difficulty. Partial credit will be given for partially correct answers. Good luck!

1) [10 points] What is Wagner’s law?

2) [15 points] “In the context of using tax and transfer schemes to redistribute income, what you think about the size of the equity-efficiency tradeoff largely depends on what you think about the slope of the labor supply curve.” Explain this statement in a few sentences with appropriate diagrams.

3) [20 points] The population of a country is composed of two groups. There are 200 red people, who have income of zero. There are 100 green people, who each have income of one.

   A. [10 points] Graph the Lorenz curve.

   B. [10 points] Calculate the Gini coefficient. Be sure to show your work.

4) [20 points] In a certain country, output is produced with only land and labor. The production function is

   \[ Y = AX^{1/2}L^{1/2} \]

where \( Y \) is total output, \( A \) is productivity, \( X \) is the quantity of land, and \( L \) is both the labor force and the total population. The quantity of land is fixed. Between the years 1600 and 1740, total population grew by a factor of four, while living standards were unchanged. Over this same period, the growth rate of technology in the economy was 0.3% per year. What was the annual growth rate of efficiency? Show how you got your answer.
5) [20 points] Two countries are both described by the Solow model with free capital flows across borders. There is no human capital, technological change, or population growth. In each country, the production function in per worker terms is

\[ y = Ak^{1/2} \]

Capital flows freely into or out of each country such that the marginal product of capital (minus depreciation, which is the same in both countries) is equal to some fixed world interest rate. Both countries are small relative to the world capital market, and so have no effect on the world interest rate.

The level of \( A \) is twice as large in country 1 as in country 2.

A) [10 points] What is the ratio of \( k \) in country 1 to \( k \) in country 2?

B) [10 points] An economist does a standard “development accounting” exercise using data from these two countries. Specifically, she asks what fraction of the variation in income per capita between the two countries is due to capital per worker, and what fraction is due to productivity. What does she conclude? **Note:** when we did this sort of analysis in class, we looked at logarithms and variances and covariances and stuff. In this case, you don’t need to do any of that (and with only two countries, it doesn’t really make sense). If you just write out the basic development accounting equation, you should be able to get the answer pretty easily.

6) [15 points] Consider the model of international technology transfer from Chapter 8, applied to a world with three countries. In this world, there will of course be one technology leader and two technology followers. We assume that all technology transfers are from the leader to the followers, and that the follower countries don’t interact with each other at all.

Suppose that the three countries all have the same levels of population. Initially, Country 1 has the highest fraction of the labor force doing R&D, country 2 has the second highest, and country 3 has the lowest. This situation has been in place for a long time, and all three countries are growing at the same rate of 1% per year.

Now, in the year 2050, the fraction of the labor force doing R&D in country 2 rises, so that it is higher than the fraction doing R&D in country 1. The fractions of the labor force doing R&D in countries 1 and 3 are unchanged.

Draw a set of three graphs with time on the horizontal axis and each country’s growth on the vertical axis. The graphs should be stacked vertically. On these graphs, trace out the growth rate of output in each country, starting before 2050, and continuing as the countries asymptote to a new steady state. Clearly indicate how the new steady state rate of growth in each country compares to the initial steady state growth rate. Also clearly indicate the timing of events, that is, if growth in one country rises or falls before growth in another, please indicate it. Also, indicate in which cases growth jumps up vs. where it rises gradually. Accompany the figures with whatever text (and additional diagrams, if you wish) that is necessary to explain what is going on, what is happening at what point in time, etc.