

## ECON 133 “Global Inequality and Growth” Midterm

### 1. True False Statement/Questions (10 points)

Explain your answer fully based on what discussed in lecture and in section (no more than 5 lines per question). All the credit is based on the explanation. (2 points for each question.)

- (a) The decline of top marginal income tax rates has played an important role in the rise of labor income inequality in the United States since the 1970s.
- TRUE. It can explain why top wages have increased much more than average wage; see lecture 12.
- (b) The Pareto coefficient  $a$  for the distribution of income is 1.7 in the US and 2.3 in France. This means that income is more concentrated in France than in the US.
- FALSE. A higher Pareto coefficient means income is *less* concentrated at the top of the distribution.
- (c) There is strong empirical evidence supporting the argument that income inequality has a causal negative effect on economic growth.
- FALSE. Although there is a cross-sectional positive correlation between equality and growth (i.e. equal countries tend to grow more), this correlation does not exist for rich countries. Moreover, the relationship cannot be interpreted as causal. While moderate levels of inequality are good for growth (incentive effect), excessive inequality may be bad (e.g. leads to political instability and resource/credit constraints, erodes institutions)
- (d) In theory, whenever the supply of college educated workers stagnates, the skill premium always rises.
- FALSE. It depends on what happens to demand. See Autor (2014).
- (e) Changes in labor income concentration are the main reason why income inequality has changed over the course of the twentieth century in developed economies.
- FALSE. The reduction in income inequality in 1913–1950 was largely a capital phenomenon (large shocks to top fortunes 1913–1945 and rise of patrimonial middle-class), but income inequality has followed very different trends across countries since 1970. In the US, inequality has increased significantly, especially due to the top 1%. This has been due to rising labor income inequality in 1970–2000. Since then, increases in capital income inequality explain an increasingly significant fraction of overall income inequality. Other Anglo-Saxon countries (e.g. UK, Canada) have followed similar patterns, while Continental Europe and Japan have not experienced these large increases in inequality.

## 2. Exercise 1 (10 points)

Consider the wealth accumulation equation  $W_{t+1} = (W_t + s_t Y_t)(1 + q_{t+1})$ .

- (a) What does this formula say about the sources of wealth accumulation? Make sure to define each component. (2 points)
- Wealth at period  $t + 1$  depends on wealth at period  $t$ , saving  $S_t = s_t Y_t$  and asset price inflation relative to CPI. (1)
  - This means that both price effects and volume effects matter for wealth accumulation. (1)
- (b) Use the fact that  $Y_{t+1} = Y_t \cdot (1 + g_t)$  to express  $\beta_{t+1}$  in terms of  $\beta_t$ ,  $s_t$ ,  $q_{t+1}$  and  $g_t$ . (2 points)
- Start out with the wealth accumulation equation:  $W_{t+1} = (W_t + s_t Y_t)(1 + q_{t+1})$ . Define  $Y_{t+1} = Y_t \cdot (1 + g_t)$  and divide both sides by  $Y_{t+1}$ . (0.5)
  - $\frac{W_{t+1}}{Y_{t+1}} = \frac{(W_t + s_t Y_t)(1 + q_{t+1})}{Y_t(1 + g_t)}$  (0.5)
  - $\beta_{t+1} = \left( \frac{W_t}{Y_t(1 + g_t)} + \frac{s_t Y_t}{Y_t(1 + g_t)} \right) (1 + q_{t+1})$  (0.5)
  - $\beta_{t+1} = \frac{(\beta_t + s_t)(1 + q_{t+1})}{1 + g_t}$  (0.5)
- (c) If there was no capital gain ( $q_{t+1}$  always equal to 0), how would it affect the equation derived in question (b)? Derive the steady-state wealth-to-income ratio in this case. What is this formula called? (2 points)
- If  $q_{t+1} = 0\%$ , then  $\beta_{t+1} = \frac{(\beta_t + s_t)(1 + q_{t+1})}{(1 + g_{t+1})} = \frac{\beta_t + s_t}{1 + g_t}$  (0.5)
  - In steady state,  $\beta_{t+1} = \beta_t = \beta$ ,  $s_t = s$  and  $g_t = g$  for all time periods  $t$ . (0.5)
  - Plugging in these values in the equation above gives  $\beta = \frac{\beta + s}{1 + g}$ . (0.5)
  - Rearranging gives  $\beta = s/g$ : the Harrod-Domar-Solow formula. (0.5)
- (d) Plot the evolution of the national wealth-national income ratio from 1870 to 2010 in Europe and the US in a graph. (2 points)
- (0.25) for plotting a U-shaped curve for Europe
  - (0.25) for plotting a curve for US that is less strongly U-shaped
  - (0.25) for showing that  $\beta_t$  ratios were 600–700% in 1870
  - (0.25) for showing that  $\beta_t$  ratios are 400–600% in 2010
  - (0.25) for plotting a dip around WWI
  - (0.25) for plotting a nadir around 1950
  - (0.25) for plotting an increase in  $\beta_t$  since 1970
  - (0.25) for showing that this increase was from 200–300% to 400–600% in 2010.
- (e) Is it always the case that the capital share of income has to rise when the wealth-to-income ratio  $\beta$  rises? Explain. (2 points)
- No. It depends on the value of the elasticity of substitution between capital and labor. If  $\sigma > 1$  then the capital share and the wealth-income ratio move in the same direction, and vice versa. (1)
  - Empirically, the capital share and the wealth-income ratio has moved in the same direction over the 20th century, suggesting  $\sigma > 1$  (0.5)
  - However in the 19th century the wealth-income ratio was relatively low in the US despite a huge quantity of land, suggesting  $\sigma < 1$ .  $\sigma$  may have risen over the path of development. (0.5)

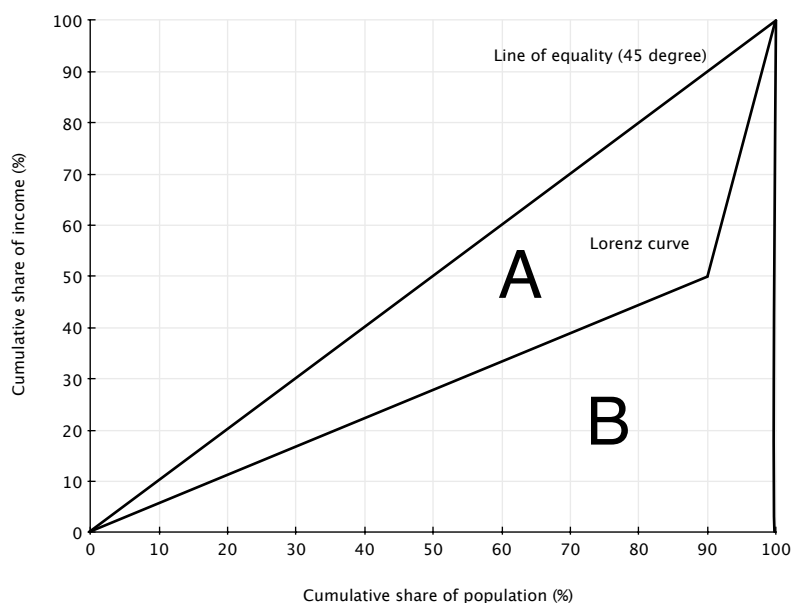
### 3. Exercise 2 (10 points)

Consider the case of Atlantis, a country where income is distributed as follows: the richest 10% of the population have 50% of total income, and the bottom 90% have the other 50% of total income.

Assume income is equally distributed within each of the two groups.

(a) Plot the Lorenz curve for Atlantis. Make sure to label both axes and to include the line of perfect equality. (2 points)

- (0.25) for labeling  $x$ -axis correctly
- (0.25) for labeling  $y$ -axis correctly
- (0.25) for line of equality
- (1) for drawing Lorenz curve correctly, i.e. with an inflection point at (0.9, 0.5).
- (0.25) for drawing Lorenz curve as a straight line and not a curve



(b) Calculate the Gini coefficient for this country (3 points).

- **Alternative 1: Calculating area of A**
  - From lecture we know that  $G = \frac{A}{A+B} = 2A$  (1)
  - $B = B_1 + B_2 + B_3$ , where  $B_1 = \frac{0.9 \times 0.5}{2} = 0.225$ ,  $B_2 = \frac{0.1 \times 0.5}{2} = 0.025$  and  $B_3 = 0.5 \times 0.1 = 0.05$ . (0.5)
  - Therefore  $B = B_1 + B_2 + B_3 = 0.225 + 0.025 + 0.05 = 0.3$ . (0.5)
  - Since  $A + B = 0.5$ , then  $A = (A + B) - B = 0.5 - 0.3 = 0.2$ . (0.5)
  - Therefore,  $Gini = 2A = 2 \times 0.2 = 0.4$ . (0.5)
- **Alternative 2: Using formula for 2 homogeneous groups**
  - From lecture, we know that the following is true for 2 homogeneous groups:  $Gini = s_1 + p_1 - 1$  where  $s_1$  is the share of income held by group  $p_1$ . (1.5)
  - Then,  $G = 0.9 + 0.5 - 1 = 0.4$  (1.5)

Now assume income is Pareto-distributed within the top 10%. To belong to the top 10%, an individual needs to have at least \$100,000 in income. The average income for those in the top 10% is \$300,000.

(c) Calculate  $b$ , the inverted Pareto-Lorenz coefficient (2 point).

- We know that  $b = \frac{y^*(y)}{y} = \frac{a}{a-1}$  where  $y^*(y)$  represents the average income above  $y$  and  $a$  is the Pareto coefficient. (1)
- From above, we have that the average income for those in the top 10% is \$300,000 and that the minimum income for this group is \$100,000. Therefore,  $b = \frac{y^*(y)}{y} = \frac{300,000}{100,000} = 3$ . (1)

(d) What is the average income above \$2,000,000 in Atlantis? (1 point)

- Since  $b = 3$  and constant for the upper trail of the income distribution, then the average income above \$2,000,000 is \$6,000,000. (1)

(e) Is income more or less concentrated at the top in Atlantis than in the US today? (2 points)

**Alternative 1:**

- In US today,  $b = 2.2 - 2.5$ . (1)
- Since  $b_{Atlantis} = 3 > 2.5 = b_{US}$ , then income in Atlantis is more concentrated at the top than in the US. (1)

**Alternative 2 (takes into account typo in Section notes):**

- According to Section's Lecture Review #3,  $a = 1.5$ , hence  $b_{typo} = \frac{a}{a-1} = 3$ . (1)
- Since  $b_{Atlantis} = 3 = b_{US-typo}$ , then income in Atlantis just as concentrated at the top than in the US. (1)