Spring 2019

ECON 133 "Global Inequality and Growth"
Final

Instruction: Write your answers in the boxes: nothing outside of the boxes will be graded. You can use a pencil but please write clearly.

Exercise 1: True False Statement/Questions (12 points)

Explain your answer fully based on what has been discussed in lecture and in section. No more than **5 lines per question**. All the credit is based on the explanation.

1. GDP = National Income - depreciation of capital + net foreign assets. *(2 points)*
   - FALSE. National Income = GDP - depreciation + net foreign income.
2. In light of the evolution of the capital share, the CES function with an elasticity of substitution of 1 isn't a good approximation for the aggregate U.S. production function. *(2 points)*
   - TRUE. A CES with $\sigma = 1$ is a Cobb-Douglas (C-D). As discussed in lecture, the C-D production function cannot accommodate the fact that the capital share increases with the wealth-to-income ratio. Recall that $\alpha = r \times \beta$. In the C-D, every change in β is exactly offset by a change in r.
3. Suppose that we have two homogeneous groups, one below percentile 90 with an income share of 45 percent and one above percentile 90 with an income share of 55 percent. The Gini Coefficient in this economy is 0.35. *(2 points)*
   - FALSE. $G = s_1 + p_1 - 1 = 0.55 + 0.9 - 1 = 0.45$
4. Since the 2000s, the main driver of the gender gap has been differences in education level between men and women. *(2 points)*
   - FALSE. Since the 2000s, education and more generally human capital cannot explain much of the gender pay gap (controlling for human capital only brings the female to male earnings ratio from 79% to 82% in 2010).
   - Industry and occupation choices are the main drivers of the gender pay gap today (controlling for them bring the female to male earnings ratio to 92%).
5. Since China has a lower tax revenue/GDP ratio than developed economies, its government has a more limited role than in Western countries. *(2 points)*
   - FALSE. The share of public wealth in national wealth can shed light on the ability of the government to regulate the economy. China has a high public wealth share compared to western economies ($\approx$ 30% vs 0%) and therefore, the role of the government goes beyond the means provided by tax collection.
6. In a dynamic random shocks model, a larger gap between r and g implies a lower Pareto coefficient for the top of the steady-state distribution of wealth. *(2 points)*

- TRUE. As discussed in lecture, a higher $r - g$ gap implies higher wealth inequality in the long run. Recall that a low Pareto coefficient implies a high inverted Pareto coefficient, and, therefore, higher inequality at the top of the distribution.

Exercise 2: Wealth Inequality (10 points)

Part A: Modigliani's life-cycle model

Assume that everybody starts working at age 0, works for N years, dies at age L, and leaves no inheritance. Labor income Y is constant at $\bar{Y}$ during working age; it is 0 afterward. Assume that individuals smooth their consumption (C) across their life cycle and that there is no growth of the economy and the interest rate is zero.

(a) Express individual annual consumption C and the savings rate S (both between 0 and N and between N and L) as a function of $\bar{Y}$, N and L. *(2 points)*

- $C = \frac{N\bar{Y}}{L}$
- $S = \begin{cases} \bar{Y} - C & = \bar{Y} - \frac{N\bar{Y}}{L} = \bar{Y}\left(\frac{L-N}{L}\right) \quad \text{if age} \leq N \\ -C & = -\frac{N\bar{Y}}{L} \quad \text{if age} > N \end{cases}$

(b) Use a graph to represent income $\bar{Y}$, consumption C, saving S, and wealth A as a function of age. What is the amount of saving an individual will have accumulated at the time when he or she retires? *(2 points)*

- See graph in lecture notes.
- $A_{\max} = N \times S_{0-N} = N\bar{Y}\left(\frac{L-N}{L}\right)$

(c) Can this model explain the inequality (of income or wealth) between two individuals of the same age? Why? *(1 point)*

- No. In this model, wealth inequality comes from differences in the number of years during which individuals save. Within age bin, all individuals save for the same number of years and therefore own the same wealth. Differences in labor income also are defined by age. Before N all individuals earn $\bar{Y}$, and after they retire, they all earn 0.

(d) Recall the parameter μ_t in the formula for the aggregate bequest flow seen in lecture. Define this parameter. What value does it take in Modigliani's life-cycle model? *(1 point)*

- This parameter is the ratio between average wealth at death and average wealth in the population. In Modigliani's model, people die with zero wealth. Therefore, $\mu = 0$.

(e) Now assume $\mu_t > 1$. Draw a graph of wealth A as a function of age that is consistent with this assumption. Indicate at least one assumption of the Modigliani model that needs to be relaxed for the wealth accumulation process to take this shape. *(1 point)*

- Figure: At age N wealth A either stay flat or keeps increasing (but doesn't decrease).
- Individuals need to be able to leave at least as much wealth as the average wealth in the population. To do so, people could over save, we could introduce $r > 0$, $g > 0$, among others. We could also drop the assumption of total consumption smoothing.

Part B: Inherited Wealth

Modigliani (1986, 1988) defines inherited wealth as $W_{Bt}^{M} = \sum_{t-H \leq s \leq t} B_s$ where B_s is the observed (past) annual inheritance flows over the last H years.

(f) What alternative formula do Kotlikoff and Summers (1981, 1988) propose for W_{Bt}? What is the main difference with Modigliani's formula? *(1 point)*

- In Kotlikoff and Summers, $W_{Bt}^{KS} = \sum_{t-H \leq s \leq t} B_s(1+r)^{t-s}$. The main difference is that KS accounts for the flow returns of capital.

(g) Explain how Piketty, Postel-Vinay and Rosenthal (2013) define W_B. How does this definition improve over the Modigliani and Kotlikoff and Summers ones? *(1 point)*

- Piketty, Postel-Vinay and Rosenthal (2013) define W_B as the wealth of inheritors plus the inherited share of savers' wealth.
  - savers: assets $>$ capitalized value of inherited wealth (they consume less than their labor income)
  - inheritors: assets $<$ capitalized value of inherited wealth (they consume more than their labor income)
- This definition improves over M and K.S. because past bequests are capitalized (contrary to M) and the share of inherited wealth is between 0 and 1 (contrary to KS).

(h) Provide a graph with the approximate values of φ over the last century for either Europe or the U.S. *(1 point)*

- See lecture notes.

Exercise 3: Taxation (10 points)

Part A: Optimal Labor Income Taxation

(a) How have top marginal labor income tax rates changed over the past century in the United States? Explain how top marginal labor income tax rates can affect the concentration of pre-tax income at the top. *(1 point)*

- Top marginal tax rates were much higher in the years following World War II (the top rate was as high as 91%). The top marginal tax rate fell a bit in the mid-1960s and substantially in the 1980s. There have been some small changes in the past 20 years, but nothing as drastic. The current top rate is 37%
- Top earners can decrease their labor supply when top marginal tax rates increase (supply side response), reducing the concentration of pre-tax income. Moreover, when the top marginal tax rate is high, company executives have less of an incentive to bargain for higher compensation (the reward is much lower).

(b) Write the optimal labor income tax rate formula under a Rawlsian social welfare function. Provide the formula and intuition behind the elasticity term in this optimal labor income tax rate formula. *(2 points)*

- $$\tau^* = \frac{1}{1+e}$$
- where $e = \frac{dZ}{d(1-\tau)} \cdot \frac{1-\tau}{Z}$ is the elasticity of earnings (Z) with respect to the keep rate $1-\tau$.
- As e increases, τ^* decreases. Therefore, the optimal tax rate is lower when labor supply is more elastic. That's the key rule of optimal taxation: don't tax what's elastic. Why? Because the behavioral response of tax payers (either lower labor supply or income sheltering) will offset the mechanical effect of a tax increase

Part B: Optimal Capital Taxation

(c) Provide one argument supporting the view that it may not be desirable to tax capital if labor income is already taxed. *(1 point)*

- High capital mobility and no international coordination imply that the efficiency cost of capital taxation might be very high, with capital accumulation being very sensitive to the net-of-tax return.
- If like in the Modigliani theory, all capital accumulation comes from labor income, it would imply taxing labor income twice and taxing labor income progressively is enough to achieve any desired level of redistribution while minimizing efficiency losses.

(d) Explain why the following statement is incorrect: If the tax-base shifting elasticity is zero, then there is no reason to tax capital. *(1 point)*

- If the tax-base shifting elasticity is zero, then there will no shifting from L to K (or vice versa) when $\tau_K \neq \tau_L$.
- However, there are other reasons why capital should be taxed. For instance, equity concerns in a context where capital income concentration is higher than labor income concentration; and the fact that a large share of capital comes from inheritance.

(e) Write the optimal inheritance tax rate formula when the government cares about maximizing the welfare of people born with no inheritance, and explain every term in the formula. *(2 points)*

- $\tau_B = \frac{1-\bar{b}}{1+e_B}$
- where $\bar{b}$ is the average bequest left by zero-bequest receivers relative to the average bequest
  - $\bar{b} = 0$ if zero-bequest receivers leave no bequest (in other words, people who received nothing from their parents are all going to transmit also zero wealth to their kids)
  - $\bar{b} = 1$ if zero-bequest receivers leave as much bequest as average
  - $\bar{b} < 1$ if zero-receivers leave smaller bequests than average
- e_B is the elasticity of bequest to the net-of-tax rate.

Part C: Comparison

(f) Why does the optimal tax rate formula differ for labor income vs. bequest taxation? *(2 points)*

- In the optimal labor income taxation, the unique goal of the social planner is to maximize tax revenue so as to make the largest transfer possible to the lowest income person.
- In the optimal bequest taxation problem, the social planner needs to balance government revenue maximization and the fact that even zero bequest receivers have a preference for leaving a bequest to their children. Therefore the optimal tax rate is not necessarily revenue maximizing.

(g) Empirically, how does the top marginal bequest tax rate compare to the top marginal labor income tax rate in the United States today? How can this be rationalized? *(1 point)*

- Top marginal labor income tax rate: 37%; top bequest tax rate: 40% (but kicking in only for extremely high bequests)
- Can be rationalized if policy makers feel that labor is more elastic than bequests (low e_B)

Exercise 4: Tax avoidance and tax evasion (8 points)

(a) Provide a concrete example of a way in which a firm may shift their profits from a high tax to a low tax country. Be as precise as possible. *(2 points)*

- Examples should have to illustrate either transfer pricing, intra-firm borrowing or locating intangibles in tax havens.
- Transfer pricing is when a multinational firm manipulates prices at which goods are sold between subsidiaries of the firm. For example, U.S. firms export goods to low-tax subsidiaries at low prices and import at high prices.
- Intra-firm borrowing is when a multinational firm uses borrowing/lending schemes between subsidiaries of the firm to minimize its global tax liability. For example, U.S. firms borrow at a high-interest rate from low-tax subsidiaries.

(b) Define formula apportionment and explain how it can help solve the problem of corporate tax evasion. It is not necessary to write down the formula if you do not remember it. *(2 points)*

- *formula apportionment* involves taxing the various parts of a multinational company based on what it is doing in the real world. Specifically, the formula apportionment allocates profits to a jurisdiction based upon real factors such as total third-party sales (S); total employment (L, calculated either by headcount or by salaries) and the value of physical assets (K) actually located in each territory where the multinational operates. That is, if a company's worldwide profits are π, jurisdiction i imposes tax on a fraction of π equal to $\alpha_K \frac{K_i}{\sum_j K_j} + \alpha_L \frac{L_i}{\sum_j L_j} + \alpha_S \frac{S_i}{\sum_j S_j}$, where $\alpha_K + \alpha_L + \alpha_S = 1$.
- Imagine a company with a one-person booking office in Panama, with no local sales. Under current "arm's length" rules, this company can shift profits into this office, and use this to reduce its tax liability. Formula apportionment can help fix this issue, to the extent that $\alpha_S > 0$ and/or $\alpha_L > 0$. Indeed the formula based on sales and payroll would allocate only a small fraction of the income under the formula to Panama, so only a small portion would be subject to Panama's low tax rate. Indeed, the main attraction of formula apportionment is that it eliminates the opportunity for companies to engage in profit shifting, as the tax base in any jurisdiction does not depend on profits reported there. Importantly, this works because sales and employments are much harder to move than profits (i.e. lower elasticity of sales / employments to the net of tax rate)..

(c) Explain what an integrated corporate tax is and why it could reduce profit-shifting. *(2 points)*

- The best way to explain it is with an example. Assume an individual owns a firm with annual profits of \$100, all of which are annually paid as dividends. Assume the corporate tax is 30% and the dividend income tax is 40%. The total tax bill is $100 \times 30\% + 70 \times 40\% = 58$. Assume now that the corporate income tax is integrated. The total tax bill is $100 \times 30\% + (100 \times 40\% - 30) = 40$. In this case, the individual pays dividend tax on the total profit but gets credit for corporate tax paid.
- Under the non-integrated system, if the corporation decides to evade taxes then the government loses 30 in revenue. The advantage of corporate income tax integration is that the total tax bill is not subject to corporate tax evasion

choices. Indeed if the company decides not to pay their corporate tax (30), then the shareholders do not receive credit for corporate tax paid and have to pay 40. In this context, the interest of shareholders and the government are aligned so that ultimately companies have fewer incentives to avoid.

(d) Assume you are given estimates of the top income share computed using tax returns data. Do these estimates over or underestimate inequality? Explain why. *(2 points)*

- Top income share based on tax returns data are computed using only taxable income. In other words, these estimates do not include income that is hidden from tax authorities
- There are reasons to believe (for instance Alstadsaeter et al., 2019) that tax evasion is more concentrated at the top of the income distribution and therefore that estimates based on tax returns underestimate income inequality.

Bonus (2 points): We tweeted an NPR article about the wealth tax ("Why A Wealth Tax Didn't Work In Europe"). Give one reason why European countries abolished their wealth tax. Should the U.S. implement a federal wealth tax, would it face the same problem(s)?

- There are multiple reasons: tax competition, liquidity issues (leading governments to introduce exemptions), low revenue collection (in part due to loopholes created by governments), etc. With a federal wealth tax, tax competition would be much less of a concern in the US. Restricting the wealth tax to the very rich would make liquidity issues irrelevant. And with no exemptions or loopholes the tax would be hard to avoid and generate sizable revenue given the concentration of wealth in the US.