Department of Economics
University of São Paulo
EAE-1234 - Public Economics
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Exercise list 1
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Instructions: The exercise list can be solved in group (maximum 4), but each member has to **write** and deliver the list separably. When solved in group, please note the group participants. Exercise lists "copy and pasted"will be punished as defined in the syllabus.

1. **(Tax incidence)** Consider the market for toilet paper. An economic consultant has been hired to estimate aggregate demand for toilet paper in the state o São Paulo, and they estimated a linear demand of the form $Q^D = 120 - 30P$, where P is the price of toilet paper and Q the traded quantity. Assume the aggregate supply is $Q^S = 10P$.
   (a) What is the equilibrium price and quantity in the market for toilet paper in São Paulo?
   (b) Calculate the elasticity of demand and supply at the equilibrium. Only looking at the elasticities, what side of the market do you expect would absorb an increase in the ICMS (sales tax) for toilet paper?
   (c) Now assume a fixed ¢40 tax t is introduced to the toilet paper price tag. Calculate the new equilibrium quantity and price of supply and demand. What is the reduction in consumption of toilet paper?
   (d) What is the statutory incidence of this tax? What is the economic incidence? Calculate based on the new equilibrium in (c) and compare it with the formula seen in class.
   (e) What revenue does the São Paulo government earn from this tax? How mistaken would the government be if it used the pre-tax quantity to estimate the tax revenue?

2. **(Deadweight loss)** Consider an economy with domestic demand for cellphones given by $Q^D = D(P) = 5,000 - 100P$, where the price P is measured in reais and the quantity Q is measured in thousands of units per year. Domestic supply is given by $Q^S = S(P) = 150P$.
   (a) What is the equilibrium in the domestic market for cellphones?
   (b) Assume that an unlimited amount of cellphones now can be imported from China at the price of R$10 each. What is the new market equilibrium? How many cellphones will be imported?
   (c) Now let the federal government impose an import fee of R$5. What is the new equilibrium? What is the government revenue?
   (d) What amount of consumer surplus is transfered to national producers? What is the deadweight loss?
   (e) Now imagine that the government establishes instead an import quota of 1,250,000 units per year. What is the new equilibrium and deadweight loss in this case?

3. **(Taxes and labor supply)** Individuals decide their labor supply and consumption with preferences represented by an utility function of the type

$$U(c, l) = c - \frac{l^2}{2},$$

where c is consumption, l the labor supply (measured in hours per week), which earns a wage per weekly hour w and taxed at a proportional (labor) income tax with single rate of τ.

   (a) Write down the workers' budget constraint and solve it for the optimal (Marshallian) labor supply as a function of w and τ.

   (b) Draw the Laffer curve and find its optimum (the taxation that maximizes government revenue). Clarify the role of the mechanical and behavioral effects on establishing the curve's shape.

   (c) Now assume all income tax revenue is returned to workers as a lump-sum transfer (e.g. an universal basic income). Draw the workers' budget constraint. What is the behavioral effect of the UBI in this scenario?

   (d) Assume there are 2 individuals in our economy: the first earns R$20 per hour of work, while the second earns R$100 per hour. Find the Marshallian labor supply of each kind of individual given the tax rate that maximizes government revenue in (b) and the UBI in (c), as well as each worker's income after taxes and transfers.

   (e) Consider now a different policy, where the government subsidizes labor at 100% up to R$1000, and taxes it at a rate of 50% after that amount. (The government revenue is distributed as before in a lump-sum manner.) Draw the new budget constraint and find the new optimal labor supply and after-tax income. Considering a Benthamite welfare function, what policy is better for social welfare?

4. **(Taxation and welfare)** Let's continue with the case in item (d) of the previous question. Namely, let there be two (kinds of) workers, the first earning R$20 per hour, while the second earns R$100 per hour, and a proportional (labor) income tax rate τ, which is returned to workers in a lump-sum manner as a transfer $T = R(\tau)/2$.

   (a) What is the workers' indirect utility function (as a function of their wages and the tax), $V(w, \tau)$, already taking into account that the government revenue is returned to workers as a lump-sum transfer? What is the preferred tax rate for the poorer worker? (Here you can apply the *envelope theorem* to simplify the math.)

   (b) Now compute the taxable income elasticity regarding the net-of-tax rate for each worker at the optimal labor supply. Compare the result of the formula for the top of the Laffer curve seen in class with the maximizing rate in exercise 3 (d), as well as with the favorite rate for the poor worker in item (a).

(c) What is the after-tax income and utility of each individual under the tax rate in item (b)? Find the tax rate that maximizes a Rawlsian welfare function.

(d) For the rest of this question, assume that workers are risk averse, with preferences represented by the utility function

$$U(c, l) = \ln c - \frac{l^2}{2},$$

but assume that workers always supply 20 weekly hours of labor. What is the tax rate that maximizes a Benthamite welfare function?

(e) What is the after-tax income and utility of each worker under the tax in item (d)? Show that this solution satisfies Edgeworth's principle of equimarginal sacrifice. Why is that?

5. **(Taxes and savings)** Imagine an economy with two periods, where individuals earn an income of $Y = 100$ in the first period and earn zero (retired) in the second. There is only one financial asset: a doge coin with zero risk and that pays 40% interest per year. Individuals have preferences that can be represented by the utility function

$$U = \ln c_1 + \ln c_2,$$

where c_t is the consumption at time t, $t \in \{1, 2\}$.

(a) Define the intertemporal optimization problem of the individuals in this economy, and find the optimal consumption (for $t = 1, 2$) and savings.

(b) Now assume the government introduces a comprehensive income tax (that burdens both labor and capital income) of $\tau = 20\%$. Solve for optimal consumption and savings.

(c) Compare the results in (a) and (b). Does taxation distort intertemporal consumption decisions? Without explicit calculation, what are the directions of the substitution and income effects, and which is stronger?

(d) The Congress is studying changing this system for one in which only labor is taxed. What is the government revenue with the comprehensive tax in (b)? Find the labor income tax τ_L that is *budget neutral*.

(e) Now find the optimal consumption and savings under the tax τ_L in (d). Does the labor tax distorts intertemporal consumption?