

Economics 602  
**Macroeconomic Theory and Policy**  
**Problem Set 2**  
Professor Sanjay Chugh  
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1. **Interaction of Consumption Tax and Wage Tax.** A basic idea of President Bush's economic advisers throughout his administration was to try to move the U.S. further away from a system of investment taxes (which we will discuss later in the course) and more towards a system of consumption taxes. A nationwide consumption tax would essentially be a national sales tax. Here, you will modify our basic consumption-leisure model to include both a proportional wage tax (which we will now denote by  $t_n$ , where, as before,  $0 \leq t_n < 1$ ) as well as a proportional consumption tax (which we will denote by  $t_c$ , where  $0 \leq t_c < 1$ ). A proportional consumption tax means that for every dollar on the price tags of items the consumer buys, the consumer must pay  $(1+t_c)$  dollars. Throughout the following, suppose that economic policy has no effect on wages or prices (that is, the nominal wage  $W$  and the price of consumption  $P$  are constant throughout).
- Construct the budget constraint in this modified version of the consumption-leisure model. Briefly explain economically how this budget constraint differs from that in the standard consumption-leisure model we have studied in class.
  - Suppose currently the federal wage tax rate is 20 percent ( $t_n = 0.20$ ) while the federal consumption tax rate is 0 percent ( $t_c = 0$ ), and that the Bush economic team is considering proposing lowering the wage tax rate to 15 percent. However, they wish to leave the representative agent's optimal choice of consumption and leisure unaffected. Can they simultaneously increase the consumption tax rate from its current zero percent to achieve this goal? If so, compute the new associated consumption tax rate, and explain the economic intuition. If not, explain mathematically as well as economically why not.
  - A **tax policy** is defined as a particular combination of tax rates. For example a labor tax rate of 20 percent combined with a consumption tax rate of zero percent is one particular tax policy. A labor tax rate of five percent combined with a consumption tax rate of 10 percent is a different tax policy. Based on what you found in parts a and b above, address the following statement: a government can use many different tax policies to induce the same level of consumption by individuals.
  - Consider again the Bush proposal to lower the wage tax rate from 20 percent to 15 percent. This time, however, policy discussion is focused on trying to boost overall consumption. Is it possible for this goal to be achieved if the consumption tax rate is raised from its current zero percent?
  - Using a Lagrangian, derive the consumer's consumption-leisure optimality condition (for an arbitrary utility function) as a function of the real wage and the consumption and labor tax rates.

2. **Non-Backward-Bending Labor Supply Curve.** Consider an economy populated by 100 individuals who have identical preferences over consumption and leisure. In this economy, the aggregate labor supply curve is upward-sloping. For simplicity, suppose throughout this question that the labor tax rate is zero.
- For such a labor supply curve, how does the substitution effect compare with the income effect?
  - Using indifference curves and budget constraints, show how such a labor supply curve arises.
3. **A Backward-Bending Aggregate Labor Supply Curve?** Despite our use of the backward-bending labor supply curve as arising from the representative agent's preferences, there is controversy in macroeconomics about whether this is a good representation. Specifically, even though a backward-bending labor supply curve may be a good description of a given individual's decisions, it does **not** immediately follow that the representative agent's preferences should also feature a backward-bending labor supply curve. In this exercise you will uncover for yourself this problem. For simplicity, assume that the labor tax rate is  $t = 0$  throughout all that follows.
- Suppose the economy is made up of five individuals, person A, person B, person C, person D, and person E, each of whom has the labor supply schedule given below. Using the indicated wage rates, graph each individual's labor supply curve **as well as** the aggregate labor supply curve.

Nominal Wage, $W$	Person A	Person B	Person C	Person D	Person E
\$10	20 hours	0 hours	0 hours	0 hours	0 hours
\$15	25	15	0	0	0
\$20	30	22	8	0	0
\$25	33	27	15	5	0
\$30	35	30	20	15	0
\$35	37	32	25	20	6
\$40	36	31	27	25	21
\$45	35	30	26	28	30
\$50	33	29	24	25	29

Now suppose that in this economy, the "usual" range of the nominal wage is between \$10 and \$45.

- Restricting attention to this range, is the aggregate labor supply curve backward-bending?
- At a theoretical level, if we want to use the representative-agent paradigm and restrict attention to this usual range of the wage, does a backward-bending labor supply curve make sense?

- d. Explain qualitatively the relationship you find between the individuals' labor supply curves and the aggregate labor supply curve over the range \$10 – \$45. Especially address the “backward-bending” nature of the curves.