

ECON 110, Prof. Hogendorn

Problem Set 8

1. *SmallCountry*. Remember that a country's supply of loanable funds is the *net* supply after households that borrow are subtracted from those who save. Suppose there is a small country with 1000 households. 700 of these have a savings function $s = 50r$, where r is the rate of return on capital. The remaining 300 households have savings function $s = -1 + 10r$. (You can imagine that both the number of households and the amount of savings are in thousands.)
 - (a) Graph the individual and aggregate savings functions. Describe in words what happens to both types of household and the whole country when the interest rate rises from 3% to 11%.
 - (b) There are 100 firms, and each firm has an investment demand function ($i(r) = 10/r$). Find and graph the aggregate investment function for the whole country.
 - (c) Show that the equilibrium interest rate in this country is 16.6% (rounded to one decimal).
 - (d) In most countries, a real interest rate of 7% would be more typical. Do you think this country will have higher or lower economic growth than the typical country? Explain.
2. *OldGermans*. In Germany, the birth rate is low and the population is ageing. As a result, the working age population is falling at about 0.2% per year. It has been suggested that this population decline puts the German economy at risk. This question asks you to use our simple neoclassical model to evaluate that claim.

Let there be $\mathcal{L} = 243$ German workers who inelastically supply labor and who spend all of their income on beer consumption. These workers own the German beer firms which have aggregate production function $f(L) = \frac{54}{4}L^{4/5}$. (Aggregate meaning we treat all the firms as if there were just 1.) There is no money, so the price of one beer is one beer.

- (a) Find the equilibrium real wage in the labor market and graph the labor market.
- (b) Verify that there is also equilibrium in the beer market and graph the production function. What share of workers' income comes from wages and what share from dividends?
- (c) Suppose that over 10 years, the German population falls and there are only $\mathcal{L}' = 198$ workers. Find the new general equilibrium.

3. *GrowingChina*. This problem discusses the Malthusian trap that has worried China for centuries and that the country now seems to have escaped. Let there be $\mathcal{L} = 1000$ Chinese workers who inelastically supply labor and who spend all of their income on rice. These workers own the Chinese rice firms which have aggregate production function $Y = f(L, K) = A(hL)^{2/3}K^{1/3}$. (Aggregate meaning we treat all the firms as if there were just 1.) Let $A = 3.33$, $h = 1$, $p = 1$ and let $K = 729$. Note that the Chinese capital stock is constant until part (d) of this problem.

- (a) Find the equilibrium real wage and graph the labor market.
- (b) Verify that there is also equilibrium in the rice market and graph the production function. What is output per worker (Y/\mathcal{L})?
- (c) Suppose that over several years, the Chinese workforce rises to 1,728 workers. If nothing else changes, what is the new

general equilibrium (the new wage and the new output per worker)? Why don't these new workers produce enough to keep the output per worker at least as high as before?

- (d) Consider the following changes to the production function: an increase in A , an increase in K , and an increase h . How would each of these help China escape the Malthusian trap? What is the name for each of these sources of growth?

Review Problems only, not to turn in:

4. *Deflate*. Given the information below about the U.S. economy, how much did real GDP grow between 1980 and 1990? Between 1990 and 2000?

	1980	1985	1990	1995	2000
Nominal GDP (trillions)	2.8	4.21	5.8	7.4	9.96
GDP deflator (1996=100)	57.0	73.7	86.5	98.1	106.9

5. *Uchitelle*. The following are quotes from an op-ed by Louis Uchitelle that appeared in the New York Times on August 25, 2002. It provides some food for thought, but we can evaluate the arguments a lot more clearly in a simple macroeconomic model. At the end of the article is a suggestion for trying to model Uchitelle's idea.

In Alice in Wonderland fashion, we talk of expansion and ignore the contraction all around us. We convince ourselves that out of cost-cutting will come prosperity. But while cost-cutting can lift a single company or two, when practiced widely enough it can pull down an economy. And that is happening today.

... consider what happens in an imaginary country where Burger King and McDonald's are the entire business sector and the total national output 100 hamburgers a day, evenly divided between the companies matches the demand from this nation's consumers. Demand and sales revenue, however, stay flat. So Burger King lays off two workers and uses the saved wages partly to fatten profits and partly to discount prices by just enough to take sales and revenue away from McDonald's. And McDonald's responds in kind. But soon,

the four laid-off workers, with little income, buy fewer hamburgers, and the nation's total consumption drops to 95 hamburgers a day. That sets off another round of cost-cutting and price discounting, and our imaginary nation sinks gradually into stagnation or deep recession not unlike America in the 1930's.

Let the entire population of the economy be 32 workers who inelastically supply labor and who spend all of their income on hamburgers. Let McDonald's and Burger King be identical firms that each have production function $f(L) = 25L^{0.25}$. Let them both behave as perfect competitors. Let the price of one burger be one burger.

- (a) Find the equilibrium real wage in the labor market. Remember that there are TWO firms, so the total demand for labor is the sum of each firm's demand for labor. Illustrate with a graph.
- (b) Verify that there is also equilibrium in the hamburger market and comment on the sources of the workers' total income.
- (c) Suppose that the two firms each laid off 2 workers as Uchitelle wrote. Assume the laid-off workers get no income whatsoever. Also suppose that the remaining 28 workers receive the same wage as before. Show the situation on a labor market diagram. Are the firms' profits higher? What about the workers' incomes?

Answers to Review Problems:

4. *Deflate_a*. Total growth in real GDP between 1980 and 1990 was 36.5% and between 1990 and 2000 was 38.9%.
5. *Uchitelle_a*.

- (a) The profit of one of the firms is $\pi(L) = p \cdot 25L^{1/4} - wL$. The first order condition for the optimal L to demand is

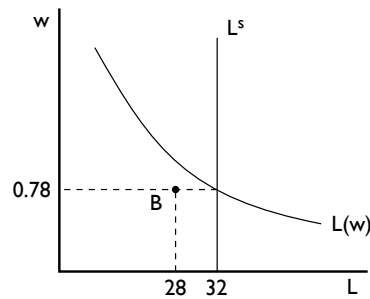
$$\frac{d\pi}{dL} = 6.25L^{-3/4} - w = 0$$

Solving for L , we find that the firm's labor demand is

$$L^D = 11.5w^{-4/3}$$

Setting labor supply equal to *market* labor demand gives us:

$$32 = 23w^{-4/3} \Rightarrow w^* = 0.78$$



- (b) At this wage, each firm hires $L^D = 16$ workers and produces an output of $f(16) = 50$ hamburgers. Each firm makes a profit of $\pi(16) = 50 - 0.78 \cdot 16 = 37.52$. The income of the consumers is the total wage bill of $0.78 \cdot 32 = 25$ plus the dividends earned from owning the firms, for a total of $25 + 2 \cdot 37.5 = 100$. With nothing else to buy, this means consumers demand 100 hamburgers, which is the total output of the firms.
- (c) Each firm now hires 14 workers, although this is not on their correctly-calculated labor demand curve as shown by point B in the diagram. Each firm's output is now $f(14) = 48.36$ hamburgers. The wage bill is only $0.78 \cdot 14 = 10.92$, so the profits of a firm are $\pi(14) = 48.36 - 10.92 = 37.44$. So firm profits fall slightly, which makes sense since they are no longer

profit-maximizing. This implies that the dividend portion of household income also falls slightly.

The wage income portion of household income clearly falls, since fewer people are employed, although this reduction falls entirely on the 4 unemployed workers.