Department of Economics. Harvard University. Spring 2011

Answers to Macroeconomics Questions

April 6, 2011

Question 4 (20 points)

(a) (4 points) The Cobb-Douglas CRS production function described in this question is the standard one from our study of the Solow Model:

$$Y = K^{\alpha}(EL)^{1-\alpha}.$$

(b) (4 points) In a Cobb-Douglas production function, the capital share is always equal to α, no matter what the levels of K, L, or E. This term is an exogenous parameter of the model, so it is not affected by any other variable. Because no other variables affect α, it does not change if physical capital K were to be reduced in a war. In the United States, this capital share is on the order of one-third.

(c) (5 points) The first derivative of the production function with respect to capital is

$$\frac{dY}{dK} = \alpha K^{\alpha-1}(EL)^{1-\alpha} = \alpha\left(\frac{K}{EL}\right)^{\alpha-1}$$

Because $\alpha > 0$ and $\alpha - 1 < 0$, a reduction in K relative to EL would raise the marginal product of capital.

(d) (7 points) In most cases, output-per-worker will grow more quickly after the war than before the war. This fact is easiest to see if we assume that the economy was in steady-state before the war, so that output-per-worker was growing at rate g (a key empirical implication of the Solow Growth model). When the war occurs, capital-per-effective-worker k declines, setting off transition dynamics that will eventually restore k to the (unchanged) steady-state value. As this transition occurs, both k and output-per-effective-worker y rise back to their previous levels, so that growth in output-per-worker $\frac{Y}{L}$ increases faster than the steady state rate of g. In reality, countries do not need to be at steady state before the disaster for this speeding-up to occur. If a country is below the steady state when the disaster occurs, a further reduction in k will move it farther below its steady-state value, causing its transitional growth rate to speed up for a time. However, if a country was *above* the steady state before the disaster, the reduction in k will cause the growth rate of output-per-worker to rise. This is because a country with k above k^* will be experiencing transitional *declines* in output-per-worker. The reduction in k will bring the country closer to k^*, so that the decline in output-per-worker are smaller in absolute value or the growth rate of output per worker becomes positive. (To get most of the credit for this question, however, it was enough to assume that the economy was above the steady state before the disaster, so that the growth rate of output-per-worker increases.)

Question 5 (20 points)

Institutions matter because they condition entrepreneurial incentives and savings incentives. In particular, poor property rights protections discourages growth and/or reduce long-run levels of

per capita GDP. To establish the importance of institutions, one can use natural experiments such as the comparison between North and South Korea after the split; or exploit information on settlers mortality and show that settlers mortality is a good instrument for property rights protection; or establish that reversal of fortune occurred between Northern and Southern US states with the industrial revolution and link this reversal to the fact that Southern states had developed extractive institutions which became unsuitable once the industrial revolution occurred.

Question 6 (20 points)

(a) (10 points) Households should smooth out the impact of the fall in wealth. According to the Life-Cycle Theory (Modigliani), the Permanent Income Theory (Friedman), or any other related consumption theory, households should consume the annuity value of their wealth or households should elect a (nearly) constant flow of consumption over their lifetimes. If financial wealth falls by a \$1, then the annuity value of wealth falls by r times \$1, where r is the real interest rate. If the real interest rate is about 2 percent, then the fall in consumption should be just 2 cents per year. Even if we assume that the real interest rate is higher, say 5 percent, then the fall in consumption should still be only 5 cents per year. Of course, mortality may also matter. For a young person, mortality does not make much of a difference. Young people have a long time horizon over which to smooth the loss of wealth. For an older adult—say age 85—who was planning to deplete all of their wealth before dying, a \$1 drop in financial wealth might lead to a considerable drop in consumption (for example, 20 cents per year). Whatever the case, we don't expect a \$1 drop in financial wealth to generate a drop of more than a 5 to 10 cents in annual consumption, on average, across a representative sample of households. So a \$5 trillion drop in financial wealth should lead to a decline in consumption that is no greater than \$500 billion per year, and is likely to be less.

Housing wealth is a bit more complicated, since housing is both a source of wealth and an expense. Lower housing prices reduce the wealth of homeowners and lower the cost of buying/renting houses. It is therefore not clear whether a fall in housing prices will make households feel poorer and thereby reduce expenditure on non-housing consumption goods. However, if many households are using their homes as collateral to finance borrowing, then a drop in housing wealth would lead to meaningful drop in non-housing consumption expenditure. On the other hand, the households that are renting their homes will see an increase in their non-housing consumption expenditure.

If the marginal propensity to consume out of financial wealth and housing wealth is 5 percent, then the fall in aggregate consumption resulting from a \$10 trillion fall in national wealth would be \$500 billion, which is also about 5 percent of aggregate consumption.

(b) (10 points) Theories of consumption smoothing (for example, Life-Cycle, PIH, and Random Walk) all predict that households will try to smooth transitory changes in income. So a \$1 trillion transitory fall in income may lead only to a (5% times \$1 trillion) fall in consumption. However, if households are liquidity constrained and therefore can't borrow, they may not be able to undertake this smoothing and we may observe a much bigger fall. Likewise, if households are myopic (for example, rule of thumb) then they may also let consumption track income instead of trying to smooth consumption. Most estimates suggest that the annual marginal propensity to consume (MPC) out of transitory movements in income is at least 25 percent, suggesting a strong deviation of theories of smoothing.

If the \$1 trillion fall in income is thought to be permanent, then we would expect to see an

even stronger response. If households can adjust their consumption immediately and don't have "habits," then we would expect to see a $1 trillion immediate fall in consumption.