Name _____

Midterm Exam

Intertemporal Choice

Fall, 2020

You are expected to answer all parts of all questions. If you cannot solve part of a question, *do not give up*. The exam is written so that you should be able to answer later parts even if you are stumped by earlier parts.

Write all answers on the exam itself; if you run out of room, use the back of the previous page.

Part I: Short Questions

Explain why the Mankiw (1982) model of durable goods expounded in `Durables` implies that expenditures on durable goods will be more volatile than spending on nondurable goods. In particular, how and why is the degree of volatility related to the degree of durability?

Fisherian Separation (Fisher (1930)). Explain what is meant by the "Fisherian separation" proposition, then explain how relaxing each of the following assumptions in the Fisher model might undermine the proposition:

1. Liquidity constraints
2. Uncertainty
3. Failure to optimize intertemporally
4. Time inconsistent preferences

Part II

Buffer Stock Responses To Shocks.

In August 2007 global financial markets experienced turmoil triggered by problems in the U.S. subprime mortgage market. Several theories were advanced for the events in financial markets, and some of those theories had important implications for other aspects of macroeconomic behavior, including consumption dynamics. This question asks you to use the `TractableBufferStock` model to analyze the consequences for consumption of various theories of asset market movements. Specifically, for each theory, you should draw diagrams showing the level of consumption and the growth rate of consumption you would expect to be implied by the theory for continuing-employed consumers if the shock hits in period t and employed consumers were at their target level of wealth before that date.

1. The first theory is that there was an increase in the degree of uncertainty. (While the connection of financial uncertainty to the kind of uncertainty considered in the buffer stock model $\mathcal{U}$ is tenuous, the right way to think about $\mathcal{U}$ is as a proxy for all kinds of uncertainty, including financial uncertainty).

2. The next theory is that there was a sudden, worldwide increase in the coefficient of relative risk aversion ρ. In showing the effects of this, you may assume that the interest rate is equal to the time preference rate, if you find that such an assumption helps clarify your thinking.

3. The next theory is that the losses in the subprime market are like a transitory negative shock to wealth.

4. The final hypothesis is that the era of the 'global savings glut' is coming to an end as the baby boom generation approaches retirement. This corresponds to an increase in the rate of time preference ϑ.

Part III

Productivity Growth and Dynamic Inefficiency in the OLG Model.

Consider a Diamond (1965) OLG economy like the one in the handout OLGModel, assuming logarithmic utility and a Cobb-Douglas aggregate production function,

$$Y = \mathrm{F}(K, PL) \tag{1}$$

where P_t is a measure of labor productivity that grows by

$$P_{t+1} = \mathrm{G}P_t \tag{2}$$

from period to period. Assume that population growth is zero ($\Xi = 1$; for convenience normalize the population at $L_\tau = 1 \ \forall \ \tau$), and assume that productivity growth has occurred at the rate $\mathsf{g} = \mathrm{G} - 1$ forever.

One unit of the quantity PL is called an 'efficiency unit' of labor: It reflects a unit of labor input to the production process.

1. Assume that $\mathrm{F}(K, PL)$ is a Constant Returns to Scale function, and show how to rewrite the capital accumulation equation

$$K_{t+1} = A_{1,t} \tag{3}$$

in per-efficiency-unit terms as

$$k_{t+1} = a_{1,t}/\mathrm{G} \tag{4}$$

2. Show that under these assumptions, the process for aggregate k dynamics is

$$k_{t+1} = \left(\frac{(1-\alpha)\beta}{\mathrm{G}_{t+1}(1+\beta)} \right) k_t^{\alpha} \tag{5}$$

3. Derive the steady-state level of k_t that the economy achieves if the rate of productivity growth is constant at $\mathrm{G}_t = \mathrm{G} \; \forall \; t$.

Now suppose that the economy had been growing at this constant rate G since the beginning of time, but all of a sudden at the beginning of period t everybody learns that henceforth and forever more, productivity will grow at a faster rate than before, $\hat{\text{G}} > \text{G}$.

4. Define the new steady-state as $\bar{\hat{k}}$. Will this be larger or smaller than the original steady state $\bar{k}$? *Explain your answer.*

5. Next, use a diagram to show how the $k_{t+1}(k_t)$ curve changes when the new growth rate takes effect, and show the dynamic adjustment process for the capital stock toward its new steady-state, assuming that the economy was at its original steady state leading up to period t.

6. Define an index of aggregate consumption per efficiency unit of labor in period t as $\chi_t = c_{1,t} + c_{2,t}/\mathrm{G}$, and derive a formula for the sustainable level of χ associated with a given level of k.

7. Derive the conditions under which a marginal increase in the productivity growth rate g will result in an increase in the steady-state level of χ, and explain in words why this result holds. (You can leave the term $\partial\bar{k}/\partial\mathsf{g}$ unevaluated in your answer, using only what we know about this term from above).

References

Diamond, Peter A. (1965): "National Debt in a Neoclassical Growth Model," *American Economic Review*, 55, 1126–1150, http://www.jstor.org/stable/1809231.

Fisher, Irving (1930): *The Theory of Interest*. MacMillan, New York.

Mankiw, N. Gregory (1982): "Hall's Consumption Hypothesis and Durable Goods," *Journal of Monetary Economics*, 10(3), 417–425.