Ec 102
Seminar in Advanced Macroeconomics
Week 2 Assignment: Economic Growth

Professor S. O'Connell Fall 2012

Although Romer's chapters 1-4 constitute one of the best presentations of modern growth theory and empirics I've seen anywhere, chapters 3 (endogenous growth theory) and 4 (cross-country income differences) shed very little light on the macroeconomic stabilization problem that is our main focus in the seminar. We will therefore focus mainly on neoclassical growth theory as represented by the Solow model (chapter 1), which should be familiar to you from Intermediate Macroeconomics, and the Ramsey-Cass-Koopmans model (chapter 2), which differs from the Solow model only in having the household sector – modeled as a representative household – choose its saving rate optimally. These models don't shed direct light on the stabilization problem either, but they introduce a set of issues and methods that we will revisit throughout the semester. Much of the remaining growth material – the neoclassical overlapping-generations model of chapter 2, the endogenous growth models of chapter 3, and the cross-country evidence on institutions and growth in chapter 4 – can be viewed as responding to one or more of the theoretical and/or empirical shortcomings of these one-sector, representative-household neoclassical models.

Readings:
Romer, chapter 1
Romer, chapter 2, especially Part A (skim part B)
Romer, chapter 3, especially "Learning-by-Doing" (pp 121-23) and section 3.8 (skim the rest)
Romer, chapter 4 (skim)

PROBLEM SET #2

1. Equation (1.28) shows a first-order Taylor expansion of the function $\dot{k}(k)$ around $k = k^*$. Recalling your calculus, what does a second- or higher-order Taylor expansion of $\dot{k}(k)$ look like? Under what condition does the first-order expansion around k^* give a good approximation to true value of the function at k?

2. Romer problem 1.5. [Supplementary questions: What is the definition of the 'golden rule' capital stock? Will a Solow economy converge to the golden rule?]

3. Romer problem 1.6. [Hint: See footnote 13 and Figure 1.5: If X_t is growing at a constant exponential rate, then $\log X_t$ is a linear time trend. This means that the path of $\log X_t$, when plotted against time on the horizontal axis, is a straight line.]

4. Romer problem 1.9. [Supplementary question: A constant return to capital and constant shares of output going to capital and labor are two of the six stylized facts put forward by Nicholas Kaldor (1957) as statistical properties of long-term economic growth. These are now known as the "Kaldor facts" and are regarded as useful generalizations for industrial countries (see Acemoglu's *Introduction to Modern Economic Growth*). As recounted in Wikipedia:

"He pointed out the 6 following 'remarkable historical constancies revealed by recent empirical investigations':

1. The shares of national income received by labor and capital are roughly constant over long periods of time
2. The rate of growth of the capital stock per worker is roughly constant over long periods of time
3. The rate of growth of output per worker is roughly constant over long periods of time
4. The capital/output ratio is roughly constant over long periods of time
5. The rate of return on investment is roughly constant over long periods of time
6. The real wage grows over time."

Does the Solow model display <u>all</u> of the Kaldor facts on its balanced growth path?

5. Romer problem 2.4 (The consumption function with log utility).

6. Romer problem 2.6 (The productivity slowdown and saving in the Ramsey-Cass-Koopmans model), parts (a), (b), and (c). [Supplementary question: trace out the full adjustment path of c and k.]

7. Romer problem 3.7 (Learning-by-doing).

8. Romer problem 4.9 (Increasing returns in a model with human capital). [Hint: This model displays Kaldor growth fact #4, which means that if there is a balanced-growth path, it has the property that K/Y is constant (or, equivalently, Y/K is constant). Solve for the dynamics of the output/capital ratio, $y = Y/K$).]

References

Acemoglu, Daron (2009) *An Introduction to Modern Economic Growth* (Princeton: Princeton University Press)

Kaldor, Nicholas (1957) "A Model of Economic Growth" *Economic Journal* 67(268): 591-624