

Macroeconomics Qualifying Exam
Part I (Economics 6110)
19 August 2009

1. At least since Malthus, some economists have argued that because some factors of production (notably land and natural resources) are available in finite supply, economic growth must eventually come to a halt. This problem asks you to address the Malthusian hypothesis in the context of the Solow-Swan model. Assume the economy is governed by the following equations:

$$\begin{aligned} Y(t) &= K(t)^\alpha [A(t)L(t)]^\beta R^{1-\alpha-\beta} && \text{where } \alpha, \beta \in (0, 1) && \alpha + \beta < 1 \\ \dot{L}(t) &= nL(t) \\ \dot{A}(t) &= gA(t) \\ \dot{K}(t) &= sY(t) \end{aligned}$$

Note that the depreciation rate of physical capital is zero. The saving rate (s), as well as the growth rates of labor (n) and technology (g) are constant and exogenous. Additionally, the amount of land given by R does not change over time. That is, $\dot{R} = 0$.

- a. Does this economy have a unique and stable balanced growth path? That is, does the economy converge to a situation in which Y and K are growing at constant rates? If so, what are those growth rates? If not, why not? Justify your results.
- b. In light of your answer to part a, does the fact that the stock of land is constant imply that permanent growth is not possible? Explain your answer and try to compare your results to the standard Solow-Swan model discussed in class.

2. Consider the following dynamic Keynesian model embodying rational expectations:

$$\begin{aligned} \text{(IS)} \quad & y_t = -a[i_t - E_{t-1}(p_{t+1} - p_t)] + u_t \\ \text{(LM)} \quad & m_t - p_t = b_1 y_t - b_2 i_t + \eta_t \\ \text{(AS)} \quad & y_t = c(p_t - E_{t-1}p_t) \\ \text{(Policy)} \quad & m_t = \lambda i_t \end{aligned}$$

where $\{a, b_1, b_2, c\}$ are positive and all time-dependent variables are expressed as natural logarithms except for the nominal interest rate. E_{t-1} is a mathematical expectations operator conditional on information available through date $t - 1$. The stochastic shocks η_t and u_t are **independent** white noise disturbances with variances σ_η^2 and σ_u^2 , respectively. The coefficient λ represents the systematic feedback parameter that governs the response of the money supply to fluctuations in the interest rate.

- a. Determine the rational expectations solution for real output y_t and the price level p_t .
- b. Find expressions for the **unconditional** variances of y_t and p_t in terms of the variances of the stochastic shocks and the model's exogenous parameters.
- c. Suppose that the only shocks hitting the economy are LM shocks ($\sigma_u^2 = 0$). What value of λ would minimize the impact of LM shocks on real output y_t ? Try to illustrate your result graphically.
- d. Suppose that the only shocks hitting the economy are IS shocks ($\sigma_\eta^2 = 0$). What value of λ would minimize the impact of IS shocks on real output y_t ? Try to illustrate your result graphically.
- e. Discuss the Sargent-Wallace *policy ineffectiveness proposition* and explain why it does not hold in this model.