

**ECO 305: Intermediate Macroeconomics**  
**Assessment Exercise: Economic Growth**  
**Administered: Final Exam Week, Fall 2011**

**Learning Objectives:**

LO1: Students will be able to understand theories for determinants of economic growth, including the impact macroeconomic policies may have on economic growth.

LO6: Students will be able to accomplish these objectives above using quantitative skills and graphical models of the macroeconomy.

**Introduction:**

This assessment exercise is a follow-up from the Economics Department Competency in the Major (CITM) assessment processes conducted in Spring 2011, of which a major component included a class-embedded assessment exercise in ECO 305: Intermediate Macroeconomics, at the time taught by another instructor. The general findings from that assessment were that students did not understand well the assumptions behind various theories for economic growth and they had difficulty applying different models to the same scenario and understanding the different conclusions that would be reached.

The present assessment task extends the Spring 2011 CITM assessment task to three models of economic growth (CITM only looked at two), and asked students to list all the strengths, weaknesses, and implications of each model. While the present task asks much more from the students, the task was also part of a take-home exam, so students had access to their textbook and class notes and they had more time to answer the questions. Still, successfully answer these questions requires students to have a full understanding of each model. Lists of these answers do not appear anywhere in the notes or textbook, but instead would need to be pieced together based on an understanding of the larger picture.

The task below asks students identify the (a) assumptions of each model, (b) the variable that are constant in the long-run steady state, (c) the conclusions of the model, (d) strengths of the model in terms of explaining real-world phenomena or data, (e) weaknesses of the model in terms of explaining real-world phenomena or data, and (f) a prescription for government policy that the model suggests will encourage long-run economic growth. The second question, concerning the behavior of variables in the steady state, connects the assumptions to the logical and mathematical implications in the abstract model. The following questions connect those results to real world phenomena and economic policy.

**Teaching Strategy Prior to Assessment:**

We had previously identified from a previous section with another instructor that students struggle with understanding the assumptions behind various models of economic growth, and understanding how these assumptions drive different explanations for economic growth and different policy prescriptions to encourage economic growth. I emphasized these connections in my class lecture, I gave two in-class exercises on the assumptions of the assumptions and conclusions of the Malthusian growth model and Solow growth model, and I had an exam question (and re-administered as another in-class exercise) comparing the implications of the Solow growth model and the endogenous growth model.

**Assessment Task / Rubric:**

1. Economic growth is the principle source for improving the standard of living for people over time. We have learned three models to explain economic growth. Identify each model, and answer the following questions for each:

(a) Explain the assumptions behind each model.

**Summary of Possible Answers:**

<b>Malthusian</b>	<b>Solow (Exogenous Growth)</b>	<b>Endogenous Growth</b>
i. Production depends on land.	i. Saving and consumption are exogenous.	i. Production depends on human capital.
ii. Quantity of land used for production is fixed.	ii. Population growth is exogenous.	ii. Investment in human capital does not depreciate.
iii. Production does not use capital.	iii. Production uses labor and capital.	
iv. No saving / no investment.	iv. Constant returns to scale.	
v. Population growth depends positively on output/person.	v. Diminishing marginal product of capital.	
vi. Constant returns to scale.		

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student identifies less than half of the assumptions of at least one of the models.
- **Meets Expectations (2):** Student correctly identifies at least half of the assumptions for each model.
- **Exceeds Expectations (3):** Student correctly identifies more than half of the assumptions of each model *and* does not list incorrect assumptions.

(b) Identify what variables are constant in the long-run (if any) and what variables grow in the long-run.

**Summary of Possible Answers:**

<b>Malthusian</b>	<b>Solow (Exogenous Growth)</b>	<b>Endogenous Growth</b>
The following variables are constant: i. Consumption / worker ii. Output / worker iii. Land The following variables grow: i. Population	The following variables are constant: i. Output per worker ii. Consumption per worker iii. Capital stock per worker The following variables grow: i. Population.	No variables are constant. All of the following variables grow: i. Output per worker ii. Consumption per worker iii. Capital stock per worker iv. Human capital per worker v. Population.

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student fails to identify that output/worker (alternatively, consumption/worker) are constant in either the Malthusian or Solow growth models.
- **Meets Expectations (2):** Student correctly identifies that output/worker (alternatively, consumption/worker) are constant in the Malthusian and Solow growth models.
- **Exceeds Expectations (3):** Student meets expectations (previously stated) and correctly identifies that human capital *and* output per worker grow in the long-run.

(c) Explain the conclusions of the model.

**Summary of Possible Answers:**

<b>Malthusian</b>	<b>Solow (Exogenous Growth)</b>	<b>Endogenous Growth</b>
<p>Even with technology growth, output per worker and therefore consumption per worker remain constant in the long-run. This is a result of a fixed amount of land, and population growth responding to any temporary increases in consumption per person.</p>	<ul style="list-style-type: none"> <li>i. Capital per worker reaches a long-run steady state for a given level of technology.</li> <li>ii. Economies with low levels of capital per worker experience high rates of growth.</li> <li>iii. Highly developed economies (with high levels of capital per worker) experience low rates of growth.</li> <li>iv. An improvement in technology can cause an increase in long-run output per worker.</li> </ul>	<p>Investment in human capital allows output per worker to grow indefinitely.</p>

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student fails to correctly identify at least one conclusion for each of the three models.
- **Meets Expectations (2):** Student correctly identifies the conclusions of the Malthusian and Endogenous growth models, and at least one of the assumptions of the Solow growth model.
- **Exceeds Expectations (3):** Student correctly identifies the conclusions of the Malthusian and Endogenous growth models, and at least three of the assumptions of the Solow growth model.

- (d) Identify the strengths of the model. That is, which conclusions or implications are realistic? You may include in your answer when these conclusions were realistic, or for what types of countries these conclusions are realistic.

**Summary of Possible Answers:**

<b>Malthusian</b>	<b>Solow (Exogenous Growth)</b>	<b>Endogenous Growth</b>
Output per worker constant in the long-run was common in agricultural societies before the industrial revolution.	Highly developed economies do grow at a slow pace compared to developing economies (with lower levels of capital stock per worker) such as China and India.	<ul style="list-style-type: none"> <li>i. Output per worker does grow indefinitely, even in highly developed economies.</li> <li>ii. Model correctly predicts that we do not experience convergence in long-run output per worker among all countries.</li> </ul>

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student fails to correctly identify at least two of the above strengths.
- **Meets Expectations (2):** Student correctly identifies at least two of the above strengths.
- **Exceeds Expectations (3):** Student correctly identifies at least one strength of each model and does not include any incorrect strengths.

- (e) Identify the weaknesses of the model. That is, which conclusions or implications are not realistic? Explain as you do in part (d).

**Summary of Possible Answers:**

<b>Malthusian</b>	<b>Solow (Exogenous Growth)</b>	<b>Endogenous Growth</b>
Most modern day economies do experience long-run economic growth.	Not all under-developed economies (with low levels of capital stock) experience high rates of economic growth.	For highly developed economies, the model incorrectly suggests there will be no convergence in output per worker.

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student fails to correctly identify at least two of the above weaknesses.
- **Meets Expectations (2):** Student correctly identifies at least two of the above weaknesses.
- **Exceeds Expectations (3):** Student correctly identifies all the above weaknesses, and does not include any incorrect weaknesses.

- (f) Identify a government policy that can cause output per worker to increase in the long run. Use the model to explain why your government policy suggestion is effective.

**Summary of Possible Answers:**

Possible answer using a Malthusian growth model:

- Government policy to limit population growth.

Possible answers using a Solow growth model:

- Government policy to increase the saving rate.
- Government policy to decrease population growth.

Possible answers using an endogenous growth model:

- Government policy to encourage education and training.
- Government policy to encourage investment of physical capital to education and training.

**Assessment Evaluation Rubric:**

- **Below Expectations (1):** Student fails to identify a correct policy, fails to use the correct model, and/or makes substantial errors in using the model.
- **Meets Expectations (2):** Student identifies a correct policy, uses the correct model, gives correct intuition in his/her explanation, and makes only minor errors in using the model.
- **Exceeds Expectations (3):** Student identifies a correct policy, uses the correct model, gives correct intuition in his/her explanation, and correctly illustrates the policy with the model.

**Results:**

All 22 students in the class completed the assessment exercise. The percentage of the class performing in each category for each question are given below.

Performance Category	Topic (Problem #)						Overall Average
	Assumption (Problem A)	Variables (Problem B)	Conclusions (Problem C)	Strengths (Problem D)	Weaknesses (Problem E)	Policy (Problem F)	
Below Expectations	4.5%	40.9%	18.2%	36.4%	22.7%	45.5%	28.0%
Meets Expectations	22.7%	0.0%	27.3%	18.2%	54.5%	9.1%	22.0%
Exceeds Expectations	72.7%	59.1%	54.5%	45.5%	22.7%	45.5%	50.0%

Overall I am very pleased with the results. On average 72% of the class met or exceeded expectations. When discussing the assumptions behind a model, 95.5% of the class met or exceeded expectations, and when discussing the conclusions of the model 91.9% of the class met or exceeded expectations. Still, these results do provide a deeper look into student understanding which identifies aspects of this analysis that many students still fail to understand.

The result that 40.9% of students fell below expectations in their explanations of the steady state variables in the model suggests that students still have a hard time understanding how the assumptions influence the abstract mathematical and logical conclusions in the model. Also the result that 45.5% of the students fell below expectations in recommending economic policy suggests that while students know the conclusions of the model, many cannot translate these into economic policies.

**Closing the Loop:**

I did find that students largely succeeded in learning learning the assumptions and conclusions of the three economic growth models, so much of my teaching strategy will remain the same. I will continue to emphasize the importance of the assumptions, and continue to draw connections from the assumptions to the conclusions. To address students' weaknesses prescribing economic policy, I will add to this part of the class additional homework problems or in-class exercises that asks students to use the model to evaluate policy.