

Final Exam

5/7/2025

Answer the following questions. You can use a (1 page) notes sheet and a calculator (but no other devices).

For the first part pick any 4 questions to answer. For the multiple choice part you must answer all questions.

1. (20 points) **Technology Transfer in the Solow Model.** One explanation for Ireland's rapid economic growth during the last several decades is its expansion of policies that encourage "technology transfer." By this, we mean policies — such as opening up to international trade and attracting multinational corporations through various incentives — that encourage the use and adoption in Ireland of new ideas and new technologies. This question asks you to use the Solow model to study this scenario.

Suppose Ireland begins in steady state. To keep the problem simple, let's assume the sole result of these technology transfer policies is to increase \bar{A} by a large and permanent amount, one time. Answer the following questions:

- (a) Analyze this change using a Solow diagram.
 - (b) What happens to output per person in Ireland in the long run? Give an expression for it (feel free to assume any values for α and β in the production function).
 - (c) Show graphically what happens to the per capita GDP (and its growth rate) in Ireland over time.
 - (d) Discuss in a couple of sentences what your results imply about the effect of technology transfer on economic growth.
2. (20 points) **Analyzing Macroeconomic Events with the IS-MP Plot.** Consider the following events. Show how to represent them using the IS-MP diagram. In each case, explain how GDP is affected in the short run and how the central bank would respond to stabilize output.
 - (a) The government extends a tax reduction based on investment. For each additional dollar invested by firms, the firms pay fewer taxes on corporate income.
 - (b) A housing bubble burst, housing prices fall by 20% and new home sales drop sharply.
 - (c) A growth surge abroad (e.g., in Europe) leads to an unexpected increase in their consumption of all types of goods.
 - (d) There are innovations in AI that increase potential GDP by 10%.
 3. (20 points) **Measuring \bar{Y}_t and \hat{Y}_t .** This problem exposes you to a real-world policy problem faced by policymakers, forecasters, and businesses every day: how to judge the state of the economy. Consider the following table:

Year	Current Output Y_t	Potential Output \bar{Y}_t	Short-Run Output $Y_t - \bar{Y}_t$ \tilde{Y}_t	
2024Q1	25.00			
2024Q2	25.20			
2024Q3	25.40			
2024Q4	25.30			
2025Q1	25.20			
2025Q2	25.15			
2025Q3	25.13			
2025Q4	25.30			
2026Q1	25.50			
2026Q2	26.00			
2026Q3	26.80			
2026Q4	27.10			

Table 1: Hypothetical measures of real GDP

The table shows hypothetical measures of real GDP in the coming years (at a quarterly frequency), starting at a level of \$25.0 trillion in the first quarter of 2024. Your job is to fill in the remaining columns of the table by answering the following questions.

- (a) What is the potential output in 2024Q1? Notice that this is a trick question: there is no way for you to know! As in reality, we have to make some extra assumptions. Let's suppose we have external information (e.g., from business surveys or policy reports) indicating the economy is already operating at potential output in 2024Q1. Fill that first value of \bar{Y}_t in the table.
 - (b) Assume potential output grows at an annual rate of 2.50%. This implies growing at a quarterly rate of about 0.62%. Complete the remainder of the table.
 - (c) Briefly, comment on the state of the hypothetical economy over the period considered. When does the economy enter a recession? When does the recession end?
4. (20 points) **COVID-19 and the Zero Lower Bound.** This question asks you to analyze the COVID-19 shock in an economy in which interest rates are eventually limited by the zero lower bound. Assume the economy starts at its long-run values.
- (a) Show the initial impact of the COVID-19 shock on the economy in the IS-MP diagram. Indicate the initial equilibrium and the next one after the shock.
 - (b) Indicate what policy the central bank implements in response if it wants to bring the economy closer to its potential. Assume the interest rates are so low such that the zero lower bound

prevents the interest rates from adjusting to the extent necessary to nullify the shock. Represent the new equilibrium in the diagram. What is the value of the interest rate in that equilibrium?

- (c) Now let's consider implementing additional policies to help the economy (just like the Fed did back then). Suppose the government implements a generalized subsidy transfer program benefiting all households. Represent the effect of this policy in the diagram, indicate the new equilibrium. For this part, you can assume the government has the capacity to adjust the scale of its subsidy program as necessary to meet its final stabilization goal.
- (d) Indicate what is the policy trade-off for this government that closing the output gap (bringing the actual GDP back to its potential) with this combination of policies implies? How can you relate that to the economic environment in the US in the post-COVID years?

5. (20 points) **A new model multiplier.** Consider the following equations:

$$Y_t = C_t + I_t + G_t + EX_t - IM_t$$

$$\frac{C_t}{\bar{Y}_t} = \bar{c} + \bar{x}\tilde{Y}_t; \quad 0 < \bar{x} < 1$$

$$G = \bar{g}\bar{Y}_t$$

$$EX = 0$$

$$IM = 0$$

Instead of the usual investment function, consider the following “accelerator” investment function where investment rises with short run output:

$$\frac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b}(R_t - \bar{r}) + \bar{i}_y\tilde{Y}_t; \quad \bar{b} > 0; \quad 0 < \bar{i}_y < 1 - \bar{x}$$

- (a) Derive the IS curve as a relation between short run output \tilde{Y}_t and the real interest rate gap $R_t - \bar{r}$.
 - (b) What is the effect of \bar{i}_y ? Does it mitigate or amplify the effects of the shocks and interest rate fluctuations on output? What is a good intuition for this effect?
 - (c) Does the effect of \bar{i}_y differ in any way from the effect of \bar{x} (the one we covered in class)?
6. (15 points) **Production functions.** Consider the following variation of the aggregate production function. Now firms must use oil M to produce output (in addition to labor and capital). The price of a unit of oil is p :

$$\max \Pi_f = AK^\alpha L^\beta M^\gamma - wL - rK - pM$$

- (a) What must be true about the parameters α, β , and γ if this production function exhibits constant returns to scale?
- (b) If $\alpha + \beta = 4/5$ what are the values of γ we would need for this production function to exhibit increasing returns to scale?
- (c) Re-express the production function of this problem per-capita terms.

Multiple Choice Questions

For the following questions check the correct answer. Notice that in some cases there is more than one correct answer (in such cases you are asked to select "All that apply").

7. Which characteristics describe a Real Business Cycle (RBC) model? Select all that apply.
- ☐ I) Focuses solely on nominal shocks
 - ☐ II) Incorporates TFP shocks
 - ☐ III) Derived from the Solow growth model
 - ☐ IV) Ignores microeconomic foundations
 - ☐ V) Neither of the above
8. What are key features of Dynamic Stochastic General Equilibrium (DSGE) models? Select all that apply.
- ☐ I) Incorporation of microeconomic foundations
 - ☐ II) Substitute TFP shocks and replace them with nominal rigidities
 - ☐ III) Incorporate the presence of market failures (frictions) into the models
 - ☐ IV) Dynamic analysis of the macroeconomy with expectations
 - ☐ V) Neither of the above
9. What analyses become feasible with DSGE models and **weren't possible at all** with simpler models and diagrams. Select all that apply.
- ☐ I) We can gauge the magnitude of the responses of variables to shocks
 - ☐ II) We obtain effects consistent with microeconomic behavior, rather than just correlations
 - ☐ III) We can analyze the effects of monetary policy
 - ☐ IV) We can approximate the duration of the effects of a shock
 - ☐ V) We can consider the general equilibrium effects of a shock
10. Why would the labor supply depend on consumption in a microfounded model
- a) Aggregate consumption increases output which implies hiring more workers
 - b) In equilibrium these two variables are positively correlated
 - c) Workers balance their leisure and consumption decisions when deciding how much to work
 - d) If firms owners want to consume more they increase their willingness to hire more workers to increase profits
11. Which of the following statements **best describes** the impact of a positive TFP shock?
- a) It creates a wealth effect that boosts consumption, investment and output rapidly
 - b) Output increases more strongly on impact as A increases in the production function.
 - c) It increases output beyond the direct effect of the shock since investors build more capital due to the higher productivity
 - d) It increases output similar to what we would observe after a positive shock on government spending