

Econ 100B: Economic Analysis – Macroeconomics
Problem Set #4 – Solutions
Due Date: October 2, 2020

General Instructions:

- Please upload a PDF of your problem set to Gradescope by 11:00 pm.
- **Late homework will not be accepted.**
- Please put your name and student ID at the upper right corner of the front page.

1. The current population of the United States is 328.2 million with 2.2% of the population is engaged in R&D at an efficiency rate of 1/500 per million persons per year.

- (a) If R&D is the only source of total-factor productivity growth what is the growth rate of labor efficiency in the United States?

Solution:

$$g_E = \chi \gamma L_T = \frac{1}{500} (\text{MM persons})^{-1} \text{yr}^{-1} \times 0.022 \times 328.2 \text{ MM persons} \quad (1)$$

$$= 0.0181 \text{ yr}^{-1} \quad (2)$$

or 1.44% per year

- (b) If the growth rate of total factor productivity is 0.75% per year, what is the value of α in the Cobb-Douglas production function?

Solution: These growth rates are related by

$$g_E = \left(\frac{1}{1 - \alpha} \right) g_A \quad (3)$$

or

$$1 - \alpha = \frac{g_A}{g_E} \quad (4)$$

so

$$\alpha = 1 - \frac{g_A}{g_E} = 1 - \frac{0.75\%/yr}{1.44\%/yr} = 0.479 \quad (5)$$

2. Listen to [Prof. Lisa Cook's Planet Money Interview](#) to address the following:

(a) How is the research of Prof. Lisa Cook's and Prof. Paul Romer related?

Solution: Their research is related on the topic of endogenous growth. Prof. Cook has studied the link between the endogenous-growth model of Prof. Paul Romer and the experience of African-American inventors in the United States.

Note: Your answer may differ from mine, but should cover roughly the same ground.

(b) Briefly discuss the relationship between the Tulsa race massacre and the variables in the Romer model for the growth rate of labor efficiency.

Solution: The Romer model is written

$$g_E = \chi\gamma L \quad (6)$$

where χ is the efficiency of R&D, γ is the fraction of the labor force involved in R&D, and L is the size of the labor force. Taking each in turn:

- χ : The reduction in patents that resulted from the Tulsa race massacre is consistent with a decrease in χ . African-American inventors would be spending time and energy on this event and its aftermath that would otherwise have been spent on the creative process of patent generation.
- γ : The reduction in patents that resulted from the Tulsa race massacre is consistent with a decrease in γ . While this will become more apparent when we examine property rights later in the course, patent-focussed R&D presumes that the legal system will be there to enforce your patent rights. The Tulsa race massacre clearly demonstrated that this was not the case, and this message would be expected to reduce the fraction of the population involved in R&D.
- L : people died, so L declined. The size of the decline relative to the size of the labor force was small, so while this did contribute to a reduction in g_E , the impact of the reduction in χ and γ were likely larger.

Note: Your answer may differ from mine, but should cover roughly the same ground.

- (c) How has racism limited economic growth in the United States from the perspective of endogenous growth theory?

Solution: Racism has limited economic growth in the United States by reducing the number of African-American inventors and making them less productive.

Note: Your answer may differ from mine, but should cover roughly the same ground.

3. The figure below illustrates the output gap and the real interest-rate gap in the United Kingdom as a function of time.

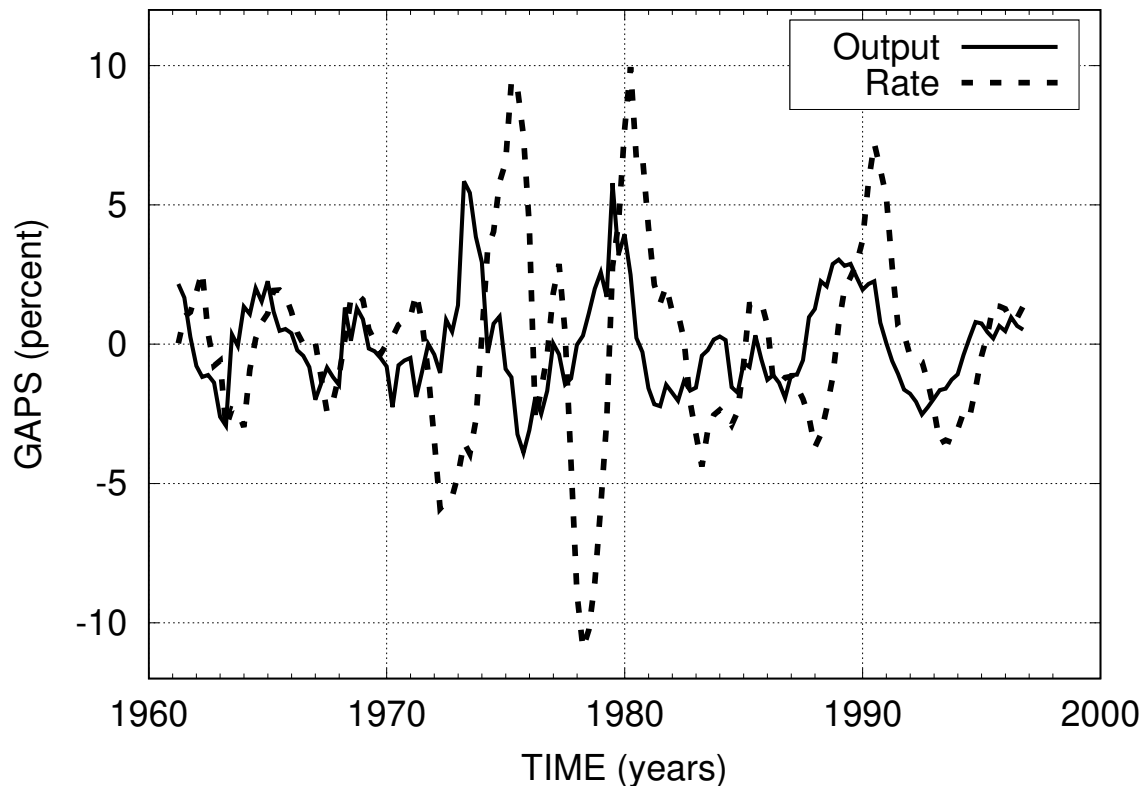


Figure 1: Based on Figure 4 of R.J. Hawkins and C.N. Nguyen (2018). “Macroeconomic dynamics and the IS puzzle.” *Economics: The Open-Access, Open-Assessment E-Journal*, 12 (2018-59): 1–13.

Is the output gap generally

- leading and procyclical,
- lagging and procyclical,
- leading and countercyclical, or

- lagging and countercyclical,

with respect to the real interest-rate gap gap after 1988? Briefly explain your choice.

Solution: The output gap is leading and procyclical with respect to the rate gap. If we consider the comovement of these time series during this time, they move in the same direction (thus procyclical) with the output gap moving in a given direction before the rate gap (thus leading).