

Written Exam, Department of Economics, summer 2019

Economic Growth

(3-hour closed book exam)

June 4, 2019

Answers in English only.

This exam consists of 7 pages in total

Falling ill during the exam:

If you fall ill during an examination at Peter Bangs Vej, you must:

- contact an invigilator who will show you how to register and submit a blank exam paper
- leave the examination
- contact your GP and submit a medical report to the Faculty of Social Sciences no later than five (5) days from the date of the exam

Be careful not to cheat at exams!

You cheat at an exam, if during the exam, you:

- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

Question 1: Essay questions

1.a

In the Russian Roulette model in Jones (2016): Life and Growth, explain how the optimal growth path is affected if innovation in rare cases lead to disasters. How does your answer depend on assumptions about relative risk aversion?

1.b

Explain why Google, despite being one of the world's leading companies, has a relatively small impact on GDP. Which of Google's activities count towards higher GDP, and which activities do not.

1.c

How does Chinese import competition affect European firms? Can we, based on the available empirical evidence, conclude that China's ascension to the WTO has been good for economic growth in the EU? Has it been good for welfare?

1.d

Evidence suggests that economic growth across countries are highly interdependent. Suppose we think of the world economy as comprising a leader nation, being the center of innovation, and a number of follower countries in terms of technology. Please, explain how a positive productivity shock in the final goods producing sector of the leading nation may affect growth in the rest of the world.

1.e

Suppose a group of countries establish a "common market", which ensures a fully integrated labor market and more competition overall. Imagine these are the only effects of the common market. Will the common market necessarily increase growth in the member state countries according to the Aghion-Howitt model? Please, explain why/why not.

1.f

Statement: “*One should subsidize Research and Development!*”. Do you agree or disagree? Please explain why.

Question 2: Endogenous growth through factor accumulation

Consider a representative firm i , which employs the production technology

$$Y_{it} = A_t K_{it}^\alpha L_{it}^{1-\alpha},$$

where

$$A_t = \bar{A} K_t^\beta. \tag{2.1}$$

Y is output, A is productivity, K is capital and L is labor. We assume the total labor force is constant over time $L \equiv \sum_i L_{it}$.

2.a

Provide an interpretation of equation (2.1).

2.b

Assume competitive markets and that firms are profit maximizing. Denote the real rate of interest by r and the real wage by w . We disregard capital depreciation, which is therefore put at zero. (a) Derive the aggregate production function. (b) Under which parameter restriction is endogenous growth feasible?

2.c

Assume the production technology is as stated above, and that the condition for endogenous growth to arise has been imposed. Assume time is continuous. Consumers derive utility from

consumption over an infinite horizon. Specifically $\int_{t=0}^{\infty} \ln(c_t) e^{-\rho t} dt$. As noted above, total population is constant, and there is no capital depreciation. It can be shown that it is optimal for consumers to allow consumption to follow $\dot{c}/c = r - \rho$. (a) Derive the growth rate of the economy along a balanced growth path. (b) Provide three (3) testable implications, and discuss their empirical relevance.

2.d

The social planner's optimally chosen growth rate, given the assumptions above, is

$$\gamma = \bar{A}L^{1-\alpha} - \rho$$

Please, (a) explain why this solution differs from the decentralized solution derived above, and (b) sketch a policy that ensures the market solution coincides with the planner solution.

Question 3: House prices and city size

Consider the model in Hsieh and Moretti (2019): Housing Constraints and Spatial Misallocation. In the model, output in city i is produced according to:

$$Y_i = A_i L_i^\alpha K_i^\eta T_i^{1-\alpha-\eta}, \quad (3.1)$$

where A_i is local TFP, L_i is labor, K_i is capital, and T_i is land. Land is in fixed supply, but labor and capital are adjustable. The production function is assumed to have constant returns to the three inputs, meaning that $0 < \alpha < 1$, $0 < \eta < 1$, and $\alpha + \eta < 1$. Assume that the return to capital, R , is determined by the world interest rate. By contrast, nominal wages W_i are set at the local level.

Indirect utility of the representative agent living in region i is given by:

$$V_i = \frac{W_i Z_i}{P_i^\beta} \quad (3.2)$$

where Z_i is the value of local amenities, and P_i denotes local nominal house prices. The parameter β is the expenditure share on housing. Local house prices are determined by:

$$P_i = \bar{P}_i L_i^{\gamma_i} \quad (3.3)$$

where \bar{P}_i is a constant, and $\gamma_i > 0$ is the (inverse) elasticity of housing supply with respect to the number of workers in the city.

3.a

Figure 1 and 2 show the distribution of wages (conditional on education, age, etc.) and house prices across cities in the United States. In light of the indirect utility function in Equation (3.2), explain why these distributions might be inefficient. What assumptions do you need to make?

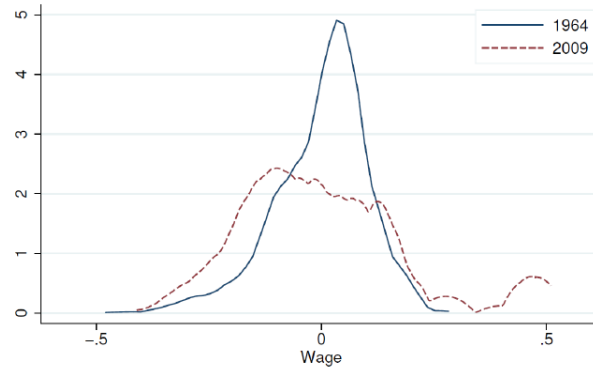


Figure 1: Conditional wages

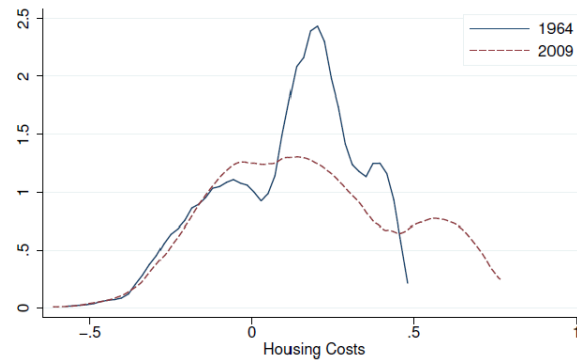


Figure 2: Housing costs

3.b

Show that the (inverse) labor demand in region i is given by:

$$L_i = \left(\frac{\alpha^{1-\eta} \eta^\eta}{R^\eta} \frac{A_i}{W_i^{1-\eta}} \right)^{\frac{1}{1-\alpha-\eta}} T_i$$

3.c

Under the assumption of perfect worker mobility, show that equilibrium employment in a city is given by:

$$L_i = \left(\frac{\alpha^{1-\eta} \eta^\eta}{R^\eta V^{1-\eta}} A_i T_i^{1-\alpha-\eta} \left(\frac{Z_i}{\bar{P}_i^\beta} \right)^{1-\eta} \right)^{\frac{1}{1-\alpha-\eta+\beta\gamma_i(1-\eta)}}$$

where V is common across regions.

3.d

Everything else being equal, what is the elasticity of city size (L_i) with respect to the local productivity level (A_i)? Explain why the effect of an increase in A_i might be different across cities, and relate your answer to the descriptive statistics in Table 1 (reproduced from Hsieh and Moretti, 2019).

Table 1: Employment, Average Wages, TFP, Housing Prices, and Amenities

	1964	2009
log Employment		
New York, San Francisco, San Jose	2.89	2.55
Rust Belt Cities	1.63	0.96
Southern Cities	.82	1.14
Other Large Cities	2.68	2.23
log Residual Wage		
New York, San Francisco, San Jose	.041	.465
Rust Belt Cities	.072	-.121
Southern Cities	-.038	-.037
Other Large Cities	.010	.046
log TFP		
New York, San Francisco, San Jose	3.81	7.14
Rust Belt Cities	2.77	1.14
Southern Cities	1.14	1.95
Other Large Cities	3.36	3.68
log Housing Price		
New York, San Francisco, San Jose	.409	.610
Rust Belt Cities	.125	-.104
Southern Cities	-.128	.106
Other Large Cities	.225	.333
log Amenities		
New York, San Francisco, San Jose	.094	-.174
Rust Belt Cities	-.040	-.049
Southern Cities	-.065	-.026
Other Large Cities	.034	.020

Note: The sample includes 220 metropolitan areas observed in both 1964 and 2009. There are 37 Rust Belt Cities, 86 Southern Cities, and 19 Other Large Cities. The table presents the employment-weighted average of each group of cities relative to the weighted average in all 220 cities in the year. Residual wage controls for educational attainment (high school drop-out, high school, college), race, gender, age,