MACROECONOMICS

Sponsored by a Grant TÁMOP-4.1.2-08/2/A/KMR-2009-0041

Course Material Developed by Department of Economics,

Faculty of Social Sciences, Eötvös Loránd University Budapest (ELTE)

Department of Economics, Eötvös Loránd University Budapest

Institute of Economics, Hungarian Academy of Sciences

Balassi Kiadó, Budapest

HUNGARY'S RENEWAL

The project is supported by the European Union.

Authors: Áron Horváth, Péter Pete

Supervised by: Péter Pete

February 2011

Week 6

Economic growth II

Solow moldel

- The decision on saving is exogenous. It lacks micro foundation
- In the long run it is not restricitve, s is quite stable in the long run and it does not have a trend
- In the short run s fluctuates reacting to exogenous and endogenous (returns) factors

Ramsey model

- Set as a social planner problem
- Labor is assumed away, $z = 1$
- $Y_t = f(k_t)$, $i_t = k_{t+1} – (1 – d)k_t$
- $Y = C + i$ for all t
- Problem:

Solution

Lagrange:

$$L = \sum_{t=0}^{\infty} \beta^t \ln C_t + \lambda_t \{ f(k_t) - k_{t+1} + (1-d)k_t - C_t \}$$

$$\frac{\beta^t}{C_t} = \lambda_t$$

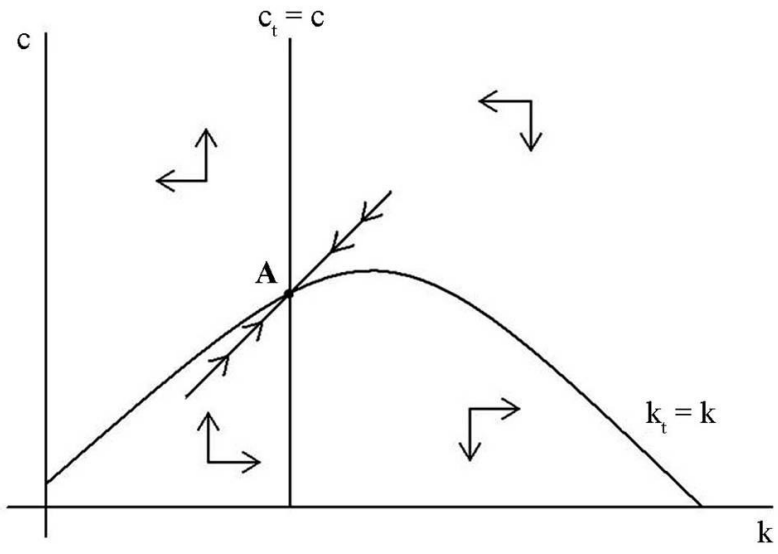
$$\Lambda_t = \lambda_{t+1} \{ f'(k_{t+1}) + (1-d) \}$$

1. $$\frac{C_{t+1}}{C_t} = \beta \{ f'(k_{t+1}) + (1-d) \}$$
2. $$C_t = f(k_t) - k_{t+1} + (1-d)k_t$$

Steady state

- In steady state C = C*, k = k* konstan, therefore y = y* is konstant.
- From 1. 1 = β{f '(k*) + (1 – d)}
- From 2. C* = f(k*) – dk*
- if β = 1, then this is the same as Solow's golden rule.

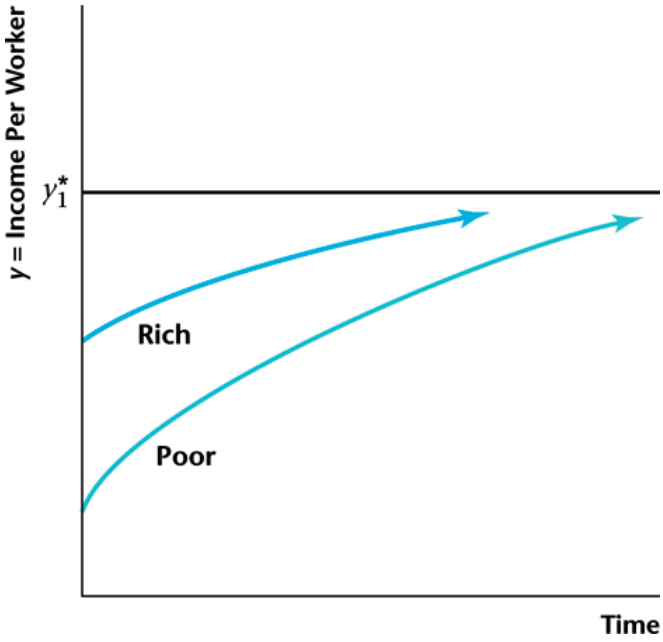
Ramsey diagram



Solow model – convergence

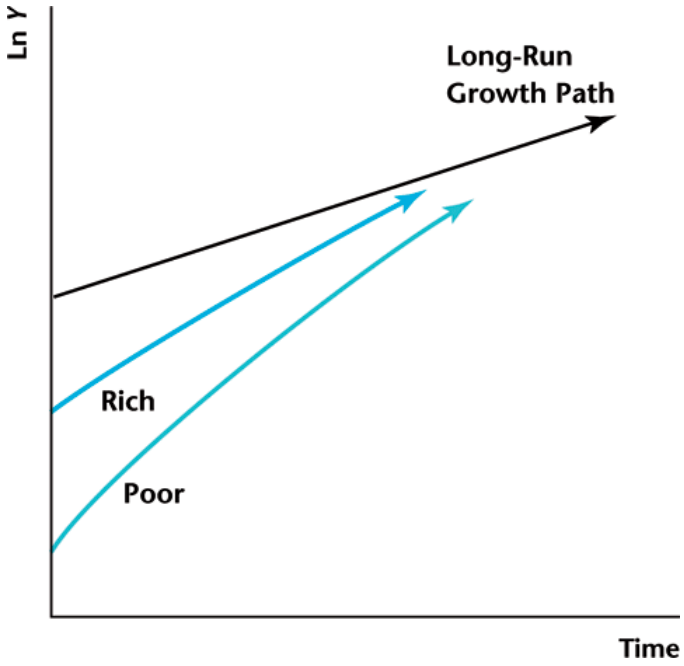
- Countries with the same s and n, moreover equal access to technology would converge to the same stedy state, regardless of their starting level of development (starting level of income and capital per capita
- It seems to happen among developed countries only. Poor countries do not seem to catch up in general

Solow model – convergence



- If countries have the same acces to technology, but have different s and n, they will head toward different steady state level, but their rate of growth will be the same there
- This prediction is not supported by empirical data. Long run growth rate is quite different among countries, some leg hopelessly behind

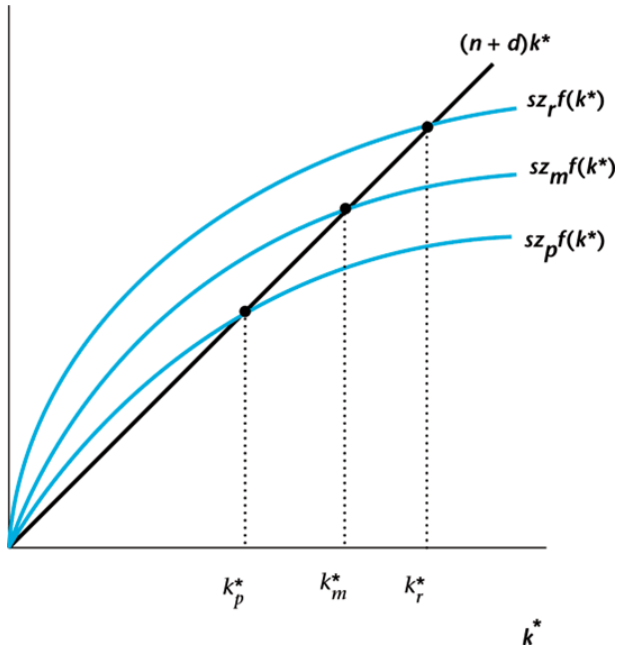
Solow model – convergence



Lack of convergence in terms of the Solow model

- The source of long run growth is the exogenous technology in this model. Therefore lack of convergence can happen as a result of countries having different acces to technology
- Restrictions in technology transfer. Interests of pressure groups may have conflicting interests with respect to new technology
- Restrictions in international trade of goods and technology

Countries having different technoogies



Solow model – convergence

- The reason is the decreasing return of capital. Accumulation of capital results in decreasing efficiency
- TFP is exogenous, z is not explained in the model
- Endogenous growth model: contemporeus models try to explain progress of technology in terms of the model

Endogenous growth

- Growth in TFP is most of all due to technological development, new methods, accumulation of human knowledge
- Acquiring knowledge: investment into human capital, schooling, experience etc.
- Human capital is special, carries externalities, unlike with phisical capittal, decreasing return does not hold.
- Knowledge can grow without limits

Model

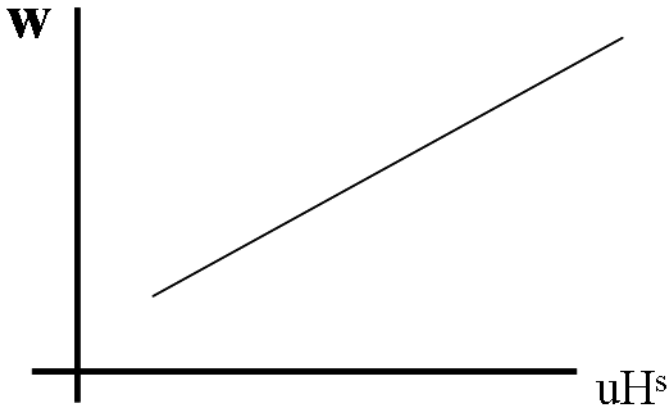
- We have human (knowledge) capital and labor only. More knowledge capital makes labor more productive, functions like more simple labor
- Representative consumer has one unit of time
- Share of u is spent on working. Owns H^s of human capital. Labor supply measured in units of efficiency labor is uH^s

Consumer

- Real wage per unit of efficiency labor is w
- Consumer spends all her income on consumption (no phisical capital exists). Her budget constraint is:

$$C = wuH^s$$

Together wit a U(C, u) utility function this defines a labor supply relation with a positive slope



Accumulation of human capital

(1 – u) portion of her time she spend with education, accumulating knowledge. Law of motion in capital accumulation is:

$$H^{s'} = b(1-u)H^s$$

Accumulation of knowledge depend on knowledge axquired before, on time spent with schooling and on the efficiency of schooling
b(1 – u) > 1

Producer

- Production function depends on labor and technology

$$Y = zuH^d$$

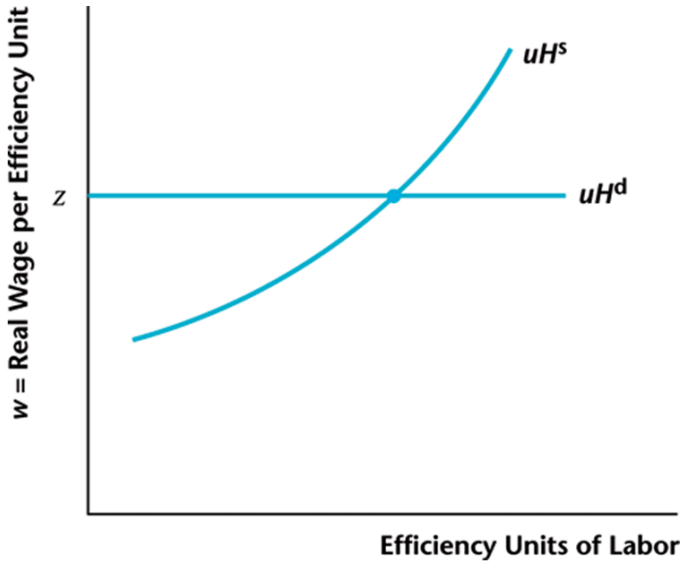
Notice thet the function exhibits constant returns in knowledge capital. With increasing knowledge production can grow without limits
Producer profit is:

$$\pi = zuH^d - wuH^d = (z-w)uH^d$$

Profit maximization

- We have constant returns. Therefore,
  if z > w then demand for labor is infinite
- If z < w then demand for labor is zero
- If z = w then the producer is indifferent with respect to the quantitity of labor employed. Equilibrium quantity of labor is determined by the supply. In equilibrium z = w

Equilibrium in the labor market

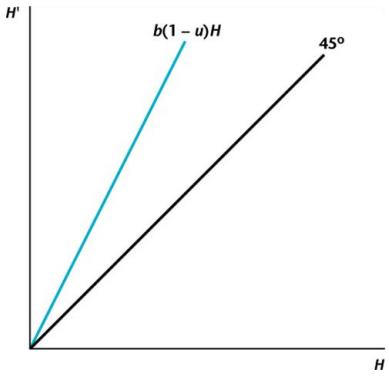


$$uH^d = uH^s \quad \text{ezért} \quad H^d = H^s = H$$

Equilibrium

- Consumption: C = zuH
- Motion of human capital:

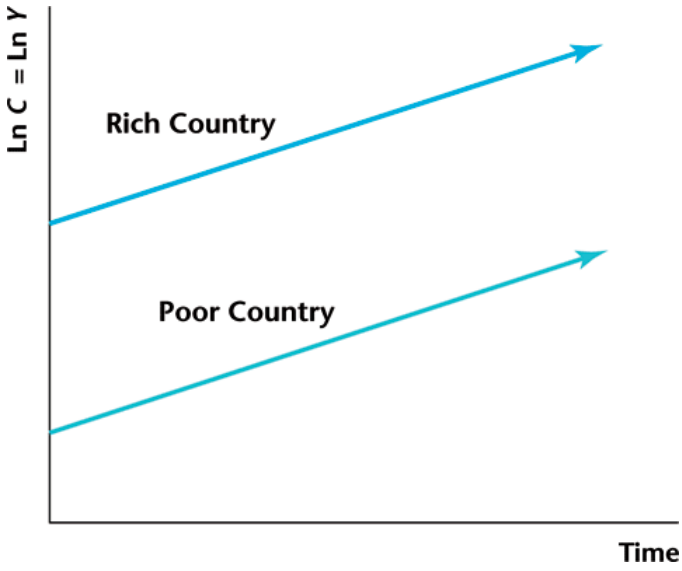
$$H' = b(1-u)H$$



Human capital grows without limit. C and Y grow in the same rate. Growth is determined inside the model, it is endogenous

No convergence

- Rate of growth depends on b and (1 – u). Even if these parameters are the same, there is no convergence if the starting level of human capital is different. Countries lagging behind initially cannot catch up, although they grow at the same rate.
- If these parameters are different the rate of growth will also be different



Economic policy

- The government may try to manipulate the values of b and u in order to manipulat the rate of growth
- Accelerating human capital accumulation is not free lunch
- We have to give up current consumption in order to spend more on education. It is an intertemporal chice

Accelerating growth