

Paolo Sospiro
Dipartimento degli Studi sullo Sviluppo Economico
Facoltà di Scienze Politiche
Università di Macerata
paolo.sospiro@unimc.it

From Growth to Development

Macerata 26 March 2013
Development Economics
University of Macerata

The Exogenous growth

- The H-D and the SM could not be considered endogenous models. In fact, they are not able to explain the growth considering endogenous model.
- In fact, the growth process cannot be explained through endogenous factors production variable.
- This is due to the facts that the HD model consider the relationship amongst saving, Investment, Kapital and Growth (Development) while the SM model, starting from the microeconomics point of view in which the production function or better the productivity is a decreasing function, highlights the role of the technical progress as the only factor of the growth process on the long term.
- however, is still an exogenous process.

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The Human Kapital role

- Starting from

• 7.2
$$Y = AK^\alpha P^{1-\alpha}$$

- Translating

• 9.1
$$y = k^\alpha h^{1-\alpha}$$

- where h is the Human Kapital

• 9.3
$$h(t+1) - h(t) = qy(t)$$

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The Human Kapital role

- Where q is the part S of Human Kapital

• 9.4 $K(t+1) - K(t) = sy(t)$

- The saving rate dedicated on investment on Physical Kapital

- Substituting at 7.2 the left side of the 9.3 and 9.4 we have

• 9.5
$$\frac{k(t+1) - k(t)}{k(t)} = sr^{1-\alpha}$$

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The Human Kapital role

- and

• 9.6
$$\frac{h(t+1) - h(t)}{h(t)} = qr^{-\alpha}$$

- Giving the fact that H and K are two factors of long term growth taking into account the SM then is

• 9.7 $sr^{1-\alpha} = qr^{-\alpha}$ or 9.8 $r = \frac{q}{s}$

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The role of the progress

- Coming back to the important role that plays the progress on the SM and considering the variables introduced on the previous slides then now we can be able to include as well as the progress as endogenous variable. In fact if

• 9.8
$$Y(t) = E(t)^\gamma K(t)^\alpha [uH]^{1-\alpha}$$

- where $E(t)^\gamma$ is the progress and u is the fraction of the Human Kapital dedicated at the production of the final goods.

- Then we'll have

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The role of the progress

$$\bullet \text{ 9.10 } \frac{E(t+1) - E(t)}{E(t)} = a(1-u)H$$

- Where the right side represents the Human Kapital dedicated at the (R&D) while on the left side we have the growth equation of the progress that is in fuction of the number of workes employed on the R&D sector.

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TFP (Total Factors Productivity)

- The TFP allows to indicate which factors influence the growth.
- In fact, most of the variable that insist on the growth attitude of the countries are well known thus we can be able to analysis the TFP and are the following

$$Y(t) = F(k(t), P(t), E(t))$$

- Moreover, actually the exogenous variables have been identified and are endogenous.
- Last but not least, now that those exogenuos variables become endogenous thus we are as well as able to measure them at national and global levels, except for $E(t)$.

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Total Factors Productivity

- Given the first order condition we get 9.11

$$\Delta Y(t) = MPK \Delta K(t) + MPL \Delta P(t)$$

- That means, the variation of $Y(t)$ is given by the Productivity of K multiplied by MPK that is the variation of the K $\Delta K(t)$
- And it's summed up to the product of the population $\Delta L(t)$ and the marginal labour MPL .
- Dividing everything per $Y(t)$ and multiply and dividing everyting per $K_{K(t)}$ and $L_{P(t)}$ we get

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Total Factors Productivity

• 9.12

$$\frac{\Delta Y(t)}{Y(t)} = \frac{MPK \cdot K(t)}{Y(t)} \frac{\Delta K(t)}{K(t)} + \frac{MPL \cdot P(t)}{Y(t)} \frac{\Delta P(t)}{P(t)}$$

• If define $\theta_k(t) \equiv \frac{MPK \cdot K(t)}{Y(t)}$

• and $\theta_p(t) \equiv \frac{MPL \cdot P(t)}{Y(t)}$

• then

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Total Factors Productivity

• 9.13

$$\frac{\Delta Y(t)}{Y(t)} = \theta_k(t) \frac{\Delta K(t)}{K(t)} + \theta_p(t) \frac{\Delta P(t)}{P(t)}$$

• The difference between the two sides of our equation will give the role of the technology on our production process or economical system. In fact 9.14, represents the relationship among k , L and A or $E(t)$ as residual.

$$\frac{\Delta Y(t)}{Y(t)} = \theta_k(t) \frac{\Delta K(t)}{K(t)} + \theta_p(t) \frac{\Delta P(t)}{P(t)} + FTP(t)$$

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