

Dynamics of an Economic Growth Model with New Stylized Facts

ADAM ZSIROS^{1*}, ZSOMBOR LIGETI^{1,2}

1. Budapest University of Technology and Economics, Faculty of Economic and Social Sciences, Department of Economics, Budapest, Hungary
2. Email: ligeti.zsombor@gtk.bme.hu

* Presenting Author

Abstract: The last two decades' social and economic events have proven the importance of feedback mechanisms for determining the income dynamics of countries of the world. The first feedback mechanism is the neglected endogenous population: the inverse relationship between income and population growth. The second feedback mechanism is – partly as a consequence of the previous one – aging society: the simultaneous reduction of labour force and increasing economic cost of the dependency ratio, additionally, the lower technological adaptability of the aging society to new technological innovations. The third feedback mechanism is the rising functional income inequality: the increasing relative income share of the rich. The consequence of these mechanisms is a qualitatively new national and global income path in the 21st century compared to that of the 20th century. The results of these feedback mechanism question not only the stability of social and economic performance but the sustainability of these systems, as well.

Keywords: economic growth, new stylized facts, endogenous population, functional income inequality, aging society

1. Introduction

United Nations Sustainable Development Goals (SDGs) summarize the most important environmental, social, economic, and global challenges. In the 20th century the – investment based – technological change driven economic growth was thought to be the solution for them. As the 2019 Nobel laureates in Economics, Abhijit Banerjee and Esther Duflo describe, however, one of the biggest illusions of the last 40 years – that the savings of the rich stimulate economic growth more than the savings of the poor – has been refuted [1]. This illusion-led-policy has caused increasing inequality, environmental degradation and unsustainable social and economic institutions. What did go wrong?

A standard economic growth model (the Solow model) consists of a Cobb-Douglas type production function and the standard capital-accumulation feedback loop. Macroeconomic income is the function of production factors: technological change $A(t)$, capital $K(t)$, and labour $L(t)$:

$$Y(t) = A(t) \cdot [K(t)]^\alpha \cdot [L(t)]^{1-\alpha}, \quad 0 \leq \alpha \leq 1. \quad (1)$$

The dynamics of per capita capital

$$k(t) = \frac{K(t)}{L(t)}, \quad (2)$$

and thus per capita income

$$y(t) = \frac{Y(t)}{L(t)} = A(t) \cdot [k(t)]^\alpha, \quad (3)$$

are given by capital accumulation – investment – and a set of constants (saving rate s , population growth rate n , capital depreciation rate δ and technological growth rate g):

$$\dot{k} = sy(t) - (n + \delta + g)k. \tag{4}$$

The mechanism of developed countries’ enrichment was characterised by stylized facts of the 20th century [2] which were enlarged and revisited at the beginning of the 21st century [3]. By the second decade of the 21st century, the long run results of – so far neglected – interactions of social and economic factors have been proven. The two Nassim Taleb-type Grey Swan events (the financial crisis of 2007–2009 and the present COVID-19 pandemic), the increasing income inequality elaborated by Thomas Piketty [4] and the rapidly aging societies of rich countries are revealed new stylized facts for the analysis of economics growth. We can conclude, what was wrong with the former models: they neglected important feedback mechanisms.

2. Results and Discussion

We present three new stylized facts published in the recent literature, that are essential to be considered for a better description of developed economies. These empirical facts can be determined with feedback mechanisms which are supported by econometric analysis. Thus, we integrate the following three terms into the standard growth model:

1. *Aging population*: dependency ratio $D(t)$ is increasing tendentiously in developed countries.
2. *Endogenous population*: the growth of the population is inversely proportional to the income per capita ($g_N(y), dg_N/dy < 0$).
3. *Time-varying functional income distribution*: the share of labour and capital in total output tends to vary over time. The presumed determining factor of the changes is income ($\alpha(y(t))$)

Considering these new stylized facts, we had run simulations. The qualitative changes of the expected income values compared to the original Solow model (red line) can be seen in Figure 1: recent changes in society (new stylized facts) imply qualitative changes in GDP per capita predestination of the Solow model. Maintaining the current growth requires the replanning of current economic policies.

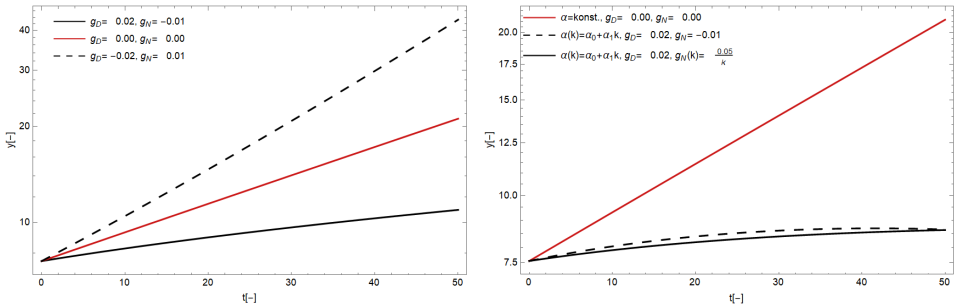


Fig. 1. Forecasted time path scenarios of GDP per capita considering the new stylized facts.

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