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THE SOLOW MODEL OF ECONOMIC GROWTH FOR DEVELOPING COUNTRIES

MODELUL SOLOW DE CREȘTERE ECONOMICA PENTRU ȚARILE IN CURS DE DEZVOLTARE

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Abstract: *The Solow Model, also known as the Solow-Swan Growth Model, is a foundational concept in economics that explains long-term economic growth by looking at capital accumulation, labour or population growth, and technological progress. This paper examines the theoretical shift from the Harrod-Domar to the Solow growth model through the lens of inference to the best explanation, while also highlighting the relevance of Solow's steady-state capital-labour ratio within an instrumentalist framework. Furthermore, it explores how the model's structure provided the basis for predicting income convergence in developing countries, as interpreted through Hempel's covering-law model.*
Key words: *Solow Model, economic growth, capital-labour ratio*

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INTRODUCTION

Robert Solow is widely believed to be one of the most influential economists of the 20th century. After receiving his B.A., M.A. and Ph.D. in economics at Harvard University, he went on to teach at the Massachusetts Institute of Technology where he spent most of his career. Robert Solow is best known for his contributions to the field of macroeconomics and growth theory as well as working as a consultant for organizations like The World Bank and The International Monetary Fund. In 1987, he was awarded the Nobel Memorial Prize in Economic Sciences for his work on the theory of economic growth which was published in the article *A Contribution to the Theory of Economic Growth* (1956). Solow managed to show how economies grow in the short and long run by proving that sustained national economic growth is based on a country's capital, labour and technological progress over time (Solow, 1956). The purpose of this paper is to first analyse how the Solow model supplanted the Harrod-Domar model by inferring the best explanation. Secondly, underline the importance of Solow's findings on the steady-state capital-labour ratio by the principle of instrumentalism. Finally, explain how the model subsequently predicted income convergence in developing countries according to Hempel's covering law model.

SOLOW MODEL, THE EXTENSION TO THE 1946 HARROD-DOMAR MODEL

Robert Solow aimed to improve the Harrod-Domar model of economic growth. He argued that Harrod's main concern was to base the natural rate of growth on the increase of the labour force and the savings and investments made by organizations (Solow, 1956). The Harrod-Domar model was describing the capacity of a country's economic growth as something unrelated to technological change. The model had a definitive assumption at its core that was not proven or tested before and thus, made it untrustworthy and the results questionable (Solow, 1956). Solow stated that under the circumstances and assumptions made by Harrod, "the possibility of steady growth would be a miraculous stroke of luck" (Solow, 1988, p. 307).

However, in the Solow growth model, the defining factor was the allowance of technological change and an interest-elastic savings schedule that would ultimately make his model less complex,

more realistic and thus easier to use, not only on a higher government level but also, on a lower level of production (Solow, 1956). The conclusion that Solow came to was that the allowance of a small degree of technological pliability created a range of capital-labour equilibria, which already brought a new insight into the science of growth theory (Solow, 1988). Moreover, the model showed that a developing economy that succeeds in always increasing its investment rate will experience higher levels of output than if it had not (Solow, 1988).

Therefore, it is reasonable to believe that the principle relevant to Solow's work is inference to the best explanation (IBE), as his main concern, considering the previously cited sources, was to simplify the Harrod-Domar model. He did so by allowing technological progress to be more flexible, which made his predictions more accurate and the model easier to apply, hence less complex (Okasha, 2016).

THE DEVELOPMENTS OF THE CAPITAL-LABOUR RATIO OVER TIME

Solow's model created important conclusions based on different initial values of the capital-labour ratio as his economic model showed the relationship between the investment rate and the rate of depreciation of capital (Solow, 1956). While analysing the behaviour of both, Solow concluded that the investment rate tends to decrease over time and eventually intersects with the depreciation curve. The intersection point of these two curves is the steady state capital-labour ratio and it will be maintained, capital and labour will grow from that point onwards (Solow, 1956).

Solow distinguished three cases: the capital is initially below the steady state, above the steady state or equal to zero. He concluded that no matter where the capital initially was, it will always tend to move towards the point of intersection (Solow, 1956). However, if the capital is initially equal to zero then there is virtually no starting point for the system and so no output will follow, making this the only case when the system is unstable.

According to the Harrod-Domar model, the investment rate equals the product of the growth rate of labour and capital-output ratio defined by technological progress, then by doubling the investment rate, the growth rate should double too. This conclusion would be impossible because "doubling the ex-ante saving rate would not double the ex-post saving rate unless something were taking care of the ex-ante investment rate at the same time" (Solow, 1988, p. 308).

Solow's basic conclusion is that if the investment rate is fully above the depreciation rate, then the system will be so highly productive "that perpetual full employment will increase the capital-labour ratio (and also the output per head) beyond all limits; capital and income both increase more rapidly than the labour supply" (Solow, 1956, p. 72). Conversely, if the investment rate is completely below the depreciation rate, the system will be very unproductive and "full employment path leads only to forever diminishing income per capita" (Solow, 1956, p. 73).

Following these statements, the most suitable principle of the philosophy of science related to this section is instrumentalism because Solow's theory, as he observes and ultimately predicts the tendency of capital to move towards the steady state capital-labour ratio, serves as "instruments for helping us predict observable phenomena, rather than as attempts to describe the underlying nature of reality" (Okasha, 2016, p. 56).

CONCLUSIONS ABOUT DEVELOPING ECONOMIES UNDER THE SOLOW MODEL

According to Solow (1956), his analysis led to the hypothesis of income convergence in developing countries. In his work, he concluded that technological progress is a crucial factor in long-run economic growth (Solow, 1988). In order to underline the importance of this, Solow (1988) mentions that N. Wolff (1987) concludes that there exists a strong connection between the rate of technological progression and the speed of investment. This shows that if countries have the same level of technological innovations "then it appears that the ones that invested fastest were best able to take advantage of the available knowledge" (Solow, 1988, p. 315). All of this comes down to the income convergence hypothesis, as predicted by Solow.

Ertugrul and Tanriseven (2018) mention that income differences have become a real social issue in the present-time. Due to globalization, for trade to be possible between countries, it is necessary for incomes to converge, thus concluding that converging countries have a better economical connection between each other (Ertugrul & Tanriseven, 2018). Solow's model predicts that countries that already have a high capital and are closer to the steady state capital-labour ratio are less likely to have a high economic growth rate. This is because a bigger part of their economy is aimed at fulfilling the depreciation or maintenance needs of capital (Solow, 1956). To add to this, a study on the European Union (EU) confirms Solow's predictions, as the data analysed displayed a "conditional convergence in per capita income" (Ertugrul & Tanriseven, 2018, p. 347), considering that the EU contains developed and developing economies in its complex economical structure.

However, in structures like The Association of Southeast Asian Nations (ASEAN), where most members have developing economies, income convergence is less identifiable (Ertugrul & Tanriseven, 2018). According to Ertugrul and Tanriseven (2018) only three ASEAN countries had convergence effects. It is worth mentioning that a crucial condition is the time when a member has joined the association, "Looking at old members, it seems that convergence continues for a long term. Yet, new members seem to have slowly adapted to the region." (Ertugrul & Tanriseven, 2018, p. 347).

Solow's findings aim to prove and give a reason to the higher and more rapid economic growth in developing economies. His system proves show that this happens because of the income convergence hypothesis (Solow, 1956). This can be referred to Hempel's covering law model as a principle of philosophy of science, as Solow wanted to show why weaker economies in the past had a high economic growth rate over a period of time and became a developed economy today (Solow, 1988). Hempel's covering law model says that scientific explanations have a conclusion that "states that the phenomenon which needs explaining occurs, and the premises tell us why the conclusion is true." (Okasha, 2016, p. 37), which is relevant to income convergence and Solow's system in view of the arguments provided in this section.

FINDINGS AND CONCLUSIONS REVEALED THROUGH THE RESEARCH PROCESS

Robert Solow's neoclassical model of economic growth serves as a base for many different views on growth theory in various countries. Consequently, one can conclude that Solow's model improved its predecessor's model of economic growth. As stated before, the most important aspect of Robert Solow's findings, based on the behaviour of the capital-labour ratio at a stable and unstable state of equilibrium, was its applicability to both big and small levels of production. Moreover, the Solow model confirmed the hypothesis of income convergence in countries with developing economies and, as it was critically examined, explained why and how this model was applied according to the principle of instrumentalism. Indeed, as Solow (1988) confirms, the model quickly found its way into the textbooks and the foundation of macroeconomics and growth theory.

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