Theoretical Comparisons and Empirical Illustration of Malmquist, Hicks–Moorsteen, and Luenberger Productivity Indices

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Abstract : Productivity is one of the essential goals of companies to improve performance, which as a strategy-oriented method, determines the basis of the company's economic growth. The history of productivity goes back centuries, but most researchers defined productivity as the relationship between a product and the factors used in production in the early twentieth century. Productivity as the optimal use of available resources means that "more output using less input" can increase companies' economic growth and prosperity capacity. Also, having a quality life based on economic progress depends on productivity growth in that society. Therefore, productivity is a national priority for any developed country. There are several methods for calculating productivity growth measurements that can be divided into parametric and non-parametric methods. Parametric methods rely on the existence of a function in their hypotheses, while non-parametric methods do not require a function based on empirical evidence. One of the most popular non-parametric methods is Data Envelopment Analysis (DEA), which measures changes in productivity over time. The DEA evaluates the productivity of decision-making units (DMUs) based on mathematical models. This method uses multiple inputs and outputs to compare the productivity of similar DMUs such as banks, government agencies, companies, airports, Etc. Non-parametric methods are themselves divided into the frontier and non frontier approaches. The Malmquist productivity index (MPI) proposed by Caves, Christensen, and Diewert (1982), the Hicks–Moorsteen productivity index (HMPI) proposed by Bjurek (1996), or the Luenberger productivity indicator (LPI) proposed by Chambers (2002) are powerful tools for measuring productivity changes over time. This study will compare the Malmquist, Hicks–Moorsteen, and Luenberger indices theoretically and empirically based on DEA models and review their strengths and weaknesses.

Keywords : data envelopment analysis, Hicks–Moorsteen productivity index, Leuenberger productivity indicator, malmquist productivity index