

## **Measuring Technological Change using the Field of Influence Approach to I-O Analysis: Applications to Growth Dynamics in Selected Asian Countries**

Topic: Classical IO applications (Chair: Eduardo Moreno Reyes, University of Macerata)

Author: Norman De Guzman Dytianquin

Economic growth in East Asia, dubbed as a miracle story by a World Bank report, has inspired thinking into a new development paradigm in East Asian economies leapfrogging the industrialization process. This miracle story, however, has triggered a debate into the causes of the spectacular economic rise of the Asian economies. This debate on the Asian miracle has crossed various disciplines, spanning the political (democratic versus authoritarian rule) and cultural (Asian values versus Western values) to the economic spheres, where growth accounting studies ushered the economic controversy on accumulation (growth by increase in inputs) versus assimilation (growth by learning new technologies) behind Asia's stellar economic performance. Both results of growth accounting though of 'accumulationists' and 'assimilationists' are based on the neoclassical growth theory of Solow-Swan and depending on the assumptions on parameters such as factor shares and elasticity of substitution propose either way convincing arguments. Endogenous growth theories as well as evolutionary and Schumpeterian approaches have also proliferated in growth literature, challenging the neoclassical explanation for economic growth. Because of the assumptions and limitations of growth accounting, new approaches such as the field of influence technique of input-output analysis, which is Schumpeterian in approach, have recently emerged with promising implications and applications for growth theory.

A key assumption of input-output analysis is that the inverse of technical coefficients are fixed and yet the inverse coefficients change over time. The proponents of the field of influence approach to input-output analysis, i.e., Hewings, Sonis & Jensen (1988) assume that this change in coefficients represent technological change as sectors compete for fixed shares of inputs when producing their outputs resulting from innovation diffusion. This Schumpeterian competition operates in both production (supplying industries) and consumption (buying industries) spheres between new and old products displaying characteristics of the logistics or sigmoid curve where a period of slow growth is followed by rapid and then decelerating growth and consequent decline. Given a longer time series of input-output tables, the changes in coefficients can depict technological diffusion across industries akin to Schumpeterian waves.

In this study, the focus is on economic growth in East Asia (particularly on Malaysia, Thailand and the Philippines), where the field of influence approach was applied over a period of four to five decades. The use of field of influence as a novel approach in studying growth episodes reveals an interesting evolution of the growth dynamics of the selected countries similarly starting out as basically agricultural and yet producing different development trajectories with the type of industries that these economies eventually promoted and developed. The creators of the field of influence approach introduced the calculation of a first order intensity of the direct field of influence of the base year that, in turn, is linked to key sector analysis of backward and forward linkages which can be ranked to form a hierarchy that depicts the economic landscape of countries over time. A second order intensity could likewise be produced, generating scaling effects of inter-sectoral linkages from which bilateral balances and imbalances through push-pull effects of backward and forward linkages are generated. Finally, the propagation of influence through feedback loops can be mapped to see how innovation diffuses throughout the entire economy.

The general purpose technology that propelled technological change in the sample Asian economies is information and communication technology (ICT) represented by the semiconductor industry classified in the national accounts under electrical machinery where the three countries competed as assemblers in the global supply chain. The semiconductor industry are among three

sectors, the other two being transport equipment (automotive) and textiles/wearing apparel, which became archetypes of an emerging development paradigm of global production networks, also referred to as supplier-oriented model of development. The study ends with policy implications in targeting industries that are technology intensive in industrial policy and national innovation systems and in identifying national champions with the right balance among sectors that contribute most to growth and those that minimize vulnerabilities from sectoral or even global-specific shocks. It also indicates the need to graduate into higher value-added phases under the new development paradigm such as developing own brand and design as well as original equipment manufacturing rather than just remaining as assembly, packaging and testing satellites.