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Dynamic technological learning trends in Turkish manufacturing industries

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Abstract

Efficient development of industries requires a broad range of technological capabilities which can be acquired only by a long process of learning. Continuous measuring and monitoring of the ever-changing technological learning would be useful for building technological capability and managing technological policies. Nevertheless, research on how to measure the technological learning over time at macro levels remains largely untouched. In this paper, by adding the experience curve into the multifactor productivity part of Neoclassical production function, we will develop a model which will allow one to estimate the technological learning levels over long periods. This model would allow a user to both estimate the past learning experiences and forecast its future path on a time varying basis. The model has been used and tested in the estimation of the annual technological learning values for 28 Turkish manufacturing industries from 1981 to 2000.

Keywords: Technological learning; Learning curve; Experience curve; Technological capability; Manufacturing industry Turkey

1. Introduction

It has been widely recognized that improvement of productivity through building technological capability has been the key aspect of economic growth and development and has become even more

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critical in the global competitive economic environment. This could be achieved by continual technological learning in an economy that has the necessary resources such as a skilled workforce, raw materials, capital and institutions [1,2]. For this reason, continuous measuring and monitoring of the ever-changing technological learning would be useful for building technological capability and managing technological policies. Yet, how to measure the technological learning over time at the macro level remains unanswered. In this paper, by using the experience curve and the progress ratio concepts together with the Neoclassical production function, we develop a model which allows the technological learning to be estimated at the industrial level on a time-varying basis for long periods. This model assumes that the learning is a part of the productivity, and it would allow a user to both estimate past learning experiences and forecast its future path.

In the paper, first, technological capabilities and technological learning concepts and their connection are discussed. Following that, the developing countries' positions on building technological capabilities are briefly expressed. Next, a picture of the industrial and technological progress in Turkish manufacturing is given. Then, after presenting both the traditional learning and experience curve models, the dynamic nature of these models are shown. A general mathematical model has been derived which incorporates the experience curve model into the Neoclassical production function. The model allows the estimation of learning over time, and can be used for the estimation of learning in different economies as well. Moreover, using this model, the annual or dynamic technological learning has been estimated and evaluated for Turkish manufacturing industries. Results have clarified that the estimation model worked well and that it reflected the time-varying nature of technological learning in industries. It also has shown that some industries could learn better than others and that they could respond to some economic events including the various economic policy changes. Moreover, it proposed that industries some times go through unlearning processes which are temporary in nature and could be avoided or be overcome more easily by government interventions and policies.

2. Building technological capability through technological learning and developing countries

Technological capability is construed as an ongoing process of learning [3]. Kim [2] defines the technological capability as the ability to make effective use of technological knowledge in production, engineering, and innovation in order to sustain competitiveness in price and quality. Likewise, Najmabadi and Lall [4] define technological capability in industry as the skills—technical and organizational—that are necessary for enterprises to set up a plant, utilize it efficiently, improve and expand it over time, and develop new products and processes.

Various studies articulate that accumulation of technological capabilities require technological learning [2,5–11]. The technological learning can be understood as a process of accumulation of knowledge, information, skills, competencies, and experience in order to generate changes in a productive system [7]. It is also the trajectory or path along which the accumulation of technological capability proceeds. The way this path proceeds may change over time: technological capability may be accumulated in different directions and at differing rates [5].

Many scholars say that the technological learning is a cumulative and costly process. It is a cumulative process because it utilizes the existing knowledge base, which is embedded not only in humans but also in informal and formal documents, machines and organizational routines in a great variety of ways, as input. Hence, the greater the existing knowledge base and intensity of efforts, the