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JOURNAL OF
Economic
Dynamics
& Control

Journal of Economic Dynamics & Control 28 (2004) 1625–1634

www.elsevier.com/locate/econbase

Industrialization and substitutability: a note

Masao Yamada*

Faculty of Economics, Yamaguchi University, 1677-1 Yoshida, Yamaguchi 753-8514, Japan

Received 5 March 2001; accepted 11 March 2003

Abstract

This paper analyzes the relationship between industrialization and technology in detail. Three main conclusions are obtained: (i) the crucial factor for the existence of a poverty trap is the degree of substitutability among intermediate inputs; (ii) the effects of technological progress in the manufactured good sector and the intermediate goods sector on industrialization differ with the degree of substitutability among intermediate inputs; (iii) technological progress in the manufactured good sector and the intermediate goods sector weakens the lock-in effect of historical events while strengthening the role of expectations. These suggest that the degree of substitutability among intermediate inputs should be an important factor when we plan a development strategy.

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JEL classification: O11; O14

Keywords: Poverty trap; Substitutability among intermediate inputs; Technological progress

1. Introduction

In recent years, a variety of works has examined problems of industrialization using models with increasing returns (see, for example, [Murphy et al., 1989](#); [Krugman, 1991](#); [Matsuyama, 1991](#); [Chen and Shimomura, 1998](#); [Dei, 1998](#)). In these models, there are multiple equilibria; therefore the problem of equilibrium selection arises. [Krugman \(1991\)](#) and [Matsuyama \(1991\)](#) tackle this problem and show that the relative importance of history and expectations in determining equilibrium depends on the underlying structure of the economy. Their analyses are extremely important to the issues in industrialization, such as a poverty trap and a take off. The effects of technology on industrialization, however, are not sufficiently examined in their papers

* Tel./fax: +81-83 933 5540.

E-mail address: mayamada@yamaguchi-u.ac.jp (M. Yamada).

because they assume Marshallian externalities as the source of increasing returns. In this paper, we assume that manufacturing technology is subject to increasing returns due to specialization, as in Ethier (1982) and Romer (1987), and show how technology affects industrialization.

Three main conclusions are obtained from the model: (i) the crucial factor for the existence of a poverty trap is the degree of substitutability among intermediate inputs; when this substitutability is large, there exists a poverty trap, and vice versa; (ii) the effects of technological progress in the manufactured good sector and the intermediate goods sector on industrialization differ with the degree of substitutability among intermediate inputs; when this substitutability is small, technological progress in the manufactured good sector and the intermediate goods sector degenerates industrialization, and vice versa; (iii) technological progress in the manufactured good sector and the intermediate goods sector weakens the lock-in effect of historical events while strengthening the role of expectations.

There are other existing studies related to our analysis. Dei (1998) analyzes the relationship between multiplicity of equilibria and substitutability among intermediate inputs and points out that expectations play an important role in determining the degree of industrialization. Ottaviano (1999) uses the model based on Krugman (1991) and examines how trade liberalization and factor mobility affect the international distribution of economic activities.

This paper is organized as follows. The simple model is presented in Section 2. In Section 3, we analyze equilibrium dynamics and examine the effects of technological progress in the manufactured good sector and the intermediate goods sector. Finally, concluding remarks appear in Section 4.

2. The model

Consider a small open economy with two final goods, an agricultural good and a manufactured good. Both goods are traded at a constant price, one, in world markets. The agricultural good is produced with constant returns and the unit labor requirement is unity. Thus, the wage rate in the agricultural sector is unity.

The manufactured good is produced by assembling intermediate inputs and the production function is given by

$$Y = A \left[\int_0^n x(i)^\alpha \, di \right]^{1/\alpha}, \quad 0 < \alpha < 1, \quad (1)$$

where Y is the output of the manufactured good, A is the index of the technology, $x(i)$ is the amount of the i th intermediate good, and n is the variety of intermediate goods. The elasticity of substitution is $1/(1-\alpha) > 1$. Unit cost function which corresponds to (1) is given by

$$c = A^{-1} \left[\int_0^n p(i)^{-\alpha/(1-\alpha)} \, di \right]^{-(1-\alpha)/\alpha}, \quad (2)$$

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