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Modifications of the Balassa–Samuelson Model: The Effects of Balanced Growth and Capital Accumulation

Taizo Motonishi[1]

Faculty of Economics, Nagasaki University, 4-2-1 Katafuchi, Nagasaki 850-8506, Japan
E-mail: moto@net.nagasaki-u.ac.jp

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In this paper modifie versions of the Balassa–Samuelson model are developed. We stress the effects of balanced productivity growth and capital accumulation, which is often ignored or not fully understood in existing studies. Our theoretical analysis shows that these effects and the differential productivity growth effect can be presented in a unifie framework. Empirical estimates using 1970–1990 sectoral data for the OECD show that our modifie models are more suited to the data than the commonly used Balassa–Samuelson model. *J. Japan. Int. Econ.*, March 2002, **16**(1), pp. 31–49. Faculty of Economics, Nagasaki University, 4-2-1 Katafuchi, Nagasaki 850-8506, Japan. © 2002 Elsevier Science (USA)

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1. INTRODUCTION

This paper explores the determinants of the relative price of nontradables to tradables. This relative price is the key factor in understanding actual deviations from purchasing power parity (PPP). Harrod (1939), Balassa (1964), and Samuelson (1964) argue that high productivity growth of the tradables sector compared to the

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nontradables sector leads to a rise in the relative price of nontradables, which puts upward pressure on a country's real exchange rate. Many empirical studies have tried to explain f uctuations in real exchange rates focusing on the relative price of nontradables.[2]

The commonly used framework in this line of research assumes that international f nancial markets are perfect and that the wage rate is f exible. As a result, the relative price of nontradables is affected not only by differential productivity growth, but also by balanced productivity growth between the tradables and the nontradables sectors, since balanced productivity growth raises the wage rate but does not affect the rental rate of capital. This leads to an increase in the relative price of labor-intensive goods, which is more likely to characterize nontradables.

It has often been overlooked, however, that the assumptions of the commonly used framework regarding factor prices have only weak empirical support, especially in the short run. For example, other empirical studies have shown that capital is not perfectly mobile internationally.[3] In addition, it is often pointed out that the wage rate is sticky, especially in the short run. In both cases, the commonly used framework is inappropriate.

Under alternative assumptions about factor prices, the effect of balanced productivity growth is different from the commonly used framework. Let us assume that international capital mobility is imperfect and the wage rate is sticky. Then balanced productivity growth *lowers* the relative price of labor intensive goods, unlike in the commonly used framework. Moreover, the balanced productivity effect disappears when international capital mobility is imperfect and the wage rate is f exible.

These changes in assumptions have an impact that is not only through the balanced productivity growth effect. When international capital mobility is imperfect and the wage rate is f exible, capital accumulation becomes a determinant of real exchange rates. In this case the progress of capital accumulation lowers the relative price of capital-intensive goods. This is based on the insights of Kravis and Lipsey (1983) and Bhagwati (1984). Existing studies, however, do not present the differential productivity growth effect (the Balassa–Samuelson effect), the balanced productivity growth effect, and the capital accumulation effect (the Kravis–Lipsey–Bhagwati effect) in an integrated fashion. Our theoretical analysis, however, enables us to understand those effects in a unif ed framework and to test them simultaneously.

The modif ed models are very simple and can be easily examined empirically. Our estimates, using 1970–1990 sectoral data for 14 OECD countries, show that the commonly used framework is not suited to the data both in the short run and in the long run and that our modif cations are supported, even after taking into account possible demand effects.

[2] See Hsieh (1982), Yoshikawa (1990), Asea and Mendoza (1994), De Gregorio and Wolf (1994b), Rogers and Jenkins (1995), and Kawai and Ohara (1997).

[3] See, for example, Feldstein and Horioka (1980).