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# Evolution of the relative price of goods and services in a neoclassical model of capital accumulation <sup>☆</sup>

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## Abstract

The paper provides an explanation for the secular increase in the price of services relative to that of manufactured goods that relies on capital accumulation rather than on an exogenous total factor productivity growth differential. The key assumptions of the two-sector, intertemporal optimizing model are relatively high capital intensity in the production of goods and limited cross-border capital mobility, allowing the interest rate to vary. With plausible parameterization, the model also predicts a decline in the employment share of the goods sector over time.

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## 1. Introduction

An increase in the price of services relative to that of manufactured goods is a well-documented feature of economic development (Baumol and Bowen, 1966; Obstfeld and Rogoff, 1996). As manufactured goods are tradable across borders while services are

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largely not, in an open economy one may observe a secular increase in the price of nontradables relative to that of tradables—the celebrated Balassa–Samuelson effect.<sup>1</sup>

The explanation for this phenomenon relies largely on the difference in the growth of labor productivity over time between the two sectors.<sup>2</sup> As labor productivity goes up in manufacturing, wages will go up in that sector as well. In the presence of intersectoral labor mobility, this will put upward pressure on the wages in services. If labor productivity growth lags behind in the services sector, unit labor cost will rise in that sector, and the price of services will have to go up for their provision to remain profitable.

Labor productivity growth can be decomposed into contributions from capital deepening (increase in the capital–labor ratio) and total factor productivity (TFP) growth. While early models were agnostic about the source of labor productivity differential (e.g., Baumol, 1967), lately the emphasis has been on TFP. This is particularly true of open-economy models (such as one in Obstfeld and Rogoff 1996, Chapter 4), where it is customary to assume the domestic interest rate to equal a given world interest rate, the parity being maintained by perfect capital mobility. As technological parameters and the rate of interest completely determine capital–labor ratios and relative prices, TFP growth becomes the only possible source of a change in the relative price of the two sectors' outputs.

This emphasis is not always justified. While TFP growth drives economic progress in the long run, developments in the medium term may be determined by capital accumulation. This is particularly true of economies that have high level of human capital and access to advanced technology, but relatively low physical capital stock. This description fits well post-war economies, like Western European countries or Japan after World War II. Other examples could include the Asian Tigers at the beginning of their takeoff and, arguably, post-communist economies. One can also note that fast growth and change in relative prices occurred in many of these economies when cross-border capital movements were quite restricted, so that the assumption of an exogenously given interest rate was not applicable.

In this paper we propose an explanation for the change over time of the relative price of services and manufactures, or nontradables and tradables, that does not rely on TFP differential. The driving force in the model is capital accumulation, which leads to an increase in the relative price of services under the assumption that this sector is relatively less capital intensive than manufacturing. According to Obstfeld and Rogoff (1996, p. 209), this assumption reflects reality.

While our result seems intuitive and has a familiar counterpart in trade theory, we have not been able to trace this particular application in the literature. Brock (1994) provides a rare example of an intertemporal optimizing model that avoids the use of exogenous technological change as an explanation of changes in relative prices. Brock's objective is to emphasize the importance of investment, but as he assumes perfect capital mobility, he has

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<sup>1</sup> Of course, the mapping of manufactured goods into tradables and services into nontradables is less than perfect, given the presence of other sectors in the economy and the fact that some services may be tradable while some manufactured goods may be rendered nontradable by policy measures. For that reason, empirical support for the Balassa–Samuelson effect is not as strong as for the Baumol–Bowen effect (Froot and Rogoff, 1995; Harberger, 2003).

<sup>2</sup> Canzoneri et al. (1999) present empirical evidence of this link. Other possible reasons—such as a shift of consumer demand from goods to services—appear to play a relatively minor role.

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