Endogenous phase switch in Baumol's service paradox model

Hiroaki Sasaki

Graduate School of Economics, Kyoto University, Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501, Japan

ARTICLE INFO

ABSTRACT

This paper develops a two-sector model that considers Baumol's service paradox. The paper simultaneously incorporates two ideas about technological progress in the model: (1) the consumption of services contributes to human capital accumulation and (2) the production of manufacturing leads to technological progress due to learning-by-doing. Accordingly, productivity growth in both services and manufacturing is endogenously determined. We show that initially, a shift in the employment share toward the services sector decreases the per capita real GDP growth rate, but at some point in time, the shift begins to increase the growth rate. Therefore, we observe an endogenous phase switch from a phase where the employment shift toward services depresses the economy to another where the employment shift promotes the economy.

1. Introduction

Baumol (1967) predicts that in developed countries, the services employment share tends to increase. He explains this as follows. There are two sectors—a progressive sector (manufacturing) and a stagnant sector (services)—in the economy. Suppose that the productivity growth in services is lower than that in manufacturing. Suppose also that the ratio of manufacturing output to services output is constant.[1] Then, though the price of services relative to

that of manufacturing continues to rise, the demand for services keeps increasing because the output ratio (i.e., consumption ratio) is constant. Since the productivity growth in services is lower than that in manufacturing, more employment in services is necessary to meet the increasing demand for services, which results in a rise in the services employment share. Given the productivity growth differential and the constant demand ratio, the tendency toward a services economy is inevitable.[2] Indeed, we can easily see the employment shift toward services in developed countries.

In the same paper, Baumol makes an important prediction: as the employment share shifts toward services, the per capita real GDP growth rate will decline. He explains

---

E-mail address: sasaki@econ.kyoto-u.ac.jp

[1] Baumol (1967) justifies the assumption of a constant ratio between services and manufacturing output with reference to a low price elasticity of demand for services or to a public policy that sterilizes the effects of relative costs on prices through budgetary transfers. Moreover, Baumol's (1967) oversimplification—the assumption of the constant output ratio—can be seen as a deliberate expository device, which dramatizes an important possible consequence for the overall growth rate of the economy.

---

[2] In Baumol's (1967) model, labor is fully employed. In contrast, based on Pasinetti's (1993) pure labor economy model, Notarangelo (1999) presents a model with unemployment. She shows that given the productivity growth differential and price-non-elastic demand, employment shifts toward services as in Baumol (1967).

this as follows. The per capita real GDP growth rate is given by a weighted average of the productivity growth in manufacturing and the productivity growth in services with the weight being the corresponding employment share. Suppose that the employment share shifts toward services. Because the employment share of the services sector in which productivity growth is lower increases, the per capita real GDP growth continues to decline and converges to the productivity growth in services in the end. Hence, if the shift in the employment share toward services is inevitable, then the decline in the per capita real GDP growth is also inevitable.

However, does the shift in employment share toward services necessarily lower the per capita real GDP growth? For this issue, there are some theoretical contributions.

Pugno (2006) considers that the consumption of services augments human capital à la Lucas (1988). The consumption of health care and education services will lead to human capital accumulation. Accordingly, the consumption of services increases the productivity of workers, thereby resulting in an increase in the productivity of both manufacturing and services. This means that productivity growth is endogenized. He incorporates this human capital accumulation effect into Baumol's model, and shows that if this effect is relatively strong, the employment shift toward services increases, and not decreases, the per capita real GDP growth.

De Vincenti (2007) reaches a conclusion similar to Pugno (2006). He assumes that both the growth rate of productivity in manufacturing and that in services are increasing functions of the employment share of services, and then, incorporates these specifications into Baumol's model. He also shows that the employment shift toward services increases the per capita real GDP growth. The basic idea of De Vincenti (2007) is similar to that of Pugno (2006).[3]

These two theoretical studies pay attention to the external effects from the consumption and production of services and endogenize the productivity growth. If the productivity growth is exogenously given and the productivity growth in services is lower than that in manufacturing, then the employment shift toward services necessarily decreases the per capita real GDP growth. However, if the productivity growth is endogenously determined, then the employment shift toward services does not necessarily decrease the per capita real GDP growth.

Unlike in these researches, there exist theoretical studies wherein services are used as intermediate inputs for manufacturing. Oulton (2001) shows that if services are used as intermediate inputs for manufacturing, the employment shift toward services raises the per capita real GDP growth. In Oulton's model, services are only used as intermediate inputs, and hence, not used as final demand. In contrast, Sasaki (2007) shows that if services are used as

both intermediate inputs and final demand, the employment shift toward services decreases the per capita real GDP growth in the long run.[4] In these two studies, productivity growth is exogenously given as in Baumol (1967).

The above studies pay attention to whether the employment shift toward services increases or decreases the per capita real GDP growth. In contrast, unlike in these studies, some theoretical studies show that the per capita real GDP growth is constant even if the employment share shifts toward services. These studies attempt to make structural changes compatible with Kaldor's (1961) stylized facts. Kaldor asserts that in developed countries, per capita real GDP growth is almost constant in the long run and there is no downward tendency.

Kongsamut et al. (2001) build a three sector (agriculture, manufacturing, and services) neoclassical growth model, and show that along the generalized balanced growth path, the per capita real GDP growth is constant although the employment share of each sector continues to change.[5] When deriving the result, they use a non-homothetic preference, which yields an endogenous structural change. Iscan (2010) modifies Kongsamut et al.'s (2001) model and examines how the interaction between the productivity growth differential à la Baumol, and Engel's law explains the long-run tendency of the services employment share in the US. He concludes that two thirds of the movements of the services employment share in reality can be explained by the two effects. These models, in contrast to Baumol's model that considers only labor input, consider capital accumulation.[6]

As explained above, there are three types of views on the relationship between the employment shift toward services and the per capita real GDP growth.[7] A question then arises as to which view is consistent with reality.

Hartwig (2011) empirically treats this problem. He conducted an empirical analysis with regard to how the expenditure shift toward services such as health care and education affects the per capita real GDP growth rate. He analyzes 18 OECD countries during the period 1970–2005, and concludes that the expenditure shift lowers the per capita real GDP growth rate, which is broadly consistent

---

[3] However, under certain conditions, there occurs an inverted U-shaped relationship between the service employment share and the per capita real GDP growth. That is, initially, the per capita real GDP increases with the employment shift toward services, but at some point in time, it begins to decrease with the employment shift. This will be explained in detail in Section 4.

[4] If the elasticity of substitution between labor input and services input in manufacturing is sufficiently larger than unity, then it is possible that the per capita real GDP growth increases up until some point in time with the employment shift toward services. However, even in that case, the per capita real GDP growth decreases in the long run.

[5] For the result where the per capita GDP growth becomes constant in spite of the structural changes, see also Ngai and Pissarides (2007), Acemoglu and Guerrieri (2008), and Foellmi and Zweimüller (2008).

[6] Bonatti and Felice (2008) investigate a model in which capital is accumulated in both sectors, manufacturing productivity increases endogenously, and consumer preferences are non-homothetic.

[7] The above explanations are based on the models of closed economy. Spilimbergo (1998) builds an open economy model, and shows that in a transition from a closed to an open economy, owing to a comparative advantage effect, the speed of employment shift toward services is faster in an open economy than in a closed economy, and consequently, the per capita real GDP growth declines much further in an open economy. Matsuyama (2009) presents a three-sector model, and shows that in a closed economy, the productivity growth differential results in structural changes, and that this is not necessarily the case in an open economy.