«BAUMOL'S DISEASE», PRODUCTION EXTERNALITIES AND PRODUCTIVITY EFFECTS OF INTERSECTORAL TRANSFERS

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Abstract

This paper presents a model which introduces in an unbalanced growth framework *à la* Baumol the hypothesis of an endogenous productivity growth due to a positive externality of the service sector on manufacturing productivity and a learning-by-doing process inside both sectors. The model shows that a policy aimed at keeping the ratio between outputs in the two sectors constant in real terms, that is at supporting an increase in the service sector employment share, may improve the aggregate productivity performance of the economy, depending on the elasticity of substitution between services and goods and on the relevance of the externality and learning by doing effects. Then the model derives the dynamics of the intersectoral transfer which is necessary to keep the ratio between outputs constant, and verifies that the amount of the transfer turns out to be always lower than the output of the manufacturing sector, and only asymptotically approaches it. So, the paper adds a productivity-based argument in favour of such a policy and corroborates Baumol's idea that the productivity growth offers society the resources for the solution of the politico-budgetary problems that stem from the "cost disease".

JEL classification:

Keywords: cost disease, productivity growth, fiscal policy

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1. Introduction

For the first time, in his famous seminal essay, Baumol (1967) clarified the physiological tendency for unit costs to increase relative to costs of goods in the production of services. This tendency stems from a structurally lower rate of growth in labour productivity in the service sector than in other sectors of the economy. The fact is that productivity rises faster where labour is instrumental to the product and can be replaced by machinery as technology advances; it rises more slowly where labour is the product itself and accordingly cannot be replaced by machinery[1]. Given that wage trends for work of the same level of skill tend to be equal across sectors, those in which productivity rises more slowly will experience a rise in unit labour costs relative to those of fast-rising productivity, with a constantly widening gap[2].

Baumol called this the "cost disease" but highlighted its "beneficial" nature: "properly interpreted, the moral of the cost disease analysis is sanguiity embodied"[3], since "in an economy in which productivity is growing in almost every sector and declining in none, it is a tautology that consumers can have more of every good and service. […] To achieve such a goal — ever greater abundance of everything — society must change the proportions of its income that it devotes to the different products"[4].

The analysis of "cost disease" and its implications has been refined and developed by many theoretical and applied contributions. Several theoretical extensions of Baumol's model have been proposed, introducing the economies of scale (Schwarz, 1986), the international trade (Guccione and Gillen, 1990), the microfoundation of consumer demand in an imperfect competitive framework (Brunello and Scaramozzino 1992), the role of investment in determining the dynamic equilibrium path and the role of intersectoral transfers in improving the employment performances of the economy (De Vincenti, 2000), the relationship between employment and output shares on the one hand and price and income elasticities on the other (Appelbaum and Schettkat, 2001)[5]. A body of empirical

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[1] Baumol likes to clarify this case by examples that are referred to the performing arts sector: for instance, Baumol (1996) emphasizes that in the performance of Mozart quartets "the productivity of quartet players remains unchanged year after year" (p. 195). The performing arts are the sector to which his theory has been applied for the first time: see Baumol and Bowen (1966) and the monographic number devoted by the *Journal of Cultural Economics* to the 30th anniversary of this book (vol. 20, n. 3, 1996). See also Pennella and Trimarchi (1993).

[2] See also Baumol (1970).

[3] Baumol and Baumol (1985), p. 69.

[4] Baumol (1996), p. 202.

[5] Moreover, Notarangelo (1999) emphasises the role played by the effective demand, through an extension of Baumol's model based, *à la* Pasinetti (1993), on an exogenous time path of demand for goods and services.

research has been devoted to analyse productivity trends in services (Kendrick, 1985, Baumol, Blackman and Wolff, 1985 and 1991, Pellegrini, 1993, Boitani and Pellegrini, 1997, Mattey, 2001, Mohnen and ten Raa, 2001) and final product productivity (Russo and Schettkat, 2001); to measure price and income elasticities of demand for goods and services (Summers, 1985, Borooah, 1987, Siracusano, 1990, De Vincenti, Morelli and Pollastri, 1999, Moller, 2001); to the employment benefits of having the right proportion between services and industry (Appelbaum and Schettkat, 1994, Sestito, 1997, Simonazzi and Villa, 1999, Borzaga, Demozzi and Povinelli, 1999)[6].

In the theoretical literature referred to above, the growth rates of productivity in manufacturing and services are assumed to be exogenous. There is also a narrower, but very interesting literature, which tries to endogeneize productivity growth in the unbalanced growth framework. Baumol and Wolff (1995) analyse the feedback between R&D produced by the service sector and the growth rate of productivity in the manufacturing sector, obtaining a cyclical behaviour of the economy. Oulton (2001) assumes exogenous sectoral specific growth rates of productivity, but introduces the hypothesis that a portion of the service sector produces intermediate goods for the manufacturing sector; he obtains an increase in the growth rate of aggregate productivity when there is a shift of primary inputs from the manufacturing sector to that portion of the service sector. Cellini and Cuccia (2004) investigate the dynamics of an economic system in the presence of Baumol's disease and a growth rate of productivity in each sector which depends (*à la* Lucas 1988) on the accumulation of human capital inside the same sector, thanks to learning-by-doing phenomena; their model is aimed at obtaining the possibility of a balanced steady state growth path without the vanishing of the services.

The present paper couples itself to this narrower literature, and proposes a simple model based on two hypotheses: a) the service sector produces a positive externality on manufacturing productivity, an hypothesis which is in some measure analogous to that of Baumol and Wolff (1995)[7]; b) a learning-by-doing process, similar to that assumed by Cellini and Cuccia (2004), takes place inside both sectors. Under our hypotheses, the model shows that the spontaneous dynamics of the economy due to the "cost disease" implies a growth rate of aggregate productivity which declines over time when the share of the service sector employment reduces, that is, just in the situation which would imply an increasing growth rate of aggregate productivity in the model with exogenous technical progress. Then, under some

[6] For a comprehensive analysis of the long run trends in service and manufacturing output, see Baumol, Blackman and Wolff (1991), and the volumes edited by Inman (1985) and by ten Raa and Schettkat (2001a).

[7] In Baumol and Wolff (1995) services affect manufacturing productivity through R&D acquired as an input by manufacturing firms, while in our model the service sector produces final outputs.

assumptions on the relevance of externality and learning-by-doing effects, we will show that keeping the ratio between outputs in the two sectors constant, in real terms, can improve the aggregate productivity performance of the economy. The invariance of the ratio between outputs may require a government policy which is aimed at sterilising the effects of the cost disease on relative prices through intersectoral transfers, that is, levies on the manufacturing sector and subsidies to the service sector. Therefore, we will conclude the paper by deriving the dynamics of the intersectoral transfer which is necessary to keep the ratio between outputs constant, and we will verify that the amount of the transfer turns out to be always lower than the output of the manufacturing sector, and only asymptotically approaches it.

Our argument is not the only argument which may be advanced in favour of a services development policy. Services include activities which not only produce positive externality on manufacturing productivity but also more general externalities for citizens. Moreover, several services are highly meritorious in a social welfare perspective. Therefore, there are several good grounds for an intersectoral transfer policy aimed at keeping the ratio between outputs in the two sectors constant, in real terms. Of course, the need of such a policy differs from one type of service to another. Services – for instance communications, electricity and gas[8] - which exhibit productivity trends equal to, or even greater than, those of manufacturing industries do not need subsidies, whereas it seems difficult to maintain an adequate growth of health care, education, other personal services and performing arts without some kind of subsidy[9]. Moreover, the higher the income elasticity and the lower the price elasticity for services, the lower the amount of intersectoral transfers which is necessary to sterilise the effects of the cost disease. In any case, in the real world an intersectoral transfer policy has contributed to keeping the ratio between services output and aggregate output in real terms unchanged in the long run in the main industrialised countries.[10]

2. The model with exogenous productivity growth

Let us consider a closed economy consisting of two sectors, one producing services and the other producing goods. Labour is the only input used by both sectors. We assume that the growth rate of labour productivity is lower in the

[8] See, for instance, Wolff (2005).

[9] See Baumol (2001).

[10] On the approximately invariance of the services share of GDP in real terms, see Summers (1985), Baumol, Blackman and Wolff (1991, Chapter 6), Ramaswamy and Rowthorn (1997), Baumol (2001), ten Raa and Schettkat (2001b).

services than in manufacturing; that is, designating the two rates as p_s and p_m, we have $p_s < p_m$.

In this section we will assume that p_s and p_m are exogenous and constant over time. Setting the productivity at time 0 equal to 1 in both sectors, the output of services and goods at time *t* is:

[1] $$Y_{st} = N_{st}e^{p_s t} \qquad \text{and} \qquad Y_{mt} = N_{mt}e^{p_m t}$$

where Y_{st} and N_{st} denote output and employment in the service sector at time *t* and Y_{mt} and N_{mt} those in manufacturing. Let us assume for simplicity a constant aggregate labour-force *N* which is fully utilised, so that:

[2] $$N_{st} + N_{mt} = N$$

Adopting Baumol's hypothesis (1967) that unit wages are the same in the two sectors and rise over time at a rate equal to that of labour productivity in manufacturing, we get:

[3] $$W_t = We^{p_m t}$$

where W is the starting level of wages. Prices in the two sectors are formed by price-makers firms on the basis of unit labour costs plus a mark-up, m, which for simplicity is assumed given and equal in both sectors[11], so that $P_{jt} = (1+m)\dfrac{W_t}{Y_{jt}/N_{jt}}$. Let us normalise prices at time 0 to 1, setting $W = (1+m)^{-1}$, so that we have at time t:

[4] $$P_{st} = e^{(p_m - p_s)t} \qquad P_{mt} = 1$$

Therefore, from now on manufactured goods are the *numeraire* of the model.

Assuming a utility function with constant elasticity of substitution between services and goods *à la* Dixit-Stiglitz (1977), households' optimisation problem is:

$$\text{Max} \quad U_t = \left(Y_{st}^{\frac{q-1}{q}} + Y_{mt}^{\frac{q-1}{q}} \right)^{\frac{q}{q-1}}$$

$$\text{s.t.} \quad P_{st}Y_{st} + P_{mt}Y_{mt} = W_t(1+m)N$$

where it is assumed that households receive all the income produced (i.e., that profits are entirely distributed), and $q > 0$ denotes the substitution elasticity between services and goods. Solving this optimisation problem taking prices given by [4] into account, we obtain:

[11] For a discussion of the effects of changes in agents' market power in the presence of "Baumol's disease", see Brunello and Scaramozzino (1992).

[5] $$Y_{st} = \frac{e^{[p_m - q(p_m - p_s)]t}}{1 + e^{(1-q)(p_m - p_s)t}} N \qquad Y_{mt} = \frac{e^{p_m t}}{1 + e^{(1-q)(p_m - p_s)t}} N$$

Therefore, the ratio y_t between outputs in the two sectors at time t is:

[6] $$y_t = \frac{Y_{st}}{Y_{mt}} = e^{-q(p_m - p_s)t}$$

For $q > 0$ this ratio declines gradually over time, asymptotically tending to zero. The decrease of y_t is faster, the higher the value of q. This result reiterates Baumol's Proposition 2,[12] with the only difference being that the ratio between the outputs of the two sectors declines even for very low values of the elasticity of substitution between services and goods, because in our model the income elasticity of demand is 1, as a consequence of the Dixit-Stiglitz shape assumed for the utility function.

From the first of equations [5], taking the first of equations [1] into account, we immediately obtain the share of the employment in the service sector at time *t*:

[7] $$n_t = \frac{N_{st}}{N} = \frac{e^{(1-q)(p_m - p_s)t}}{1 + e^{(1-q)(p_m - p_s)t}}$$

whose trend depends on the sign of $(1-q)$: for $q > 1$ the share of employment in the service sector declines over time, asymptotically tending to zero, while for $q < 1$ it increases and asymptotically tends to 1.

Of course, the growth rate of aggregate productivity p_t is a weighted mean of the growth rates in the two sectors, where the weights are the employment shares at time *t*, that is:

[8] $$p_t = p_m(1 - n_t) + p_s n_t = p_m - (p_m - p_s) n_t$$

For $q > 1$ the growth rate of aggregate productivity increases over time along the reduction in the employment share n_t, and it asymptotically tends to p_m. For $q < 1$ it declines over time along the increase in the employment share, and it asymptotically tends to p_s.

Proposition 1*: In the model with exogenous productivity, the growth rate of aggregate productivity increases over time, asymptotically approaching the growth rate of manufacturing productivity, when the elasticity of substitution between services and goods is sufficiently high; vice versa, for low values of the substitution elasticity, the growth rate of aggregate productivity decreases over time and asymptotically approaches the growth rate of service sector productivity.*

[12] Baumol (1967), p. 418 and (1970), pp. 429-30.

3. Endogeneizing productivity growth

Let us introduce the hypothesis that the service sector produces a positive externality on labour productivity in manufacturing, *via* innovations which are borne by R&D activities, and *via* the general improvement in human capital available to the economy[13]: for instance, improvements in the quality of labour force produced by a more effective school system (several authors have recently claimed the beneficial effects of education services for economic growth; for a theoretical contribution, see Kaganovich and Zilcha 1999, and for empirical analyses, see Benhabib and Spiegel 1994 and Temple 1999)[14]; or increases in labour time and in its efficiency due to improvements in the population's health (for a theoretical model, see Grossman 2000, and for the empirical evidence, see Hamoudi and Sachs 1999 and Bloom, Canning and Sevilla 2004). At the same time, we will assume that a learning-by-doing process takes place inside both sectors, so that an increase in sector specific employment increases the growth rate of productivity in the same sector.

We can simplify the analysis assuming the two growth rates of productivity at time *t* are a function of the employment share in the service sector: p_{mt}, the growth rate of productivity in the manufacturing sector will depend positively on n_t, but with diminishing returns, because of the reduction in the learning-by-doing effect due to the reduction in the manufacturing employment share $(1-n_t)$; p_{st}, the growth rate of productivity in the service sector will be a constant return increasing function of n_t. That is:

$$\begin{array}{llll} & p_{mt} = p_m(n_t) & p'_m(\cdot) > 0 \quad p''_m(\cdot) < 0 & \\ [9] & & p_m(0) = 0 \quad \lim_{n_t \to 0} p'_m(n_t) = \infty & p_m(1) = \bar{p}_m \\ & p_{st} = a n_t & a > 0 \qquad p_s(1) = \bar{p}_s = a & \end{array}$$

where, in order to maintain the cost disease hypothesis, we will assume $p_{st} < p_{mt} \quad \forall n_t > 0$.

Equations for outputs, wages and prices now become:

[10] $$Y_{st} = N_{st} e^{\int_0^t p_s(n_t)dt} \qquad \text{and} \qquad Y_{mt} = N_{mt} e^{\int_0^t p_m(n_t)dt}$$

[11] $$W_t = W e^{\int_0^t p_m(n_t)dt}$$

[13] For a survey of the literature on the relationship between welfare policies and economic growth, see Grazzini and Petretto (2005).

[14] Checchi (1999) presents a comprehensive analysis of the controversial results of the empirical literature on this topic.

[12] $$P_{st} = e^{\int_0^t [p_m(n_t) - p_s(n_t)]dt} \qquad P_{mt} = 1$$

and solutions of households' optimisation problem are:

[13] $$Y_{st} = \frac{e^{\int_0^t \{p_m(n_t) - q[p_m(n_t) - p_s(n_t)]\}dt}}{1 + e^{(1-q)\int_0^t [p_m(n_t) - p_s(n_t)]dt}} N$$

$$Y_{mt} = \frac{e^{\int_0^t p_m(n_t)dt}}{1 + e^{(1-q)\int_0^t [p_m(n_t) - p_s(n_t)]dt}} N$$

The ratio y_t between outputs in the two sectors at time t is now:

[14] $$y_t = \frac{Y_{st}}{Y_{mt}} = e^{-q\int_0^t [p_m(n_t) - p_s(n_t)]dt}$$

so that it monotonically declines over time, tending asymptotically to zero[15].

From the first of equations [13], taking the first of equations [10] into account, we immediately obtain the share of employment in the service sector at time t:

[15] $$n_t = \frac{N_{st}}{N} = \frac{e^{(1-q)\int_0^t [p_m(n_t) - p_s(n_t)]dt}}{1 + e^{(1-q)\int_0^t [p_m(n_t) - p_s(n_t)]dt}}$$

whose trend depends on the sign of $(1-q)$, as in the case of exogenous productivity growth.

As a consequence, the growth rate of aggregate productivity p_t is:

[16] $$p_t = p_m(n_t) - [p_m(n_t) - p_s(n_t)]n_t$$

Its derivative with respect to time is:

[17] $$\frac{dp_t}{dt} = \{[p'_m(n_t) \cdot (1 - n_t) - p_m(n_t)] + 2an_t\}\frac{dn_t}{dt}$$

For $q > 1$ the share of service sector employment declines over time, so that, as n_t declines, sooner or later the derivative [17] must become negative because, for hypotheses [9], the term in curly brackets becomes positive. Therefore, for $q > 1$ the growth rate of aggregate productivity must decline over time and it asymptotically approaches zero. For $q < 1$ the share n_t increases over time: starting from a level of the share which implies the term in square brackets is positive, the derivative is

[15] This result confirms Baumol's one, to the contrary of the result obtained by Cellini and Cuccia (2004) in their model which does not present an externality effect of the service sector on the manufacturing one.

certainly positive; as long as n_t increases, the derivative always remains positive if $p'_m(n_t)\cdot(1-n_t) > p_m(n_t) - 2an_t$ for all values of the employment share, that is, if the marginal externality p'_m of the service sector on manufacturing productivity and the marginal effect a of the learning-by-doing process which takes place inside the service sector are sufficiently high (note also that, for $n_t = 1$, the above condition implies $2a = 2\overline{p}_s > \overline{p}_m$); otherwise, sooner or later the derivative becomes negative; in any case, for $q < 1$ the growth rate of aggregate productivity asymptotically tends to $\overline{p}_s$.

Proposition 2: *In the model with endogenous productivity, the growth rate of aggregate productivity sooner or later begins to decline when the elasticity of substitution between services and goods is sufficiently high to cause a reduction in the service sector employment share, that is, just in the case which would imply an increasing growth rate of aggregate productivity in the model with exogenous technical progress. Vice versa, for low values of substitution elasticity which imply an increasing services employment share, the growth rate of aggregate productivity may increase over time, and it actually always increases when the externality effect of the service sector on manufacturing productivity and the learning-by-doing effect inside the service sector are sufficiently high; in any case, for low values of the substitution elasticity, the growth rate of aggregate productivity asymptotically approaches the maximum value of the growth rate of service sector productivity.*

4. Dynamic equilibrium with intersectoral transfers

The outcomes of the model with endogenous productivity, as summarised in Proposition 2, lead us to wonder whether the productive performance of the economy could be improved by means of a government policy aimed at keeping the ratio between outputs in the two sectors constant in real terms. As Baumol makes clear on several occasions[16], modifying the spontaneous dynamics in the proportion between services and goods may require a transfer of resources which sterilises the effects of relative costs dynamics on prices. So, in order to keep the ratio between outputs constant over time, some government budgetary transfer payments may be necessary - taxes on manufacturing sector and subsidies to the service one – which are able to keep the relative price of services unchanged[17].

[16] For instance, Baumol (1967) and (1996).

[17] Often, the desired level of service output has been fulfilled through the direct production of services by the public sector, with budget deficits covered out of taxation. This is not the only possible way. Indeed, at least for many kinds of service, it can be replaced by methods of building their markets that realize the transfer of resources in the presence of private sector supply and demand through an

Firstly, let us obtain the dynamics of the growth rate of aggregate productivity when the ratio y_t between outputs in the two sectors is kept constant at its starting level $y_0 = 1$ (equation [14]). From equations [10], the dynamics of the service sector employment share consistent with $y_t = y_o = 1$ is:

[18] $$n_t = \frac{e^{\int_0^t p_m(n_t)dt}}{e^{\int_0^t p_m(n_t)dt} + e^{\int_0^t p_s(n_t)dt}}$$

which increases over time and asymptotically approaches 1. Therefore, in equation [17] dn_t/dt is certainly positive, so that, starting from a level of the employment share which implies the term in square brackets is positive, the derivative is certainly positive. As long as n_t increases, the growth rate of aggregate productivity always increases when the condition $p'_m(n_t)\cdot(1-n_t) > p_m(n_t) - 2an_t$ is satisfied. In this case, keeping $y_t = y_o = 1$ certainly improves the productivity performance of the economy: even for $q < 1$ and a spontaneous increasing trend of the employment share, equation [15] implies a slower increase of n_t than the increase implied by equation [18], so that the growth rate of aggregate productivity at any instant of time is higher when the ratio between outputs is kept constant. When the above condition is not met, sooner or later the growth rate of aggregate productivity begins to decrease for $y_t = y_o = 1$. In this case, keeping the ratio between outputs constant certainly improves the productivity performance of the economy, if $q > 1$, but this is not necessarily the case if $q < 1$. In any case the growth rate of aggregate productivity asymptotically tends to $\overline{p}_s$.

Proposition 3*: In the model with endogenous productivity, keeping the ratio between outputs in the two sectors constant over time may increase the growth rate of aggregate productivity. This is certainly the case when: a) the elasticity of substitution between services and goods is high, so that it would spontaneously cause a decline in the service sector employment; or b) when the externality effect of the service sector on manufacturing productivity and the learning-by-doing effect inside the service sector are sufficiently strong. In both cases, keeping the ratio between outputs constant improves the productivity performance of the economy.*

Now, we can derive the tax on the manufacturing sector and the subsidy to the service sector which ensure a constant ratio in real terms between outputs in the two sectors.

appropriate system of taxes and subsidies. See the discussion within the European Community as it emerges from Commissione Europea (1995) and the survey in Aronica and Montebugnoli (1997); for a theoretical model of regulation of social markets, see De Vincenti (2004).

Let us begin by observing that the intersectoral transfer has to meet the following balance condition:

$$P_{mt}Y_{mt} - (1+m)W_t N_{mt} = (1+m)W_t N_{st} - P_{st}Y_{st}$$

which, if we impose the invariance over time of prices at $P_{st} = P_{mt} = 1$, becomes:

[19] $$Y_{mt} - (1+m)W_t N_{mt} = (1+m)W_t N_{st} - Y_{st}$$

The wage trend which has been assumed earlier with equation [11] cannot, given the assumptions [10], meet condition [19]. Now, the wage which satisfies condition [19] is the one which, given the mark-up percentage m, creates a surplus in the manufacturing sector which can be levied for financing the equivalent excess of costs on revenues in the service sector. Solving equation [19] for $(1+m)W_t$ and taking assumptions [10] into account, we get:

[20] $$(1+m)W_t = (1-n_t)e^{\int_0^t p_m(n_t)dt} + n_t e^{\int_0^t p_s(n_t)dt}$$

Let us now derive the amount of the intersectoral transfer at time *t*. Denoting with T_t the size of the transfer at time *t* (the levy on the manufacturing sector equal to the subsidy to the service sector), we have:

[21] $$T_t = Y_{mt} - (1+m)W_t N_{mt} = N_{mt}\left[n_t\left(e^{\int_0^t p_m(n_t)dt} - e^{\int_0^t p_s(n_t)dt}\right)\right]$$

Dividing by the national income at constant prices $Y_{st} + Y_{mt}$ and taking the second of equations [10] into account, we obtain the transfer per unit of national income:

[22] $$\frac{T_t}{Y_{st}+Y_{mt}} = \frac{T_t}{2Y_{mt}} = \frac{1}{2}n_t\left[1 - \frac{e^{\int_0^t p_s(n_t)dt}}{e^{\int_0^t p_m(n_t)dt}}\right]$$

Therefore, the transfer per unit of national income is an increasing function of time which asymptotically tends to $\frac{1}{2}n_t = \frac{1}{2}$: the size of the transfer is always lower than the output of the manufacturing sector, and only asymptotically approaches it (i.e. when the employment in the services sector as a ratio to total employment will be equal to 1).

Proposition 4: *The amount of intersectoral transfers, which are necessary to keep the ratio between services and goods constant, increases over time as a proportion of national income and asymptotically approaches a finite upper limit; in any case, it turns out to be always lower than the output of the manufacturing sector, and only asymptotically approaches it*.

5. Concluding remarks

The model which has been presented in this paper emphasises the role of services in improving the productivity performance of the economy: a) thanks to the positive externality that the service sector produces on manufacturing, *via* innovations which are borne by R&D activities, and *via* the general improvement in human capital available to the economy; b) thanks to the learning-by-doing process which takes place inside the service sector. Endogeneizing productivity growth, the model shows that the spontaneous dynamics of the economy due to the "cost disease" implies a growth rate of aggregate productivity which declines over time in the case the share of the service sector employment reduces, that is, just in the situation which would imply an increasing growth rate of aggregate productivity in the model with exogenous technical progress.

Then, we verified that keeping the ratio between outputs in the two sectors constant, in real terms, may increase the growth rate of aggregate productivity. This is certainly the case when: a) the elasticity of substitution between services and goods is high, so that it would spontaneously cause a decline in the service sector employment; or b) when the externality effect of the service sector on manufacturing productivity and the learning-by-doing effect inside the service sector are sufficiently strong. In both cases, keeping the ratio between outputs constant improves the productivity performance of the economy.

The invariance of the ratio between outputs may require a government policy aimed at sterilising the effects of the cost disease on relative prices through intersectoral transfers, that is a levy on the manufacturing sector and a subsidy to the service sector. Therefore, we derived the amount and the dynamics of intersectoral transfers which is necessary to keep the ratio between outputs constant: the transfer increases over time as a proportion of national income and asymptotically approaches a finite upper limit; in any case, its size turns out to be always lower than the output of the manufacturing sector, and only asymptotically approaches it.

So, the model advances a productivity-based argument in favour of keeping the ratio between services and goods constant, in real terms, and in favour of increasing the service sector employment share[18]. Of course, our argument is not the only argument which may be advanced in favour of a services development policy.

[18] The argument could be reinforced by considering the likely underestimate of service sector productivity due to the difficulties in measuring output (Ramaswamy and Rowthorn, 1997) and to the nature of "intangible goods" which characterises the outcome of several actitivites included in the service sector (Parrinello, 2004).

Services include activities which not only produce positive externality on manufacturing productivity but also more general externalities for citizens. Moreover, several services are highly meritorious in a social welfare perspective. There is vast literature both on significant losses in social welfare which would derive from a reduction of the services share of aggregate output in real terms and on market failures which may result in underproduction of services[19]. Therefore, there are several good grounds for an intersectoral transfer policy aimed at keeping the ratio between outputs in the two sectors constant in real terms, that is, at supporting an increase in the service sector employment share.

Finally, our analysis of the intersectoral transfer dynamics tells in favour of Baumol's conclusion that "contrary to appearances, we can afford ever more ample medical care, ever more abundant education, ever more adequate support for the indigent, and all this along with a growing abundance of private comforts and luxuries. It is an *illusion* that we cannot do so". "In an economy in which productivity is growing in almost every sector and declining in none", the productivity growth offers society the resources for "the solution of the politico-budgetary problems that stem from the cost disease"[20]. The intersectoral transfer policy supports the change in the proportions of inputs that society devotes to goods and services, and allows a balanced growth of the two sectors. Of course, this does not eliminate the problem of which are the best forms for implementing such a policy. If intermediation via the government budget appears largely inevitable, activating by it market-compatible mechanisms of redistribution is decisive for sustained high growth in the output of both services and goods[21].

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[19] See, for instance, Baumol (1970) and (1996), Holmstrom (1985), Gramlich (1985), Satterthwaite (1985), Fiorentini (1996), De Vincenti (1997), and Boitani and Pellegrini (1997).

[20] Baumol (2001), pp. 23-25.

[21] See, for instance, the literature referred to in footnote 17.

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