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"BAUMOL'S COST DISEASE, GOVERNMENT EXPENDITURE AND EDUCATION"

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Abstract

A partire dalla fine del XIX secolo, la spesa pubblica ha registrato una crescita sostenuta in tutte le economie attualmente più avanzate. Vari fattori, economici, politici e sociali hanno contribuito all'aumento della spesa e varie teorie sono state infatti formulate per spiegare tale fenomeno.
Tra queste possiamo includere la teoria della "crescita sbilanciata" formulata da William Baumol che, pur non essendo rivolta direttamente ed esclusivamente alla spiegazione dell'andamento della spesa pubblica, offre certamente utili elementi interpretativi.

Come è noto, infatti, secondo Baumol, l'aumento dei costi di produzione e, quindi, dei prezzi relativi in alcuni settori (cd. "stagnanti") sarebbe imputabile al divario di produttività rispetto ai cosiddetti settori "progressivi". Poiché molti settori nei quali è tipicamente coinvolto il settore pubblico, quali ad esempio sanità e formazione, esibiscono le caratteristiche individuate da Baumol per qualificare un settore stagnante, la "malattia dei costi" potrebbe, almeno in parte, spiegare l'aumento della quota del PIL destinata alla spesa pubblica per beni e servizi.

Con il presente lavoro ci proponiamo di analizzare la teoria di Baumol e il suo contributo alla spiegazione della crescita della spesa pubblica.
L'elaborato è organizzato in tre capitoli. Il primo capitolo è dedicato all'esposizione del modello formulato da Baumol, sia nella sua versione originale (1967) che in quella rivisitata (1985), analizzando il pensiero dell'autore, le implicazioni che ne derivano e le relative conseguenze in ambito economico, politico e sociale. Il capitolo si dipana poi, con una considerazione riguardo il ruolo di tale teoria nella spesa pubblica, dando voce anche ad altri autori che hanno formulato opinioni riguardo al drastico aumento che ha visto come protagonista il bilancio statale.
Il secondo capitolo seleziona alcuni tra i più accreditati lavori incentrati nella verifica empirica del modello per appurare se tale teoria trova riscontro nella realtà, successivamente si andrà alla rassegna di alcune critiche che vari autori hanno rivolto a Baumol facendo trapelare alcune debolezze del modello; per concludere poi con una breve analisi intersettoriale discutendo delle propaggini del modello nei campi della sanità, delle arti performative e dell'istruzione.

Nel terzo capitolo, infine, si esaminerà specificatamente il caso dell'istruzione, poiché essa possiede caratteristiche peculiari che la rendono, ad oggi, uno dei maggiori esempi di attività in cui il "morbo" di Baumol è presente. Esponendo, a seguito, lavori empirici a sostegno della tesi secondo la quale, il modello sopracitato è utile a spiegare l'incremento dei costi che ha visto il settore dell'istruzione come protagonista. Concludendo, infine, con una riflessione su cosa s'intende per *outcome* nel caso dell'istruzione e se tale settore, nel ventunesimo secolo, è passibile o meno di miglioramenti produttivi o se, viceversa, è destinato a subire inerte la sua condizione di inoperosità.

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Introduction

The aim of this paper is to investigate the role played by Baumol's cost disease theory in the growth of public expenditure and in particular its role in the education sector. William J. Baumol, in 1967, tries to give an explanation to why the cost of some services grows faster than the general average of the economy.

According to him, sectors that suffer from cost disease are characterised by slow productivity growth due to a high labour coefficient. As a result, unit costs of these sectors rise inexorably if the respective wages increase with productivity growth of the progressive industries such as manufacturing.

This work is organised as follows. The first chapter will deal in detail with Baumol's cost disease theory, both in its original and revived versions, and analysing the role of this theory in interpreting the increase in public spending.

In the second chapter I will review some works which have empirically tested the Baumol's theory and some of the criticisms that various authors have addressed to Baumol. Then, I will expose the role of this model in a cross-sectoral analysis combining the healthcare, performing arts and education sectors.

Finally, in the third chapter, I will focus on the role of this model in explaining the inexorable increase that involves the costs of the education sector, as well as reflecting on what is meant by outcomes in the case of education and whether in this sector, in the twenty-first century, productive improvements are possible or whether it is destined to suffer inert its condition.

Chapter 1

Cost disease and government expenditure

In this chapter, I will first analyse Baumol's theory of unbalanced growth, both in its original (1967) and revised (1985) versions. Baumol's model is often labelled as "Baumol cost disease", precisely because it analytically describes the vicious circle that leads to an increase in the costs (and consequently in the relative prices) of goods and services of certain industries, due to low productivity growth, at a faster rate than the overall inflation rate.

In the following I will carry out a brief analysis of the implications of Baumol's model for the interpretation of the increase in public spending also proposing a short review of the main contributions of some economists, aimed at interpreting and giving a qualitative-quantitative explanation to evolution of public spending starting from the second half of the nineteenth century.

1.1. The model

The central topic of this chapter will be William Baumol's theory of cost disease, both in its original and revised version.

In an article published in 1965, "Performing Arts, the Economic Dilemma: A Study of Problems Common to Theater, Opera, Music and Dance", Baumol and Bowen argued that there are two types of sectors: "*let us think of an economy divided into two sectors: one in which productivity is rising and another where productivity is stable" (*Baumol and Bowen, 1965: 499).

The sector with stable productivity includes all the activities in which there is little or no chance of increases in labour productivity because they base their activity on the human element, hence it will be impossible a change in their technology without distorting the product.

In a subsequent article "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis" (1967), Baumol move on to describing the model in a more in-depth and analytical way, by spelling out the main assumptions:

1. Economic activities can be grouped into two categories: *technologically progressive activities*, characterized by a cumulative increase in output per man-hour because of innovation, capital accumulation and economies of scale; and *non-progressive activities*, which group together all those activities which by their nature allow only low or no increases in productivity.

   The classification of an activity in one sector rather than another essentially depends on the technological structure of the activity considered, because it is the latter that determines whether the labour productivity grows rapidly or slowly.

   Another factor to consider when it comes to differentiate the two types of activity depends on the role played by the "human labour" input in production: if it represents an intermediate tool used to obtain the finished product, the activity falls within the progressive sector (e.g. manufacturing activity); if, on the other hand, it constitutes the finished product as such, the activity falls within the non-progressive sector: "*The singer singing, the dancer dancing, the pianist playing".(* Heilbrun J., 2003: 91)

   While in the first case the consumer is not aware, and perhaps even indifferent, about the quantity of human labour entered into the product, in the second case "*the quality of the end product depends primarly on the amount of human effort devoted to it*" (Baumol and Blackman 1983: 182), it means that if the labour factor increases, it also increases the quality of the finished work.

   Baumol finally goes on to specify that this distinction is purely theoretical, and that *"[...] there are, as the reader will recognize, all sorts of intermediate activities which fall between the two more extreme varieties."* (Baumol, 1967: 417).

2. All costs other than labour costs can be ignored. This assumption is unrealistic but helps to greatly simplify the mathematical model.

3. The wages of workers in the two sectors are moving in the same direction and the reason of that is the perfect long-term mobility of labour. It is therefore assumed, for simplicity of presentation and calculation, that hourly wages tend to align in both sectors. A wage inequality is possible, but it will only be a temporary and deadlock situation, which will be resolved and realigned in the long run.

4. Wages increase in line with the change in productivity in the sector with increasing productivity.

Denoting the non-progressive sector as "sector 1" and the progressive sector as "sector 2" (in which productivity, indicated as output per man-hour, grows at a rate *r*) and indicating with Y_{1t} and Y_{2t} the output of the two sectors at time *t*, we obtain:

$$Y_{1t} = a\ L_{1t} e^{st} \qquad \text{with } s>0 \text{ and } s<r \tag{1.1}$$

$$Y_{2t} = b\ L_{2t}\ e^{rt} \qquad \text{with } r>0 \tag{1.2}$$

where L_{1t} and L_{2t} represent the amount of labour employed in each sector, *r* and *s* represent long run productivity growth of the progressive sector and the stagnant sector, respectively, and *a* and *b* are two constants that represent long run technology in each sector

Now suppose that wages are the same in the two sectors and that they are set at a W_t level. W_t is the equal wage for both sectors (assumption 3), which grows in parallel with the productivity of sector 2, and therefore at a rate *r* (assumption 4).

$$W_t = W\ e^{rt} \tag{1.3}$$

Given these assumptions, Baumol goes on to enunciate the four propositions of this system, which together constitute the so-called "theory of unbalanced growth".

- Proposition 1: costs per unit of output in sector 1 (C_1) will grow without limits as labour productivity is constant; the costs per unit of output of sector 2 (C_2), on the other hand, remain constant due to the weight of the labour factor on the total of inputs decreasing continuously.

$$C_1 = \frac{W_t L_{1t}}{Y_{1t}} = \frac{W e^{rt} L_{1t}}{a L_{1t}} = \frac{W e^{(r-s)t}}{a} \tag{1.4}$$

$$C_2 = \frac{W_t L_{2t}}{Y_{2t}} = \frac{W e^{rt} L_{2t}}{b L_{2t} e^{rt}} = \frac{W}{b} \tag{1.5}$$

Hence the relative cost, which will depend on the wage increase not compensated by an increase in productivity and therefore by the growth differential.

Equations (1.4) and (1.5) show that while the unit costs in the sector 2 (progressive) will remain constant over time, the unit costs of sector 1 (stagnant) will growth at a rate $e^{(r-s)t}$, which is characterized by the productivity differential between industries.
The greater the differential in the productivity growth rate, the higher the effect of Baumol's cost disease on the unit costs of the stagnant industry
If *r* equals *s*, then Baumol's disease would be cured that is, there would be no productivity growth differential.

- Proposition 2: the sector's outputs can vary their destiny according to their price elasticity, that is, the extent to which their demand from consumers varies as their price changes. The demand for the output of the stagnant sector whose demand is price elastic (as the price increases, the quantity demanded of these goods decreases considerably because consumers are very sensitive to price changes) will either disappear or rely on subsidies or focus on a restricted market niche (e.g. luxury niche attentive to the human element).

  If these goods are instead characterized by a low demand elasticity with respect to the price, they will be able to survive in the market as they will be required by citizens. despite rising prices (e.g., education, health care, etc.).

- Proposition 3: In the unbalanced growth model, if the ratio between outputs is kept constant, more and more workforce will be "swallowed up" by the stagnant sector while the amount of the employees in the progressive sector will tend to zero over time. This is due to the fact that significant technological improvements, which can reduce the number of workers needed to perform a certain task, can only occur in the progressive sector.

  Baumol illustrates this result mathematically:

$$\left(\frac{b}{a}\right)\frac{Y_1}{Y_2} = \frac{L_1}{L_2\, e^{rt}} = K \qquad (1.6)$$

Since $L = L_1 + L_2$ it follows that:

$$L_1 = (L - L_1)\, K\, e^{rt} = \frac{LK\, e^{rt}}{(1 + K\, e^{rt})} \tag{1.7}$$

$$L_2 = L - L_1 = \frac{L}{(1 + K\, e^{rt})} \tag{1.8}$$

From the definition of L_1 and L_2, it follows that, for *t* tending to infinity, L_1 will tend to L (all the workforce will be poured into sector 1) and L_2 will tend to 0 (the workforce will be zero in sector 2).

- Proposition 4: any attempt to achieve balanced growth in a world characterized by different degrees of productivity leads inexorably to a reduction in the growth rate of the economy, tending asymptotically towards zero.

To describe what happens to the overall growth rate of the economy, we proceed as follows (always bearing in mind the conditions for which the ratio between the outputs of the two sectors is kept constant):

First of all, let's consider the output index (I) as a weighted average of the outputs of the two sectors:

$$I = B_1 Y_1 + B_2 Y_2 = B_1\, a\, L_1 + B_2\, b\, L_2\, e^{rt} \tag{1.9}$$

where B_1 and B_2 represent the weights associated with the two sectors.

Referring to the equations (1.7) and (1.8) we obtain:

$$I = \frac{L\,(KB_1 a + B_2 b)e^{rt}}{1 + K\, e^{rt}} = \frac{R\, e^{rt}}{1 + K\, e^{rt}} \tag{1.10}$$

where $R = L\,(B_1 aK + B_2 b)$

Deriving this index of the outputs with respect to *t* we obtain:

$$\frac{d\, I}{d\, t} = \frac{R\, r\, e^{rt}\,(1 + K\, e^{rt}) - R\, e^{rt}\, K\, r\, e^{rt}}{(1 + K\, e^{rt})^2} = \frac{R\, r\, e^{rt}}{(1 + K\, e^{rt})^2} \tag{1.11}$$

Consequently, the percentage rate of growth of the outputs will be:

$$\frac{\frac{d\,I}{d\,t}}{I} = \frac{R\,r\,e^{rt}}{(1+K\,e^{rt})^2}\,\frac{1+K\,e^{rt}}{R\,e^{rt}} = \frac{r}{(1+K\,e^{rt})} \qquad (1.12)$$

which, as *t* increases, tends asymptotically to 0.

After setting out the model analytically, Baumol summarizes the analysis in intuitive-descriptive terms, stating that if productivity increases to a greater extent in one sector than in the rest of the economy, while wages rise equally in all areas, then the relative costs of the stagnant sector will inevitably soar upwards and grow inexorably and without limits.
This happens because, while the increase in relative costs does not occur in the progressive sector because the increase in wages is offset by the increase in the productivity of that input, in the stagnant sector any increase in wages, since it is not accompanied by increases in productivity, will be followed by a proportional increase in costs, which in turn will cause a parallel increase in prices. Stated differently, the rising costs on the stagnant sector are simply a reflection of increased productivity in the progressive sector.

Therefore, unless labour mobility between sectors is limited or wages are kept absolutely constant, "*a most unlikely possibility*" (Baumol, 1967: 420), any technological advance adds costs to the stagnant sector.

If, as already stated before, the differentiation between the two types of activities takes place mainly on the basis of the technological structure linked to the input process, this means that the increase in costs occurs for reasons beyond the control of the people involved, but it is a characteristic of the activity itself: "*this is a trend for which no man and no group should be blamed, for there is nothing that can be done to stop it*". (ibid. p. 423)

Finally, Baumol reviews some practical examples, first mentioning higher education, an activity whose demand is income-elastic (demand increases as income increases) and price-rigid (as price increases demand decreases to a lesser extent) and whose productivity is substantially constant.

The costs of the education sector will therefore be destined to increase without respite and this is not a temporary phenomenon, but a mechanism destined to persist and to feed itself over time.

Rising costs undoubtedly impose serious hardships to low-income students, but this is accompanied by the spread of awareness that a high level of education is essential to be able to access to many prestigious jobs. For this reason, most families are willing to bear these expenses, perhaps even giving up other goods and services in order to invest in the future of their children.
This spiralling increase in costs is not a temporary phenomenon, but an intrinsic condition, so that whatever the amount of funds needed today "*we can be reasonably certain that they will require more tomorrow, and even more on the day after that* " (ibid. p. 421).

In 1985, almost twenty years after the publication of his first article on the theory of unbalanced growth, Baumol realized that the model he outlined required some modifications.

The main novelty of the "revised unbalanced growth model" consists in the introduction of a third sector, called "asymptotically stagnant". It is located as an intermediate level between the progressive sector and the non-progressive sector and uses inputs (in fairly fixed proportions) from both categories.
Normally, activities in this sector have a two-stage life cycle: initially there is a phase of rapid growth due to the increase in productivity and declining costs; subsequently, the behaviour of costs tends to be similar to that of stagnant sectors, with a consequent increase in prices and a lowering of the rate of labour productivity (diseconomies of scale).

The main reasons why this model was introduced are essentially two:

1. The model is a structured and simplified representation of reality. This means that outputs, companies and industries do not differ exactly in the two categories in a dichotomous way, each of them in reality is in an interlude between the two. Even the most stagnant sector of the economy undergoes some technological change over time.
2. An activity that can be defined as stagnant will not necessarily remain so forever: it may be replaced by a product belonging to the progressive category or undergo an explosion of innovation, thanks to research, which would not have been possible in the past.

The two examples of asymptotically stagnant activities cited by the author are TV broadcasting and data processing.

In the first sector, "*one hour of its progressive component (electronic transmission) required for one hour of its stagnant input (performance or program production)*" (Baumol, 1985: 807).

The transmission of a television program, in fact, involves both the costs of the transmission from a technical point of view (circuits, cables, connections, energy, etc.), and the programming costs as such (in which the main component is the human factor).

The empirical evidence, as exemplified by Figures 1.1 and 1.2 (source: Baumol, 1985), confirms what the model predicts:

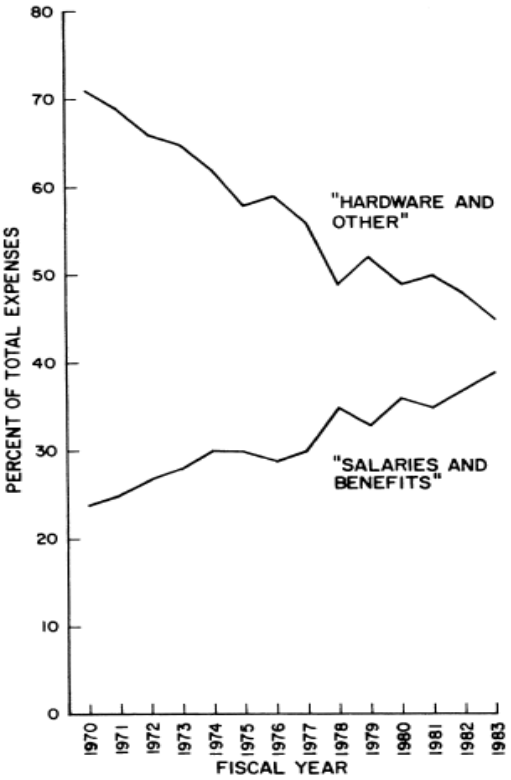

Figure 1.1*: Labour costs vs Hardware costs as a percentage of total costs (Princeton University Computer Center, 1970-83)*

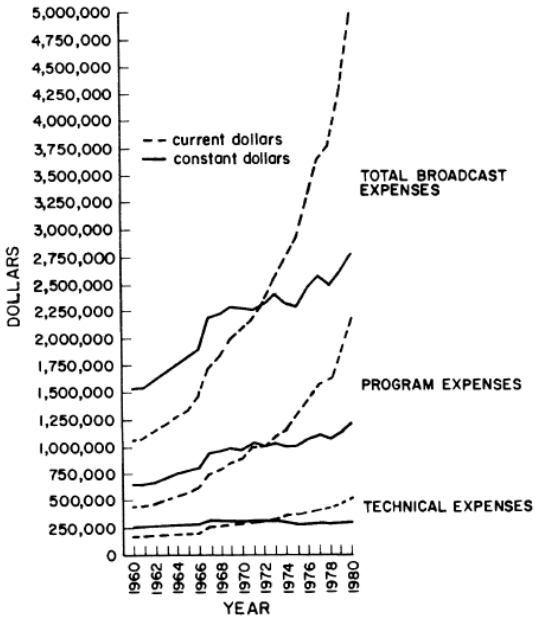

Figure 1.2: *Broadcasting expenses per average television station (US Federal Communications Commission, Annual Report; "Television Financial Data 1980, FCC Financial Figures" August 10, 1981, No. 6, Vol. 101, p. 54)*

Figure 1.1 shows that the cost of labour has grown at a rate of 2.6 percent per year, while total real equipment costs fell at an annual rate of 4.6 percent.

Figure 1.2 indicates that, from 1960 to 1980, programming costs rose in the United States, while technical expenses remained at a roughly constant throughout the period.

1.2. Cost disease and the growth of public expenditure

From the end of the nineteenth century, a growing trend in public spending began to be observed (see Table 1.1), which tended to develop at a higher rate than that of the national product, especially in the most industrialized and developed countries. This high growth rate began to spread concern among scholars and non-scholars, so that the first economists who began to observe this phenomenon began to look for explanations and to evaluate the economic consequences.

In the previous paragraph we analysed the model developed by W. Baumol, which model has no trivial implications: if it is true that wages in the stagnant (non-progressive) sector grow at a faster rate than the growth of their productivity (minimum, if not zero), then labour costs (constituted, based on the assumptions set by the model itself, only by wage costs) are bounded to rise steadily.

This has the consequence that, in order to keep the output level unchanged, it is necessary that the policy maker constantly increases the funds allocated to these services which otherwise, left to themselves, would suffer a decline and / or disappear (e.g. healthcare, education, etc.).

Leaving the level of funds provided unchanged over time, the final result would be to deliver an even smaller amount of output, and this often goes to the detriment of the community because these types of services often generate positive externalities and are for the most part essential goods and basic necessities.

Therefore, it is essential to bring together public investments that enter resources in a structural way and not just one-off, only in this way can the State intervene to remedy this intrinsic deficit that afflicts this type of sector due not to "taste" or "market" factors, but from an intrinsic productive and technological characteristic of this type of activity.

Clearly, Baumol was not the only one to formulate theories regarding the sharp increase of public spending.
The evidence of increasing public spending at a rate higher than that of the national product has directed the studies of numerous economists, including Nitti, Wagner, Peacock and

Wiseman. They have tried to illustrate the causes of the growth in public spending by elaborating concise and synthetic explanations.

Francesco Saverio Nitti, an Italian scholar, analysed in his textbook ("La Scienza delle Finanze", 1903) the phenomenon of the increase in public expenditures, distinguishing between "*apparent*" and "*actual*" increases.

The "apparent" increases are so called because they keep the ratio between public expenditure and national income constant and unchanged. The phenomena which belong to this category:

- inflation, or a generalized increase in prices which therefore leads to a mere nominal increase in public spending, but not a real one;
- population increases and the territorial extension of the state, since these elements involve greater expenditure for the state as it must satisfy a greater number of public needs (but the per capita ratio does not necessarily change).

The "effective" increases, so-called as they determine an increase in the share of public spending on national income, include:

- the continuous and incessant increase in military spending;
- large public works related to technical progress (roads, railways, military and civil constructions, etc.);
- the increase in public debt (with the consequences on the annual interest burden due to subscribers);
- the development of forms of social protection and the growing and increasingly consistent participation of the popular classes in public life (universal suffrage, reduction in the level of income corresponding to the median voter, etc.) leading to an enlargement of social classes to be satisfied and to be taken into account in the implementation of policies.

This element refers to the extension of electoral suffrage and, therefore, to the lowering of the income level corresponding to the "median" electoral (Black, 1948; Downs, 1957), whose preferences should exert a strong influence on public choices.

Adolph Wagner, a German economist with socialist ideas, is responsible for the most in-depth explanation regarding the long-term growth of public spending, his analysis is remembered as “Wagner's law” or “law of the progressive increase in public spending”.

Wagner identifies the causes of the long-term growth of public spending essentially in three orders (Wagner, 1883):

I. the replacement of private activities, resulting from industrialization and urbanization;
II. existence, among public goods, of superior goods, or goods whose elasticity with respect to income is high and higher than unity (education, culture) whose demand increases more than proportionally with respect to income;
III. the time horizon with which the convenience of certain investments (airports, railways, etc.) is measured requires increasing public intervention, as does the existence of natural monopolies.

Another traditional “synthetic” explanation of the dynamics of the share of public spending is the theory of the displacement effect developed by Peacock and Wiseman (1961).

According to them, the weight of public spending undergoes a “leap” upwards in correspondence with exceptional events (for example wars, catastrophic natural events but also profound political-social transformations, etc.) which justify acceptance by citizens of a democracy, of a corresponding sharp increase in the tax burden.

When the exceptional event (e.g., war, famine, pandemic) ceases, the weight of public spending is reduced, but it does not return to the initial level, but rather to a higher level than the previous one: a definitive “displacement” has occurred in the “weight” of public finance as citizens have become addicted, they are no longer able to deprive themselves of the greater services offered by the state.

All these theories mentioned above that refer to public expenditures cannot be applied directly to expound private spending as well, as this would entail, as John K. Galbraith (1998) writes, a *compositional error*.

To better clarify this concept, we need to go on to explain what differentiates public expenditures from private one. The difference firstly lies in their purpose: private spending satisfies the needs of the individual while public spending satisfies public needs or the general

interests of the community; this odds in purpose undermines the way citizens see and perceive these expenses.

Furthermore, what features public spending is the fact that it is affected by the *fiscal illusion'*s phenomenon, that is, the failure to accurately perceive the "price" of government services.

The price of public goods is not perceived as fully and accurately as the price of private goods. This is because taxpayers do not have the exact sense of the actual tax burden of certain taxes and therefore the perception of the real sacrifice they sustain is altered.

This theory ("Theory of Financial Illusion") was developed for the first time in 1903 by the Italian economist Amilcare Puviani. He argues that the rulers, through public financial activity, allocate a significant part of the financial resources of the state to the benefit of ruling class (which exercises the greatest power) without the knowledge of the popular classes or citizens, who are deceived with tricks and deceptions (for example that the State responds to their needs), in order to cause citizens to misjudge the purposes of political choices and consequently the citizens will allow the rulers to stay in power.

Table 1.1 - The growth of public expenditure (total expenditure as percentage of GDP)

	Late 19th century (around 1870)	Early 20th century (around 1913)	Around 1920	Around 1937	1960	1980	1990	1996
Austria			14.7	15.2	35.7	48.1	48.6	51.7
Belgium				21.8	30.3	58.6	54.8	54.3
Canada			13.3	18.6	28.6	38.8	46.0	44.7
France	12.6	17.0	27.6	29.0	34.6	43.1	49.8	54.5
Germany	10.0	14.8	25.0	42.4	32.4	47.9	45.1	49.0
Italy	11.9	11.1	22.5	24.5	30.1	41.9	53.2	52.9
Japan	8.8	8.3	14.8	25.4	17.5	32.0	31.7	36.2
Holland	9.1	9.0	13.5	19.0	33.7	55.2	54.0	49.9
Norway	3.7	8.3	13.7		29.9	37.5	53.8	45.5
Spain		8.3	9.3	18.4	18.8	32.2	42.0	43.3
Sweden	5.7	6.3	8.1	10.4	31.0	60.1	59.1	64.7
Switzerland		2.7	4.6	6.1	17.2	32.8	33.5	37.6
UK	9.4	12.7	26.2	30.0	32.2	43.0	39.9	41.9
United States	3.9	1.8	7.0	8.6	27.0	31.8	33.3	33.3
Average	*8.3*	*9.1*	*15.4*	*18.3*	*28.5*	*43.3*	*46.1*	*47.1*
Australia					21.2	31.6	34.7	36.6
Ireland					28.0	48.9	41.2	37.6
New Zeland					26.9	38.1	41.3	47.1
Average					*25.4*	*39.5*	*39.1*	*40.4*
Total Average	*8.3*	*9.1*	*15.4*	*20.7*	*27.9*	*42.6*	*44.8*	*45.9*

Source: Di Majo (1998)

Chapter 2

Empirical Evidence

After expounding on Baumol's model, in this chapter I will initially present the works of some authors who have tried to empirically test whether the model is supported by data. Then I will go on to list some criticisms and comments on the model, both from an analytical and descriptive point of view. Finally, I will give a brief description of how the model shows itself in some central sectors of public expenditure.

2.1 Empirical Tests: A Macroeconomic Perspective

In the years following the publication of Performing Arts (1965), many scholars have been involved in analyzing data series to verify whether the model proposed by Baumol and Bowen fully explained the reality and therefore whether it was ascertained from empirical evidence.

As we have seen in the previous chapter, the main assumption deriving from Baumol's writings is that the costs (and consequently the prices) of the outputs produced by the progressive sector are destined to remain constant, or even fall, while the costs of the outputs produced by the stagnant sector have the opposite trend, that is, they are destined to grow without limits.

This “pattern” can also be analyzed in reality. In Figure 2.1 we can see the behavioural path of some characteristic sectors of almost every economy in each developed country (notes: prices are normalized to 100 in 1950 and the Y axis uses a ratio scale). It is notable that services such education, healthcare, legal services, and even car repair tend to be at the top of the figure, whereas goods such as cars and home appliances are at the bottom.

Figure 2.2 instead shows a similar scene but posed in a slightly different way, that is, grouping all activities into only two categories: services and goods.

Consumer goods in general have fallen in price by a factor of two (from 100 to 53), while services have increased in price by a factor of approximately 1.5 (from 100 to 157).

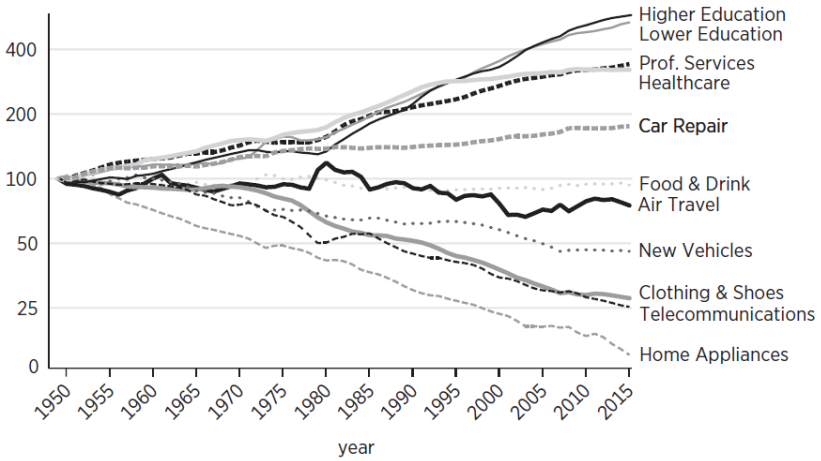

Figure 2.1. The Real Price of Selected Goods and Services, 1950-2016
Source: Bureau of Economic Analysis (BEA), "National Income and Product Accounts"; Helland and Tabarrok, 2019:2

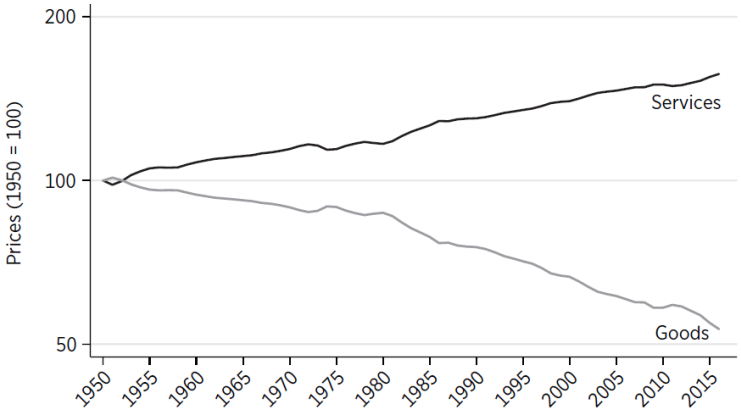

Figure 2.2. Prices of Goods versus Services, 1950-2016
Source: BEA, "National Income and Product Accounts"; Helland and Tabarrok, 2019: 42

From the previous graphs (Figure 2.1 and Figure 2.2), it is clear to see how the price of services has grown more than that of goods. Bureau of Economic Analysis defined what is meant by services: *"services are products that cannot be stored and are consumed at the place and time of their purchase"* (Bureau of Economic Analysis Glossary: "Services").

From proposition 1 and equations (1.4) and (1.5) Baumol bends us how the increase in cost per unit is strongly correlated with the differential productivity growth. For this reason, it could be checked if the increase in the prices of services compared to that of goods (shown in Figure 2.2) is due to the fact that productivity in the production of goods is increasing more than that of services, and the answer to this question is depicted in Figure 2.3, which shows the labour productivity of the manufacturing sector against that of the health, education, and government services sector.

The panel A of Figure 2.3 shows productivity levels. Panel B shows the manufacturing-to-services productivity ratio. The productivity of manufacturing relative to services grew by a factor of six between 1950 and 2010. Since this trend is of the same magnitude as the growth in relative prices, we can declare the assumption made by Baumol verified.

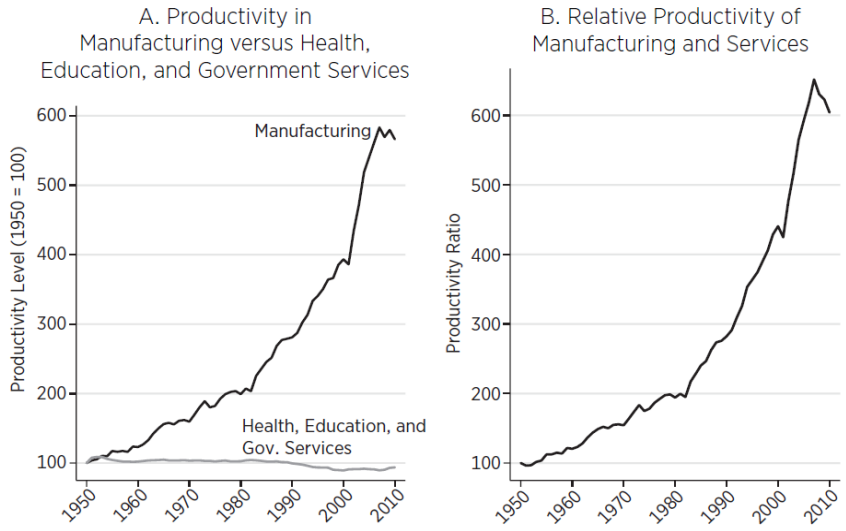

Figure 2.3. Productivity in Manufacturing versus Services
Source: Groningen Growth and Development Centre, "10-sector Database"; Helland and Tabarrok, 2019:44

Nordhaus (2008), trying to validate the theses postulated by Baumol, also finds compelling evidence that sectors characterized by stagnant technology have increased their unit cost and lowered outputs relative to the rest of the economy.

The author relies on aggregated industry level data to analyse the impact of Baumol's cost disease.

He shows how the hypothesis of a cost disease due to a low level of productivity is strongly supported by the data (Figure 2.4), in fact we see how there is an almost perfectly linear negative association between the growth of total factor productivity and prices. change with an estimated coefficient of [-0.965].

As already mentioned, Baumol argued that *"if productivity per man hour rises cumulatively in one sector relative to its rate of growth elsewhere in the economy, while wages rise commensurately in all areas, then relative costs in the non-progressive sector must inevitably rise, and these costs will rise cumulatively and without limit"* (Baumol, 1967: 419) and then he adds in 1985: *"with the passage of time, the cost per unit of a consistently stagnant product*

(live concert) will rise monotonically and without limit relative to the cost of a consistently progressive product (watches and clocks)" (Baumol, 1985: 807).

Thus, that lower productivity growth leads to higher prices it is not a big surprise, in fact the results are quite clear, they indicate that the major determinant of the long-term relative price trends are productivity trends.

Figure 2.5 also reveals that wage growth is not significantly related to productivity growth, as regressions show that the association between both variables is very small with a coefficient of [0.017]. From this analysis it is possible to understand how the gains from productivity growth are distributed. The results show that most of the gains are captured by consumers in the form of lower prices, however, given the little relationship between productivity growth and wage growth, we see that higher productivity growth has a small positive impact on wage relative growth with an inconsistent sign. Therefore, the importance of productivity in wage formation is very small.

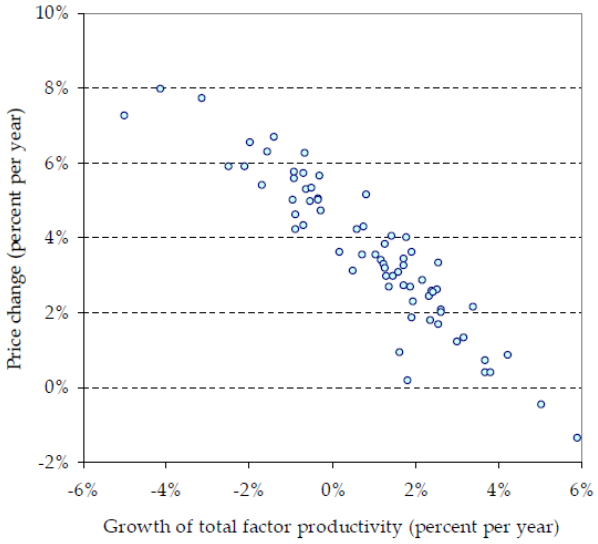

Figure 2.4. Price and Total Factor Productivity Trend from 1948 to 2001
Source: Nordhaus (2008):22

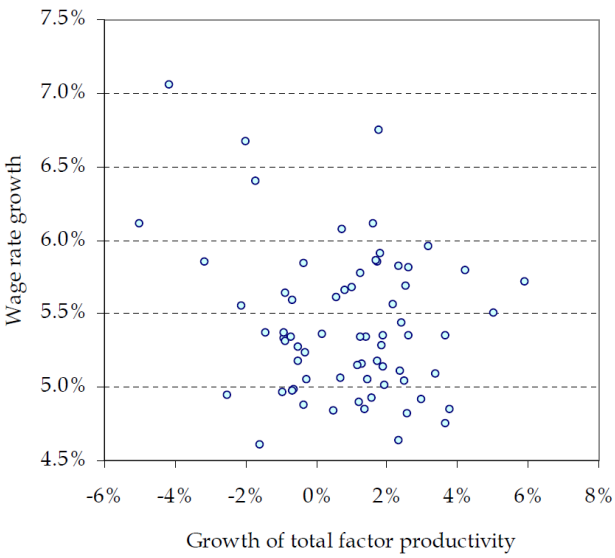

Figure 2.5. Productivity growth and wage growth by industry, 1948-2001 (annual average percent per year)
Source: Nordhaus (2008):29

Hartwig (2007) tried to empirically test the hypotheses postulated by the model using data from a panel of 19 OECD countries and found robust evidence in favour of Baumol's theory. His findings suggest that the relative price of medical care is in fact a statistically significant explanatory variable for healthcare expenditure, thus lending support to Baumol's theory.

Hartwig's aim is to find out whether the assumptions of the model postulated by Baumol are warranted specifically for the healthcare sector.
Before him, many economists argued that Baumol's assumptions are unwarranted for the health sector. The objections were mainly two:

1. First, since that the capital intensity (medical appliances) used in the healthcare sector is growing more and more, and technological progress is substantial and continuous in this field. Given this increasing intensity of capital injection into the healthcare sector, it *"might be as capital-intensive as manufacturing activities - or even more so"* (Hartwig, 2007: 3). However, this objection is not entirely correct, since the use of medical appliances in hospitals does not replace (displace labour) work. *"They equip the staff with new instruments. Also, they are not primarily installed in order to raise labour productivity, but in order to allow for better diagnoses or treatments"* (Hartwig, 2007: 4).
   Furthermore, as Baumol writes: *"Despite the use of computer in medicine [...] there is no substitute for the personal attention of a physician"* (Baumol, 1967: 423).
2. The second objection is about output measurement method. Newhouse (2001: 52) believes that there is *"a large constant upward bias"* in medical prices, since it is extremely difficult if not impossible to measure qualitative changes resulting from new technologies and procedures.

Other implications of Baumol's model are that variations in the relative price of medical care contribute significantly to explaining variations in healthcare expenditures in the same direction. Hartwig found, after many attempts, the growth rate of relative medical care prices to contribute positively, and significantly, to healthcare expenditure growth.

Therefore, the empirical evidence in favour of Baumol's model of unbalanced growth seems to be growing more and the data are consistent with the Baumol effect: industries with smaller increases in productivity exhibit larger increases in prices.

2.2 Comments and criticisms

Following the publication of the first articles in which Baumol began to theorize his model, many authors have begun to question the actual existence of cost disease or have tried to demonstrate that it is not such a significant and unsolvable problem as described instead from

Baumol. Much of the attention has been paid to undermining the hypothesis that any increase in productivity in the stagnant sector is rare if not impossible.

Among the authors who have questioned the whole theory of cost disease, or at least wondered about its predictive depth, it can be mentioned Throsby (1994), who states that the combined effect of production adjustments, of the increase in demand and the rising level of government grants and donations offset the perpetual rising trend in deficits. In his opinion, although the cost disease will continue to create difficulties for stagnant activities (he takes the performing arts organizations as an example), the disease is not terminal because the productive measures, implemented mainly by the public operator, tend to limit it.

Lynch and Redman (1968) criticize the model on the grounds that it simplifies the cause of the total interruption of the production or supply of a good or service by identifying it with the price elasticity of demand. They believe that the model neglects the fact that real income, the real purchasing power of consumers, tends to increase due to the productivity growth, as well as prices in the non-progressive sector, so there are many variables to be considered to evaluate the future of a good/service and relying exclusively on elasticity would lead to an estimate error.

This point was also dealt with by Bradford (1969), who believes that in an economic system where productivity does not decline in any sector, consumers can buy and take advantage of an ever-greater quantity of goods. and services. In stagnant sectors (performing arts) any periods of low productivity, which would lead to an increase in prices and consequently a fall in demand, can be balanced by an income effect that stimulates demand.

Given these criticisms regarding the income effect, Baumol (1996) revised his original thesis stating that in the stagnate sector *"in terms of the number of labour hours it takes to acquire them, over the long run, their cost is decreasing steadily"* and that *"the claim that we cannot afford them is simply a manifestation of what economics call money illusion"* (Baumol, 1996: 200-201).

Cutler (1998), anticipating the work of Newhouse (2001), believes that for some services it is extremely difficult to come up with accurate measures of productivity, therefore, the conclusion that those industries face the disease might be biased or overstated. This is due to the fact that the measurement of price deflators in some industries are flawed, in part since the

driver of costs is technological progress as well as the characteristics of the health care service offered changed over time with technology adoption.

This is one of the fundamental points of the debate regarding the Baumol's model, in many industries it is difficult to understand which method to use for measuring the output. Therefore, any conclusion postulated according to the hypothesis of stagnant productivity would be distorted.

Bell (1968), using that of shaving razors as a metaphor, puts forward his argument by pointing out that goods and services, by their very nature, have different production and consumption times: in goods, production, distribution, purchase and consumption can be displaced in time (storage is possible); in services, on the other hand, production and consumption must occur simultaneously.

Having said this, Bell states that the only correct way to evaluate an industry is to use an input-output methodology in which the input is the labour factor, while the output is the utility of the resulting consumption. Therefore, an increase in productivity would be obtained, for example, with a smaller amount of work for a given level of customer satisfaction or with the same amount of work for greater customer satisfaction. Nevertheless, given the difficulty, if not impossibility, in measuring an individual's satisfaction in the consumption of a good or service, this input-output measure, in services, is altered and distorted. This has already been addressed by Abbing: *"Due to technical reproduction the technically reproduced art product moves out of the realm of personal service and into the domain of cheap industrial good"* (Abbing, 2002: 159).

Some authors have criticized the model not in its conclusions but rather on the assumptions placed on it, introducing hypotheses under which its conclusions are no longer supported.

Robinson (1969) points out that changing the assumptions of the model, also the conclusions reached will do the same. The author imagines a world in which wages are fixed for each occupation (they do not vary as productivity varies) and the interest rate on capital is constant. Under these hypotheses, which are quite different from those set by Baumol, the situation that arises is the following (Robinson, 1969):

- the output produced in the industrial sector increases and the price of goods decreases;

- the output produced in the stagnant sector remains constant, the price of services does not change and the cost of services in relation to the cost of goods increases because the cost of goods in terms of labour costs decreases.

However, the strongest criticism came from Keren (1972), who identifies in the model of Baumol's paper a glaring error of interpretation of a result.
In proposition 2 Baumol writes that *"there is a tendency for the outputs of the nonprogressive sector whose demands are not highly inelastic to decline and perhaps, ultimately, to vanish"* (Baumol, 1967: 418), which formally can be:

$$\frac{Y_1}{Y_2} = \frac{a\,L_{1t}}{b\,L_{2t}\,e^{rt}} = \frac{a\,A}{b\,e^{rt}} \tag{2.1}$$

from which it can be deduced that the ratio between the outputs of the two sectors tends to 0 as *t* tends to infinity.

According to Keren, the ratio between the outputs of the two sectors (Y_{1t} / Y_{2t}), as shown by equation (2.1), decreases not because the numerator decreases, since in the worst case it remains constant, but rather because the denominator increases at the rate *r*.

Baumol in a reply in 1972 acknowledges his imprecision and agrees with Keren, but adds that this error does not compromise the main argument of his analysis*: "The basic argument of the original analysis still remains valid: the financial problem of the cities increases (in part) because the costs of the services rise more rapidly than the general price level"* (Baumol, 1972: 150).

Finally, as a last consideration on Baumol's model, it is worth mentioning Oulton's thought. The Baumol's model, as we have already said, states that if the ratio between the outputs of the two sectors is kept constant, an increasing share of the total workforce will be transferred to the non-progressive sector and consequently the overall growth rate of the economy will tend to slow down (proposition 3).

According to Oulton (2001), this conclusion is correct only if the stagnant sector produces finished products; if it produces intermediate inputs, on the contrary, the aggregate growth rate of the economy might even rise rather than decrease.

To explain the reasons of this interpretation, Oulton compares two simplifying models of the economy. In the first of them there are two industries, one belonging to the manufacturing sector (car production) and the other belonging to the stagnant sector (hairdressing). In the second model, there are still two industries, one belonging to the progressive sector (car production as the previous one) and the other belonging to the non-progressive sector but aimed at the production of an intermediate input (business service).

In the latter case, cars are produced through the combination of work and business service inputs, while the second sector requires only the human work. The productivity growth in the manufacturing sector, certainly higher than that of the service sector, corresponds to the total factor productivity growth. In the business service sector, on the other hand, labour productivity corresponds to the productivity of total factors.

Consequently, even if productivity growth is low in the service business sector, a transfer of resources in that industry will be accompanied by an increase in the global growth rate of the economy.

2.3 Healthcare, Education and Performing Arts

Baumol's model, as we have already said, offers useful interpretations to explain many trends underway in contemporary economies, focusing in particular on the dynamics of public spending (see par. 1.2).

We have seen how, according to Baumol and then verified by empirical evidence, there are sectors where the price of outputs (caused in most cases by the increase in the price of inputs) has experienced an immense and limitless growth.

The most illustrative examples of sectors in which more analyzes have been carried out, and where the effect of the rising costs is most visible, are mainly three: healthcare, performing arts and education.

2.3.1 Healthcare

In recent decades, spending on healthcare has grown significantly in all economically developed countries (Figure 2.6). This rapid growth has raised particular concerns, so much

so that it has become one of the main financial problems of policy makers, inserted in the programs of every political candidate. However, according to Baumol, any effort aimed at countering the growth of healthcare spending proves to be ineffective, since the cause of this phenomenon is inherent in the technological characteristic of the sector, as the public health sector is characterized by limited increases in productivity and therefore, is suffering from the cost disease.

As already mentioned, the use of capital in healthcare facilities has a different function than that used in industries. In fact, if in industries capital is often used to replace human labour or to make it more productive, in hospitals, on the contrary, it does not take the place of doctors and nurses but serves to help them achieve better treatment and formulate more precise and accurate diagnoses (Hartwig, 2007).

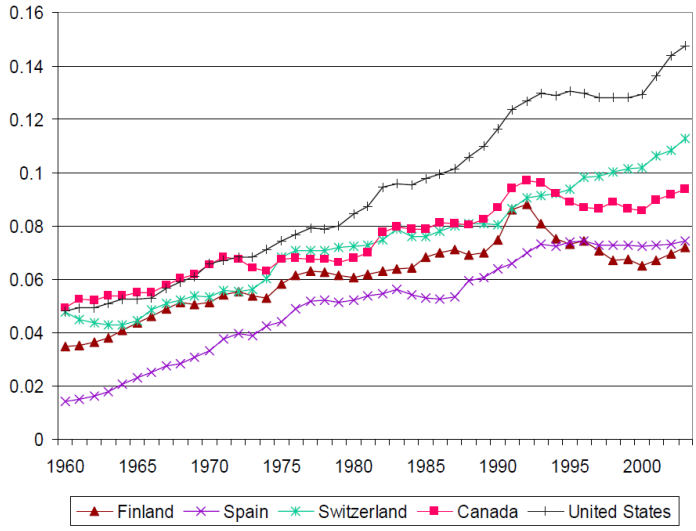

Figure 2.6. Shares of current health care expenditure in GDP.
Source: OECF Health Data 2005 CD ROM; Hartwig, 2007:15

Hodgson (1973), speaking of the dramatic US health situation, wrote *"for those not protected by insurance - and often for those who are partially protected - illness means financial disaster"*. Hodgson himself also points to healthcare costs as *"out of control"* and *"skyrocketing"*.

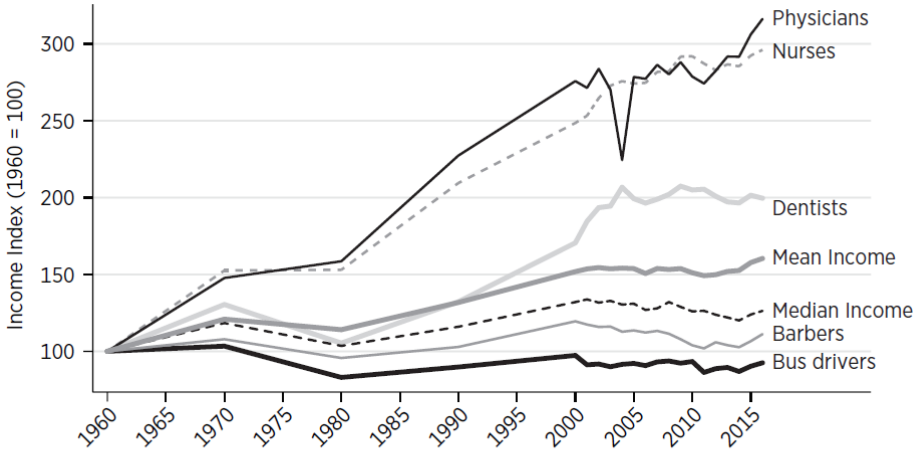

Figure 2.7. Average Annual Income for selected professions
Source: Integrated Public Use Microdata Series (IPUMS), 1950

There are numerous studies directed to explain the cause of this disproportionate increase in costs.

Some authors attribute the cause of this increase to the price of skilled labour. No profession other than physicians has seen such large increases in incomes over the past 50 years. Figure 2.7 shows the real income of physician from 1960 to 2016, indexed to 100 in 1960. Since 1960 the real income of physicians has increased by a factor of three.

Moreover, not only are physicians and nurses earning more, but also the number of healthcare workers is increasing to similar levels. Since 1960, the number of physicians and nurses per capita has more than doubled. Thus, at three times the price and twice the number, the cost of phycians has increased by a factor of almost six.

From this information, it can be assumed that Baumol's disease applies in the healthcare sector, which is why, in order to avoid losses in terms of health services, it is essential to guarantee a constant growth in health expenditure in the overtime.

2.3.2 Performing Arts

The performing arts sector is the one used as an example by Baumol in the first formulations of his model: *"the output per man-hour of the violinist playing a Schubert quartet in a*

*standard concert hall is relatively fixed, and it is fairly difficult to reduce the number of actors necessary for a performance of Henry IV, Part II" (*Baumol and Bowen, 1965: 500).

This proposition means that, as this sector records slow and sporadic increase in productivity, an hour of arpeggio today produces as much Mozart as in the eighteenth century, but an hour of manufacturing work today produces *n* times more output than at Mozart's period.

Concept already taken up by Helland and Tabarrok: *"in 1826, when Beethoven's String Quartet No.14 was first played, it took four people 40 minutes to produce a performance. In 2010, it still took four people 40 minutes to produce a performance"* (Helland and Tabarrok, 2019: 36).

We can state, in a different way, that in the nearly 200 years between 1826 and 2010, there was no growth in the performing arts sector.

It must also be said that technological progress allows benefits in terms of productivity also in this sector: for example, television, which allows the use of the service at a distance, or audio amplification, which gives the possibility to reach many more spectators in the same place. They, however, represent only punctual and unique increases over the previous productivity; after these, the cost disease continues to influence production costs with the previous intensity, furthermore this comparison is inaccurate because the substitution between the two goods is imperfect, a live show and a TV show are two goods with a myriad of differences, and this does not allow a comparison as perfect substitutes: *"recording can make a performance available to millions at low cost, but a recording is not a perfect substitute for a live performance. We can eat strawberries rather than huckleberries, but they are not the same" (*Cowen, 1996: 210-211).

Therefore, although the performing arts can to some degree exploit and exploit the benefits of technological progress to increase their productivity, they will not be able to solve their problem in the long run, but these will only be point-in-time productivity gains. This is because the cause of the increase in costs is to be attributed to the very nature of these activities

Also defining the output of an organization operating in the performing arts sector is a complicated process due to several factors. As described by Thorsby, this sector is *"an extreme case of heterogeneous commodity"* (Thorsby, 1994: 4) in which each output is different because it varies according to how it is interpreted and perceived by the viewer, therefore it is subjective.

In economic modelling of the performing arts, different output measures can be used. The two most commonly used criteria are the number of performances for a given production and / or the number of appearances. The goal of an orchestra, or a theatrical troupe, is to provide a performance to an audience, so the focus of the orchestra's activities is that group of people who attend the performance. For this reason, as Boyle (2006) states, *"it would appear more appropriate to assess the production activities of an orchestra in relation to the number of people that attend the concerts and experience the cultural activity, rather than assessing the number of concerts themselves".*

However, as pointed out by Goudriaan and Pommer (1987) point out *"all indicators measure only one dimension of performing arts"*, so the measurement of productivity in the sector is affected by theoretical problems in defining the output due to the intangible and experiential nature of the cultural product.

2.3.3 Education

Similarly, to healthcare and the performing arts expenditures, even that relating to education has recorded continuous growth in all advanced economies.

"The cost of education is rising faster than the average rate of inflation today, and we can be reasonably confident that it will continue to do so tomorrow, as well the day after that, while the opposite will be true of automobile manufacturing, where costs continually fall behind the economy's average inflation" (Baumol, Wolff and Saini, 2014: 3).

Education, in fact, is a service in Baumol's non-progressive domain, which requires direct interaction between the service provider and the "consumer". The human element, in education, is fundamental, because the quality of the product is strongly conditioned by the quantity and intensity of the human effort dedicated to the task and it is not possible to achieve productivity gains without giving up part of the value of the output finished.

What characterizes education is its role in triggering an improvement in general economic performance; in fact, it increases technical progress, labour productivity, ensures innovation and allows operating in conditions of greater effectiveness and efficiency, consequently producing funds to restart the process.

"Without education and with the resulting decline in innovation and education of the workforce, productivity growth can be expected to slow or cease altogether, just as the educational process will be handicapped - or perhaps harmed irreparably - by inadequate funding" (Wolff et al., 2014: 1).

This sector will be examined in depth in the next chapter.

Chapter 3

The Baumol's Disease on Educational Costs

In this chapter we will deal more specifically with how the cost disease theorized by Baumol occurs in the education sector. I will initially try to give a brief overview of the specific characteristics of this sector and why it is often placed in the stagnant productivity sectors' category. Subsequently, I will present some studies carried out on the veracity of the assumptions relating to the costs of education. Finally, I will draw conclusions by trying to set up whether any productivity increase is possible in this sector.

3.1. General Overview of the Industry-Specific Characteristics

The cost of education has begun to become more and more a sizable part of every country's budget since unit costs of public education have been continuing to rise at varying degrees around the world. These costs have been rising persistently and dramatically during the last decade. Figure 3.1 shows real cost of education per student for some countries, confirming that these expenditures have indeed grown everywhere over the bulk of the period since World War II.

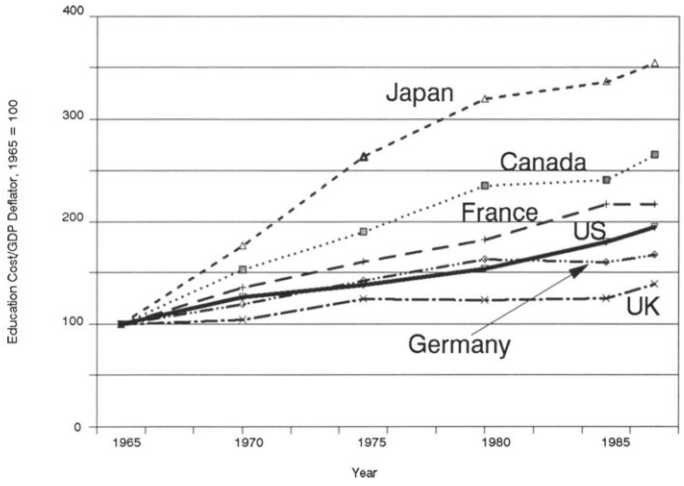

Figure 3.1. Education: Real cost per student (Education cost/GDP deflator)
Source: UNESCO; Baumol (1993): 18.

Many studies that have tried to explain the causes of the increase in costs. Some argue that the increase in education costs (increased on average by a factor of five) occurred in conjunction with an increase in the quality of service. To verify this hypothesis, we rely on a standardized test analysis: Figure 3.2 shows the mathematics scores of high school students compared with the evolution of real expenditure per student while Figure 3.3 shows a thirty-year look at NAEP performance for seventeen- year-old.

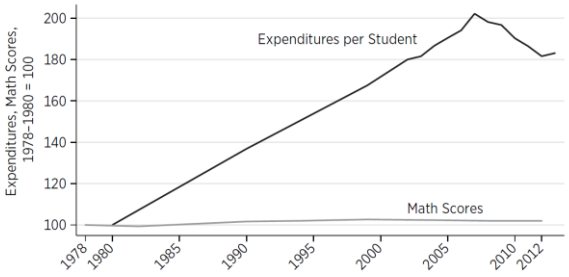

Figure 3.2. Relative Growth in Expenditures and Math Scores, U.S., 1978-2015
Source: NCES; Helland and Tabarrok (2019): 5.

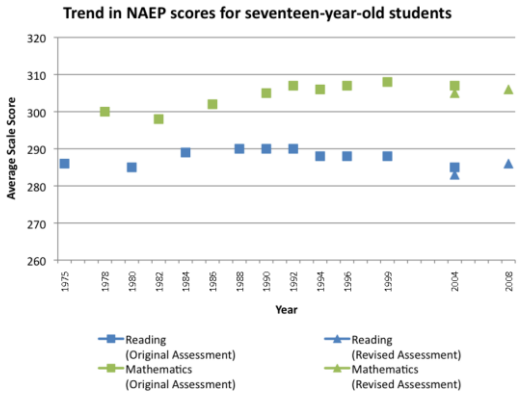

Figure 3.3. Change in NAEP scores for seventeen-year-old students
Source: U.S. Department of Education, Institute of Education Science, National Assessment of Educational Progress (NAEP); Hill and Roza (2010): 4

These graphs suggest that increase in unit costs was not correlated with the increase in the quality of outcomes (which were minimal), therefore it could be assumed that this increase in expenditure, from this point of view, was fruitless and wasteful and that *"changes in quality are not anywhere near large or sustained enough to explain the large and sustained increases in the costs of producing education"* (Helland and Tabarrok, 2019: 12).

It must be said that this behavioural path of rising costs for education did not happen overnight, but was rather driven by a slowly but steadily process: *"cost increases in education are more like rising sea levels than hurricanes"* (Helland and Tabarrok, 2019: 15).

The most plausible truth behind this stagnant situation, echoing the concepts expressed by Baumol, is that no more productive schooling models have emerged in the last 50 years, although costs in this sector have increased largely than inflation or increase in GDP. Almost all schools look today as they did many years ago. This is because, despite there have been waves of reform, the basic structure of education is unchanged: *"despite huge advances in computing and communications in other sectors, the core technology of education has*

remained virtually intact: schools are dominated by a cadre of teachers who guide a group of same-aged children through curricula delivered in nine-months segments" (Hill and Roza, 2010: 1).

Following the Baumol's theory, the reason why education is inlaid within the stagnant productivity sectors is that this activity, unlike the manufacturing sector, is unable to implement an automation process and, moreover, the quality of the service is intertwined with the quantity and intensity of human work injected into production, therefore any form of help or support deriving from technology is seen as a swindle towards the users of the service, i.e. the students.

However, if productivity (the pupil-teacher ratio), remain constant, any growth at all in the teachers' salaries will lead to a commensurate rise in cost per pupil. Since such increments are spread over a fixed number of students (or even fewer students when class sizes are reduced) and the result is dramatic increases in cost per unit of output.

The issue of the class size can be analysed with a concrete case cited in Wolff et al. (2014): Norway and United States has some of the smallest class sizes in the world, while South Korea's classes are among the largest (source: OECD and Pearson Foundation, 2010). Yet, South Korean students continue to outclass Norwegian and American students on international assessments. Thus, it seems reasonable to conclude that small class sizes do not necessarily improve student performance.

Furthermore, not only is the cost per employee increasing due to the perfect symmetry of wages (assumption 3 of the model), but so is the number of employees (see Figure 3.5). Schools and districts now employ many more teachers per pupil in a wider range of additional specialist categories than in the past *"thus in education, the string quartet both gets wage and benefit increases and adds enough new members to become a sextet"* (Hill and Roza , 2010: 2).

What makes education a fairly peculiar sector is also the criterion used to measuring the outcomes "produced" by it, and in this regard have been developed several viewpoints.
Participants in a Brookings workshop on Measuring the Outputs of the Education Sector (2000) struggled with how to quantify efficiency and outputs (including quality), noting that student performance is only one lens on the quality of the product.
Fraumeni et al. (2008) reckon that education outputs extend well beyond student learning and may include effects of sorting, childcare, lifetime earnings, societal impacts, etc.

The previously mentioned works (the Brookings workshops (2000) and Fraumeni et al. (2008)), show how the thinking regarding the evaluation of education is moving from a performance-based logic through the mere consideration of grades, to a more comprehensive evaluation where many additional parameters are taken into consideration.

3.2. Empirical Evidences

Many studies have been undertaken in trying to test the Baumol's model in various industries, especially in the health care sector (Hartwig, 2008; Colombier, 2012), while education not much attention has been paid, so the factors driving higher per-pupil public education spending are still a black box.

However, the "out of control" increase that is having the costs of the education sector as its protagonist has meant that policymakers have begun to study the determinants of this path of increase in unit costs of public education.

Wolff et al. (2014) argue that the cost disease model also applies to the education sector. Thus, education everywhere can be expected to grow ever more expansive with the passage of time.

Their findings prove some key observations, which are in accord with the cost disease analysis:

a. there is a negative correlation between the ratio of total educational expenditures to GDP and the level of labour productivity across OECD countries. This means that the more rapidly overall productivity increases in a particular country, the more slowly total education costs can be expected to grow relative to GDP;
b. there is a positive correlation between real educational expenditures per student and the level of labour productivity across OECD countries (Figure 3.4). As already noted, education plays a fundamental role in triggering an improvement in general economic performance, that is, more spending on education leads to a more efficient and productive workplace.

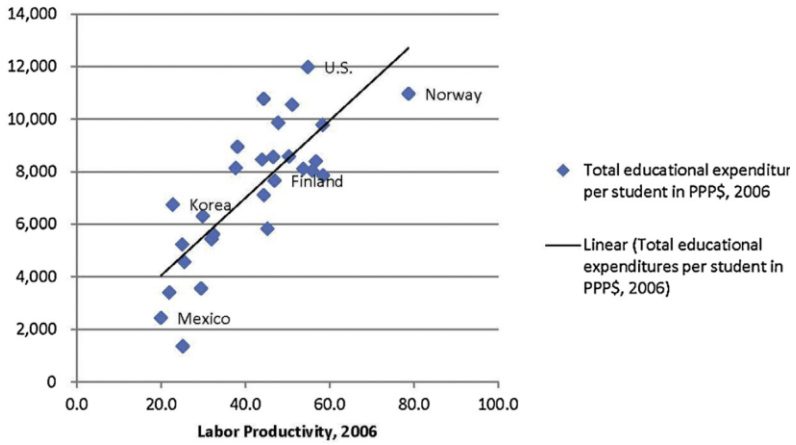

Figure 3.4. Labour productivity and total educational expenditures per student
Source: Wolff et al. (2014): 5

Wolff et al. (2014) also formulated an economic modelling to predict the future trend of education spending.

The basic model analyses how educational expenditures vary with country-wide average labour productivity and students per capita, and can be generalized as follows:

$$EDUCGDP_{ct} = \left[\frac{EDUC_{ct}/STUD_{ct}}{GDP_{ct}/HRS_{ct}}\right]\left[\frac{STUD_{ct}}{HRS_{ct}}\right] = \tag{3.1}$$

$$= \left[\left(\frac{EDUC_{ct}}{STUD_{ct}}\right)\left(\frac{PPP_{ct}}{LP_{ct}}\right)\right]\left(\frac{STUD_{ct}/POP_{ct}}{HRS_{ct}/POP_{ct}}\right) =$$

$$= \left(\frac{EDUCSTUD_{ct}}{LP_{ct}}\right)\left(\frac{PPPED_{ct}}{PPP_{ct}}\right)\left(\frac{STUDPOP_{ct}}{EMPPOP_{ct}}\right)$$

Where each abbreviation *ct* stands for "in country *c* at time *t*": $EDUC_{ct}$ is annual educational expenditures in current prices; GDP_{ct} is GDP in current prices; $STUD_{ct}$ is the number of students; HRS_{ct} is total hours worked; $EDUCGDP_{ct}$ is the ratio of annual educational expenditures to GDP; LP_{ct} is the average labor productivity in Purchasing Power Parity (PPP) exchange rates; PPP_{ct} is the overall PPP exchange rate; POP_{ct} is the population; PPPEDct is the PPP exchange rate for educational; $EDUCSTUD_{ct}$ is educational expenditures per student

in PPP exchange rates; $STUDPOP_{ct}$ is the ratio of students to population; and $EMPPOP_{ct}$ is the ratio of employment in hours to population.

They then formulated the model in natural logarithms (ln), to create a regression model:

$$\ln(EDUCGDP_{ct}) = \beta 0 + \beta 1\,(TIME_t) + \beta 2 \ln(STUDPOP_{ct}) + \beta 3 \ln(EMPPOP_{ct}) + \sum_c \varphi_c\, CNTY_c + \varepsilon_{ct} \quad (3.2)$$

Where TIME is defined as current year minus 2007; CNTY is a set of dummy variables for countries; and ε_{ct} is a stochastic error term assumed identically and independently distributed (i.i.d.).

Therefore, based on Baumol's assumptions about the incompressible cost trend, we would expect the β_1 coefficient to be positive, due to the incompressible trend of cost over time; that the coefficient β_2 is positive, since educational spending should, in general, rise with the number of students and they predicted also that the coefficient β_3 would be negative.

The first column of Table 3.1 shows the regression results for the (equation 3.1) using OLS. First, we note that the estimated coefficient of TIME (β_1) is positive and significant at one-percent level. The coefficient of ln (STUDPOP) is positive and significant at the one-percent level.

Table 3.1. Regression of educational expenditures in total and by component as a percent of GDP
Source: Wolff et al. (2014): 12

Independent variables	Dependent variable				
	ln(EDUCGDP)	ln(EDUCGDP)	ln(COMPGDP)	ln(NONPGDP)	ln(CAPGDP)
Constant	−2.200**		−3.513**	−4.823**	−3.487**
	(4.34)		(6.58)	(6.25)	(4.55)
ln(STUDPOP)	1.377**	2.401**	0.917**	1.203**	1.216**
	(5.14)	(3.32)	(3.29)	(2.98)	(2.75)
ln(EMPPOP)	−1.082**	−0.424	−1.531**	−2.423**	0.258
	(2.93)	(0.34)	(4.02)	(4.40)	(0.43)
TIME	0.0453**	0.0398**	0435**	0.0646**	0.0255**
	(12.34)	(2.96)	(11.61)	(11.92)	(4.27)
Country dummies included[a]	Yes	No	Yes	Yes	Yes
U.S. coeff. minus the mean value of the other 29 countries	0.263		0.298	0.512	0.519
R^2	0.865		0.884	0.879	0.882
Adjusted R^2	0.848		0.868	0.862	0.866
Standard error	0.143		0.143	0.207	0.225
Root mean square error		0.395			
Estimation method	OLS	GMM[b]	OLS	OLS	OLS
Sample size	278	214	253	253	250

Note: The sample consists of panel data, with observations on each of 31 countries by year from 1998 to 2008. Robust standard errors are used. The absolute value of the *t*-statistic is shown in parentheses below the coefficient estimate. See notes to Table 1 for the key. In addition, TIME: Calendar year minus 1997.
[a] Australia is the excluded country.
[b] The GMM instrument is ln(COMPGDP).
[#] Significance level: 10%.
[*] Significance level: 5%.
[**] Significance level: 1%.

3.3. Education and Cost Disease: Further Remarks

As we have seen, the central issue of the current debate regarding education is whether there is a possibility of making innovations to *"do more with less"*, but this concept, quite simple as regards the manufacturing sector, is very difficult to contextualise in education.

The current model of schools is highly resistant to change and most schools look fundamentally the way they have for decades, *"compared to other sectors where innovation appears ongoing, and where technology has been used to fundamentally transform products and the way they are produced, education seems antiquated"* (Hill and Roza, 2010: 8).

However, in recent years some sectors that initially fell into the category of stagnant sectors, including education, have managed to overcome the cost disease with innovation creating productivity improvements in the service sectors that outpace those in manufacturing, these services have said the disease is *"cured"* (Triplett and Bosworth, 2003).

However, the cost disease analysis takes as its premise the idea that while some valuable avenues for labour-saving have been possible, none of these has resulted in steadily decreasing costs anywhere near what computer manufacturing has been able to achieve.

A solution to bring about an upheaval of the current educational model could be to reduce the total staffing required, and sometimes in excess (just see the increasing amount of "other instructional staff" in Figure 3.5), this would lead to freeing a large number of resources, which could then be used for many functions, such as raising salaries to make the teaching profession more attractive to many more capable young people, or investing in productivity-enhancing technology.

As Ravitch (2011) writes, what arguably has significantly contributed to the students' success is not so much the number of teachers, but rather the focus on recruiting and training excellent teachers, mostly because well-trained teachers can spot struggling students before they fall behind and adjust their teaching methods to accommodate different students' needs.

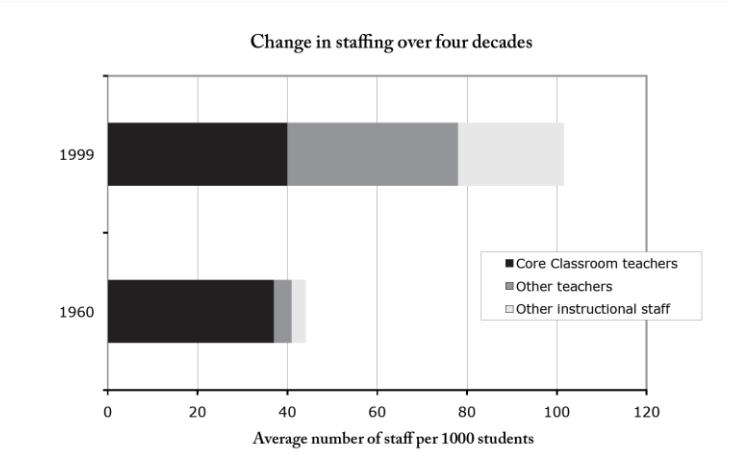

Figure 3.5. Addition of many new staff drive up per-pupil education spending
Source: Hill and Roza (2010): 4

A fundamental breakthrough would be trying to include information technology in the education sector, considered one of the greatest examples of the labour-intensive sector and in which the human element is considered fundamental.

Some worry that productivity gains imply reduced service quality as humans are replaced by machines, the common thought is that in the statement *"human element not readily replaceable by machines in their production process, which makes it difficult to reduce their labour content"* (Wolff, Baumol and Saini, 2014: 3).

Unlike other sectors, education has not realized the same advances from information technology.

A study carried out by ITHACHA (Bowen, 2013), a non-profit organization that seeks to advance the use of digital technologies in teaching and research, compared outcomes for students taking a traditional (offline) version of courses with outcomes for students in the online and hybrid-online course, and found no statistically significant differences between the two groups. Indeed, the same study concluded that hybrid education had even better outcomes than purely offline instruction.

Reservations about this new educational approach are understandable even if it would allow much larger group of students, without imposing significant additional costs, to receive lessons from top-quality and gifted professors.

Harden (2013) writes that a live-streamed lecture by an extraordinary talented teacher may provide better instruction than the same material presented live by a local professor who is

mediocre expositor. Meanwhile, large numbers of academics could be freed to focus on research and writing, rather than teaching.

Talking about the role of technology in education, Bowen (2013) concludes:
"[I]s online learning a fix for the cost disease? My answer: no, not by itself. But it can be part of an answer. [...] I continue to believe that the potential for online leaning to help reduce costs without adversely affecting educational outcomes is very real".

More and more scholars reckon that best practices for higher education may take a hybrid approach combining the best elements of the traditional classroom with the innovations of online learning. From the numerous studies carried out, it is indicated that this innovation does not seem to pose a threat to the quality of teaching, and may even improve it. In other words, it is possible to constrain the rising costs of education without damaging its quality and perhaps even enhancing it.

Final Remarks

As already stated, the aim of this paper is to investigate the role played by Baumol's cost disease theory in the growth of public expenditure with a review on the education sector.

The Baumol's cost disease says that there are activities characterised by low (or no) productivity growth and whose relative cost increases mainly due to the effects of productivity growth in dynamic.

Therefore, the causal determinant of the costs of the rest of the production system is precisely the production differential between the two sectors, which is why this theory is also called "Baumol's theory of unbalanced growth".

This model also explains why a growing trend in public spending began to be observed, which caused much concern among policymakers.

It has been shown that the data reflect the truthfulness of this theory, comparing the prices of some sectors with those of manufactured goods, and that this gap has been growing steadily for decades, and is not about to stop.

The most illustrative examples of sectors in which more analyses have been carried out are healthcare, performing arts and education. But what do these sectors have in common? What unites them is that in all these sectors the human element is fundamental, because the quality of the outcomes is strongly conditioned by the quantity and intensity of the human effort dedicated to the task and it is not possible to achieve productivity gains without giving up part of the value of the output finished.

Education is one of the sectors most affected by this disease, in the U.S. college tuition increased by more than 250 percent during the last 30 years, and the reason for this is that more productive schooling models have not been developed so they look today as they did many years ago. This, as mentioned, creates a gap between the industrial sector, where productivity gains occur daily basis, and the stagnant education sector, where there is no improvement.

Unfortunately, while in other stagnant sectors innovative solutions have been found to make them more efficient and try to cure the disease that oppresses them, for education, given the resistance of common thought, there is no inclination to annex technology because this, it is believed, would lead to a distortion of the product.

To sum up, while it is true that costs related to healthcare and education follow an upward trend, which might justify "spending cuts" in the funds allocated to these sectors, investments in these sectors contribute to generate productivity increases which then flow into economic growth. Thereby, ceasing to subsidise those low-productivity services would lead to a money savings in the short term, but a far greater social loss of the long run.

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