Baumol's cost disease in the local transit sector - A comparative analysis of Germany and the USA

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Abstract

This paper examines the existence of Baumol's cost disease in the local transit sector and its possible political implications. We perform efficiency and productivity analyses in order to test this hypothesis. Our findings confirm the existence of Baumol's cost disease for this sector, but at the same time reveal less funding difficulties. However, funding problems may arise, if other stagnant sectors are taken into account.

Keywords: Baumol's Cost Disease, Total Factor Productivity, Data Envelopment Analysis, Public Transport.

JEL-Codes: L92, L98, J45, E62, H79.

1. Introduction

According to Baumol´s hypothesis the economy can roughly be divided into two sectors, a progressive one and a stagnant one. The basic idea behind the concept of cost disease states that industries affected by the disease display slower productivity growth than the rest of the economy (see Baumol 1967, p.417). In this section we describe the basic idea behind cost disease and its further implications.

Figure 1 illustrates the main elements of Baumol's cost disease. From this point of view an economy can roughly be divided into two sectors; a progressive one, in which technological improvements lead to productivty gains, and a stagnant one where there is little or no productivity growth (Baumol &

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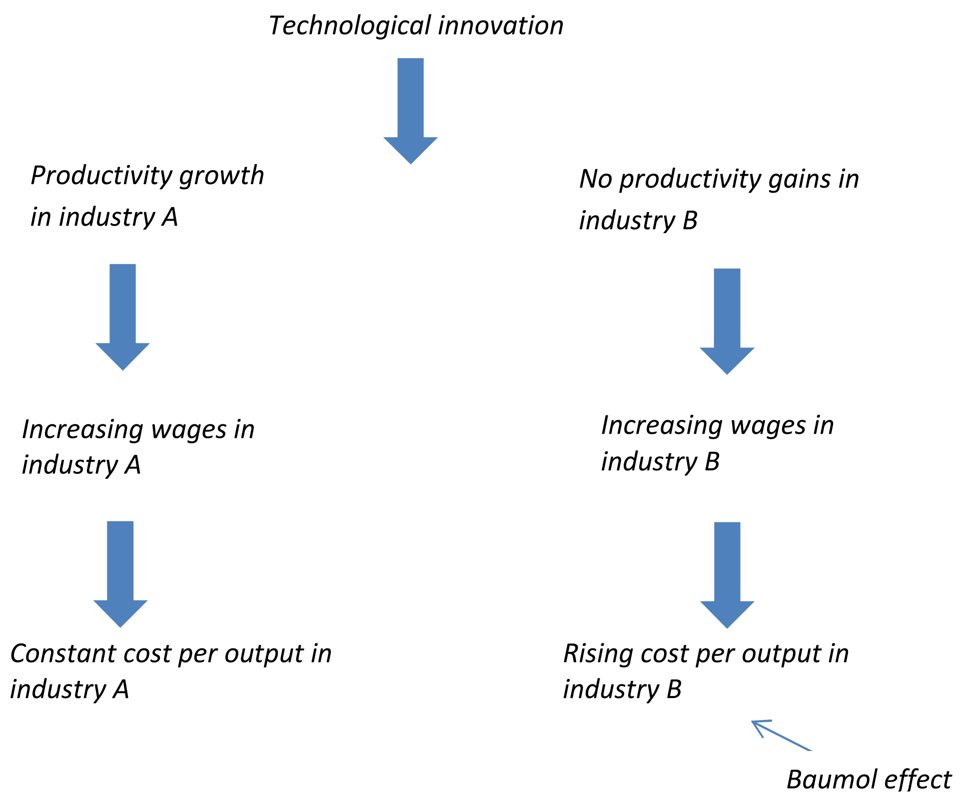
Bowen, 1966, p.166f). This, in turn, leads to increasing wages in the progressive sector.[2] In an economy where the industries are strongly interconnected, wages in the stagnant sector increase in a similar way to the productivity in the progressive sector. This occurs mainly due to labor mobility and the competion between industries to attract labor. Rising wages and limited productivty gains lead to increasing costs per output in the stagnant industries.

Figure 1: Baumol's cost disease



Source: Own depiction in reference to Zureiqat (2007)

However, in the progressive sector productivty gains compensate the rising wages and the cost per output remains constant. This implies continuously rising costs per output in the stagnant sector in relation to the progressive one. The costs per output in both sectors could increase but the cost per output in the stagnant sector would rise at a higher rate, leading to a growing gap between the costs per output in the two sectors. There are at least two reasons for this. First, the production process can rarely be standardized. The production of automobiles, for instance, can be done by robots on an

[2] We assume that productivity gains will be fully passed on to the workers.

assembly line due to identical working steps for each car. This may not be the case in every sector of the economy. Second, the strong correlation between output and quality for many (labor intensive) service oriented sectors in the economy, may also lead to the gap mentioned above. A teacher, for example, can hardly cut down the time he spends on teaching (see Baumol, 1993, p.20). The question now arises concerning how an economy is able afford such vital services as education, health care or orther stagnant services in the future. Our analysis for public transport verifies this hypothesis in single sectors and without tax funding.

The paper is organized as follows: section 2 discribes Baumol's model for cost disease. Section 3 tests the assumption of the existence of cost disease in public transport and presents the empirical results. Section 4 deals with the question of financing public transport due to the existence of cost disease. Finally section 5 present the conclusion.

2. Baumol's model of the cost disease[3]

In this section we discribe Baumol's formal concept of cost disease. We still asume that an economy can be divided into two sectors. The stagnant sector is denoted with Y_{1t} and the progressive sector with Y_{2t}. In sector two, the progressive one, the productivity per man hour increases with a cumulative constant rate of r over the time t. In sector one the productivity per man hour remains constant.

$$Y_{1t} = aL_{1t} \tag{1}$$

$$Y_{2t} = bL_{2t}e^{rt} \tag{2}$$

Where L_{1t} and L_{2t} are the quantities of labor in the two sectors.

We suppose wages in both sectors are equal and grow at the same rate w in accordance to the productivity growth in the progressive sector.

$$w_t = we^{rt} \qquad w = base\ level\ of\ wage \tag{3}$$

Based on this model it is clear that the cost per unit of output in sector one C_1, will rise without limit

[3] This section is based on Baumol, (1967) and can be omitted by the reader familiar with this literature.

and the cost per output in sector two C_2 will remain constant.

$$C_1 = \frac{w_t L_{1t}}{Y_{1t}} = \frac{we^{rt} L_{1t}}{aL_{1t}} = \frac{we^{rt}}{a} \tag{4}$$

$$C_2 = \frac{w_t L_{2t}}{Y_{2t}} = \frac{we^{rt} L_{2t}}{bL_{2t}e^{rt}} = \frac{w}{b} \tag{5}$$

The relative costs will behave in the following manner.

$$\frac{C_1}{C_2} = \frac{\left({}^{L_{1t}}/_{Y_{1t}}\right)}{\left({}^{L_{2t}}/_{Y_{2t}}\right)} = \frac{be^{rt}}{a} \tag{6}$$

Under normal circumstances[4] one would expect that the demand for products from the stagnant sector would decline. Suppose, for example, the demand and income elasticity in both sectors are unity in terms of prices, then the relative outlays for the two commodities remains constant.[5] The amount of labor in the two sectors also behaves in the same way.

$$\frac{C_1 Y_{1t}}{C_2 Y_{2t}} = \frac{we^{rt} L_{1t}}{we^{rt} L_{2t}} = \frac{L_{1t}}{L_{2t}} = A \tag{7}$$

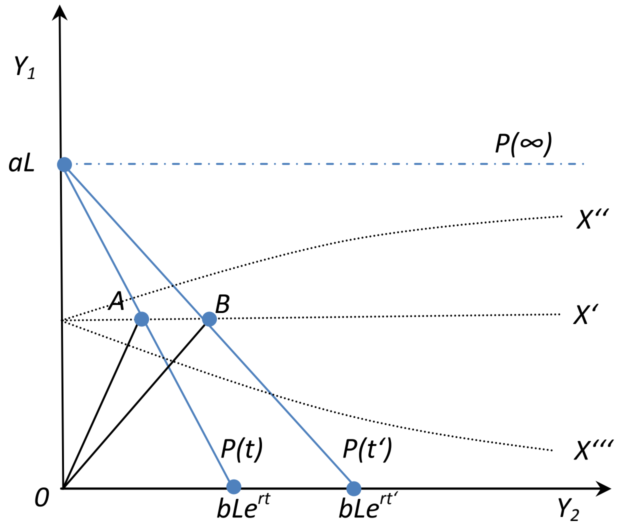
As a consequence the real output ratio declines.

$$\frac{Y_{1t}}{Y_{2t}} = \frac{aL_{1t}}{bL_{2t}e^{rt}} = \frac{a}{be^{rt}} \tag{8}$$

[4]Common and normal goods.

[5]This occurs because both elasticities in both sectors equalize each other. A higher price, proportionate to the cost, leads to a declining demand, however, the higher income compensates this effect and keeps the demand constant.

Figure 2: Consumer behavior



Source: Own depiction in reference to Bradford (1969)

Figure 2 depicts this situation. The blue ray $P(t)$ describes the production facility curve, which shifts outwards with advancing time, due to increasing productivity and declining relative costs in the progressive sector. When demand and income elasticity compensate each other consumer behavior follows ray X'. In this situation we would be able to afford a constant amount of goods from the stagnant sector and a continuously increasing amount of goods from the progressive sector. Only if the demand elasticity is higher than the income elasticity will goods from the stagnant sector disappear due to continuously declining demand. In figure 2 this situation is described by ray X'''. In the opposite case, if the income elasticity is higher than the demand elasticity then consumer behavior follows ray X''. The relative outlay for Y_1 from the entire income is determined by the ratio of the distance $AbLe^{rt}$ to $aLbLe^{rt}$ in time period t. This ratio still remains constant in the case of X', even when time advances[6]. Also, the amount of labor used to produce Y_1 remains constant at ray X'. However, the real output ratio of Y_1 to Y_2 declines.

The implication is that the output of goods which has higher demand elasticity than income elasticity will decline and ultimately vanish. But in the case of equal elasticity it is possible to consume a constant amount of Y_1 and a continually growing amount of Y_2 by maintaining a constant proposition be-

[6]Proof: The ratio of $AbLe^{rt}$ to $aLbLe^{rt}$ in period t is equal to the ratio of $BbLe^{rt'}$ to $aLbLe^{rt'}$ in period t'.

tween expenditure, in terms of money and labor for the two goods (see Bradford, 1969, p.295f).

In the next subsection we ask what happens if the real output ratio is kept constant, for example, through government subsidies.

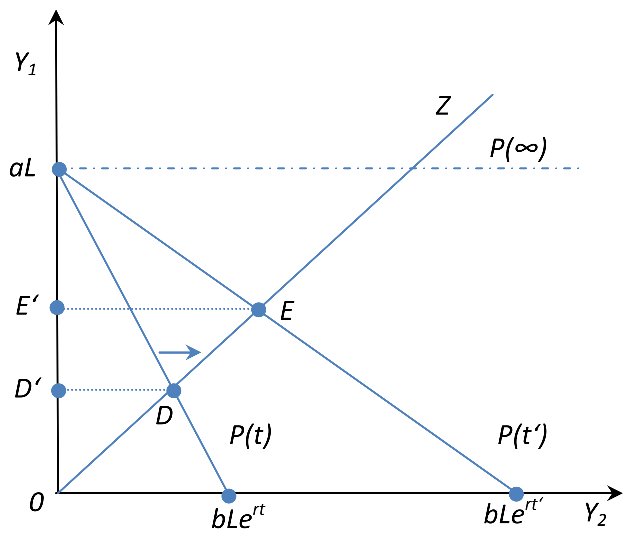
$$\frac{bY_1}{aY_2} = \frac{L_1}{L_2 e^{rt}} = K \tag{9}$$

If $L = L_1 + L_2$ is the total labor supply then it follows that:

$$L_1 = \frac{LKe^{rt}}{(1+Ke^{rt})} \qquad and \qquad L_2 = \frac{L}{(1+Ke^{rt})} \tag{10}$$

Hence, as t approaches infinity, the entire amount of labor is shifted to the stagnant sector and is used to produce Y_1. In this situation the consumption curve is represented by ray Z in figure 3, where the output ratio is constant.

Figure 3: Consume behavior in the case of a constant real output ratio



Source: Own depiction in reference to Bradford (1969)

The relative outlay of Y_1 from the total income, which, again, is given by the ratio of $DbLe^{rt}$ and $EbLe^{rt'}$ to $aLbLe^{rt'}aLbLe^{rt}$ respectively, increases over time, and, in addition the amount of labor which is given by the ratio OD' to $0aL$ and OE' to $0al$ respectively, it also grows. Thus, one may conclude that, if the ratio of output in the two sectors is held constant, an increasing amount of the labor must be transferred to the stagnant sector and the amount of labor in the progressive sector will tend towards zero. The amount of total income also increases continuously (see Baumol, 1967, p.419).

Most of the goods in the stagnant industries are provided by public entities and have to be financed through taxes. Hence, we have to consider what happens with the marginal tax rate due to increasing expense for the stagnant industries. Formally, the marginal tax rate r could be derived in the following manner; all assumptions from above remain the same and the total costs of the two sectors are the unity cost from equation (4) and (5) times the respective outputs:

$$C_{1t}Y_{1t} = \frac{we^{rt}}{a} \cdot aL_{1t} = wL_{1t}e^{rt} \tag{11}$$

$$C_{2t}Y_{2t} = \frac{w}{b} \cdot bL_{2t}e^{rt} = wL_{2t}e^{rt} \tag{12}$$

The tax rate must be equal to the share of public-sector[7] costs relative to the aggregate national economy.

$$\tau = \frac{C_{1t}Y_{1t}}{C_{1t}Y_{1t}+C_{2t}Y_{2t}} = \frac{wL_{1te}{}^{rt}}{wL_{1t}e^{rt}+wL_{2t}e^{rt}} = \frac{L_{1t}}{L_{1t}+L_{2t}} \tag{13}$$

It can be seen that the marginal tax rate depends on the fraction of total labor employed in the public sector. It must be raised as long as this fraction increases. Let us include equations (11) and (12) in the formula and we obtain:

$$\tau = \frac{Y_{1t}we^{rt}/a}{Y_{1t}we^{rt}/a+Y_{2t}w/b} = \frac{1}{1+\frac{aY_{2t}}{bY_{1t}} \cdot e^{-rt}} \tag{14}$$

In the case where the real output ratio is held constant[8], the tax rate must be raised over time. The onset of Baumol's cost disease could be slowed down if it were possible to increase the rate of productivity growth in public sector relative to the rest of the economy. However, a faster productivity growth in the rest of the economy would not help. Indeed the tax rate has to increase more quickly as seen from equation (14) (see Lindbeck, 2005, p.25). Consequences of a continuously increasing marginal tax rate are expanding welfare costs and the risk of exceeding the peak of the Laffer-curve. It is therefore clear that the main problem behind Baumol's cost disease is financing through taxes rather than

[7]We assume that the entire public sector is a stagnant lacking in productivity.
[8]Y_1/Y_2 = constant

continuously increasing relative unit costs. In the next section we analyze whether local transport is susceptible to Baumol's cost disease.

3. Baumol's cost disease and public transport

The local transport sector is a labor intensive industry not heavily affected by technological improvements. Given the fixed proportion between one bus and one bus driver in order to provide the service at a certain frequency and for a certain time, it is clear that productivity growth is limited (Zureiqat, 2007, p.4). To examine the productivity growth of the local transport sector we use three types of data.

1. Economy-wide productivity data. We compare the growth of productivity in the public transport over time with the overall productivity;
2. Company-specific data. We compute total factor productivities (TFP) of several companies by means of a data envelopment analysis (DEA);
3. Company-specific cost data. We compare a company's growth rate of unit costs with the development of the consumer price index (CPI).

In the first case we expect a productivity growth rate in the local transit sector which is lower than the overall productivity. In the third case we expect that unit costs increase faster than the consumer price index. The second examination is used to test differences in productivity growth between different types of companies. We assume that rail operating companies[9] tend towards higher productivity growth rates than enterprises which only provide bus services. This may occur because efforts are made to automate rail transport operation and economies of scale may also play a role here.

3.1 Economy-wide analysis

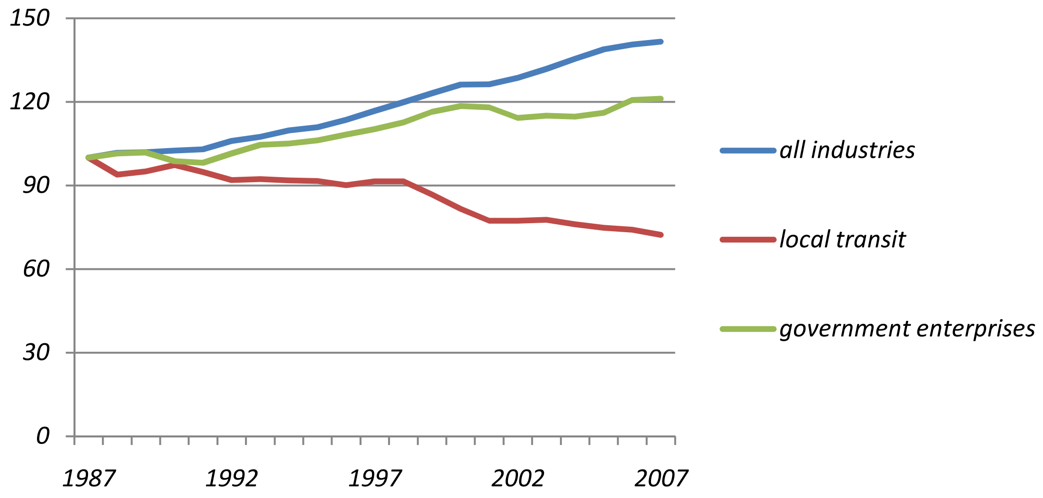
We use annual industry data from the USA for the time period 1987-2007 to compute the real GDO (gross domestic output) and the GDP (gross domestic product) per full- and part-time employees for the local public transport industry and the entire economy.

$$\frac{GDO/p}{L_i} \qquad and \qquad \frac{GDP/p}{L_i} \tag{15}$$

[9]Or firms with mixed (bus and rail) operations.

Where p is a price deflation factor and L denotes the full- and part-time employees. Subsequently, we plot these ratios over time and make a comparison. Figure 4 shows the results.

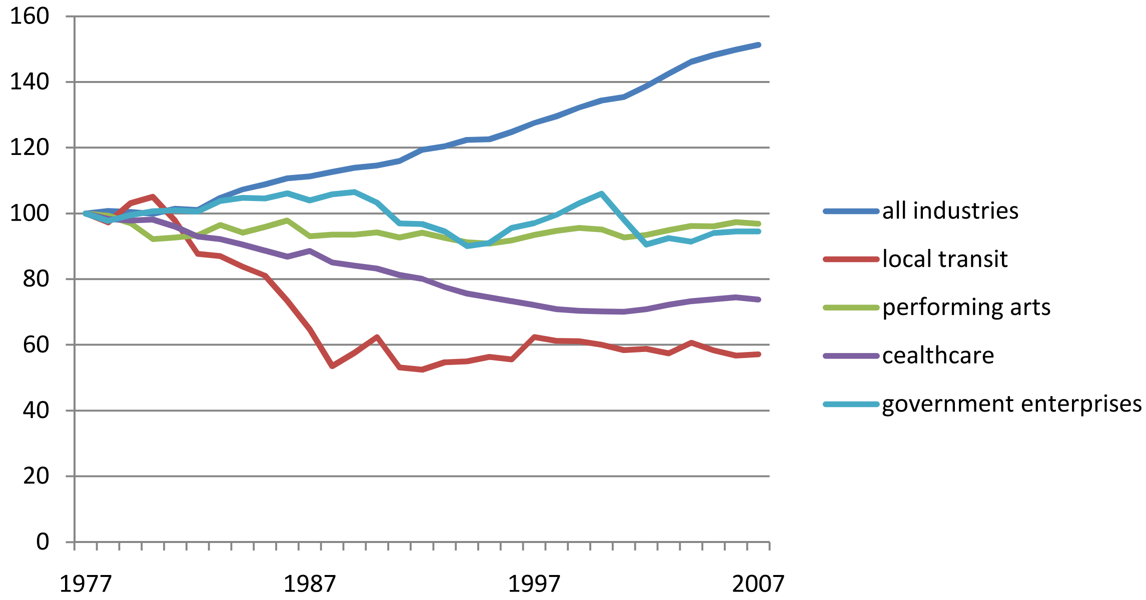
Figure 4: GDO over full- and part-time employees



The results show a slower labor productivity growth in the two industries than in the entire economy. The average difference between local public transport and the entire economy is 1.8%, and for government public industry 0.8%. Despite the fact that the classification public enterprises include non-stagnant industries, which we couldn't isolate, its labor productivity growth rate is lower than the entire economy.

In another analysis we compare the ratios of the GDP per full- and part-time employees for healthcare, performing arts, government enterprises and public transport as well as for the entire economy over the time period 1977-2007. Figure 5 shows the results.

Figure 5: GDP over full- and part-time employees



By using the GDP instead of GDO all included industries indicate negative growth rates over the time period. Only the entire economy indicates a positive average growth rate. The average growth rates for each industry may be seen in table 1.

Table 1: Average growth rate

1977-2007	**average annual growth rate in %**
local transport	-1.631
entire economy	1.394
government enterprises	-0.139
performing arts	-0.089
health care	-0.896
education	-0.838

We can conclude that local transport services for the USA show slower growth rates of labor productivity than the entire economy and also than other industries, which belong, according to conventional wisdom, to stagnant ones (see Baumol, 1996, p.183). It is however impossible to draw safe results from this calculation. The reason here is the aggregate measure related to the output in terms of GDO and GDP. Nonetheless, a rough direction is still recognizable. In order confirm these first indicative results and to eliminate the measuring problems connected with them, we proceed in the next subsection with a more disaggregated analysis by using the concept of DEA to compute the TFP for several companies in Germany and the USA.

3.2 Enterprise analysis

3.2.1 Methods

First, we determine the variables for the DEA model. As DEA analysis describes a production frontier, it is essential to define input and output variables.[10] As input variables we take full-time employees, the number of vehicles together with an environmental variable, population density, into account. The output variable is more difficult to define. In public transport we could argue that a unit of output is a passenger kilometer. However, in our analysis we use vehicle kilometer as a pure supply indicator. Reasons why we use vehicle kilometers or miles instead of passenger kilometers miles are:

1. Vehicle kilometers variegate symmetrically with the labor and engaged vehicles inputs.
2. Vehicle kilometers are a decision variable – enterprises can influence it to a certain degree.
3. In contrast to passenger kilometers, vehicle kilometers describe the companies' pure performance, leaving the effect of demand unaffected (see De Borger, 2002, p.18).

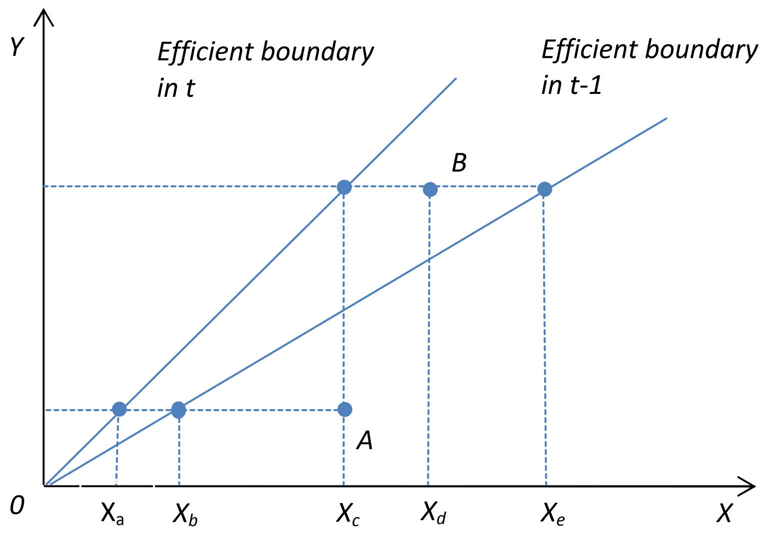
Furthermore, we distinguish between enterprises which solely provide bus operations and enterprises which supply mixed operations. We measure the TFP with the help of the Malmqusit approach. Figure 6 shows how the computation works. In each period we calculate the production frontier. Companies under the frontier are inefficient and are able to increase their output or decrease their input. The

[10] At this point it must be stated that we are aware of the problems related with the use of DEA analysis in public transport, mainly connected to outliers and sample treatment (see, Evangelinos & Matthes, 2010).

Malmquist approach measures the shift of the frontier from period $t-1$ to period t by means of distance functions: [11]

$$\Delta TFP = TFP_t / TFP_{t-1} = \frac{X_c/X_a}{X_d/X_c} \tag{16}$$

Figure 6: The Malmquist approach



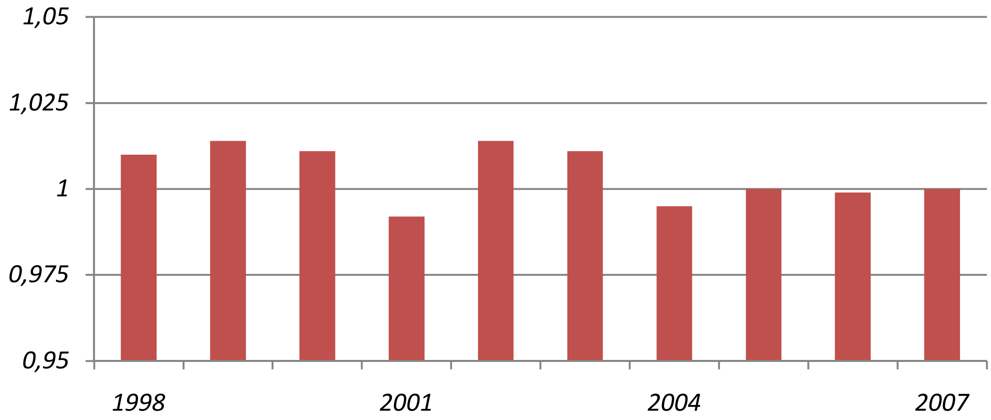
Source: Own depiction in reference to Muller (2009).

3.2.2 Results

For the USA the first sample includes 250 bus companies and 21 companies with mixed operations[12]. The observation period is 1997 - 2007. In the following figures we plot the average growth rate of the TFP over time.

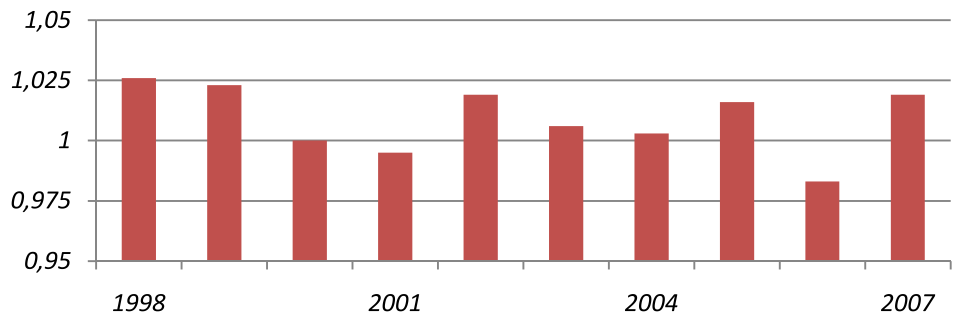
[11]For an in depth treatment of data envelopment analysis see Coelli (2005)
[12]Heavy rail, light rail, commuter rail, motorbus, trolleybus, cable cars

Figure 7: Average annual TFP for bus operations – USA



The average growth rate for the TFP is 0.5%. For enterprises with mixed operations the situation is quite different (see figure 8).

Figure 8: Average annual TFP for mixed operations – USA



The average growth rate for the TPF is now 0.9%. This is not much higher than in the preceding analysis, and hence, we assume no difference between the train services and bus services in terms of improvements in productivity. However, an exclusion of all bus operations results to an average growth rate for the TFP of 1.6%. Hence, it could be stated that enterprises with mixed services tend to have higher productivity growth rates and are therefore not susceptible to Baumol's cost disease. However, in order to draw some more general conclusions we also test this assumption for Germany. Our approach remains the same as for the USA. For Germany the sample includes 75 companies with only bus operations and 49 companies with mixed services.

Figure 9: Average annual TFP for bus operations – Germany

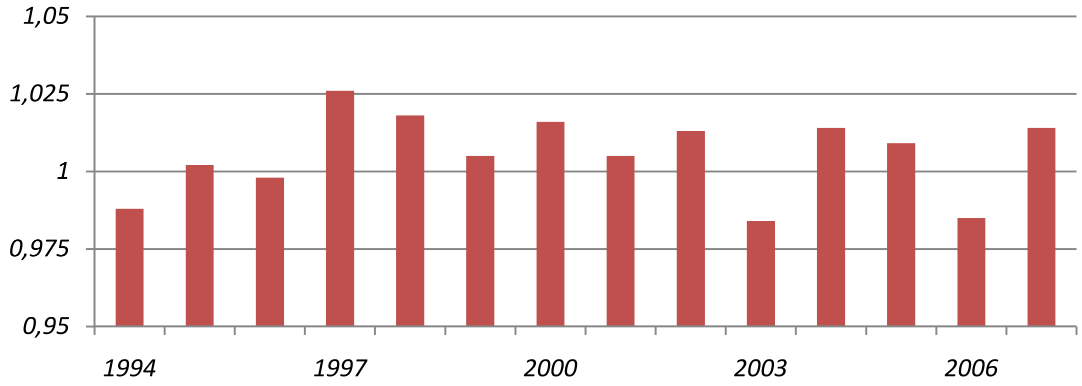
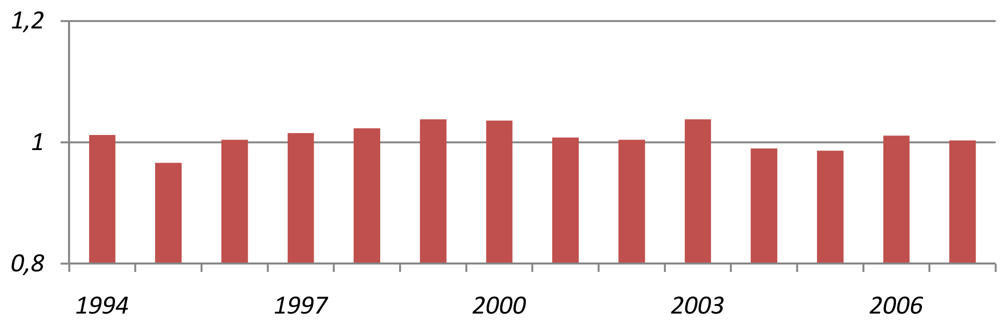


Figure 9 shows the results for bus operations. Interestingly, TFP in Germany for companies with only bus operations increases with exactly the same average rate of 0.5% as for the USA. For mixed operations[13] we calculated average growth rates for TFP of 0.9% (see figure 10).

Figure 10: Average annual TFP for mixed operations – Germany



When we include heavy rail services in the sample, the average TFP growth rate raises to 1.9% per year. This confirms our assumption that rail services tend to have higher average growth rates of TFP than bus operations alone, and hence, the hypothesis that only bus services are susceptible to Baumol's cost disease. Table 2 summarizes all calculations made so far:

[13]Only light rail and bus services.

Table 2: Average growth rates of TFP

country	sample (sample size)	TFP in %
Germany	bus (75)	0.5
	mixed operations (49)	1.9
	lightrail and bus (31)	0.9
USA	bus (250)	0.5
	mixed operation (21)	0.9
	only rail operation (31)	1.6

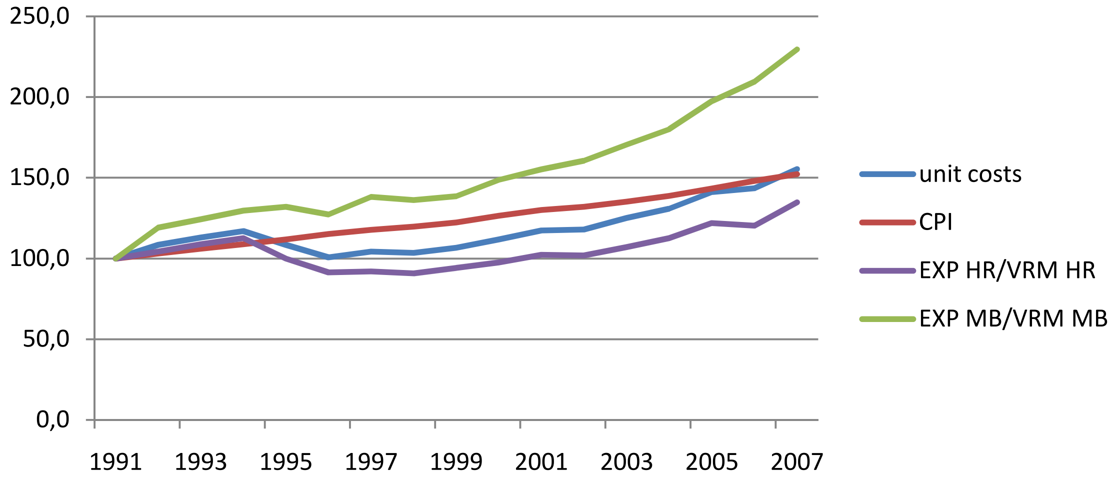
The productivity analysis in this chapter indicates very low TFP growth rates for bus services and tendentially higher growth rates for mixed operations. Hence, the TFP examination confirmed the low labor productivity from the sector analysis for the local transit sector.

3.3 Unit Costs

In this subsection we consider unit costs. We hypothesize that bus services show higher unit cost growth rates of than the growth rate for the CPI, and rail services show unit cost growth rates of less than the growth rate for the CPI. We compute unit cost as the ratio between total operating cost and vehicle kilometers.

Figure 11 shows the growth in total operating cost per vehicle mile at the New York Transport agencies and the growth in the CPI over the time period 1991 - 2007.

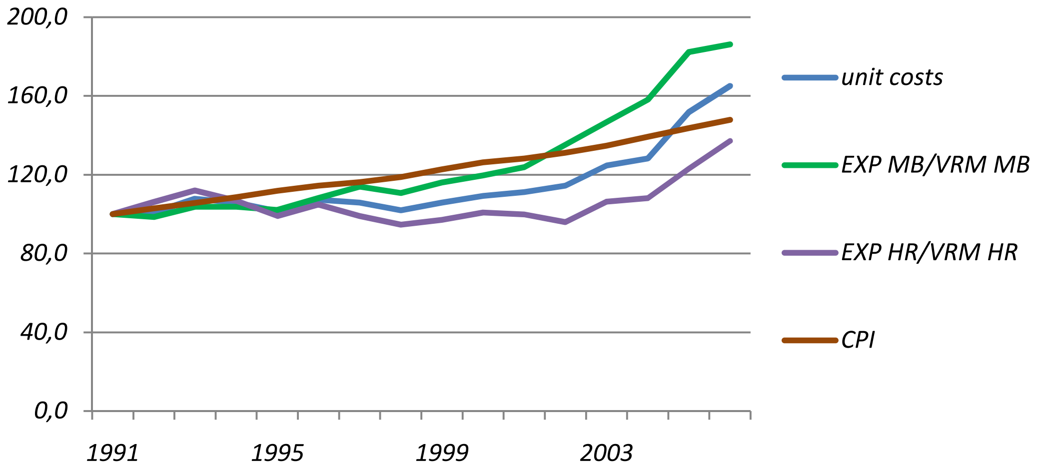
Figure 11: Total operating cost per vehicle mile – New York



EXP HR/VRM HR = Expense heavy rail/vehicle revenue miles heavy rail; EXP MB/VRM MB = Expense motor bus/vehicle revenue miles motor bus

The graph supports our hypothesis that particularly bus operations are susceptible to Baumol's cost disease. Costs per vehicle mile for bus operations (green line) clearly increase at a higher rate than the CPI. Our findings from the TFP analysis are also confirmed by the cost analysis. The operating expenditures per vehicle mile for rail operating services (purple line) increases at a lower rate than the CPI. The reason is rail operating services show higher productivity growth rates than bus services. However, this fact should be analyzed over a longer time period. In the following we show one more figure which shows unit cost development from one other transport agency in the USA and tables which provide the growth rates in unit cost for them.

Figure 12: Total operating cost per vehicle mile – Chicago



EXP HR/VRM HR = Expense heavy rail/vehicle revenue miles heavy rail; EXP MB/VRM MB = Expense motor bus/vehicle revenue miles motor bus

Table 3: Average growth rate unit costs – New York

1991-2007	average growth rate in %
unit costs	2.897
unit cost bus	5.447
unit cost rail	2.047
CPI	2.663

Table 4: Average growth rate unit costs – Chicago

1992-2007	average growth rate in %
unit costs	3.544
unit cost bus	4.333
unit cost rail	2.331
CPI	2.649

4. Is public transport affordable in the long term?

4.1 Long term demand development for public transport services

We now consider whether public transit services are still affordable. In this chapter we therefore want to test the assumptions and implications Baumol made in his theoretical analysis. We ask the following questions:

1. Does the demand for stagnant services, particularly transit services, grow in line with the entire economy?
2. Do passengers have to pay increasingly more for such services?
3. Is there a labor transfer to the stagnant sector?

As noted in section 2, only when growth in the stagnant sector, particularly the transit sector, is in line with the entire economy must an increasing amount of disposable income be used to finance the stagnant sector leading to tax increases. If this were not the case an economy would use a constant amount of stagnant services and an increasing amount of all other goods and services without increasing relative expenses. To analyze this we calculate the share public transit services to the GPO/GDP (real and nominal values). To start with we only test the transport sector in relation to the entire economy. Subsequently, we include other stagnant sectors in our analysis.

Figure 13: Ratio on the nominal GDP I

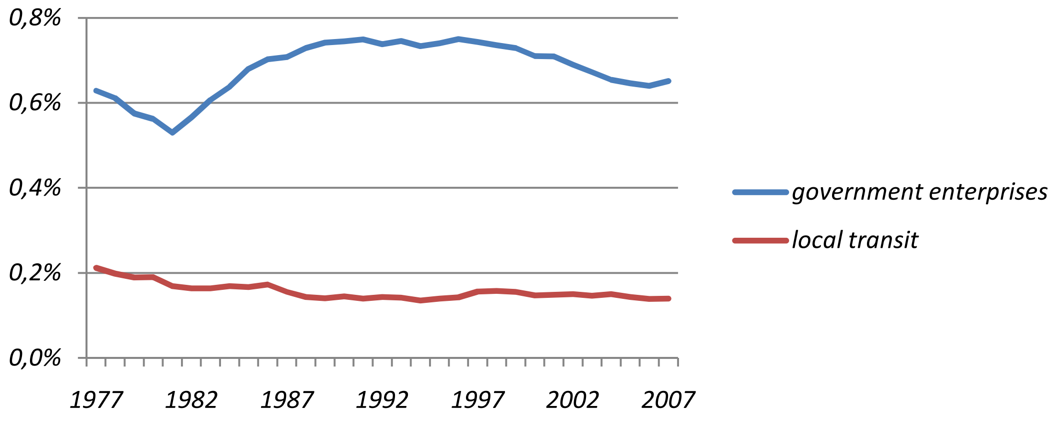
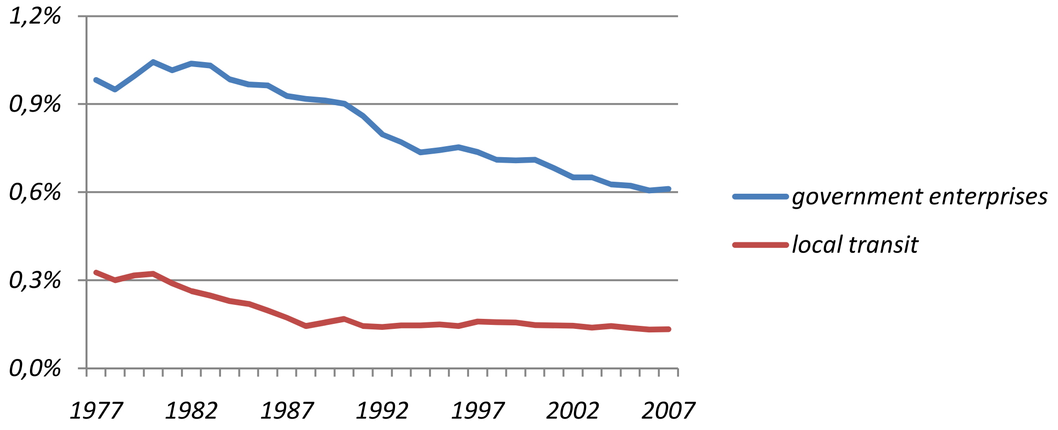


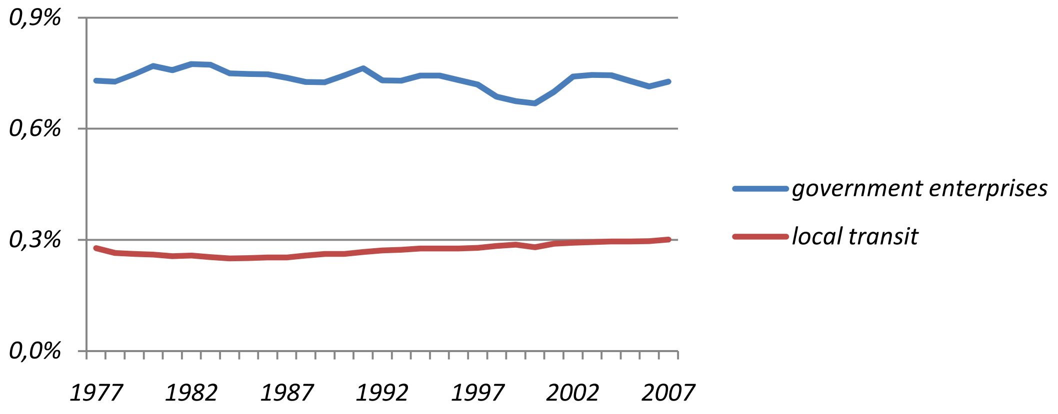
Figure 13 depicts the nominal GPO ratio of the transit sector to the entire economy in the USA. In figure 13 it is clear that the nominal ratio of the transit sector is constant over the time period. There are deflections, especially in the government enterprises sector, but the trend is constant. Figure 14 shows the real values for the GPO ratio of the transit sector to the GDP of the entire economy.

Figure 14: Ratio on the real GDP I



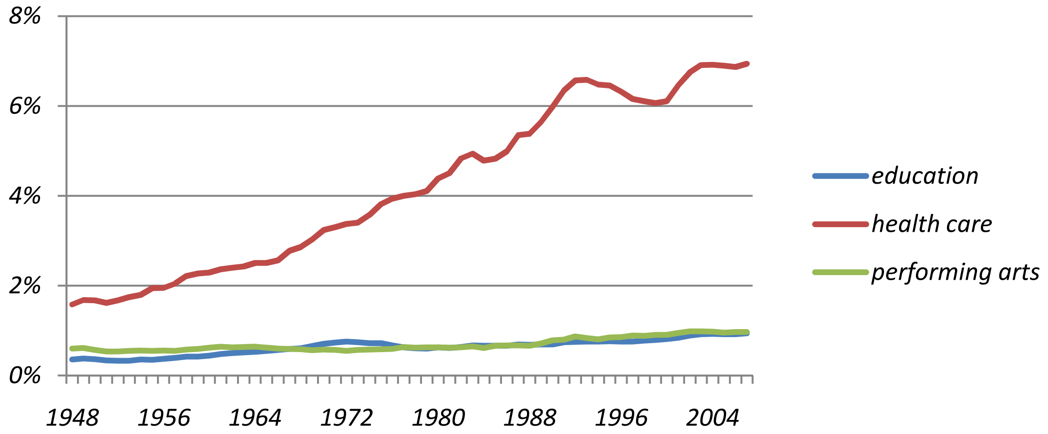
Taking both figures into account we conclude that the real transit sector ratio of the entire economy declines and the nominal ratio remains constant. This implies that, if we only take the transit sector into account, the marginal tax rate does not have to rise, therefore welfare losses will not appear and the peak of the Laffer curve will not exceeded. In addition, in figure 15 we calculate the ratio of labor engaged in the transit sector relative to the amount of labor in the whole economy. This ratio is, as expected, constant.

Figure 15: Ratio on the entire labor force I



We have seen that in the transit sector alone there are no future affordability problems expected. The picture may however change if all possible stagnant sectors, financed through the publicly, are taken into account. We therefore calculate the same three figures and include the stagnant sectors of education, health care and performing arts.

Figure 16: Ratio on the nominal GDP II



The nominal share of these sectors increases strongly for healthcare and moderately for the two other sectors. Hence, individuals spend an increasing amount of their total income on such services. The real share of the GDP is constant for education and performing arts and increasing for healthcare as depicted in figure 17.

Figure 17: Ratio on the real GDP II

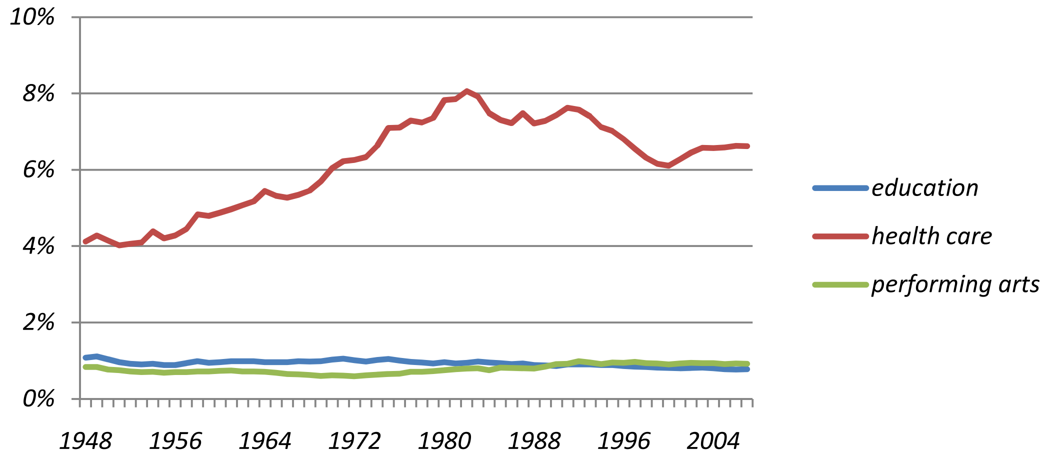
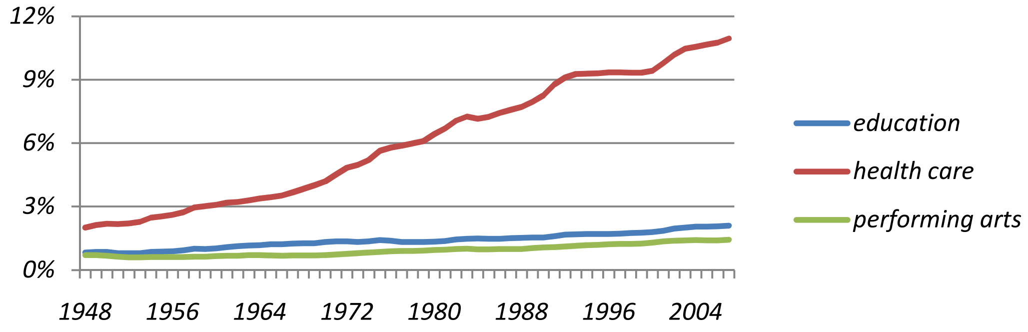


Figure 18: Ratio on the entire labor force II



Similarly, the development of labor share shows a similar trend. The demand of all stagnant sectors grows in line with the demand of the entire economy. This leads to increasing relative expenses for stagnant services and an increasing marginal tax rate if they are financed through taxes. This in turn may lead to welfare losses.

4.2 Consequences for the local transit and for the economy - possible solutions

Despite the fact that local transit services are still affordable, due to the existence of more than one stagnant sector, subsidies will be limited or even reduced over time. It is therefore conceivable that decision makers may prioritize some public services. Decreasing subsidies for the public transport sector are therefore a real option. Bearing this in mind, it is important for public transport companies to achieve a higher degree of cost recovery. In the following we name two possible solutions, without trying to go into too much detail, since, at this point, further research is necessary. The first is to increase the productivity to alleviate a part of the continuing rise in cost. New technologies should be developed and adopted and the private sector should play a larger role. Long term measures like city planning should also be adopted to make the local transit more efficient in the future. (see Westholm, 1999) Another way to combat Baumol's cost disease would be the introduction of appropriate pricing schemes. Ramsey pricing may be a good means of maximizing revenue from passengers, decoupling the financial basis of public transport from public budget.

5. Conclusions

In this paper we tested the existence of Baumols cost disease in the local transit sector and its possible political implications. According to Baumol's hypothesis, the economy can be roughly divided into two sectors - a progressive and a stagnant one. The basic idea behind the concept of cost disease states that industries which are affected by the disease show slower productivity growth than the rest of the economy. Consequently, the respective unit costs increase at higher rates. Consequently public funding is put under pressure due to the rising costs in stagnant sectors which are mainly provided by public entities.

To that end we compared the development of public transport in the USA and Germany. Using data envelopment analysis we showed that in both cases total factor productivity for the local transit sector is comparable and is below the productivity of the whole economy. These results are confirmed by partial productivity measures and by cost data for specific companies, namely those responsible for solely running bus operations. We can therefore only confirm the hypothesis of the existence of the cost disease in this sector and reject it for companies with mixed operations.

Subsequently, we have attempted to determine whether the existence of the cost disease leads to future financing problems in local transit. Referring to Bradford (1969), only a rising demand for local transit services leads to financial problems in the public budget, due to rising marginal tax rates. Consequently, it might be impossible to continue financing an increase in local transit services through taxes. However, we can show that real local transit demand - defined as the ratio of local transit Gross Product Originating (GPO) to the Gross Domestic Product (GDP) - has declined over time. This finding leads to the consequence that an economy can finance public transit services via taxes. However, taking all other (publicly owned) stagnant sectors into account we observed an increasing nominal share and a constant real share of the GDP, a fact which means these sectors, as a whole, cannot constantly be funded out of the public budget. The probability therefore that subsidies also for local transit may decrease in the future is still present, especially if policy makers are forced (due to the necessity of cutting subsidies) to prioritize financing of certain other public services.

Finally, we name some possible solutions for an economically sustainable local transit sector, mainly related to the introduction of appropriate pricing schemes and future city planning instruments.

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