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The estimated income elasticity of demand for public consumption expenditure of 0.85 suggests that Wagner's law is not confirmed. In contrast, price-inelastic demand combined with a strong increase in the prices of public services relative to private goods suggest that Baumol's cost disease is at work.

A counterfactual exercise shows that in the absence of the rise in the relative price of publicly provided goods, current public consumption would equal 15.98% of GDP instead of the actually observed 19.92%. We further confirm the main observations using a cointegration model.

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Wagner's law, Baumol's cost disease, Austria, public consumption

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Growth of public consumption in Austria: testing Wagner's law and Baumol's cost disease

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Abstract

In this paper, we analyze the development of public consumption expenditure in Austria starting in the 1940s. We focus our attention on two hypotheses as to why public consumption expenditure has been constantly increasing: Wagner's law and Baumol's cost disease. The estimated income elasticity of demand for public consumption expenditure of 0.85 suggests that Wagner's law is not confirmed. In contrast, price-inelastic demand combined with a strong increase in the prices of public services relative to private goods suggest that Baumol's cost disease is at work. A counterfactual exercise shows that in the absence of the rise in the relative price of publicly provided goods, current public consumption would equal 15.98% of GDP instead of the actually observed 19.92%. We further confirm the main observations using a cointegration model.

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JEL classification: H11, H50

1. The problem: explaining the growth of public consumption

Diverse theories and hypotheses have tried to find an explanation for an empirical regularity found in many countries, namely that the size of the state tends to increase over time.

At first sight, this regularity also seems to hold for Austria, as illustrated in Figure 1. Public consumption measured as a fraction of GDP has been rising since the end of World War II at a pace similar to real per capita income. Yet, as will be shown shortly, this relationship might be spurious, and other factors might provide a more convincing explanation for the growing size of the state.

At the end of the 19th century, Adolph Wagner noticed a positive correlation between economic development and public spending: Wagner concluded that the public sector had increased both in relative and absolute terms with an increase in the size of the economy (Wagner, 1883). He argued that this could be due to the industrialization process and gave three reasons that support the hypothesis:

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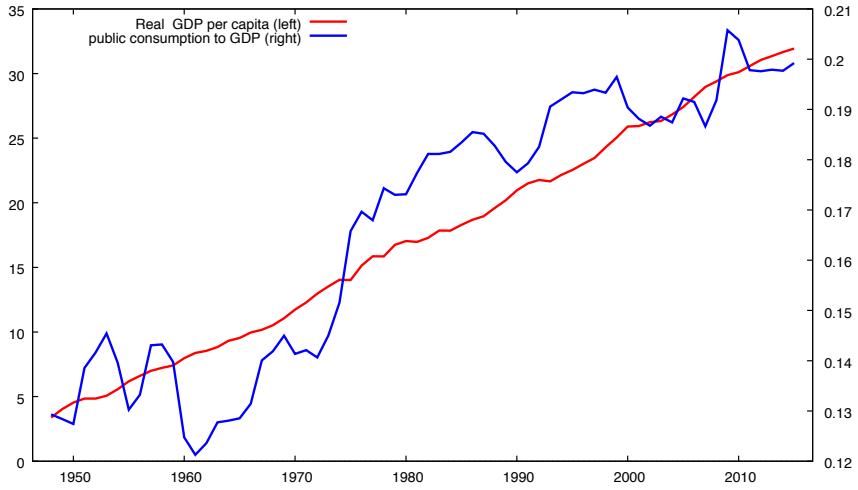
Figure 1: Development of nominal public consumption to GDP (blue) and real income per capita (red)



- Administration and regulation: through industrialization, the cost of domestic protection rises significantly. Additionally, urbanization and, hence, a more concentrated population causes more social friction, which necessitates new forms of public control.

- Welfare services: typical government services such as defence, education or culture are more efficiently controlled by the government than privately.

- Large-scale projects: public projects that necessitate huge investments (such as infrastructure investments) could hardly be provided by private investors.

Government sectors that necessitate large expenditure such as education, health or public infrastructure bring about more chances and welfare improvement for every person in a country independently of his or her social background and residence. Following Aschauer (1989) these expenditures significantly improve aggregate productivity in the economy. Aschauer (1989) compares different types of public expenditures and concludes that infrastructure investment involves the highest rise in productivity. Nevertheless, the role of the public sector is often criticized because of its lower efficiency compared to the private sector.

Based on the empirical methods used, estimations of Wagner's law in the literature can be divided into two categories (see, e.g., Sideris, 2007): the studies conducted until the mid-1990s are mainly based on the assumption of stationary data series and are estimated as simple OLS models (see, e.g., Ram, 1987; Courakis et al., 1993), while from the mid-1990s onwards, the studies test for cointegration between government expenditure and national income (see, e.g., Magazzino,

2012), and occasionally also population.

Peacock and Scott (2000) argue that authors estimating Wagner's law should not vie with one other in the specification of a more sophisticated econometric method, but should rather focus on the correctness of the specification. They find that estimation differences might arise from the model specifications that differ from Wagner's original definition. Their criticism of the models used can be summarized as follows:

1. Meaning of government activity: Wagner originally included the public finances of central and local governments as well as public enterprises. The privatization of state firms also significantly affects the size of a government.
2. Econometric "over-kill": Wagner argues that the speed of the increase might differ from one government sector to another, which might affect the statistical analysis.
3. Time period of the analysis: the law was not designed originally to make predictions. Wagner realized that there must be an upper limit to the proportion of government growth that should be determined by the resistance of taxpayers arising from the high tax burden affecting their consumption.

In short, the discussion of Wagner's hypothesis is far from being resolved. For the case of Austria, one approach by Neck and Getzner (2011) found no confirmation of the thesis whatsoever. Unlike Neck and Getzner (2011), however, we focus only on public consumption in this work.

Another explanation for the increasing size of the state is "Baumol's cost disease". In his classic article, Baumol (1967) suggests that industrialized economies contain both progressive and nonprogressive sectors. The progressive sectors are typically capital intensive in nature and subject to many innovations over time, which raises labor productivity. While the wage rate tends to rise in the progressive industries over time, the unit costs remain fairly flat because of the proportional increases in labor productivity. In contrast, nonprogressive industries, such as medical care and education, are fairly labor intensive and relatively void of productivity-enhancing innovations. Consequently, labor productivity tends to be relatively stagnant in these industries. Nevertheless, wages tend to rise in all sectors in a similar fashion, as otherwise nonprogressive sectors would not find suitable workers. Thus, given the rise in wages but relatively constant productivity due to stagnant technologies, unit costs are driven up in the nonprogressive industries over time. This variant of Baumol's hypothesis is strongly supported by data, showing that sectors with low productivity growth experience, percentage point for percentage point, higher growth in relative prices (see Nordhaus, 2008, for an overview of the literature).

It should be emphasized that productivity growth in the provision of government services has not been zero or negligible. There have been efficiency gains in the government sector. But the important point for Baumol's cost disease is not that productivity growth in that sector is zero, but rather that it is simply less than the rate of productivity growth in other sectors.

In this paper, we look at the development of final public consumption expenditure in Austria. According to ESA 2010, final consumption expenditure by the government includes two categories of expenditures:

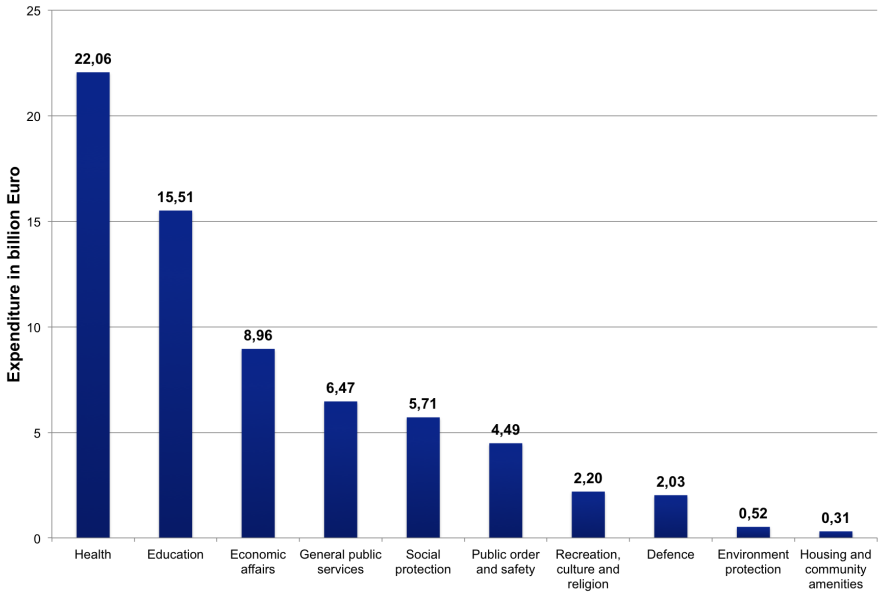
1. the value of goods and services produced by the general government itself other than own-account capital formation, market output, and payments for non-market output;
2. purchases by the general government of goods and services produced by market producers that are supplied to households, without any transformation, as social transfers in kind.

Practically speaking, the two major expenditures that constitute government final consumption are intermediate consumption and the compensation of public employees. The first component is the public demand for products and services, which are subsequently used to provide public goods and services, and the second component is the sum of wages of all public employees. Public consumption expenditure can also be categorized according to function (COFOG classification). Figure 2 presents the components of public consumption according to function in 2015. Overall expenditure equaled 68.24 billion euros. As Figure 2 shows, three major posts, healthcare, education, and general services, make up over 44 billion euros, or 64.5% of the total consumption expenditure. Even more striking is the relationship for public wages: out of 36.64 billion euros, healthcare, education, and general services make up 25 billion, or 68%.

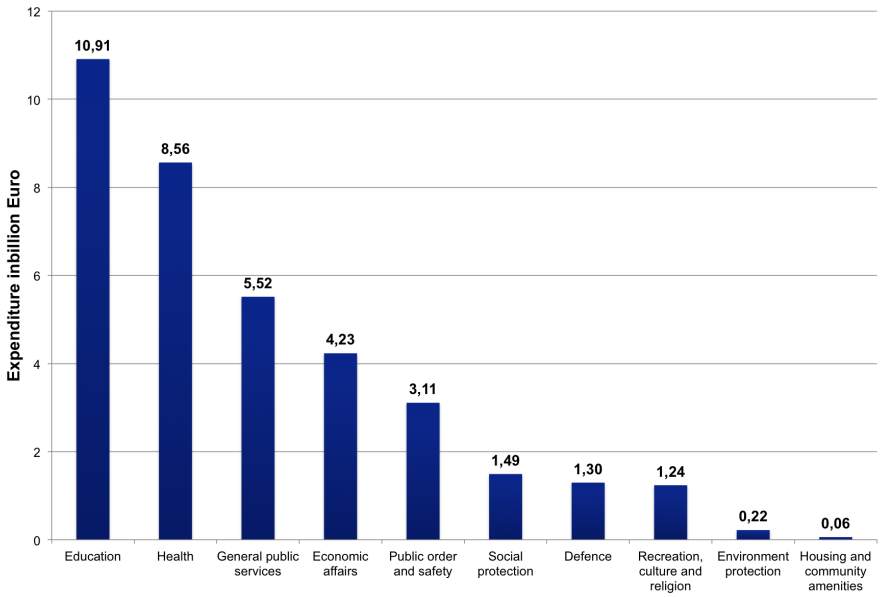
In line with Baumol's hypothesis, the reason for the increasing costs in the provision of public services is wages, which rise faster than productivity. In fact, public-sector wages in Austria have been growing at a *higher* rate than wages in the private sector since 1954, as illustrated in Figure 3. Figure 3 shows the index of average wages in the public and private sectors, calculated as the total wage bill divided by employment. Indeed, the wages in the public sector have not only been keeping up with private wages, but have potentially also contributed to the increasing size of the government.

Increasing wages combined with slowly growing productivity lead to decreasing output, as a result increasing the price of products in the nonprogressive sectors relative to other sectors. This relation can be visualized by looking at the relative prices in the basket of goods provided by the state versus the basket of goods provided by the private sector. Since the demand for medical

Figure 2: Public consumption in 2015 for COFOG categories

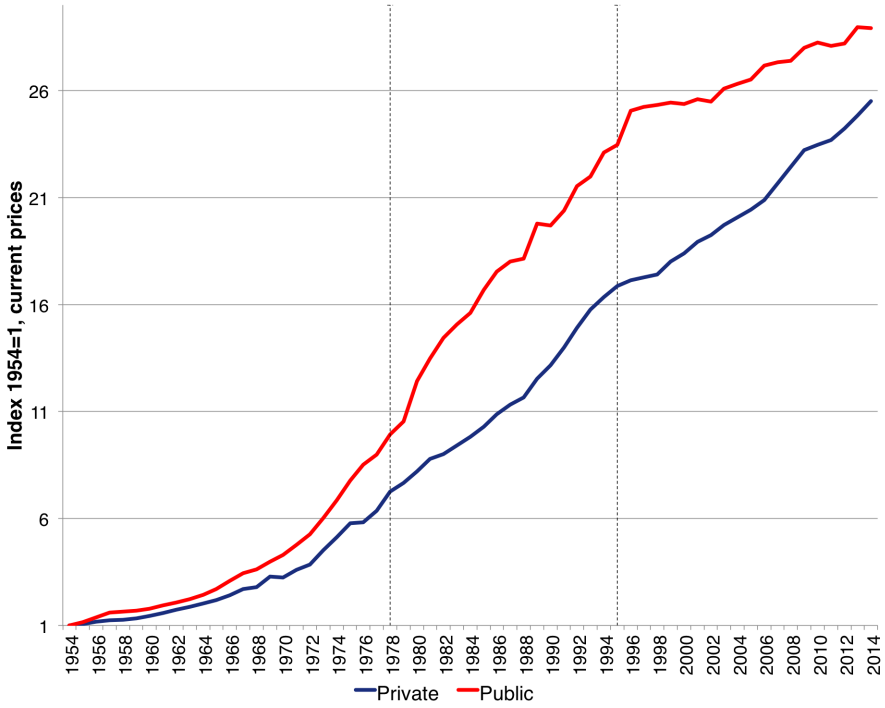


(a) Final government consumption



(b) Compensation of public employees

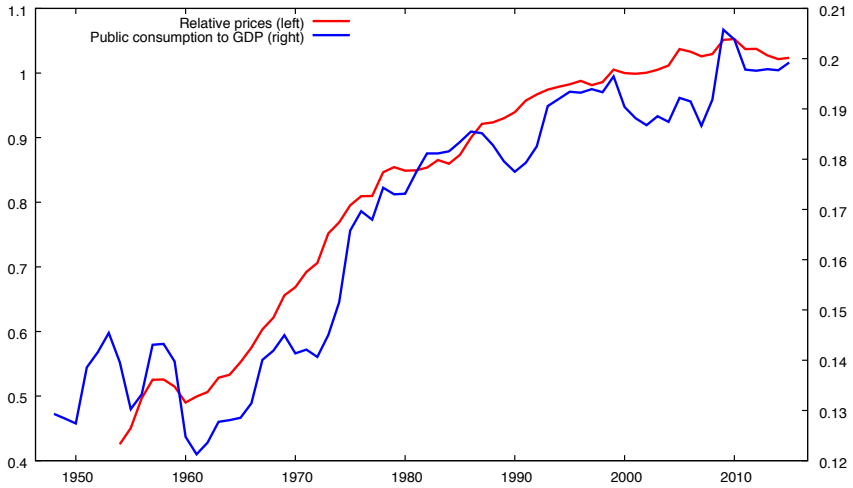
Figure 3: Development of average wages



Source: WIFO Statistical Yearbooks 1954-1994, Main Association of Austrian Social Security Institutions, Statistics Austria, the authors' own calculations.
Vertical lines denote breaks in the series: exclusion of the OeBB (Austrian Federal Railways) from the public-sector statistics starting in 1978 and the change to ESA1995 accounting in 1995.

care, education, and general public services is relatively price inelastic, i.e., increasing prices do not correspond to a one-to-one decrease in output, the price effect leads to increasing overall expenditure. The development of the relative prices between private and public consumption and public consumption to GDP is presented in Figure 4. It is evident from the figure that the relationship between relative prices and the size of the state might be a more convincing one than the relationship between income and public consumption.

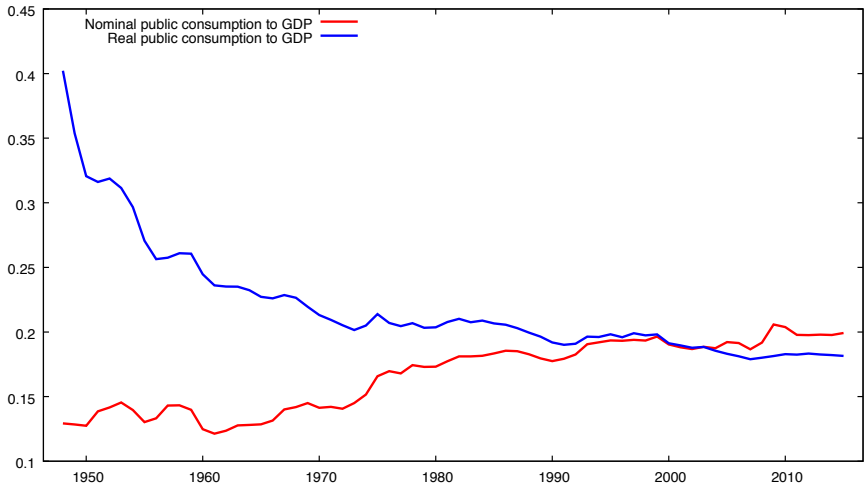
Figure 4: Development of nominal public consumption to GDP (blue) and relative prices (red)



Given the information about the development of public and private price levels, we can analyze whether an increase in public consumption is due to increasing output or due to price effects. Figure 5 presents the development of nominal and real public consumption expenditure to GDP. Real expenditure has been constructed by deflating the expenditure for public consumption with prices for public consumption and by deflating the nominal GDP with the general price deflator. It is clear that real output has not increased much since the 1970s, and in fact a mild decrease can be observed. In other words, despite the fact that public consumption expenditure has increased by some 7 percentage points since the 1940s, the actual output of the public sector has been constantly decreasing. It seems that increasing expenditures are driven by the price effects, a hypothesis which will be tested formally further on.

This paper is structured as follows. In the next section, we present the theoretical model used and the data. Section 3 presents the main results of the analysis. Section 4 provides an alternative empirical specification using a cointegration model, which tests the robustness of the results. Section 5 concludes the paper.

Figure 5: Development of nominal (red) and real (blue) public consumption to GDP



2. Data and the model

Given the determinants of increasing public consumption, it is possible to estimate demand for public goods with a simple model. A median voter has preferences for the consumption of public goods of the form

$$q = As^{\eta}y^{\delta}m^{\phi}, \tag{1}$$

where q is the amount of public good, s is the price to be paid, y is the income and m is the voter's political ideology. In this equation, η and δ can be directly interpreted as price and income elasticities of demand for q respectively. Following Borcherding (1985), we can operationalize q as

$$q = X/N^{\alpha}, \tag{2}$$

where X is the overall production of the good, N is the size of the population and $\alpha \in (0, 1)$ measures the degree of "publicness", whereby 0 means q is a pure public good and 1 that it is purely private. The subjective price of the public good faced by the individual, s, is a result of the marginal cost of production and the tax burden faced by that individual. The tax burden is an increasing function of the tax rate but a decreasing of the population as the individual's share in the financing of public goods decreases:

$$s = tpN^{\alpha}, \tag{3}$$

where t is the percentage share in the cost of public goods borne by the median voter defined as $\dot{t} = \dot{T} - \dot{N}$ where T is the tax ratio and p is the marginal cost of production. Manipulating the formula (see Borcherding, 1985, for more details) and expressing the overall formula in terms of growth rates yields

$$\dot{g} = (\eta + 1)\dot{p} + (\delta - 1)\dot{y} + (\alpha\eta + \alpha - 1)\dot{N} + \eta\dot{t} + \delta k + \phi\dot{m}, \tag{4}$$

where $\dot{()}$ denotes the annual growth, and k is the ratio of median to mean income. g is the ratio of public consumption to GDP, p is the relative price of public to private consumption and m is a dummy for periods with a prime minister from the Social Democratic party. Due to the lack of data for the whole analyzed period, we can only estimate the equation without the mean/median ratio k. The population variable reflects (dis)economies of scale so that the sign of the overall effect is *a priori* unclear. In terms of the real income of the population, we follow the suggestion of Peltzman (1980), who agrues that permanent rather than transitory income should be considered, and we, thus, use a 5-year moving average of the income variable.

To estimate this equation we first test the stationarity of the series, and conclude that all variables are either I(1) or I(0), and their growth rates are stationary. Details are given in Table 1.

Table 1: Unit root tests of the series (p-values)

Variable[a]	ADF		KPSS	
	const.	const. & trend[b]	const.	const. & trend
$YPOPR$	0.962	0.19***	0.01	0.001
RP	0.02	0.99	0.01	0.01
G	0.75	0.26**	0.01	0.18
POP	0.99	0.97	0.01	0.04

[a]The number of lags chosen according to Akaike's information criterion
[b]In DF regressions, trend significant at * 0.1, ** 0.05 and *** 0.01 level

Parameter restrictions present in Equation 4 require, however, that the equation is estimated using non-linear least squares, rather than ordinary least squares, while the OLS estimates serve as initial values for the estimation. To account for unobservables, we include the constant in the regression, and to account for autocorrelation of the standard errors, two lags of the dependent variable also enter the equation.

3. Results

The results of the estimation are presented in Table 2 which gives an overview of the estimated parameters.

Table 2: Non-linear least squares estimation of Equation 4

Parameter	Estimate	S.E.	t-Stat	p-value
α	0.916948	1.39333	0.6581	0.5131
η	-0.221079	0.102897	-2.149	0.0364**
δ	0.854514	0.186917	4.572	3.11e-05***
ϕ	0.0110503	0.00667473	1.656	0.1040

Observations: 1956-2015; Durbin-Watson statistic 2.021808; Adjusted R^2 0.536815.
Additional variables: const, ΔG_{t-1} and ΔG_{t-2}; Significance: * 0.1, ** 0.05, *** 0.01

α equal to 0.92 denotes a low degree of publicness for public goods and it is consistent with previous estimates, for example by Borcherding and Deacon (1972) and Bergstrom and Goodman (1973) who find $\alpha \approx 1$. The price elasticity of demand is estimated at -0.22, which is slightly lower than the values otherwise found in the literature at -0.4 (Borcherding and Deacon, 1972). Finally, the income elasticity of demand, δ=0.85, lies within the range of previous estimates, falling between 0.75 and 1, whereas a lower value of 0.75 has been found for temporary income levels and is, thus, possibly underestimated, as pointed out by Friedman (1957).

The annual growth rate of public consumption to GDP ratio equals 0.0069687, or 0.7% per year, whereby it can be divided into periods with Social Democratic prime ministers with a growth rate of 0.009892, that is almost 1% p.a. and Christian Democratic ones for whom the growth rate equaled 0.003138, that is 0.3% per year.

Table 3: Contributions to the growth of public consumption

Variable	Value	Average growth	Contribution abs	Constribution as % of $\dot{g}$
p	0.778921	0.014762	0.011498	164.9%
y	-0.145486	0.034559	-0.005027	-72.1%
N	-0.285769	0.003234	-0.000924	-13.2%
t	0.221079	0.002977	0.000658	9.4%
$p+y+N+t$			0.004889	89%
m	0.0110503	0.55882	0.0067541	

Given the estimated low price elasticity of demand for public goods, the overall contribution of prices to the growth in public consumption is high. Without other effects, the overall growth rate of public consumption would have equalled 1.15% per year, that is 164.9% of the actually observed

growth. On the other hand, income elasticity of demand below one reduces the growth in public consumption resulting from the growth in national income. We do not, thus, find confirmation of Wagner's hypothesis that the income elasticity of demand for public goods is greater than one. Given the growth in real income of 3.45% per year in the analyzed period, changes in income contribute to -72.2% of the growth rate of public consumption. Population growth contributed negatively to the growth in public consumption due to the existence of mild sharing economies (α equals 0.91). Overall, population change contributed to -13.2% of the overall growth. Finally, tax sharing is a result of increasing taxation and changing population size: the overall effect of these two variables is positive, suggesting that the tax-sharing effect due to the increasing population has more than offset the increased cost due to the higher ratio of taxes to GDP, and equals 9.4%. Without the political dummy, these four parameters explain about 89% of the overall growth in public consumption in the analyzed period, whereby the highest contribution by far comes from the effect of prices.

Figure 6: Actual and predicted growth rates of public consumption

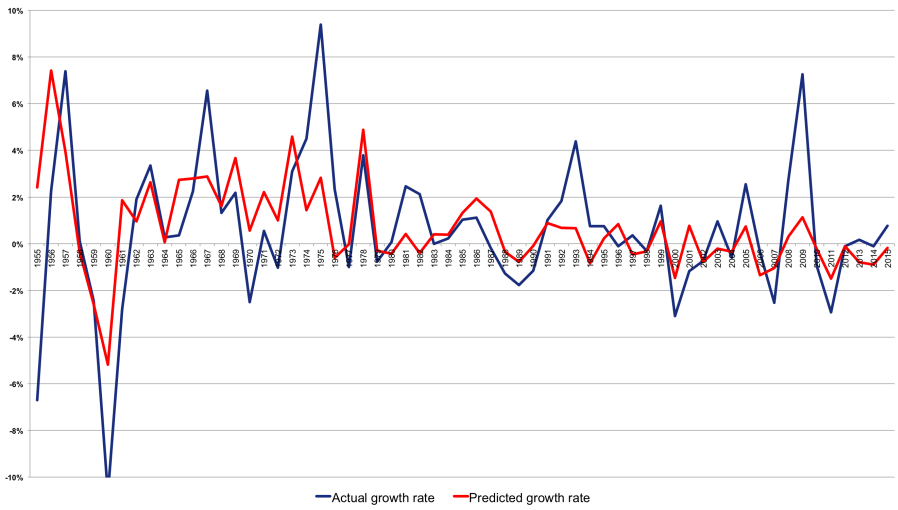
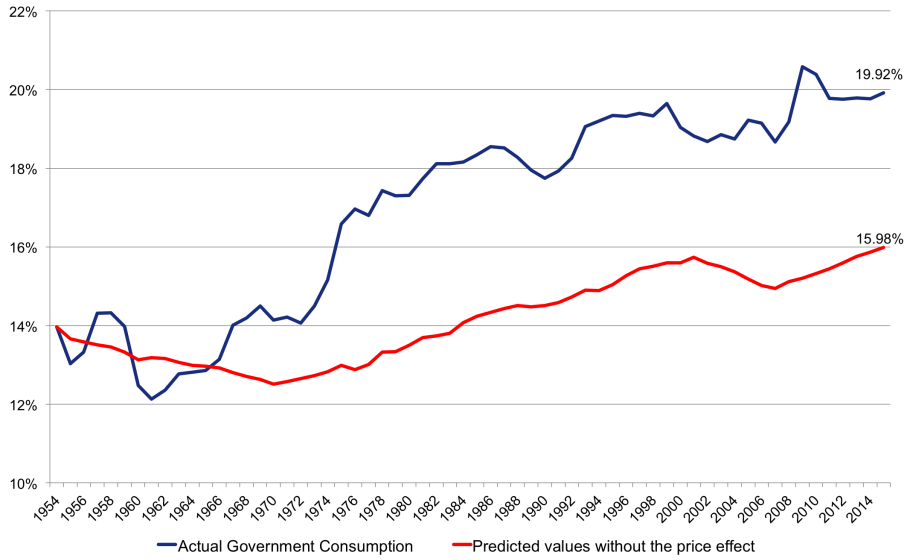


Figure 6 presents the actual and predicted growth rates of public consumption. The predicted values correspond well to the actual ones, except for a one-time effect in 2009, a sharp increase resulting from the global economic crisis.

Figure 7 shows the growth in public consumption using the predicted values of public consumption without the contribution of prices. If inflation in the public sector had developed in a similar fashion to the private sector, public consumption in 2015 would have equaled 15.98% of GDP instead of the actually observed 19.92%. The difference of 3.94% of GDP in 2015 equaled

Figure 7: Predicted government consumption



about 13.4 billion euros of additional government expenditure due to the increasing prices of public goods.

4. An alternative specification using a cointegration model

As an additional test of the hypotheses, we test the data with an alternative approach, namely using a cointegration analysis, which is data-driven and, unlike the model presented above, abstracts from any theoretical restrictions. Since the time series of relative prices between the public and private sector might be stationary, we need to approach the analysis of a long-run relationship between public consumption and relative prices using the approach developed by Pesaran et al. (2001). We can estimate an unrestricted error correction model of the form

$$\Delta G_t = \beta_0 + \sum_{j=1}^{p} \lambda_j \Delta G_{t-j} + \sum_{j=0}^{q} \delta_j \Delta RP_{t-j} + \cdots + \theta_0 G_{t-1} + \theta_1 YPOPR_{t-1} + \theta_2 RP_{t-1} + \cdots + \epsilon_t. \tag{5}$$

Pesaran et al.'s approach involves testing whether $\theta_0 = \theta_1 = \theta_2 = 0$ and comparing the F-statistic obtained to the critical values in Pesaran et al. (2001). If we can reject the joint insignificance, we can conclude that a long-run relationship exists, and we can proceed with the estimation of a restricted error correction model. The unrestricted error correction model is given

Table 4: Unrestricted error correction model for ΔG

	Coefficient	Std. Error	t-ratio	p-value
G_{t-1}	−0.320388	0.0785749	−4.0775	0.0002
$YPOPR_{t-1}$	7.93309e–05	0.000274425	0.2891	0.7738
RP_{t-1}	0.0281609	0.0143932	1.9565	0.0564
Social-Dem	0.00155642	0.00126826	1.2272	0.2259
ΔDebt	0.0978227	0.0363347	2.6923	0.0098
ΔUQ	0.00365601	0.00116751	3.1314	0.0030
EU	0.00329289	0.00188946	1.7428	0.0879
ΔRP	0.100471	0.0505629	1.9871	0.0528
ΔYPOPR	−0.00288874	0.00206472	−1.3991	0.1684
$\Delta YPOPR_{t-1}$	0.00119583	0.00207517	0.5763	0.5672
ΔG_{t-1}	0.0349413	0.160055	0.2183	0.8281
const	0.0271835	0.00678747	4.0050	0.0002

Table 5: Test results

Test	F-value	I(0)[a]	I(1)	Sign.
$\theta_0 = \theta_1 = \theta_2 = 0$	7.548	4.13	5.16	97.5%
$\theta_0 = \theta_2 = 0$	9.966	5.43	6.42	99%

[a]Critical values of Pesaran et al. (2001) for 95% bounds test with restricted constant and no deterministic trend.

in Table 4. Table 5 presents the test results for two hypotheses: a long-run relationship between G, RP, and $YPOPR$ and between G and RP only. Other variables potentially affecting the changes in public consumption are added as regressors. Lags for the right-hand-side variables have been chosen according to the usual information criteria.

Reading the results of Table 5 we can conclude that although the variables of interest have different orders of integration, there is strong evidence in favor of the existence of a long-run relationship in levels between (nominal) public consumption to GDP, relative prices, and real income per capita. We proceed with the estimation of a restricted error correction model of the form

$$\Delta G_t = \sum_{j=1}^{p} \lambda_j \Delta G_{t-j} + \sum_{j=0}^{q} \delta_j \Delta RP_{t-j} + \cdots - \theta(G_{t-1} - \theta_1^* YPOPR_{t-1} - \theta_2^* RP_{t-1} - \beta_0^*) + \cdots + \epsilon_t, \quad (6)$$

which will be estimated using non-linear least squares. θ corresponds to the error-correction term, and the coefficient on G_{t-1} is restricted to equal 1. Table 6 presents the results.

As we can observe in Table 6, the error correction term θ is significant and has the expected

Table 6: Restricted error correction model for ΔG

	Coefficient	Std. Error	t-ratio	p-value
θ	0.305965	0.0721441	4.241	0.0001
const	0.0890802	0.0123398	7.219	3.40e-09
RP_{t-1}	0.0793721	0.0339681	2.337	0.0237
YPOPR_{t-1}	0.000378586	0.000960716	0.3941	0.6953
G_{t-1}	1.	.	.	.
ΔYPOPR	-0.00296053	0.00196840	-1.504	0.1391
ΔYPOPR_{t-1}	0.000882481	0.00197661	0.4465	0.6573
ΔUQ	0.00376833	0.00114564	3.289	0.0019
ΔG_{t-1}	-0.0554624	0.138323	-0.4010	0.6902
ΔDebt	0.0983320	0.0362811	2.710	0.0093
ΔRP	0.115773	0.0452800	2.557	0.0138
EU	0.00333963	0.00201177	1.660	0.1034
Social-Dem	0.00173881	0.00131272	1.325	0.1916

negative sign. The long-run relationship has the form

$$G_t = 0.079RP_t - 0.001YPOPR_t + 0.089,$$

whereby $YPOPR$ is not significantly different from zero. In contrast, there is a strong and significant relationship in levels between the percentage of GDP spent on public consumption and the relative price of public and private consumptions. The latter findings suggest, as expected from a visual inspection of the data, that the level of public consumption is determined by the development of prices for public consumption but is less dependent on the increasing real income per capita. In short, increasing expenditure on public consumption is driven less by the demand side but rather results from the potential inefficiency of the public provision of goods and services. Similarly, in the short run, positive changes in the relative prices correlate with positive changes in public consumption.

As for the other variables, changes in the unemployment rate correlate positively with changes in the public consumption to GDP ratio as they reflect short-run changes along the business cycle. Changes in the level of public debt also correlate positively with increasing public consumption, which is likely to be a reverse causation phenomenon but also reflects changes along the business cycle. Other variables do not correlate significantly with changes in public consumption.

5. Conclusion

In this paper, we analyzed two complementary theories which aim to explain the growth of the public sector over time, the one focusing on the role of demand for public services which, as formulated by Wagner, should grow over time as the population becomes richer and the other stressing the role of the increasing costs of production of public goods, resulting from increasing wages in the public sector without accompanying increases in the productivity of the public sector. We show that the latter hypothesis is confirmed by the data for Austria and that demand cannot explain the growing nominal public consumption expenditure since the 1940s.

For many, Baumol's cost disease is an inherent feature of labor-intensive sectors of the economy and as such cannot be counteracted. It is, indeed, quite difficult to increase productivity in the performance of a string quartet playing Beethoven, following Baumol's original example. However, the other problem is that Baumol's cost disease is often presented in relation to sectors that *cannot* increase productivity, but it is often applied to sectors that *will not*. This holds true for many goods and services typically provided by the state, including general administration.

Public sector administration could be performed much more efficiently, as though it were not a "monopoly": services of general administration are no different from market-oriented financial or professional services, and they could certainly make more use of access to new technologies and digitalization. Moreover, recent research (see, e.g., Borge et al., 2017) suggests that Baumol's disease in public administration is driven by political fragmentation and the necessity to accommodate the interests of diverse bureaucrats belonging to diverse political groups, an issue of great relevance in Austria. Moreover, a more efficient federal system, allowing for fiscal competition between local and regional units, could be of help in reducing the cost disease, as local and regional governments facing tax autonomy rather than transfers from the higher-level units would find it more difficult to inefficiently expand their budgets for employment in public adminstration (see also Christl and Köppl-Turyna, 2017).

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