Productivity growth in Europe: is Baumol cost disease an explanation?[1]

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Abstract

This paper examines the existence and extent to which the "Baumol cost disease" could have affected aggregate growth in Europe. This would arise if lower productivity sectors began to account for an increasing share of output which would then put downward pressure on the prospective growth rate of aggregate productivity (Baumol, 1967 & 2012). This has reemerged as a potential issue of policy concern in the light of an aging population structure increasing demand for comparatively lower-productivity services such as health and social care. Our results show that although there is some evidence of the patterns suggested by Baumol, particularly in relation to price developments in lower productivity sectors, that these have not (to date) been substantial enough to generate a drag on overall productivity growth across Europe.

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1. Introduction

As the population structure ages, there is likely to be increasing demand for health and care services in countries across Europe. These are typically more labour-intensive sectors with rates of productivity growth that have tended to be on the lower end of the sectoral spread. An issue of potential macroeconomic consequence is that if these lower productivity sectors account for an increasing share of output driven by population aging, this could put downward pressure on the prospective growth rate of aggregate productivity. This compositional effect of differing sectoral productivity growth rates was described by Baumol (1967, 2012) as being driven by lower productivity growth sectors linking wages to overall productivity growth rather than that of their own sector. While this phenomenon, often referred to as "Baumol's disease", was formulated across all economic sectors, it has particular relevance for the public sector where a number of labour-intensive services such as health, education and social care are concentrated.

For example, healthcare is a labour-intensive industry where productivity gains are hard to achieve because many tasks require personal interaction and expertise, such as patient diagnosis and care. As wages in more productive sectors rise, healthcare workers' salaries must also increase to remain competitive, even though their productivity may not have increased to the same degree. This results in escalating healthcare costs, consuming larger portions of household and government budgets (Lorenzoni, de Biase and Dougherty, 2024). Whether this effect is present in the healthcare sector is particularly relevant, as healthcare is set to consume a greater share of output in European countries due to population ageing.

Examining sector-level data in the United States over a fifty-year time period (1948-2001), Nordhaus (2008) found some evidence that changes in spending shares were a contributor to slower economic growth. His estimate of the Baumol growth disease for this period was that changes in sector composition had lowered annual aggregate productivity growth by slightly more than one-half of percentage point. Previous evidence in Europe from Hartwig (2011) found that there was mixed evidence for several of the specific hypotheses that Nordhaus (2008) had developed to test for the presence of Baumol disease. However, price dynamics in lower productivity sectors supported one of the main propositions. Any drag that this placed on aggregate productivity growth was however relatively modest.

In this paper, we revisit this issue to examine the existence and extent to which the Baumol cost disease could have affected aggregate growth in Europe. Broadly following the Nordhaus (2008) research on the US, the approach examines sectoral dynamics to estimate how the changing composition of sectors relates to overall growth. To do this, we use comparable data across the EU from the EU KLEMS database. Our results show some evidence of the patterns suggested by Baumol. However, these dynamics have not been substantial enough to generate a drag on overall productivity growth across Europe. Our strongest result is that prices tend to increase more rapidly in stagnant sectors, a finding of particular relevance to service-oriented industries such as healthcare. However, this has not resulted in reallocation of labour to lower productivity sectors, but rather the reverse, with real output shares of highly productive industries generally expanding at a faster pace than those of less productive industries. The continued growth of the more productive sectors therefore has to date offset the potential adverse implications of Baumol's cost disease. These findings are similar to those of earlier work on Baumol's disease in Europe by Hartwig (2011), who also found growing productive sectors dampened the potential negative effect of cost disease on aggregate economic growth.

The paper is organised as follows: Section 2 examines the existing literature on Baumol's disease. Section 3 outlines the methodology. Section 4 describes the data and presents some descriptive evidence. Section 5 presents the evidence on the presence of Baumol's disease across European sectors and Section 6 examines if sectoral composition has impacted aggregate productivity growth. Section 7 provides an overview of the policy implications of these results.

2. Existing evidence

Baumol (1967, 2012) described a pattern whereby the cost base of sectors (primarily services) would increase despite stagnant productivity rather than follow the classical economic prediction that wages would relate to marginal productivity. He hypothesised that this pattern was driven by pressure for wages in the less productive sectors to keep pace with more productive sectors. He further argued that this could lead to a larger portion of the workforce being employed in these sectors as productivity improvements reduce the need for labour input in other sectors. In other words, Baumol presented a potential path for sectoral structure where service sectors could come to dominate the economy, not necessarily due to an increase in demand, but because of the rising costs associated with them.

In order to estimate the presence of Baumol's disease, Nordhaus (2008) examined changes in sectoral structure in the United States between 1948 and 2001. He developed a number of testable hypotheses based on the logic underlying Baumol's arguments and found that the evidence was largely in support of the existence of Baumol's disease in the US. Nordhaus (2008) empirically tests each of Baumol's proposed "diseases" using U.S. industry-level data for 1948–2001.

Nordhaus's first major result confirms the cost disease: industries with lower productivity growth experience significantly higher price growth. The second hypothesis, that real output shares remain constant across sectors, is rejected. Instead, real output grows more rapidly in high-productivity sectors, implying that demand dynamics and output expansion counterbalance Baumol's stagnation mechanism. For nominal output shares, the estimated coefficients are weakly negative, suggesting some tendency for nominal output to grow faster in slow-productivity sectors (as Baumol predicted), but not strongly enough to constitute a major "shift" in economic structure.

Examining an aggregate decomposition shows that structural change — i.e., shifts in nominal output shares toward slower-productivity sectors — has exerted a "modest drag" on U.S. aggregate productivity growth. The estimated impact is around 0.05 percentage points per year. Overall, Nordhaus (2008) concludes that while Baumol's cost disease exists, the "growth disease" at the macroeconomic level is mild. The U.S. economy, during the period studied (1948–2001), exhibited strong compensatory dynamics: rapid growth in productive sectors offset the drag from stagnant ones.

Hartwig (2011) follows the Nordhaus (2008) methodology and applies it to sector-level data (EU-KLEMS) for ten European countries over the period 1970 to 2005. He finds largely comparable results in terms of disproportionate cost growth and changes in output shares for sectors with lower productivity growth rates. Likewise, in terms of the effect of compositional changes on overall productivity growth, he finds that industries with poorer productivity performances increase in their weight of aggregate productivity over time, thereby pulling down the rate of aggregate productivity growth, albeit slightly. Both the evidence from the US and from the EU in previous decades indicate that structural change has had an impact of dampening overall productivity growth.

3. Methodology for identifying a Baumol effect

Nordhaus (2008) begins with Baumol's original model of "unbalanced growth", in which an economy is divided into a "progressive" sector (with somewhat high productivity growth) and a "stagnant" (or non-progressive) sector with low or no productivity growth. In the simplest form:

- In the progressive sector labour productivity rises at a rate r.
- In the stagnant sector labour productivity remains constant (or grows much more slowly).
- Wages across sectors tend to rise according to the rate in the progressive sector (because labour markets are unified).

From these assumptions Baumol argued that the cost per unit in the stagnant sector must rise indefinitely relative to the progressive sector, because wages rise but productivity does not. Therefore costs and ultimately prices in stagnant sectors grow faster. Nordhaus (2008) extends this idea, calling the set of predicted outcomes "Baumol's diseases". Nordhaus (2008) frames the testing as reduced-form regressions in which key outcomes (price growth, real output growth, nominal output growth, employment growth, wage growth) are functions of productivity growth and other factors.

We follow the structure set out by Nordhaus and estimate a range of OLS regressions based on the following specification:

$$X_{it} = a_{it} + b_{it}Y_{it} + \text{Industry\_FE} + \text{Year\_FE} + \varepsilon$$

Where X_{it} is the growth rate of a number of variables of interest: real and nominal output, employment, wages or prices in industry i in year t and Y_{it} is the corresponding growth rate of productivity. We test two measures of productivity: TFP and labour productivity. Each regression also includes industry and year fixed effects.

We use this formulation to test each of the Nordhaus (2008) empirical hypotheses:

1. The cost and price disease hypothesis: Expect negative correlation between productivity growth and cost/price growth.
2. The "constant real share" hypothesis. Baumol assumes that the relation of real output of the two sectors remains constant. Expect zero correlation between growth rate of real output and productivity growth.

3. The unbalanced nominal growth hypothesis i.e. the share of progressive industries' value added in nominal GDP should drop. Expect negative correlation between growth rate of nominal output and productivity growth.
4. The hypothesis of declining employment shares of progressive industries as labour is reallocated from the progressive to the stagnant industries. Expect negative correlation between employment/hours growth and productivity growth.
5. The uniform wage growth hypothesis. Baumol assumes uniform wage growth across industries. Expect zero correlation between industry wage growth and productivity growth.

The final hypothesis put forward by Nordhaus on how changes in sector weights impact aggregate productivity growth is:

6. The growth disease hypothesis. Baumol's model predicts that unbalanced productivity growth will lead to a decrease in the growth rate of overall GDP over time.

This requires a different empirical approach using a "shift-share" procedure. To do this, we calculate the share of each industry GVA in total nominal GDP for each year. These shares are used to calculate alternative productivity growth paths by weighting each industry's productivity growth by its share from a fixed year. To test the growth disease, the share of each sector is held constant over time while calculating total productivity growth for each country over time. This counterfactual fixed-share path is then compared to how total productivity growth evolved when sector weights changed over time. If average growth rate is lower using shares fixed in more recent years, Nordhaus (2008) interprets as evidence of cost disease.

4. Data

EU KLEMS and INTANProd is a cross-country productivity database for the 27 European Union countries, the United Kingdom, United States and Japan across 40 industries and 23 industries aggregates between 1995 and 2021.[2] The data includes information on key variables for analysing productivity including output, intermediate outputs and inputs, gross value added, employment, compensation of employees and capital stocks in tangible and intangible assets.

EU KLEMS and INTANProd is organised into two modules – a statistical module and an analytical module.[3] The statistical module contains key variables for industry level productivity analysis taken from the national accounts of individual countries. The analytical module is a complement to the statistical module providing information on investment and capital stocks for intangible assets that are not included as gross fixed capital formation in countries official national accounts.

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[2] See, https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/eu-klems-capital-labour-energy-materials-and-service_en

[3] For more information, see, Corrado et al, (2023), EUKLEMS & INTANProd: industry productivity accounts with intangibles, Luiss Lab of European Economics. Available at: https://euklems-intanprod-llee.luiss.it/wp-content/uploads/2023/02/EUKLEMS_INTANProd_D2.3.1.pdf

In examining these datasets, a number of limitations were identified, primarily related to missing observations of key data points or NACE sectors in various countries – for example missing wage data in Japan. As a result of these limitations, we chose to limit the sample to 16 countries in the EU and 16 NACE sectors, with this sample being sufficiently broad in sectoral scope and country mix to allow for a thorough analysis, while also avoiding issues with identification. Details are included in the annex on the countries, NACE sectors and traded/non-traded classification.

It should also be noted that Irish output data is distorted by the level of multi-national activity in the economy. These distortions are attributable to Ireland's highly globalised economy, with the onshoring of intellectual property assets, contract manufacturing, aircraft leasing activities and corporate domiciliation all contributing to an inflated output figure in Ireland that does not reflect domestic production (e.g. see Casey 2023). Moreover, there is a large divergence in productivity performance between domestic-owned and foreign-owned sectors, with for example labour productivity in foreign-dominated sectors being six times higher than in domestic sectors (CSO, 2025).

As mentioned previously, Hartwig (2011) also used the EU-KLEMS database for testing the Baumol-Nordhaus (2008) model for an aggregate of EU countries and the US between 1970 and 2005 for 47 detailed industries and 16 broad industry groups. In contrast to Hartwig (2011), we examine productivity at an individual country level rather than at an EU aggregate level. This allows for a more systematic identification of the impacts of Baumol's cost disease in Europe through specifications containing different country groups. We provide results for the full sample of countries, six EU "core" member states, nine "non-core" EU member states, as well as specific results for Ireland only.

A Cobb-Douglas production function is used to calculate TFP:

$$Y_{it} = A_{it} * {K_{it}}^{a} * {L_{it}}^{\beta}$$

Where Y_{it} is output in industry i in time t measured as gross value added using chain linked volumes, A_{it} is total factor productivity, K_{it} is the capital stock and L_{it} is the stock of labour. By rearranging the equation, we can isolate A_{it} and calculate TFP.

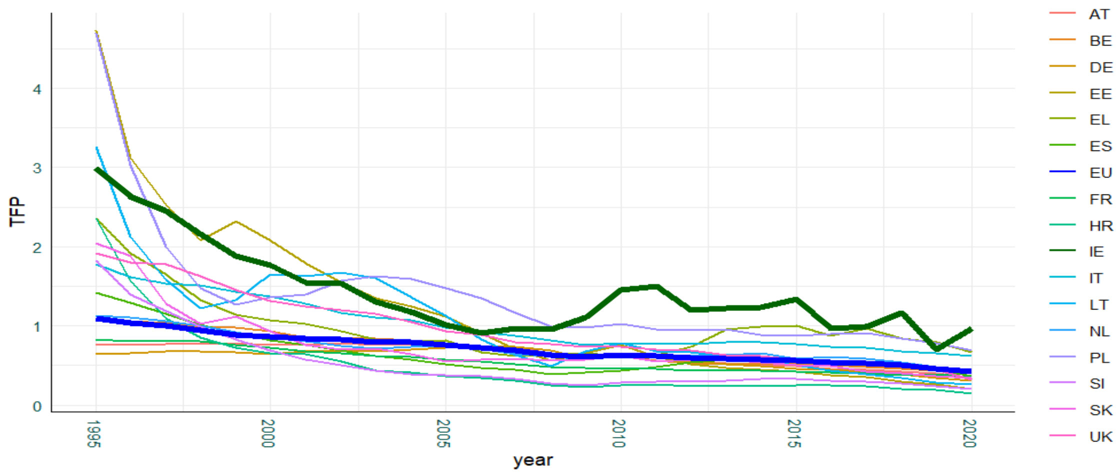
Labour productivity is calculated as -

$$LP_{it} = \frac{Y_{it}}{H_{it}}$$

Where LP_{it} is labour productivity, Y_{it} is output measured in industry i at time t as gross value added using chain linked values and H_{it} is hours worked by persons engaged.

Figure 1 summarises the development of TFP over the entire time period. For the majority of countries under consideration, the path is relatively flat with moderate increases early in the sample period largely undone in the aftermath of the financial crisis. Ireland is above the EU for the entirely of the sample period, though this gap has narrowed in recent years.

FIGURE 1: TFP DEVELOPMENTS BY COUNTRY, 1995-2020



The key element of the Baumol hypothesis is productivity growth in some sectors is much stronger than in others. The original specification in the 1960s contrasted manufacturing with services in this regard. However, with the growth of high-technology services sectors in the interim, it seems that the more appropriate comparison in the modern economy is between the traded sector, comprising both manufacturing and traded services such as ICT, and the non-traded sector which comprises many of the person-to-person services such as education, healthcare and hospitality that Baumol used as examples of areas where productivity growth might be expected to be more constrained.

FIGURE 2: TFP DEVELOPMENTS IN TRADED AND NON-TRADED SECTORS, 1995-2020

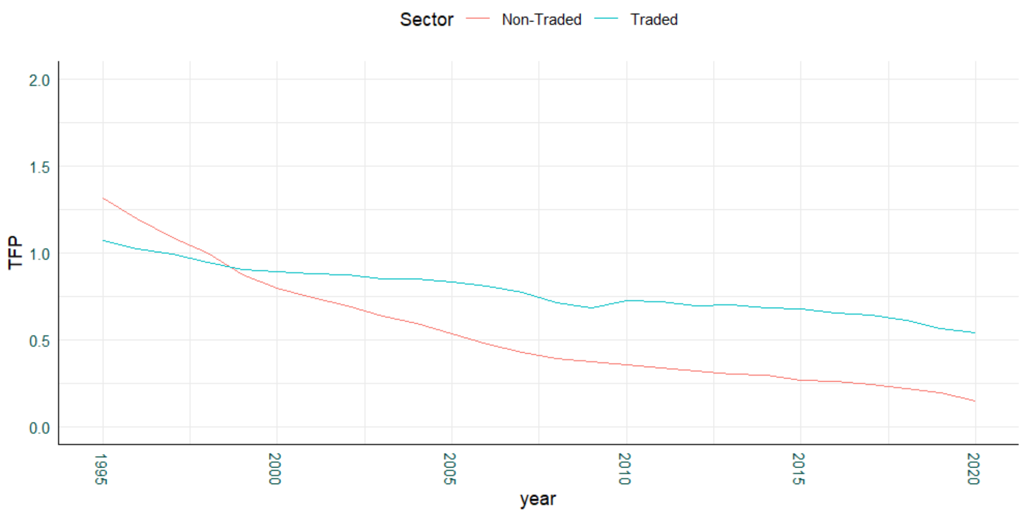
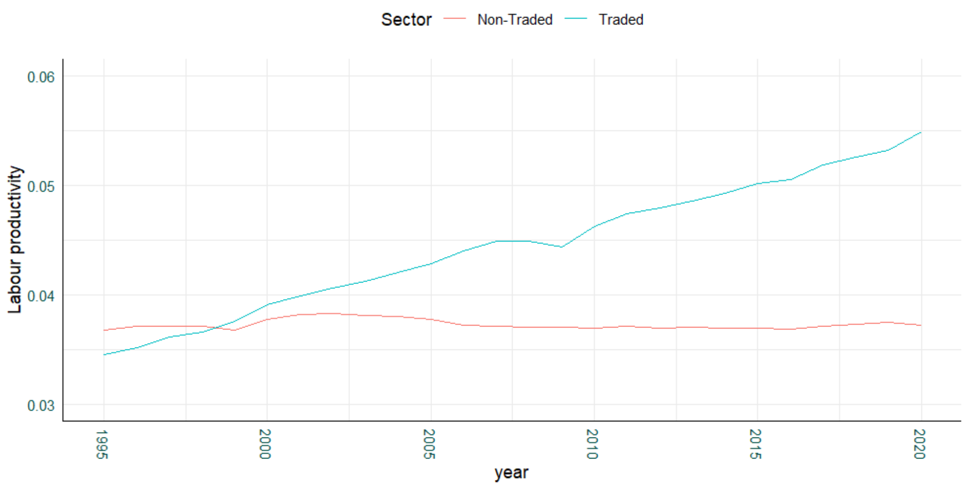


Figure 2 shows the overall decline in TFP between these two broad sectoral groupings at an aggregate level across countries. However, for the majority of the time period the traded sector has had TFP growth in excess of that by the non-traded sector. The gap between the two sectors has grown between 2000 and 2005 before remaining relatively constant.

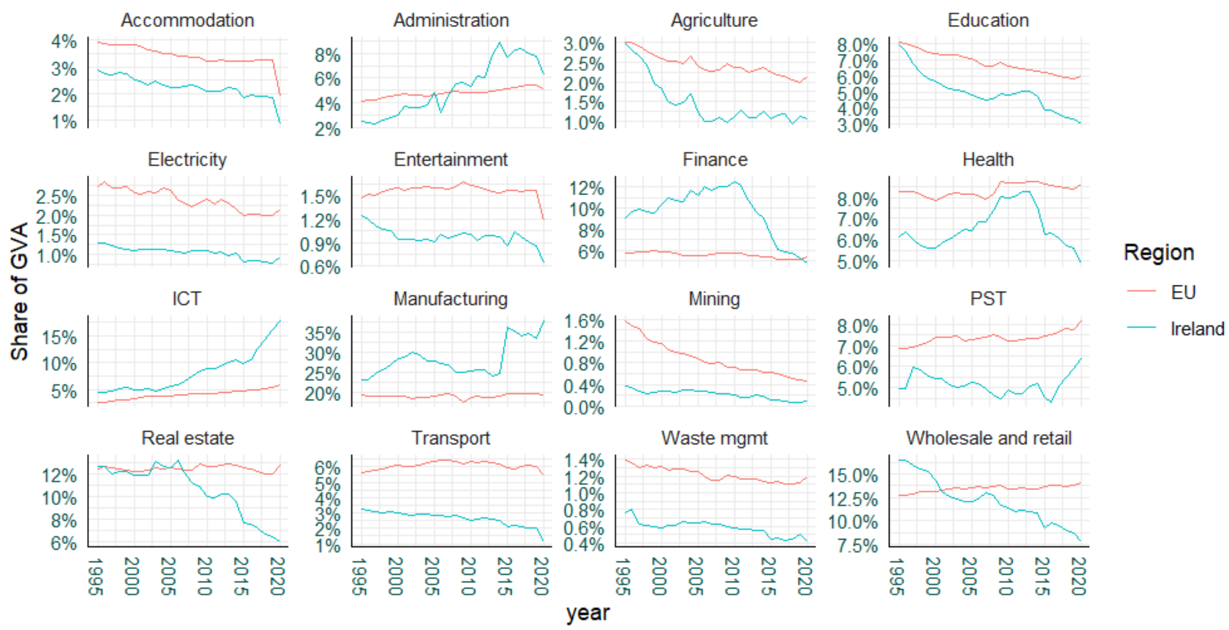
Labour productivity developments in the traded and non-traded sectors are shown in Figure 3. There has been sustained growth in labour productivity over the time period, with the exception of a small dip in both sector groupings at the time of the financial crisis. However, the pace of growth has differed with a gap emerging between the traded and non-traded sectors as the former's growth performance, particularly since 2010, has been considerably stronger.

FIGURE 3: LABOUR PRODUCTIVITY IN TRADED AND NON-TRADED SECTORS, 1995-2020



How the differing productivity growth rates of sectors impact aggregate measures will depend on their weighting in total output. Figure 4 shows how the shares of different sectors in total output have evolved over time. For the EU as a whole, most sectors have broadly stable shares with no notable transitions occurring between (for example) manufacturing to health or education. The picture for Ireland is one of more volatility over time but without any strong signal of movement from more productive traded sectors to the non-traded areas.

FIGURE 4: CHANGES IN SECTOR SHARE OF GROSS OUTPUT, 1995-2020



5. Regression analysis results

In this section, we test the first five hypotheses described in the previous section. We examine the relationship between productivity and each dependent variable (prices, nominal output, real output, hours and wages). Productivity is measured in two ways using TFP or labour productivity. Each specification controls for sector and year fixed effects. With the exception of the aggregated specification, country fixed effects are also included. For each outcome of interest, we run a range of specifications:

1. The full cross-country data;
2. Six "core" EU countries – Austria, Belgium, France, Germany, Netherlands and United Kingdom[4]
3. Countries not in the core EU6 – essentially newer member states and those most affected by the financial crisis such as Spain, Greece and Ireland;
4. Ireland only; and
5. Aggregation of all countries to examine sector-year variation only.

Table 1: Price growth and Productivity

	(1)	(2)	(3)	(4)	(5)
	Price growth	**Price growth EU6**	**Price growth non-EU6**	**Price growth Ire**	**Price growth agg**
TFP growth	-0.045***	-0.087***	-0.038***	-0.054***	-0.174***
	(0.008)	(0.014)	(0.008)	(0.012)	(0.045)
Constant	3.753***	0.719	10.989***	0.525	1.951
	(0.741)	(0.867)	(1.164)	(3.842)	(1.814)
Observations	6,400	2,400	4,000	400	400
R-squared	0.179	0.159	0.210	0.258	0.281

	(6)	(7)	(8)	(9)	(10)
	Price growth	**Price growth EU6**	**Price growth non-EU6**	**Price growth Ire**	**Prices growth agg**
LP growth	-0.177***	-0.407***	-0.145***	-0.252**	-0.521***
	(0.023)	(0.041)	(0.025)	(0.114)	(0.125)
Constant	3.538***	1.062	13.132***	-3.149	2.316
	(0.705)	(0.798)	(1.207)	(4.327)	(1.665)
Observations	6,400	2,400	4,000	400	400
R-squared	0.165	0.205	0.193	0.171	0.275

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All specifications include year, country and sector controls.

[4] The UK exit from the EU occurred in the final year of the dataset but for simplicity, we refer to this set of countries as EU6 for the entire period.

Table 1 examines the first hypothesis that costs (or prices) will grow more rapidly in the sectors experiencing lower productivity growth. We find a statistically significant negative relationship between total factor productivity (TFP) growth and price growth across all model specifications, corroborating this hypothesis. This is in line with the findings of both Nordhaus (2008) and Hartwig (2011) both of whom find strong evidence for the cost/price disease: sectors with lower total factor productivity (TFP) growth consistently experience faster price increases.

The second hypothesis, corresponding to the "constant real share" assumption of Baumol, proposes that the real output of distinct sectors should maintain a constant proportional relationship over time. Under this assumption, the correlation between the growth rate of real output and productivity growth is expected to be zero. The empirical evidence, however, does not support this hypothesis. Instead, the results indicate predominantly positive associations between real gross value added (GVA) growth and productivity growth, suggesting that sectors exhibiting higher productivity growth have also experienced faster real output growth. There is one exception which is a negative, albeit marginally significant, coefficient in the specification for TFP using only Irish data. Comparing again to Nordhaus (2008) and Hedwig (2011), all three papers reject the constant real share hypothesis, indicating that sectors with higher productivity growth expand more rapidly in real output, thereby altering relative sectoral shares. Although the finding does not back up the theoretical hypothesis, our empirical results are consistent with the previous findings of Nordhaus (2008) and Hartwig (2011).

TABLE 2: REAL GVA GROWTH AND PRODUCTIVITY

	(1)	(2)	(3)	(4)	(5)
	Real GVA growth	**Real GVA growth EU6**	**Real GVA growth non-EU6**	**Real GVA growth Ire**	**Real GVA growth agg**
TFP growth	0.046**	0.077***	0.047**	-0.015*	0.124
	(0.019)	(0.015)	(0.021)	(0.008)	(0.081)
Constant	8.104***	1.479	19.054***	-8.893	2.376
	(1.025)	(0.938)	(1.526)	(7.148)	(1.677)
Observations	6,400	2,400	4,000	400	400
R-squared	0.243	0.223	0.264	0.230	0.348
	(6)	(7)	(8)	(9)	(10)
	Real GVA growth	**Real GVA growth EU6**	**Real GVA growth non-EU6**	**Real GVA growth Ire**	**Real GVA growth agg**
LP growth	0.521***	0.429***	0.531***	0.364**	0.430**
	(0.044)	(0.045)	(0.049)	(0.181)	(0.212)
Constant	3.366***	0.619	12.582***	-15.414**	-7.726***
	(0.860)	(0.851)	(1.444)	(6.936)	(2.846)
Observations	6,400	2,400	4,000	400	400
R-squared	0.410	0.284	0.445	0.296	0.359

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All specifications include year, country and sector controls.

The third hypothesis, often referred to as the "unbalanced nominal growth" hypothesis, contends that the share of progressive industries' value added in nominal GDP should decline over time. This would imply a negative correlation between the growth rate of nominal output and productivity growth. The empirical results, however, do not substantiate this prediction. On the contrary, a positive relationship between nominal output growth and productivity growth is observed consistently across all model specifications. These findings suggest that the hypothesised reallocation of economic activity towards lower-productivity sectors has not occurred. Here we diverge from the earlier findings as Nordhaus (2008) found a weak negative correlation and Hartwig (2011) also observed a slight shift toward slower-productivity sectors. These discrepancies may reflect variations in sectoral composition, study periods, or measurement methods. Nevertheless, all studies suggest that structural reallocation toward low-productivity sectors does not substantially drive nominal growth, underscoring the limited macroeconomic impact of such shifts.

TABLE 3: NOM GVA GROWTH AND PRODUCTIVITY

	(1)	(2)	(3)	(4)	(5)
	Nom GVA growth	**Nom GVA growth EU6**	**Nom GVA growth non-EU6**	**Nom GVA growth Ire**	**Nom GVA growth agg**
TFP growth	0.091***	0.163***	0.085***	0.053***	0.287***
	(0.017)	(0.021)	(0.018)	(0.011)	(0.047)
Constant	4.178***	0.934	7.687***	-9.768*	0.521
	(0.740)	(0.682)	(1.146)	(5.413)	(0.609)
Observations	6,400	2,400	4,000	400	400
R-squared	0.335	0.511	0.319	0.374	0.746
	(6)	(7)	(8)	(9)	(10)
	Nom GVA growth	**Nom GVA growth EU6**	**Nom GVA growth non-EU6**	**Nom GVA growth Ire**	**Nom GVA growth agg**
LP growth	0.667***	0.818***	0.644***	0.645***	0.921***
	(0.020)	(0.024)	(0.022)	(0.065)	(0.126)
Constant	-0.276	-0.264	-0.590	-11.186***	-9.561***
	(0.427)	(0.504)	(0.662)	(4.131)	(2.164)
Observations	6,400	2,400	4,000	400	400
R-squared	0.645	0.725	0.633	0.644	0.769

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All specifications include year, country and sector controls.

The fourth hypothesis concerns the declining employment shares of progressive industries, driven by the reallocation of labour from progressive to stagnant sectors. This hypothesis predicts a negative correlation between employment (or hours worked) growth and productivity growth. The results provide only partial support for this proposition. Within the TFP-based specifications, three models yield statistically significant negative coefficients, whereas the remaining three are insignificant. By contrast, the labour productivity (LP) specifications offer stronger support, with most coefficients being negative and statistically significant, except in the aggregated model. These results indicate a negative correlation between LP growth and hours growth, thereby lending partial support to the hypothesis.

TABLE 4: HOURS GROWTH AND PRODUCTIVITY

	(1)	(2)	(3)	(4)	(5)
	Hours growth	**Hours growth EU6**	**Hours growth non-EU6**	**Hours growth Ire**	**Hours growth agg**
TFP growth	-0.006**	0.002	-0.006**	-0.006	0.047
	(0.003)	(0.005)	(0.003)	(0.006)	(0.055)
Constant	-2.339***	-2.088***	-4.145***	-12.880***	-2.324***
	(0.433)	(0.475)	(0.637)	(4.131)	(0.580)
Observations	6,400	2,400	4,000	400	400
R-squared	0.152	0.297	0.138	0.306	0.515

	(6)	(7)	(8)	(9)	(10)
	Hours growth	**Hours growth EU6**	**Hours growth non-EU6**	**Hours growth Ire**	**Hours growth agg**
LP growth	-0.304***	-0.166***	-0.325***	-0.299***	-0.033
	(0.019)	(0.025)	(0.022)	(0.058)	(0.146)
Constant	-0.445	-0.125	-0.513	-9.867**	-9.987***
	(0.402)	(0.486)	(0.617)	(4.168)	(2.421)
Observations	6,400	2,400	4,000	400	400
R-squared	0.334	0.343	0.352	0.456	0.502

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All specifications include year, country and sector controls.

The fifth hypothesis, known as the "uniform wage growth" hypothesis is that wage growth is uniform across industries, implying an absence of correlation between wage growth and productivity growth. The empirical evidence for this hypothesis is mixed. In the TFP specifications, the expected pattern emerges in the aggregate sample and in the case of Ireland, but not across other specifications. In contrast, the LP specifications reveal no correlation between wage growth and productivity growth, while the TFP results indicate a general correlation between the two. Overall, the evidence for uniform wage growth is therefore inconclusive. Both Nordhaus (2008) and Hartwig (2011) observed similarly weak or insignificant correlations, confirming that wages generally rise uniformly across sectors. The slight TFP-based correlation we find may reflect sector-specific returns to capital or methodological differences but does not undermine the overall pattern of uniform wage growth.

TABLE 5: WAGE GROWTH AND PRODUCTIVITY

	(1)	(2)	(3)	(4)	(5)
	Wage growth	**Wage growth EU6**	**Wage growth non-EU6**	**Wage growth Ire**	**Wages growth agg**
TFP growth	-0.032***	-0.029***	-0.028***	-0.013	-0.016
	(0.008)	(0.009)	(0.008)	(0.008)	(0.055)
Constant	7.104***	3.110***	15.869***	-4.649	1.212**
	(0.737)	(0.529)	(1.073)	(4.073)	(0.592)
Observations	6,400	2,400	4,000	400	400
R-squared	0.297	0.231	0.336	0.363	0.457
	(6)	(7)	(8)	(9)	(10)
	Wage growth	**Wage growth EU6**	**Wage growth non-EU6**	**Wage growth Ire**	**Wages growth agg**
LP growth	0.020	-0.029	0.022	0.004	0.057
	(0.016)	(0.026)	(0.017)	(0.042)	(0.134)
Constant	7.031***	3.725***	16.044***	-6.296	-3.194*
	(0.695)	(0.590)	(1.088)	(3.852)	(1.871)
Observations	6,400	2,400	4,000	400	400
R-squared	0.273	0.214	0.317	0.355	0.457

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All specifications include year, country and sector controls.

6. Shift-share analysis of sectoral composition

To test the existence of a “growth disease” where structural change has had a negative on overall productivity growth Nordhaus (2008) weights industries productivity growth rates with their value-added shares in alternative years. As Baumol suggests, if stagnant industries gain weight over time, then the overall productivity growth rate should be higher if earlier years are used as weights or base years. As such, updating the base years leads to a decrease in the overall productivity growth rate. Nordhaus (2008) find this pattern in the US and a similar pattern for the EU aggregate emerges in Hartwig (2011)’s analysis. Therefore, Nordhaus (2008) and Hartwig (2011) find evidence that structural change has had a growth dampening effect.

However, in our case, by holding sector shares of total output fixed at their 1995 levels and comparing actual productivity growth to the fixed-share counterfactuals, the results show little difference in how aggregate productivity would have evolved in the absence of compositional shifts.

Figure 6: TFP growth versus TFP growth fix at 1995 levels, 1995-2020

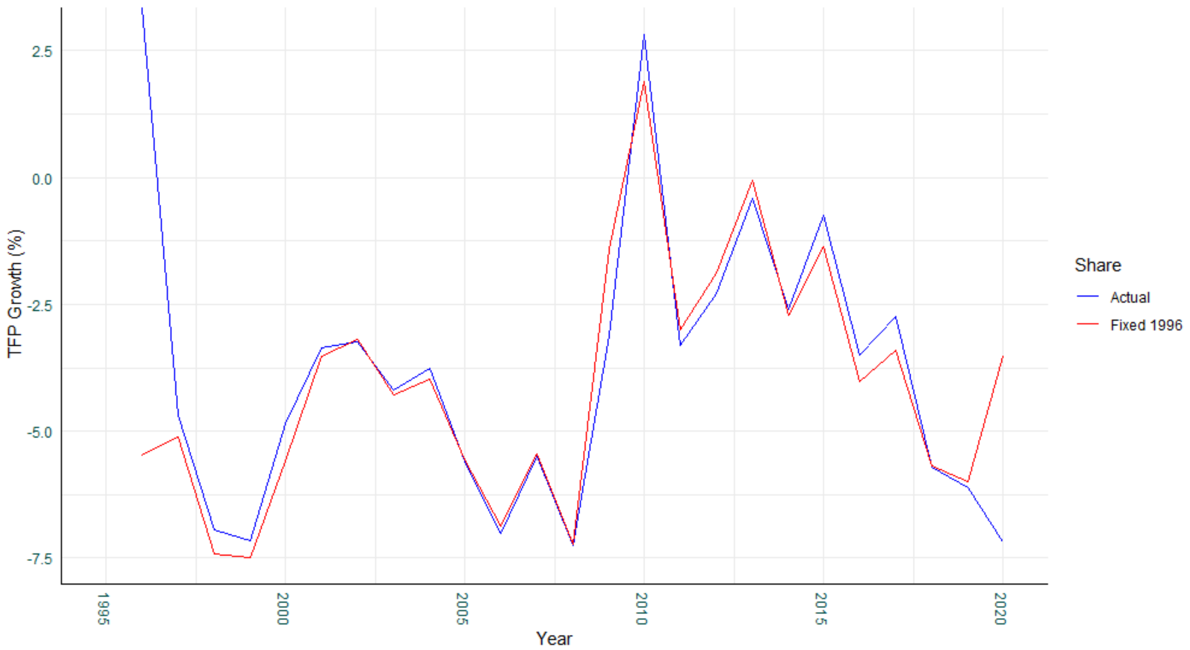
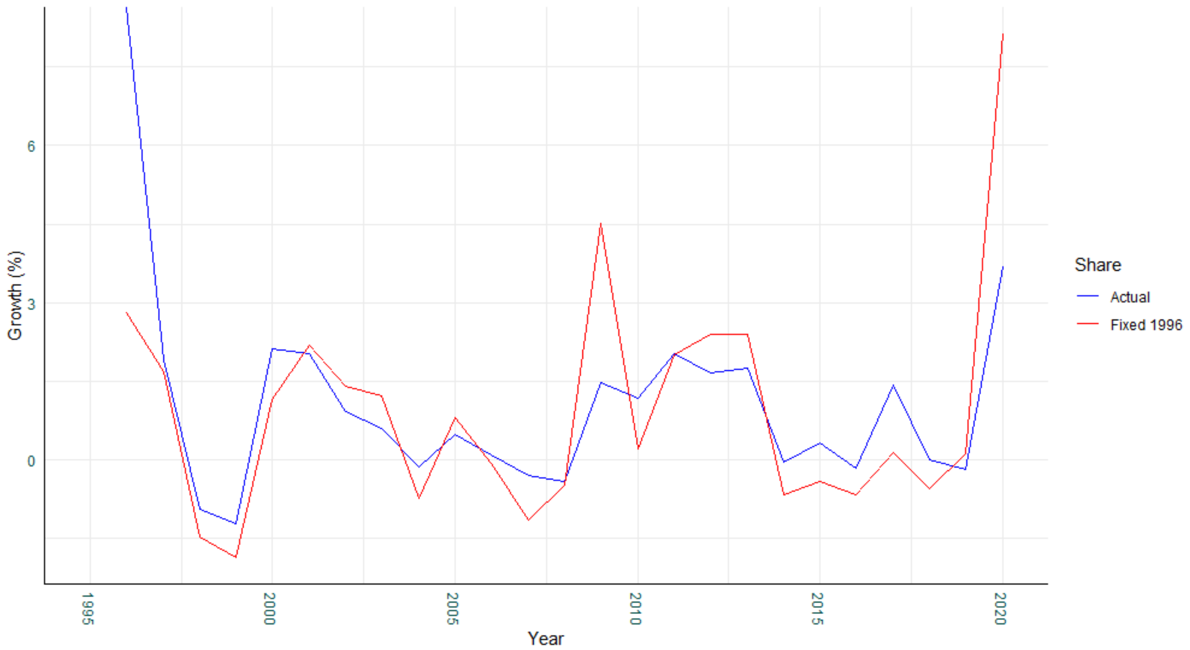


Figure 7: Labour productivity growth versus labour productivity growth fixed at 1995 levels, 1995-2020



Across individual countries (TFP in Figure 8 and labour productivity in Figure 9), essentially the same pattern holds. Linking back to the data description and the patterns of sector shares in Figure 4, an obvious explanation is that the compositional changes in our sample have been much more limited relative to the longer span of data examined by Nordhaus (2008) in particular.

Finally, all studies agree that aggregate growth is largely resilient to structural shifts. This analysis indicates that sectoral composition changes had minimal impact on overall growth, as the effects of Baumol's cost disease were offset by strong productivity gains in other sectors. Nordhaus (2008) estimated the structural shift effect at approximately –0.05 percentage points per year, and Hartwig (2011) reported similarly modest effects, reinforcing the conclusion that structural reallocation exerts only a limited drag on aggregate productivity.

FIGURE 8: TFP SHIFT-SHARE BY COUNTRY, 1995-2020

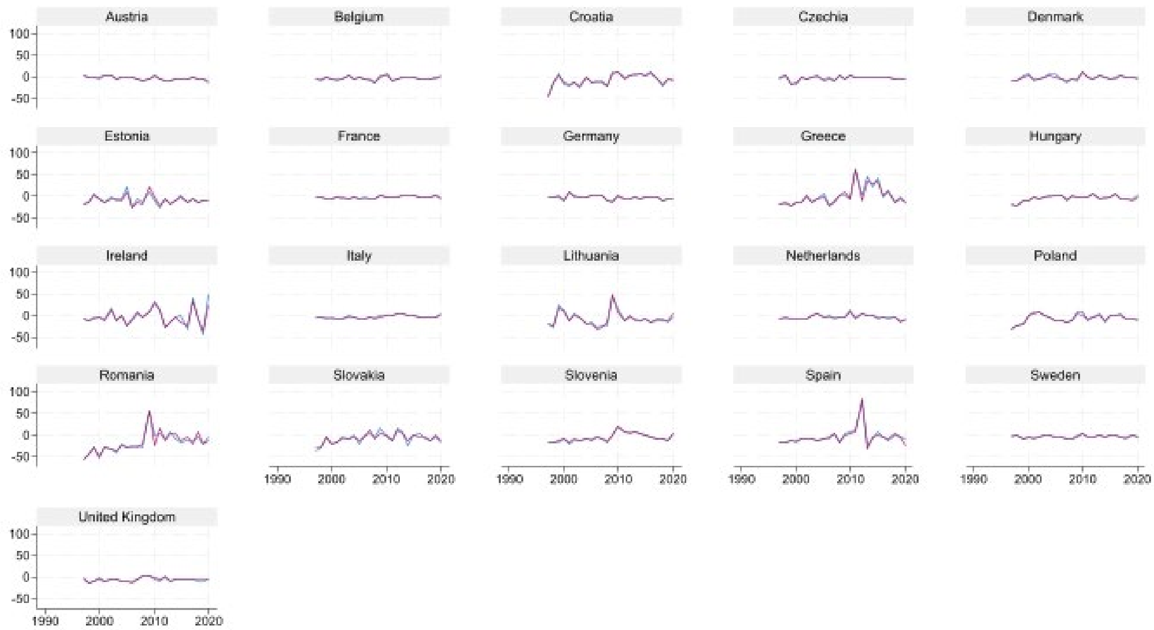
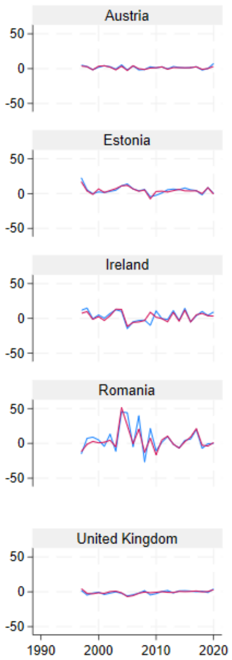


FIGURE 9: LABOUR PRODUCTIVITY SHIFT-SHARE BY COUNTRY, 1995-2020



7. Conclusions and Policy Implications

In this paper, we examine the extent to which changes in the balance between higher and lower productivity sectors in Europe could be seen to contribute to imbalance in price and wage dynamics or to generate a drag on overall productivity growth within the economy.

Our results suggest that prices do indeed tend to increase more rapidly in stagnant sectors, a finding of particular relevance to microeconomic analysis and to service-oriented industries such as healthcare. In contrast, the real output shares of highly productive industries appear to expand at a faster pace than those of less productive industries. This dynamic serves to offset the adverse implications of Baumol's cost disease by mitigating the impact of rising nominal prices in low-productivity sectors. As noted by Hartwig (2011), this compensatory mechanism dampens the potential negative effect of cost disease on aggregate economic growth. Moreover, the nominal output shares of productive industries have also increased over time, implying that the influence of productivity growth on real output growth outweighs its effect on price movements. Collectively, these findings indicate that the impact of Baumol's cost disease on overall economic growth is considerably weaker than theoretical models would predict.

Notably, our analysis finds little evidence of a correlation between wage growth and productivity growth at the sectoral level, at least when measured by labour productivity. However, a negative association between wage growth and TFP growth is observed across the full sample, suggesting that productivity gains are being disproportionately captured by workers in less productive sectors. This pattern may reflect the influence of returns accruing to non-labour factors of production, such as capital. Changes in the composition of sectoral output shares over time appear to have exerted minimal influence on aggregate economic growth.

Our results largely corroborate those of Nordhaus (2008) and Hartwig (2011), with particularly strong agreement on the cost/price disease and the rejection of the constant real share hypothesis. However, we find weaker evidence of a drag on overall productivity growth and more mixed results on other variables such as nominal growth and employment shifts. Overall, these findings indicate that productivity dynamics, rather than structural reallocation, are the primary drivers of real and nominal economic growth, while the macroeconomic effects of Baumol's "diseases" remain limited.

A number of limitations to the analysis should be borne in mind, in particular that measurement problems, especially in public services could be substantial. Our relatively simple data structure also precludes us from examining more complex interactions arising from changing demand elasticities, substitution or intermediate inputs.

In addition, it should be noted that most of the regression tables display relatively low r-square values indicating that the model may be explaining only a small portion of the variation in TFP or labour productivity. However, this is not entirely problematic as analysing TFP and labour productivity has a greater amount of unexplainable variation given it is difficult to estimate precisely.

Furthermore, the data environment presents challenges for measuring productivity at a sectoral level across countries. Missing observations for key NACE sectors in several countries reduced our final sample to 16 countries in the EU, from initial consideration of 30 countries. In addition, results that include Ireland are complicated by the distortions to economic output in that country arising from multi-national activity. Nonetheless, our findings are broadly consistent across specifications, both when including and excluding certain countries.

These results carry potential implications for economic policy. Demographic ageing is expected to generate an exogenous shift in consumption patterns, increasing demand for services produced by non-productive sectors such as healthcare. Although the aggregate impact of this shift may be substantial for public finances, the evidence to date examined here suggests that it is likely to be less pronounced in terms of aggregate productivity trends. Historically, the upward pressure on prices in non-productive sectors has been offset by strong real output growth in productive industries. Nevertheless, the anticipated rise in demand for non-productive services could begin to exert downward pressure on aggregate growth rates and contribute to an increasing share of employment in these sectors. These dynamics underscore the need for policies that enhance efficiency of service delivery in non-traded sectors, such as healthcare and education, while also encouraging further investment and growth of high-productivity sectors in order to counterbalance this oncoming structural challenge.

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Annex

Table A1: List of Countries (EU-Klems)

Countries	Category
Austria	EU "Core"
Belgium	EU "Core"
Germany	EU "Core"
France	EU "Core"
Netherlands	EU "Core"
UK	EU "Core"
Estonia	EU "Non-Core"
Greece	EU "Non-Core"
Spain	EU "Non-Core"
Croatia	EU "Non-Core"
Ireland	EU "Non-Core"
Italy	EU "Non-Core"
Poland	EU "Non-Core"
Slovenia	EU "Non-Core"
Slovakia	EU "Non-Core"

Table A2: List of NACE Sectors (EU-Klems)

NACE sectors	
A - agriculture	B - mining
C - manufacturing	D - electricity
E – waste management	G – wholesale and retail
H - transport	I - accommodation
J - ICT	K - finance
L – real estate	M - PST
N - administration	P - education
Q - health	R - entertainment

TABLE A3: CATEGORISATION OF SECTORS BY TRADED AND NON-TRADED CLASSIFICATION

Traded	Non-traded
A (agriculture)	N (administration)
B (mining)	P (education)
C (manufacturing)	Q (health)
D (electricity)	R (entertainment)
E (waste mgmt)	
G (wholesale and retail)	
H (transport)	
I (accommodation)	
J (ICT)	
K (finance)	
L (real estate)	
M (PST)	