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The Relationship Between National Debt and Healthcare Expenditure in Europe: A 2007 Analysis

Abstract

This paper examines the relationship between national debt and healthcare expenditure in Europe, using cross-sectional data from 2007. Through multiple linear regression models, we demonstrate that per capita GDP and national debt are significant determinants of healthcare expenditure. Although government deficit and healthcare system type (tax-funded national healthcare versus social health insurance) were not statistically significant, understanding the context of these systems offers insights into the broader economic and political landscape. Despite the data being over a decade old, the findings remain relevant for current healthcare policy discussions.

Introduction

Healthcare in Europe is provided primarily through public systems, with funding structures that vary across countries. These systems can broadly be categorized into two types: **National Health Systems (NHS)**, which are funded through general taxation, and **Social Health Insurance (SHI) Systems** funded through obligatory payroll contributions.ⁱ (see appendix 1a) Understanding how these systems function and their impact on healthcare expenditure is crucial, particularly in the context of rising national debt across Europe. The healthcare expenditure/GDP ratio has steadily increased over time in a wide range of countries with differing funding systems (see appendix 1b).

A large body of research, such as studies by **Wagstaff and Van Doorslaer**,ⁱⁱ has focused on the relationship between health system financing and health outcomes.ⁱⁱⁱ Other research by **Gerdtham et al.** and **Newhouse** has highlighted the significance of economic factors like GDP in healthcare expenditure.^{iv v} This paper builds on this literature by incorporating national debt^{vii} (see appendix 2) as a determinant of healthcare expenditure, which has not been studied extensively in the context of European countries with predominantly public health systems.

This paper aims to explore the relationship between national debt and healthcare expenditure, focusing on the influence of healthcare system type. Specifically, we address:

1. Is there an association between national debt and healthcare expenditure in European countries?
2. Does the type of healthcare system (NHS vs. SHI) significantly impact healthcare expenditure?

Methods

We used **multiple linear regression** to examine the relationship between healthcare expenditure (as a percentage of GDP) and national debt (as a percentage of GDP), controlling for several other factors, including per capita GDP, government deficit, and healthcare system type.

The data used in this study were obtained from **Eurostat** and the **OECD** databases. Eurostat provides data on healthcare expenditure and economic indicators, while OECD data was used to supplement information for some countries, such as the UK, Greece, and Italy, where Eurostat data was incomplete.

Variables

Dependent variable (Y):

- Healthcare expenditure as a percentage of GDP.

Independent variables:

- **National debt (ND) (% of GDP):** Reflects the financial burden of a country's accumulated deficit.



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- **Per capita GDP (GDPp.c):** Used to control for overall economic prosperity, which typically influences healthcare spending.
- **Government deficit (GD) (% of GDP):** The annual budgetary shortfall of a country, which contributes to its national debt.
- **Healthcare system type (dummy variable):** Coded as 0 for National Health Systems (NHS, tax-funded) and 1 for Social Health Insurance Systems (SHI, payroll-funded)

Regression Models

We tested three models to capture the relationship between national debt, healthcare expenditure, and the other variables:

1. **Model A** (Comprehensive model):

$$\frac{HCE_{Exp}}{GDP} = \beta_1 + \beta_2 \log(GDPp.c.(EURO)) + \beta_3 \left(\frac{budget\ deficit}{GDP} \right) + \beta_4 \left(\frac{national\ debt}{GDP} \right) + \beta_5 Type\ of\ system\ (Dummy\ variable\ 1\ or\ 0) + \mu$$

2. **Model B** (Simplified model without deficit and system type):

$$\left(\frac{HCE_{Exp}}{GDP} \right) = \beta_1 + \beta_2 \log(GDPp.c.(EURO)) + \beta_4 \left(\frac{national\ debt}{GDP} \right) + \mu$$

3. **Model C** (Basic model with national debt only):

$$\left(\frac{HCE_{Exp}}{GDP} \right) = \beta_1 + \beta_4 \left(\frac{national\ debt}{GDP} \right) + \mu$$

Results

Data Summary

The dataset includes data from 27 European countries, with healthcare expenditure as a percentage of GDP ranging from 5.24% (Romania) to 11.07% (France). National debt levels varied significantly, with Greece (105.4% of GDP) and Italy (103.6% of GDP) being the most indebted countries. The countries were divided into two groups based

on their healthcare funding systems: **NHS systems** (e.g., Sweden, Spain) and **SHI systems** (e.g., Germany, France).

Statistical Results: Model A

In **Model A**, which includes all variables (GDP per capita, national debt, government deficit, and system type), the results are summarised in appendix 3:

Interpretation of Model A:

- $\log(\text{GDP per capita})$ is a strong predictor of healthcare expenditure. Wealthier countries tend to allocate a larger share of their GDP to healthcare, consistent with the literature indicating healthcare as a "luxury good" with an income elasticity greater than one.
- National debt is positively and significantly associated with healthcare expenditure. This implies that countries with higher national debt allocate more of their GDP toward healthcare, perhaps reflecting the political importance of healthcare services and the reluctance of governments to cut healthcare budgets, even in times of fiscal distress.
- Government deficit and system type (NHS vs. SHI) were not statistically significant, suggesting that short-term fiscal imbalances and the type of healthcare system may not have had a strong direct impact on healthcare expenditure in 2007.

Statistical Results: Model B

Model B, which removes the insignificant variables (government deficit and system type), yielded the following results see appendix

4:

Interpretation of Model B:

- Per capita GDP and national debt remain significant, positive predictors of healthcare expenditure. The adjusted R^2 is slightly higher in this model compared to Model A, suggesting



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that removing the insignificant variables improves the model's explanatory power.

- The results confirm the hypothesis that healthcare expenditure increases with both a country's wealth and its accumulated debt. Higher GDP per capita and higher national debt both reflect the broader economic and fiscal environment that drives healthcare expenditure.

Statistical Results: Model C

In Model C, which focuses solely on national debt as the predictor of healthcare expenditure, the results were as follows, please see appendix 5:

Interpretation of Model C:

- National debt alone explains a significant portion of the variance in healthcare expenditure. However, the adjusted R^2 for this model is lower compared to Models A and B, indicating that national debt, while significant, cannot fully explain the variations in healthcare spending.

Model Comparison (see appendix 6)

Model	Adj R^2	SE	Significant Variables
A	0.5404	1.0944	Log GDPp.c, ND
B	0.5476	1.0859	Log GDPp.c, ND
C	0.3143	1.3368	ND

Model B provides the best overall fit (Adjusted $R^2 = 0.5476$), explaining the most variance in healthcare expenditure using per capita GDP and national debt. Model C, which focuses solely on national debt, provides the weakest fit. This indicates that while national debt is an important factor, per capita GDP significantly enhances the model's explanatory power. See appendix 7 for all 2007 data utilized in the models.

Discussion

This study confirms that both national debt and per capita GDP are significant determinants of healthcare expenditure in European countries. The positive association between national debt and

healthcare spending suggests that countries with higher debt levels may be allocating more resources to healthcare, potentially due to political pressures to maintain or increase healthcare services, even during periods of fiscal stress.

Role of System Type (NHS vs. SHI)

Although system type (NHS vs. SHI) was not statistically significant in the models, it remains an important contextual factor. National Health Systems (NHS), which are tax-funded, typically offer centralized control over healthcare expenditure. In contrast, Social Health Insurance (SHI) systems rely on payroll contributions and may feature more variability in spending. However, the lack of statistical significance in this analysis suggests that, in 2007, differences in funding structures did not play a significant role in driving healthcare expenditure.

This could be due to the National Health Accounts (NHA) system used to standardize healthcare expenditure reporting across countries, which may smooth out some of the differences between NHS and SHI systems. Additionally, even in SHI systems, strong governmental regulation may reduce variability in healthcare spending, leading to similar expenditure patterns across the two system types.

Broader Implications

The findings from this study are consistent with previous research that has shown GDP per capita to be a major driver of healthcare expenditure. As countries become wealthier, they tend to spend more on healthcare, reflecting both increased demand for services and the ability to finance them.

The study also highlights the importance of national debt as a factor influencing healthcare spending. In times of high national debt, governments may still choose to protect healthcare budgets, leading to higher expenditure as a percentage of GDP. This finding aligns with the political economy literature, which emphasizes the centrality of healthcare in electoral politics and public policy.

Conclusion



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This study demonstrates that both national debt and per capita GDP are key drivers of healthcare expenditure in European countries. While system type (NHS vs. SHI) was not found to be significant in the 2007 data, the broader financial context, particularly national debt, plays a crucial role in shaping healthcare spending decisions.

These findings remain relevant today as European countries continue to face the dual challenges of rising healthcare costs and increasing national debt. Future research should focus on more recent data to assess whether these relationships have changed in response to the 2008 financial crisis and subsequent healthcare reforms.

to assess how these dynamics have shifted in response to ongoing economic developments and healthcare reforms.

Acknowledgments

This paper is based on data from 2007, and while the findings provide valuable insights, it is important to acknowledge that both healthcare systems and economic conditions have evolved significantly since then. Further studies are required

About the Purple Ocean Advisory

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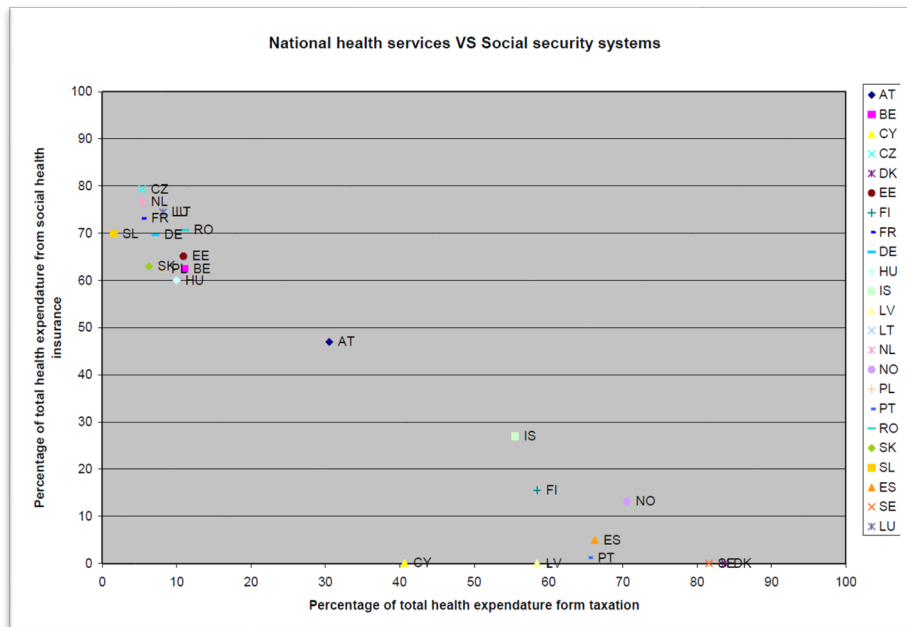


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Appendix 1A: National health services vs Social security systems^{viii}



ISO country codes: Austria (AT), Belgium (BE), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Hungary (HU), Iceland (IS), Latvia (LV), Lithuania (LT), Luxemburg (LU), The Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SL), Spain (ES) and Sweden (SE).



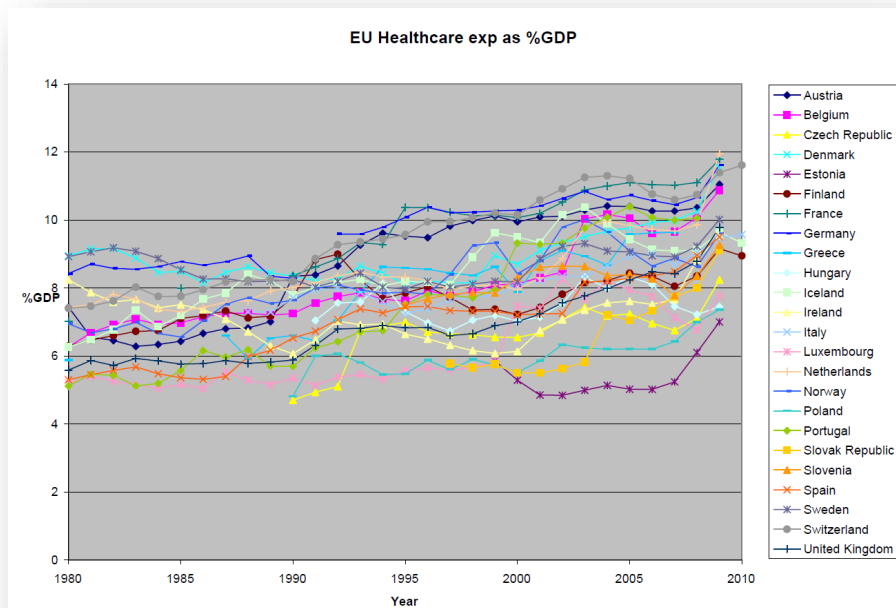
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Appendix 1b: Healthcare expenditure expressed as percentage of GDP ^{ix}

This indicates that healthcare expenditure is growing faster than the rate of GDP. Figure 2 expresses healthcare expenditure as a percentage of GDP from 1980 to 2010.





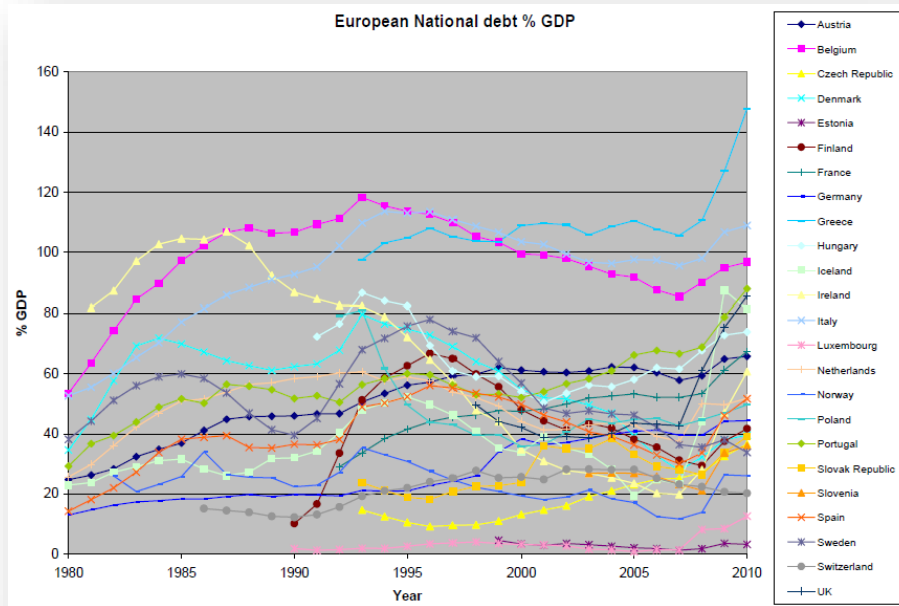
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Appendix 2: National debt expressed as % of GDP^x

National-debt-to-GDP ratio for a number of countries in Europe has grown to the point where it has surpassed the countries annual GDP.



Appendix 3:

Variable	Coefficient	t-Stat	p-Value	Significance
Intercept	-8.1597	-2.015	0.0563	Not significant
Log(GDP per capita)	3.4954	3.672	0.0013	Significant
Government deficit	-0.0703	-1.081	0.2916	Not significant
National debt	0.0259	2.841	0.0095	Significant
System type (NHS = 0, SHI = 1)	0.1854	0.394	0.6973	Not significant

Appendix 4:

Variable	Coefficient	t-Stat	p-Value	Significance
Intercept	-4.9686	-1.574	0.1286	Not significant
Log(GDP per capita)	2.7328	3.727	0.0010	Significant
National debt	0.0299	3.768	0.0009	Significant



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Appendix 5:

Variable	Coefficient	t-Stat	p-Value	Significance
Intercept	6.6992	13.536	<0.001	Significant
National debt	0.0346	3.594	0.0014	Significant

Appendix 6: Comparison of models A, B & C

Model	F-sig.	SS	S ²	Adjusted R ²	df	Variables	Coefficients	P-value
A	0.00023739	26.35072056	1.198	0.540440611	22	<ul style="list-style-type: none">GDP Per capitaGovernment deficitNational debtType of system	3.495361937 -0.070254971 0.025927509 0.185398131	0.001339249 0.291576391 0.009509572 0.697269472
B	2.815E-05	28.30031971	1.179	0.547569444	24	<ul style="list-style-type: none">GDP Per capitaNational debt	2.732782318 0.029877302	0.001047904 0.000945772
C	0.001392743	44.67720334	1.787	0.314325814	25	<ul style="list-style-type: none">National debt	0.034631603	0.001392743

The best model that estimates the ratio of observed to predicted healthcare expenditure according to GDP per capita and national debt is model (B). Model (B) provides the smallest value of the estimation of variance of the error term (S²) thus the part that is not explained by the explanatory variables in the model is minimal in comparison to models A and B.

- S²: **Model (B)** 1.179 < Model (A) 1.198 < Model (C) 1.787

In addition the observed value of adjusted R² in relation to model (B) is larger than that of the other models thus Model (B) provides the best linear fit.

- Adjusted R²: Model (C) 0.31 < Model (A) 0.540 < **Model (B)** 0.548

Model (B) provides the best overall results and incorporates two explanatory variables thus further interpretation of model B was pursued.



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Appendix 7: Data set 2007

Variable	Dependent	Explanatory			
Year 2007	HCExp (%GDP) ^{xi}	log (GDP Per capita (Euro)) ^{xii}	Government deficit (%GDP) ^{xiii}	National debt (%GDP) ^{xiv}	Dummy variable – type of system (National health system "taxation" = 0) (National Health Insurance system = 1) ^{xv}
Country	Y	X1 (β) (log)	X2 (δ)	X3 (λ)	X4 (Dummy)
Austria	10.27	4.52	-0.9	60.7	1
Belgium	9.66	4.50	-0.3	84.2	1
Cyprus	6.03	4.31	3.4	58.3	0
Czech Republic	6.76	4.11	-0.7	29	1
Denmark	9.99	4.62	4.8	27.5	0
Estonia	5.24	4.08	2.5	3.7	1
Finland	8.04	4.53	5.2	35.2	0
France	11.07	4.47	-2.7	63.9	1
Germany	10.45	4.47	0.3	64.9	1
Greece	9.641*	4.31	-6.4	105.4	0
Hungary	7.46	4.00	-5.0	66.1	1
Iceland	9.09	4.68	5.4	28.5	0
Ireland	7.667*	4.64	0.1	25	0**
Italy	8.683*	4.41	-1.5	103.6	0**
Latvia	6.98	3.96	-0.3	9	0
Lithuania	6.26	3.93	-1.0	16.9	1
Luxembourg	7.05	4.89	3.7	6.7	1
Netherlands	9.68	4.54	0.2	45.3	1
Norway	8.88	4.78	17.5	51.5	0
Poland	6.43	3.91	-1.9	45	1
Portugal	9.99	4.20	-3.1	68.3	0
Romania	5.24	3.76	-2.6	12.6	1
Slovakia	7.74	4.01	-1.8	29.6	1
Slovenia	7.79	4.23	-0.1	23.1	1
Spain	8.48	4.37	1.9	36.1	0
Sweden	8.92	4.57	3.6	40.2	0

* Data sources from the OECD database²²

** System defined in the literature.



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