Essays

Efficiency and Equity: Assessing the Relationship Between Health System Efficiency and Social Inclusion in Europe

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ABSTRACT: This paper investigates the relationship between health system efficiency and social inclusion in Europe. Using a two-stage empirical strategy on a panel of 25 countries over the period 2009 – 2019, we first estimate health system efficiency scores through Stochastic Frontier Analysis (SFA), where per capita health expenditure is related to a composite health index including infant mortality, life expectancy, and hospital discharges. In the second stage, these efficiency scores are introduced into pooled OLS and panel mixed-effects models to assess their association with social outcomes, measured by both the Gini index and a multidimensional index of social inclusion. The results reveal wide cross-country differences in efficiency, with Germany, Austria, and Italy among the most efficient, while Romania, Latvia, and Bulgaria rank lowest. More importantly, the analysis demonstrates that greater efficiency in health systems is systematically associated with lower inequality and higher social inclusion. These findings suggest that efficiency in health resource allocation extends beyond improved health outcomes to broader societal benefits, reinforcing the case for policies that integrate fiscal sustainability, equity, and social cohesion within the European Social Model and the UN 2030 Agenda for Sustainable Development.

KEYWORDS: Social inclusion; health system efficiency; stochastic frontier analysis; panel data; social cohesion

1. Introduction

Understanding the relationship between health system efficiency and social inclusion is essential for advancing equitable and sustainable development in Europe. In the context of rising socio-economic disparities, demographic aging, and increasing fiscal pressures, the effi-

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cient allocation of health resources has become a central concern for policymakers. When health systems are able to achieve strong health outcomes while minimizing input use, they are not only more financially sustainable but also possess the potential to reduce inequality and enhance social cohesion.
The pursuit of more efficient health care systems has long been a key policy objective. This imperative was intensified following the 2007–2008 global financial crisis and, in Europe, the subsequent sovereign debt crisis of 2011–2012. These crises necessitated widespread fiscal consolidation and reinforced the need to rationalize public expenditure across all sectors, including health care, through spending review policies. Over the past four decades, health care expenditure as a share of GDP has increased substantially reaching 13.3% in OECD countries by 2016 underscoring the urgency of improving efficiency to ensure long-term financial sustainability.
An extensive body of empirical research has examined health system performance across various contexts, including OECD countries (e.g., Mobley and Magnussen, 1998[1]; Hollingsworth, 2003[2]; Osterkamp, 2004[3]; Retzlaff-Roberts et al., 2004[4]; Bhat, 2005[5]; Afonso et al., 2005[6]; Grosskopf et al., 2006[7]; Siciliani, 2006[8]; Hollingsworth, 2008[9]; Spinks and Hollingsworth, 2009[10]; Adam et al., 2011[11]; Mirmirani and Lippmann, 2011[12]; Sinimole, 2012[13]; Cetin and Bahce, 2016[14]; Carrillo and Jorge, 2017[15]; Ozcan and Khushalani, 2017[16]; Gavurova et al., 2021[17]), European Union member states (Afonso et al., 2010[18]; Jer-

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[2] B. Hollingsworth, *The measurement of efficiency and productivity of health care delivery*, in *Health economics*, 17(10), 2008, 1107-1128.
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[5] V.N. Bhat, *Institutional arrangements and efficiency of health care delivery systems*, in *The European Journal of Health Economics*, 6, 3, 2005, 215-222.
[6] A. Afonso, L. Schuknecht, V. Tanzi, *Public sector efficiency: an international comparison*, in *Public Choice* 123, 2005, 321-347.
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[15] M. Carrillo, J.M. Jorge, *DEA-like efficiency ranking of regional health systems in Spain*, in *Social Indicators Research*, 133, 3, 2017, 1133-1149.
[16] Y.A. Ozcan, J. Khushalani, *Assessing efficiency of public health and medical care provision in OECD countries after a decade of reform*, in *Central European Journal of Operations Research*, 25, 2, 2017, 325-343.

emic et al., 2012[19]; del Rocio Moreno-Enguix et al., 2018[20]; Lupu and Tiganasu, 2022[21]), and emerging economies (Herrera and Pang, 2005[22]; Afonso et al., 2010[23]; Moses et al., 2022[24]), employing a diverse set of socio-economic indicators.

Methodologically, much of this literature utilizes nonparametric production frontier techniques such as Free Disposable Hull (FDH-Deprins et al.,1984[25]) and Data Envelopment Analysis (DEA-Farrell, 1957[26]; Charnes et al.,1978[27]), which impose minimal restrictions on the data. More recent studies complement or replace these approaches with parametric methods, notably Stochastic Frontier Analysis (SFA) (e.g., Greene, 2004[28]; Greene, 2010[29]; Kumbhakar, 2010[30]; Varabyova and Schreyögg, 2013[31]; de Cos and Moral-Benito, 2014[32]; Hamidi and Akinci, 2016[33]).

Within this context, the present study has two primary objectives: (a) to estimate the efficiency scores identifying the efficiency degree of European health systems; and (b) to examine the potential role of health system efficiency on social inclusion, while controlling for socio-economic, demographic and in-

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[23] A. Afonso *et al*., *op. cit.*

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[33] S. Hamidi, F. Akinci, *Measuring efficiency of health Systems of the Middle East and North Africa (MENA) region using stochastic frontier analysis*, in *Applied health economics and health policy*, 14, 3, 2016, 337-347.

stitutional variables. The empirical analysis covers 25 European countries over the period 2009-2019. Social exclusion/inclusion is assessed using two complementary measures: the Gini index, which is in fact a proxy for social exclusion, and a multidimensional index that captures various aspects of social participation and inclusion.

This research is situated within prominent international and regional policy frameworks, notably Sustainable Development Goal 3 ("Ensure healthy lives and promote well-being for all at all ages") and Goal 10 ("Reduce inequality within and among countries") of the United Nations 2030 Agenda, as well as the European Pillar of Social Rights, which underscores timely access to affordable, preventive, and curative health care alongside the right to social protection and inclusion.

The empirical strategy employs a two-stage approach. In the first stage, Stochastic Frontier Analysis (SFA) is used to estimate country-level health system efficiency scores by modelling the production of health outcomes as a function of relevant inputs. In the second stage, these efficiency scores serve as explanatory variables within a panel data framework using pooled Ordinary Least Squares (OLS) and panel mixed-effects models to investigate their association with social inclusion. The models incorporate a comprehensive set of socio-economic, demographic and policy control variables.

By empirically exploring the relationship between health system efficiency and wider measures of social inclusion and inequality, this study contributes to ongoing discussions on the societal benefits of health policy. The findings aim to inform evidence-based policymaking at both national and European levels, thereby supporting efforts to reinforce the social dimension of health systems consistent with the 2030 Agenda for Sustainable Development and the core values of the European Social Model.

2. Methodology and Data

The empirical analysis presented relies on a panel dataset covering 25 European countries over the period 2009–2019. The methodological approach follows a two-step strategy. In the first step, we estimate health system efficiency scores, using a parametric Stochastic Frontier Analysis (SFA). In the second these estimates are used as the central explanatory variable in the analysis of broader social outcomes through Ordinary Least Squares (OLS) and panel mixed-effects models. This sequential framework allows us not only to measure the performance of health systems in transforming resources into health outcomes but also to investigate the extent to which efficiency is associated with distributive dynamics and patterns of social inclusion.

In the first step, the efficiency of national health systems is assessed through a production frontier model that compares health outcomes with the resources employed to achieve them. We adopt a stochastic frontier approach, which is particularly suitable for distinguishing between inefficiency and random shocks or measurement errors. This step requires the definition of inputs and outputs in the health production process. Following the literature (e.g., Afonso and St. Aubyn, 2011[34]), we use per capita health expenditure as the input and a composite, multidimensional index of population health as the output.

[34] A. Afonso, M. St. Aubyn, *Assessing health efficiency across countries with a two-step and bootstrap analysis*, in *Applied Economics Letters*, 18, 15, 2011, 1427-1430.

This Health Index (HI) is constructed using literature-based indicators (Mbau et al., 2023[35]). Specifically, it incorporates two health status indicators—infant mortality rate (IMR) and life expectancy (LE)—and a treatment-related indicator, hospital discharges (HD), which serves as a proxy for inpatient care provision (Castaldo et al., 2020[36]). Table 1 provides further details on the variables included.

Table 1. Basic Indicators for Health Index

Variables	Description	Source
Infant Mortality Rate (IMR)	Number of deaths under one year of age occurring among the live births in a given geographical area during a given year, per 1,000 live births occurring among the population of the given geographical area during the same year. In other terms, IMR is equal to (Number of children who died before 12 months) / (Number of born children) x 1,000	OECD
Life expectancy (LE)	Life expectancy at birth (how long, on average, a newborn can expect to live, if current death rates do not change)	OECD
Hospital discharges (HD)	Number of patients who leave a hospital after receiving care. Hospital discharge is defined as the release of a patient who has stayed at least one night in hospital. It includes deaths in hospital following inpatient care. Same-day discharges are usually excluded. This indicator is measured per 100,000 inhabitants	OECD

To ensure that all variables are positively oriented such that higher values indicate better outcomes—we transform the Infant Mortality Rate (IMR) by calculating 1000 – IMR, which reflects the number of children surviving their first year of life per 1,000 live births.

To enable comparability across indicators, we normalize each output variable by subtracting its minimum value and dividing by the range (maximum minus minimum)[37], following the methodology adopted in the construction of the Human Development Index (HDI), Afonso et al. (2005)[38] and Antonelli and De Bonis (2017[39]; 2019[40]) obtaining the following normalized variables ($V_{i,j,t}$) for each output:

$$0 \leq V_{i,j,t} = \frac{x_{i,j,t} - x_{minj}}{x_{maxj} - x_{minj}} \leq 1 \qquad (1)$$

[35] R. Mbau, A. Musiega, L. Nyawira, B. Tsofa, A. Mulwa, S. Molyneux, E. Barasa, *Analysing the efficiency of health systems: a systematic review of the literature*, in *Applied health economics and health policy*, 21, 2, 2023, 205-224.
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[37] Where the minimum and maximum are computed over the entire panel.
[38] A. Afonso *et al.*, *op. cit.*
[39] M. A. Antonelli, V. De Bonis, *Social Spending, Welfare and Redistribution: A Comparative Analysis of 22 European Countries*, in *Modern Economy* 8, 2017, 1291-1313.
[40] M.A. Antonelli, V. De Bonis, *The efficiency of social public expenditure in European countries: a two-stage analysis*, in *Applied Economics*, 51, 2019, 47-60.

Where *i= 1, 2, 3….29* (countries); *j =1, 2, 3* (*IMR, LE, HD* output variables); *t = years*
The overall health output indicator (HI) for country *i* and time *t* is computed as follows:

$$HI_{i,t} = \sum_{j=1}^{3} V_{i,j,t} \qquad (2)$$

Table 2 presents the variables employed in the estimation of the efficiency scores, while Table 3 reports the ranking of countries according to the efficiency scores obtained.

Table 2. SFA-Based Input, Output, and Technical Efficiency Scores

Variables	Description	Source	Unit of Measure
Health indicator	Composite multidimensional index of overall health outcomes	Our elaboration on OECD and Eurostat data	Index
Health_Exp_pc	Per capita Health expenditure	Eurostat	Euro per inhabitant (at constant 2010 prices)
Efficiency scores	Health sector technical efficiency indicator	Our elaboration on OECD and Eurostat data	Index

At the top of the distribution, we find Germany, Austria, and Italy, which emerge as the most efficient systems in Europe. At the opposite end, Romania, Latvia, and Bulgaria display the lowest scores, highlighting the substantial heterogeneity that characterizes the continent.

Table 3. Efficiency scores (average value) and country rankings

Rank	Country	Efficiency score
1	Germany	0,964
2	Austria	0,947
3	Italy	0,925
4	Finland	0,916
5	Spain	0,915
6	Slovenia	0,910
7	Sweden	0,901
8	Norway	0,900
9	France	0,880
10	Greece	0,868
11	Czechia	0,861
12	Belgium	0,835
13	Denmark	0,777
14	Portugal	0,764
15	Estonia	0,764
16	Ireland	0,763

17	Luxembourg	0,750
18	Netherlands	0,675
19	Lithuania	0,630
20	Poland	0,610
21	Hungary	0,590
22	Slovakia	0,561
23	Bulgaria	0,546
24	Latvia	0,488
25	Romania	0,402

The variability in efficiency scores suggests that differences may also reflect contextual social and institutional factors, in addition to expenditures.

In the second step, our study explores whether the efficiency of the health sector exerts an influence beyond health itself, shaping social and distributive outcomes. To his purpose, we use the efficiency scores, obtained in the first step, as a key covariate to investigate their relationship with the social inclusion phenomenon across European countries, while controlling for socio-economic variables. Our empirical investigation is based on the following equation:

$$SO = \alpha_0 + \alpha_1 EFF_{HS_{i,t}} + \alpha_2 X_{i,t} + \alpha_3 Y_{i,t} + \alpha_4 Z_{i,t} + \alpha_5 Age\_Dep_{i,t} + T_t + \varepsilon_{i,t} \quad (3)$$

Where the subscripts *i* and *t* respectively represent countries and time. Initially, we estimate a pooled OLS model with robust standard errors, followed by the application of a panel mixed-effects model that incorporates unobserved heterogeneity across countries and accounts for both intra- and inter-country variation. As dependent variables representing social outcomes (*SO*) capturing different aspects of inequality and inclusion. we employ two alternative measures: the Gini index (*GNI*), measured on a 0–100 scale, and a composite multidimensional index (*SOC_INC*) that reflects broader dimensions of social inclusion.

However, there is no single, universally accepted definition of social inclusion, more recent interpretations – such as that of Bellani and D'Ambrosio (2011)[41]; Giambona and Vassallo (2014)[42] – conceptualize it as an individual's capacity to participate meaningfully in the social, economic, and political spheres of society. Similarly, the European Commission (2004)[43] defines social inclusion as a process that ensures individuals at risk of poverty and exclusion have the necessary resources and opportunities to fully engage in economic, social, and cultural life, to attain an adequate standard of living, and to exercise their fundamental rights. In this vein, our composite indicator (*SOC_INC*) captures dimensions of economic marginalization and limited access to essential goods and services by aggregating the following varia-

[41] L. BELLANI, C. D'AMBROSIO, *Deprivation, social exclusion and subjective well-being*, in *Social Indicators Research*, 104, 2011, 67–86.

[42] F. GIAMBONA, E. VASSALLO, *Composite indicator of social inclusion for European countries*, in *Social indicators research*, 116, 1, 2014, 269-293.

[43] EUROPEAN COMMISSION, *Joint report on social inclusion 2004*, Luxembourg, Office for Official Publications of the European Communities, 2004.

bles: the average of male, female, and youth unemployment rates, the poverty rate, and the housing cost overburden rate. All data are obtained from Eurostat[44].

Unemployment is included in the index, as employment serves not only as a fundamental source of income but also as an essential mechanism for social integration. It facilitates access to financial resources, social relationships, and active participation in society. Consequently, unemployment can contribute to social isolation and a diminished sense of self-worth.

Poverty often results in insufficient income to secure access to basic needs such as food, healthcare, education, and adequate housing, which are essential for maintaining minimum living standards.

The housing cost overburden rate – measuring the proportion of individuals living in households where total housing costs exceed 40% of disposable income – reveals less visible forms of poverty, capturing situations in which individuals may not fall below the poverty threshold yet still face substantial financial strain. High values may indicate housing insecurity and exclusion from adequate living conditions. Since all the previous variables are negatively oriented, they are transformed to have a positive orientation[45] and subsequently normalized using the same methodology described for the health indicator $HI_{i,t}$ in equations (1) and (2). As regressors, we include a set of control variables covering key dimensions of social inclusion: the health system efficiency (EFF_{HS}); socio-economic factors (*X*) such as GDP per capita and education population level; policy variables (*Y*) including social protection expenditure per capita and net replacement rate for the unemployed; labour market indicators (*Z*) as maternal employment rate and overall unemployment rate; and a demographic variable reflecting the population composition, measured by the age dependency ratio (Age_Dep). Finally, in eq. (3) *T* represents years fixed effects and ε is a well-behaved error term distributed IID (0, σ2). All variables are described in the following Table 4.

Table 4. Variables description

Variables	Description	Source	Unit of Measure
Health indicator (HI)	Composite multidimensional index of overall health outcomes	Our elaboration on OECD and Eurostat data	Index
Health_Exp_pc	Per capita Health expenditure	Eurostat	Euro per inhabitant (at constant 2010 prices)
EFF_{HS} *(Efficiency scores)*	Health sector technical efficiency indicator	Our elaboration on OECD and Eurostat data	Index
SOC_INC	Composite multidimensional index of social inclusion	Our elaboration on Eurostat data	Index
GNI	Gini index	Eurostat	Index (scale 0-100)

[44] A detailed description of the variables is provided in Appendix (table A1).

[45] In this case all the variables (x_i) are expressed in percentages. Then, to give them a positive orientation we use the transformation 100- x_i.

GDPpc	The indicator is calculated as the ratio of real GDP to the average population of a specific year	Eurostat	Euro per capita, Chain Linked Volumes (2010)
Unemployment	Unemployment rate per population 15-74 years	Eurostat	Percentage
SOC_Exp_pc	Expenditure on social protection per capita	Eurostat	Euro per inhabitant (at constant 2010 prices)
NRR	Net replacement rate in unemployment: net unemployment benefits as a percentage of previous net earnings, indicating the income support level for unemployed individuals (calculated for a single person without children, earning 67% of the average wage)	OECD	Percentage
MTE	Maternal employment rate: employment rate for women (15-64 years old) by the presence of at least one child (aged 0-14)	Eurostat	Percentage
Age_Dep	Age dependency ratio: ratio of people older 64 to working age population (15-64)	World Bank, World Development Indicators	Percentage
Edu	Percentage of population from 15 to 74 years with upper secondary, post-secondary non-tertiary and tertiary education (levels 3-8)	Eurostat	Percentage

In conducting the second-stage analysis, we rely on two complementary estimation strategies: a pooled Ordinary Least Squares (OLS) model and a panel mixed-effects model. The use of pooled OLS provides a straightforward benchmark, offering an overall picture of the association between efficiency and social outcomes by pooling all country-year observations together. However, this approach does not fully account for the fact that countries differ in persistent ways that cannot be directly observed. For this reason, we also employ a mixed-effects panel model, which explicitly incorporates unobserved heterogeneity across countries while still allowing us to exploit the time variation in the data. By combining the two methods, we strengthen the robustness of the findings: if the results hold under both specifications, we can be more confident that they are not simply driven by country-specific characteristics or short-term fluctuations but rather reflect a systematic relationship between health system efficiency and social inclusion.

3. Descriptive Statistics

Table 5 presents the descriptive statistics—number of observations, mean, standard deviation, minimum, and maximum—for the variables included in the analysis. The Health Indicator (*HI*) ranges from 0.785 to 2.402, with a mean value of 1.83, while health expenditure per capita exhibits considerable variation, ranging from €183 to over €5,200. This highlights significant disparities in health resource allocation across countries. The efficiency score (EFF_{HS}) for national health systems averages 0.77, with a range from 0.30 to 0.99, indicating varying degrees of system performance.

Table 5. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
HI	275	1.834	0.356	0.785	2.402
Health_Exp_pc	275	1917.728	1380.252	182.62	5236.31
EFF_{HS}	275	0.766	0.169	0.299	0.987
SOC_INC	275	0.715	0.143	0.107	0.944
GNI	275	29.621	4.095	20.9	40.8
GDPpc	275	27930.51	18882.96	4970	84750
Unemployment	275	8.945	4.804	2	27.5
SOC_Exp_pc	275	7176.732	5154.078	825.56	18641.75
NRR	275	70.284	11.954	35	97
MTE	262	70.097	8.939	50.729	86.57
Age_Dep	275	27.165	4.24	16.244	36.173
Edu	275	72.256	11.484	27.8	88.9

Social inclusion (*SOC_INC*) shows a mean of 0.72, but values as low as 0.11 point to marked disparities in levels of inclusion. Similarly, the Gini index, ranging from 20.9 to 40.8, and GDP per capita, spanning from €4,970 to €84,750, reflect diverse income distributions and levels of economic development.

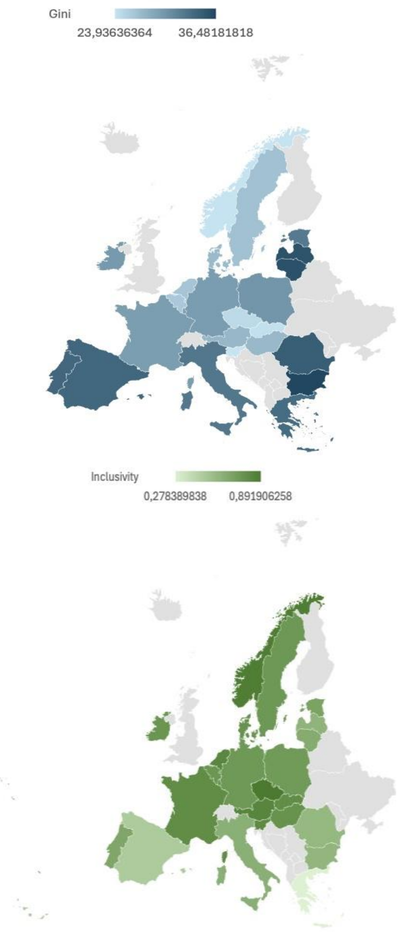
On average, 72% of individuals aged 15–74 have attained education levels ranging from upper secondary to tertiary education.

Social policy indicators also display substantial variation: social expenditure per capita ranges from €826 to over €18,600, and the net replacement rate for the unemployed averages 70.3%.

The average maternal employment rate is relatively high (mean = 70.1%, SD = 8.9) and exhibits greater variability across countries compared to the unemployment rate, which has a mean of 8.95% and a standard deviation of 4.8. Finally, the age dependency ratio averages 27.2%, reflecting differences in demographic pressures across national contexts.

To visualize the geographical distribution of income inequality and social inclusion, Figures 1 presents the maps of the Gini index and the Social Inclusion Indicator index across Europe.

Figure 1. Geographical distribution of the Gini Index and the Social Inclusion Indicator



The comparison shows that Northern and Western European countries generally perform better in terms of inclusivity, while higher inequality levels are observed in several Southern and Eastern member states. These patterns confirm well-known divides within Europe but also offer a spatial dimension that is useful for interpreting the statistical results.

The relationship between efficiency of national health systems and social outcomes is then illustrated by means of scatter plots. Figure 2 relates the efficiency scores to the Gini index, displaying a negative association: countries with more efficient health systems tend to record lower levels of income inequality.

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Figure 2. Relationship between Income Inequality and Efficiency of the Health Systems

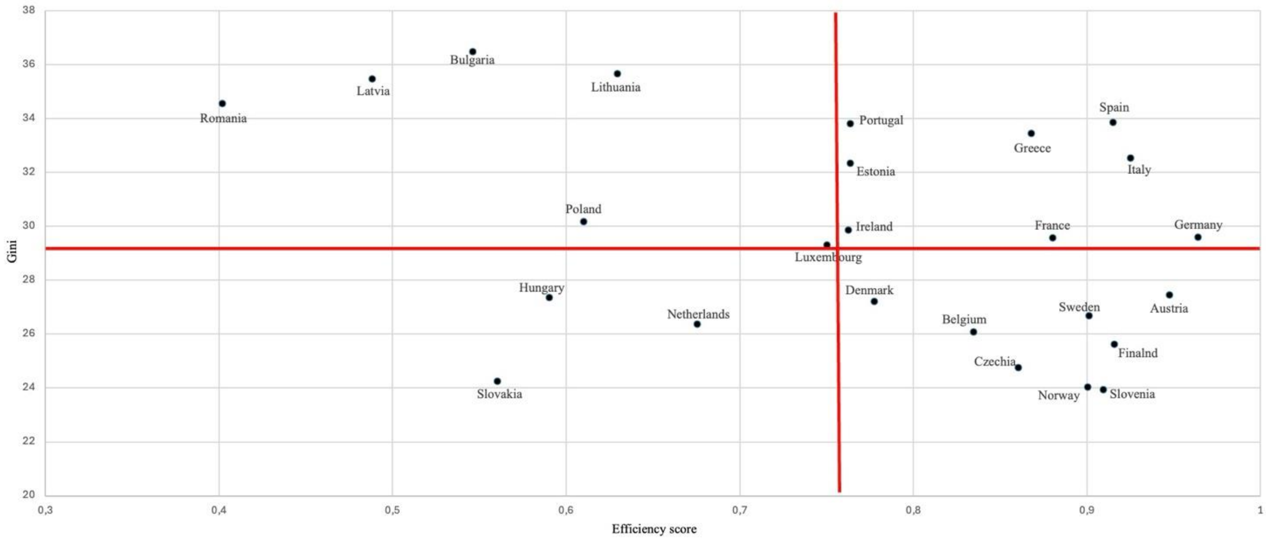
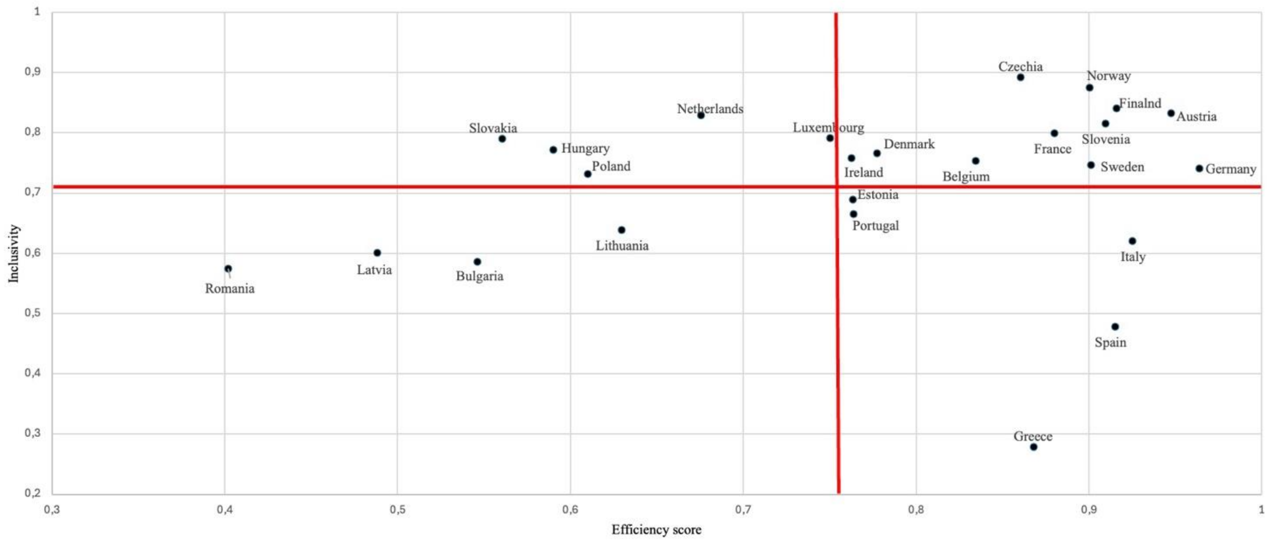


Figure 3 shows the connection between efficiency scores and the Social Inclusion index, highlighting instead a positive association: higher efficiency correlates with more inclusive societies.

Figure 3. Relationship between the Social Inclusion Indicator and the Efficiency of the Health Systems



While these relationships do not establish causality in a strict sense, they provide robust evidence of a systematic link between the way health resources are employed and the quality of social and distributive outcomes.

In summary, the two-step methodology adopted here makes it possible to move from the measurement of efficiency within health systems to the evaluation of its potential societal implications. By combining frontier analysis with panel econometrics, the study contributes to a better understanding of how health policy performance and resource allocation are connected with broader goals of social cohesion and equity. This approach situates the debate within the European policy context, where the challenge of ensuring sustainable health systems is increasingly intertwined with the pursuit of inclusive and balanced development.

4. Estimation Results

The results of the econometric analysis are summarized in Table 6, which reports both pooled OLS estimates and linear mixed-effects models for the two alternative dependent variables, the Inclusivity index and the Gini coefficient. Overall, the findings indicate a robust and consistent relationship between health system efficiency and social outcomes across specifications, confirming the central role of efficiency as identified in the first step of the empirical strategy.

Table 6. Estimation Results

Variables	OLS Dependent variable: Social Inclusion	MIXED Dependent variable: Social Inclusion	OLS Dependent variable: Gini index	MIXED Dependent variable: Gini index
EFF_{HS}	0.0687*** (0.0159)	0.0626*** (0.0155)	-0.141*** (0.0345)	-0.140*** (0.0330)
GDPpc	-0.107*** (0.0298)	-0.129*** (0.0273)	0.378*** (0.0518)	0.367*** (0.0495)
Unemployment	-0.132*** (0.0123)	-0.127*** (0.0116)	0.0758*** (0.0144)	0.0785*** (0.0140)
SOC_Exp_pc	0.0878*** (0.0234)	0.107*** (0.0205)	-0.336*** (0.0382)	-0.328*** (0.0369)
NRR	0.00174*** (0.000301)	0.00176*** (0.000303)	-0.00155*** (0.000449)	-0.00153*** (0.000426)
MTE	0.00103** (0.000435)	0.000930** (0.000418)	0.000993 (0.000708)	0.000949 (0.000658)
Age_Dep	-0.195*** (0.0266)	-0.223*** (0.0278)	0.410*** (0.0615)	0.401*** (0.0514)
Edu	0.0746*** (0.0243)	0.0715*** (0.0244)	-0.241*** (0.0276)	-0.239*** (0.0266)
Time	YES	YES	YES	YES
Constant	1.291*** (0.228)	1.441*** (0.239)	2.001*** (0.414)	2.049*** (0.375)
Countries	25	25	25	25
Observations	239	239	239	239
F.stat or Wald chi2	27.26***	461.71***	37.49***	651.51***
R-squared	0.730	-	0.587	-

When considering social inclusion as the dependent variable, the coefficient of the efficiency score is positive and statistically significant in both models. This suggests that countries whose health systems use resources more efficiently also tend to achieve higher levels of social inclusion. The result is in line with the idea that efficiency in the allocation of health expenditure does not merely translate into better health outcomes but also contributes to creating more inclusive societies, where access to opportunities and participation is more equally distributed. The effect remains stable across estimation techniques, further strengthening its robustness. The positive association identified in the estimates is visually consistent with the pattern already highlighted in Figure 4, where higher efficiency scores are correlated with stronger inclusivity.

Turning to the regressions with the Gini index as the dependent variable, the estimated coefficient of the efficiency score is negative and highly significant. This implies that more efficient health systems are associated with lower levels of income inequality. In other words, efficiency in the health sector appears to play a redistributive role, narrowing the gap between higher- and lower-income groups. The consistency of this finding across both pooled OLS and mixed-effects models provides compelling evidence that the link between efficiency and inequality is not driven by model specification or country-specific unobservable. Once again, the statistical results confirm the descriptive evidence shown in Figure 3, where countries with higher efficiency tend to cluster at lower levels of inequality.

Beyond efficiency, the estimates for the control variables also offer important insights. Social protection expenditure per capita exerts the expected effect, being positively associated with inclusivity and negatively with inequality, thereby highlighting the relevance of welfare transfers in shaping distributive outcomes. The net replacement rate (NRR) and maternal employment (MTE) are positively correlated with inclusivity and negatively with inequality, underlining the role of income support and gender-related factors in fostering more equitable societies. Conversely, GDP per capita displays a negative association with inclusivity and a positive one with inequality, suggesting that economic growth alone does not automatically guarantee cohesive social outcomes. Education contributes positively to inclusivity and reduces inequality, in line with its role in enhancing human capital and opportunities. Finally, unemployment and age dependency ratios are negatively associated with inclusivity and positively with inequality, reflecting their impact on vulnerability and social fragmentation.

Taken together, these findings provide a coherent picture of the channels through which health system efficiency interacts with broader social dynamics. Efficient health systems not only succeed in transforming spending into better health outcomes but also contribute to reducing income disparities and strengthening social participation. The stability of the results across alternative specifications and dependent variables reinforces the validity of these conclusions, while the graphical evidence provided by the scatter plots further illustrates the systematic nature of these relationships. This supports the hypothesis that efficiency in the health sector has a significant and beneficial impact on social cohesion in Europe.

5. Conclusions

This paper has explored the relationship between health system efficiency and broader social outcomes in Europe over the decade 2009–2019. By combining a two-step empirical strategy with a rich panel of 25 countries, the analysis has shown that efficiency in the health sector is not only a matter of internal performance but also a factor with far-reaching social consequences. The results provide consistent evi-

dence that health systems capable of generating good health outcomes efficiently, are also those more likely to sustain higher levels of social inclusivity and to reduce income inequality.
The first step of the analysis provide a measure of the health systems efficiency by estimating how effectively per capita health expenditure is transformed into a multidimensional health outcome indicator. The resulting scores revealed striking cross-country differences: while Germany, Austria and Italy emerged among the most efficient health systems, countries such as Romania, Latvia and Bulgaria lagged behind. These gaps underscore the relevance of institutional capacity and governance quality in shaping how resources are converted into tangible results, beyond the sheer level of spending.
The second step demonstrated that efficiency has a significant bearing on distributive outcomes. Regression results indicated a positive and robust association between efficiency scores and social inclusivity, as well as a negative and equally strong relationship with the Gini coefficient of inequality. In practical terms, this means that efficiency in health care is not only fiscally desirable, but it also promotes a fairer and more cohesive society. Scatter plots provided additional visual confirmation of these relationships, making clear that more efficient countries are systematically better positioned in terms of both inclusion and equality.
From a policy perspective, these findings carry important implications. First, they suggest that efforts to improve efficiency in health systems through better management of resources, evidence-based allocation, and innovation in service delivery can generate benefits that extend well beyond the health sector itself. A more efficient health system reinforces social cohesion, contributes to reducing inequality, and strengthens the inclusiveness of economic growth. Second, the results highlight the importance of complementing efficiency improvements with broader social policies. Investments in education, gender equality, and employment opportunities emerge as critical complements that amplify the redistributive potential of efficient health systems. Finally, public policies matter: social expenditure and income support measures foster social inclusion, underscoring the importance of redistributive public intervention.
In conclusion, health system efficiency should be seen as a cornerstone of a broader development strategy in Europe. Far from being a purely technical issue, it is intrinsically linked to the social dimension of growth and to the ability of societies to ensure equal opportunities for all citizens. Policymakers aiming to reconcile fiscal sustainability with social cohesion would therefore do well to treat efficiency not as an end in itself but as a key driver of inclusive and equitable development.

6. Appendix

Table A1. Basic indicators for the Social Inclusion indicator

Variables	Description	Source
Unemployment rate (average value)	Male unemployment rate: number of unemployed males, expressed as a percentage of the male labour force (aged 15–74)	Eurostat
	Female unemployment rate: number of unemployed females, expressed as a percentage of the female labour force (aged 15–74)	Eurostat

	Youth unemployment rate: share of unemployed individuals aged 15 to 24 expressed as a percentage of the labor force in that same age group	Eurostat
Poverty rate	At-risk-of-poverty-rate (AROP): share of persons with an equivalised disposable income below the risk-of-poverty threshold (60% median income)	Eurostat
Housing cost overburden rate	Percentage of the population living in households where the total housing costs ('net' of housing allowances) represent more than 40 % of disposable income	Eurostat