TOWARD A MORE EFFICIENT HEALTHCARE SYSTEM USING MODELLING APPROACH

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Abstract

This scientific article aims to identify the most optimal healthcare financing model suitable for a country's unique healthcare context while focusing on overcoming the fragmented and costly way in which healthcare is traditionally delivered. The tasks set for this research include evaluating and benchmarking different countries and environments to identify the most efficient model, reducing transaction costs, and analysing the agents and their motivations and decision situations using agent theory and game theory. To achieve the goal and tasks, the author conducted a comprehensive study based on the transaction cost theory, which explains how inefficient contracts can lead to an inefficient healthcare system. Additionally, the author used agent theory to understand the motivations of various stakeholders involved in healthcare financing and game theory to analyse decision-making processes leading to socially and individually beneficial outcomes. The empirical segment of the research utilised data from the OECD annual healthcare database for 2016-2019. A range of analytical tools, including descriptive analysis, data visualization, correlation analysis, and hypothesis testing were employed to examine the dataset for this study. The analysis results revealed four healthcare financial models with various indicators with different levels of influence. This research provides valuable insights for senior healthcare managers and policymakers to make informed decisions and lead their organisations toward more efficient and effective healthcare financing models.

In conclusion, this study fills the research gap and addresses the central research question by comprehensively analysing healthcare financing models. The results emphasize the importance of reducing transaction costs and understanding the motivations of different stakeholders for achieving more efficient and effective healthcare outcomes. Countries can move towards a more integrated and cost-effective healthcare system by implementing the most efficient model identified in this study.

Keywords: Healthcare systems, health expenditure, economic growth.

JEL Classification Codes: I1, I15, I11, H51

1. Introduction

Healthcare cost growth faces challenges in keeping up with inflation, exacerbated by the Covid-19 pandemic, which has prompted increased government spending on vaccination programs and health infrastructure. However, the government's strategy to sustain or boost healthcare spending to address non-Covid care backlogs and staffing issues amidst the global economic slowdown is not clearly defined. The World Bank predicts a 4.9% rise in total healthcare expenditure (public and private) in nominal U.S.

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dollar terms in 2023, driven by higher costs and wages. Nevertheless, in real terms, spending is falling due to its inability to keep up with inflation, making 2023 the second consecutive year of declining real funding. This persistent fall in real funding poses a critical challenge, significantly impacting healthcare providers.

The existing gap between income and expenditure puts healthcare providers in a challenging position, necessitating tough decisions about healthcare delivery, such as cutting non-essential services and extending waiting lists. OECD data reveals that after the global financial crisis 2008 2009, spending on preventive care and medication experienced the most significant decline. Therefore, it is imperative to avoid repeating the same pattern to maintain a robust healthcare system (The World Bank, 2023).

To address these issues, the author of this research aims to do this in as focused way as possible, evaluating, benchmarking different countries and environments, so that findings can be generalised. The author aims to identify an effective healthcare financing model, with a focus on overcoming fragmentation and high costs in traditional delivery. The goals include evaluating countries, reducing transaction costs, and analysing stakeholders' motivations using agent theory and game theory. To achieve this, the author will study transaction cost theory, examine the impact of inefficient contracts, and provide insights to enhance global healthcare financing strategies.

The author's decision was to evaluate data from a handful of relevant countries (see Appendix A for the full list of included countries) rather than solely focusing on the effective United States model. This is justified for several reasons: (1) it allows for a comparative analysis of different healthcare systems; (2) increases the generalizability of findings and (3) enables learning from global experiences. By studying diverse list of countries, the research can address limitations and enhance objectivity. Striking a balance is essential to draw insights for improving the healthcare system while considering broader perspectives. This approach offers a comprehensive view of healthcare financing strategies and provides valuable recommendations for healthcare systems worldwide.

2. Healthcare Systems: Four Basic Models

World Health Organization (2010) emphasizes the importance of meeting the three basic goals of a functional healthcare system: keeping people healthy, treating the sick, and protecting families against financial ruin caused by medical bills. Since there are more than 200 countries, the author of this research point out the limitation of this research showing that not all systems in isolation are examined to understand how countries manage with the healthcare system. Therefore, the focus is on the four basic systems that combine all local variations of healthcare systems (Reid, 2010). Only developed industrial countries have established healthcare systems, which in total are about 40 out of the 200 countries in the world (Raid, 2010). The healthcare financing model and the compensatory policy of medical institutions are the most fundamental and important issues in the healthcare system (Luc L. Hagenaars, Niek S. Klazinga, Michael Mueller, David J. Morgan, Patrick P.T. Jeurissen, 2017).

First, the Beveridge Model is introduced. The establishment of the National Health Service began in 1948. This system funds healthcare from general government revenues, which covers the entire population. Accordingly, WHO (2010) reports a funding base similar to that of the USSR system, but providers are much more independent. The government owns most hospitals and clinics; some doctors are government employees, but some private doctors pass their fees to be paid by the government. Countries using the Beveridge are more generally high income countries, with a shift from health coverage as a right of labour, to "health as a human right" or "health as human right" or health coverage as a constitutional or legal right (WHO 2010). For example, countries that are users of this model: its birthplace Great Britain, Spain, most of Scandinavia and New Zealand. Cuba represents the extreme application of the Beveridge approach; it is probably the world's best example of total government control (Reid, 2010).

Second, the Bismarck Model. The Bismarck Model has become the roots of government-mandated health insurance. Its beginning can be considered Bismarck's Act "Social Health Insurance" in 1883. Compulsory funding by employers and employees, administered by pre-existing "sickness funds" Bismarck-type health insurance schemes must cover everyone and not make a profit. It is not aimed at "universal coverage". Doctors and hospitals tend to be private in Bismarck countries; for example, Japan has more private hospitals than the U.S. (Reid, 2010). The similar laws are found in Germany, France, Belgium, the Netherlands, Japan, Switzerland, and, to a degree, in Latin America. Finally, there are differences within the model in Estonia, France, Hungary, and Korea with their single insurer (WHO, 2010). Reid (2010) says that Germany has about 240 different funds.

Third, the National Health Insurance Model. This system is a mix of elements from both Beveridge and Bismarck. It uses private providers, but because there is no need to make a profit, these universal insurance programs are cheaper and administratively much simpler. The single payer usually has significant market power to negotiate lower prices (Reid, 2010). For example, Canada's system, has negotiated such low prices with pharmaceutical companies that Americans have given up their pharmacies to buy tablets in the north of the border (Reid, 2010). NHI also plans to control costs by limiting the medical services they pay for or making patients wait for their treatment (Raid, 2010). The classic NHI system is found in Canada and some newly industrialised countries such as Taiwan and South Korea (Reid, 2010). With a great deal of caution it can be accepted that the NHS can generally be considered the most efficient system (Leiter, Theurl, 2021).

Last, the Out-of-Pocket Model. Most countries on the planet are too poor and too disorganised to provide any mass medical care. The basic rule in such countries is that the rich receive medical care, but the poor become ill or die. Hundreds of millions of people live in rural Africa, India, China, and South America all their lives without a doctor's appointment. In a poor world, patients can sometimes raise enough money to pay a doctor's bill, or else they will pay with potatoes, goat's milk or childcare, or anything else they can provide. If they have nothing, they will not receive medical attention. However, the U.S., which is included in this model, has healthcare costs that are much higher than the share of GDP compared to other countries. According to the

OECD, U.S. healthcare costs were 16.9% of GDP in 2015, which is more than 5% of GDP higher than the next OECD country in terms of price (OECD, 2017). Reasons for higher costs than other countries include higher administrative costs, spending more for the same services (ie, higher unit prices), more medical care (units) per capita than in other countries, cost differences across hospital regions without differential outcomes, higher per capita income levels, and less active government intervention to reduce costs. Despite these expenditures, the overall quality of healthcare is low by OECD measures (OECD, 2014). The Commonwealth Fund ranked the United States last among similar countries for the quality of healthcare (Roehr, 2008) (Davis, 2010). It is difficult to assess the efficiency of the American healthcare system clearly. On the one hand, survival after a cancer diagnosis is the highest, which may indicate high-quality medical care (American Cancer Society, 2019). On the other hand, life expectancy is not impressive, especially when compared to health spending (Health System Tracker, 2022) In this case, poor disease prevention among the uninsured is a major factor.

Hence, the only difference between the models is related to the nature of entitlement. according to the new System of Health Accounts (OECD, WHO, Eurostat), There appears to be some variation in specific classifications, but the four categories above are widely accepted (Reid, 2010). All in all, there are four main models of healthcare: the Beveridge model, the Bismarck model, the National Health insurance and the out-of-pocket model. Although each model is different, most countries do not strictly adhere to one model; rather, most create hybrids that incorporate multiple traits.

The author seeks to determine the optimal model. To achieve this, comprehensive data analysis was conducted, and the results are contingent upon data availability. Each country has its own starting point and context, so the steps to improve efficiency and maintain performance are different. For example, in post-socialist countries, the main healthcare problem was the lack of neutrality between private and public entities operating in the sector (Reibling, Ariaans, Wendt, 2019*).* It poses another question: which modelyields the best outcome depending on the country's prerequisites? Hence, labelling systems might be discouraging. Based on sound fiscal policies, counter-cyclical spending should be better prepared for the uncertainties and next crisis (WHO, 2016). Finally, it is all about raising efficiency, highlighting the importance of the efficient management of the healthcare financing system, which is vital (Leiter, Theurl, 2021).

All countries' health systems exercise some form of financing models. The author aimed to get a picture of how 200 countries manage healthcare for all the local variations. There are four basic systems (Reid, 2010). The four systems are: the Beveridge Model, the Bismarck Model, the National Health Insurance Model and the Out-of-Pocket Model. The original idea of this article consists of the background of four basic models and to split the data from 200 countries between these four groups. To do so, one can analyse the data of the four models through different indicators. The result of this analysis indicates which system would be considered as optimal.

3. Methodology and data

The most common healthcare models in the world are characterised by specific components such as: contributors, insurance organisations, service recipients, service providers, etc. Therefore, it is useful to provide a graph for all 4 models and include the fifth version of the mixed model (Table 1).

Table 1. Different healthcare financing models. Composed by the author.

Feature	Bismarck	Beveridge	Out of Pocket (OUP)	National Health Insurance (NHI)
Entitlement basis	Contribution	Citizenship/Residence	Market Driven	Citizen/Permanent Residents
Insurer	Employer/ Occupational	Government/State	Market Driven	Government Managed
Funding Base	Wages	Public Revenues	Market Driven	Tax Based and National Insurance Fund
Management	Independent	Government/State	Market Driven	Market Driven/Government/ Public- Private Partnership
Providers	Privately Contracted	Publicly Contracted/Salaried	Market Driven	Government or Privately contracted

This article considers publications, books, conference publications and text mentioned in the reference lists to the specific healthcare industry. The literature between 2016-2023 was reviewed, and the following databases searched: Scopus, Google Scholar and OpenGrey. Comparative and clustering analysis was conducted.
The corresponding information of health variables were taken from OECD official website and the period of four-year data has been used. Further information on data availability is described in Table 2. Data is based on OECD database, including the data of 38 OECD countries and 5 selected non-member economies such as China, India, Indonesia, Russia and South Africa. However, the missing data of some indicators is considered a limitation of this study.

Table 2. Data Specifications. Composed by the author.

Variables	Nature of data	Sources of Data	Timeframe
Country	Text	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019
Health expenditure (% of GDP)	Numeric	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019

Government expenditure per capita in EUR, PPP	Numeric	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019
ICT Access and Usage by Households and Individuals	Numeric	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019
Businesses having performed Big data analysis (%)	Numeric	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019
Exports of goods and services/Percentage of gross domestic product (GDP)	Numeric	OECD Stat	From 1st Jan, 2016 to 31th Dec, 2019
Models in health financing	Text	Different sources	From 1st Jan, 2016 to 31th Dec, 2019

4. Theory: Agent, Game and Transaction Cost Theory in explaining healthcare financing.

In the context of healthcare financing, agent theory describes the agents and their motivations, and game theory describes the possible decision situations, the processes leading to socially and individually beneficial decisions, and the relation of the processes and situations to the structure of the game theory. The founders of agent theory are Michael C. Jensen and William H. Meckling (Ahmad, Farley, Naidoo 2012: 12), who formulated a problem of the different interests of company managers and owners already raised by A. Smith in 1776 (Kiser 1999). They defined an agency contract as an agent and a principal contractual between relationships where the principal hires the agent to get the services needed and by delegating for this part of their decision-making power to the agent (Jensen, Meckling 1976). In the case of healthcare service, in the agent-theoretic approach to public financing, the principal is the state and the agent is health facilities. Private investors also intervene in the agency relationship in healthcare financing. Public healthcare funding is due to a market failure, which the state has to mitigate and intervene. The literature describes a game as a competitive activity whose participants follow defined rules (Oxford Dictionaries 2013). Game theory can be defined as a mathematical theory of decision-making in the conditions of competition between actors (Dresher 1961). Game theory helps us understand situations in which the game's participants may act, and it consists of models that generalise observations and experiences. A strategic game consists of three elements: players, decision options from the list for each player and the outcome preferences for each player. Individual game-theoretic ideas have been described as early as the 18th century, but more rapid development in this field began in the 1920s with the work of mathematicians Emile Borel and John von In Neumann. Game theory gained public attention in 1944 when John von Neumann and Oskar Morgenstern published the book Theory of Games and Economics Behaviour. In the 1950s, John F. Nash developed one of basic concepts of the game theories – Nash equilibrium.

Transaction cost theory explains that inefficient contracts may turn the healthcare system into an inefficient system. The author of the article assumes that the most efficient model can be used by reducing the transaction costs. The idea that deals form the basis of economic thinking was introduced by institutional economist John R. Commons (1931). The argument is that the reasons for the transaction costs were widely known through the cost economics of the Oliver E. Williamson's (Williamson, 1981). The basis of the analysis elaborates on transaction costs. At a time of increasing health system complexity due to the introduction of new technologies, well-functioning management with low transaction costs will likely become more important (Busse, Figueras, Robinson, Jakobowski 2005)

5. Discussion

All public and private institutions' expenditure on healthcare has been constantly increasing. For example, it currently accounts for 18,3% of GDP in the USA and is expected to increase to 33% by 2050 (WHO 2023). In 2013, 1,353 billion euros were spent in the EU-28 and 1,481 billion euros in 2017, which means an increase of 11.7%. The logical conclusion is that countries with the largest population and high economic development spend the most on healthcare. (EUROSTAT database). Between 2013 and 2017, the largest increase in spending (by population) is in the smallest countries, such as Malta (50%), Estonia (33%), Latvia (31%) and Lithuania (27%), but also in larger (but poorer) countries such as Romania (30%) and Bulgaria (27%). Healthcare costs decreased only in Greece (EUROSTAT database).

The relationship between public health expenditure and economic growth has been extensively studied in developing and developed countries Hashmati (2001).concluded the positive relationship between health spending and economic growth was investigated using a sample of Organization for Economic Co-operation and Development (OECD) countries from 1970 to 1992. Bloom (Bloom, 2004) estimated a production function that aggregates capital, labor and human capital (education, experience and health) to conclude that health spending has a positive and statistically significant effect on economic growth. Next, Kwak (Kwak, 2009) estimated the impact of health expenditure on economic growth by dividing health expenditure into public and private expenditure. He analysed data from members of the Organization for Economic Co-operation and Development (OECD) and developing countries, and his findings showed that public health spending had a relatively greater positive impact than that of the private sector spending. A comparative analysis of public and private sector expenditures was carried out by Guissan and Arranz (Guissan, Arranz, 2003) assessing the impact of health expenditures on economic growth in 24 OECD countries between 1970 and 1996. The study's main findings were that health spending plays an essential role in increasing people's overall well-being through higher individual consumption and overall productivity. At the same time, it is important to understand that simply pumping money into the healthcare sector does not automatically lead to economic growth, other conditions must also exist for the optimal response of healthcare spending. Management issues should ensure that health investments are aimed at improving the health of the population. Economic growth may increase due to other public policies, not necessarily healthcare spending, but the importance of efficient healthcare spending as a potential

driver of economic growth needs to be emphasized. Possible positive benefits are quickly felt if the governance framework of countries is transparent in financial management. It is important to acknowledge that a unit increase in health spending could potentially lead to an additional 0.08% increase in economic growth in those countries that increase health spending, especially if the necessary conditions are created to achieve the planned development goals (Serge Mandiefe Piabuo, Julius Chupezi Tieguhong, 2017).

Public-private partnerships are used in many countries, including in the health sector. As a result of these partnerships, spending can be increased in order to achieve the important social goal of ensuring a good healthcare system (Baldacci, 2004). In post-socialist countries, the main problem related to healthcare is the lack of neutrality of private and public entities operating in the sector (Kwak, 2009). Leśniowska-Gontarz (2015) pointed out that the increase in spending on healthcare can become an encouraging factor for the development of the private healthcare sector. A study by Khan and Mahumud (2015) included 9 regional countries in Southeast Asia. They found that one percentage point increase in GDP per capita increased private health spending by 1.128%, while public spending increased by only 0.412%.

Based on the conducted research, it can be concluded that the level of spending on healthcare and their share in GDP generally increases with the development of the economy (Hagenaars et al, 2017).
Healthcare providers should be High Reliability Organisations (HROs) where managers make decisions in a highly unpredictable and dynamic environment. In addition, these organisations must rely on complex interactions between patients (e.g. patient advocacy groups), payers (e.g. health insurers), service providers (e.g. doctors) and supplies (e.g. drugs). Their success depends on “an accurate and timely description of the process and conditions” (Nemeth and Cook, 2007).

Although the adoption of digital health technology among older people has been slow, efforts have been made to address the situation by developing more user-friendly devices (Pew Research Center, 2015, Smith, 2015). The routine integration of digital technology into older people's health management strategies will increase as people become more digitally savvy (Currie, Philip, & Roberts, 2015). An estimated 60% of the older population currently use the Internet regularly, 18% own a smartphone, and 18% own a tablet (Pew Research Center, 2015, Smith, 2015) and 30% regularly search for health information online (Pew Research Center, Smith 2015). On the other hand, the claim of Newhouse (1992), empirically confirmed in the USA by Fuchs (1996), that 85% of the rapid growth of national health expenditure is due to technical/innovative change. The report shows that in February 2020, less than 1% of Medicare primary care visits were conducted via virtual care, showing 43% of the volume rise (WHO, 2021). Undoubtedly, healthcare innovations and fresh perspectives can be expected in the coming years. But healthcare stakeholders have never hesitated to rise to the occasion to provide innovative, high-quality treatment that would benefit everyone. Repositioning organisations for speed and efficiency, adapting to an ecosystem model, and increasing innovation to achieve meaningful change are just a few ways to help both healthcare professionals and patients.

According to the author of this article, a logical conclusion is that countries with the largest population and high economic development tend to spend the most on healthcare. Additionally, innovation and economic openness also influence healthcare financing. It is worth noting that healthcare innovation is currently a prominent topic, especially in light of the COVID-19 pandemic, which has exposed significant flaws and shortcomings in the existing healthcare systems. By educating ourselves about the challenges we face and learning from the solutions implemented in other countries, there is a higher likelihood of promoting healthcare innovation in the United States. Lastly, it is observed that economic freedom has a positive effect on controlling the COVID-19 pandemic, but primarily in highly egalitarian countries.

6. Research design

Based on theory and literature review, three hypotheses have been formulated to achieve the stated objective:
Hypothesis 1: There is a significant relationship between Government expenditure per capita in EUR, PPP (Purchasing Power Parity) and health expenditure, operationalised as % of GDP.
Hypothesis 2: There is a significant relationship between Government expenditure per capita in EUR, PPP and exports of goods and services/Percentage of gross domestic product (GDP).
Hypothesis 3: There is a significant relationship between Government expenditure per capita in EUR, PPP ICT access and Usage by Households and Individuals.
For the research question, I have identified three main groups of motivational factors which affect health sector (Table 3).

Table 3. Motivational factors which affect health sector. Composed by the author.

Hypothesis	Motivational factors
1.	Country's ability to contribute to health.
2.	Express the economic freedom of the country.
3	Express the level of innovation in the country.

Table 3 breaks down models in health financing in selected countries, the information is gathered from various data sources. In addition to OECD data, also the World Health Organization information was used and official websites of different countries visited, to compose the model. The novelty of the research is that according to our knowledge, the similar approach has not been identified before for modelling purposes.

Table 4. Models in health financing. Composed by the author.

Models	Several countries in total
The Beveridge Model	12
The Bismarck Model	17
The National Health Insurance Model	4
The Out-of-Pocket Model	10

7. Analysis

7.1 Results of the analysis

The analysis is based on statistical reasoning: descriptive statistics, data visualisation, correlation analysis and hypothesis testing. The descriptive statistics are extracted by using the options in SPSS. The following variables are analysed: Health expenditure (% of GDP), Government expenditure per capita in EUR (in PPP), ICT Access and Usage by Households and Individuals, Businesses having performed Big data analysis (%), Exports of goods and services/Percentage of gross domestic product (% in GDP) (Table 4).

Table 5. Health and economic indicators' names in Descriptive data analysis. Composed by the author.

Health expenditure (% of GDP)	Healthcare_expenses_%_GDP
Government expenditure per capita in EUR, PPP	Government_expenditure_per_capita_PPP
ICT Access and Usage by Households and Individuals	ICT_Access_Usage
Businesses having performed Big data analysis (%)	Businesses_performed_big data_analysis_%
Exports of goods and services/Percentage of gross domestic product (GDP)	Exports_goods_services_%_GDP

7.2 Descriptive data analysis

First, the basic characteristics of descriptive analysis are given: arithmetic mean, standard deviation and number of countries (Table 5).

Table 6. Descriptive statistics. Composed by the author.

Mean		Std. Deviation	N
Healthcare_expenses_%_GDP	6.1	2.4	169
Governement_expenditure_per_ capita_PPP	2675	1730	169
ICT_Access_Usage	84.89	113	129
Businesses_performed_big data_analysis_%	11.77	4.39	45
Exports_goods_services_%_GDP	65.18	37.75	104

Countries spend on healthcare on average 6,1 percent of GDP, with some variation with standard deviation 2.4 (Table 5). Next, the basic statistics are split by years and types of medical models (Table 6).

Table 7. Descriptive statistics for variables. Source: OECD; composed by the author.

		Healthcare_ expenses_% _GDP Mean	Government_ expenditure_ per_capita_ PPP Mean	ICT_Access _Us age Mean	Businesses_ performed_ bigdata_ analysis_% Mean	Exports_ goods_ services_%_ GDP Mean
Scheme	Year					
Beveridge	Year 2016	6.9	2994.3	85.29	11.7	46.3
	2017	6.8	3088.8	87.83	.	47.5
	2018	6.8	3241.8	89.35	13.4	49.0
	2019	6.9	3378.6	90.90	.	49.6
Bismarck	Year 2016	6.6	2898.9	84.76	11.2	75.8
	2017	6.6	2996.1	86.99	.	77.8
	2018	6.6	3155.9	87.63	12.3	77.8

		2019	6.7	3296.9	89.86	.	76.9
NHI	Year	2016	4.9	1891.5	83.64	3.2	23.1
		2017	4.9	1961.9	84.77	.	26.0
		2018	5.0	2092.0	86.07	7.7	31.2
		2019	5.2	2178.4	87.96	.	32.6
OUP	Year	2016	4.5	1353.7	59.22	.	
		2017	4.5	1409.2	71.26	.	
		2018	4.5	1481.3	59.54	.	
		2019	5.7	2109.1	68.68	.	

By medical models, there is much more variation regarding the percentage of healthcare in GDP. For example, in OUP-model countries, the indicator is around 4.5 in years 2016-2018, in contrast to Beveridge-model countries, where the expenses to healthcare is around 7% of GDP (Table 6).

Table 8. Correlations between variables, 2019. Source: OECD; Composed by the author.

		Healthcare_expenses_%_GDP	Government_expenditure_per_capita_PPP	ICT_Access_Usage	Businesses_performed_bigdata_analysis_%	Exports_goods_services_%_GDP
Healthcare_expenses_%_GDP	Pearson Correlation	1	.906**	.443**	.321*	-.302**
	Sig. (2-tailed)		<.001	<.001	.032	.002
	N	169	169	129	45	104
Government_expenditure_per_capita_PPP	Pearson Correlation	.906**	1	.589**	.463**	.102
	Sig. (2-tailed)	<.001		<.001	.001	.302

	N	169	169	129	45	104
ICT_Access_Us age	Pearson Correlation	.443**	.589**	1	.234	.186
	Sig. (2-tailed)	<.001	<.001		.122	.062
	N	129	129	129	45	101
Businesses_performed_bigdata_analysis_%	Pearson Correlation	.321*	.463**	.234	1	.203
	Sig. (2-tailed)	.032	.001	.122		.198
	N	45	45	45	45	42
Exports_goods_services_%_GDP	Pearson Correlation	-.302**	.102	.186	.203	1
	Sig. (2-tailed)	.002	.302	.062	.198	
	N	104	104	101	42	104

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

There is significant positive strong correlation between government expenditure per capita and healthcare expenses, ICT Access and Businesses performed big data analysis r = 0.906; r= 0. 589 and r = 0.463, respectively). On the other hand, there is a negative significant correlation between healtcare expenses and exports of goods and services (r = - 0.302) (Table 7). Figure 1 shows the variation of health expenditure (% of GDP) for different models in 2019.

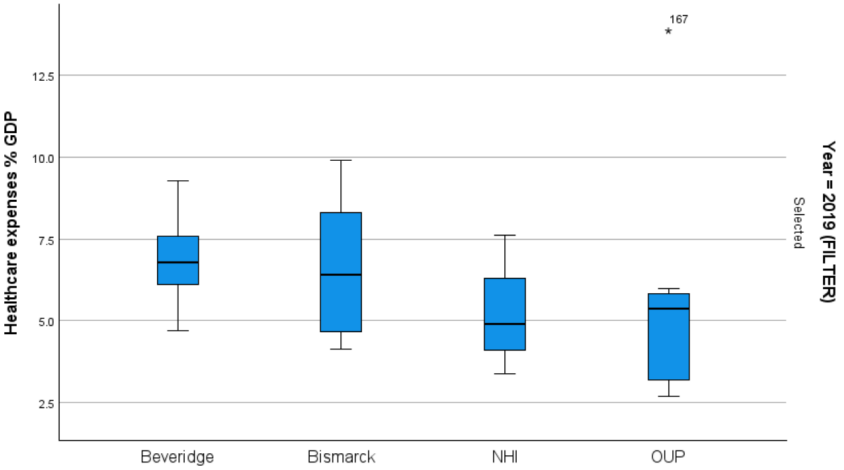

Figure 1. Healthcare expenditure of GDP, in %, 2019: boxplots of models. Composed by the author.

(N=Beveridge 12, Bismarck 17, NHI 4, OUP 7).
The median (centre of the boxplot) is the highest for Beveridge model countries, followed by Bismarck, OUP and NHI (Figure 1)
Figure 2 show the variation of government expenditure per capita in EUR, PPP by models, in 2019. Next, the boxplot for healthcare expenditure per capita is given (Figure 2).

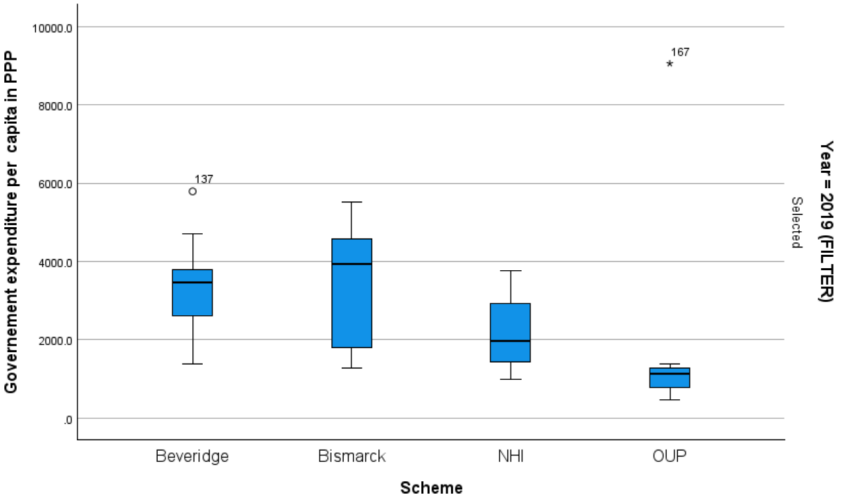

Figure 2. Healthcare expenditure per capita in EUR, in PPP boxplots by models. Composed by the author.

N is Beveridge 12, Bismarck 17, NHI 4, OUP 7.
Regarding the variation of healthcare expenditure per capita across countries, the Bismarck model countries have the highest median (4000 euros, in PPP), followed by Beveridge, NHI and OUP.

7.3. Regression analysis

Next, we run three regression models with four variables: Government expenditure per_capita_in PPP as the dependent variable, healthcare expenses in % GDP, Exports of goods and services % in GDP, and ICT Access Usage as independent variables **(Table 8).**

Table 9. Regression models. Composed by the author.
Model Summaryd

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906a	.822	.821	726.4735
2	.936b	.876	.874	608.1079
3	.946c	.896	.894	559.0745

a. Predictors: (Constant), Healthcare_expenses_%_GDP

b. Predictors: (Constant), Healthcare_expenses_%_GDP, Exports_goods_services_%_GDP
c. Predictors: (Constant), Healthcare_expenses_%_GDP, Exports_goods_services_%_GDP, ICT_Access_Usage
d. Dependent Variable: Governement_expenditure_per_ capita_PPP

Since the largest R-square (=0.896) is in the third model (table 8), it will be used in further analysis.

Table 10. ANOVA. Composed by the author.

Model 3		F	Sig.
3	Regression	480.264	<.001d

a. Dependent Variable: Government_expenditure_per_ capita_PPP

d. Predictors: (Constant), Healthcare_expenses_%_GDP, Exports_goods_services_%_ GDP, ICT_Access_Usage

F-test shows that the model is also statistically significant as $p < 0.001$ (Table 9).

Table 11. Regression Coefficients.Composed by the author.

Unstandardised Coefficients			Standardised Coefficients	t	Sig.
Model	B	Std. Error	Beta		
3 (Constant)	-4305.597	377.472		-11.406	<.001
Healthcare_expenses_%_GDP	641.022	19.498	.894	32.877	<.001
Exports_goods_services_%_GDP	12.318	1.508	.211	8.169	<.001
ICT_Access_Usage	26.621	4.710	.152	5.652	<.001

a. Dependent Variable: Government_expenditure_per_ capita_PPP

The presented model shows that unstandardised betas are 641, 12.3 and 26.62 (Table 10). Hence, the model can be written as follows:
Government expenditure per capita in PPP = -4305 + 641*healthcare expenses %GDP + 12*exports%GDP + 26*ICT_access In Table 11, we show the relationships between the models and factors.

Table 12. Relationship between models and factors. Composed by the author.

Models	Motivational factor 1	Motivational factor 2	Motivational factor 3
The Beveridge Model	Strong positive	Weak positive	Weak positive
The Bismarck Model	Strong positive	Weak positive	Weak positive
The National Health Insurance Model	Strong positive	Weak positive	Weak positive
Out-of-Pocket Model	Strong positive	Weak positive	Weak positive

8. Results

In this section, the key findings of the study are summarized. First, the author explored how health expenditure (% of GDP) and government expenditure per capita in EUR, in PPP, affected the four health financing modules. The current analysis of the health financing modules includes different aspects where indicators are identified using box plots. At first sight, the box blot shows an almost equal trend on both indicators. Next, the chart visualisation shows different trends in mean and interval. The trend line shows that the trend of both indicators has remained almost the same.

Similarly, it is confirmed through the box plots and the trend line generated from it that both the stocks are distributed in similar ways and the extracted trend is also equal. Finally, the correlation between the two is identified. It means that the change in one

indicator results a similar change in another but with a lesser tendency. It is also confirmed by regression results where the impact of one indicator is the same for all free indicators but with different effects.

Second, the author researched how the variation in government expenditure per capita in EUR, in PPP, affects the Health expenditure (% of GDP), Exports of goods and services/Percentage of gross domestic product (GDP) and ICT Access and Usage by Households and Individuals. The question is linked with measuring the relationship of the variation in Government expenditure per capita in EUR in PPP. In this regard, the regression analysis was conducted where Government expenditure per capita in EUR, PPP were treated as independent variables while other free indicators were treated as dependent variables. The outcomes provided that there is a significant and positive relationship between health expenditure (% of GDP) and government expenditure per capita in EUR, PPP. However, the impact is not so strong for the ratio of Exports of goods and services/Percentage of gross domestic product (GDP) and Exports of goods and services/Percentage of gross domestic product (GDP). It is shown that with the impact in PPP affects Health expenditure (% of GDP), Health expenditure (% of GDP), for 0.89 units which is huge as compared to Export of goods and services/Percentage of gross domestic product (GDP) 0,21 and ICT Access and Usage by Households and Individuals 0,15. Overall, it is extracted that the variation in Government expenditure per capita in EUR, PPP affects the Health expenditure (% of GDP) and the free indicators in a similar direction.

9. Conclusions

In conclusion, this comprehensive research has undertaken an in-depth analysis of four distinct healthcare financial models, utilising various indicators. Each of these indicators, the study has revealed, plays a role in shaping the efficiency and effectiveness of the healthcare financing model to varying degrees. The results shed light on pivotal elements that must be addressed further to refine the models and optimise their function.

In the process of this analysis, the study underscores the irreplaceable value of both political and technical capacity in implementing any healthcare financing model. It emerges that the potential for success in implementing these models significantly hinges on the combined strength of these capacities and the necessary financial capabilities. The ability to balance robust administration further proves to be essential, given that a successful administrator must deftly balance the demands of clinical staff with the needs of the broader organisation, ensuring stable and smooth operation (Safian, 2020).

Akin to how individuals of limited financial means may not frequent places like Disneyland (Reisman, 2017), access to healthcare, too, can be influenced by economic capacity. However, unlike other sectors, the healthcare system represents an area where the community cannot afford to be let down by market forces. In these instances, it is the expectation that political intervention would rectify any market failures, steering the system towards market success.

It can be concluded, that one of the main vulnerabilities of the Beveridge model is its potential overutilization. Unrestricted access can enable patients to request healthcare services that are either unnecessary or inefficient, potentially straining the healthcare system. The result is an increase in costs and higher taxes. Healthcare funding during an emergency or a crisis is also criticized. Whether it's a war or a health crisis, a government's ability to provide healthcare can be at risk if spending increases or government revenues decrease. It should be followed whether this will be the case due to the COVID-19 pandemic. Regarding the Beveridge-model, benefits would be accessible without having to determine their level and quality amidst competing demands for portions of the national budget. The main criticism of Bismarck's model revolves around addressing the needs of individuals who are unable to work or afford contributions, particularly in the context of an aging population and an imbalance between retirees and workers. Most of the benefits of the Bismarckian system would be available without administrative costs, potentially adverse effects on work incentives, and uncontrollable costs. The primary criticism of the National Health Insurance Model is the possible long queues and treatment delays, which are considered a serious health policy problem.

Topics involving providers, systems, payers, and government should be considered. Health financing is a key function of health systems that can enable progress towards universal health coverage through effective service coverage and improved financial protection. Today, millions of people cannot access services because of high cost. Many others receive poor quality services even if they pay out of pocket. The avenue for further research is to provide an in-depth analysis of the strengths and weaknesses of these global models, thereby informing new health policies and ultimately crafting a tailored model that accommodates the unique needs of each country, as well as creating optimized models. The USA healthcare system often requires people to cover their medical costs out of pocket. However, when evaluating healthcare financing models such as Beveridge, Bismarck, and National Health Insurance used worldwide, it's crucial to understand that none is inherently superior to the others. The choice depends on the unique requirements and circumstances of a particular healthcare system.

Ultimately, the study highlights the necessity of a cooperative relationship between capitalist gains and socialist cohesion (Reisman, 2017). This intricate balance forms the cornerstone for a successful healthcare financing model, blending the efficiency of capitalism with the equity and access championed by socialist systems.

This study represents a significant step towards understanding and improving the healthcare financing models. The findings offer practical insights that healthcare leaders, policymakers, and administrators can use to refine their approach to healthcare financing, thereby driving towards a more integrated, efficient, and cost-effective healthcare system.

10. Limitations and implications

While these findings are interesting, my analysis is not free of warnings. First, cross-country data is not always available, there are 40 partial data from about 200 countries.

Second, the indicators used in the analysis should be extended; indicators selected for the current analysis are not based on their frequency or depth reference in existing theories in the explored area. Third, categorising countries into four healthcare financing models is always self-conscious.

References

1. **Ahmad, A.R., Farley, A. and Naidoo, M**. (2012) `Analysis of Government-University Relationship from the Perspective of Agency Theory`, Journal of Education and Practice. Online version, vol. 3, no. 6.
2. **American Cancer Society** (2019) ´Cancer Facts & Figures`. Available at: https://www.cancer.org/content/dam/cancer- org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2019/cancer-facts-andfigures-2019.pdf.
3. **Baldacci, E., Clements, B., Gupta, S. and Cui, Q.** (2004) `Social Spending, Human Capital, and Growth in Developing Countries: Implications for Achieving the MDGs`, IMF Working Paper No. 04/217.
4. **Bloom, D.E., Canning, D. and Sevilla, J**. (2004) `The Effect of Health on Economic Growth: A Production Function Approach`, World Dev. 2004;32.
5. **Busse, R., Figueras, J., Robinson, R. and Jakobowski, E**. (2005) `Strategic Purchasing to Improve Health System Performance: Key Issues and International Trends`, HealtcarePaper Vol 8 Special Issue.
6. **Commons, J.R.** (1931) `American Economic Review`, Vol.21.
7. **Currie, M.** (2015) `Attitudes towards the use and acceptance of eHealth technologies: A case study of older adults living with chronic pain and implications for rural healthcare`, BMC Health Services.
8. **Davis, K., Schoen, C. and Stremikis, K.** (2010) `Mirror, Mirror on the Wall: How the Performance of the U.S. Healthcare System Compares Internationally`, The Commonwealth Fund.
9. **Dresher, M.** (1961) `The Mathematics of Games of Strategy: Theory and Applications`, New Jersey: Prentice Hall.
10. **EUROSTAT** database. Available at: https://ec.europa.eu/eurostat/data/database.
11. **Fuchs, V.** (1996) `Economics, Values, and Healthcare Reform`, Am Econ Rev.86 (1).
12. **Guissan, M.C. and Arranz, M.** (2003) `Econometric models of private and public health expenditure in OECD countries`.,Q Rev Econ Finance. 2003; 44(2).
13. **Hady, J. and Lesniowska-Gontarz, M.** (2015) `Expenditures on healthcare system against health condition of Polish society`, Journal: Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu.

14. **Hagenaars, L.L., Klazinga, N.S., Mueller, M., Morgan, D. and Jeurissen, P.P.T.** (2017) `How and why do countries differ in their governance and financing-related administrative expenditure in healthcare? An analysis of OECD countries by healthcare system typology`, International Journal of Health Planning and Management.

15. **Hashmati, A.** (2001) `On the causality between GDP and Healthcare Expenditure in Augmented Solow Growth Model`, Stockholm: Department of Economic Statistics Stockholm School of Economics.

16. **Health System Tracker** (2017) `How does U.S. life expectancy compare to other countries`? Available at: https://www.healthsystemtracker.org/chart-collection/u-s-life-expectancy-compare-countries/.

17. **Jensen, M. C. and Meckling, W. H.** (1976) `Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure`, Journal of Financial Economics. Harvard University Press, vol. 3, no. 4.

18. **Kiser, E.** (1999) `Comparing Varieties of Agency Theory in Economics, Political Science, and Sociology: An Illustration from State Policy Implementation`, Sociological Theory, online version, vol. 17, no. 2.

19. **Kwak, R.** (2009) `The Relative Role of Public and Private Health Expenditure for Economic Growth: A Solow Growth Model Expansion`, Senior Honors Theses.

20. **Leiter, T.** (2021) `Determinants of prepaid systems of healthcare financing: a worldwide country-level perspective`, International Journal of Health Economics and Management.

21. **Matos, F., Selig, P.M. and Henriqson, E.** (2022) `Resilience in a digital age: Global challenges in organisations and society`, Cham: Springer.

22. **Cook, N.** (2007) `Studying the Technical Work of Emergency Care`, Annals of Emergency Medicine.

23. **Newhouse JP**. (1992) ´Medical Care Costs: How Much Welfare Loss`?, J Econ Perspect.;6(3).

24. **OECD** (2021) OECD.Stat, OECD website. Available at: https://www.oecd.org/.

25. **OECD** (2017) OECD website. Available at: https://www.oecd.org/.

26. **OECD** (2016) Available at: https://www.oecd.org/.

27. **Piabuo, S.P., Tieguhong, J.C**. (2017) `Is healthcare a 'Necessity' or 'Luxury'? An empirical evidence from public and private sector analyses of South-East Asian countries?, 2015, Health Economics ReviewHealth expenditure and economic growth - a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries Health Economics Review.

28. **Reibling, N., Ariaans, M. and Wendt, C.** (2019) `Worlds of Healthcare: A Healthcare System Typology of OECD Countries`, Health Policy.

29. **Reid, T. R.** (2010) `The healing of America: A global quest for better, cheaper, and fairer healthcare`, New York: Penguin Books.

30. **Reisman, D**. (2017) `Health Policy`, Eduard Elgar.

31. **Rokicki, T., Perkowska, A. and Ratajczak, M.** (2021) `Differentiation in Healthcare Financing in E.U. Countries`, MDPI

32. **Roehr, B.** (2008) `Healthcare in U.S. ranks lowest among developed countries`, *BMJ* webside. Available at: https://www.bmj.com/content/337/bmj.a889.

33. **Safian, S.C.** (2020) `Fundamentals of Healthcare Administration`, Pearson.

34. **Smith, A.** (2014) ` U.S Smartphone Use in 2015`, Pew Research Center,

35. **Spencer, S. and Seldon, A**. (2007) 'Immigration', Blair's Britain 1997–2007`, Cambridge: Cambridge University Press.

36. **The World Bank** (2023) `Healthcare outlook 2023`, The World Bank website. Available at: https://www.worldbank.org/.

37. **Wahl, M. F. and Durst, S.** (2021) `Digital ownership strategies: The healthcare services case`.

38. **WHO** (2000), ´The structure of most reforms made in the world's health systems have been influenced by World Health Organization's (2000)`, WHO website. Available at: https://www.who.int/.

39. **WHO** (2010), `Report with emphasis on the importance of universal coverage, highlighted that a healthy society is not attainable, if the health system is ineffective, and defined an efficient health system as access to healthcare everywhere and with any financial power`, WHO website. Available at: https://www.who.int/.

40. **WHO** (2016) ´Strategising national health in the 21st century`, A handbook WHO website. Available at: https://www.who.int/.

41. **WHO** (2021) Report 2021 website. WHO website. Available at: https://www.who.int/.

42. **WHO** (2023) Global Health Expenditure Database [online database]. WHO website. Available at: https://www.who.int/.

43. **Williamson, O.E.** (1981) ´The Economics of Organization: The Transaction Cost Approach´, American Journal of Sociology,

Appendix A. Additional information:

List of countries from which data it calculates variables in SPSS statistics.

Models	**Country**
Beveridge	Australia
Beveridge	Finland
Beveridge	Greece
Beveridge	Iceland
Beveridge	Ireland
Beveridge	Italy
Beveridge	New Zealand
Beveridge	Norway
Beveridge	Portugal
Beveridge	Spain
Beveridge	Sweden
Beveridge	United Kingdom
Bismarck	Poland
Bismarck	Austria
Bismarck	Belgium
Bismarck	Czech Republic
Bismarck	Denmark
Bismarck	Estonia
Bismarck	France
Bismarck	Germany
Bismarck	Hungary
Bismarck	Lithuania
Bismarck	Latvia
Bismarck	Netherlands
Bismarck	Slovak Republic
Bismarck	Slovenia
Bismarck	Switzerland

Bismarck	Japan
Bismarck	Luxembourg
NHI	Canada
NHI	Israel
NHI	Korea
NHI	Turkey
OUP	Chile
OUP	Colombia
OUP	Costa Rica
OUP	Mexico
OUP	United States
OUP	China
OUP	India
OUP	Indonesia
OUP	Russia
OUP	South Africa