“Relationship between the Human Development Index and public social spending: European experience for Ukraine”

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RELATIONSHIP BETWEEN THE HUMAN DEVELOPMENT INDEX AND PUBLIC SOCIAL SPENDING: EUROPEAN EXPERIENCE FOR UKRAINE

Abstract

This study focuses on the relationship between the Human Development Index (HDI) and public social expenditures, analyzing socio-economic models using the examples of selected European countries and Ukraine. The study used the values of the HDI, GDP, and indicators of public expenditures for social purposes, namely, healthcare, education, leisure, culture and religion, and social protection for the period from 2010 to 2021. The analysis targeted 13 European countries using data sets from Eurostat, the Office for National Statistics of the United Kingdom, the State Statistics Service of Ukraine, and the Ministry of Finance of Ukraine. The input time series were checked for lagged values using the STATISTICA software.

Empirical evidence suggests a relationship between HDI and public social spending. An increase in the share of public social expenditures in GDP leads to an increase in HDI and vice versa. European countries with a social-democratic model of development have the highest level of centralization of public expenditure in GDP (34.72%) and the highest HDI (0.930), while countries belonging to the Southern European model have the lowest share of socially oriented public expenditure (30.41%) and the lowest HDI (0.873). In addition, there is a time lag between the investment of public funds in healthcare, education, leisure, culture and religion, and social protection and their impact on HDI changes. Thus, ensuring a high level of HDI is achieved, among other things, through state financial support for the relevant components of the social sphere and social protection.

Keywords HDI, public social spending, human capital, social sphere, relationship, socio-economic models

JEL Classification H50, I31, O15

INTRODUCTION

The effective functioning of the state is impossible without investing in human capital, which is ensured through the development of the social sphere. The main goal of the country's social development is to improve the quality of its citizens' lives, which includes not only the level of consumption of material goods and services but also the satisfaction of health, life expectancy, education, and various spiritual needs (Schultz, 1960; Becker, 1964). Ensuring social standards is critical for human capital, which affects the increase in the level of human potential, which directly depends on the ever-increasing requirements, in particular, to education, professionalism, and the ability to adapt to rapid changes.

Ensuring sustainable human development depends, to a large extent, on public financing and distribution of social expenditures. There is a close multidirectional relationship between the level of human de-

velopment and public spending (Dekhtyar et al., 2019). For example, insufficient funding for education, healthcare, and culture makes it impossible to grow human development, accumulate new knowledge, increase labor productivity, and introduce innovations. Setting clear priorities for the development of the state and choosing an effective model of socio-economic development will help improve the situation in the country, transforming the economy into one that ensures sustainable human development (Esping-Andersen, 1990). A sufficient amount of financial resources concentrated at all levels of budgets is the basis for confidently moving forward to achieve strategic economic development goals, addressing complex political, defense, and other socio-economic priorities and tasks, and improving the availability and quality of public goods for the population. Therefore, the study of sustainable human development through the prism of public expenditure management requires special attention and allows one to assess the quality of management, rationality of distribution, and efficiency of the use of financial resources to ensure the social function of the state.

1. LITERATURE REVIEW

According to the UN Sustainable Development Goals, human development should be the ultimate goal of any socio-economic policy of the state, while economic growth is only a means to achieve this goal (Didenko et al., 2023). Human capital is the main condition for innovative progress and the key to transforming natural capital into productive capital, and this is possible only through the availability of an appropriate level of education, well-being, and health of citizens. Thus, human capital is the strategic resource of the country that ensures the stable development of both the economy and society as a whole (Plaksiuk et al., 2023).

Foreign and domestic scholars have studied the issue of human capital development. Thus, representatives of the concept of human capital include Schultz (1960, 1961) and Becker (1964). Their basic ideas relate to the need to invest in human capital to increase the level of human potential, which in the future will increase the profitability of economic entities.

Sen (1999) and ul Haq (1996) are considered to be the founders of the modern human development concept foundations. This concept focuses on the individual, his or her capabilities, and freedom of choice. The main aspects of human development are the ability to live a long and healthy life, gain knowledge, and access the resources necessary for a decent level of well-being. A special achievement of these scientists is the development of the Human Development Index (HDI). Their proposed index is an integrated assessment of the civilization of each country.

The methodology for assessing the level of human development is based on the HDI calculation, which is an integral indicator that considers the standard of living, literacy, education, and longevity as the main characteristics of human potential. This indicator is calculated annually for cross-country comparison and measurement and is a standard tool for the general comparison of living standards in different countries and regions (Figure 1).

To compare the level of social development in different countries of the world, both highly developed and developing, the Human Development Index has been calculated annually since 1990. Depending on the HDI value, the countries under study are divided into the following groups:

- 0.800–1.000 – a very high level of human development;
- 0.700–0.799 – a high level of human development;
- 0.550–0.699 – an average level of human development;
- 0.350–0.549 – a low level of human development.

To assess the level of human capital development, one of the criteria is taken into account, namely longevity, which involves the study of issues and problems that arise in the field of health care. Therefore, studies of the determinants of economic (Tu et al., 2023; Wang et al., 2023), social (Gentle, 2023), and medical (Awojobi et al., 2023; Ng'etich & Mang'unyi,

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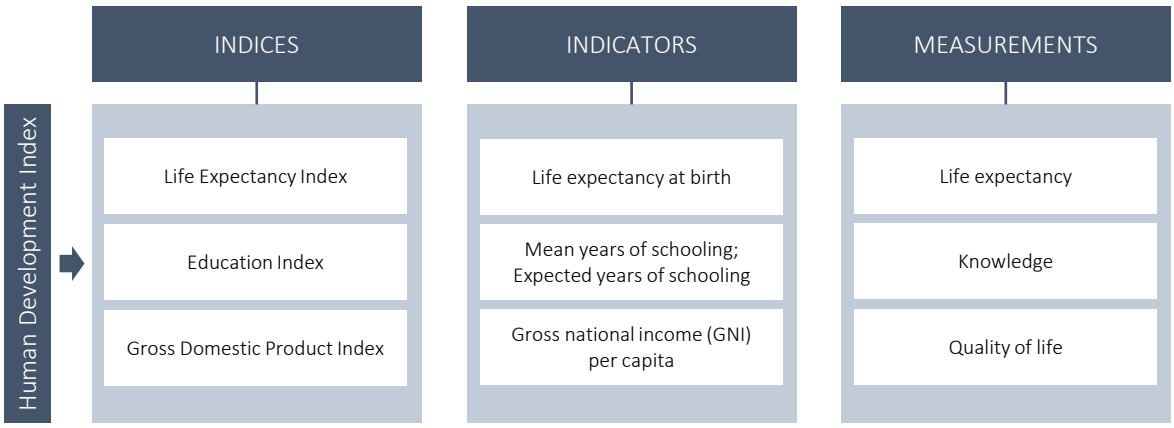

Figure 1. The main components of the Human Development Index

2023) aspects allow one to determine the nature of their impact on life expectancy (Koibichuk et al., 2023; Kuzior et al., 2023; Lyeonov et al., 2021a).

The quality of education has a significant impact on the level of human development, ensuring the necessary level of well-being of society through access to lifelong education, elimination of gender and material disparities in the context of achieving sustainable development goals (Didenko et al., 2023), and the quality of educational services (Mahato & Gaurav, 2023).

Studies of economic and social factors of quality of life as a component of HDI on the example of European countries concluded that public spending on education and healthcare stimulates improvement of quality of life (Kuzior et al., 2022b; Vasylieva et al., 2023). In addition, when forming a favorable socio-economic environment, it is necessary to take into account the level of the shadow sector, which has a negative impact on the macroeconomic characteristics of the country's development and indicators of the population's well-being (Lyeonov et al., 2021b; Makarenko et al., 2023; Tiutiunyk et al., 2022).

Abraham and Mallatt (2022) developed the modern concept of human development. They believe that human capital should be measured using three approaches – indicator, cost, and income – that should help increase the objectivity of human capital assessment.

Djokoto (2022) studied the relationship between the level of human capital development and the level of economic growth. He established a close relationship between these indicators. At the same time, he noted that accelerating economic growth, specifically GDP growth, is possible by increasing the amount of budget funding for social services, including education and healthcare. Makarenko et al. (2023) analyzed the relationship between human capital and GDP.

The intellectualization of human capital and innovative transformation will solve several issues to ensure economic growth and well-being of the population, which are important factors in determining the HDI (Kuzior et al., 2022a).

Dekhtyar et al. (2019) and Petrukha et al. (2023) concluded that Ukraine needs to form a new social model for the post-war recovery of the domestic economy during the period of martial law. This model must meet the principles and standards of social policy in EU member states. This, in turn, will help improve the population's quality of life, counteract demographic changes, strengthen social protection, and contribute to poverty reduction with maximum parity with the state's financial capabilities.

Cristóbal et al. (2021) and Djamal et al. (2023) studied the role and relationship between economic growth, human development and the level of public financing of social expenditures. It was found that low, middle- and upper-middle-income countries have opportunities to more rationally formulate and use public expenditures to ensure the Sustainable Development Goals.

World practice has formed various models of socio-economic policy, which are combined into appropriate types of models according to the level

Table 1. Characteristics of socio-economic development models of countries

Model	Characteristics	GDP Centralization Level
Liberal	characterized by targeted social assistance to the most vulnerable groups of the population; social support is provided through developed insurance systems with minimal state intervention	25-30%, low
Conservative	based on a social insurance system with the solidarity participation of employers and employees; ensures a fairly high level of social protection through the involvement of state and entrepreneur funds; characterized by passive state intervention	35-45%, moderate
Southern European	has a relatively low level of social protection; characterized by an uneven distribution of social expenditures; the level of state intervention in providing social support is not high	35-40%, medium
Social Democratic	characterized by an active type of social policy; most common in countries with a high GDP per capita; the income redistribution system aims to reduce societal inequality; the state plays a leading role in social protection	50-60%, high

of GDP centralization. A significant factor distinguishing social models is the structure, configuration, and combination of the most important social protection institutions: insurance, social assistance, state social security, medical care and education, and the amount of resources allocated for their functioning (Becker, 1964). Aiginger and Guger (2005) studied the main characteristics of European socio-economic models and the stages of their development. They viewed the accession of new EU members and identified the peculiarities of their implementation compared to the USA.

Socio-economic models differ in the level of state intervention in the country's economy due to the share of GDP redistribution through the budget and social funds (Table 1).

The European countries that are typical representatives of specific models include:

- The United Kingdom, which implements the liberal model;
- Austria, Germany, and Switzerland, which implement the conservative model;
- Sweden, Norway, Finland, Denmark, and the Netherlands with the social democratic model;
- Italy, Spain, Greece, and Portugal with the Southern European model.

Therefore, it is interesting to investigate the relationship between the level of human capital development and the redistribution of state social expenditure in the dynamic and uncertain economic environment.

The aim of this study is to determine the relationship between the Human Development Index and the level of public financing of social expenditures in countries with different models of socio-economic development.

2. METHODS

To study the interdependence of HDI, the model of socio-economic development, and the level of public expenditures on social protection, Ukraine was chosen, which supports a socially-oriented economic development vector and a number of European countries that are typical representatives of relevant models. At the same time, the level of human development directly depends on the socio-economic development model of the country, which is determined by historical features, economic trends, and human potential.

The study used macroeconomic indicators and comparative analysis of individual EU countries (Eurostat data) and Ukraine (data of the State Statistics Service of Ukraine) development, annual Human Development Reports, and Human Development Index (HDI) for 2010–2021.

The presence of lagged values in analyzing the relationship between the HDI and the share of public expenditures in GDP was checked using the STATISTICA software product based on the elements of the distributed lag method. The time lag was justified using the mutual correlation function:

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$$r_\tau = \frac{(n-\tau)\sum_{t=1}^{n-\tau} y_t x_{t+\tau} - \sum_{t=1}^{n-\tau} y_t \sum_{t=1}^{n-\tau} x_{t+\tau}}{\sqrt{\left[(n-\tau)\sum_{t=1}^{n-\tau} y_t^2 - \left(\sum_{t=1}^{n-\tau} y_t\right)^2\right]\left[(n-\tau)\sum_{t=1}^{n-\tau} x_{t+\tau}^2 - \left(\sum_{t=1}^{n-\tau} x_{t+\tau}\right)^2\right]}}. \quad (1)$$

where τ – shift period (lag), $x_{(t+\tau)}$ – lag variable, y_t – dependent variable.

Among the obtained correlation coefficients, the one with the highest absolute value was selected, and the corresponding time shift value was accepted as the time lag. Additionally, the study determined time lags of the impact of government funding for social expenditures on the HDI while considering the values of the *t*-test and the *p*-parameter.

3. RESULTS

Table A1, Appendix A, shows the selected countries and their HDI values. All countries have a very high value of this indicator. In addition, the first group (countries with a high HDI) showed an improvement in the level and duration of life, access to educational services, health care, and ensuring the rights and security of the population of developed European countries. This is evidenced by the growth of this indicator compared to 2010 in all the countries studied. When analyzing the average values of this indicator by groups of countries, countries implementing the Southern European social development model have the lowest HDI values. Countries with the social democratic and conservative models had the highest results and were at the top of the overall HDI ranking. Ukraine is an exception, as its HDI value was 0.743–0.786 during the analysis period. According to the 2021 data, only 0.007 percentage points separate Ukraine from a very high HDI.

Figure 2 shows the dynamics of the share of public spending on social needs in GDP and HDI in the studied countries to identify their relationship.

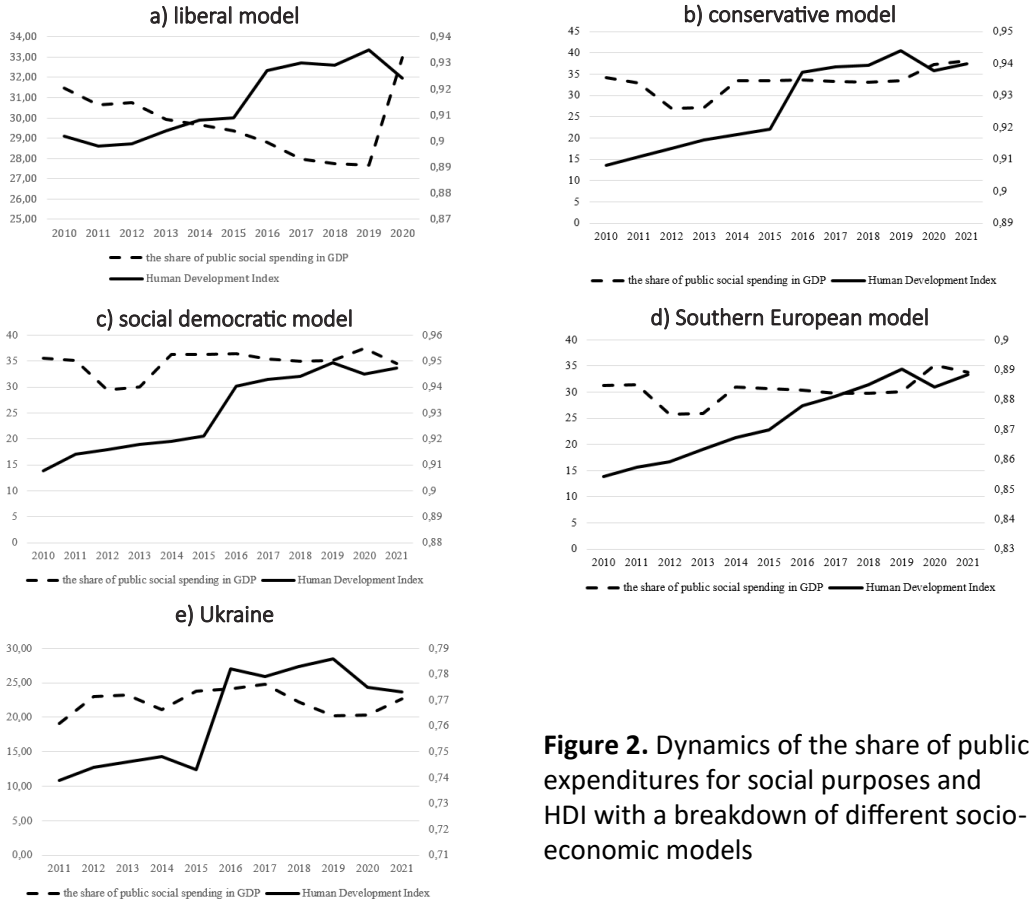

Figure 2. Dynamics of the share of public expenditures for social purposes and HDI with a breakdown of different socio-economic models

The change in the proportion of state funding for social activities was driven by a combination of economic, political, and social factors, including both domestic reforms and policies and external economic conditions.

Thus, in 2010–2014, most of the countries failed to cope with the consequences of the financial and economic crisis of 2008–2009, resulting in a significant reduction in the share of public expenditures on social protection and social services. For example, in the UK, from 2010 to 2011, GDP decreased by 0.82 p.p. In countries with a conservative market economy model, the level of centralization of social expenditures in GDP decreased by almost 8.5 p.p. from 2010 to 2012. In countries with social democratic models, the decline in the share of expenditures was 6 p.p. in 2012–2013. In countries with the Southern European model, expenditures were reduced to 5.9 p.p. in 2012–2013. European countries implemented a policy of austerity in public spending on healthcare, education, and social protection in order to reduce budget deficits and public debt. They also reformed the social security system, including consolidating certain types of social benefits into one system to reduce administrative costs and stimulate employment.

The recovery of economies after the crisis led to an increase in macroeconomic indicators of their development. Since GDP growth was faster than public spending, this reduced the share of spending in GDP even as it increased nominally.

The situation was more stable in 2014–2019, when there was a slight decrease in the share of social expenditures in all the groups of countries studied, except for the UK and Ukraine. Migration processes (2015–2016) significantly impacted the social protection policy change in European countries, which was reflected in the reorientation of public funds to increase social expenditures on integration and support for refugees.

The uncertainty and economic consequences associated with the UK's exit from the European Union have affected economic and fiscal policy, forcing the country to limit spending, including social spending.

As for Ukraine, it showed an unstable trend in this indicator, which is generally associated with a redistribution of the structure of public expenditures, with an increase in the share of defense spending, which is related to the annexation of Crimea and the following war.

The COVID-19 pandemic has led to an increase in spending on healthcare services and support for the healthcare system, which has increased the share of public spending in GDP in all countries of the European Union, the United Kingdom, and Ukraine in 2019–2020.

Thus, when examining the dynamics of social expenditures in GDP, the average level of this indicator for the period of analysis for countries in terms of socio-economic development models was as follows: liberal – 29.72%; conservative – 33.05%; social democratic – 34.72%; Southern European – 30.41%; Ukraine – 19.52%.

When comparing the indicators of public social expenditures with the HDI, it is worth paying attention to the existing relationship between them. For example, countries with the highest share of expenditures in GDP also have a very high HDI. For countries implementing the liberal model, the average HDI value is 0.915; conservative – 0.927; social democratic – 0.930; and Southern European – 0.873. And Ukraine has the lowest average HDI value compared to the countries studied – 0.761, which corresponds to a high level of HDI according to the generally accepted scale.

Given the composition of the HDI's constituent elements, state financial support for quality of life, increasing access to healthcare, shaping cultural development, expanding and improving educational services, and ensuring the implementation of social programs and standards is of great importance. Figure 3 shows the dynamics of the share of social expenditures in GDP by areas of their use.

The liberal model of social policy pays considerable attention to financing health care (10.0% of GDP) and education (5.54% of GDP), but culture (0.67% of GDP) and social protection (16.75% of GDP) are not priorities of this model, while only a small amount of cultural activities and social guarantees are allocated. The trends of changes in

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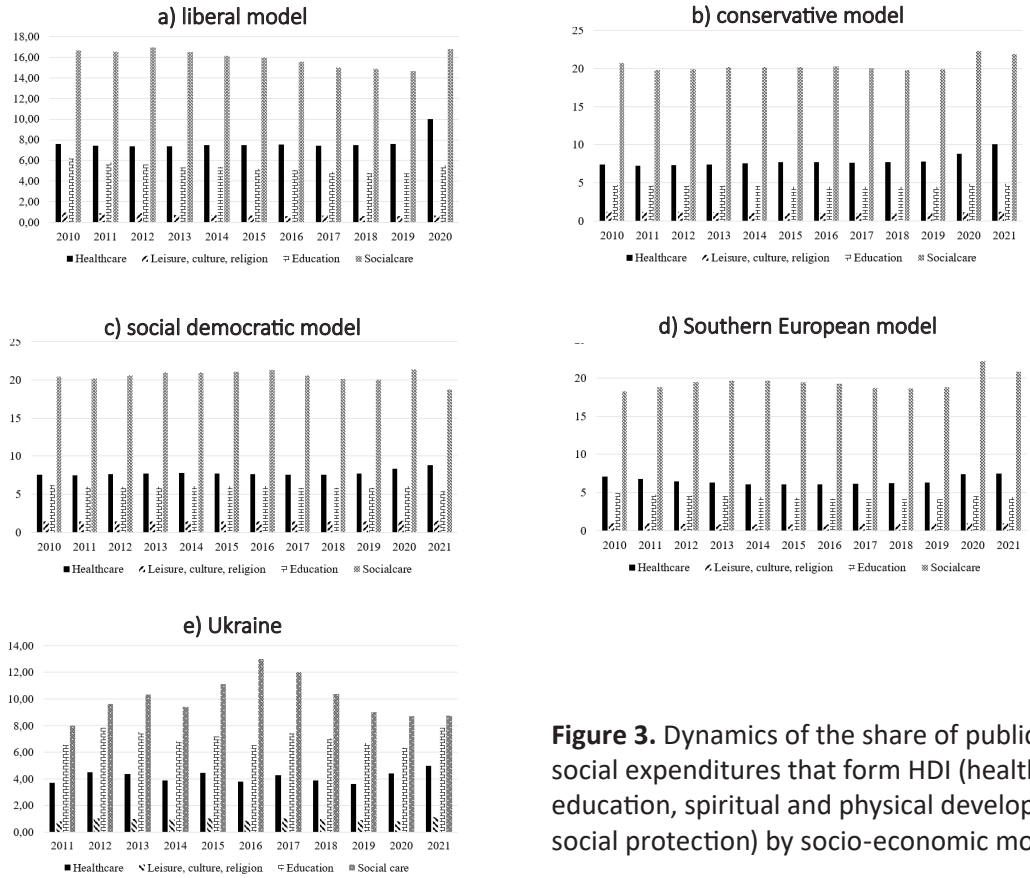

Figure 3. Dynamics of the share of public social expenditures that form HDI (healthcare, education, spiritual and physical development, social protection) by socio-economic models

state funding of social expenditures note a stable situation with almost insignificant fluctuations in the share of relevant expenditures in the UK GDP, which represents a liberal model of socio-economic development.

The conservative model is characterized by significant state attention to support for healthcare (10.1% of GDP), cultural development (1.2% of GDP), and social protection (21.9% of GDP), while education (4.9% of GDP) is provided at the expense of individual capabilities of the population. In countries with a conservative socio-economic development model, the share of GDP spending on social development, education, and social protection has been increasing over the analyzed period. The indicator in terms of recreation, culture, and religion expenditures remained almost unchanged in 2010–2021.

The assessment of the level of social expenditures in GDP has shown that a rather high share of social expenditures is observed in the group of countries with a social democratic model of social development, where the main principles of state social policy include a solidarity approach to all segments of the population. In other groups, state funding for social programs is of a different priority. In the social democratic model, there is an increase in the share of GDP expenditures on healthcare and recreation, culture, and religion. The share of GDP spending on education and social development in 2021 is lower compared to 2010.

The Southern European model provides for state financial support to ensure an adequate level of healthcare (7.5% of GDP) and social protection (20.8% of GDP), while the indicators for financing culture (1.0% of GDP) and education (4.43% of GDP) are the lowest compared to other groups. In countries with the Southern European model, there was an increase in state financial support for healthcare and social protection, while the level of funding for education and culture decreased.

As for Ukraine, there has been a rapid increase in the share of healthcare expenditures in GDP from 0.8% in 2010 to 3.2% by the end of 2021, and in social protection expenditures from 0.5% to 3.0%. At the same time, the share of funding for culture and education is decreasing.

a) liberal model

Indicator	Year									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
The share of state expenditures in GDP on: health care	↗	↘	↗	↗	↗	↗	↘	↗	↗	↗
spiritual and physical development	↘	↘	↘	↘	↘	↘	↗	↘	→	↗
education	↘	↘	↘	↗	↘	↘	↘	↘	→	↗
social care	↘	↗	↘	↘	↘	↘	↘	↘	↘	↗
Human Development Index	↘	↗	↗	↗	↗	↗	↗	↘	↗	↘

b) conservative model

Indicator	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The share of state expenditures in GDP on: health care	↘	↗	↗	↗	↗	→	↘	↗	↗	↗	↗
spiritual and physical development	→	→	↘	↘	→	→	→	→	→	↗	↗
education	↘	→	↗	↘	↘	→	↘	↗	→	↗	→
social care	↘	↗	↗	→	→	↗	↘	↘	↗	↗	↘
Human Development Index	↗	↗	↗	↗	↗	↗	↗	→	↗	↘	↗

c) social democratic model

Indicator	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The share of state expenditures in GDP on: health care	↘	↗	↗	↗	↘	↘	↘	↗	↗	↗	↗
spiritual and physical development	↘	↘	↗	↘	↗	↘	→	→	→	↗	↘
education	↘	↗	↘	↗	↘	→	↘	→	→	↗	↘
social care	↘	↗	↗	→	↗	↗	↘	↘	↘	↗	↘
Human Development Index	↗	↗	↗	↗	↗	↗	↗	↗	↗	↘	↗

d) Southern European model

Indicator	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The share of state expenditures in GDP on: health care	↘	↘	↘	↘	→	→	↗	↗	↗	↗	↗
spiritual and physical development	↘	↘	↘	→	→	→	↗	↗	↗	↗	↗
education	↘	↘	↘	↘	↘	↘	↘	→	→	↗	↘
social care	↗	↗	↗	→	↘	↘	↘	↘	↗	↗	↗
Human Development Index	↗	↗	↗	↗	↗	↗	↗	↗	↗	↘	↗

e) Ukraine

Indicator	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The share of state expenditures in GDP on: health care	→	→	→	↘	↘	↘	↗	→	↗	↗	→
spiritual and physical development	↘	↗	↘	→	→	↘	↗	→	→	→	→
education	↘	→	↘	↘	↘	→	↘	↘	→	↗	→
social care	↘	↗	↘	→	↗	→	→	→	↗	↗	→
Human Development Index	↗	↘	↗	↗	↘	↘	↗	↘	↗	↘	↘

Figure 4. Visualization of trends in the share of social expenditures in GDP and HDI

a) liberal model

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X1 Dep: Y
Lag: 2 R= ,9999 R-square= ,9999 N: 9

Lag	Regressn Coeff.	Standard Error	t(6)	p
0	-0,005626071831	0,006619349198	-0,849943349788	0,427963371300
1	0,123190998557	0,051367672260	2,398220381358	0,053424269201
2	0,005698111771	0,047176067354	0,120783950213	0,907805459762

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X2 Dep: Y
Lag: 4 R= ,9998 R-square= ,9995 N: 7

Lag	Regressn Coeff.	Standard Error	t(2)	p
0	0,573452033944	0,557726280393	1,02819618530	0,411949047068
1	2,348817982957	0,772493774596	3,04056558149	0,093278547474
2	0,056592240133	0,506909279997	0,11164175202	0,921302199224
3	-0,989075762313	0,548466327149	-1,80334819724	0,213109040997
4	-0,387671956205	0,585477576872	-0,66214654757	0,575968367738

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X3 Dep: Y
Lag: 4 R= ,9995 R-square= ,9991 N: 7

Lag	Regressn Coeff.	Standard Error	t(2)	p
0	0,093286486405	0,071339518585	1,30764109788	0,321099727380
1	-0,071917177815	0,303118525732	-0,23725761281	0,834545779227
2	0,281896090021	0,298710660675	0,94370950599	0,444933189954
3	0,166479985051	0,318494819942	0,52270861134	0,653312238568
4	-0,278072865636	0,179181587023	-1,55190536180	0,260864208570

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X4 Dep: Y
Lag: 4 R= ,9999 R-square= ,9998 N: 7

Lag	Regressn Coeff.	Standard Error	t(2)	p
0	0,019536067767	0,011056494976	1,76693136561	0,219275291965
1	-0,083106121092	0,067199970291	-1,23669877728	0,341717933253
2	0,009511781935	0,061929266058	0,15359106511	0,892029610842
3	0,001140004789	0,042952415144	0,02654111032	0,981235905124
4	0,106610138523	0,034429419780	3,09648373989	0,090378752498

b) conservative model

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X1 Dep: Y
Lag: 4 R= ,9953 R-square= ,9906 N: 8

Lag	Regressn Coeff.	Standard Error	t(3)	p
0	0,121915160366	0,036902479489	3,303711892888	0,045606388144
1	0,003050095556	0,045110438010	0,067613964549	0,950347049073
2	-0,008761874447	0,041866036618	-0,209283590105	0,847632555930
3	0,003933771894	0,033051918934	0,119017957817	0,912783522592
4	-0,009578535361	0,027419506460	-0,349332887321	0,749922077200

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X2 Dep: Y
Lag: 4 R= ,9998 R-square= ,9996 N: 8

Lag	Regressn Coeff.	Standard Error	t(3)	p
0	0,451369968191	0,635097743545	0,710709450283	0,528534884247
1	0,163611933751	1,277037472004	0,128118349961	0,906161387611
2	0,298036634856	1,208845897681	0,246546425337	0,821166766480
3	-0,609147745966	1,133570404043	-0,537370897999	0,628312893297
4	0,526925523745	0,635097743544	0,829676264955	0,467573778104

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X4 Dep: Y
Lag: 4 R= 1,000 R-square= 1,000 N: 8

Lag	Regressn Coeff.	Standard Error	t(3)	p
0	0,000151248166	0,002253179234	0,06712655799	0,950704262474
1	0,009790244487	0,002858599746	3,42483920680	0,041695046578
2	-0,029091192834	0,011996196389	-2,42503472685	0,093745415548
3	0,069349765011	0,011478773557	6,04156573577	0,009094203283
4	-0,003644959483	0,004262147382	-0,85519320571	0,455306568817

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X3 Dep: Y
Lag: 4 R= ,9999 R-square= ,9998 N: 8

Lag	Regressn Coeff.	Standard Error	t(3)	p
0	0,113238805486	0,060244917924	1,879640796086	0,156750751736
1	-0,041589735336	0,079103492696	-0,525763577798	0,635439719969
2	-0,182222685398	0,184267268351	-0,988904253204	0,395615773495
3	0,253698742975	0,185578106216	1,367072593569	0,265028647586
4	0,058514668273	0,139889462635	0,418292179914	0,703872405421

Figure 5. Results of checking input time series for lagging values

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c) social democratic model

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X1 Dep: Y
Lag: 2 R= ,9742 R-square= ,9490 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,065412418779	0,029033133625	2,253026477396	0,058934435045
1	0,001313139565	0,040652701917	0,032301409320	0,975133408969
2	0,069292600892	0,029590757552	2,341697429365	0,051715586497

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X2 Dep: Y
Lag: 2 R= ,9999 R-square= ,9999 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,100271614188	0,107420243003	0,933451753455	0,381657473232
1	0,199074655554	0,097517307748	2,041428954006	0,080542843307
2	0,331144329251	0,116265629671	2,848170436849	0,024753202364

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X3 Dep: Y
Lag: 2 R= ,9997 R-square= ,9994 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	-0,005885189819	0,045756824314	-0,128618843353	0,901276645482
1	0,115012531792	0,083714385473	1,373868196512	0,211860029764
2	0,046619259680	0,101897378777	0,457511863792	0,661164794971

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X4 Dep: Y
Lag: 3 R= ,9999 R-square= ,9999 N: 9

Lag	Regressn Coeff.	Standard Error	t(5)	p
0	-0,001694374266	0,005403023813	-0,31359740850	0,766487515559
1	0,021051462772	0,007866958130	2,67593425863	0,044034114569
2	-0,026492375042	0,016042810151	-1,65135501784	0,159576787012
3	0,052291202591	0,012565859389	4,16137097931	0,008812367185

d) Southern European model

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X1 Dep: Y
Lag: 2 R= ,9717 R-square= ,9442 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,078656195716	0,031585408497	2,490270015764	0,041580133814
1	-0,003558193430	0,044425001298	-0,080094391134	0,938403942631
2	0,080442396989	0,031922738846	2,519909002077	0,039815834348

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X2 Dep: Y
Lag: 2 R= ,9992 R-square= ,9983 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	1,129624436471	0,474419550581	2,38106636855	0,048805533457
1	-0,888479955165	0,852654355633	-1,04201655606	0,332049398616
2	0,730041370606	0,448432904897	1,62798350129	0,147552992252

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X4 Dep: Y
Lag: 3 R= ,9999 R-square= ,9998 N: 9

Lag	Regressn Coeff.	Standard Error	t(5)	p
0	0,009563269769	0,004438726217	2,154507690094	0,083766336787
1	0,006041142608	0,005600904282	1,078601294349	0,330027410678
2	-0,008514036699	0,016915769897	-0,503319491266	0,636123893833
3	0,038575507208	0,014812295716	2,604289567815	0,047999861117

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X3 Dep: Y
Lag: 2 R= ,9987 R-square= ,9974 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,181889853435	0,099045068435	1,836435234076	0,108912866747
1	0,025243940703	0,140377313208	0,179829205492	0,862381623448
2	-0,005551469751	0,098284335067	-0,056483769744	0,956534874753

e) Ukraine

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X1 Dep: Y
Lag: 2 R= ,9880 R-square= ,9762 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,103835010572	0,065482905397	1,58568117805	0,156831433793
1	-0,227528929488	0,099240036390	-2,29271307997	0,055584813527
2	1,171722073273	0,117278796760	9,99091144900	0,000021522823

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X2 Dep: Y
Lag: 2 R= ,9927 R-square= ,9855 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	1,310000000000	0,817374482900	1,602692556969	0,153036830637
1	1,275000000000	0,555039471868	2,297133924025	0,055223842857
2	-0,060000000000	0,581173119752	-0,103239461635	0,920668395415

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X3 Dep: Y
Lag: 2 R= ,9852 R-square= ,9706 N: 10

Lag	Regressn Coeff.	Standard Error	t(7)	p
0	0,534068121069	0,404728754474	1,31957049052	0,228497302772
1	0,210193990343	0,472290960466	0,44505190219	0,669718928098
2	-0,254421785238	0,254151419441	-1,00106379810	0,350136773075

Polyn. Distr. Lags; Regression Coefficients (Spreadsheet1)
Indep: X4 Dep: Y
Lag: 3 R= ,9809 R-square= ,9622 N: 9

Lag	Regressn Coeff.	Standard Error	t(5)	p
0	0,070055888752	0,096678007824	0,72463107515	0,501155788810
1	-0,175098240122	0,163564416608	-1,07051548101	0,333318825535
2	0,830708659252	0,430925841099	1,92772997120	0,111815126933
3	0,983915498821	0,353601471831	2,78255487379	0,038784704691

Figure 5 (cont.). Results of checking input time series for lagging values

Comparing the dynamics of trends in the share of social expenditures in GDP and trends in the HDI demonstrates the possible existence of a time lag in the formation of the impact of these expenditures on the performance indicator, as well as the different nature of this impact (Figure 4).

Using the STATISTICA software, the indicators selected for the study were checked for lagged values based on the analysis of *t*-statistics and *p*-values (Figure 5).

The results show that changes in public funding for health care, cultural development, and social protection have an impact on the HDI with a certain time lag. For example, changes in healthcare funding will affect the HDI only after one year in the UK and after two years in countries that follow the Southern European and social democratic models and Ukraine.

Changes in state financial support for social protection also affect the HDI with a certain time lag.

For example, fluctuations in the level of funding for social standards in countries with a conservative model will affect the HDI in two years, and in countries with a southern European, social democratic model and Ukraine in three years. In the countries with the social democratic model and Ukraine, there is also a time lag of two and one year, respectively, between the expenditure on cultural development and the change in the HDI value.

4. DISCUSSION

The results establish that human capital is the primary driver of economic growth and development. The study identified key structural parameters influencing human development levels, including demographic trends, economic and technological aspects, environmental conditions, domestic situations within countries, and international relations (Rayevnyeva et al., 2020). Analysis of international experience confirmed that various indices are used globally to assess human potential development, with the Human Capital Index, regularly computed by the World Bank, being the most significant. It is noteworthy that factors contributing to the Human Development Index include not only quantitative characteristics but also qualitative indicators, such as consistent improvements in healthcare, education systems, culture, and other social components (Plaksiuk et al., 2023; Makarova & Ghladun, 2012). However, the financial aspect should not be overlooked in ensuring sustainable human development as a necessary foundation for securing adequate financial resources to meet societal needs (Hrysenko et al., 2019).

Considering various models of socio-economic development, it is important to note the influence of the share of government expenditures in GDP on changes in the Human Development Index. This influence stems from different approaches to financing the social sphere within individual countries. The redistribution and structure of government expenditures directly depend on the chosen social policies implemented by the state, which vary according to the socio-economic development model adopted.

The results regarding a time lag between government investment in the social sphere and the realization of effects, particularly in terms of changes in the Human Development Index (HDI), can inform the rationale behind managerial decisions in shaping national social and financial policies. This, in turn, facilitates improvements in the population's well-being and the achievement of targeted socio-economic development goals for countries.

Currently, the issue of justifying the optimal model of socio-economic development for Ukraine, which would ensure social standards comparable to those in developed European countries, remains a topic of debate. The majority of scholars consider the social-democratic model to be the most socially-oriented, aiming to provide high living standards for the population. This model emphasizes the leading role of the state in protecting citizens and implements an income redistribution system that reduces societal income disparities, thereby leveling income levels across the population. A key feature of this model is that in countries where it is implemented, the basic provision of essential social services is funded through government budgets and is accessible to all segments of the population.

For Ukraine, determining the optimal socio-economic model should be based on synthesizing possible variations of existing models. This will ensure support for the overall well-being of the population and promote the country's development.

CONCLUSION

The aim of this study was to determine the relationship between the Human Development Index (HDI) and the level of government financing of social expenditure across countries that represent different models of socio-economic development. Assessing the level of human development was conducted based on the calculation of the composite indicator – the Human Development Index (HDI) – which considers components such as standard of living, literacy, education, and life expectancy.

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The calculations confirmed a relationship between government expenditures on social welfare and the Human Development Index (HDI). Promoting human development is significantly supported by state financial assistance, the level of which depends on the adopted model of socio-economic development implemented by the respective country.

Besides, there is a time lag between the volumes of government spending in the social sphere and the dynamics of the HDI. This time lag between funding social needs and the HDI can be explained by varying states and levels of socio-economic development among countries, which are categorized into different groups. Apart from that, it is influenced by the functioning characteristics of financial systems that adhere to principles of market-oriented or socially-oriented economies. Moreover, the manifestation of such a time lag in government expenditures on social protection is explained by the proportion of financial resources redistributed among government, private, and grant funding for different social needs; models of financial equalization; and the possibility of applying different levels of pension and social insurance (solidarity and accumulation-based systems).

However, despite the high Human Development Index (HDI) globally during the period under analysis, attention is drawn to several objective external threats in the world economy. These include pandemics, military conflicts, global climate change, and others that decrease the quality and safety of human life. Therefore, countries with lower income levels, including Ukraine, may face harsh budgetary conditions and will be forced to service public debt rather than support the social needs of citizens in overcoming various consequences of global socio-economic crises.

The results can be taken into account when optimizing the structure of government expenditures, refining social policies, and substantiating the fundamental principles of socio-economic development of the country.

AUTHOR CONTRIBUTIONS

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APPENDIX A

Table A1. Dynamics of the Human Development Index in European countries and Ukraine for the period 2010–2021

Source: United Nations Development Programme (2023).

Country	Year											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ukraine	0.734	0.739	0.744	0.746	0.748	0.743	0.782	0.779	0.783	0.786	0.775	0.773
Liberal model												
The United Kingdom	0.902	0.898	0.899	0.904	0.908	0.909	0.927	0.93	0.929	0.935	0.924	0.929
Conservative model												
Austria	0.880	0.884	0.887	0.892	0.891	0.893	0.915	0.916	0.914	0.922	0.913	0.916
Germany	0.912	0.916	0.919	0.92	0.924	0.926	0.941	0.944	0.945	0.948	0.944	0.942
Switzerland	0.932	0.932	0.934	0.936	0.938	0.939	0.956	0.957	0.959	0.962	0.956	0.962
Social democratic model												
Sweden	0.901	0.903	0.904	0.906	0.909	0.913	0.939	0.941	0.942	0.957	0.942	0.947
Norway	0.939	0.941	0.942	0.945	0.948	0.949	0.955	0.959	0.962	0.961	0.959	0.961
Finland	0.878	0.884	0.887	0.89	0.893	0.895	0.931	0.934	0.936	0.939	0.938	0.940
Denmark	0.910	0.922	0.924	0.926	0.923	0.925	0.943	0.944	0.942	0.946	0.947	0.948
The Netherlands	0.911	0.921	0.922	0.923	0.923	0.924	0.933	0.937	0.939	0.943	0.939	0.941
Southern European model												
Italy	0.872	0.877	0.876	0.877	0.881	0.887	0.887	0.888	0.893	0.897	0.889	0.895
Spain	0.867	0.871	0.874	0.877	0.882	0.884	0.895	0.897	0.901	0.908	0.899	0.905
Greece	0.860	0.858	0.86	0.862	0.865	0.866	0.877	0.880	0.886	0.889	0.886	0.887
Portugal	0.818	0.824	0.827	0.837	0.841	0.843	0.853	0.859	0.860	0.867	0.863	0.866

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