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HUMAN DEVELOPMENT BY FISCAL INSTRUMENT DIMENSION: EMPIRICAL EVIDENCE FROM OECD COUNTRIES

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Abstract

This research aims to analyze the impact of fiscal instruments on the human development index. The study considers public expenditures, taxes, budgets, and public debt as fiscal instruments and uses panel data analysis. Considering 24 OECD countries and the period between 2004 and 2021, the impact of fiscal instruments on the human development index was analyzed using fixed effects (FE) and Driscoll-Kraay (DK) estimators. The analysis results show that each fiscal instrument impacts the human development index differently. The tax burden negatively affects the human development index, causing it to decrease. On the other hand, public expenditures, debt burden, and budget deficits contribute positively to human development. These findings suggest that fiscal instruments may influence human development index in different directions.

Keywords: *Human Development Index (HDI), public spendings, tax burden, budget deficits, public debt*

1. INTRODUCTION

In today's world, where globalization is accelerating, the primary goals of states have gone beyond economic growth. In addition to economic growth and stability, improving people's quality of life, in other words, ensuring sustainable human development, has taken its place among the main goals. In this context, The Human Development Index (HDI) has come to the fore as an indicator of social welfare for countries. The HDI, developed by the United Nations Development Program (UNDP), measures countries' development levels in terms of human dimensions. The HDI is an important criterion that considers not only the economic development level of a country but also factors such as quality of life, education level, and life expectancy. Therefore, the HDI takes a multidimensional approach to how economic growth and development affect the human capital in the country and allows a comparison of human development levels between countries.

Increasing the human development index is not only related to socioeconomic policies but also to the effectiveness of fiscal policies and instruments. Fiscal policies and instruments are critical for ensuring macroeconomic stability and increasing social welfare and human development. However, factors such as the effectiveness of public expenditures, the fairness of the tax structure, and the sustainability of borrowing policies are among the important dynamics that determine the social effects of this policy. Policymakers should use fiscal instruments that are not only in line with fiscal policy objectives but also with an eye on improving social welfare and human development. For example, tax policies should not solely aim to generate revenue. Considering the types and structural characteristics of taxes, protecting citizens' income levels and quality of life should also be considered. Therefore, a transformation based on fairness and efficiency in the tax structure can eventually accelerate social development and the human development index. The same applies to other fiscal instruments. Fiscal policies and instruments should be designed to strengthen human capital and prioritize human development alongside economic growth and development. In this context, policymakers should develop a holistic fiscal policy approach, considering the diverse impacts of each fiscal instrument on human development. The question of how fiscal instruments affect human development constitutes an important field of study. In this study, we aim to contribute to the literature in various dimensions. First, by including different types of fiscal instruments in the analysis scope, we examine each fiscal instrument's impact on human development. In this respect, we differ from other studies in the literature that use only public expenditures or tax variables. Thus, the impact of fiscal instruments on HDI can be evaluated from a holistic perspective.

In doing so, we use a country sample with data suitable for analyzing fiscal instruments and HDI. The content of the study is organized as follows. Section 2 presents theoretical information on fiscal instruments and human development. Section 3 examines the findings of empirical studies that examined the relationship between fiscal instruments and HDI in the literature. Section 4 explains the econometric methodology and dataset. Section 5 presents the

econometric results, and Section 6 compares the findings with those of other studies in the literature.

2. THEORETICAL FRAMEWORK

Human development holds an important position in terms of competition between countries. The UNDP developed the HDI to measure human development between countries. The human development index is not solely related to countries' economic growth levels. The HDI considers individuals' abilities and development. The differences between countries with the same income level but different levels of human development are revealed through the Human Development Index. In this way, countries' policy priorities can be discussed, and areas that they should focus on for higher human development can be identified¹. The UNDP's 1990 Human Development Report first included the Human Development Index. The report emphasizes the richness of human life rather than people's wealth within the scope of human development. It was stated that income is not the entirety of human life, and human development was presented from a multidimensional perspective. The report drew attention to the opportunities for better nutrition, health, education, access to information, and people's income (UNDP, 1990, p. 9).

HDI is an average measure of basic human capacities. It also reflects human development and measures the average achievements of a country based on three basic dimensions of human development. The UNDP report considered three basic dimensions for the calculation of human development (UNDP, 2005, p. 341):

- A long and healthy life, measured as life expectancy at birth,
- Knowledge, measured as adult literacy rate and gross school enrollment rate, and
- A desirable standard of living, measured as GDP per capita calculated according to purchasing power parity (PPP).

The HDI, calculated using education, health, and income variables, is between 0.00 and 1.00. The classification of countries according to the calculated HDI values are as follows: (Şaşmaz & Yayla 2018: 82; Human Development Report, 2024, pp. 274-277):

- If it has a value between 80-100 at the top, it is in the "Very High Level of Human Development" country group,
- If it has a value between 70-79, it is in the "High Level of Human Development" country group,

¹ <https://hdr.undp.org/data-center/human-development-index#/indicies/HDI>. 15.12.2024.

- If it has a value between 55-69, it is in the “Moderate Level of Human Development” country group,
- If it has a value between 00-54 at the bottom, it is in the “Low Level of Human Development” country group.

Fiscal policy is a set of policies controlling a country's economy and development that directly or indirectly affects growth and development. Fiscal instruments refer to tools used within the scope of determined fiscal policies. Fiscal policy aims to affect the total demand side of the economy in the short term, increase economic capacity, and ensure sustainable development by affecting the economy's supply side in the long term. J.M. Keynes emphasized that fiscal policy has an important effect on economic growth and development and that fiscal instruments have a dominant and positive place in development and progress (Aisyah et al., 2024, p. 3774). Every country aims to improve social welfare and make it sustainable. Improving social welfare will also improve a country's social life and economic quality. Fiscal policies and instruments that states will implement to achieve this goal are important. Fiscal instruments help improve human capital quality, reduce poverty and unemployment rates, reduce income inequality, expand business areas, enable economic activity in various sectors, and ensure human development (Firmansyah et al., 2024, p. 38).

Human development includes the development of human skills and the provision of healthier, longer, and more fulfilling lives for people. The basis of public expenditures made by countries is to provide people with a long and healthy life, be knowledgeable, have a reasonable standard of living, and increase their level of welfare. Government expenditures within the scope of human development provide the opportunity for skilled, healthy, and educated human capital by significantly contributing to national development (Omodero, 2019, p. 51). However, increases in public spending may not necessarily be proportional to increases in welfare. In other words, welfare is not solely related to economic growth or public spending. Despite high public spending in a country, human development and welfare may not increase accordingly. Therefore, to achieve positive social welfare and human development results, appropriate and effective public spending must be directed to areas where society needs it (Andrijić, 2022, p.260).

Along with public spending, taxes are among the tools that directly or indirectly affect a country's level of human development. Taxes reduce individuals' disposable income. Therefore, taxes can be perceived as a burden. The tax burden can become even heavier as individuals' costs to meet their tax obligations increase (Bobek et al., 2025, p. 302). Low tax compliance will reduce tax revenues. Decreasing tax revenues, in turn, can lead to limited investments that would improve the quality of human capital and lower human development. Taxes are the state's primary source of revenue for public expenditures and investments. A balanced and equitable distribution of the tax burden across society will also ensure efficiency in public revenues. Excessively high tax burdens can increase

informality, lower production, and fail to provide the financial resources necessary for human development. Therefore, the state should design tax policies that are fair and effective and that do not worsen income inequality.

Budgets, and borrowing, which are included in fiscal instruments, can indirectly affect development indicators, such as the welfare level of society, education level, income, and living conditions. In the framework of expansionary fiscal policy, budget deficits may occur because of increasing public expenditures and decreasing public revenues. Directing increasing public expenditures to areas that will increase the welfare level of society and human development may improve human development. Thus, both public expenditure and budget deficits may positively affect human development. On the other hand, not increasing public expenditures in productive areas for the country's economy and human capital, increasing the budget and debt burden, and reaching an unsustainable state may negatively affect economic growth and human development. Fiscal policies must be implemented harmoniously by supporting sustainable growth and development. In this context, the effectiveness of public expenditure and tax policies, particularly, comes to the fore. Fiscal policies should not be implemented solely by focusing on economic stability without considering human development objectives. This situation may negatively affect long-term development policies and lead to human and sustainable development failures (Vıcı & Konukman, 2022, p. 237).

We prepared Table 1 to examine the trends in the fiscal and human development indices of the countries included in this study over the years. The table includes changes in the human development index, public expenditures, tax burden, budget deficit, and debt burden indicators of 24 countries between 2004 and 2021. The human development index shows a significant increase for all countries. Although there has been an increase in public expenditures in many countries, the increase in countries such as France, Finland, and Greece is particularly striking. In contrast, there has been a parallel decrease in public expenditures and tax burdens in countries such as Turkey, Hungary, Ireland, and Israel. While there has been a decrease in the budget deficit in Denmark, Sweden, Poland, and Portugal, there have been deteriorations in the budget balance in England, America, and Slovakia. While there has been an increase in the debt burden of many countries, especially Greece, Italy, and America, there has been a decrease in the debt burden of Türkiye, Denmark, and Israel.

Table 1 Various statistics for 24 OECD countries

Country / Year	HDI		Public Spending (%GDP)		Tax Burden		Budget Deficit (%GDP)		Debt Burden (%GDP)	
	2004	2021	2004	2021	2004	2021	2004	2021	2004	2021
<i>Austria</i>	0.88	0.92	53.70	56.08	49.19	50.27	-4.80	-5.76	64.84	82.27
<i>Belgium</i>	0.89	0.93	49.31	54.878	48.94	49.92	-0.23	-5.40	97.16	109.19
<i>Czechia</i>	0.84	0.89	42.32	46.51	39.95	41.42	-2.36	-4.95	28.37	42.02
<i>Denmark</i>	0.91	0.95	53.00	49.88	56.44	53.86	2.23	4.10	44.16	36.62
<i>Estonia</i>	0.84	0.89	34.06	41.47	36.33	39.39	2.27	-2.44	5.11	17.60
<i>Finland</i>	0.90	0.94	49.12	55.82	51.33	52.96	2.16	-2.87	42.57	72.60
<i>France</i>	0.86	0.91	52.98	59.02	49.64	52.63	-3.55	-6.58	65.94	113.00
<i>Greece</i>	0.85	0.89	47.61	57.50	38.79	50.04	-8.83	-7.51	103.75	200.71
<i>Germany</i>	0.92	0.95	46.79	51.03	43.31	47.35	-3.42	-3.17	65.20	68.62
<i>Hungary</i>	0.80	0.85	48.72	48.35	42.13	41.20	-6.59	-7.16	58.15	74.55
<i>Ireland</i>	0.89	0.95	32.82	24.38	34.89	22.79	1.30	-1.47	28.09	55.38
<i>Israel</i>	0.85	0.91	43.88	40.65	44.93	36.48	-3.40	-3.38	88.30	67.98
<i>Italy</i>	0.87	0.90	46.88	54.12	43.96	48.30	-3.46	-8.85	105.10	149.89
<i>Latvia</i>	0.81	0.87	35.05	44.42	32.34	37.41	-0.99	-5.53	13.74	44.72
<i>Lithuania</i>	0.81	0.88	34.07	37.30	29.03	32.09	-1.39	-1.15	18.69	44.03
<i>Netherlands</i>	0.90	0.94	43.65	45.84	44.33	43.73	-1.82	-2.20	50.31	52.43
<i>Poland</i>	0.81	0.88	43.46	44.09	38.47	42.26	-5.01	-1.83	45.11	53.75
<i>Portugal</i>	0.81	0.87	46.23	47.46	41.26	44.85	-5.97	-2.88	67.10	125.38
<i>Slovak Republic</i>	0.79	0.85	37.92	45.54	35.61	40.14	-2.31	-5.18	41.72	62.19
<i>Slovenia</i>	0.86	0.92	46.63	49.23	44.69	44.85	-1.98	-4.61	26.90	74.47
<i>Sweden</i>	0.90	0.95	52.46	49.09	52.66	48.09	0.19	0.01	48.48	36.26
<i>United Kingdom</i>	0.89	0.93	40.08	48.11	39.49	38.01	-3.19	-7.86	39.78	105.93
<i>United States</i>	0.90	0.92	36.87	44.93	29.48	31.40	-4.24	-11.02	66.10	126.43
<i>Türkiye</i>	0.69	0.84	34.56	31.18	30.44	27.23	-4.12	-3.05	57.16	41.80

Source: Prepared by the authors using data obtained from OECD, UNDP and IMF databases.

3. LITERATURE REVIEW

Various studies in the literature examine the relationship between HDI and fiscal instruments. The examination of the studies revealed different findings. We evaluated the differences in the findings because the data sets, explanatory variables, and econometric methods used in the studies were not the same. Although the findings obtained in this study are similar to those of some studies in the literature, they are not similar to the results of some studies. The primary

purpose of this study is to investigate the effects of different fiscal instruments on HDI. This section focuses on studies that align with the primary purpose of the research and use similar variables, allowing for comparison with the findings.

The studies in the literature were divided into three groups for examination. The first group included studies examining the relationship between public expenditures and HDI, and the second group included studies focusing on the effect of taxes on HDI. The third group examined studies that considered public debt and budget deficits. The literature review revealed that studies examining the impact of public debt and budget deficits on the HDI are limited compared to those focusing on public spending and taxes. In particular, studies examining the impact of budget deficits on the HDI are limited. This approach limits a complete understanding of the direct and indirect effects of fiscal policies and instruments on human development. It also demonstrates a gap in the literature regarding a holistic approach to addressing the social welfare and human development dimensions of fiscal policies. This inclusion of public debt and budget deficit in this study's analysis, in addition to tax burden and public spending, provides a holistic assessment of the impact of fiscal instruments on human development and offers more comprehensive implications for policymakers. Furthermore, the limited studies in the literature on this topic have commonly focused on Nigeria, Indonesia, the BRICS, and the ASEAN countries. Therefore, this study, which addresses 24 OECD countries, overcomes the existing limitation in terms of sample size and evaluates the results across different country groups.

Many studies in the literature examine the relationship between public expenditures and HDI. Some studies have found a positive relationship between public expenditure and human development. Examples of these studies are Prasetyo and Zuhdi (2013), Kızılkaya et al. (2015), Vijesandiran & Selvarasa (2018), Agnello et al. (2018), Fadilah et al. (2018), Paterl & Annapoorna (2019), Geyik & Aydın (2021), Yayla & Şaşmaz (2020), Rahmawati & Intan (2020), and Firmansyah et al. (2024). Prasetyo and Zuhdi (2013) examined the relationship between per capita public health, education expenditure, and human development in 81 countries. The study found that public expenditure improved the human development index in countries such as Singapore, Zambia, Australia, Chile, and Georgia. Fadilah et al. (2018) stated that education and health expenditures increase the human development index. In their study on East Java (Indonesia), Rahmawati and Intan (2020) found that local public expenditures, especially education expenditures, positively affect human development. Some studies have stated that public expenditures have no effect on HDI or have an adverse effect (Ali et al., 2012; Omodero, 2019; Maharda & Aulia, 2020). Ali et al. (2012) found in their study on Pakistan that real expenditures negatively affect the human development index. Maharda and Aulia (2020), who investigated the effect of public expenditures on the human development index in Indonesia, found that health expenditures had no effect. In their study on Nigeria, Omodero (2019) concluded that public investment expenditures did not affect human development. Studies in the literature examine the relationship between public expenditures and HDI using

causality analysis. Paterl and Annapoorna (2019), Yayla & Şaşmaz (2020), and Geyik & Aydın (2021) provide examples of these studies. As a result of the study, Paterl and Annapoorna (2019) found a one-way causality relationship between public expenditures and HDI; Yayla & Şaşmaz (2020) found a one-way causality relationship from HDI to public expenditures.

Various studies have examined the relationship between taxes and HDI in the literature (Ali et al, 2012; Kızılkaya et al., 2015; Şaşmaz & Yayla, 2018; Vijesandiran & Selvarasa, 2018; Agnello et al., 2018; Vatavu et al., 2019; Ibadin & Oluwatuyi, 2021; Mgammal, 2024). Among these studies, Ali et al. (2012), Kızılkaya et al. (2015), Agnello et al. (2018), and Vijesandiran and Selvarasa (2018) investigated the effects of both public expenditures and taxes on HDI. Some studies have found that taxes positively contribute to human development. Ibadin and Oluwatuyi (2021) found that SCT and VAT positively affect the human development index in Nigeria. Mgammal (2024), as a result of his panel data analysis on 163 countries, found that tobacco taxes and VAT contributed positively to human development. Some studies in the literature have concluded that there is a negative relationship between taxes and HDI or that taxes have no effect on HDI. Kızılkaya et al. (2015) and Vijesandiran & Selvarasa (2018) found that taxes negatively affect HDI; Agnello et al. (2018), as a result of his panel data analysis on 182 countries, concluded that tax-focused fiscal policies do not affect HDI. There are also studies in the literature that examine the relationship between taxes and HDI using causality analysis. Şaşmaz and Yayla (2018) and Vatavu et al. (2019) are examples of such studies. Şaşmaz and Yayla (2018) found a bidirectional causality relationship between human development and indirect taxes and a unidirectional causality relationship for direct taxes in 11 countries. Vatavu et al. (2019) found a unidirectional causality relationship toward HDI taxes.

Examples of studies examining the relationship between HDI and public debt are Wang et al. (2021), Ezenwobi and Anisiobi (2021), Alli-Momoh et al. (2022), Nwokoye et al. (2024), and Mostafa et al. (2025). Ezenwobi and Anisiobi (2021) and Nwokoye et al. (2024) concluded that public debt has a positive contribution to human development, whereas Wang et al. (2021) and Alli-Momoh et al. (2022) found that an increase in the public debt burden reduces human development. Mostafa et al. (2025) examined the effect of public debt on HDI using panel data analysis, considering the G7 and ASEAN countries. The results obtained in this study differed for both country groups. Accordingly, while public debt contributes to the increase in human development in G7 countries, it decreases human development in ASEAN countries. Wulandari et al. (2018) examined the relationship between budget deficits and human development in the case of Indonesia and found a negative relationship.

4. DATA AND METHODOLOGICAL APPROACH

4.1. Data

The sample and period of the study were selected according to the usable data criteria in the analysis. In this context, the horizontal section of the study focuses on 24 OECD countries and the period between 2004 and 2021. Information on the countries included in the analysis are presented in Table 2.

Table 2 Cross-section of the research

Australia	France	Italy	Slovak Republic
Belgium	Greece	Latvia	Slovenia
Czechia	Germany	Lithuania	Sweden
Denmark	Hungary	Netherlands	United Kingdom
Estonia	Ireland	Poland	United States
Finland	Israel	Portugal	Türkiye

Source: Prepared by the authors.

Detailed explanations of all variables included in the econometric model and their data sources are presented in Table 3; descriptive statistics are presented in Table 4.

Table 3 Description of variables and data sources

Variables	Symbol Definition	Measure	Data Source
Human Development Index	HDI	Index	UNDP
Gini	Gini	Index	Our World in Data
Total Unemployment Rate	UR	% Total Labor Force	World Bank
ln Total Public Spendings	PS	% GDP	OECD
ln Tax Burden	TB	% GDP	OECD
ln Total Public Debt	PD	% GDP	IMF
Budget Deficits	BD	% GDP	IMF

Source: Prepared by the authors with data obtained using the STATA 18.

Table 4. Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Minimum	Maximum
HDI	432	0.8845139	0.0427961	0.696	0.951
Gini	432	0.3201148	0.0478799	0.2323232	0.4436484
UR	432	8.162919	3.792221	2.015	27.686
lnPS	432	3.723983	0.1868798	3.099777	4.057126
lnTB	432	3.803684	0.1625567	3.1895	4.172763
lnPD	432	4.015224	0.6614442	1.325732	5.358415
BD	432	-2.953617	3.584273	-32.10832	5.307823

Source: Prepared by the authors with data obtained using the STATA 18.

4.2. Models

Panel data analysis, which allows analysis of cross-sections and time units together, was used as the method in this study. Drawing on previous studies in the literature (Mikk, 2008; Prasetyo, 2013; Hysa, 2014; Vatavu, 2019; Sarkodie & Adams, 2020; Hashmat et al., 2023; Nwokoye 2024 and Giri & Arora, 2024), this study includes tax, public expenditure, public debt, and budget variables among the factors influencing the human development index. The model excludes economic growth as an explanatory variable because per capita GDP is based on purchasing power parity, which is used to calculate the human development index. This study uses the following equation to investigate the effect of fiscal instruments on the human development index in OECD countries:

$$HDI_{it} = \beta_0 + \beta_1 Gini_{it} + \beta_2 UR_{it} + \beta_3 \ln PS_{it} + \beta_4 \ln TB_{it} + \beta_5 \ln PD_{it} + \beta_6 BD_{it} \quad (1)$$

In the model, HDI represents the human development index, Gini represents the Gini coefficient of countries, UR represents the unemployment rate, PS represents the total public expenditure, TB represents the tax burden, PD represents the public debt burden, and BD represents the budget deficit. In order to reduce the large-scale differences between variables, normalize the data distribution, and obtain more consistent estimates, it is possible to use the logarithm of the variables in the analyses (Cameron & Trivedi & 2005; Gujarati & Porter 2009, and Wooldridge 2012). Therefore, to obtain reliable results, the study applies logarithmic transformation to some variables in the model and conducts analyses accordingly.

4.3. Methodology

Various econometric tests were used in the study to investigate the effect of fiscal instruments on the human development index. The first step entailed carrying out model determination tests. First, the ANOVA F test was used to choose between the Classical model (OLS) and the fixed effects model (FE). Moulton and Randolph (1989) stated that the ANOVA F test produced a strong result to test the significance of the fixed effects model. The ANOVA F test is computed as follows (Moulton & Randolph, 1989, p. 688):

$$F = \frac{y'MD(D'MD) - D'My/(p-r)}{y'Ny/[n - (k + p - r)]} \quad (2)$$

The Lagrange Multiplier (LM) test was developed by Breusch-Pagan (1980) to choose between the pooled OLS model and the random effects model. The Breusch-Pagan Lagrange Multiplier test was conducted in the second stage of the model specification process. This test examines whether the error terms are randomly distributed or exhibit fixed unit effects. The statistic is computed as follows (Breusch-Pagan, 1980; Wooldridge, 2010, p. 60):

$$LM = \left(N^{-1/2} \sum_{i=1}^N \hat{r}_i' \hat{u}_i \right)' \left(\hat{\sigma}^2 N^{-1} \sum_{i=1}^N \hat{r}_i' \hat{r}_i \right)^{-1} \left(N^{-1/2} \sum_{i=1}^N \hat{r}_i' \hat{u}_i \right)' \quad (3)$$

The Hausman test was applied as a final test within the scope of model determination tests in the study. Hausman (1978) developed the Hausman test to decide between the FE and RE models in panel data analyses. This commonly employed test, used in panel data analyses, is predicated on the assumption that "there is no correlation between the explanatory variables and the error term." If this basic hypothesis is rejected due to the test, it is decided that the RE estimator is inconsistent (Hausman, 1978; Baltagi, 2021; Yerdelen Tatoğlu, 2020). The Hausman test statistic is computed as follows (Hausman, 1978; Wooldridge, 2010):

$$H = (\hat{\delta}_{FE} - \hat{\delta}_{RE})' [Avar(\hat{\delta}_{FE}) - Avar(\hat{\delta}_{RE})]^{-1} (\hat{\delta}_{FE} - \hat{\delta}_{RE}) \quad (4)$$

Following model determination tests, it is essential to verify the presence of cross-sectional dependency, autocorrelation, and heteroscedasticity issues within the model to secure more reliable outcomes. In this context, the existence of the heteroscedasticity problem was first tested in the model. Heteroscedasticity is a problem that can occur in panel data or time series models. The term heteroscedasticity describes variability in the model's observations that is not consistent throughout (Greene, 2002, p. 215). The Modified Wald test was employed in the study to investigate heteroscedasticity. The Wald statistic is computed according to the following formula (Baum, 20011; Greene, 2002).

$$W = \sum_{i=1}^{N_g} \frac{(\hat{\sigma}_i^2 - \hat{\sigma}^2)^2}{V_i} \quad (5)$$

The model's efficiency is negatively affected by autocorrelation. The concept of autocorrelation is defined by the presence of statistically dependent error terms in time series or panel data, which exhibit a correlation among these terms. The presence of a connection between error terms in panel data sets is an indication of an autocorrelation issue (Gujarati & Porter, 2009, p. 413). The Durbin-Watson and Baltagi-Wu tests were employed to determine whether an autocorrelation issue existed in the model developed in the study. The Durbin-Watson test was created by Bhargava et al. to address the issue of autocorrelation in panel data models. The d statistic is computed as follows (Bhargava et al., 1982):

$$d = \frac{\sum_{i=1}^H \sum_{t=2}^T (\tilde{u}_{it} - \tilde{u}_{it-1})^2}{\sum_{i=1}^H \sum_{t=1}^T \tilde{u}_{it}^2} \quad (6)$$

The Baltagi-Wu (1999) Local Best Invariant (LBI) test is an alternative test to the Durbin-Watson test used in panel data models to address the issue of autocorrelation. The Baltagi-Wu test calculates the d statistic according to the following formula (Baltagi & Wu, 1999):

$$d = \frac{z' A_0 z}{z' z} \quad (7)$$

The null hypotheses of the Durbin-Watson and Baltagi-Wu tests are identical, although the alternative hypotheses for these two tests are distinct. The alternative hypothesis of the Baltagi-Wu test is $H_a^+ : \rho > 0$ or $H_a^- : \rho < 0$; while $|\rho| < 1$ is considered for Durbin-Watson (Bhargava et al., 1982; Baltagi & Wu, 1999). The test statistics from the Durbin-Watson and Baltagi-Wu tests are compared to a value of 2. Statistics below 2 indicate the presence of autocorrelation within the model (Yerdelen Tatoğlu, 2020).

Finally, the study tested for cross-sectional dependence as one of the deviations that may disrupt the model's efficiency. Cross-sectional dependence is a common challenge in panel data models. Ignoring cross-sectional dependence in established models leads to misleading analytical outcomes (Pesaran, 2015, p. 750). The Breusch-Pagan LM test is frequently used to test cross-sectional dependence. However, this test is more suitable for $T > N$ panel data models and may be insufficient for panel data where $N > T$. (Pesaran, 2004, pp. 1-5). A variety of tests have been developed to evaluate the cross-sectional dependence in panel data models, especially those with a unit dimension larger than the time dimension. These are the CD tests, developed by Pesaran (2004), and the Friedman tests, developed by Friedman (1937). The Pesaran CD test is computed as follows (Pesaran, 2004):

$$CD_{lm} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T\hat{\rho}_{ij}^2 - 1) \quad (8)$$

The Friedman test, developed by Friedman to evaluate cross-sectional dependency, is computed as follows (Friedman, 1937):

$$FR = \frac{12}{np(p+1)} \sum_{j=1}^p \left(\sum_{i=1}^n r_{ij} \right)^2 - 3n(p+1) \quad (9)$$

5. EMPIRICAL FINDINGS

First, model determination tests were conducted for the model developed in the study, and the test outcomes are presented in Table 5.

Table 5 Results of model determination tests

	ANOVA F Test	Breusch- Pagan Lagrange Multiplier (LM) Test	Hausman Test
<i>Hypothesis</i>	H_0 : There is no unit effect. The Ordinary Least Squares (OLS) applies.	H_0 : There is no unit effect. The classic model (OLS) applies.	H_0 : RE model applies.
	H_1 : There is a unit effect. FE model applies.	H_1 : There is a unit effect. RE model applies.	H_1 : FE model applies.
<i>Test Statistics</i>	65.09	1852.19	15.55
<i>Prob.</i>	0.0000	0.0000	0.0164
<i>Decision</i>	H_0 Rejected	H_0 Rejected	H_0 Rejected

Source: Prepared by the authors with data obtained using the STATA 18.

Upon examining the results of the ANOVA F test and Breusch-Pagan LM test presented in Table 5, it is observed that the p-values are statistically significant at a 1% level. The null hypothesis (H_0), which assumes that the OLS model is accurate, has been rejected. Consequently, the study's model is incompatible with Ordinary Least Squares estimation methods. The Hausman test results indicate a statistically significant p-value at a 5% significance level. The null hypothesis (H_0) that the RE model is valid is rejected, and the FE model is accepted as consistent. The second step of the econometric analysis section involved testing several assumptions that could compromise the model's efficiency to achieve accurate results. The outcomes of the tests carried out for this aim are shown in Table 6.

Table 6 Results of assumption tests in panel data analysis

Heteroscedasticity Test Results				
Wald	Null Hypothesis	Test Statistics	Prob.	Decision
	H ₀ : There is no heteroscedasticity between units.	4614.48	0.0000	H ₀ Rejected
Autocorrelation Test Results				
Durbin Watson	Null Hypothesis	Test Statistics	Prob.	Decision
	H ₀ : There is no autocorrelation	0.1815	< 2	H ₀ Rejected
Baltagi-Wu		0.42113	< 2	H ₀ Rejected
Cross-Section Dependency Test Results				
Pesaran-CD	Null Hypothesis	Test Statistics	Prob.	Decision
	H ₀ : There is no cross-section dependency	34.688	0.0000	H ₀ Rejected
Friedman		195.398	0.0000	H ₀ Rejected

Source: Prepared by the authors with data obtained using the STATA 18.

The Wald test outcomes in Table 6 showed that the null hypothesis (H_0) was rejected, and it was found that there was a heteroscedasticity issue in the model. To evaluate the model for autocorrelation, both the Durbin-Watson and Baltagi-Wu tests were performed. The tests yielded statistics that fell below the threshold value of 2. The null hypothesis (H_0) was thus invalidated, revealing an issue of autocorrelation within the model. The Pesaran-CD and Friedman tests were subsequently employed to verify the presence of a cross-section issue within the model. Results from both tests showed that the null hypothesis (H_0) was rejected, and cross-sectional dependence was found to be present within the model. Upon evaluating the results of all tests conducted, it was found that all issues causing disruptions to the model's efficiency were present.

The Driscoll-Kraay (DK) is a method that allows consistent results to be obtained in panel data models, especially in cases where $N > T$ (Driscoll & Kraay, 1998, p. 550). Furthermore, it provides dependable results when the model encounters issues with heteroscedasticity, autocorrelation, and cross-section dependency (Yerdelen Tatoğlu, 2020, p. 335). The DK method was used alongside

the FE method to yield consistent results when determining the impact of fiscal instruments on the human development index. The results of the FE and DK estimation methods are presented in Table 7.

Table 7 Results of FE and DK methods

<i>Dependent Variable: HDI</i> <i>N=24 T=18 Number of Observations=432</i>							
<i>Variables</i>	1	2	3	4	5	6 (FE)	7 (DK)
<i>C</i>	0.9636	0.9321	0.8645	0.9289	0.8644	0.6993	0.6993
<i>Gini</i>	-0.2159*** (-2.98)	-0.1133 (-1.50)	-0.0970 (-1.27)	-0.0874 (-1.14)	-0.0978 (-1.41)	-0.1618** (-2.34)	-0.1618* (-1.78)
<i>UR</i>		-0.0013*** (-4.07)	-0.0016*** (-4.28)	-0.0016*** (-4.32)	-0.0025*** (-7.44)	-0.0029*** (-8.56)	-0.0029*** (-6.10)
<i>lnPS</i>			.0168 (1.37)	0.0274** (1.96)	-0.0116 (-0.91)	0.1531*** (4.08)	0.1531** (2.55)
<i>lnTB</i>				-0.0288 (-1.58)	-0.0243 (-1.51)	-0.1481*** (-4.80)	-0.1481*** (-3.50)
<i>lnPD</i>					0.0359*** (10.88)	0.0343*** (10.58)	0.0343*** (12.46)
<i>BD</i>						0.0038*** (4.66)	0.0038*** (3.03)
<i>R²</i>	0.021	0.059	0.064	0.069	0.281	0.317	0.317

Note: ***, ** and * denote statistical significance at the 1%, 5% and %10 levels, respectively. The values in parentheses show the t-statistic.

Source: Prepared by the authors with data obtained using the STATA 18.

The variables considered in the model were included in the analysis sequentially. The R^2 value increased with each variable added to the model. Therefore, the R^2 value, which was 0.021 in the initial model, increased in subsequent models, demonstrating the accuracy of the established models. However, the small R^2 value constitutes a limitation of the study. This study aimed only to examine the impact of financial instruments on the human development index; therefore, a limited number of variables were included in the established model. The human development index is calculated using multidimensional variables and can be affected by various variables. Therefore, it is possible to conclude that the low R^2 value is due to this situation.

Examining the results of the two estimation methods (FE and DK) presented in Table 7 shows that all variables in the model significantly affect the human development index. However, the statistical significance levels of each variable differ from each other. Accordingly, the human development index is statistically significant at the 10% level with the Gini coefficient and at the 1% level with the unemployment rate. Both statistical significances are negative. A one-unit increase in income inequality reduces the human development index by 0.168, and a one-unit increase in the unemployment rate reduces it by 0.029.

When the statistical results regarding public expenditures, budget deficit, and debt burden are examined, a positive relationship is observed between the human development index. This positive relationship has a statistical significance

level of 5% for public expenditures and 1% for the budget deficit and the debt burden. A 1% increase in public expenditures translates to a 0.153-unit increase. A 1% increase in the debt burden increases the human development index by 0.034 units, and a 1% increase in the budget deficit increases the human development index by 0.0038 units. A negative statistical significance exists at the 1% level between the tax burden and the human development index. Accordingly, a 1% increase in the tax burden reduces human development by 0.148.

The results of the analysis indicate that policies prioritizing economic growth alone will be insufficient or limited in achieving high human development. Adopting active labor market policies to reduce unemployment will empower individuals and raise living standards. Furthermore, reducing income inequality through tools such as social transfers and increasing access to education, health, and social services for those with limited access to these opportunities will also positively contribute to human development. Therefore, adopting more inclusive policies, promoting employment, and prioritizing reducing societal inequalities is crucial for achieving high levels of human development.

When the statistical results are interpreted from a fiscal instrument perspective, it is observed that an increase in public spending contributes positively to the human development index. This finding indicates that public spending should be designed from a fiscal instrument perspective and as a development tool that supports human development. Long-term sustainable human development can be supported by public spending in infrastructure, education, and healthcare, improving individuals' living standards. In future studies, examining the impact of different types of public spending on the human development index will help determine which public spending should be prioritized in human development.

The debt burden and budget deficit also impact the HDI in a manner similar to public spending. In other words, increases in the budget deficit and debt burden, although not as strong as increases in public spending, increase the HDI. This finding highlights that debt and budget deficits are not merely undesirable or negatively evaluated. Policymakers' use of budget deficits or borrowing in areas that directly enhance the quality of human capital, such as infrastructure, education, healthcare, and social protection, will contribute to social welfare and human development. However, the crucial point is that the budget deficit and debt burden are sustainable, effectively managed, and used for long-term development rather than short-term investments.

When the analysis results are evaluated regarding tax burden, the outcome is a decrease in human development. An increase in the tax burden may reduce households' disposable income, thus limiting their spending on education, health, and living standards. A tax system dominated by indirect taxes, in particular, can place a heavier burden on low-income households. This, in turn, can negatively impact human development by causing income inequality. However, it would be incorrect to state that increasing the tax burden will always reduce the human development index. The impact of taxes on the human development index can vary

depending on the structure of the tax system and the areas in which tax revenues are used. Therefore, adopting an effective and fair tax system and using tax revenues for socially beneficial purposes can positively impact human development.

6. CONCLUSIONS

This study investigated the impact of various variables on the human development index, considering 24 OECD countries and the period between 2004-2021. The study focused on how fiscal instruments affect the human development index. The external validity of this study is limited to the OECD countries included in this research. Therefore, these findings can be generalized to countries with similar structural, social, and economic characteristics to those included in the study. However, this generalization may be limited because each country has different fiscal and economic capacities. For example, this study found that budget deficits contribute positively to human development in selected OECD countries. However, unsustainable debt burdens or budget deficits can negatively affect human development in a developing country. Future studies could analyze underdeveloped or developing countries to offer different policy implications for these countries. Furthermore, findings generalizable to a broader range of countries could be produced by selecting a global sample.

The study first developed an econometric model based on existing literature. Then, using various tests, the impact of fiscal instruments on the human development index was analyzed using the FE and DK methods. The analysis showed that all model variables affected the human development index. The study found a negative relationship between income inequality and human development, indicating that an increase in inequality reduces human development. In addition, an increase in unemployment also harmed human development. These findings are consistent with the findings of the study by Mikk (2008), Hysa (2014), and Sarkodie and Adams (2020). Human development is a multifaceted process that considers income, education, and living conditions. For this reason, an increase in income inequality in society or people not having the income or jobs they need to improve their living conditions may also harm human development. Therefore, implementing policies aimed at reducing inequality and unemployment problems in countries can help increase social welfare and ensure sustainable human development.

The study also investigated the effect of the tax burden on the human development index. The findings indicate that rising tax burdens have a diminishing effect on human development. This finding is not consistent with the results of the studies of Agnello et al. (2018), Ibadin & Oluwatuyi (2021), and Mgammal (2024), while it is consistent with the studies of Kızılkaya et al. (2015) and Vijesandiran & Selvarasa (2018). The tax policies implemented by the state can positively or negatively affect human development. Taxes are a public income necessary for the state to finance its basic services. However, high tax rates, the

unjust distribution of the tax burden, and the adverse effects of taxes on consumption, investment, and savings decisions can also negatively affect the human development process. On the other hand, directing the public revenues collected by the state, especially to education, health, and social areas that will contribute to human development, can support the human development process. Therefore, designing tax policies and allocating the generated income effectively have an important place in advancing human development.

The study concluded that public expenditures increase human development. This result is consistent with the results of various studies in the literature (Agnello, 2018; Fadilah, 2018; Yayla & Şaşmaz, 2020; Geyik & Aydın, 2021). Public expenditures made by the state in education, health, social, and economic areas can affect human development. For example, education and health expenditures support the increase in the welfare level of society, the competence of individuals, the development of qualified human capital, and the economic growth and development process. All these gains can also help increase the level of human development. Similarly, increasing investment expenditures in areas that support the country's economy and development can positively impact human development. Just as in tax policies, implementing an efficient spending policy in public expenditures, directing them to areas that can be effective in human development, and ensuring that all segments of society benefit from these expenditures are important in increasing human development.

The analysis determined that budget deficits and public debt positively affect human development. It is consistent with the results obtained in the studies conducted by Nwokoye et al. (2024) and Ezenwobi and Anisiobi (2021). While the analysis results of Mostafa et al. (2025) for G7 countries support this finding, the results conducted for ASEAN countries do not support it. States can invest in areas that contribute to human development, increase public expenditures, or reduce the tax burden. For this reason, increases in public debt burden or budget deficits may occur. Incorrect management of increases in public debt and budget deficits may lead to various economic problems. Therefore, it is important that the budget deficit or debt burden is sustainable and supports economic growth. Budget and debt policies that support economic growth and development can also contribute to increased human development. In addition, the fact that budget and debt are efficient fiscal policy instruments in terms of human development may vary depending on the economic and social conditions of the country and the effectiveness of budget and debt management.

In summary, fiscal policy and its instruments significantly impact the human development index. The content and implementation of fiscal measures are important for human development. The study assesses that focusing on fiscal policies prioritizing human development – using effective and appropriate spending, tax, and borrowing instruments that do not hinder development and growth – will also contribute to increasing the human development index. Furthermore, a country's high human development index can positively support its fiscal capacity. This is because countries with a high HDI have more qualified

human capital and a more qualified workforce. This, in turn, will support a country's economic growth, increased public revenues, and efficient public spending. While effective fiscal instruments positively impact human development, high human development also serves as a tool that directly supports fiscal capacity. High human development can increase existing fiscal capacity, and increased fiscal capacity can provide the opportunity to reinvest in human development. Thus, a positive cycle will emerge between human development and fiscal instruments. This positive cycle is especially significant for sustainable development. The effective use of fiscal capacity is also significant for the sustainable continuation of the positive cycle. Public revenues from increased fiscal capacity must be distributed effectively and equitably throughout society. Otherwise, the potential fiscal advantages offered by a high level of human development may be limited, and inequalities may increase.

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LJUDSKI RAZVOJ KROZ PRIZMU FISKALNIH INSTRUMENATA: EMPIRIJSKA ANALIZA ZEMALJA OECD-A

Sažetak

Cilj je istraživanja analizirati utjecaj fiskalnih instrumenata na indeks ljudskog razvoja. U studiji se javni rashodi, porezi, proračuni i javni dug razmatraju kao fiskalni instrumenti te se koristi analiza panel podataka. Uzimajući u obzir 24 zemlje OECD-a i razdoblje od 2004. do 2021. godine, utjecaj fiskalnih instrumenata na indeks ljudskog razvoja analiziran je korištenjem estimatorom fiksnih učinaka (FE) i Driscoll-Kraay (DK). Analiza pokazuje da svaki fiskalni instrument ima drugačiji učinak na indeks ljudskog razvoja. Porezno opterećenje negativno utječe na indeks ljudskog razvoja, uzrokujući njegovo smanjenje. S druge strane, javni rashodi, teret duga i proračunski deficit pozitivno doprinose ljudskom razvoju. Rezultati ovog istraživanja ukazuju na to da fiskalni instrumenti imaju različite učinke na indeks ljudskog razvoja.

Ključne riječi: indeks ljudskog razvoja, javna potrošnja, porezno opterećenje, proračunski deficit, javni dug.

JEL klasifikacija: E62, 015, H20, H50, H60.