Revisiting the Kuznets Hypothesis: The Role of HDI and GDP in High and Upper-Middle Income Countries (1990-2018) Using Panel Data[1]

Damla GÖKMEN-DEMİRCİ *(https://orcid.org/0000-0002-0570-8388), Bartın University, Türkiye; dgokmen@bartin.edu.tr*

Orhan KANDEMİR *(https://orcid.org/0000-0002-9274-3420), Kastamonu University, Türkiye; okandemir@kastamonu.edu.tr*

Asiye TÜTÜNCÜ *(https://orcid.org/0000-0001-9473-9401), Kastamonu University, Türkiye; atutuncu@kastamonu.edu.tr*

Kuznets Hipotezinin Yeniden Değerlendirilmesi: Panel Veri Analizleri ile Yüksek ve Üst-Orta Gelirli Ülkelerde İGE ve GSYH'nin Rolü (1990-2018)[2]

Abstract

This study examines the Kuznets hypothesis in high and upper-middle-income countries from 1990 to 2018 using panel data analysis. Income inequality dynamics are analysed with two economic development indicators: the Human Development Index (HDI) and Gross Domestic Product (GDP) per capita. Two models are built to conduct cointegration analysis and estimate long-run coefficients. The Westerlund and Edgerton (2007) test assesses cointegration, while the Augmented Mean Group (AMG) approach estimates long-term coefficients. Findings indicate a pronounced U-shaped relationship in both country groups and suggest that HDI explains income inequality more effectively than GDP per capita.

Keywords : Kuznets Hypothesis, HDI, Income Inequality, Economic Development.

JEL Classification Codes : O11, O15.

Öz

Bu çalışma, 1990-2018 döneminde yüksek ve üst-orta gelirli ülkelerde Kuznets hipotezini panel veri analizi ile incelemektedir. Gelir eşitsizliği dinamikleri, İnsani Gelişme Endeksi (HDI) ve kişi başına Gayri Safi Yurt İçi Hasıla (GSYİH) olmak üzere iki ekonomik kalkınma göstergesiyle analiz edilmiştir. Eşbütünleşme analizi ve uzun dönem katsayılarını tahmin etmek için iki model oluşturulmuştur. Westerlund ve Edgerton (2007) testi eşbütünleşmeyi, Genişletilmiş Ortalama Grup (AMG) yaklaşımı ise uzun dönem katsayılarını tahmin etmektedir. Bulgular, her iki ülke grubunda

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belirgin bir U şeklinde ilişki olduğunu ve HDI'nin gelir eşitsizliğini GSYİH'den daha iyi açıkladığını göstermektedir.

Anahtar Sözcükler : Kuznets Hipotezi, İGE, Gelir Eşitsizliği, İktisadi Gelişme.

1. Introduction

From the twentieth century to the present, the world has transformed from a bipolar world order to one dominated by a single country. This shift has increasingly widened income distribution inequalities between countries, and economics has fallen short in finding solutions to this issue (Gönel, 2016: 2). To discuss the development and welfare increase of a country, income distribution should also be focused on. When per capita income rises significantly in a country, but only a small portion of the population utilises this increase while the living standards of the remaining population do not improve, economic growth may occur, but economic development cannot be claimed (Kaynak, 2009: 69).

While many factors lead to poverty, one of the foremost reasons is income inequality. The concentration of income in specific segments of the population results in a division between a group living in wealth and prosperity and another group living in poverty and misery. Income distribution inequalities are not merely an economic concern but also a fundamental issue for social cohesion and political stability. Income inequality limits individuals' access to essential services such as education, healthcare, and housing, reduces social mobility, and adversely impacts long-term sustainable development. Therefore, economic policies aimed at reducing income inequality should be aligned not only with growth objectives but also with efforts to enhance social welfare. The primary objective of economic policies is to increase the economic welfare level of society. Changes in the welfare level of society can be analysed through shifts in income distribution and poverty during economic development. Distribution of income and poverty data in a country can serve as important indicators for assessing the country's welfare level and changes in welfare over time (Çalışkan, 2010: 90-91).

Determining the level of income distribution and the factors that affect it can inform policies aimed at achieving fair income distribution and the country's development goals. Many studies have investigated the factors that affect and are related to inequalities in income distribution. One of these studies was conducted by Simon Kuznets in 1955. Kuznets (1955) indicated that in the initial phases of economic development, as a result of the economic structural change from agriculture to industry with industrial and urban transformation, the difference between rural and urban incomes will increase and income inequality will increase, but in later stages, as these processes mature, inequality will decrease. The association between inequality indicators, such as the Gini coefficient, and per capita production level is defined as the "Inverted-U" or "Kuznets Curve" (Barro, 2000: 9). Kuznets (1955) stated that "this work is perhaps based on 5% empirical information and 95% speculation" which opened the door for subsequent studies to examine the validity of

these assumptions. In subsequent years, numerous studies investigated the accuracy of the Kuznets hypothesis, and this research continues today.

In most studies testing the Kuznets hypothesis (Ram, 1991; Trible, 1996; Oczki et al., 2017), per capita income is used as a proxy for economic development. However, economic development is defined not only by per capita income but also by increases in welfare in economic, social, and cultural terms (Kaynak, 2009; Berber, 2015; Han & Kaya, 2015). In this context, it is essential to assess the empirical support for the Kuznets hypothesis using a broader welfare measure, such as the HDI, rather than relying solely on per capita income. This is because some economists argue that per capita national income is insufficient to represent development comprehensively (Hopkins, 1991; Dynan & Sheiner, 2018; Costanza et al., 2009). According to them, per capita national income fails to capture the distribution of economic benefits adequately. It does not reflect economic and social issues such as poverty, malnutrition, illiteracy, and limited personal and social freedom, all of which contribute to low living standards. Since the 1960s, alternative measures of economic development, referred to as "social indicators," have gained popularity. The Human Development Report (HDR), launched by the United Nations Development Program (UNDP) in 1990, is one of the leading indicators aiming to measure development based on social criteria (Todaro, 1992: 359). Since 1990, the HDI has been calculated in the HDR developed by the UNDP. HDI is a multidimensional index that captures human development through three main aspects: life expectancy at birth as an indicator of health, mean and expected years of schooling as a measure of education, and gross domestic product as a representation of living standards (UNDP, 2018: 1).

In this study, to investigate the empirical support for the Kuznets hypothesis, two country groups, namely "High Income Group" and "Upper Middle Income Group", classified by the World Bank based on the per capita income level, are considered. To test the Kuznets Hypothesis, two models were constructed using data from 1990 to 2018. In the first model, GDP data are used as a proxy for economic development, whereas in the second, HDI data are used. Therefore, this study aims to assess the validity of the hypothesis using a different economic development indicator across countries in two income groups.

2. Kuznets Hypothesis

The link between economic development and income inequality has been analysed in the literature for many years. One of these studies was conducted by Simon Kuznets in 1955. Kuznets (1955), using data from Germany, the UK and the US, proposed that income inequality initially rises during the early stages of economic development but declines in the later phases. The link between an indicator of inequality and per capita production level is defined as the "Inverted-U" or "Kuznets Curve" (Barro, 2000: 9).

The Kuznets Curve is depicted in Figure 1. The vertical axis represents income inequality, and the horizontal axis shows per capita income as a proxy for economic development. In the initial stages of economic development, income inequality continues to

rise until it peaks. After a certain income threshold, however, income inequality declines as economic development progresses. According to Kuznets (1955), two factors influence income inequality. The first concerns the savings intensity of high-income groups. During the initial phases of economic development, savings are concentrated among the upper-income groups, while the total savings of lower-income groups are nearly zero. Due to capital scarcity in the early stages, returns on savings are high. As a result, the wealth of high-income groups increases further, exacerbating inequality. However, in the later stages of economic development, as capital becomes more abundant, lower-income groups also begin to save. This results in a decline in income inequality (Kuznets, 1955: 7).

Figure: 1
Kuznets Curve
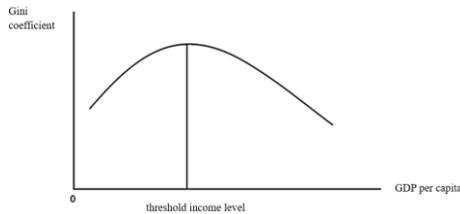
Source: Cypher & Dietz, 2009: 58.

The second factor relates to the industrial structure of income distribution. In developed countries, the growth process is followed by the transition from agriculture to industrialisation and urbanisation. Per capita income is typically lower in rural areas than in urban areas. Furthermore, inequality within rural populations is lower than in urban populations. Thus, ceteris paribus, the increasing share of urban populations makes income distribution more unequal. During economic growth, as per capita productivity in the industrial sector grows faster than in agriculture, the relative income gap between rural and urban populations widens. Thus, inequality in overall income distribution increases (Kuznets, 1955: 7-17). However, as the agricultural sector's share of the economy declines amid ongoing urbanisation, poorer agricultural workers transition to the comparatively wealthier secondary sector. Additionally, the shrinking labour force in the agricultural sector leads to a rise in relative wages within the industry. When all these factors converge to reduce income inequality, the link between per capita production level and inequality tends to become negative again at the higher levels of development (Barro, 2000: 9). As economies progress to advanced stages, the increasing share of industrial sector in the economy leads to a rise in both the income and population shares of the industrial sector, ultimately resulting in a decline in income inequality (Kuznets, 1955: 17).

Kuznets' assumption is based on a migration-driven model in which a population with lower inequality transitions from agriculture to industry, characterised by significantly higher average income and inequality. This implies that, in the early stages of economic development, the movement of the labour force from low-wage, agriculturally dominated

rural areas to the higher-wage industrial sector tends to increase inequality between the two sectors. However, at higher levels of development, as the excess and low-productivity labour in agriculture is absorbed, total income grows, making sectors more productive and reducing inequalities (Hossain, 2013: 198).

The relationship proposed by Kuznets began to lose its validity in many developed countries in the 1960s and 1970s. Since the 1960s, income inequality has risen in many developed countries alongside increases in per capita income. One reason for this is attributed to the transition from manufacturing to services (Gallet & Gallet, 2004: 44). Milanovic (2018) states that since the 1980s, the downward portion of the inverted-U curve, in which inequality declines as income increases, has started to rise again, describing this phenomenon as "Kuznets Waves."

As Kuznets also indicated, Milanovic (2018: 58) argues that structural changes and urbanisation following the Industrial Revolution in wealthy countries led to increasing inequality, which peaked by the late 19th or early 20th century. From this peak, inequality has begun to decline, as Kuznets suggested. Milanovic highlights the presence of certain "benign" and "malign" forces that reduce inequality. Benign forces include the supply of an educated workforce, demands for equality, and declining returns on capital, whereas wars represent malign forces. He argues that the troops that reduced inequality ended after World War I, marking this period as the beginning of the "Second Kuznets Curve." The 1980s witnessed a new technological revolution characterised by globalisation, advances in information technology, and the emergence of diverse service-sector professions, which led to increasingly significant income disparities. The rise in inequality during this period was partly due to technological change, which increased the demand for skilled labour, thereby widening income and wage gaps (Milanovic, 2018: 58-59). The increase in inequality, as in the first technological revolution, results from the replacement of labour by capital through technological innovations and shifts in the workforce between sectors. During the first Kuznets wave, labour shifted from agriculture to industry, whereas in the second Kuznets wave, the transition occurred from industry to services. Compared with the industrial sector, the service sector is more heterogeneous and exhibits greater wage disparities. As a consequence, income inequality rises (Milanovic, 2018: 98-111).

3. Empirical Literature

Numerous studies tested the hypothesis proposed by Kuznets (1955) in the years that followed. The relevant literature shows studies supporting inverted-U hypothesis (Papanek & Kyn, 1986; Jha, 1996; List & Gallet, 1999; Oyvat, 2015, Lazar & Litan, 2023), studies that did not reach findings supporting the hypothesis (Matyas et al., 1998), studies suggesting a U-shaped relationship contrary to the inverted-U hypothesis (Ram, 1991; Tokatlıoğlu & Atan, 2007; Gallet & Gallet, 2004; Oczki et al., 2017; Çakmak & Tosun, 2017; Zungu et al. 2021), and studies suggesting an N or S shape relationship (Tribble, 1996; Akalin et al., 2018; Sinha, 2005). Studies indicate that the relationship between economic progress and income inequality is inverted-N or horizontal-S. The horizontal-S curve

suggests that the first turning point in the trajectory of income inequality during economic development aligns with the transition from agriculture to manufacturing, whereas the second corresponds to a structural shift from manufacturing to services. This curve indicates that the Kuznets (1955) process will continue, and that at advanced stages of economic development, income distribution may deteriorate again (Sinha, 2005: 371). The inverted-N curve describes a situation in which economic growth initially improves income distribution, then worsens after reaching a certain threshold, and improves again after surpassing another threshold (Akalin et al., 2018: 73). In these studies, GDP data were used as a proxy for economic development. In addition, further studies employ GDP as the proxy of economic development (Mbaku, 1997; Theyson & Heller, 2015; Ayhan, 2018). These studies examined the hypothesis at the level of a single country, within a specific group of countries over a particular time period, or through cross-sectional analysis. This section provides a comprehensive review of the related literature. Studies in the literature are categorised into two groups: those that traditionally test the hypothesis using GDP and those that employ a more comprehensive development indicator. Studies that analyse the Kuznets hypothesis using GDP as a measure of economic development are presented in Table 1.

Table: 1
Studies Analysing the Kuznets Hypothesis with GDP per capita

Author(s)	Country/ Countries	Period	Methods	Result
Papanek & Kyn (1986)	83 countries	1955-1971	OLS	Inequality increases with per capita income and decreases with subsequent increases in revenue; however, the empirical evidence is weak.
Jha (1996)	56 countries	1978-1992	OLS	Results indicate that the Kuznets hypothesis holds.
Dawson (1997)	36 less developed countries	The period is not mentioned.	OLS	Results support Kuznets's hypothesis.
Oyvat (2015)	106 countries	1985-2005	2SLS	The inverted-U relationship holds only in developed economies.
List & Gallet (1999)	71 high and low-income countries	1961-1992	OLS, Fixed and Random Effect Models	The inverted-U hypothesis holds for low-income countries. Inequality and development exhibit a positive correlation in high-income countries.
Melikhova & Cizek (2014)	145 countries	1979-2009	Linear Regression	In countries with low levels of social welfare, the inverted-U curve is valid.
Özdemir et al., (2011)	15 transition economies	1992-2007	Fixed Effects Model	These countries were in the initial phase of the Kuznets curve
Topuz & Dağdemir (2016)	94 developed and developing countries	1995-2011	GMM	Their findings provided support for the inverted-U
Akıncı & Akıncı (2016)	Türkiye	1960-2014	Enders-Siklos Cointegration Test, Toda-Yamamoto causality test	The inverted-U hypothesis holds.
Günaydın & Çetin (2015)	Türkiye	1970-2006	VECM	The inverted-U hypothesis holds.
Ram (1991)	U.S.	1947 and 1988	OLS	Their results showed a U relationship.
Gallet & Gallet (2004)	U.S.	1947-1987	Gradual Switching regression	Their results showed a U relationship.
Çakmak & Tosun (2017)	11 middle-income and 14 high-income countries	2002-2013	Fixed Effects Model	Their results showed a U relationship.
Oczki et al. (2017)	European Union countries	2004-2013	LSDV and GLS	Their results showed a U relationship.
Ram (1997)	19 developed countries	1950-1992	Fixed Effects Model	Their results showed a U relationship.
Tribble (1996)	U.S.	1947-1990	OLS	The Kuznets curve was S-shaped in the country. Inequality increased with the transition to the service sector.
Sinha (2005)	India	1981-1998	OLS	The Kuznets curve was S-shaped in the country

Akalin et al. (2018)	Türkiye	1984-2011	ARDL	Their results showed inverted-U and inverted-N relationships.
Matyas et al. (1998)	47 and 62 countries	1970-1993	Fixed and Random Effect Models	They did not find strong evidence
Riveros-Gavilanes et al. (2022)	A total of 151 countries from the regions of East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa.	1990-2019	Semiparametric regression	The Kuznets hypothesis holds in East Asia and the Pacific, and in Latin America and the Caribbean. In Sub-Saharan Africa, South Asia, and Europe and Central Asia, the data show an N-shaped pattern. In the Middle East and North Africa, a negative correlation is observed, whereas in North America, inequality increases with higher per capita income.
Zungu et al. (2021)	13 Southern African Development Community (SADC) countries	1990-2015	Panel smooth transition regression	A U-shaped relationship is observed, contradicting the Kuznets hypothesis.

The economic development process, which encompasses multiple dimensions, is captured by per capita income in studies investigating the Kuznets hypothesis. However, economic development is defined as progress in per capita income and in social areas such as education and health. HDI measures economic development using an index comprising per capita income, education, and health. In the recent literature testing the Kuznets hypothesis, there are a few studies that have used HDI as a proxy for development (Theyson & Heller, 2015; Mbaku, 1997; Martínez-Navarro et al., 2022; Martínez-Navarro & Guarnido-Rueda, 2020; Tarakcıoğlu Altınay et al., 2024; Kılıç & Gökçeli, 2024). Studies that analyse the Kuznets hypothesis using alternative measures of economic development are presented in Table 2.

Table: 2
Studies Analysing the Kuznets Hypothesis with An Alternative Measure of Economic Development

Author(s)	Country/ Countries	Period	Methods	Result
Mbaku (1997)	58 countries	1970	Multivariate Analysis Method	This study, using both per capita income and HDI and Physical Quality of Life Index as alternative measures of economic development, confirmed the Kuznets hypothesis.
Theyson & Heller (2015)	147 countries	1992-2007	OLS, Fixed Effect model	The study's findings indicate that per capita GDP and the GDP Index exhibit an inverted-U-shaped relationship, whereas the HDI, Life Expectancy Index, and Education Index exhibit an S-shaped relationship. Furthermore, it is emphasised that the shape of the curve depends on the choice of development indicator.
Ayhan (2018)	45 countries	1995-2014	Driscoll-Kraay estimator	The study's results showed a U-shaped relationship. Moreover, his findings indicate that the HDI-based model had greater explanatory power than the GDP-based model.
Martínez-Navarro & Guarnido-Rueda (2020)	89 developing and developed countries	1990-2017	GMM	The findings confirmed the Kuznets hypothesis. The relationship described by Kuznets is also valid when a variable other than GDP is used as a measure of development, such as the HDI or the share of agriculture in GDP.
Martínez-Navarro et al. (2022)	45 African countries	1975-2019	PMG	The findings confirmed the Kuznets hypothesis in the model constructed using GDP across the countries considered; however, they did not obtain a significant result regarding the hypothesis's validity in the model built using the HDI.
Tarakcıoğlu Altınay et al. (2024)	MIST countries	1990-2022	Panel ARDL model	The results indicate that economic development contributes to a decline in income inequality.
Kılıç & Gökçeli (2024)	Brazil and Ireland	1990-2020	ARDL model	The study's findings demonstrate that the Human Development Index has contributed to a reduction in income distribution inequality in both Brazil and Ireland.

In the literature, the econometric methods used to test the Kuznets hypothesis, the diversity of income inequality indicators, and the diversity of countries and country groups considered have yielded different results. Moreover, the choice of economic development indicators used to test the hypothesis plays an essential role in shaping the results. While most of the literature relies on GDP as the primary economic development indicator, studies that incorporate broader development indicators, such as the HDI, may yield different findings. In this context, the methodological heterogeneity of the literature provides valuable insights into how the hypothesis unfolds in various economic contexts and periods.

4. Data & Methodology

Consistent with the study's objective, a cointegration test was conducted to examine the long-run relationship among the variables. To investigate cointegration, it is essential to determine the stationarity properties of the series. Therefore, following the preliminary tests, such as cross-sectional dependency and homogeneity tests used to determine the appropriate econometric method, the stationarity levels of the series were examined using the unit root test. Cross-sectional dependency, defined as the correlation between the residuals estimated for each unit in a panel data model (Yerdelen-Tatoğlu, 2020a: 3), can arise from cross-sectional correlations, economic distance, and common unobservable shocks (Sarafidis et al., 2009: 149). Ignoring cross-sectional dependence in panel data can lead to critical errors (Baltagi et al., 2016: 1).

One of the pioneering studies in the literature testing cross-sectional dependency is based on the LM (Lagrange Multipliers) test introduced by Breusch & Pagan (1980) (Pesaran, 2004: 4). CD_{LM1} test is valid in cases where the time dimension is sufficiently large. The unit dimension is relatively small (Pesaran, 2004: 5). To address this limitation of the LM test by Breusch & Pagan (1980), Pesaran (2004) proposed a test known as CD_{LM2} test. Pesaran's (2004) CD test yields effective results under conditions where the time dimension is larger than the unit dimension (T>N). The null hypothesis for both tests is that the variables are cross-sectionally independent. Furthermore, the homogeneity or heterogeneity of the units in econometric models is crucial for determining the appropriate methods. Based on Swamy's (1970) study, Pesaran and Yamagata (2008) developed the $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests under the null hypothesis that the slope coefficients are homogeneous.

This study employs the PANIC (Panel Analysis of Nonstationarity in Idiosyncratic and Common components) unit root test, accounting for cross-sectional dependency. The PANIC test serves two purposes. First, it determines whether nonstationarity arises from a common source or from a particular source. Second, it develops valid pooled tests for panel data when the units are interconnected (Bai & Ng, 2004: 1127). In their study, Bai and Ng (2004) propose combining the unit-level probability values and aggregating the results of individual ADF tests on distorted data (Baltagi, 2005: 248-249). In addition, examined the cointegration relationship using Westerlund & Edgerton's (2007) test, which accommodates cross-section dependence and heterogeneity. This test is based on the LM test of McCoskey & Kao (1998). It is represented in Equation 1.

$$y_{it} = \alpha_i + x'_{it}\beta_i + z_{it} \tag{1}$$

$$z_{it} = u_{it} + v_{it} \tag{2}$$

$$v_{it} = \sum_{j=i}^{t} \eta_{ij} \tag{3}$$

$$w_{it} = \sum_{j=0}^{\infty} \alpha_{ij} e_{it-j} \tag{4}$$

Here, t=1,…, T and i=1,…,N represent time series and cross-sectional units, respectively; η_{ij} is a random variable that follows an independent and identically distributed process with a zero mean and a finite variance. The vector x_{it} includes K-dimensional regressors, while z_{it} denotes the error term. The vector $w_{it} = (u_{it}, \Delta x'_{it})'$ provided in Equation 4 represents a satisfactory linear process (Westerlund & Edgerton, 2007: 186). To avoid misleading results, Westerlund & Edgerton (2007) recommend using bootstrap critical values for the test. The current test examines the cointegration relationship among the variables under the null hypothesis of cointegration (Westerlund & Edgerton, 2007: 187).

A significant limitation of cointegration tests is their inability to indicate the nature of the relationship between independent variables and the dependent variable. For this reason, the Augmented Mean Group (AMG) estimator was used to examine the validity of the Kuznets curve. The primary reason for choosing this estimator is the heterogeneous structure of the models considered in this study and the presence of cross-sectional dependency. This estimator, developed by Eberhardt and Bond (2009), accounts for cross-sectional correlation by employing heterogeneous estimators, SUR-type estimators, or common factors, thereby yielding efficient estimates (Yerdelen-Tatoğlu, 2020b: 72).

This study investigates the validity of the Kuznets hypothesis, with countries classified by the World Bank's 2021 income classification (Hamadeh et al., 2021) into two groups: High Income and Upper Middle Income. Accordingly, the analysis includes 22 High-Income and 15 Upper Middle-Income countries, for which data are available for the 1990-2018 period. The complete list of these countries is shown in Table 3.

Table: 3
Countries Examined in the Study

High Income Levels		Upper-middle Income Levels
Australia	Poland	Armenia
Austria	Portugal	Brazil
Canada	Slovenia	Bulgaria
Cyprus	Spain	Columbia
Czech Republic	Sweden	Costa Rica
Denmark	United Kingdom	Dominican Republic
Finland	Uruguay	Kazakhstan
Germany		Mexico
Greece		Panama
Ireland		Paraguay
Israel		Peru
South Korea		Romania
Netherlands		Russia
New Zealand		Thailand
Norway		Türkiye

Since the HDR featuring the HDI has been published since 1990, the earliest available year was set to 1990. Due to the limited availability of Gini coefficient data for several countries in recent years, the period was restricted to 1990-2018 to ensure coverage of more countries. Annual data were utilised in the analyses, which were conducted using Stata and GAUSS. Table 4 summarises the variables used in the study and their respective data sources.

Table: 4
Variables and Sources

Variables	Description	Source
Gini	The Gini coefficient represents inequality in disposable income after taxes and transfers.	Standardised World Income Inequality Database (SWIID) - Version 8-9.
GDP	Real GDP per capita in 2010 US dollars.	World Bank World Development Indicators Database.
GDP^2	The square of real GDP per capita.	
HDI	Human Development Index.	United Nations Development Programme (UNDP).
HDI^2	The square of the Human Development Index.	

The descriptive statistics of the study variables are provided in Table 5. The table shows that in high-income countries, the average, minimum, and maximum values of the Gini coefficient are 29.53, 20.2, and 42.4, respectively. In upper-middle-income countries, the average, minimum, and maximum values of the Gini coefficient are 42.34, 22, and 54.7, respectively. The average, minimum and maximum values of GDP in high-income countries are 34,688.5 USD, 5,510.618 USD and 92,119.52 USD, respectively. In upper-middle-income countries, the average, minimum, and maximum values of GDP are 6,458.585 USD, 885.217 USD, and 15,190.1 USD, respectively. The average, minimum, and maximum values of the HDI in high-income countries are 0.860, 0.694 and 0.956, respectively. In upper-middle-income countries, the average, minimum, and maximum HDI values are 0.714, 0.577, and 0.823, respectively.

Table: 5
Descriptive Statistics

	Gini	GDP	GDP^2	İGE	İGE^2
High-Income Group					
Mean	29.53	34,688.5	1,500,000,000	0.86	0.742
Maximum	42.4	92,119.52	8,490,000,000	0.956	0.914
Minimum	20.2	5,510.618	30,400,000	0.694	0.482
Standard Deviation	4.336	17,375.76	1,530,000,000	0.057	0.096
Skewness	0.245	0.848	2.33	-0.613	-0.485
Kurtosis	2.675	4.007	9.74	2.663	2.456
Upper-Middle-Income Group					
Mean	42.34	6,458.585	49,500,000	0.714	0.512
Maximum	54.7	15,190.1	231,000,000	0.823	0.677
Minimum	22	885.217	783,609.10	0.577	0.333
Standard Deviation	7.971	2,792.442	40,500,000	0.057	0.082
Skewness	0.509	0.438	1.26	-0.134	0.022
Kurtosis	2.195	2.555	4.64	2.309	2.265

This study utilises a commonly adopted model in the literature to examine the Kuznets hypothesis. The model assumes that income inequality is a function of linear and quadratic income terms (Ram, 1991; Gallet & Gallet, 2004; Dawson, 1997). In addition, the

explanatory power of the HDI as an indicator of economic development in the context of the Kuznets hypothesis is assessed. The models used in this context are given below.

$$Gini_{it} = \alpha_0 + \alpha_1 GDP_{it} + \alpha_2 GDP^2{}_{it} + \varepsilon_{it}$$

$$Gini_{it} = \beta_0 + \beta_1 HDI_{it} + \beta_2 HDI^2{}_{it} + \epsilon_{it}$$

In the model, i=1, …, N represents the countries, t=1, …, T represents the time period, "GDP", representing economic growth, refers to the GDP value, GDP^2 denotes the square of GDP, included in the model to test the Kuznets hypothesis, and "Gini" represents income inequality, as measured by the Gini coefficient. In the second equation, "HDI" denotes the HDI value, used as a proxy for economic development, and "HDI^2" represents the square of the HDI. If the possible estimation results of the coefficients are $\alpha_1, \beta_1 > 0$ and $\alpha_2, \beta_2 < 0$ the Kuznets Hypothesis (inverted-U curve) is valid.

5. Empirical Findings

The present study employed pre-tests, including cross-sectional dependence (CD), homogeneity, and unit root tests, to determine the appropriate econometric method. The CD test results obtained in this context are presented in Table 6.

Table: 6
CD Test Results

Variables	High-Income Group		Upper-Middle-Income Group	
	CD_{LM1}	CD_{LM2}	CD_{LM1}	CD_{LM2}
Gini	383.8***	7.11***	125.185*	1.393*
GDP	407.59***	8.216***	152.97***	3.31***
GDP2	468.05***	11.029***	173.575***	4.732***
HDI	358.329***	5.924***	163.85***	4.061***
HDI2	355.05***	5.771***	173.4***	4.72***

*** and * indicate 1% and 10% statistical significance levels, respectively.

When examining the CD test results for both income groups, the null hypothesis of cross-sectional independence is rejected, indicating that the variables under consideration exhibit cross-sectional dependence. In addition to applying the cross-sectional dependence test to the variables, this test is also applied to econometric models to determine which cointegration test to use. The results of the CD test and homogeneity tests conducted for this purpose are presented in Table 7.

Table: 7
CD and Homogeneity Test Results for Models

High-Income Group		
Test Statistics	Model 1	Model2
CD_{LM1}	1093.128***	1171.31***
CD_{LM2}	40.11***	43.747***
$\tilde{\Delta}$	30.529***	36.375***
$\tilde{\Delta}_{adj}$	32.794***	39.073***
Upper-Middle-Income Group		
Test Statistics	Model 1	Model2
CD_{LM1}	690.009***	841.825***
CD_{LM2}	40.369***	50.846***
$\tilde{\Delta}$	27.552***	31.501***
$\tilde{\Delta}_{adj}$	29.595***	33.838***

*** indicate 1% statistical significance level.

According to Table 7, cross-sectional dependence is identified in the models of both country groups. Moreover, the homogeneity test indicates that the slope coefficients are heterogeneous. Consequently, cointegration tests that address cross-sectional dependence and heterogeneity should be utilised.

Given the presence of cross-sectional dependence in the series, the PANIC unit root test, which accounts for this dependence, is employed to assess stationarity. The results obtained from the PANIC unit root test are presented in Table 8.

Table: 8
Unit Root Test Results

Variables		High-Income Group		I(1)
		I(0)		
		Constant	Constant& Trend	Constant
Gini	P_c	-2.221	-1.821	2.387***
	P_m	23.158	26.915	66.390**
GDP	P_c	-3.167	-3.248	6.329***
	P_m	14.295	13.532	103.368***
GDP2	P_c	-3.413	-3.734	7.309***
	P_m	11.984	8.977	112.564***
HDI	P_c	-2.137	-0.818	7.263***
	P_m	23.951	36.329	112.130***
HDI2	P_c	-2.279	-0.991	6.643***
	P_m	22.621	34.700	106.312***
Variables		Upper-Middle-Income Group		I(1)
		I(0)		
		Constant	Constant &Trend	Constant
Gini	P_c	-1.495	0.010	1.410*
	P_m	18.420	30.075	40.919*
GDP	P_c	-1.591	-1.397	4.267***
	P_m	17.679	19.181	63.054***
GDP2	P_c	-2.144	-1.853	2.872***
	P_m	13.389	15.650	52.242***
HDI	P_c	-0.349	0.718	8.5678***
	P_m	27.300	35.561	96.366***
HDI2	P_c	0.357	-0.951	8.373***
	P_m	32.768	22.632	94.856***

P_c and P_m represent the statistics proposed by Choi (2001) and Maddal & Wu (1999), respectively. *** and * indicate 1% and 10% statistical significance levels, respectively.

According to the unit root test results presented in Table 8, the variables of both country groups are stationary at the I(1) level. Since the series are detrended when

differenced, the results for the model with only a constant term are presented (Gujarati, 2021).

The variables employed in the study were determined to be of the same order, that is, I(1). This allows for examining long-term relationships between the variables. In addition, the homogeneity test revealed that the models are heterogeneous. The results obtained from the panel cointegration test are presented in Table 9.

Table: 9
Cointegration Test Results

	High Income Group	
	Model 1	Model 2
LM statistic	3.272	0.065
Bootstrap probability value	0.121	0.915
	Upper Middle-Income Group	
	Model 1	Model 2
LM statistic	0.214	0.312
Bootstrap probability value	0.836	0.942

Note: The Schwarz information criterion is used to select the lag length. The maximum lag length is set to 3, and 10,000 bootstrap samples are used.

When examining the table, the null hypothesis cannot be rejected for both country groups. Therefore, there is a long-term relationship between the variables. Thus, the long-term coefficient was examined with the AMG estimator.

The AMG long-term coefficient estimation results for the first model in high-income countries are presented in Table 10, given in the appendix. According to the estimation results, the Inverted-U hypothesis is supported in five countries (Australia, Finland, Norway, Portugal, the United Kingdom), whereas the U hypothesis is supported in eight countries (Austria, Cyprus, Denmark, South Korea, the Netherlands, Slovenia, Spain, Sweden). In nine countries (the Czech Republic, Canada, Germany, Ireland, Greece, Israel, Poland, New Zealand, and Uruguay), there is no significant association between the Gini coefficient and economic growth. The AMG estimation results for the second model in the high-income group are presented in Table 11, given in the appendix. The results indicate that the Inverted-U hypothesis is valid in nine countries (Australia, the Czech Republic, Finland, Ireland, South Korea, Norway, New Zealand, the United Kingdom, Uruguay), while the U hypothesis is valid in nine countries (Austria, Cyprus, Denmark, Germany, Greece, the Netherlands, Poland, Portugal, Slovenia). In four countries (Canada, Israel, Spain, Sweden), no statistically significant relationship is found between the Gini coefficient and economic development.

The estimation results for the first model in the upper-middle-income group are presented in Table 12 in the appendix. The results suggest that the inverted-U hypothesis is valid in four countries (Colombia, Costa Rica, the Dominican Republic, Romania), while the U hypothesis is valid in six countries (Armenia, Brazil, Bulgaria, Panama, Russia, Türkiye). In five countries, there is no significant relationship between the Gini coefficient and economic growth. According to Table 13, given in the appendix, which shows the estimation results of the second model, the inverted-U hypothesis is valid in three countries

(Colombia, Costa Rica, Mexico), while the U hypothesis is valid in eight countries (Armenia, Brazil, Bulgaria, Panama, Paraguay, Romania, Russia, Türkiye). In four countries (the Dominican Republic, Kazakhstan, Peru, and Thailand), there is no statistically significant relationship between the Gini coefficient and economic development.

The study's findings indicate that a U-shaped relationship, contrary to the Kuznets Hypothesis, is more prevalent across both country groups. The empirical findings of this study align with previous research (Papanek & Kyn, 1986; Jha, 1996; Günaydın & Çetin, 2015; Topuz & Dağdemir, 2016; Lazar & Litan, 2023; Akıncı & Akıncı, 2016), which provides evidence for the inverted-U relationship. Similarly, our empirical analysis results revealing a U-shaped relationship between economic development and income inequality, contrary to the Kuznets hypothesis, are consistent with other studies in the literature (Ram, 1991; Tokatlıoğlu & Atan, 2007; Gallet & Gallet, 2004; Oczki et al., 2017; Çakmak & Tosun, 2017).

6. Conclusion

In addition to countries that have rapidly increased their wealth through technological innovation and globalisation, some countries are unable to utilise these advantages and continue to struggle with poverty. The UNDP also emphasises the issue of poverty, listing "ending poverty in all its forms everywhere" among the Sustainable Development Goals (United Nations, 2016: 3). One of the primary causes of poverty in countries is the unequal distribution of wealth and income. The wealthiest 10% of the global population receives 52% of total revenue, whereas the poorest 50% accounts for only 8.5%. Furthermore, income and wealth inequality within countries remains a crucial issue that warrants significant attention. Within countries, the average income difference between the wealthiest 10% and the poorest 50% has nearly doubled, growing from 8.5 to 15 (Chancel et al., 2022).

Determining the level of income distribution, identifying the factors influencing this distribution, and analysing the trajectory of income inequality during economic development play a guiding role in both formulating policies for equitable income distribution and achieving a country's developmental objectives. In the context of income inequality during economic development, this study investigates the validity of Kuznets' inverted-U hypothesis for two groups of countries: 22 high-income and 15 upper-middle-income countries. This study tested the Kuznets Hypothesis using both GDP per capita and the HDI, an alternative indicator of economic development. The primary reason for utilising the HDI in this study is to evaluate the validity of the inverted-U hypothesis using a more comprehensive measure of economic development than GDP per capita, given the criticisms regarding the inadequacy of GDP per capita as an indicator of economic development (Hopkins, 1991; Dynan & Sheiner, 2018; Costanza et al., 2009). Accordingly, the study aims to test the validity of the inverted-U hypothesis using a more comprehensive economic development indicator compared to GDP per capita. As the literature contains only a few studies on this subject, testing the inverted-U hypothesis by use of an alternative economic development indicator like HDI (Martínez-Navarro & Guarnido-Rueda, 2020; Mbaku,

1997; Theyson & Heller, 2015; Martínez-Navarro et al., 2022; Tarakcıoğlu-Altınay et al., 2024; Kılıç & Gökçeli, 2024), this study may contribute significantly to the literature.

The empirical findings indicate that a U-shaped relationship, contrary to the Kuznets Hypothesis, is more prevalent across both country groups. Additionally, the empirical evidence suggests that the HDI, widely recognised as a more effective indicator of welfare, provides a stronger explanation of income inequality than GDP per capita, corroborating Ayhan's (2018) findings.

The greater explanatory power of the HDI is attributable to its inclusion of welfare indicators, such as education and health, which significantly influence both income and inequality. According to the empirical findings, variation in the two models' estimates for certain countries may stem from these countries' inability to fully translate their income levels or material wealth into other dimensions of human development, due to existing structural deficiencies. Therefore, using the HDI rather than GDP per capita would be more effective for assessing the Kuznets hypothesis. For instance, a country with a high GDP per capita may not be sufficiently developed in social terms or in redistribution mechanisms such as taxation and social transfers. As a result, an analysis using GDP per capita would yield different results than an analysis using an index such as the HDI, which includes not only income but also social indicators such as education and health.

In contrast to the Kuznets Hypothesis, the study finds that most countries examined exhibit an initial decrease in income inequality followed by a rise as economic development progresses. This points to the process referred to as the Second Kuznets Wave, as expressed by Milanovic (2018). Although the trend toward increasing income inequality varies across countries, it primarily stems from globalisation, developments in information technology, and the emergence of diverse professions in the services sector. These factors drive the growing demand for skilled labour, thereby increasing income and wage disparities.

The observed increase in income inequality following a decline in the analysis results can be attributed to rising spatial disparities between urban and rural areas, as well as to inequalities created by globalisation, technological development, and the transition to the services sector, particularly in developing countries. The primary factor driving inequality between rural and urban areas is the faster growth of urban incomes relative to rural incomes. Another factor lies in the labour market, where informal employment in many poor countries plays a significant role. Informal employment contributes to inequality in various ways, including lower wages, uncertainty about job termination, and limited opportunities, such as training and promotion, for workers (Keeley, 2015: 37-38).

The course of income inequality varies across countries, depending on domestic factors such as economic policies, income redistribution mechanisms, technological levels, and resource endowments, rather than solely on income. In other words, a higher average income does not necessarily imply lower inequality. Inequality within a society is primarily a consequence of political choices, as the structure of economic organisation, including the

rights and restrictions placed on firms, governments, individuals, and other economic actors, plays a crucial role in shaping income distribution (Chancel et al., 2022: 30).

Income distribution inequality impacts society in various ways, leading to significant adverse effects on welfare. Inequality, one of the primary triggers of poverty, causes an increase in social and political unrest within society. Therefore, it is crucial to focus on the factors that drive inequality within the country and to implement redistribution mechanisms and necessary structural transformations to reduce it. Although the policies implemented specifically in every country and their effects vary greatly, the following issues should be emphasised to reduce inequality:

- It is essential to minimise wage disparities between labour incomes through redistribution mechanisms. Reducing labour inequalities and maximising labour productivity can be achieved by investing in education (Piketty, 2021). Therefore, countries should always prioritise educational investments.
- The increasing demand for skilled labour in the current technology age is the main reason behind wage disparities between skilled and unskilled labour. Although unequal access to education remains a challenge in developing countries, and participation in education is very high in developed countries, the quality of school graduates plays a significant role in the labour market. Individuals with the same level of education are differentiated by the quality of the school from which they graduated, thereby contributing to the emergence of wage inequalities (Piketty, 2022). Therefore, promoting equal opportunities in quality education for all individuals is necessary.
- The issue of informal employment, which significantly impacts inequality, should be addressed with due attention, and appropriate policies should be adopted to ensure that the workforce is protected and secured.
- The proportion of public expenditure allocated to education and healthcare is a crucial factor. Taxes, as part of the redistribution mechanism, must be used effectively to fund social transfers, including retirement and unemployment benefits, to play a significant role in addressing redistribution issues.

The present study has certain limitations. Firstly, due to insufficient data on income distribution inequality, the analyses are limited to the period from 1990 to 2018, as well as high-income and upper-middle-income countries. Due to data unavailability, countries in the low- and lower-middle-income groups were excluded from the analysis. Additionally, due to the limited availability of data for alternative economic development indicators, the current study used HDI. Since the data used in this study comprises the period from 1990 to 2018, the effects of the COVID-19 pandemic are not included.

In light of the results of this study, further research could contribute to the literature by providing greater access to data on income distribution inequality and alternative economic development indicators for more countries. By utilising various economic development indicators and econometric methods for a larger number of countries, the

literature can be supported. Moreover, given estimates that the COVID-19 pandemic increased global poverty by 90 million and raised the global Gini index by 0.7 points relative to the pre-pandemic period (Mahler et al., 2022), future studies incorporating inequality data from the COVID-19 period could offer valuable insights into the pandemic's effects.

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Appendix

Table: 10
AMG Estimation Results of Model 1 in the High Income Group

Countries	Independent Variable Gini		
	GDP	GDP2	Shape of the Curve
Australia	0.0009213***	-0.00000000825***	Inverted-U
	(0.0002428)	(0.00000000224)	
Austria	-0.0027561***	0.0000000271***	U
	(0.0005288)	(0.00000000543)	
Canada	-0.0000509	-0.00000000028	-
	(0.000365)	(0.00000000397)	
Cyprus	-0.0010265***	0.0000000156***	U
	(0.0002512)	(0.00000000427)	
Czech Republic	-0.0006538	0.00000000632	-
	(0.0005042)	(0.0000000128)	
Denmark	-0.0037651***	0.0000000327***	U
	(0.0004793)	(0.00000000394)	
Finland	0.0007148***	-0.00000000824***	Inverted-U
	(0.0001627)	(0.00000000193)	
Germany	-0.000509	0.00000000861	-
	(0.0011286)	(0.000000013)	
Greece	0.0000271	-0.00000000146	-
	(0.0005178)	(0.0000000101)	
Ireland	0.0001019	-0.00000000116	-
	(0.000071)	(0.000000000575)	
Israel	-0.00000293	-0.0000000049	-
	(0.0004402)	(0.00000000694)	
South Korea	-0.0011373*	0.0000000279**	U
	(0.0006009)	(0.000000122)	
Netherlands	-0.0020199***	0.00000002***	U
	(0.0002321)	(0.00000000224)	
New Zealand	-0.0008875	0.000000113	-
	(0.0008111)	(0.000000112)	
Norway	0.000548***	-0.0000000275**	Inverted-U
	(0.0002104)	(0.00000000132)	
Poland	-0.0013736	0.0000000288	-
	(0.0006707)	(0.0000000254)	
Portugal	0.0013235*	-0.00000000318*	Inverted-U
	(0.0007709)	(0.0000000182)	
Slovenia	-0.0009257*	0.0000000199*	U
	(0.0004793)	(0.0000000104)	
Spain	-0.0053612***	0.0000000807***	U
	(0.0006899)	(0.0000000117)	
Sweden	-0.000597*	0.00000000663**	U
	(0.0003302)	(0.00000000318)	
United Kingdom	0.0008594**	-0.0000000119***	Inverted-U
	(0.0003759)	(0.00000000451)	
Uruguay	-0.0000564	-0.0000000497	-
	(0.0008831)	(0.0000000379)	

*Standard errors are given in parentheses. *, ** and *** denote significance at 10%, 5% and 1% statistical significance levels, respectively.*

Table: 11
AMG Estimation Results of Model 2 in the High Income Group

Countries	Independent Variable Gini		
	HDI	HDI2	Shape of the Curve
Australia	1529.47***	-813.86***	Inverted-U
	(-399.92)	(-215.92)	
Austria	-782.29***	441.67***	U
	(-524.68)	(294.83)	
Canada	-318.03	174.22	-
	(465.27)	(258.14)	
Cyprus	-93.32*	63.79**	U
	(51.23)	(29.77)	
Czech Republic	362.12***	-222.5***	Inverted-U
	(117.41)	(67.958)	
Denmark	-824.11***	485.69***	U
	(174.97)	(94.81)	
Finland	942.57***	-508.77***	Inverted-U
	(85.97)	(46.82)	
Germany	-620.45***	363.54***	U
	(175.70)	(94.69)	
Greece	-357.18***	198.72**	U
	(135.60)	(80.14)	
Ireland	158.48***	-101.35***	Inverted-U
	(58.74)	(32.32)	
Israel	-545.06	292.64	-
	(374.35)	(207.78)	
South Korea	594.29***	-312.11***	Inverted-U
	(143.70)	(80.26)	
Netherlands	-742.33**	413.93**	U
	(343.68)	(186.79)	
New Zealand	1699.93***	-926.33***	Inverted-U
	(292.39)	(159.51)	
Norway	753.75**	-393.81**	Inverted-U
	(351.88)	(185.82)	
Poland	-284.92***	145.54**	U
	(103.95)	(61.69)	
Portugal	-166.85***	87.32***	U
	(46.29)	(27.57)	
Slovenia	-537.51***	315.94***	U
	(162.96)	(93.31)	
Spain	68.05	-15.56	-
	(435.67)	(246.97)	
Sweden	-231.89	146.04	-
	(149.2)	(81.79)	
United Kingdom	274.34***	-159.95***	Inverted-U
	(63.33)	(34.42)	
Uruguay	1499.70**	-1014.03**	Inverted-U
	(749.63)	(477.58)	

*Standard errors are given in parentheses. *, ** and *** denote significance at 10%, 5% and 1% statistical significance levels, respectively.*

Table: 12
AMG Estimation Results of Model 1 in the Upper-Middle Income Group

Countries	Dependent Variable Gini		
	GDP	GDP2	Shape of the Curve
Armenia	-0.0028218***	0.000000575***	U
	(0.0007261)	(0.000000146)	
Brazil	-0.007003***	0.000000247**	U
	(0.001948)	(0.0000000993)	
Bulgaria	-0.0016102**	0.000000269***	U
	(0.0008365)	(0.0000000705)	
Columbia	0.0127718***	-0.00000114***	Inverted-U
	(0.0016492)	(0.000000137)	
Costa Rica	0.0013817***	-0.000000276***	Inverted-U
	(0.0008262)	(0.0000000676)	
Dominican Republic	0.0013817*	-0.000000208*	Inverted-U
	(0.0008262)	(0.000000842)	
Kazakhstan	0.0000969	-0.0000000387	-
	(0.0001239)	(0.0000000852)	
Mexico	0.004987	-0.000000408	-
	(0.0046006)	(0.000000255)	
Panama	-0.0020811***	0.0000000878***	U
	(0.0001765)	(0.0000000115)	
Paraguay	0.0003174	-0.000000122	-
	(0.006184)	(0.000000714)	
Peru	-0.0015598	-0.0000000721	-
	(0.0010005)	(0.000000114)	
Romania	0.0038084***	-0.000000146***	Inverted-U
	(0.0005452)	(0.0000000369)	
Russia	-0.0031367***	0.000000207***	U
	(0.0009482)	(0.000000054)	
Thailand	-0.0017458	0.0000000317	-
	(0.0006816)	(0.0000000784)	
Türkiye	-0.0019659***	0.0000000745***	U
	(0.0001893)	(0.00000000901)	

*Standard errors are given in parentheses. *, ** and *** denote significance at 10%, 5% and 1% statistical significance levels, respectively.*

Table: 13
AMG Estimation Results of Model 2 in the Upper-Middle Income Group

Countries	Dependent Variable Gini		
	HDI	HDI2	Shape of the Curve
Armenia	-267.97*	189.65*	U
	-145.90	-104.67	
Brazil	-2191.75***	1530.21***	U
	-365.62	-262.99	
Bulgaria	-1503.02***	1031.64***	U
	-115.13	-76.15	
Columbia	1566.37***	-1152.2***	Inverted-U
	-307.72	-223.31	
Costa Rica	503.41**	-313.46*	Inverted-U
	-241.99	-163.31	
Dominican Republic	300.44	-239.84	-
	-228.51	-168.71	
Kazakhstan	42.12	-44.47	-
	-50.60	-34.42	
Mexico	662.55***	-498.18***	Inverted-U
	-201.56	-140.30	
Panama	-584.07***	360.59***	U
	-138.77	-92.85	
Paraguay	-1587.88***	1170.73***	U
	-509.67	-382.32	
Peru	-391.45	238.42	-
	-206.56	-148.56	
Romania	-575.66***	424.25***	U
	-146.64	-97.20	
Russia	-650.72***	436.69***	U
	-230.54	-152.04	
Thailand	-60.97	24.11	-
	-61.22	-45.23	
Türkiye	-205.84***	136.33***	U
	-15.35	-10.97	

*Standard errors are given in parentheses. *, ** and *** denote significance at 10%, 5% and 1% statistical significance levels, respectively.*