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THE IMPACT OF SDG SCORES ON NEET RATES IN SELECTED OECD COUNTRIES: A TWO-STEP GMM APPROACH

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ABSTRACT

This study analyses the relationship between Neither in Education nor in Employment (NEET) rates, Sustainable Development Goals (SDG) scores and economic growth in OECD countries. The model, constructed using the two-stage generalised method of moments (2AGMM) inspired by Okun's law, analyses the dynamic relationship between NEET rates and SDG scores and economic growth. The results show that both economic growth and improvements in SDG indicators reduce NEET rates. Socially equitable and inclusive planning of economic growth increases the integration of the youth population into the labour market. Factors such as education and gender equality have a decreasing effect on NEET rates. The persistence of NEET rates points to the need for structural reforms. In conclusion, it is emphasised that policies to reduce NEET rates should be based on strategies in line with inclusive growth, structural reforms and the SDGs.

Keywords: *NEET, GMM, SDG, Okun's Law, Economic Growth.*

Jel Code: *J13, J14, I30, C33.*

1. INTRODUCTION

The Sustainable Development Goals (SDGs) represent a universal call adopted by the United Nations in 2015, encompassing 17 global goals to be achieved by 2030. These goals include the eradication of poverty, the tackling of inequalities, the protection of the planet, and the securing of prosperity for all (United Nations, 2015). The attainment of these objectives is contingent not solely on economic growth, but also on a multitude of factors, including social inclusion and environmental sustainability. In this context, the situation of young people plays a critical role in countries' progress towards achieving the SDGs.

A salient structural impediment to be surmounted in this critical process is the issue of NEET youth, which is included in the SDG targets. The NEET (Not in Education, Employment, or Training) concept was first coined in the UK in the late 1990s to address the challenges posed by youth unemployment and social exclusion, expanding beyond conventional unemployment statistics. Initially utilised as a rudimentary categorization instrument, the term has proliferated on an international scale,

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attaining significance in youth policies worldwide. The term NEET encapsulates a multifaceted phenomenon, signifying the disengagement of young individuals from educational institutions, employment opportunities, and active participation in social life. This phenomenon is influenced by a myriad of factors, including economic crises, educational deficiencies, familial challenges, and health concerns.

Beyond its role as a significant indicator of social exclusion, the concept of NEET underscores concerns regarding the squandering of human capital from economic perspectives, the perpetuation of intergenerational inequalities, and the imperative for formulating of social policies. The failure of young people to realise their potential engenders substantial losses, both for the individual and for society as a whole. Consequently, the concept of NEET assumes critical importance in assisting governments and civil society organizations to formulate more inclusive and effective policies for young people, whilst also functioning as an early warning system for economic and social problems.

The young population is a demographic group of significance, determining the future composition of the labour force, innovation capacity and social dynamism of a nation. The proportion of young people who are 'Neither in Education nor in Employment' (NEET) is a key indicator of the difficulties in integrating young people into the labour market and society. High NEET rates have been shown to engender inequalities of opportunity at the individual level within the context of the welfare economy, as well as economic and social losses at the macro level (OECD, 2023).

This study undertakes a definitive examination of the relationship between NEET rates and SDG scores in OECD countries, utilizing the Generalised Method of Moments (GMM) to model Okun's Law. Okun's Law elucidates the inverse relationship between the unemployment rate and gross domestic product (GDP) (Okun, 1962). However, this study employs the fundamental logic of Okun's Law and adapts it to model the relationship between NEET rates and SDG scores. The NEET rate is a more comprehensive metric for gauging the situation of young people outside the labour market.

In the extant literature, studies linking Sustainable Development Goal (SDG) scores to National Educational Evaluation and Testing (NEET) rates are generally more specific, associating them with SDG targets and presented as time series analyses. For instance, Target 6 of Goal 8, entitled "Decent Work and Economic Growth," explicitly aims to reduce the number of NEET youth. It is evident from the extant literature that studies are limited to time series analyses directly focused on growth and NEET rates concerning this target. However, this study adopts a holistic approach by considering all the direct and indirect targets of the SDGs as factors that potentially impact NEET rates. The present study aims to utilize the GMM method to ascertain the causal relationships between NEET, growth, and SDG scores for 23 OECD countries. In this respect, the absence of such a study in the literature and its potential to address a significant gap by revealing the causality relationships between the variables are considered noteworthy.

The primary hypothesis of this study posits that improvements in SDG scores exert a negative impact on the NEET rates of OECD countries. This hypothesis will be examined using panel data regression analysis and GMM. GMM is a robust econometric method commonly employed to address endogeneity issues, particularly in panel data contexts (Arellano and Bond, 1991; Tarı et al., 2019). In this study, NEET rates will serve as the dependent variable, SDG scores as the independent variable, and economic growth rates as the control variable. The rationale behind using economic growth rates as a control variable lies in its acknowledged importance as a macroeconomic factor that has the potential to influence both NEET rates and SDG scores. The application of GMM aims to produce more reliable results by accounting for the possible endogenous relationship among these variables.

The initial phase of the study will involve a thorough review of the existing literature, followed by an assessment of the study's contribution to the academic field. The second phase will establish a theoretical framework to examine the relationship between the two concepts and provide an in-depth explanation of the NEET and SDG concepts. The third section will detail the study's model, methodology, and dataset. The fourth section will present and interpret the findings obtained from the model analysis. Finally, the fifth section will provide conclusions and policy recommendations for decision-makers.

2. LITERATURE

The Sustainable Development Goals (SDGs) aspire to establish a more equitable, prosperous and just future on a global scale. In achieving these goals, the situation of the youth population, especially the proportion of young people who are neither in education, employment nor vocational training (NEET), is a critical indicator. The NEET phenomenon is directly or indirectly associated with several SDGs, particularly SDG 8 (Decent Work and Economic Growth), SDG 4 (Quality Education) and SDG 10 (Reducing Inequalities). Recent academic studies have explored this complex relationship in different regional contexts and methodological approaches.

For instance, Cieslik et al. (2020) analyse the situation of youth NEET in Sub-Saharan Africa through the lens of the SDGs. The study's findings underscore the failure of Sustainable Development Goal 8.6 to achieve its 2020 target of substantially reducing the NEET youth population, and the deterioration of the regional situation over the past decade. The study undertakes a review of the extant literature on youth employment in Africa and analyses the reasons for the stagnation in progress. The study debunks five common misconceptions that have hindered understanding and progress on youth unemployment and underemployment. These misconceptions include the flawed nature of education systems, the notion that youth entrepreneurship is a panacea, the belief that the informal sector is part of the problem and not the solution, the idea that care work is tantamount to inertia, and the assertion that the agricultural sector has low job creation potential.

Castillo et al. (2020)'s study explores the relationship between the state of youth employment in Colombia and the Sustainable Development Goals (SDGs), specifically quality education (SDG 4), gender equality (SDG 5), and decent work (SDG 8). The study emphasizes that Colombia faces significant challenges in achieving the SDG targets due to issues such as high youth unemployment rates, widespread informality, and the marginalization of NEET (neither in education nor employment) youth. Youth unemployment in Colombia is observed to be nearly twice as high as adult unemployment, while the rates are even higher for women, both among adults and youth. Additionally, informality in the labor market exceeds 60%. The study aims to analyze the determinants of youth unemployment and its connection with the SDGs, utilizing Colombian household survey data alongside an age-period-cohort methodology and Probit/Logit Multinomial models. The findings reveal that although the younger generation is more educated, education alone does not guarantee access to quality employment, particularly for young women. The paucity of work experience and labor market segmentation have been identified as significant contributing factors to this issue.(Castillo et al., 2020).

More specifically, Fabris and Longobardi (2023), in their editorial article, draw attention to the study by Carmichael-Murphy et al. (2022) to underscore the link between Sustainable Development Goal 16 and education, with a focus on young people at risk of becoming NEET. Carmichael-Murphy et al.'s research demonstrates how education can foster social inclusion and contribute to more equitable and inclusive societies—achieved not only through academic success but also by supporting at-risk groups via school-based interventions. Furthermore, their findings highlight that youth "participation" in a program is not merely an individualistic condition; rather, it constitutes an "ecological construct" influenced by environmental factors. This insight strongly advocates for holistic approaches and safe environments that focus not only on individual youth but also on their surrounding context. The study underscores the critical role of education in addressing societal challenges, illustrating its potential to contribute to achieving SDG targets, particularly in the context of NEET youth and SDG 16 (Carmichael-Murphy et al., 2022).

In her study focusing on Africa, Ingutia (2022) highlights how resource deprivation prevents young people from realizing their potential. This situation creates barriers to accessing education, training, or the labor market, ultimately leading to an increase in NEET (Not in Education, Employment, or Training) rates. The study reveals that the Sustainable Development Goal (SDG) target 8.6, which aims to reduce NEET rates by 2020, has not been achieved. Ingutia identifies self-employment—common within youth employment—as a factor contributing to higher NEET rates, while gender equality, internet access, irrigation services, and institutional quality are found to be effective factors in reducing NEET rates.

Berigel et al. (2024) delve into NEET rates across 31 European countries during the period of 2005-2020, utilizing various machine learning algorithms and comparing eleven indicators reflecting socio-economic conditions and innovation levels of the countries. Their study goes beyond defining and

predicting NEET rates by examining their multifaceted connections with key Sustainable Development Goals (SDGs), such as SDG 4: Quality Education, SDG 10: Reduced Inequalities, and SDG 8: Decent Work and Economic Growth. The authors underline that the reduction of NEET rates (SDG 8.6) constitutes the only SDG target explicitly directed at youth. Furthermore, the study highlights the necessity of evidence-based approaches to understand the heterogeneous nature of NEET populations and measure the extent of progress toward achieving the SDGs. The research demonstrates the role of machine learning algorithms as modern and robust tools for deciphering the intricate network of factors influencing social and economic sustainability.

Although not directly addressing SDGs such as SDG 4: Quality Education, SDG 8: Decent Work and Economic Growth, or SDG 10: Reduced Inequalities, Erdoğan et al. (2021) emphasize that, despite European Union social policies, young people living in rural areas who are NEET experience greater marginalization and exclusion compared to their counterparts in urban areas. Analyzing the social interventions of the Youth Guarantee Program from a social innovation perspective, the study investigates the potential of transferring successful social innovations developed in urban areas to rural regions (urban-rural social innovation diffusion). This strategy seeks to create sustainable pathways for rural NEET youth in education, employment, and training. It further explores how such an approach can help address the challenges facing this population.

From a literature standpoint, this study evaluates the intricate and multidimensional relationship between NEET rates, economic growth, and SDGs through a holistic lens. The findings aim to guide policymakers and researchers in addressing this relationship from various perspectives and in formulating more effective policies to achieve sustainable development goals. Inspired by Okun's Law, the study explores the relationship between NEET rates, SDG scores, and economic growth rates, aiming to provide a clearer understanding of the interactions among these dimensions. This analysis seeks to contribute comprehensive and inclusive policy proposals by integrating macro-level economic growth dynamics with micro-level individual factors. The results are intended to assist policymakers in developing targeted and effective strategies to tackle the challenges faced by NEET youth and to achieve sustainable development goals. These recommendations adopt a holistic approach, encompassing not only economic growth but also social justice and environmental sustainability.

3. THEORETICAL FRAMEWORK

The NEET phenomenon is not simply a lack of participation in the labor market but a multidimensional concept reflecting an individual's exclusion from social and economic integration. Social exclusion theories emphasize the detachment of NEET youth from societal life, their restricted access to social capital, and the long-term consequences of these issues (Wilson, 2012; Önal ve Yenihan 2024). Human capital theory illustrates that the lack of education and skills leads to NEET status, which negatively impacts future productivity and economic growth (Zudina, 2022). Furthermore,

psychological factors and individual characteristics significantly contribute to the formation of NEET conditions. Lack of motivation, low self-esteem, and psychological challenges can prevent young individuals from participating in education and employment (Maguire, 2015,).

Despite varying definitions across countries and researchers, NEET youth generally refer to individuals aged 15–24 or 15–29 who are neither in education, employment, nor training (Eurostat, 2023; Köken and Koç, 2023, Çolak ve diğ. 2024). This issue carries consequences not only at the individual level but also at the national level. At the individual level, NEET status is associated with low income, social exclusion, poor living standards, and mental health issues (ILO, 2022; Çolak and Koç, 2023). At the national level, high NEET rates can result in the waste of potential human capital, a decline in economic efficiency, and increased social unrest (OECD, 2023a; Quintino et al., 2018). Thus, reducing NEET rates is a critical priority of sustainable development strategies.

The Sustainable Development Goals (SDGs) comprise a set of 17 global objectives adopted by the United Nations in 2015 and targeted for achievement by 2030 (United Nations, 2015). These goals prepare a holistic framework by connecting economic growth, social development, and environmental sustainability. Addressing a diverse range of issues, such as eradicating poverty, reducing inequality, and enhancing access to health and education, the SDGs depend on collaboration among stakeholders and active participation from youth. High NEET rates directly obstruct progress toward several SDG objectives. Theories of inequality underlying the SDGs discuss how social and economic disparities impede sustainable development. High NEET rates, which are particularly prevalent among disadvantaged groups, signal social injustice and unequal opportunities (Sen, 1999). By focusing on equitable access through education, employment, and social protection, SDGs aim to reduce NEET rates and promote social justice.

Economic growth is typically defined as an increase in a country's gross national income. Although it is often linked to improved living standards and increased overall welfare, it is widely recognized that economic growth alone does not suffice for sustainable development. Inequitable income distribution, environmental damage, and social disorders can overshadow the positive effects of economic growth (Kuznets, 1973). SDGs seek a balance by facilitating economic growth in harmony with social development and environmental responsibility (Kreinin and Aigner, 2022). Inclusive and high-quality economic growth contributes to decreasing NEET rates by creating more employment opportunities. Inclusive growth ensures that the economic benefits reach all layers of society, especially disadvantaged groups like NEET youth (Rauniyar and Kanbur, 2010). Enhancing access to education, healthcare, social protection, and employment opportunities while curbing discrimination and inequality are crucial for achieving this goal. Conversely, non-inclusive growth exacerbates inequality and keeps NEET rates elevated. Technological innovations, although accelerating progress, may also trigger job losses impacting NEET rates (Redmond and McFadden, 2023). Therefore, economic policies must adopt inclusive strategies featuring job creation, skills enhancement, and robust social security measures.

The relationship between NEET rates and economic growth is multifaceted. While rapid and inclusive economic growth can lower NEET rates by expanding job opportunities, the quality and distribution of growth significantly shape this connection. Unevenly distributed growth can render certain populations unemployed, keeping NEET rates high (Piketty, 2014; Çolak and Koç, 2024). Additionally, economic downturns accelerate increases in NEET rates. Periods following economic crises often lead to prolonged challenges for young individuals entering the labor market, coupled with precarious employment conditions and high youth unemployment rates. These factors elevate risks of poverty and social exclusion, discouraging youth participation in economic and social activities, thereby amplifying NEET numbers. Studies indicate that economic circumstances alone fail to explain NEET trends. Poverty and exclusion-related factors hold crucial importance (Ruesga-Benito et al., 2018; Aceleanu et al., 2015; Vancea and Utzet, 2018; De Souza et al., 2018). These studies underscore the urgency for implementing inclusive measures to curb rising NEET youth numbers and foster a balanced, sustainable society.

Significant correlations exist between SDGs and NEET rates. Objectives such as SDG 1 (No Poverty), SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), and SDG 10 (Reduced Inequalities) directly contribute to NEET reduction efforts. NEET individuals face risks of poverty due to their lack of income-generating activities, thereby reinforcing cycles of poverty across generations. Quality education prepares youth for seamless labor market integration. Gender inequality in education and employment disproportionately affects women, increasing NEET rates among female populations. Decent work and economic growth expand employment opportunities while reducing inequalities for marginalized demographics.

High NEET rates serve as critical barriers to SDG achievements. Promoting education and employment opportunities plays a central role in advancing SDG objectives. Meanwhile, improvements across SDG scores are expected to reduce NEET rates, enabling youth transition out of NEET categories. This research aims to assess the relationship between NEET rates and SDG scores in OECD countries, seeking to determine the direction and magnitude of this relationship. In this context, investments in human capital, social protection programs, and active labor market interventions emerge as essential measures to reduce NEET rates and advance sustainable development.

Inspired by Okun's Law, this study hypothesizes that adverse changes in SDG scores contribute to increased NEET rates. This notion reveals broader implications of elevated NEET rates, including individual-level inequalities and macro-scale economic and social losses that compromise sustainable development. This adaptation offers an alternative perspective, extending beyond unemployment alone to encapsulate deeper insights into youth social and economic integration.

In his 1962 paper, Arthur Okun analyzed post–World War II trends between unemployment and economic growth in the United States. Okun’s work established a cornerstone for subsequent studies

exploring this dynamic, forming what is now known as Okun's Law. This principle identifies the inverse cyclical interplay between economic growth and unemployment rates, as fluctuations in economic output influence employment practices. Firms adjust their workforce to align with production demands, creating a proportional interaction between growth and unemployment rates. This relationship is mathematically represented as follows (Ball et al., 2016):

$$u_t - u_t^* = \beta(y_t - y_t^*) + \varepsilon_t \quad (1)$$

u_t^* and y_t^* represent, respectively, the trend or potential value of unemployment and the logarithmic value of output. The error term accounts for factors such as fluctuations, changes in production, or variations in labor force participation rates, which are external to the model. The coefficient β indicates the magnitude of the relationship between these variables. Another version of Okun's equation examines the relationship between cyclical changes in unemployment and growth rates.

$$\Delta u_t = \alpha + \gamma \Delta y_t + \omega_t \quad (2)$$

Δ represents the difference in unemployment and growth figures.

Okun's Law can be calculated through the first equation, which is referred to as the 'gap' model, or through the second equation, known as the 'difference' model. In the first equation, Okun analyzed the relationship between these two variables by calculating the average or potential values of national income and unemployment, along with the deviation rates of real values from potential values. In the second equation, Okun addressed the relationship between changes in growth rates and changes in unemployment. In the model he calculated for the period 1948–1960, Okun concluded that every 1% growth above 4% resulted in a 0.7% decrease in unemployment (Arshad, 2007).

According to Okun's Law, each 1% increase in the growth rate above the trend growth rate reduces the unemployment rate by 0.5 points. In other words, a 1% increase in the unemployment rate leads to a 2% decline in real income, as a result of labor force non-participation in production (Mankiw, 2010: 290–291).

In this study, the relationship between unemployment rates and growth will be evaluated in terms of SDG scores, which are closely related to the concept of growth, beyond the relationship between NEET rates and growth rates. Accordingly, the model will be updated as follows:

$$\Delta n_t = \alpha + \beta_1 S_t + \beta_2 \Delta y_t + \varepsilon_t \quad (3)$$

Here, while *n* represents the NEET rate and *y* denotes the change in GDP compared to the previous year, the *S* parameter represents SDG scores. Similar to Okun's Law, a negative relationship between the parameters is expected. Accordingly, it is anticipated that growth and improvements in development scores would reduce the NEET rate, while, conversely, the presence of NEET individuals could negatively impact growth rates and even SDG scores.

The theoretical framework presented in this section elucidates the complex relationships between NEET rates, SDG scores, and economic growth. High NEET rates can lead to young individuals being unable to fully realize their potential, heightened social exclusion, and economic losses. While SDGs promote the empowerment of young individuals and their active participation in societal development, economic growth provides the resources necessary to achieve SDGs. However, it is imperative that these resources be directed towards policies targeting NEET youth and that growth remains inclusive. This theoretical framework supports the hypothesis that an increase in NEET rates has a negative impact on the SDG scores of OECD countries.

4. METHODOLOGY AND DATASET

This study aims to provide significant insights for policymakers by analyzing the relationship between NEET rates, economic growth, and SDGs (Sustainable Development Goals) in detail. The results are intended to support the development of policies aimed at reducing NEET rates and achieving the SDGs. To this end, panel data regression analysis and the Two-Stage Generalized Method of Moments (2SGMM) will be employed. GMM is a robust econometric method frequently used in panel data analysis to address endogeneity issues (Arellano and Bond, 1991). This method allows for obtaining more reliable results by controlling for potential endogenous relationships among independent variables.

The Arellano-Bond Difference GMM estimator is an econometric technique developed to address two key challenges in dynamic panel data models: eliminating unobserved and time-invariant individual-specific effects (fixed effects) and tackling endogeneity issues, particularly those arising from the use of lagged values of the dependent variable as an explanatory variable. By taking the first difference of the equation, the method removes fixed effects, while it also uses appropriate lagged-level values of the variables as instruments for endogenous variables in the differenced equation. This approach enables the estimation of consistent results, particularly in panels that consist of a short time period (T) and a large number of cross-sectional units (N).

GMM considers the satisfaction of specific moment conditions, i.e., $E[g(\theta)] = 0$, and the alignment of these conditions with the observed data. Here, $g(\theta)$ represents a function that defines the moment conditions dependent on the model parameters. GMM minimizes the following objective function to find the parameter values that best satisfy these moment conditions:

$$Q(\theta) = \frac{1}{N} \sum_{i=1}^{N} g_i\,(\theta)' W g_i(\theta) \quad (4)$$

Here, in Equation 4:

- N represents the total number of observations,,
- $g_i(\theta)$ denotes the moment condition for observation ii, and,
- W refers to the weighting matrix (Hansen, 1982).

This function is optimized to find the θ parameter estimate that best satisfies the moment conditions. However, the relationship between NEET rates and SKA scores examined in this study is addressed within the framework of a dynamic panel data model. Due to the nature of the model (Equation 3), the lagged value of the dependent variable, NEET rates $n_{(it-1)}$,can influence the current NEET rate due to persistence or inertia in the NEET status. This necessitates the inclusion of the lagged dependent variable $n_{(it-1)}$, as an explanatory variable in the model. Generally, the model specification is developed based on the selected variables and the relationships between these variables. Accordingly, the GMM model is defined as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \epsilon_{it} \tag{5}$$

Here, in Equation 5:

- Y_{it}: The dependent variable for country *i* at time period *t*,
- X_{it}: The independent variables for country *i* at time period *t*,
- $\beta_0 \; and \; \beta_1$: Model parameters.

The term ϵ_{it} represents the error in the model, which is required to be zero-mean and independently and identically distributed (i.i.d). Based on this, the model to be utilized in this study will be adapted from Equation (3), which is inspired by Okun's Law. This model simultaneously illustrates the growth rate as a control parameter and incorporates the lagged version of NEET rates as an explanatory parameter.

$$\Delta n_{it} = \beta_0 + \delta n_{(it-1)} + \beta_1 S_{it} + \beta_2 \Delta y_{it} + \mu_i + \epsilon_{it} \tag{6}$$

In the presence of the lagged dependent variable ($n_{(it-1)}$) and unobserved time-invariant country-specific effects (μ_i), obtaining consistent estimates using standard panel data estimators, such as Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE), becomes infeasible. At this stage, the Generalized Method of Moments (GMM) estimator starts with identifying the moment conditions. For the purposes of this study, the moment conditions will be based on minimizing the expected squared deviations between the observed values and the predicted values.

$$E = [g(Y_{it}, X_{it}, \beta)] = E[Y_{it} - \beta_0 - \beta_1 X_{it}] = 0 \tag{7}$$

To satisfy this moment condition, initial values for the parameters to be estimated were determined using one of the most commonly applied methods, the two-stage least squares (2SLS) method (Hayashi, 2000). Consequently, when the moment conditions are rearranged based on the dependent variable, NEET rates (n), the independent variable, SKA scores (S), and the control variable, growth rates (Y), from Equation (7), the new moment conditions take the form presented in Equation (8).

$$E = \left[Z_{it}\left(n_{it} - n_{(it-1)} - \beta_1 S_{it} - \beta_2 Y_{it}\right)\right] = 0 \quad (8)$$

The reliability of the GMM estimators used for model estimation has been analyzed using criteria such as asymptotic distribution and test statistics. Furthermore, the distribution of the obtained estimates has been examined and confidence intervals have been computed in line with the asymptotic properties offered by GMM. Testing the validity of the model and the instrumental variables used is of critical importance. The GMM method is evaluated with secondary tests such as Arellano-Bond and Sargan/Hansen tests to check the validity of the hypothesis.

The Arellano-Bond Autocorrelation Test examines the serial correlation of error terms $\Delta\varepsilon_{it}$ in the differenced equation. For the model to be properly specified, the original error terms ε_{it} must not exhibit serial correlation. In this context, first-order negative autocorrelation (AR(1)) in the differenced error terms is expected. This occurs because both $\Delta\varepsilon_{it}$ and $\Delta\varepsilon_{it-1}$ contain ε_{it-1}. However, there should be no second-order autocorrelation (AR(2)). Failure to reject the hypothesis (no second-order autocorrelation) in the AR(2) test serves as crucial evidence for the validity of the model specification and the instrumental variables.

The Sargan/Hansen Overidentification Restrictions Test evaluates the overall validity of the instrumental variables, specifically whether they are uncorrelated with the error term. The hypothesis assumes that the instrumental variables are valid (exogenous). Failure to reject this hypothesis (i.e., a high p-value) indicates that the instrument set is appropriate.

In light of these explanations, the GMM method has been chosen as an appropriate approach for estimating the parameters of the model, derived from Okun's law, that investigates the relationships between NEET, SDG, and growth rates for OECD countries. Considering the various types of the GMM methodology, the Arellano-Bond Difference GMM method will be applied to examine the dynamic relationship between the parameters while addressing potential endogeneity problems and controlling for unobserved country heterogeneity. This method aims to achieve more reliable and valid results by accounting for the endogeneity of the observed data.

Table 1. Selected OECD Countries

1	Australia	7	Germany	13	Mexico	19	Spain
2	Belgium	8	Greece	14	Netherlands	20	Sweden
3	Canada	9	Hungary	15	Norway	21	Türkiye
4	Czechia	10	Ireland	16	Poland	22	United Kingdom
5	Denmark	11	Italy	17	Portugal	23	United States
6	France	12	Luxembourg	18	Slovak Republic		

The data for the 23 OECD countries in the table covering the years 2000-2022 were taken from the OECD official statistics. The data set was constructed in the following manner: the data covering the most years was available for the 23 countries in the table out of 38 member countries. The NEET

rates, growth rates and SDG scores of the 23 countries were compiled as a time series in an Excel file. The flexibility offered by the GMM method provides significant advantages, particularly in dynamic panel data analyses, enhancing the accuracy of the estimates. During these analyses, the statistical software packages STATA 14.2 and Eviews 10.0 have been utilized.

5. ANALYSIS AND FINDINGS

As is well known, the Hausman test (1978) is an econometric method commonly used in panel data analysis to choose between the fixed effects model and the random effects model. The main purpose of the test is to determine which of these two models is more appropriate for a given scenario (Hausman, 1978). However, the endogeneity problem is a critical issue in econometric analyses as it can lead to biased and inconsistent estimates. Endogeneity implies that one of the independent variables is correlated with the error term (Chang-Jin, 2010; Baltagi, 2014). The Hausman test (1978) is utilized to address and control this issue. Identifying the endogeneity problem also helps establish the most appropriate panel data estimator for the model.

As detailed in the methodology section, the Generalized Method of Moments (GMM) is one of the most effective methods for estimating models with endogenous variables. For this reason, GMM has been selected as the appropriate methodology for this study, particularly as it considers NEET rates, which might exhibit autocorrelation over time. Before implementing GMM, the endogeneity problem in the variables to be used in the model will be tested using the Hausman test (1978). At this stage, the hypotheses of the Hausman test are defined as follows:

H_0: There is no endogeneity.

H_1: There is endogeneity.

If the p-value is less than 0.05 ($p<0.05$), the presence of an endogeneity problem is confirmed.

Table 2. Hausman Test Results

	Coefficient			
	(b)	(B)	(b-B)	sqrt(diag(V-b-B)
V_B	FE	RE	Difference	S.E.
Y (GrowthR)	-0,10303020	-0,1029867	-0,0000436	0,0016269
S (SDG)	-0,23009108	-0,2640452	0,0331343	0,0136763
	Chi2(2)=	6,30		
	Prob>Chi2=	0,0429		

Table 2 shows the results of the Hausman test (1978) conducted for the variables of the model. As can be understood from the table, the rejection of the hypothesis (H0) due to the p-value being less than 0.05 indicates the presence of an endogeneity problem. Therefore, it demonstrates that the two-

stage GMM method, which was selected for the analysis, is a more appropriate choice in this case. Panel data estimators adapted with the two-stage GMM method, one of the solutions to the endogeneity problem, are shown in Table 3 below.

Table 3. Two-Stage Generalised Method of Moments Results

NEET Rate	Coef.	Std.Err.	Z	P> |z|	[95% Conf.	Interval]
NEET Rate L1	0,8891547	0,0152826	58,18	0,000	0,8592013	0,9191081
Growth Rate	-0,128782	0,0089068	-14,46	0,000	-0,1462392	-0,1113253
SDG	-0,1562905	0,0282009	-5,54	0,000	-0,2115633	-0,1010178
_cons	13,75162	2,334313	5,89	0,000	9,176452	18,32679

Wald Chi2(3) = 7902,46
Prob > Chi2 = 0,0000

The general statistics of the Two-Step GMM model calculated in Table 3 indicate that the values are quite robust. The Wald Chi^2 value is as high as 7902.46, and the p-value is calculated as 0.0000. These values demonstrate that the independent variables used in the model are statistically highly significant in explaining the NEET rate. Additionally, these statistical results indicate that the model provides a reliable prediction.

Table 4. Arellano- Bond and Sargan Tests Results

Arellano-Bond Test			Sargan Test	
Order	Z	Prob > z		
1	-3,8002	0,0001	Chi2(61)	21,88988
2	0,12086	0,9038	Prob > Chi2	1.000
H_0: There is no autocorrelation			H_0: Over-Restrictive definitions are valid	

The statistical validity of the values attained by the model and parameters in Table 3 has been verified using the Arellano-Bond test and Sargan test displayed in Table 4. According to the results of the Arellano-Bond test, the p-value for first-order autocorrelation is less than 0.05, leading to the rejection of H0, which indicates the presence of first-order autocorrelation in the model—a finding typically expected in panel data analysis. However, for the second-order autocorrelation test, the p-value exceeds 0.05, implying the acceptance of H0 and the conclusion that there is no second-order autocorrelation. This result further demonstrates that the model has been properly estimated using instrumental variables. The Sargan test confirms that the instrumental variables are correctly selected and valid, while also ensuring that they do not cause over-identifying restrictions (Prob > Chi^2 = 1.000). When these test results are evaluated together, it can be concluded that the model estimations are generally statistically valid.

Based on these statistical data and the results of control tests, the model can be expressed as Regression Equation (8) with the estimated parameter values:

$$\Delta n_{it} = 13{,}75162 + 0{,}8891547 n_{(it-1)} - 0{,}1562905 S_{it} - 0{,}128782 y_{it} + \epsilon_{it} \quad (9)$$

When the variable economic growth is included in the model as a control variable, its effect on the NEET rate is observed to be negative (-0.1287). Similarly, in the study conducted by Çolak and Koç (2024), the relationship between growth rates and NEET rates was also calculated to be negative. According to their study, declines in economic growth lead to increases in NEET rates, whereas positive changes in economic growth result in decreases in NEET rates. Similarly, the findings in Table 3 indicate that an increase in the economic growth rate corresponds to a decline in the NEET rate. This demonstrates the critical role of economic development in employing the young population and preventing them from disengaging from education.

Specifically for developing countries, this relationship can be even more strategic. Economic growth policies can be considered as a significant tool for reducing NEET rates; however, it is important to remember that growth must be inclusive, inequality-reducing, and sustainable. In an environment where fertility rates are declining and aging rates are increasing, the withdrawal of elderly individuals from employment leads to increased fragility in labor markets (Ertürk and Koç, 2023). Due to the rise in aging rates, the decrease in participation in employment and production activities affects individual welfare levels both at the macro and micro levels, making the greater involvement of the young population in economic life crucial (Ertürk and Koç, 2025).

The central question of the study is whether the impact of changes in SDG indicators on NEET rates is expected to be similar to the influence of the economic growth variable as a control variable. The results in Table 3 support the accuracy of this prediction within the scope of the model. This is because the coefficient of the sustainable development indicator (SDG) is -0.1562, revealing that improvements in this indicator have a significant role in reducing NEET rates. Sustainable development indicators are directly connected to enhancements in areas such as access to education, gender equality, quality job opportunities, and social inclusion. The negative impact of SDG on the NEET rate emphasizes that greater focus should be placed on sustainable development in future policy designs.

The value of the constant term in the panel, 13.7516, represents the predicted NEET rate of the model when the effects of the independent variables are zero (i.e., no changes in economic growth or SDG). The high level of this rate indicates that serious efforts are required to combat the NEET issue, regardless of the factors explained by the model. The inertia from past periods has a substantial influence on current NEET rates. This situation also serves as an indicator of how NEET has accumulated over the years, becoming a structural problem. While this study links NEET rates to SDG and economic growth, the high value of the constant term emphasizes the importance of structural reforms in reducing NEET rates.

The analysis points to three complementary strategies for reducing the NEET rate: Firstly, taking into account the persistence of NEET rates from previous periods, establishing long-term individual and

societal support mechanisms for the youth emerges as a strategic concern for policymakers. This scope includes the effective implementation of career guidance, programs promoting labor market participation, and social welfare policies.

Secondly, economic growth policies should not merely focus on increasing youth employment but also on enabling young people to benefit more from educational and skill development opportunities, thus playing a role in reducing NEET rates. During this process, the congruence with SDG, in terms of environmental sustainability and social equality principles, must not be overlooked.

Finally, focusing on sustainable development goals, from accessibility in education and gender equality to creating quality job opportunities and projects for social inclusion, could significantly prevent inclusion of youth in the NEET group. When these three mechanisms are combined, they provide a comprehensive policy framework for both individual welfare and the long-term development of society.

The successful implementation of these three policies is evident in Scandinavian countries, where high SDG scores and a stable growth trend present a noticeable impact on NEET youth, resulting in NEET rates below the EU average. SDG-compatible policies in these countries, addressing areas such as access to education, gender equality, active labor market policies, and the creation of quality job opportunities, demonstrate a reducing effect on NEET rates. Moreover, when compared to Mediterranean countries within the EU, Scandinavian countries are observed to be in a much more advantageous position (Bostancı et al., 2024).

6. CONCLUSION

This study examines the relationships among NEET rates, economic growth, and Sustainable Development Goals (SDG) indicators in OECD countries using the Generalized Method of Moments (GMM) based on dynamic panel data analysis. The study highlights the importance of integrating young individuals into social and economic life. The findings reveal that both economic growth and improvements in SDG indicators significantly lower NEET rates. This indicates that involving the young population in the labor market and social life should be considered a fundamental priority within the perspective of sustainable development. The model strongly confirms the persistence of past NEET rates, determining that NEET status needs to be addressed as a structural issue. Particularly, it demonstrates that economic growth has not only an employment-generating effect but also a long-term impact on supporting the social and economic engagement of youth. This underscores the importance of sustainable growth policies even more clearly.

According to the findings, economic growth plays a critical role in reducing NEET rates. However, growth policies must not only produce economic gains but also be implemented in alignment with the principles of inclusiveness, social equality, and environmental sustainability. Furthermore, improvements in SDG indicators have been shown to be more effective in reducing NEET rates. This

confirms that development indicators such as equal opportunities in education, gender equality, quality employment, and social inclusion are key tools in addressing the NEET issue. In cases where sustainable development goals are not supported by inclusive policies, limited progress in reducing NEET rates is observed. These findings demonstrate that policymakers need to adopt SDG targets and develop concrete strategies to achieve them.

At this point, three fundamental policy suggestions can be presented to policymakers to reduce NEET rates: The first policy proposal involves structural reforms designed for youth. Long-term and structural reforms are needed to enable youth integration into education, employment, and social life. Individual support mechanisms such as job placement programs, career guidance, entrepreneurship incentives, and social aid should be strengthened. Supporting comprehensive vocational training projects aimed at the labor market will be effective in reducing NEET rates.

The second policy proposal emphasizes the need for inclusive and sustainable growth. Economic growth should be planned and implemented to enhance the integration of youth into education and the labor market. Inclusive economic growth policies that increase youth access to education and job opportunities are key to lowering NEET rates. Economic development should aim not only to provide welfare but also to promote social equality and environmental sustainability.

The third policy proposal underlines the necessity of integrated policies toward SDG targets. Policies based on priorities such as quality education, gender equality, social inclusion, and employment within the framework of Sustainable Development Goals should be developed and continuously monitored. Implementing policies that ensure equal access to education, increase decent job opportunities, and strengthen social inclusion within the SDG framework will not only reduce NEET rates but also support social justice and economic stability.

In conclusion, reducing NEET rates should be addressed not only as an economic concern but also as a strategic priority in terms of social inclusion and development. In this context, policymakers need to design long-term and inclusive policies aimed at resolving the NEET issue in line with sustainable development goals. These approaches should aim to enhance the welfare of young individuals while ensuring the sustainable long-term social and economic development of communities. By doing so, it will be possible to build a development process that unleashes the potential of young people and increases social welfare. Therefore, integrating NEET reduction policies into global strategies carries significant importance for the long-term welfare of individuals and the sustainability of societies.

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