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Education and Employment: Evidence from Selected OECD Countries

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Abstract

The objective of the paper is to investigate the relationship between education and employment level in 27 member countries of OECD over the period 1998–2019. To achieve this, the paper first analyses the effect of the number of graduates from upper secondary, post-secondary and tertiary education programmes. Additionally, the paper constructs an education index which covers graduates from upper secondary, post-secondary and tertiary education programmes. After calculating distribution of graduates using the standard deviation method, the paper employs two-step system GMM developed by Arellano and Bover (1995) and Blundell and Bond (1998). The findings show that graduates from upper secondary, post-secondary and tertiary education, as well as the distribution of graduates, have a positive effect on employment, respectively. It is expected that policymakers consider the effect of graduates from different education levels on employment to design substantial education and employment strategies.

Keywords: Education level, distribution, employment, system GMM

JEL Codes: I23, I26, I28

1. Introduction

The concept of human capital has been the subject of debate in both theoretical and empirical literature for many years. It is accepted that human capital plays an important role in long-term sustainable growth, especially thanks to advances in information and technology (McNeil and Slim, 2012). Accordingly, indicators are necessary to show the effect of human capital on economic activities. It is seen that indicators regarding education and health are commonly used

as determinants of human capital. On the other hand, it can be stated that there is no standard method for measurement of human capital in the literature. Thus, various numeric methods are proposed to estimate the effect of human capital on economic activities. While most studies have adopted basic methods such as education expenditure, schooling years and PISA test scores, it is seen that there are a scarcity of studies based on dispersion methods. Additionally, most of these studies concentrate on the human capital-growth nexus. Although economic growth is one of the main indicators showing the economic performance of countries, employment is also a major determinant of the economic performance of a country. Education determines a substantial part of employment. The numbers of skilled persons have increased, especially with expanding education opportunities; these developments also simplify finding a job for people with high qualifications. Although people with the lowest education qualifications also have job opportunities, they obtain lower earnings and the possibility of being unemployed is higher than for those with high qualifications (OECD, 2021). When considering data for OECD countries, the employment rate for people with upper and post-secondary education was 75% in 2020 while it was 58% for people without upper secondary education. The rate for the tertiary education was approximately 10% higher than for people with upper and post-secondary education levels (OECD, 2021). Accordingly, it can be said that upper secondary education is the final stage of secondary education in most OECD countries and prepares students for further levels of education and the labour market. Post-secondary education provides deeper knowledge, skills and competencies than upper secondary education. Thus, upper secondary and post-secondary education allows students to enter the labour market earlier (OECD, 2021). Considering that labour markets are based on increasing knowledge base, fast-changing labour market conditions require well-educated and highly adaptable individuals. These developments are therefore increasing the importance of tertiary education for the labour market. There are a few studies which investigate the contribution of human capital to aggregate employment level (Bloch and Smith, 1977; Simon, 1998; Partridge and Rickman, 1995; Nistor, 2009; Winters, 2012; Khan and Chaudhry, 2019). Almost all of these studies have been applied to United States (US) metropolitan areas and adults with high school degrees or better have been used as determinants of human capital. However, the labour supply and demand mismatch is one of the most important problems of the labour market. Thus, unemployment problems may be seen in a country where the equilibrium between education and employment cannot occur effectively. It is also worth noting that unemployment may be a chronic problem on labour markets where graduates from different levels of education are not evenly distributed.

In this context, the paper conducts an analysis for OECD countries to better understand and develop their social and economic policy in the education-employment nexus. Since data on numbers of graduates are limited, the analysis is only applied to 27 member countries

of the OECD. Accordingly, this paper first analyses the effect of primary and lower secondary education on employment to show whether people who are well-educated make a positive contribution to employment. Due to lack of data regarding the numbers of graduates from primary and lower secondary education, this paper uses enrolment data. After showing the contribution of upper secondary, post-secondary and tertiary levels of education to employment individually, the paper investigates the distribution of graduates including upper secondary, post-secondary and tertiary education on employment. The study contributes to existing literature on the relationship between different education levels and employment. Accordingly, the novelty of this paper consists in considering the impact of dispersion of graduates from different education levels on employment for OECD countries. Thus, this paper uses upper secondary, post-secondary and tertiary education as indicators of human capital. In most of studies, the human capital index is obtained by weighting basic dispersion methods such as standard deviation and variance with schooling years. Given the lack of schooling data for post-secondary education, this paper constructs an education index including graduates from upper secondary, post-secondary and tertiary education using a basic standard deviation method. To show the relationship between distribution of graduates and employment, this paper applies two-step system GMM developed by Arellano and Bover (1995) and Blundell and Bond (1998), which is the most popular method for estimating economic growth. Based on the results, it can be asserted that education and employment policies are the most important factors that affect and are affected by each other. Thus, the contribution of a pool of skilled people to the labour market can provide insight for the government about the design of education and employment policies.

The rest of the paper is organized as follows. Section 2 gives information on the literature. Section 3 presents the data. Section 4 provides the estimation methods and methodology. Section 5 discusses the empirical results. Section 6 summarizes the findings of the study.

2. Literature

In the empirical literature, education has long been regarded as a key driver of economic development, although various indicators such as education and health are commonly used as determinants of human capital (Hanushek and Wößmann, 2010). However, there is no consensus on which education indicator should be used. For instance, various international test scores are used by Hanushek and Kimko (2000), Fertig and Wright (2004), Chen and Luoh (2010), Hanushek and Wößmann (2013) and Rossi and Phillips (2019); numbers of graduates from higher and college education by Murphy et al. (1991), Tiago (2007), Tsai (2010) and Serifoglu and Guney (2021); average years of schooling by Islam (1995), Maasoumi et al. (2007), Henderson (2010) and Sunde and Vischer (2015); R&D expenditures by Bayraktar

and Yetkiner (2014) and school enrolment rate by Barro (1991), Elias and Fernandez (2000) and Sala-i-Martin et al. (2004); distribution of different education levels and construction of an index using dispersion methods such as standard deviation and variance by Ram (1984, 1990), Marin and Psacharopoulos (1976), Winegarden (1979) and Park (2004).

Considering literature on the effect of education on employment, some studies find a positive correlation between education and employment (Tarvid, 2011; Riddell and Song, 2011; Lavrinovicha et al., 2014; Klein, 2015; Hunady and Pisar, 2016), while others report that there is no evidence regarding the effect of education on employment (Kostova and Kotevska, 2011; Rajmohan and Abeysekera, 2016; Raies and Mimoun, 2016). Additionally, the paper classifies studies in the literature that investigate the impact of human capital on employment based on aggregate employment level. Bloch and Smith (1977) showed that human capital contributes positively to labour market outputs for data based on May 1973 current population survey tape. To conduct their analysis, they used years of formal education and labour market experience as determinants of human capital. Partridge and Rickman (1997) analysed the effect of human capital on unemployment rate from 1972 to 1991 for a total of 960 observations in US states using the OLS estimation method. In their analysis using college graduates, they found that there is a negative correlation between college graduates and unemployment for some regions but not for other regions. Simon (1998) conducted an analysis to show the relationship between human capital and employment over the period 1940–1986 for all US metropolitan areas. To achieve this, they used the percentage of the population with a high school degree or better. Their results suggested that employment level is strongly related to human capital. Nistor (2009) evaluated the effect of human capital expenditures on education on regional unemployment rates in the US. Using the fixed effect estimation method for 1990 and 2000, their findings show that negative correlation exists between unemployment and human capital investment. Winters (2012) examined the contribution of human capital measured as the share of age of adults with a college degree in employment for 283 US metropolitan areas in 1980 and 2000. Employing panel data estimation techniques based on OLS and IV, he found that human capital has a positive effect on employment for both women and men. Khan and Chaudhry (2019) investigated the role of human capital on employment and GDP through the fixed effect and random effect methods for developing countries over the period 1996–2018. Using life expectancy and education expenditure as human capital indicators, they found that human capital is an engine of growth and employment.

3. Data

The dataset consists of 27 member countries of the OECD[1] over the period 1998–2019. Data availability determines the number of countries and the period.

Employment is one of the most important indicators showing a country's economic per- formance. Additionally, education has a substantial effect on employment, especially vocational and tertiary education (Eckardt, 2012). In this context, the paper first analyses the impact of upper secondary, post-secondary and tertiary education on employment after showing the effect of primary and lower secondary education on employment. Then, the paper constructs an education index to show whether graduates from different fields (including upper secondary, post-secondary and tertiary education) are distributed equally and the effect of this distribution on employment. Based on the theoretical framework regarding dispersion methods, it is generally accepted that there are four main dispersion methods: range, quartile, mean and standard deviation. Standard deviation is the most common method used for variation of characteristics in populations (Svetunkov and Chanysheva, 2017). In the human capital literature, there are various indices that correlate with schooling years and basic dispersion methods such as standard deviation and variance (Park, 2004). However, the basic standard deviation method is chosen in this paper since there is a lack of necessary data on schooling years for each education level in the model. The formula used is given as:

$$E_i = \frac{Number\ of\ graduates_i}{Labour\ force\left(15-64\ years\ old\right)_i} \times 100 \tag{1}$$

where E_i is the percentage of numbers of graduates in the labour force (15–64 years old). The total number of graduates is the sum of graduates from upper secondary, post-secondary and tertiary education. Number of graduates refers to numbers corresponding to each education level (upper secondary, post-secondary and tertiary). Then, the paper constructs an education index using the numbers of graduates from upper secondary, post-secondary and tertiary education through the basic standard deviation method.

In the literature, in addition to the employment and economic growth nexus, there exist studies which investigate the relationship between unemployment and economic growth as well. Okun's law is the most popular theory based on the relationship between unemployment and economic growth. Okun (1962) proposed that with every 1% increase in the unemployment rate,

1 Australia, Austria, Belgium Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United States

a country's GDP will be roughly an additional 2% lower than its potential GDP. Accordingly, GDP per capita is included in the model as an independent variable. On the other hand, there is a large body of literature investigating the effect of trade freedom on employment. Based on these studies, it is generally seen that trade freedom has either a negative or a positive effect on employment (Jansen and Lee, 2007). It is also possible to assert that R&D expenditure enhances productivity and competition as well as job creation capacity (Bogliacino, 2011). Thus, in addition to GDP per capita, the paper uses R&D investment and trade freedom as independent variables in the model.

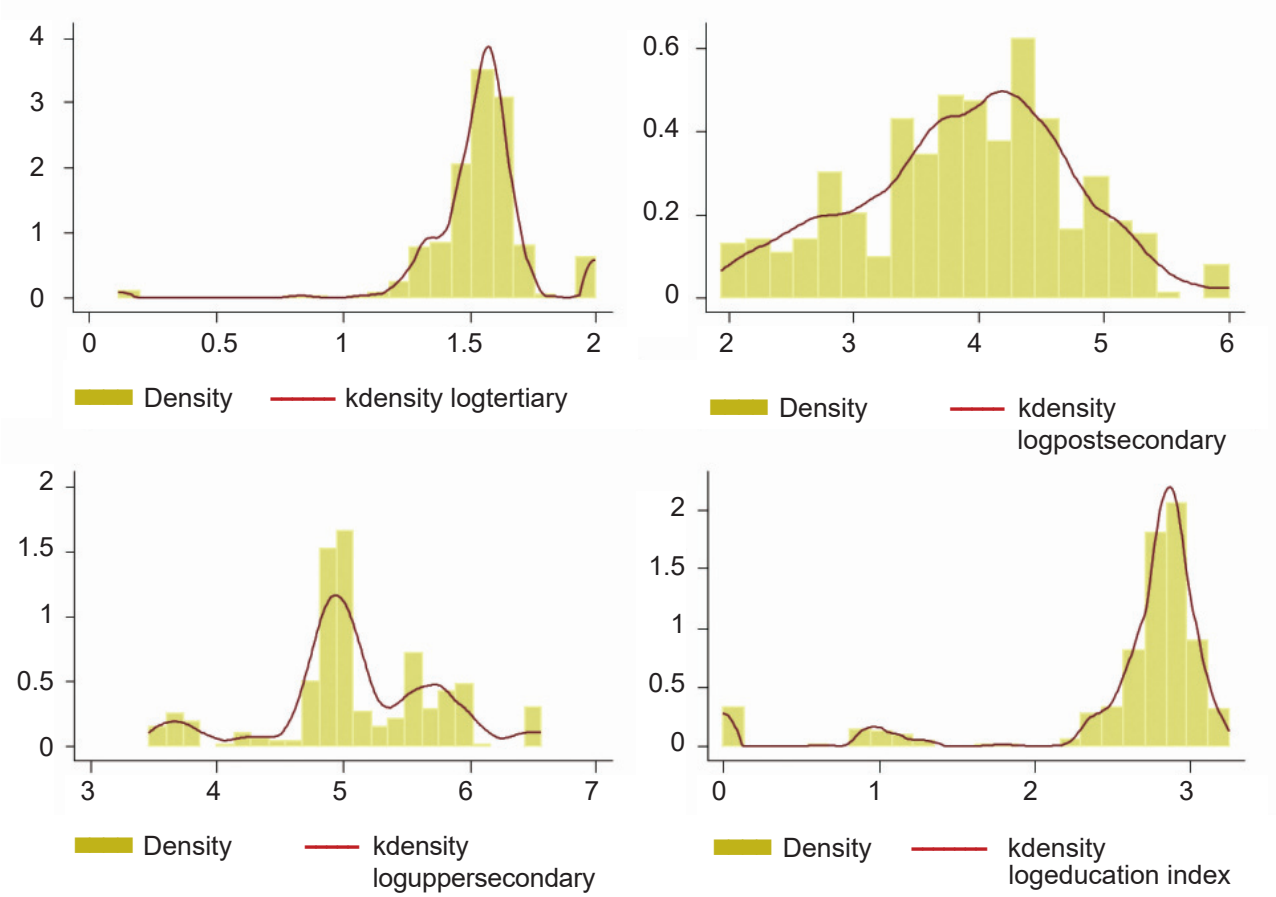
In a country, property rights play an important role in sustainable economic activities through stability and development of institutions. The new institutional approach highlights that property rights are centred on development, whereas, according to the traditional approach, economic growth is based on savings and capital accumulation in a country with perfect property rights (Besley and Ghatak, 2010). Property rights are also added to the model in order to control the robustness of the results.

The paper lacks data on the numbers of graduates from primary and lower secondary education. Because of the data shortage, the numbers of students who enrol in primary and lower secondary education are used. Data on employment and education variables in this paper are obtained from OECD statistics. The GDP per capita and R&D investment are from the World Bank (WB). Trade freedom and property rights are obtained from the Heritage Foundation. Table A1 in the Appendix gives detailed information on data and sources.

Figure 1 represents a histogram and kernel density for tertiary, post-secondary, upper secondary education and the education index, respectively, which is measured as logarithm of each variable. Kernel density shows how data are distributed over time spans and helps determine the distribution shape. The distribution for tertiary education level is left-skewed about the mean of 537 graduates. Similar to tertiary education, the education index is also left-skewed about the mean of 594 graduates. Post-secondary and upper secondary have approximately normal distribution about the means of 536 and 479, respectively.

Table A2 in the Appendix shows the descriptive statistics covering the period 1998–2019 for selected OECD countries. The average GDP per capita is 3.654% while the maximum and minimum values are 5.197% and 2.170%, respectively. The average value for primary and lower secondary education is 5.660% and 5.439%, respectively. In terms of other education variables (upper secondary, post-secondary and tertiary education), the coefficient ranges from 3.896% to 5.109%. The average education index rate is 2.590% and ranges from 0.000% to 3.251%. While the average employment rate is 3.654%, the average rates for R&D investment, trade freedom and property rights are 3.030%, 1.921% and 1.892%, respectively.

Figure 1: Distribution of tertiary, post-secondary, upper secondary education and education index



Source: author's calculation

4. Estimation Model and Methodology

In this paper, to investigate the effect of education on employment, the paper constructs two equations. In the first equation, the paper tests the contribution of primary, lower secondary, upper secondary, post-secondary and tertiary education to employment. In the second equation, to show whether graduates from upper secondary, post-secondary and tertiary education have an equal distribution, the paper builds an index covering these graduates. The regression model is as below:

$$logemployment_{i,t} = \beta_0 + \beta_1 logemployment_{i,t-1} + \beta_2 logeducationlevel_{i,t-j} + \\ + \beta_3 logGDPpercapita_{i,t} + \beta_4 logR\,\&\,Dinvestment_{i,t} + \beta_5 logtradefreedom_{i,t} + \delta_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$logemployment_{i,t} = \beta_0 + \beta_1 logemployment_{i,t-1} + \beta_2 logeducationindex_{i,t-j} + \\ + \beta_3 logGDPpercapita_{i,t} + \beta_4 logR\,\&\,Dinvestment_{i,t} + \beta_5 logtradefreedom_{i,t} + \delta_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $logemployment_{i,t}$ is the employment level of the country i and the time t; $logemployment_{i,t-1}$ shows the log of lagged employment level of the country. In terms of education variables, $logeducationlevel_{i,t-j}$ (log of each education variable with a lagged j period) refers to primary, lower secondary, upper secondary, post-secondary and tertiary education, respectively, and $logeducationindex_{i,t-j}$ (log of dispersion of education level with a lagged j period) covers graduates from upper secondary, post-secondary and tertiary education. In addition, other variables in the model are $logGDPpercapita_{i,t}$ (log of GDP per capita), $logR\&Dinvestment_{i,t}$ (log of R&D investment) and $logtradefreedom_{i,t}$ (log of trade freedom).To check whether the results are robust, the paper also includes a log of property rights instead of trade freedom. Moreover, $\delta_{i,t}$ is the time-invariant individual effect and $\varepsilon_{i,t}$ is the error term. Given that the effect of graduates on employment is expected to take time, the paper explores the effect of dispersion of graduates for a lagged 2 level (Tsai, 2010).

The panel GMM estimator discussed by Arellano and Bond (1991) is the most common method to estimate dynamic models with unobserved heterogeneity and predetermined regressors (Benito et al., 2018). The general dynamic panel data equation is as follows (Roodman, 2009):

$$y_{i,t} = \alpha y_{i,t-1} + x'_{i,t}\beta + \varepsilon_{i,t} \quad (4)$$

$$\text{where } \varepsilon_{i,t} = \mu_i + v_{it} \quad (5)$$

In Equation (4), the dependent variable is $y_{i,t}$, the independent variable is $x'_{i,t}$, $\varepsilon_{i,t}$ is the error term that sums the unobserved time-invariant heterogeneity μ_i and the idiosyncratic error term $v_{i,t}$. In models where a lagged dependent variable is involved as the explanatory variable, the endogeneity problem appears in the relationship between the error term and the lagged dependent variable. Anderson and Hsiao (1982) took the first difference of a dynamic panel data model to eliminate the endogeneity problem. Then, the equation can be rewritten as:

$$\Delta y_{i,t} = (\alpha - 1) y_{i,t-1} + x'_{i,t}\beta + \varepsilon_{i,t} \quad (6)$$

However, the estimator of Anderson and Hsiao (1982) produces inefficient results if there are weak correlations between the regressors and the instruments when the autoregressive coefficient is moderately large (Arellano, 1989). Arellano and Bond (1991) transformed the first-difference model by using an instrumental variable matrix, which removes the endogeneity

problem and the individual effect. On the other hand, the panel data model of Arellano and Bond (1991) is inefficient as it has cross sections higher than the time dimension. Arellano and Bover (1995) and Blundell and Bond (1998) developed the system GMM estimator. This estimator consists of both first-difference and level variables. Also, contrary to ordinary least square (OLS) methods, within-groups and fixed-effect estimators, system GMM mitigates potential endogeneity problems, controls for heterogeneity across countries and removes unobserved firm-specific fixed effects. Additionally, it allows the use of different instruments with different lag structures for both levels and first-difference equations (Blundell and Bond, 1998, 2000; Bond, 2002). Considering all these issues, the paper employs system GMM estimation developed by Blundell and Bond (1998). The method is applied as one-step and two-step. Although one-step and two-step GMM estimators are asymptotically normal according to conventional properties, two-step GMM is better than one-step GMM and has lower bias and standard errors (Windmeijer, 2005). Thus, this paper applies the two-step system GMM method. For consistency of the GMM estimator, there are two tests which provide further support to the model. First, the Arellano-Bond (AR) test is for serial correlation, which examines whether there is a serial correlation between error terms. This test is conducted for first-difference errors, and second-order correlation, AR(2), is checked to ascertain serial correlation. Thus, it is expected that there is no second-order serial correlation in the model (Arellano and Bond, 1991). The second test is for overidentifying restrictions developed by Hansen (1982). The test analyses the validity of the instruments. In terms of robustness of estimation results, a value of 0.25 or higher is recommended by Roodman (2009) for Hansen's J-statistic value.

5. Empirical Results

Table A3 in the Appendix provides unit root test results. The paper performs a Fisher ADF panel unit root test developed by Maddala and Wu (1999) and Choi (2001) to detect whether the series are stationary. According to the Fisher ADF test statistics, while the null hypothesis is that all series are non-stationary, at least one series in the panel is stationary under the alternative hypothesis. According to the unit root test results, the paper can reject the null hypothesis and it can be observed that all the variables in the model are stationary at level and first difference.

Tables 4 and 5 show empirical test results for selected OECD countries between 1998 and 2019. The paper employs two-step system GMM to show a long-run relationship between employment and different education levels. In the model, the paper uses the AR(2) test for serial correlation and Hansen's J-statistic to test overidentifying restrictions. The baseline model consists of the first differences of the logs of employment level, GDP per capita, R&D

investment, trade freedom and education variables. To show the robustness of the test results, property rights are also included in the model instead of trade freedom. Table 4 presents the test results including trade freedom while the results in Table 5 report findings for property rights.

According to the results in Tables 4 and 5, the coefficient of the first difference of the log of employment level is positive and significant in each case. The paper also finds that GDP per capita has a positive impact on employment level for all cases and the expected sign. When looking at R&D investment, it is seen that it positively affects employment in all the models (the coefficients of R&D investment are 0.002 and 0.003 in the case of property rights and trade freedom, respectively). In terms of the freedom variables, there is a positive and significant correlation between property rights and employment while trade freedom has a negative effect on employment for all estimations.

Columns 1 and 2 in Table 4, and 7 and 8 in Table 5 present estimation results for primary and lower secondary education. In the model including trade freedom shown in Table 4, while primary education has an insignificant effect on employment, lower secondary education affects employment negatively (The coefficient of lower secondary education is −0.001). When adding the property rights to the model excluding trade freedom as seen in Table 5, the paper finds that both education levels affect employment negatively (the coefficients of primary and lower secondary education are −0.0005 and −0.001, respectively). The paper also notes that the findings for lower secondary education remain the same in the models that include trade freedom and property rights, respectively. OECD (2021) reports that, in 2020, the youth unemployment rate for people without upper secondary education was almost twice compared to people who completed at least upper secondary education and those with at least upper secondary education have more advantage on the labour market. So, findings show that primary and lower secondary education do not have an important role in employment.

Test results for upper secondary, post-secondary and tertiary education are provided in columns 3–5 in Table 4, and 9–10 in Table 5. Based on the results, it is seen that having at least an upper secondary degree has a positive and statistically significant effect on employment.

Table 4: Test results including trade freedom

	(1)	(2)	(3)	(4)	(5)	(6)
L1.logemployment	0.977*** (0.003)	0.977*** (0.003)	0.966*** (0.008)	0.978*** (0.003)	0.963*** (0.009)	0.975*** (0.004)
logGDPpercapita	0.040*** (0.003)	0.044*** (0.003)	0.025*** (0.002)	0.034*** (0.005)	0.070*** (0.006)	0.041*** (0.004)
L2.logprimary	−0.0003 (0.000)					
L2.loglowersecondary		−0.001** (0.000)				
L2.loguppersecondary			0.017** (0.008)			
L2.logpostsecondary				0.006** (0.002)		
L2.logtertiary					0.010** 0.004	
L2.logeducationindex						0.002** (0.001)
logR&D	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003** (0.000)
Logtradefreedom	−0.174** (0.034)	−0.183*** (0.033)	−0.075*** (0.012)	−0.176*** (0.037)	−0.408*** (0.056)	−0.208*** (0.046)
Constant	0.238*** (0.058)	0.243*** (0.055)	0.068*** (0.032)	0.240*** (0.056)	0.550*** (0.096)	0.299** (0.079)
AR(1)	0.018	0.020	0.057	0.026	0.057	0.012
AR(2)	0.290	0.291	0.214	0.488	0.410	0.447
Hansen	0.414	0.410	0.433	0.349	0.258	0.427
F-statistic	39,356.75***	24,932.55***	79,282.71***	92,913.78***	81,803.80***	93,807.18***
Number of countries	27	27	27	27	27	27
Number of instruments	26	26	26	26	26	26

Notes: standard errors are in parentheses, *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively

Source: author's calculations

Table 5: Test results including property rights

	(7)	(8)	(9)	(10)	(11)	(12)
L1.logemployment	0.985*** (0.002)	0.985*** (0.002)	0.972*** (0.007)	0.984*** (0.002)	0.980*** (0.004)	0.984*** (0.003)
logGDPpercapita	0.009*** (0.002)	0.010*** (0.002)	0.010*** (0.002)	0.006* (0.003)	0.010*** (0.002)	0.008** (0.002)
L2.logprimary	−0.0005** (0.000)					
L2.loglower-secondary		−0.001** (0.000)				
L2.logupper-secondary			0.015** (0.007)			
L2.logpostsecondary				0.004** (0.001)		
L2.logtertiary					0.003** (0.002)	
L2.logeducation-index						0.001*** (0.000)
logR&D	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Logpropertyrights	0.063*** (0.008)	0.061*** (0.008)	0.044*** (0.007)	0.069*** (0.004)	0.097*** (0.006)	0.067*** (0.008)
Constant	−0.102 (0.015)	−0.102*** (0.015)	−0.099*** (0.015)	−0.115*** (0.013)	−0.174*** (0.016)	−0.105*** (0.018)
AR(1)	0.033	0.032	0.082	0.075	0.032	0.020
AR(2)	0.144	0.158	0.187	0.292	0.256	0.192
Hansen	0.410	0.397	0.361	0.430	0.240	0.449
F-statistic	153,665.68***	123,963.24***	104,743.83***	120,034.12***	138,272.11***	117,737.32***
Number of countries	27	27	27	27	27	27
Number of instruments	26	26	26	26	26	26

Notes: standard errors are in parentheses, *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively

When looking at the findings for all estimations including trade freedom and property rights in Tables 4 and 5, respectively, upper secondary education makes the highest contribution compared to post-secondary and tertiary education (the coefficients for upper secondary education for trade freedom in Table 4 and property rights in Table 5 are 0.017 and 0.015, respectively). In terms of post-secondary and tertiary education, the coefficients range from 0.003 to 0.010. After graduating from a high level of education programmes, it is observed that finding a job can take some time (Machin and McNally, 2007). Additionally, due to increasing numbers of graduates, higher education fails to provide an employment guarantee (Dimaki et al., 2005). Another explanation may be related to difficulty in finding suitable job opportunities in accordance with one's qualification (Cheong Cheng et al., 2002).

Considering the education index for columns 6 in Table 4 and 12 in Table 5, it is estimated that the education index makes a positive contribution to employment (the coefficients for the models including trade freedom in Table 4 and property rights in Table 5 are 0.002 and 0.001, respectively). The results show that graduates from different education levels play a significant role in employment. Additionally, in terms of diagnostic tests for all the models, AR(2) shows that all models in the paper do not contain second-order correlation while rejecting no first-order serial correlation AR(1) as indicated by Arellano and Bond (1991). The Hansen test results for all the models also confirm validity of instrumental variables, meaning that the instruments are correctly excluded from the model. Thus, the threshold level for the Hansen test results in the paper is higher than 0.25 as reported by Roodman (2009). Additionally, the F-test statistic results (Prob > F = 0.000) show goodness of fit of all the models in the paper.

6. Conclusion

The paper examined the relationship between different education levels and employment for selected OECD countries. To achieve this objective, the paper used numbers of graduates from upper secondary, post-secondary and tertiary education. Then, through the basic standard deviation method, the paper constructed an education index which includes graduates from upper secondary, post-secondary and tertiary education. Employing panel data from 1998 to 2019, two-step system GMM was applied to show long-run relationships among the variables.

The variables in the basic equation were GDP per capita, R&D investment and trade freedom. To check the results, the paper also added property rights to the model excluding trade freedom. After showing that the effect of primary and lower secondary does not have any effect on employment, the paper tested the role of upper secondary, post-secondary and tertiary education on employment. The results indicate that there is a positive relationship between employment and upper secondary, post-secondary and tertiary education as well as the education index.

From the economic point of view, the paper shows that different education levels and their distribution positively improve employment level. As reported in OECD (2021), the paper also confirms that upper secondary education is the minimum education level to participate in the labour market for OECD countries. Additionally, compared to primary and lower secondary education, the paper also demonstrates that people with a higher level of education are more likely to find employment. However, the results of the paper show that upper secondary education makes the highest contribution to employment level for all cases although post-secondary and tertiary education make a positive contribution on employment as well. People have to spend time and allocate their resources to complete further education. The process may delay labour market participation for young people. Considering the length of the schooling, young people with upper secondary education have an advantage in entering the labour market earlier. Additionally, upper secondary education provides better career opportunities for some people than tertiary education (OECD, 2022). However, to conduct economic activities, there is a need for people with different education levels compatible with different sectors. Given that upper secondary education is a minimum criterion to enter the labour market, it is important to understand the effect of people with different education levels on employment. Thus, countries consider graduates from different education levels to provide supply and demand on the labour market. From this point of view, the paper also confirms that there exists a positive correlation between people with different skills and employment.

Overall, it can be noted based on the findings that education is a key driver of employment. Considering the results for upper secondary education in the paper, education should be compulsory until the end of upper secondary school. Additionally, higher education should be encouraged and become attractive through suitable job opportunities. On the other hand, institutions and organizations seek individuals with different skills and abilities that can be adapted to working conditions. Thus, the paper reports that a pool of different skills serves the needs of employment and working conditions. National policy and strategies are necessary to ensure the balance between labour supply and demand. Education policies should be developed in line with market expectations and compatible with labour market dynamics. Given that the dispersion of education levels positively contributes to employment level according to the results, it is anticipated that the results will guide governments in creating education policies.

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Appendix

Table A1: Data definition and sources

Variable	Definition	Source
Employment	Thousands of persons, annual	OECD statistics
GDP per capita	GDP per capita (current USD)	World Bank (WB)
R&D investment	Research and development expenditure (% of GDP)	WB
Primary and lower secondary education	Numbers of students enrolled in primary and lower secondary education	OECD statistics
Upper secondary, post -secondary and tertiary education	Numbers of students graduated from upper secondary, post-secondary and tertiary education	OECD statistics
Education index	Standard deviation of the percentage of upper secondary, post-secondary and tertiary graduates in labour force	Author's calculation
Trade freedom	Score	The Heritage Foundation
Property rights	Score	The Heritage Foundation
Labour force	Persons, thousands (15 to 64 years)	OECD statistics

Table A2: Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
Logemployment	592	3.654	0.635	2.170	5.197
L.logemployment	565	3.652	0.635	2.170	5.192
logGDPpercapita	594	4.488	0.293	3.610	5.075
Logprimary	594	5.660	1.177	0.000	3.251
Loglowersecondary	594	5.439	1.207	0.000	7.119
Loguppersecondary	536	5.109	0.637	3.459	6.563
Logpostsecondary	479	3.896	0.846	1.944	6.003
Logtertiary	537	4.868	0.657	2.365	6.483
Logeducation index	594	2.590	0.727	0.000	3.251
logR&D	578	3.030	1.577	0.000	5.571
Logtradefreedom	594	1.921	0.027	1.771	1.966
Logpropertyrights	594	1.892	0.085	1.602	1.983

Source: author's calculations

Table A3: Unit root test results (with constant term)

	Level				First differences			
	ADF-Fisher chi square		ADF-Choi Z-stat		ADF-Fisher chi square		ADF-Choi Z-stat	
Logemployment	96.470***	0.000	–3.595***	0.000	308.818***	0.000	–16.407***	0.000
L.logemployment	104.783***	0.000	–4.019***	0.000	294.080***	0.000	–15.616***	0.000
logGDPpercapita	133.791***	0.000	–6.646***	0.000	323.399***	0.000	–17.210***	0.000
Logprimary	273.245***	0.000	–13.014***	0.000	431.586***	0.000	–22.872***	0.000
Loglowsecondary	311.202***	0.000	–16.172***	0.000	479.558***	0.000	–25.435***	0.000
loguppersecondary	144.510***	0.000	–6.952***	0.000	449.977***	0.000	–23.950***	0.000
Logpostsecondary	168.112***	0.000	–8.718***	0.000	353.478***	0.000	–18.960***	0.000
Logtertiary	214.041***	0.000	–10.994***	0.000	455.483***	0.000	–24.243***	0.000
Logstandard	295.921***	0.000	–15.547***	0.000	607.310***	0.000	–32.332***	0.000
logR&D	292.369***	0.000	–15.142***	0.000	567.995***	0.000	–29.912***	0.000
Logtradefreedom	156.992***	0.000	–8.087***	0.000	510.551***	0.000	–27.183***	0.000
Logpropertyrights	147.857***	0.000	–6.433***	0.000	517.139***	0.000	–27.532***	0.000

Notes: the p-value is in parentheses, ***, ** and * denote the rejection of the null hypothesis at the 1%, 5% and 10% significance levels, respectively

Source: author's calculations