COMPARISON OF SECONDARY EDUCATION PISA RESULTS IN EUROPEAN MEMBER STATES AND TURKEY VIA DEA AND SEM

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Abstract

The Programme for International Student Assessment (PISA) conducts educational research that involves students in the 15 year old age group and seeks to measure their proficiency in, Mathematics, Reading and Science Literacy. This study compares the results of effectiveness of education at secondary level in Turkey and the EU member states using Data Envelopment Analysis (DEA) and Structural Equation Model (SEM). In the analysis, the PISA "Mathematics", "Reading" and "Science" literacy test scores are used as output, while the "Pupil-Teacher Ratio" and the "Public Expenditure on Education as a percentage of GDP" are used as the input variable. First SEM is used to examine relationship between the input and output variables of education. In this analysis, the input latent variable indicates the independent variable and the output latent variable is the dependent variable. The input latent variable is represented by "Pupil-Teacher Ratio" and "Public Expenditure on Education as a percentage of GDP" observed variables while the output latent variable is represented by the "Mathematics", "Reading" and "Science" literacy test scores observed variables. Then DEA is used to compare secondary education PISA results in European member states and Turkey. Results of the SEM show that the most effective input variable is the public expenditure on education as a percentage of GDP, and the most effective output variable is the science literacy test score. Results of DEA in the above-mentioned variables show that the same variables are most in need of improvement. In addition, the results of the analysis indicate that Turkey could not achieve total and technical efficiency and obtained the lowest efficiency value.

Keywords: Education efficiency, Data Envelopment Analysis, Structural Equation Modeling, European Union

1. Introduction

As mentioned in endogenous growth theory, education which aims at increasing personal and national income by increasing labour productivity is an important element of human capital at all levels of development for countries which are at the beginning of the road to economic and national development (Afşar, 2009). The quantity as well as the quality of this human capital element is an effective factor in the level of welfare of nations, the development of standards of living, crime reduction, increase in total factor productivity and social cohesion (Saygılı et al., 2006).

In empirical growth literature, the duration of education is shown to be more effective than the quality of education in a lot of countries. New empirical measures of education performance used in new empirical studies are the PISA test results that allow the comparison of countries (Yılmaz, 2009). Organized by the OECD, the Programme for International Student Assessment (PISA) conducts educational research that involves students in the 15 year old age group and seeks to measure their proficiency in reading, mathematics and science literacy. The test results in this study provide the necessary data to improve planning, make it possible to identify strengths and weaknesses of the education systems of countries, are evaluated as the output of education in international comparisons and are the main determinant in the ranking of the countries according to their educational activity level.

When its PISA scores are examined, Turkey with its young population appears to lag behind the OECD countries in many of the test scores. In addition, as the enrolment rate is very low in Turkey, there is a large section 15 year-olds left outside of the education system, and as this group of students do not participate in examinations, it is understood that the actual level of qualification of this group is below what is estimated

(Kolaşin and Levy, 2010). Although the report put forth by the EU Commission on Education says that compared to other countries, Turkey showed great performance in achieving the 2020 objectives, it followed far behind the Member States of the EU. Being unsuccessful in the field of education will in turn reflect negatively on many social, demographic and economic developments that could have been reached more easily and with less economic weight with a stronger education sector.

However, for this effective factor to be at the desired level both quantitatively and qualitatively, not only consumption but also investment spending on education (Özsoy, 2010) constitutes a major item of state expenditure and can be a driving force for other investments. Effectiveness of investments in education is an issue that should be emphasized all over the world (Berberoğlu and Kalender, 2005). Especially in European countries, a large portion of this expenditure item is publicly funded, which increases the importance of a careful assessment of investment returns.

Another educational issue discussed relates to the future benefits of education at an early age (European Commission, 2011). The fact that quality of education, especially in pre-school, primary school and secondary school is not at a desired level negatively affects the efficiency and effectiveness of investments in higher education and reduces the strength of competitiveness of nations.

As we know, one of the most important aspects of human development and human investment in the Lisbon Strategy, which is focused on the global competitiveness of the European Union, is education (Cansever, 2009). During Turkey's process of becoming a member state from a candidate country, identifying its similarities and differences with member states in terms of education and drawing a road map with the resulting findings will be an opportunity for the education sector during this process and will accelerate its social harmonization with the EU.

2. Literature review

Education is the application that attracted the most attention in the early days of DEA development. Charnes himself applied DEA to evaluate the efficiency of program follow-through, which was a large-scale social experiment in public school education (Charnes et al., 1981). The effectiveness of 55 primary schools in America was observed by the study which used the inputs and outputs of the California Bsari test (Bessent and Bessent, 1980). Since then, DEA applications in the field of education have often dealt with the activities countries' educational institutions (Agasisti, 2008).

In comparing the efficiency of primary or secondary schools with DAE, student exam results in a variety of courses are used as output variables. The number of teachers or pupil-teacher ratio, the materials used in education, education grounds, school budgets, various features of teachers, and the socio-demographic characteristics of the parents of the students or as the input variables are discussed. The efficiency of secondary institutions in the province of Sivas (Balkan and Arıkan, 2010), the total efficiency of Anatolian high schools in the province of Ankara (Atan et al., 2002; Yeşilyurt and Alan, 2002), the efficiency of Science High Schools and vocational high schools in Turkey (Demir and Depren, 2010), the efficiency of high school education on a provincial basis (Davutyan et al., 2010), and the efficiency of high schools in Finland (Kirjavainen and Loikkanen, 1998) and Italy (Barbetta and Turati, 2003) were determined by using DEA.

The recent trend of efficiency studies in the education category clearly focuses on the higher education sector to evaluate the performance of universities. Studies which evaluate the efficiency of universities using DEA often deal with efficiency in terms of education and research, and differences are observed depending on the selection of input and output. In general, the number of publications and/or citations, the number of graduates, university rankings obtained by using various indicators and/or students' taking part in the workforce are used as the output variable; whereas faculty, support staff, a number of master and doctorate students, a number of students per faculty member and/or budget allocations to education are used as input variables in these analyses. Research efficiency in 100 universities in China (Johnes and Yu, 2006), the efficiency of universities in Britain and Italy (Agasisti and Johnes, 2009) and Greece (Tzeremes and Halkos, 2010), the efficiency of the MBA programmes of American universities which rank among the top 24 schools (Colbert et al., 2000), and the efficiency of the departments of a university in India (Tyagi et al., 2009) were compared with the DEA. Agasisti (2008) identified the efficiency of higher education in European countries, and Aubyn et al. (2009) identified the efficiency of spending on higher education in EU member states by using DEA and stochastic frontier analysis (SFA), while Johnes (2006) identified the efficiency of higher education in the UK with DEA. In Turkey, DEA can be found in many studies which

assess the efficiency of higher education, universities or university departments (Dikmen, 2007; Kağnıcıoğlu and İcan, 2011; Kutlar and Babacan, 2008; Özden, 2008; Oruç et al., 2009; Yeşilyurt, 2009; Ulucan, 2011).

Despite inaccessible data, different forms of data collection and unachievable homogeneity in classifications made by different institutions in the evaluation of the effectiveness of education, the most widely used output variable in such studies are students' reading, mathematics and science test scores. In assessing the efficiency of OECD countries in secondary education, Afonso and Aubyn (2006) made use of DEA and Free Disposable Hull (FDH) comparatively. Afonso and Aubyn (2006) compared the efficiency of secondary school education in 25 countries, most of which are also OECD countries, using DEA and the Tobit method. The PISA scores were used as output variable whereas the number of teachers per 100 students, the period of time spent at school in one year, parents' participation in education and GDP per capita made up for the input variable. In another study which used the results of PISA as the output variable, the efficiency of public spending on primary and secondary education in OECD countries were examined using DEA (Sutherland et al., 2009). Another country which makes use of the results of the PISA study in evaluating the efficiency on a country level is Croatia (Jafarov and Gunnarsson, 2008).

It is also possible to come across studies that assess the efficiency of education, which use the economic and social benefits of education as an output variable. By using participation rates in education, one of the indicators of Millennium Development Goal (MDG), as output and pupil-teacher ratio as input, Tandon (2005) studied the efficiency of Asian countries in achieving MDGs. The efficiency of government spending on education and health in 37 African countries were evaluated with FDH (Gupta and Verhoeven, 2001).

Today, according to the total number of application-embedded papers, banking ranks number one, followed by health care, agriculture and farm, transportation, and education (Liu et al., 2013).

Taking into consideration the aforementioned importance of education, this study compares the results of effectiveness of education at secondary level in Turkey and the EU member states[a] using Data Envelopment Analysis (DEA). In the analysis, the PISA mathematics, reading and science test scores were used as output, while the pupil-teacher ratio and the share of GDP allocated to education were used as the input variable, and environmental conditions were kept constant. Inputs and outputs were determined on the basis of studies conducted with DEA in measuring educational performance, and the causal relationship expected between input and output is shown with a structural equation model.

2. Method

The additive data envelopment analysis model and structural equation modelling methods used in the analysis are described below.

2.1 Additive DEA models

Put forward by Charnes, Cooper and Rhodes (1978) benefiting from the concept of efficiency proposed by Farrell (1957), the DEA is a linear programming based method which enables measurement of relative efficiencies of decision making units (DMUs) in production processes where inputs and outputs are measured by several different scales or with different units of measurement.

In DEA models for measuring input-oriented technical efficiency, the objective is to contract all inputs at the same rate to the extent possible without reducing any output. The output-oriented DEA models consider the possible output augmentations while keeping the current levels of inputs. An additive DEA model considers possible input decreases as well as output increases simultaneously in the sense of vector optimizations. The additive models selected are (Cook and Zhu, 2005: 12):

[1] Malta and Cyprus are not included in the research for they were not part of the PISA survey.

$$mak\, z_0 = \sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+$$

$$st$$

$$\sum_{j=1}^{N} y_{rj}\lambda_j - S_r^+ = y_{r_0}$$

$$\sum_{j=1}^{N} x_{ij}\lambda_j + S_i^- = x_{i_0}$$

$$\sum_{j=1}^{N} \lambda_j = 1$$

$$\lambda_j, S_i^-, S_r^+ \geq 0$$

$$i = 1, 2..., m \quad r = 1, 2..., n \quad j = 1, 2..., N$$

In additive model, for the DMU to be effective (Green et al., 1997):

- $z_0 = 0$, in other words, $\left[\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ = 0\right]$ is required. Otherwise, the nonzero optimal s_i^{-*} identifies an excess utilization of the i*th* input, and the nonzero optimal s_r^{+*} identifies a deficit in the r*th* output. Clearly, the evaluated *DMU* is efficient if and only if all slack variables in the optimal solution are zero in problem.

2.2. Structural Equation Modelling

Structural Equation Modelling (SEM) reveals the causal relationships among multiple observed (measured) and/or unobserved (latent) independent and dependent variables (Timm, 2002).

SEM is a compound extension of regression analysis and factor analysis. Regression analysis reveals the relative relationship between dependent variable and independent variables. SEM provides not only all of the information provided by the regression analysis but also gives us information about the relationship between independent variables and the multiple dependent variables (Maruyama, 1998). SEM can estimate many equations at once which can be interrelated, meaning that the dependent variable in one equation can be an independent variable in (an)other equation(s). In particular, in cases where a dependent variable passes to the next state as an independent variable SEM is used (Hair et al., 1998). Development of Regression Analysis, Path Analysis and Confirmatory Factor Analysis has pioneered the development of SEM (Schumacker, 2004).

What is different about SEM compared to other multivariate methods is that it enables testing and estimating the relationship between observed variables as well as latent variables. Compared to other general linear models, latent variables can perhaps be shown with one measure, but measurement errors cannot be modelled. In SEM, multiple indicators are used to represent latent variables and specification error can be measured. This difference helps us to decide the validity of the latent variables (Weston and Gore, 2006).

2.3. Input and output variables used in the analysis

Although in performance assessments many studies use the participation rates or years of education as output variables, these indicators only express quantity and are not a good indicator of the quality of education (Lee and Barro, 1997). However, what are needed are indicators which can be used in international comparisons and can measure qualitative features. Indicators obtained by PISA have these characteristics and are used in many studies (Afonso and Aubyn 2006; Berberoğlu and Kalender 2005; Jafarov and Gunnarsson 2008; Sutherland et al. 2009). This study uses as output variable the mathematics, science and reading scores of students in the 15 year-old age group obtained by PISA, which is one of the most comprehensive studies in the world for measuring and evaluating education.

This study, which assumes the socio-economic variables of students to be constant, uses as input variables the share of GDP allocated to education and pupil-teacher ratio (PTR), which are acknowledged by Card and Krueger (1996) to have a strong positive effect on school success. The GDP and PTR input variables are from 2009 and 2008 respectively and were collected from the OECD database

3. Results

In the study, the relationship between the input and output variables identified in the literature review were analysed with a structural equation model. In this analysis, the input latent variable indicates the independent variable and the output latent variable is the dependent variable.

As it is well known, the latent variable is defined as a variable that cannot be measured directly and is represented by multiple observed variables The SEM model is presented in a path diagram where the names of observed variables are within rectangles and the names of latent variables in ellipses. The measurement errors (from e1 to e6) associated with observed variable are enclosed by smaller ellipses. Dependent variable have an error term (e7) which corresponds to the assumption in multiple regression that the dependent variable is measured with some degree of error. The input latent variable is represented by GDP and pupil-teacher ratio (PTR) observed variables while the output latent variable is represented by the reading (READ), mathematics (MATH) and science (SCI) observed variables. The structural equation model is shown in Figure 1.

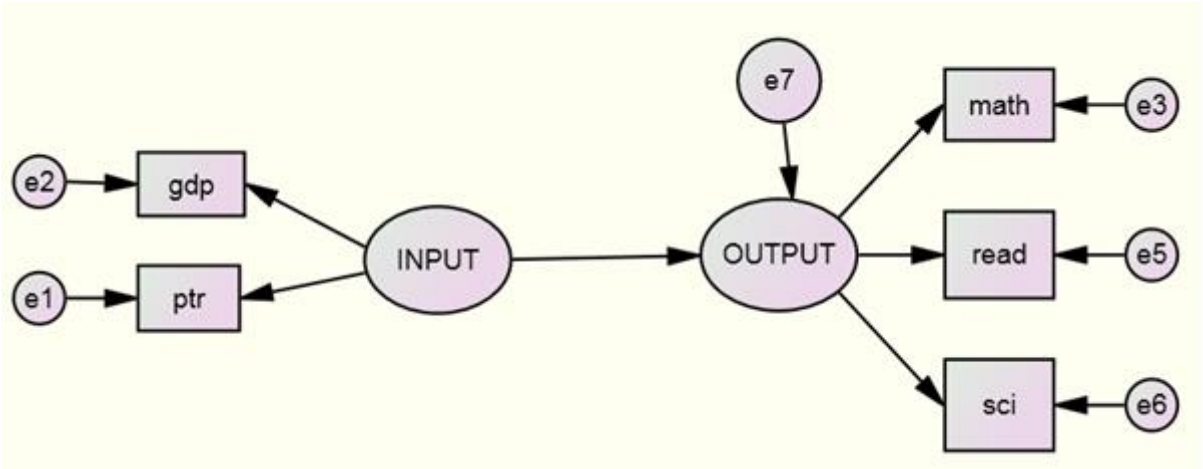

Figure 1. The Effect of Input on Output

The significance of the SEM is determined by testing the coefficients and evaluating fit indices. Analysis of Table 1 shows that regression coefficients for all paths are significant at a level of 5%. When the critical ratio (CR) is greater than ± 1.96 for a regression weight, that path is significant at the .05 level or better.

Table 1
Unstandardized Regression Coefficients of the Model

			Estimate	S.E.	C.R.	*p*
OUTPUT	<---	INPUT	-9.054	4.576	-1.979	0.048
ptr	<---	INPUT	1.000			
gdp	<---	INPUT	0.035	0.013	2.721	0.007
math	<---	OUTPUT	1.000			
read	<---	OUTPUT	0.845	0.080	10.511	***
sci	<---	OUTPUT	1.031	0.072	14.330	***

(***) ındicate significance smaller than .001.

Analysis of the standardized regression coefficients in Table 2 indicates that the effect of the input variable has a negative effect on the output variable and the regression coefficient is -0.508. In other words, a one-unit change in the input will cause a -0.508 reduction in the output. Table 2 also shows loadings. The GDP input variable (0.988) and the SCI output variable (0.981) have the highest loadings for their latent variables. The significance of the model in SEM is interpreted with fit indices. Indices help to decide whether or not the relationship between latent variables and observed variables is correctly represented. Several fit indices of the model are shown in Table 3. The fit indices reveal the model to be "very fit".

Table 2
Standardized Regression Weights

			Estimate
OUTPUT	<---	INPUT	-0.508
ptr	<---	INPUT	0.478
gdp	<---	INPUT	0.988
math	<---	OUTPUT	0.968
read	<---	OUTPUT	0.932
sci	<---	OUTPUT	0.981

Table 3
Model Fit Indices

Fit Measure	Good Fit	Specified Model
χ^2 / sd	$0 \leq \chi^2 / sd \leq 2$	0.710
GFI	$0.95 \leq GFI \leq 1$	0.950
NFI	$0.5 \leq NFI \leq 1$	0.971
RMSEA	$0 \leq RMSEA \leq 0.05$	0.000

After identifying a causal relationship between the variables in the analysis, the total and technical efficiency values of the countries were calculated using the additive model of the DEA total. Technical efficiency values of the countries together with reference countries are shown in Table 4.

Table 4
Technical Efficiency Results

Country	Efficiency	PTR	GDP	MATH	READ	SCIE	Reference Unit (Countries)
LT	**0**	0	0	0	0	0	Number of becoming reference (18)
FI	**0**	0	0	0	0	0	Number of becoming reference (10)
BE	**0**	0	0	0	0	0	Number of becoming reference (10
PT	**0**	0	0	0	0	0	Number of becoming reference (9)
DK	**0**	0	0	0	0	0	Number of becoming reference (6)
PL	**1.28**	1.26	0.02	5.13	0	0	FI (0.25) LT (0.01) PT (0.74)
IT	**1.35**	1.35	0	8.91	0	6.31	DK (0.48) LT (0.29) PT (0.23)
LU	**1.38**	1.26	0.12	0	8.36	12.16	BE (0.32) LT (0.68)
HU	**1.46**	1.45	0	4.27	0	0	FI (0.17) LT (0.14) PT (0.69)
AT	**1.49**	1.49	0	0	16.94	4.7	BE (0.43) DK (0.09) LT (0.47)
SI	**2.21**	2.21	0	0	11.09	0	BE (0.15) DK(0.01) FI (0.29) LT (0.54)
LV	**2.29**	2.29	0	3.11	0	0	FI (0.03) LT (0.32) PT (0.66)
ES	**2.40**	2.37	0.03	0	0	4.63	BE (0.03) LT (0.42) PT (0.54)
SE	**2.53**	2.53	0	10.13	0	5.52	BE (0.31) DK (0.53) PT (0.16)
EE	**3.28**	3.26	0.02	1.98	7.04	0	FI (0.59) LT (0.41)
NL	**3.72**	3.70	0.02	0	10.07	4.71	BE (0.58) FI (0.42)
FR	**4.59**	4.59	0	1	0	0.32	BE (0.37) DK(0.02) PT (0.61)
BG	**4.63**	4.60	0.03	48.54	39.44	52.00	LT (1.00)
EL	**4.76**	4.71	0.05	17.56	0	22.37	LT (0.31) PT(0.69)
CZ	**4.87**	4.82	0.05	0	6.32	0	BE (0.32) FI (0.06) LT (0.62)
UK	**5.24**	5.24	0	10.3	1.56	0	DK (0.15) FI (0.35) LT (0.50)
IE	**5.31**	5.27	0.04	10.66	0	0	FI (0.25) LT (0.26) PT (0.48)
DE	**5.55**	5.51	0.04	0	8.37	0	BE (0.28) FI (0.39) LT (0.32)
RO	**6.12**	6.10	0.02	49.52	43.98	63.00	LT (1.00)
SK	**6.14**	6.05	0.09	0	10.47	9.31	BE (0.52) LT (0.48)
TR	**14.14**	14.00	0.14	31.15	4.25	37.00	LT (1.00)

Table 4 shows that Lithuania, Finland, Belgium, Portugal and Denmark are technically efficient whereas 21 countries, including Turkey, are not. These inefficient countries, despite having the qualifications to perform current PISA results with less input, have not been able to use effectively and wasted their qualifications or have not been successful at scoring higher at PISA. In other words, under existing environmental conditions, while it is possible to obtain better indicators with their data inputs, these countries, due to administrative errors, have not been able to utilise their technical resources effectively and not been efficient. Turkey is the country which needs to change its input the most. For Turkey to be efficient:

- The 22.2 studen-teacher ratio should be decreased by 14 points to 8.8,
- GDP allocation to education should be increased by 66.78% to 4.77%,
- The current mathematics literacy score of 445.00 points should be increased to 477.00, the reading literacy score from 464.19 to 468.00 points, and the scientific literacy score from 454.00 to 491.00, and
- Lithuania should be taken as a point of reference in order to be technically efficient in PISA results.

After calculating the technical efficiency, the total efficiency of the countries was determined under constant returns to scale, the results are shown in Table 5.

Table 5
Total Efficiency Results

Countries	Efficiency	PTR	GDP	MATH	READ	SCIE	Reference	Units
LT	0	0	0	0	0	0	Number of	becoming
DK	0	0	0	0	0	0	Number of	becoming
PT	0.12	0.12	0	10.88	0	12.88	DK (0.36)	LT (0.67)
BE	0.98	0.98	0	0	0.67	10.89	DK (0.66)	LT (0.38)
IT	1.38	1.38	0	11.46	0	9.33	DK (0.56)	LT (0.44)
AT	1.92	1.92	0	0	17.23	9.44	DK (0.38)	LT (0.64)
LU	1.98	1.89	0.10	0	8.52	19.84	LT (1.03)	
HU	2.16	2.16	0	12.53	0	8.24	DK (0.34)	LT (0.69)
PL	2.47	2.47	0	14.33	0	11.54	DK (0.25)	LT (0.80)
LV	2.52	2.52	0	10.38	0	9.01	DK (0.22)	LT (0.81)
ES	2.79	2.78	0.01	5.93	0	16.21	LT (1.03)	
SE	2.86	2.86	0	11.67	0	10.79	DK (0.79)	LT (0.23)
FI	3.22	3.22	0	12.56	7.93	0	DK (0.81)	LT (0.31)
SI	3.35	3.35	0	1.95	11.81	0	DK (0.34)	LT (0.70)
FR	5.03	5.03	0	7.34	0	11.93	DK (0.48)	LT (0.55)
EL	5.18	5.15	0.03	25.09	0	36.02	LT (1.03)	
BG	5.34	5.29	0.05	8.41	0	10.66	LT (0.92)	
EE	5.51	5.51	0	5.48	7.83	0	DK (0.27)	LT (0.80)
CZ	5.74	5.72	0.02	0	6.19	7.70	LT (1.03)	
NL	6.05	6.05	0	0	8.55	10.16	DK(0.49)	LT (0.59)
UK	6.36	6.36	0	14.64	4.30	0	DK (0.43)	LT (0.61)
IE	6.73	6.72	0.01	17.14	0	11.51	LT (1.06)	
RO	6.91	6.87	0.04	4.77	0	16.90	DK (0.91)	
SK	7.11	7.05	0.05	0	10.74	21.69	LT (1.04)	
DE	7.76	7.76	0	0	6.71	6.25	DK (0.08)	LT (0.99)
TR	14.21	14.07	0.14	26.83	0	32.55	LT (0.99)	

The three countries which are technically efficient (Finland, Belgium and Portugal) are also efficient in total. The only two countries which are efficient in total are Lithuania and Denmark. The reason why countries do not show total efficiency is that they are inactive in fit scale sizes. In this table, too, Turkey is the country that needs to change its input and output the most. The changes that should be made for Turkey to be efficient in total are below:

- The pupil-teacher ratio should be reduced to 8.13,
- The share of GDP allocated to education must be increased to 4.77%, and
- The country that should be taken as a reference in total efficiency is Lithuania.

4. Conclusion

The expected relationship between educational input and output in Turkey, which has a characteristically young population, was analysed with a Structural Equation Modelling in order to examine the efficiency of investments in education, efficiency among EU countries was compared with total DEA models. The results are as follows:

- Turkey and other EU states except for Lithuania, Finland, Belgium, Portugal and Denmark are not technically efficient. In other words, they have not been able to utilise their resources in reaching PISA scores. The only two countries which are efficient in total are Lithuania and Denmark. Turkey is the country with the lowest total and technical efficiency. For Turkey to be totally and technically efficient:
  - The pupil-teacher ratio of 22.2 should be reduced to the 8.13-8.8 range,
  - The share of GDP allocated to education should be increased by 66.78% to 4.77%,
  - The mathematical literacy score of 445.00 should be increased to the 472-477.00 point range,
  - The reading literacy score of 464.19 points should be raised to 468.00 points,
  - The science literacy score of 454.00 points should be increased to the range of 487-491.00 points, and
  - Turkey should take Lithuania as a reference point in order to be relatively efficient in PISA results.

- As a result of the structural equation model, the variable with the largest effect on input is the GDP allocated to education while science literacy scores have the largest effect on output. Results of DEA in the above-mentioned variables show that the same variables are most in need of improvement.

Although the report put forth by the EU Education Commission revealed that Turkey, compared to other countries, showed a great performance in achieving the goals set for 2020, education in Turkey's scale "is far from playing a vital and central role that can be summarized as necessary for the creation of human capital formation for a sustainable economic and social development" (Türkmen, 2009). For Turkey to take its rightful place in competitive society and the European Union nomination process, and to speed up its progress, it is necessary for the society to be prepared economically and socially. During this preparatory phase, education, the development of which will affect many areas from economy to health, plays an important role with its quality, quantity and allocated resources. However, "the OECD PISA exam results show the Turkish educational system is far from raising individuals who have advanced skills in thinking, perception and problem-solving" (Saygılı et al., 2006).

When the importance of investment in human capital in the development of nations within a competitive environment is considered, it seems advisable to place a greater share of public spending in education and distribute it according to the needs and number of students. Before taking any steps, it is important to remember that Turkey has a high income inequality and that "equality of opportunity in education" is one of the most effective policies in correcting income distribution. It should also be noted that, together with material resources, the quality and quantity of teachers are of great importance as they are the ones who directly communicate with and influence students. These essential changes to the sources will create effective differences in PISA indicators which are considered a good indicator of the quality of education in international comparisons.

As successful societies are ones that are able to quickly adapt to ever-changing global and local conditions, and given the fact that the educational system is considered a key factor in increasing a country's welfare by raising innovative and creative individuals (Saygılı, et al., 2006), the experiences of the countries found successful in the analysis and the needs of Turkey indicate that making comprehensive improvements in education is of utmost importance.

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