

The Effect of Provincial Financial Development Levels on Open Education System of Anadolu University

Bahar Berberoğlu¹
C. Necat Berberoğlu²
Çağlar Karaduman³
Rabia Ece Omay⁴

İllerin Finansal Gelişme Düzeylerinin Anadolu Üniversitesi Açıköğretim Sistemine Etkileri

Öz

Bu çalışma, il bazında finansal gelişmişliğin Açıköğretim Sistemine yönelen talebi nasıl etkilediğini araştırmaya yöneliktir. İllerin gelişmişlik endeksi ile Anadolu Üniversitesi Açıköğretim Sistemi'ne yönelen talep 2012 yılı itibariyle incelenmiştir Doğrusal ve doğrusal olmayan iki farklı regresyon tekniği kullanılmıştır. Analiz sonucunda, İstanbul, Ankara ve İzmir illerinin Açıköğretim Sistemine yönelik talebi finansal koşullar altında daha özel bir yere sahip olduğu tespit edilmiştir. Analiz daha sonra bu üç il dışında bırakılarak yürütülmüştür. Doğrusal olmayan regresyon modellerinin sonuçları istatistiksel olarak daha anlamlı bulunmuştur. Sonuçta, Anadolu Üniversitesi Açıköğretim Sistemine yönelen talep ile illerin sosyoekonomik gelişmişlik düzeyleri arasında pozitif bir ilişki bulunmuştur.

Anahtar Kelimeler: Finansal Gelişme, Açıköğretim Sistemi, Doğrusal Regresyon Modeli, Doğrusal Olmayan Regresyon Modeli

The Effect of Provincial Financial Development Levels on Open Education System of Anadolu University

Abstract

This study aims to investigate how the provincial financial development levels affect the demand towards the open education system. We examined the Provincial Financial Development Index and the demand for Anadolu University Open Education System as of the year 2012. We employed two different techniques as linear and nonlinear regression. According to the analysis results, it was found that the demand for the open education system in Istanbul, Ankara, and Izmir possess special characteristics in relation to the financial conditions. In addition, similar analyses were done after excluding these three provinces. The results of the nonlinear regression models were found to be statistically more significant. In conclusion, a positive relationship was found between the demand for Anadolu University Open Education System and the levels of financial development of the province.

Keywords: Financial Development, Open Education System, Linear Regression Model, Nonlinear Regression Model

1. Introduction

There is a strong interaction between the social, economic, and financial powers and the educational and cultural levels of countries. The same interaction exists between the social, economic, and financial powers and the educational and cultural levels of provinces of a country. Economic and financial development means that industrialization, attainment of economic and political freedom, and the provision of educational opportunities to all populace. One of the most effective ways to provide educational opportunities to all segments of the society is the open and distance education. In this context, it is very meaningful and important that Anadolu University Open Education Faculty (OEF) provides these opportunities in all the provinces in Turkey.

¹ Doç. Dr., Anadolu Üniversitesi, Açıköğretim Fakültesi, İktisadi ve İdari Programlar Bölümü, bdirem@anadolu.edu.tr

² Prof. Dr., Anadolu Üniversitesi, İktisadi ve İdari Bilimler Fakültesi, İktisat Bölümü, nberbero@anadolu.edu.tr

³ Arş. Gör., Anadolu Üniversitesi, İktisat Fakültesi, İktisat Bölümü, caglarKaraduman@anadolu.edu.tr

⁴ Doç. Dr., Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, İstatistik Anabilim Dalı, receomay@gmail.com

In the 1970s, while Anadolu University was an Academy, it has established the infrastructure of open and distance education in an educational institution for the first time in Turkey, in order to make mass education. By the year 1982, Law 2547 was enacted in Turkey for restructuring the objectives of higher education. While this law was being prepared, the first Open Education Faculty in the Turkish education system was established in Anadolu University in Eskişehir. This can be considered as a success of Eskişehir Academy. The Anadolu University OEF has grown and developed since its foundation 1982, without losing speed, following the realities of the country and the developments in open and distance education (Berberoğlu, 2017).

Anadolu University OEF has been offering open and distance education to a large audience since 1982. When we discuss the situation in the 2014-2015 Academic Year by December 2014, with the number of faculties providing education with OEF system, in total 1,365,944 students were continuing education, including 602.520's women and 763.424 men (www.anadolu.edu.tr/universitemiz/sayilarla-universitemiz). With the number of students and through open and distance facilities AU is located among the mega-universities in the world. Also, it is offering educational opportunities across the country to many women who are not only in the cities but also in the countryside where they are not able to benefit from formal education. This phenomenon reflects directly to the country's gender parameters and it makes a significant contribution to the country's development.

Human and physical capital are the two major forces in the socio-economic growth and structural change in a society. Education is the most important component of human capital. While the education level is increasing the quality of human capital will also increase. However, improving the quality of human capital is possible only through lifelong education. Today, in training policies and in lifelong learning the importance of open and distance education is well known. In the areas of increasing living standards, reducing social inequalities and creating higher education opportunities the open and distance learning and lifelong education are two important factors. In order to create equal opportunities in higher education, considering the problems of increasing population, economic and financial impossibilities, being female or handicapped or being arrested and already working, the importance of open and distance education in Turkey will be more clearly understood.

Today, as well as economists, policymakers and practitioners are discussing on the ways of increasing the quality of human capital. Authorities, giving direction to the country's education policy, should be aware and take into account of the quality of human capital and have to develop policies in that direction. The quality of human capital and the quality of labor training are the most important factors in decreasing the inter-country differences in income and production levels (Berberoğlu, 2016). Skilled manpower can be created through training as a result of human and information combination. This duo, in the long term but is formed by the contribution of open and distance education and lifelong learning. In this perspective, Anadolu University is providing a positive and continuous contribution to skilled manpower in Turkey with open and distance learning since 1982.

Continuation of the life of a living being firstly depends on its adaptation to the environmental conditions and the ability of re-adaptation to any kind of change that may emerge under these conditions. Giving appropriate reactions to the differentiating environment and adaptation to differentiating conditions is only possible with continuous learning. In giving appropriate reactions to the changing conditions and learning how to adapt to the environment, obtaining

new information continuously is a basic necessity for humans to maintain their lives. Thus, humans and other living beings cannot live for a long time without learning how to make use of their environment to meet their basic needs.

As known, people have to make decisions during their lives on how to live and how to maintain their lives, since the most important difference separating humans and biological beings, from the other living beings is their social and cultural qualification. All the problems encountered by the individuals during their lives have been solved on the basis of these decisions. Undoubtedly, living quality and welfare of the people have definitely depended on the rightness of the aforementioned decisions. Because the most basic condition for making right decisions is to have correct information, lives of people must be filled with the concepts “continuously obtaining information and learning” so that people can reach the desired life quality. The most important means to provide the services of continuously obtaining information and learning, which are necessary for the individuals to have the lifestyles they desire, is the lifelong education.

Education is generally defined as “the process of reinforcing the human personality” and “the investment made in the human capital (social capital)” (Berberoğlu, 2016). The objective of obtaining information and learning can be fulfilled when education is sustained formally in a planned way at schools or informally in the individuals’ environment of residence. However, informal education has a constant characteristic while people generally benefit from the formal education in a certain time of their lives. Today, the process of technological development and popularization has led to the emergence of the “Information Age” concept. This process has made it possible to fulfill the objectives for increasing the quality of the informal education in the residence environment of the individuals, expanding and improving its scope and content.

Hence, the case of continuously obtaining information and learning with informal education, which used to occur casually in the residence environment of the people before, has gained a formal structure as a result of the technological development and spread and under the name of lifelong learning, it has become worldwide popular.

On the other hand, education is a concept which can be evaluated depending on many factors. One of these concepts is the indicator of financial development. In Turkey, within the frame of the literature, the studies in which financial development levels are compared on the basis of the country are frequently encountered. However, the studies carried out on the scale of a province for Turkey are rarely observed. While our study is assessing the relation between education and financial development, it is the first and an original study which addresses the relation between the Open Education System and province-based financial development index.

In general, the development and effective functioning of a financial system are possible in the environments in which elements such as the accessibility of financial instruments stand out (Saldanlı & Şeker, 2013). The elements which reveal the financial system of a country are the outlook, characteristics and proportional sizes of financial instruments and institutions. In a country such elements also shape the structure of the financial system, financial instruments and, institutions and the whole economy (Öcal et al, 1999).

The need for investigating the socioeconomic factors which play an active role in eliminating regional instabilities arises due to the prevention of social and economic integrity and development of the country. When it comes to economic factors, financial variables also appear as an important parameter in both regional and provincial development (Yamanoğlu, 2008).

Huang (2005) examined the basic factors of financial development for developed and developing 64 countries. According to the findings the financial development levels are determined by the elements such as income and cultural features as well as the quality of the organizational structure, macroeconomic policies and geographical features (Ak et al., 2016). “Financial development” described as variation and proliferation of the instruments used in finance markets is, in fact, a variable which cannot be easily measured. Thus, we consider that various index types can be derived in order to measure this variable in many various studies. Which indicator measures the financial development level better is through finding and selecting the indicators which can reflect the unique conditions of the relevant country and region in the best way (Ak et al., 2016). Lynch (1996) suggests that monetary magnitudes, magnitudes with respect to loans and magnitudes related to capital markets should be used as indicators related to the financial development. Kar et al. (2008) attach importance to creating an index out of the indicators with related to both monetary, credit and capital market in order to measure the financial development level. Extending indexes in a way that will include the variables related to banking and capital market will raise the information regarding financial development to the highest level. Therefore, the use of variables especially related to banking and capital markets in the index calculations should be used in the analysis due to their representing various functions of financial markets (Ak et al., 2016).

The most important index prepared on the financial development of countries is the Financial Development Index published every year by the World Economic Forum. However, when financial development is tried to be examined on the basis of provinces, it is impossible to find an index prepared by an official institution. We used the index values calculated by Gül and Çevik (2014) by taking the variables used in the calculation of the financial index of the provinces into consideration. They utilized 9 financial indicators in Table 1 while creating the index related to the financial development levels of the provinces.

Table 1: Financial Variables Used in Index Formation

Financial Development Criteria	Data Sources
Saving Deposits	Banking Regulation and Supervision Agency
Cash Loans	Banking Regulation and Supervision Agency
Non-cash Loans	Banking Regulation and Supervision Agency
The Ratio of Non-Performing Loans	Banking Regulation and Supervision Agency
Number of the branches of Banking Sector	Banking Regulation and Supervision Agency
Number of ATMs	The Banks Association of Turkey
Number of interactive banking customers	The Banks Association of Turkey
Number of merchants	The Banks Association of Turkey
Number of POS machine	The Banks Association of Turkey

Source: Gül and Çevik (2014)

When the index values were examined, among the provinces Istanbul ranks the first. It is an expected result that Istanbul which we can define as the capital of finance in Turkey. Moreover whereas Istanbul ranks first with the value of 23.17, it is followed by Ankara with the value of 7.01 and Izmir with the value of 4.06. When the total of these three provinces is proportionately evaluated at the country's level, 68.7% of the Deposit Volume, 57.8% of Cash Credits, 46% of

the Number of Branches and 43.7 % of the Number of ATMs are seen to be present in these three provinces (Gül & Çevik, 2014).

Nowadays, the concept of globalization is frequently mentioned. One of the reasons for this is that, with each passing day increasing finance capital and competition, improvements in transportation, communication, and information technologies are affecting the whole world more. These factors also have an impact on adult education (Miser, 2002).

Depending on the excess of young population and rapid population growth in Turkey, in the foreseeable future, a significant increase may be observed in the rate of the labor population to the total population. Accordingly, new employment opportunities should be created in order to increase the proportion of active workers in population.

The potentially positive effects of population growth on economic growth in the mid and long terms are closely related to the investments to be made in human capital. Hence, the knowledge and skill level of the young population who has a great potential should be raised and utilized productively by increasing the real level of education expenditures (Yamanoğlu, 2008). Especially, in countries where the young population shows a rapid increase, such as in Turkey, higher education demand can be met by providing a better education with lower cost to more people through open and distance education (Berberoğlu, 2010).

When it comes to adult education, lifelong education has the most important role in especially higher education following the secondary education and increasing the quality of human capital. In this context, open and distance education in Turkey is of great importance in lifelong education. Anadolu University is the leading university in terms of the number of students and adult education in Turkey with the Faculty of Open Education where open and distance education is given.

In parallel with the year in which the Financial Development Index was calculated, the year 2012 was also taken into consideration in the data related to the Faculty of Open Education. The dependent and independent variables included in the study are presented in Table 2.

Table 2: Variables Used in the Study and Their Definitions (2012 values)

Dependent Variables		Independent Variable	
y1	New Enrolments	fige	The Provincial Financial Development Index
y2	Additional Placements		
y3	Vertical Transitions		
y4	Degree Completions		
y5	The Second University Enrolments		
y6	Renewal of Enrolments		
y7	Total		

Source: Anadolu University, Open Education Faculty

The row data of the variables addressed in Table 2 which are 2012 values were given to the researchers with the special consent of Anadolu University, Deanship of the Faculty of Open Education.

The initial analyses and correlation diagrams results indicated the provinces of Istanbul, Ankara, and Izmir as the outliers consistent with our expectations. The outliers could weaken the

power of our estimation in linear and non-linear models. Since these 3 provinces are the settlements which display great differences from other provinces with both their financial index values and the number of students included in the Open Education System correlation diagrams were recreated by removing these provinces from the dataset.

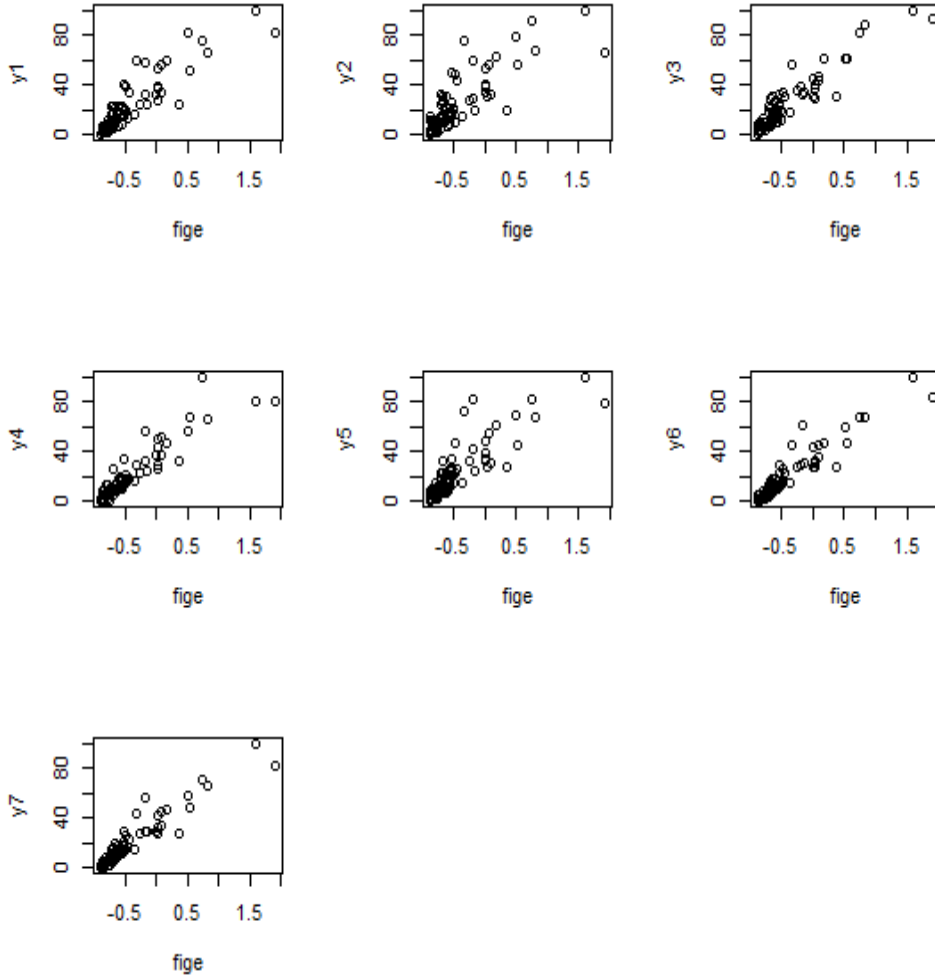


Figure 1: The Relationship Between fige and Dependent Variables

In these scatter diagrams displayed in Figure 1, the financial development index of the provinces except for Istanbul, Ankara and Izmir are on the horizontal axis and the dependent variables of the Open Education System included in Table 2 were given on the vertical axis.

2. Methodology and Analysis

In this study, two different regression models were considered, linear model (LM) and non-linear model (NLM), taking into account the relations between variables. The regression models were designed to reveal the effect of the independent variable on each dependent variable. The LM and NLM regression models were defined as in equations 1 and 2, respectively.

$$LM: y_i = \alpha + x_i' \beta + \varepsilon_i \quad (1)$$

In Equation (1) α is the constant term, y_i ($i = 1, 2, \dots, n$) is the dependent variable (response variable), x_i is the independent variable, β is the vector of slope parameters and ε_i are i.i.d. random error terms.

$$NLM: y_i = f(x_i) + \varepsilon_i \quad (2)$$

$f(x_i)$ itself included in Equation (2) is a continuous unknown smooth function in the first and second order partial derivatives $[a,b]$. While various selections of this function are possible, in the study, the natural cubic spline which renders the penalized error sum of squares minimum was used (Green and Silverman 1994; Hastie and Tibshirani, 1999; Omay, 2007; Wood, 2000; Wood, 2002).

While establishing the models, the data related to the demand for OEF were used with the normalization process being applied due to the normalization of the indexes calculated by Gül and Çevik (2014) as in Equation 3. The normalization formula is as follows:

$$Normalization = \frac{X - X_{min}}{X_{max} - X_{min}} \quad (3)$$

Where X_{min} and X_{max} are the lowest and the highest values of the significant variable, respectively.

All of the statistical analyses carried out in this study were conducted with the help of R program which contains methods, stats, graphics, splines, and MASS. (www.r-project.org).

All models excluding Istanbul, Ankara and Izmir were created initially by using the Linear, afterwards, the Non-Linear Regression Analysis. The results of LM and NLM analyses were displayed in Tables 3 and 4 respectively:

Table 3: Linear Models (LM) Created by Linear Regression Analysis

The Provincial Financial Development Index		β_0	β_1	Adj. R ²	F	AIC (Akaike Information Criteria)	Deviance
Model I (New Enrolments)	Coefficients (standard error)	38.057 (1.431)***	36.548 (2.078)***	0.8002	309.4	580.4023	7208.124
	t value	26.59	17.59				
Model II (Additional Placements)	Coefficients (standard error)	39.250 (1.913)***	34.518 (2.778)***	0.6658	154.4	625.6991	12883.360
	t value	20.51	12.43				
Model III (Vertical Transitions)	Coefficients (standard error)	39.808 (1.199)***	38.395 (1.740)***	0.8632	486.8	552.7334	5055.512
	t value	33.21	22.06				
Model IV (Degree Completions)	Coefficients (standard error)	35.765 (1.216)***	35.786 (1.765)***	0.8419	411.1	554.9367	5200.350
	t value	29.42	20.28				
Model V (The Second University Enrolments)	Coefficients (standard error)	38.811 (1.723)***	35.913 (2.501)***	0.7272	206.2	609.3047	10441.120
	t value	22.53	14.36				
Model VI (Renewal of Enrolments)	Coefficients (standard error)	34.793 (1.044)***	35.483 (1.515)***	0.8767	548.5	531.1296	3832.462
	t value	33.34	23.42				
Model VII (Total)	Coefficients (standard error)	34.813 (0.984)***	35.367 (1.428)***	0.8883	613.2	521.9086	3405.151
	t value	35.39	24.76				

Significant codes: 0 '****' 0.001 '***' 0.01 '**'

All the models and their coefficients created with linear regression turned out to be statistically significant with the F and t-test according to Table 3. Afterwards, the non-linear regression models were created with the penalized least squares method. These are presented in Table 4:

Table 4: Non-Linear Models (NLM) Created by Spline Regression

The Provincial Financial Development Index		β_0	$f(fige)$	Adj. R ²	AIC	Deviance
Model I (New Enrolments)	Coefficients (standard error)	22.0090 (1.036)	3.722			
	t and F values	t=21.25	F=79.33	0.824	575.2195	6130.85
	p values	<2e-16***	<2e-16***			
Model II (Additional Placements)	Coefficients (standard error)	24.0930 (1.361)	4.611			
	t and F values	t= 17.71	F=34.77	0.715	618.622	10453.98
	p values	<2e-16***	<2e-16***			
Model III (Vertical Transitions)	Coefficients (standard error)	22.9489 (0.8296)	5.701			
	t and F values	t=27.66	F=90.93	0.890	542.4397	3827.958
	p values	<2e-16***	<2e-16***			
Model IV (Degree Completions)	Coefficients (standard error)	20.0513 (0.8074)	5.476			
	t and F values	t=24.83	F=87.98	0.883	537.9987	3637.032
	p values	<2e-16***	<2e-16***			
Model V (The Second University Enrolments)	Coefficients (standard error)	23.0420 (1.191)	5.705			
	t and F values	t=19.35	F=40.28	0.780	598.8163	7885.287
	p values	<2e-16***	<2e-16***			
Model VI (Renewal of Enrolments)	Coefficients (standard error)	19.2121 (0.7148)	6.179			
	t and F values	t=26.88	F=97.69	0.903	519.6321	2822.597
	p values	<2e-16***	<2e-16***			
Model VII (Total)	Coefficients (standard error)	19.2800 (0.66)	6.238			
	t and F values	t=29.21	F=113	0.915	507.2455	2404.533
	p values	<2e-16***	<2e-16***			

Significant codes: 0 '***' 0.001 '**' 0.01 '*'

Based on the NLM estimation results, the parameters are also significant smaller than % 0.001 level. However, the non-linear models in Table 4 have a much better performance when

compared to the linear models in Table 3 according to R^2 , the Akaike Information Criterion, and Deviations. The R^2 value of nonlinear models turned to be higher, and the Akaike Information Criteria and deviations much lower. Thus, we created models which can much better represent the dataset in our hand with nonlinear regression. It is especially necessary to display the curvilinear graphic structure of these models. NLM Curve and confidence intervals are given in Figure 2:

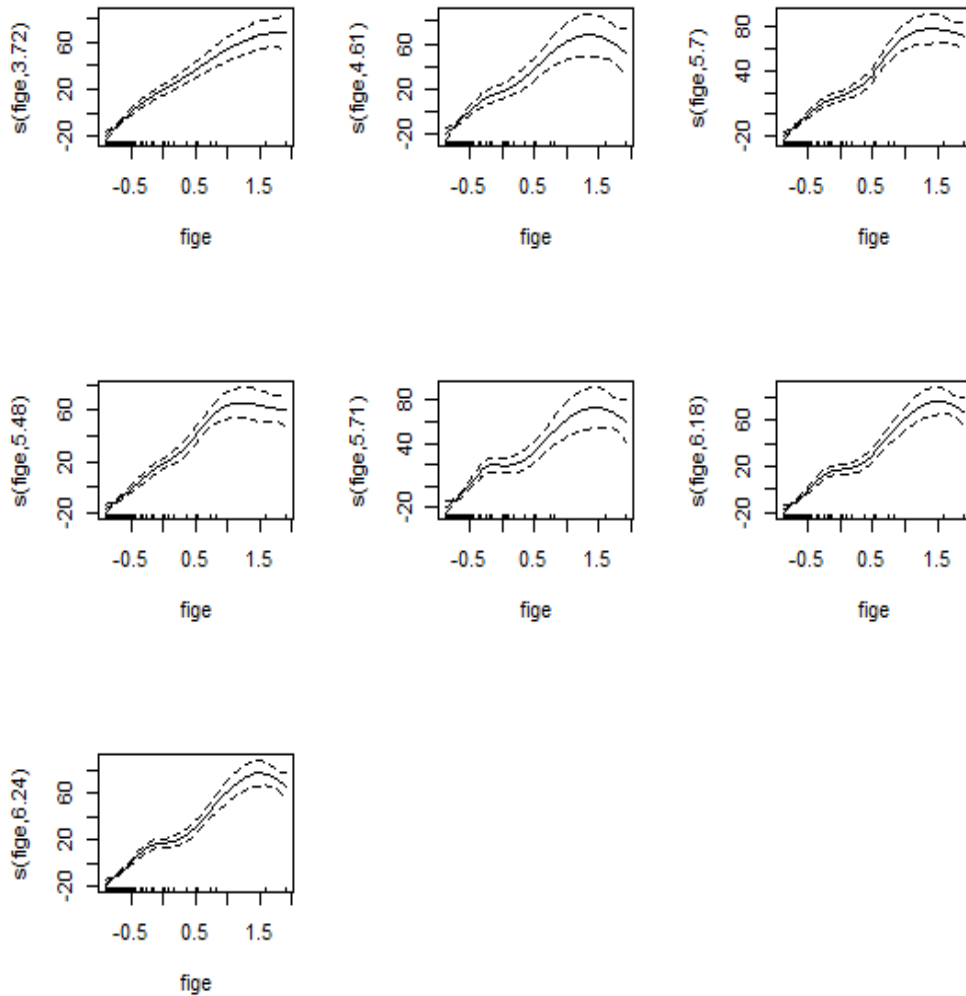


Figure 2: Curves of Relationship between Fige and Dependent Variables

The degrees of freedom were observed for every variable on the vertical axis of Figure 2. The degrees of freedom of 3.72 for y_1 ; 4.61 for y_2 ; 5.7 for y_3 ; 5.48 for y_4 ; 5.71 for y_5 ; 6.18 for y_6 and 6.24 for y_7 , were determined regarding the Open Education System included in Table 2.

3. Conclusion

The differing financial development levels of the provinces in Turkey is one of the most important starting point of the planned development. Accordingly, the realization of financial development within the country at different speeds, exposes some disparities. The development levels between the provinces in the country can be balanced by implementation of successful financial policies which are based on the results and the interpretation of such spatial studies. One of the most important indicators taken into account in determining the differences in development is education. Therefore, open and distance education together with lifelong learning will be the topics which will gain greater importance for every other day. Because, education must be considered as lifelong continuous information-obtaining, learning and research process in the information age.

The banks in developed economies, while they execute economic transactions, are used extensively in the transactions of disposition and storage of income and borrowing. The loans provided by the banks to finance commercial and industrial activities are directly related to the investment potential and the tendency of savings to turn into an investment. With regard to the banking transactions, the elements such as saving volume, provided loan level and the extensiveness of the services are defined as the development indicators. In other words, the banking system which has the feature of creating money is significant in diminishing development discrepancies due to ensuring the growth of revenue.

This study was produced with the aim of being helpful for the decision makers of the provinces to be able to see the big picture. Within the educational perspective of the country, which will be able to reflect the province-based demand level for the Open Education System in terms of the financial development in Turkey. The relations between the index value created with the financial variables that we used in our analysis and the demand for the Open Education System were examined by using both linear and non-linear models. Although the models and coefficients turned out to be statistically significant, it was seen that the non-linear models have a better performance according to R^2 , the Akaike Information Criterion, and Deviation values. As a consequence, we were able to ascertain and clarify via the non-linear models that the financial development index of the provinces affects the demand for the Open Education positively and with a curvilinear relation.

References

- Ak, Mehmet Zeki; Altıntaş, Nurullah; Şimşek, Ahmet Salih, (2016), "Türkiye'de Finansal Gelişme ve Ekonomik Büyüme İlişkisinin Nedensellik Analizi", *Doğuş Üniversitesi Dergisi*, Vol. 17, No. 2: 151-160.
- Berberoğlu, Bahar, (2017), "Anadolu Üniversitesi Açık ve Uzaktan Eğitim Programlarındaki Jenerasyonlar ve Gelişmeler", *Manisa Celal Bayar Üniversitesi Sosyal Bilimler Dergisi*, Vol. 15, No. 1: 531-554.
- Berberoğlu, Bahar, (2016), "Social Capital and Lifelong Education" *Intenational Journal of Business, Humanities and Technology*, Vol.6, No.2: 9-16
- Berberoğlu, Bahar, (2010), "Ekonomik Performansın Anadolu Üniversitesi'nde Uzaktan Eğitim Yapan Fakültelerin Mezun Sayılarına Etkisi", *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, Vol. 10, No. 2: 99-110.
- Green, Peter, J.; Silverman, Bernard, W., (1994), *Nonparametric regression and generalized linear models*, London: Chapman & Hall.
- Gül, H. Erhan; Çevik, Bora, (2014), 2010 ve 2012 Verileriyle Türkiye'de İllerin Gelişmişlik Düzeyi Araştırması, Türkiye İş Bankası, İktisadi Araştırmalar Bölümü, Şubat. https://ekonomi.isbank.com.tr/userfiles/pdf/ar_03_2012.pdf (Erişim: 15.10.2015).
- Hastie, Trevor, J.; Tibshirani, Robert, (1999), *Generalized additive models*, London: Chapman & Hall.
- Huang, Yongfu, (2005), What Determines Financial Development?, Bristol Economics Discussion Paper, No. 05/580.
- Kar, Muhsin; Peker, Osman; Kaplan, Muhittin, (2008), "Trade Liberalization Financial Development and Economic Growth in The Long Run: The Case of Turkey", *The South East European Journal of Economics and Business*, Vol. 3, No. 2; 25-38.
- Lynch, David, (1996), "Measuring Financial Sector Development: A study of Selected Asia-Pacific Countries", *The Developing Economies*, Vol. 34, No. 1; 3-33.
- Miser, Rifat, (2002), "Küreselleşen Dünyada Yetişkin Eğitimi", *Ankara Üniversitesi, Eğitim Bilimleri Fakültesi Dergisi*, Vol. 35, No. 1-2; 55-60.
- Öcal, Tezer; Çolak, Ömer, Faruk, (1999), *Finansal Sistemler ve Bankalar*, Nobel Yayın Dağıtım, Ankara.
- Omay, Rabia Ece. (2007), "Regresyonda Pürüzlülük Ceza Yaklaşımı", Anadolu University, Graduate School of Science, Unpublished PhD Dissertation Thesis, Eskişehir, Turkey
- Saldanlı, Arif; Şeker, Murat, (2013), "Finansal Gelişim Endeksi: Türkiye'deki İllerin Finansal Gelişim Seviyelerinin Ölçülmesi İçin Bir Yaklaşım", *MÖDAV*, 3; 17-38.
- Wood, Simon, N, (2000), "Modeling and smothing parameter estimation with multiple quadratic penalties", *Journal of Royal Statistical Society, Ser. B*, 62; 413-428.
- Wood, Simon, N; Augustin, Nichole, H., (2002), "GAMs with integrated model selection using penalized regression splines and applications to environmental modelling", *Ecological Modelling*, 157; 157-177.
- www.anadolu.edu.tr/universitemiz/sayilarla-universitemiz
- www.r-project.org
- Yamanoğlu, Kemal Buğra, (2008), "Türkiye'de Sosyoekonomik Faktörlerin İller Arası Yakınsama Üzerine Etkileri", *İstatistikler Dergisi*, 1; 33-49.