Journal of Applied Finance & Banking, vol. 4, no. 1, 2014, 181-191
ISSN: 1792-6580 (print version), 1792-6599 (online)
Scienpress Ltd, 2014

Efficiencies of Life/Pension Insurance Industry in Turkey: An Application of Data Envelopment Analysis

Nilüfer Dalkılıç[1] and Ayşen Altun Ada[2]

Abstract

In the study, scale efficiencies of life insurance and/or private pension companies in Turkey are analyzed using Data Envelopment Analysis (DEA) over the period 2010-2011. In the study, input driven BCC model is used for measuring scale efficiency. Compared to the previous year, an increase in the average scale efficiency of life insurance companies is detected in 2011, while a decrease in the average is detected for the companies in the life insurance and/or private pension branch. When life insurance companies and life insurance and/or private pension companies are assessed in general, the average scale efficiency of the companies was 92% in 2010 and 88.7% in 2011. In 2011 a decrease of 3.3% is seen. While 14 companies were efficient in 2010, in 2011 12 companies were efficient.

JEL classification numbers: G14, G22
Keywords: Life insurance companies, Life insurance and private pension companies, Data envelopment analysis, Scale efficiency.

1 Introduction

The life insurance and private pension industries in Turkey are regarded as industries with a potential for growth where the number of participants is increasing. This structure makes capital investment desirable for the companies in the industry. In this regard, acquisitions and mergers are quite common in the industry. In the study, the scale efficiencies of these companies with a potential for growth are analyzed. Because life insurance companies in Turkey may also provide private pension service, life insurance and/or private pension companies are included in the study.

[1]Assist.Prof.Dr., Dumlupinar University, Department of Insurance and Risk Management, Kutahya, Turkey.
[2]Assist.Prof.Dr., Dumlupinar University, Department of Banking and Finance, Kutahya, Turkey.

Article Info: *Received :* October 1, 2013. *Revised :* November 5, 2013.
Published online : January 1, 2014

The objective of the study is to analyze the scale efficiencies of the companies in life insurance and private pension industries over the period 2010-2011. In the study, primarily literature review and Data Envelopment Analysis (DEA), the method used in the study, is mentioned. The data and samples used are explained and the findings obtained in result of the analysis are discussed. In the study, the scale efficiency scores and ranking obtained in respect of the input driven BCC model are assessed. The reference sets and target values in respect of the input and output values of the companies which were inefficient in 2011 are discussed.

2 Literature Review

In the literature there are many studies conducted for measuring the efficiencies of companies in the life insurance industry using DEA. Only the studies conducted for the life insurance industry using DEA are discussed in this study.

Fukuyama [1] analyzed the production efficiency and productivity of life insurance companies in Japan over the period 1988-1993 using DEA. Life insurance companies were assessed in two separate groups as mutual and stock companies. In the study it is concluded that the main reason for the overall technical inefficiency is pure technical inefficiency in mutual companies and scale inefficiency in stock companies. Kılıçkaplan and Karpat [2] analyzed the technical, pure and scale efficiencies of companies of various sizes in life insurance industry in Turkey. The period they analyzed is 1998-2002. They preferred the Tobit Model for measuring the efficiency analysis. The number of companies, premiums and variables showing the effects of the 2000 crisis and the earthquake were used as the factors affecting efficiency. They concluded that especially the act of god and economic crisis which occurred in the period analyzed caused the decrease in efficiency scores. Tone and Sahoo [3] analyzed the efficiency of Life Insurance Corporation of India using DEA over the period 1982-2001. They detected that the cost efficiency of the corporation within the period analyzed is significantly dispersed. Qiu and Chen [4] analyzed the relative efficiency of life insurance companies in China over the period 2000-2003. They found that the technical efficiency scores of life insurance companies in China are dispersed. They have reached the conclusion that traditional life insurance companies have the power to become monopolized. Another conclusion they have reached is that small scale life insurance companies are not as competitive as the others. The findings show that the average technical efficiency of the life insurance industry is decreasing and the efficiency of many life insurance companies in China is increasing. Yang [5] analyzed the efficiencies of life and health insurance companies in Canada in respect of their investment and production performance for the year 1998. He used the two-stage data envelopment analysis method. He concluded that the industry was quite efficient during the year analyzed. Diboky and Ubl [6] researched the effect of ownership over efficiency by analyzing the life insurance companies in Germany over the period 2002-2005. They investigated the stock, mutual and public ownership forms. They found no evidence supporting the view that public ownership is an efficient corporate structure for life insurance companies. They have reached the conclusion that small scale private insurance companies dominate in production technology. It is emphasized that private property is superior to both public-private partnership and public property structure. Hussels and Ward [7] compared the life insurance companies in Germany and UK over the period 1991-2002. They concluded

that German industry dominated UK cost efficiency in this study aiming to conduct an inter-country analysis of deregulation and industry efficiency in the European insurance industry. Additionally, they found evidence supporting the expense preference hypothesis. Wu et al. [8] analyzed the production and investment performance of life and health insurance companies in Canada over the period 1996-1998. They concluded that the companies are efficient but lack scale efficiency. Borges et al. [9] analyzed the life insurance companies in Greece over the period 1994-2003. They used the DEA-CCR, DEA-BCC, Cross-Efficiency and the Super-Efficiency models. The basic conclusion they have reached is that companies working in company mergers and acquisitions perform higher activity. Hu et al. [10] analyzed the foreign and local life insurance companies in China in their study aiming to evaluate the efficiencies of life insurance companies and investigate the relationship between ownership structure and efficiency of insurance companies. The period analyzed is 1999-2004. The results indicate that the average efficiency scores of all insurance companies are cyclical. The findings indicate that the average activity scores of all insurance companies are cyclical. Technical activity and scale activity peaked in 1999 and 2000 and gradually dropped until 2004. Shahroudi et al. [11] analyzed the efficiency of insurance companies in Iran over the period 2006-2007 using the traditional DEA and two-stage DEA models. They specified the inputs and outputs as investment and marketing. They concluded that the Iran Moein company was efficient in terms of marketing over the period investigated and this company was inefficient in 2007 due to the weakness in the investment sub-process. Köse [12] observed that three companies in his sample were constantly efficient and the other companies demonstrated cyclically dispersed efficiencies in his study in which he analyzed the efficiencies of life insurance and private pension companies in Turkey over the period 2004-2008. He concluded that the inefficient companies need to reduce their inputs in order to become efficient. Md Saad and Haji Idris [13] comparatively analyzed the efficiencies of the life insurance industries in Brunei and Malaysia using DEA. The period analyzed is 2000-2005. They found that the total factor productivity of the life insurance industry is mainly due to both efficiency and technical changes. Another finding was that the main source of the efficiency change is scale efficiency rather than pure efficiency. Dutta and Sengupta [14] measured the efficiency and scale efficiency of life insurance companies in India using DEA. They chose the period 2004-2009. They concluded that the most efficient companies vary in type and a certain type does not dominate the market. In the period analyzed, scale efficiency decreased while average technical efficiency increased. They concluded their study emphasizing that their findings shed light on the future development of the policy design and life insurance sector in India. Lin [15] used DEA for evaluating the operating efficiencies of life insurance companies in Taiwan. The 25 life insurance companies analyzed within the study were categorized in four different classes. Each company has made various suggestions to improve their own class. In the study where the 2010 data was sourced, the findings indicate that the companies investigated are either of high product efficiency and low profit or low product efficiency and profit.

3 Methodology and Data

DEA is a typical non-parametric method for measuring efficiency by evaluating all the input and output combinations of the companies in the sample and generating efficiency frontiers [16]. When compared with econometric methods, DEA prevents many subjective factors as it doesn't require production function assumptions. Traditional econometric methods, on the other hand, necessitate assumptions for both production function and random errors. Regressions and tests could be performed based on these assumptions. The modified production curve could be corrected at the end. In addition, activity score could be found by measuring the distance between the actual point of production and the curve. DEA has the potential to compare one decision making unit directly with other decision making units or convex linear combinations. It is possible to prevent many subjective errors in this process. DEA works smoothly with multiple inputs and multiple outputs. This means that DEA score includes more information than the ratio analysis generally used. [4]. The method compares all the input and output combinations of all companies with efficient companies. While efficient companies receive an efficiency score of 1, the others are less efficient companies with an efficiency score of less than 1. However, a score less than 0 shall not be received [16].

In the study, the efficiencies of life insurance and/or private pension companies are evaluated using DEA Solver software program according to the DEA method. Efficiency measurement is conducted using the input driven BCC model. The efficiencies of the companies are assessed in the study by using 4 input and 3 output variables. The input variables are: shareholders' equity, operating expenses, number of agencies and number of staff employed by insurance companies. Output variables are: net gross written premiums, net claims incurred and net technical provisions.

The fields the companies in the insurance industry in Turkey operate are divided into two branches as life and nonlife. In Article 5 of the Insurance Law, it is specified that "*an insurance company may provide operations in only one branch, either life or nonlife.*" In Article 10 of the Regulation on Founding and Working Principles of Private Pension Companies, it is specified that "*a private pension company may obtain licenses in life insurance and accident insurance branches and with these licenses it may provide any coverage and supplemental coverage that may be provided by an insurance company*" ([17], [18]). A company providing operations in life insurance and private pension branch in Turkey, may provide operations in only one of either "life insurance", "life insurance and private pension" or "private pension" branches. In the study, companies providing operations in the life insurance branch only are addressed as "life insurance companies," while companies providing operations in the life insurance and private pension branches together with those in the private pension branch only are collectively addressed as "life insurance and/or private pension companies." The sample in the study comprises 6 life insurance companies and 14 life insurance and/or private pension companies, 20 in total. The sample in the study is listed in Table 1.

Table 1: The sample in the study

Life Insurance Companies	**Life Insurance and/or Private Pension Companies**
ACIBADEM SAĞLIK VE HAYAT SİGORTA A.Ş.	AEGON EMEKLİLİK VE HAYAT A.Ş.
AMERICAN LIFE HAYAT SİGORTA A.Ş.	ALLİANZ HAYAT VE EMEKLİLİK A.Ş.
BNP PARIBAS CARDIF HAYAT SİGORTA A.Ş.	ANADOLU HAYAT EMEKLİLİK A.Ş.
CIV HAYAT SİGORTA A.Ş.	AVİVASA EMEKLİLİK VE HAYAT A.Ş.
DEMİR HAYAT SİGORTA A.Ş.	ERGO EMEKLİLİK VE HAYAT A.Ş.
MAPFRE GENEL YASAM SİGORTA A.Ş.	FİNANS EMEKLİLİK VE HAYAT A.Ş.
	GARANTİ EMEKLİLİK VE HAYAT A.Ş.
	GROUPAMA EMEKLILIK A.Ş.
	İNG EMEKLİLİK A.Ş.
	VAKIF EMEKLİLİK A.Ş.
	YAPI KREDİ EMEKLİLİK A.Ş.
	ZİRAAT HAYAT VE EMEKLİLİK A.Ş.
	AXA HAYAT VE EMEKLİLİK A.Ş.
	HALK HAYAT VE EMEKLİLİK A.Ş.

In order to cover the recent period, the study is conducted over the period 2010-2011. The data in the study is obtained from the reports on life insurance and private pension operations in Turkey for the years 2010 and 2011 ([19], [20]). Because the 2010 data for Cigna Hayat Sigorta A.Ş.[3], BNP Paribas Cardif Emeklilik A.Ş.[4], Metlife Emeklilik ve Hayat A.Ş.[5] and 2011 data for NEW LIFE Yaşam Sigorta A.Ş., Fortis Emeklilik ve Hayat A.Ş. and Deniz Emeklilik ve Hayat A.Ş. does not exist, these companies are not included in the study.

[3]Commenced business in 2011 [21].

[4]"Fortis Emeklilik ve Hayat A.Ş." became the brand "BNP Paribas Cardif Emeklilik" as a subsidiary of BNP Paribas Cardif Türkiye as of July 15th 2011 [22].

[5]Acquired by MetLife, Deniz Emeklilik continues business under the title "MetLife Emeklilik ve Hayat A.Ş." as of April 2nd 2012 [23].

4 Empirical Results

The results of the efficiency measurement conducted using the input driven BCC model are shown in Table 2.

Table 2: Scale efficiencies of life insurance and/or private pension companies over the period 2010-2011

	Life and Life Insurance and/or Private Pension Companies	2010		2011	
		Efficiency Score	**Ranking**	**Efficiency Score**	**Ranking**
Life Insurance Companies	Acıbadem Sağlık ve Hayat Sigorta	0.688	18	0.944	14
	American Life Hayat Sigorta	1	1	0.970	13
	BNP Paribas Cardif Hayat Sigorta	1	1	1	1
	CIV Hayat Sigorta	1	1	1	1
	Demir Hayat Sigorta	1	1	1	1
	Mapfre Genel Yasam Sigorta	1	1	1	1
Life Insurance and/or Private Pension Companies	Aegon Emeklilik ve Hayat	0.636	19	0.386	20
	Allianz Hayat ve Emeklilik	1	1	1	1
	Anadolu Hayat ve Emeklilik	1	1	1	1
	Avivasa Emeklilik ve Hayat	1	1	1	1
	Ergo Emeklilik ve Hayat	1	1	1	1
	Finans Emeklilik ve Hayat	0.432	20	0.476	19
	Garanti Emeklilik ve Hayat	0.749	17	1	1
	Groupama Emeklilik	1	1	0.721	17
	İNG Emeklilik	1	1	0.645	18
	Vakıf Emeklilik	0.965	15	0.781	16
	Yapı Kredi Emeklilik	1	1	1	1
	Ziraat Hayat ve Emeklilik	1	1	1	1
	AXA Hayat ve Emeklilik	1	1	1	1
	Halk Hayat ve Emeklilik	0.923	16	0.822	15
	average scale efficiency	**0.920**		**0.887**	
	percentage of efficiency	**%92**		**%88.7**	

When life insurance companies and life insurance and/or private pension companies are assessed in general, the average scale efficiency of the companies was 92% in 2010 and 88.7% in 2011. In 2011 a decrease of 3.3% is seen. While 14 companies were efficient in 2010, in 2011 12 companies were efficient.

The average scale efficiency of life insurance companies was %94.8 in 2010 and 98.6% in 2011. Among life insurance companies, 5 companies were 100% efficient in 2010 and 4 companies in 2011. In 2011, while the scale efficiency of Acıbadem Sağlık ve Hayat Sigorta increased, the efficiency of Amerikan Life Hayat Sigorta decreased. While the scale efficiency of Acıbadem Sağlık ve Hayat Sigorta increased 25.6%, the efficiency of Amerikan Life Hayat Sigorta decreased 3%. In 2011, the other companies maintained their efficiencies in 2010.

When the average scale efficiency of life insurance and/or private pension companies is assessed, it is detected that it was 90.8% in 2010 and 84.5% in 2011. In 2011, a decrease of 6.3% is seen compared to 2010. In 2010, Finans Emeklilik ve Hayat was the company with the lowest efficiency at 43.2%. The scale efficiencies of some companies increased

in 2011 compared to 2010. The scale efficiency of Finans Emeklilik ve Hayat increased 4.4% and the scale efficiency of Garanti Emeklilik ve Hayat increased 25.1%.
Allianz Hayat ve Emeklilik, Anadolu Hayat ve Emeklilik, Avivasa Emeklilik ve Hayat, Ergo Emeklilik ve Hayat, Groupama Emeklilik, ING Emeklilik, Yapı Kredi Emeklilik, Ziraat Hayat ve Emeklilik and AXA Hayat ve Emeklilik were efficient in both 2010 and 2011.
The efficiencies of some companies decreased in 2011 compared to 2010. The scale efficiency of Aegon Emeklilik ve Hayat Sigorta decreased 25%, that of Groupama Emeklilik 27.9%, Vakıf Emeklilik 18.4% and Halk Hayat Emeklilik 10.1%.
The efficiency scores and ranking of life insurance and/or private pension companies over the period 2010-2011 are listed in Table 3.

Table 3: Efficiency scores and ranking of life insurance and/or private pension companies over the period 2010-2011

2010			**2011**		
Ranking	**Life and Life Insurance and/or Private Pension Companies**	**Efficiency Score**	**Ranking**	**Life and Life Insurance and/or Private Pension Companies**	**Efficiency Score**
1	American Life Hayat Sigorta	1	1	AXA Hayat ve Emeklilik	1
1	AXA Hayat ve Emeklilik	1	1	BNP Paribas Cardif Hayat Sigorta	1
1	BNP Paribas Cardif Hayat Sigorta	1	1	CIV Hayat Sigorta	1
1	CIV Hayat Sigorta	1	1	Demir Hayat Sigorta	1
1	Demir Hayat Sigorta	1	1	Mapfre Genel Yasam Sigorta	1
1	Mapfre Genel Yasam Sigorta	1	1	Allianz Hayat ve Emeklilik	1
1	Allianz Hayat ve Emeklilik	1	1	Anadolu Hayat ve Emeklilik	1
1	Anadolu Hayat ve Emeklilik	1	1	Avivasa Emeklilik ve Hayat	1
1	Avivasa Emeklilik ve Hayat	1	1	Ergo Emeklilik ve Hayat	1
1	Ergo Emeklilik ve Hayat	1	1	Garanti Emeklilik ve Hayat	1
1	Groupama Emeklilik	1	1	Yapı Kredi Emeklilik	1
1	İNG Emeklilik	1	1	Ziraat Hayat ve Emeklilik	1
1	Yapı Kredi Emeklilik	1	13	American Life Sigorta	0.970
1	Ziraat Hayat ve Emeklilik	1	14	Acıbadem Sağlık ve Hayat Sigorta	0.944
15	Vakıf Emeklilik	0.965	15	Halk Hayat ve Emeklilik	0.822
16	Halk Hayat ve Emeklilik	0.923	16	Vakıf Emeklilik	0.781
17	Garanti Emeklilik ve Hayat	0.749	17	Groupama Emeklilik	0.721
18	Acıbadem Sağlık ve Hayat Sigorta	0.688	18	İNG Emeklilik	0.645
19	Aegon Emeklilik ve Hayat	0.636	19	Finans Emeklilik ve Hayat	0.476
20	Finans Emeklilik ve Hayat	0.432	20	Aegon Emeklilik ve Hayat	0.386

The most remarkable difference in the efficiency ranking of the companies in 2011 is that American Life, which ranked at the top in 2010, was ranked 13th among the 20 companies in 2011. While American Life was an 100% efficient company in 2010, its efficiency decreased to 97% in 2011. While Garanti Emeklilik ve Hayat was inefficient in 2010, it became efficient in 2011. In the scale efficiency ranking, Garanti Emeklilik ve Hayat rose to 10th place in 2011 while it was in 17th place in 2011. The company increased its efficiency score by 25.1% from 74.9% in 2010 to 100% in 2011. The company which increased its scale efficiency most in 2011 is Acıbadem Sağlık ve Hayat Sigorta with an increase of 25.6%. The ranking of the company in scale efficiency also increased. Finans Emeklilik ve Hayat had a scale efficiency increase of 4.4%. The efficiencies of some companies decreased in 2011. The efficiency of ING Emeklilik decreased 35.5%, that of Vakıf Emeklilik 18.4%, Halk Hayat ve Emeklilik 10.1%, Aegon Emeklilik ve Hayat 25% and Groupama Emeklilik 27.9%. The reference sets and weight of inefficient life insurance and/or private pension companies in 2011 are listed in Table 4.

Table 4: Reference sets and weight of inefficient life insurance and/or private pension companies in 2011

Life and Life Insurance and/or Private Pension Companies										
Acıbadem Sağlık ve Hayat Sigorta	DEMİR	0.478582	MAPFRE	0.367649	ALLİANZ	7.86E+12	ZİRAAT	7.52E+12		
American Life Hayat Sigorta	CİV	0.571114	DEMİR	3.55E+12	ALLİANZ	0.155895	YAPI KREDİ	0.201183	ZİRAAT	3.63E+12
Halk Hayat ve Emeklilik	CİV	0.43848	DEMİR	0.306447	ALLİANZ	5.88E+12	YAPI KREDİ	3.33E+11	ZİRAAT	0.192928
Aegon Emeklilik ve Hayat	AXA	2.71E+12	CİV	0.641597	DEMİR	0.327028	ALLİANZ	3.60E+11	ZİRAAT	6.72E+10
Finans Emeklilik ve Hayat	CİV	0.869355	DEMİR	7.84E+11	GARANTİ	2.82E+11	ZİRAAT	0.119986		
Groupama Emeklilik	DEMİR	0.763213	ALLİANZ	0.108607	ANADOLU	5.56E+12	YAPI KREDİ	1.62E+12	ZİRAAT	5.64E+12
İNG Emeklilik	CİV	0.701028	DEMİR	0.283683	ZİRAAT	1.53E+12				
Vakıf Emeklilik	CİV	5.50E+12	DEMİR	0.495452	ALLIANZ	4.25E+11	YAPI KREDİ	0.325528	ZİRAAT	0.11978

When the reference company status of life insurance and/or private pension companies is analyzed, it is seen that Ziraat Hayat ve Emeklilik and Demir Hayat Sigorta were the reference companies for all 8 inefficient companies in 2011. CIV Hayat and Allianz Hayat ve Emeklilik were the reference companies for 6 companies. It is seen that Yapı Kredi Emeklilik was the reference company for 4 companies. It is seen that AXA Hayat ve Emeklilik, Mapfre Genel Yaşam Sigorta, Anadolu Hayat ve Emeklilik, and Garanti Emeklilik ve Hayat were the reference companies for only 1 company. BNP Paribas Cardif Hayat Sigorta, Ergo Emeklilik ve Hayat and Avivasa Emeklilik ve Hayat were not reference companies.

Table 5: Percentage of change for input and output variables of inefficient life insurance and/or private pension companies in 2011

	Shareholders' Equity Change %	Operating Expenses Change %	Number of Agencies Change %	Number of Staff Change %	Net Gross Written Premiums Change %	Net Claims Incurred Change %	Net Technical Provisions Change %
Acıbadem Sağlık ve Hayat Sigorta	-5,65%	-5,65%	-21,36%	-66,08%	0%	0%	221,13%
American Life Hayat Sigorta	-88,52%	-2,97%	-2,97%	-2,97%	37.68%	0%	0%
Halk Hayat ve Emeklilik	-53%	-17,74%	-17,74%	-17,74%	0%	56,15%	0%
Aegon Emeklilik ve Hayat	-78,46%	-61,35%	-61,35%	-61,35%	0%	155,26%	0%
Finans Emeklilik ve Hayat	-52,42%	-52,42%	-52,42%	-83,59%	0%	115,47%	165,28%
Groupama Emeklilik	-44.59%	-27,90%	-27,90%	-27,90%	39,83%	0%	0%
İNG Emeklilik	-35,49%	-35,49%	-94,73%	-64,90%	0%	336,9%	51,99%
Vakıf Emeklilik	-42,34%	-21,93%	-21,93%	-21,93%	18,37%	0%	0%

Percentage of change for the inputs and outputs of life insurance and private pension companies are assessed just for 2011 in Table 5. When the target values for the inputs and outputs of the 8 inefficient companies in 2011 are assessed, it is seen that the inputs of these companies should be decreased. These 8 companies should decrease their operating expenses as well as the number of agencies and employees. As seen in the table, regarding output values, various outputs should be increased in each company and some outputs should not be changed. No conclusion is made such that output values should be decreased. When only the written premium variable is evaluated, it is concluded that no change should be made in Acıbadem Sağlık ve Hayat Sigorta, Halk Hayat ve Emeklilik, Aegon Emeklilik ve Hayat, Finans Emeklilik ve Hayat, ING Emeklilik and Vakıf Emeklilik. American Life Hayat Sigorta and Groupama Emeklilik should increase their written premiums.

5 Conclusion

In the study, scale efficiencies of 20 life insurance companies and life insurance and/or private pension companies in Turkey are analyzed. The average scale efficiency of the 20 companies analyzed decreased from 92% in 2010 to 87.7% in 2011. It is detected that 14 companies were efficient in 2010 and 12 companies in 2011.

The average scale efficiency of life insurance companies increased from 94.8% in 2010 to 98.6% in 2011. The average scale efficiency of life insurance and/or private pension companies decreased from 90.8% to 84.5% in 2010. When the average scale efficiency of life insurance companies is assessed, it is possible to conclude that they are more efficient than life insurance and/or private pension companies. It is seen that Ziraat Hayat ve

Emeklilik and Demir Hayat insurance companies are the reference companies for all the companies which were inefficient in 2011. When percentage of change for the inputs and outputs of the companies which are inefficient in 2011 are evaluated, it is concluded that 8 companies should decrease their input variables. Regarding output variables, different results are observed for each company. Some outputs should be increased while some should not be changed.

References

[1] H. Fukuyama, Investigating productive efficiency and productivity changes of Japanese life insurance companies, *Pacific-Basin Finance Journal*, 5(4), (1997), 481-509.

[2] S. Kılıçkaplan and G. Karpat, Türkiye hayat sigortası sektöründe etkinliğin incelenmesi, *D.E.Ü. İ.İ.B.F. Dergisi*, 19(1), (2004), 1-14.

[3] K. Tone and B.K. Sahoo, Evaluating cost efficiency and returns to scale in the life insurance corporation of India using data envelopment analysis, *Socio-Economic Planning Sciences*, 39(4), (2005), 261–285.

[4] S. Qiu and B. Chen, Efficiencies of life insurers in China - An application of data envelopment analysis, *China International Conference in Finance*, July, (2006), 1-38.

[5] Z. Yang, A two-stage DEA model to evaluate the overall performance of Canadian life and health insurance companies, *Mathematical and Computer Modelling*, 43(7-8), (2006), 910–919.

[6] F. Diboky and E.Ubl, Ownership and efficiency in the German life insurance market: a DEA bootstrap approach, *34 th Seminar of the European Group of Risk and Insurance Economics*, September, (2007), 1-40.

[7] S.Hussels and D. R. Ward, The Impact of deregulation on the German and UK life insurance markets: an analysis of efficiency and productivity between 1991-2002 , *Cranfield Research Paper Series*, (4), (2007), 1-24.

[8] D. Wu, Z. Yang, S.Vela and L. Liang, Simultaneous analysis of production and investment performance of Canadian life and health insurance companies using data envelopment analysis, *Computers & Operations Research*, 34(1), (2007), 180-198.

[9] M.R. Borges, M. Nektarios and C. P. Barros, Analysing the efficiency of the Greek life Insurance industry, *European Research Studies Journal*, 11(3), (2008), 35-52.

[10] X. Hu, C.Zhang, J.L. Hu, N. Zhu, Analyzing efficiency in the Chinese life insurance industry, *Management Research News*, 32(10), (2009), 905-920.

[11] K. Shahroudi, M. Taleghani and G. Mohammadi, Efficiency decomposition in data envelopment analysis: an application to insurance companies in Iran, *Interdisciplinary Journal of Contemporary Research in Business*, 3(4), (2011), 676-684.

[12] A.Köse, Türk sigorta sektörü hayat ve emeklilik şirketlerinin etkinlik analizi, *Akademik Araştırmalar Dergisi*, 12(44), (2010), 85-100.

[13] N. Md Saad, and N.E. Haji Idris, Efficiency of life insurance companies in Malaysia and Brunei: a comparative analysis, *International Journal of Humanities and Social Science*, 1(3), (2011), 111-122.

[14] A. Dutta and P.P. Sengupta, Efficiency measurement of Indian life insurance industry in post-reforms era, *Global Business Review*, 12(3), (2011), 415-430.

[15] H.T. Lin, Two-stage evaluation of life insurance industry in Taiwan using data envelopment analysis, *Advanced Materials Research*, (468-471), (2012), 2588-2598.
[16] M. Luhnen, Determinants of efficiency and productivity in German property-liability insurance: evidence for 1995–2006, *Geneva Papers on Risk & Insurance - Issues & Practice*, 34(3), (2009), 483-505.
[17] http://www.tsrsb.org.tr/default.aspx?pageID=654&yid=189.
[18] http://www.tsrsb.org.tr/Document/Yonetmelikler/Emeklilik_Sirketleri_Kurulus_ve_Calisma_Esaslari_Hakkinda_Yonetmelik_0.pdf.
[19] SDK- Sigorta Denetleme Kurulu, 2011 yılı Türkiye'de sigortacılık ve bireysel emeklilik faaliyetleri hakkında rapor, (2011): http://www.hazine.gov.tr/default.aspx?nsw=BKsmUPQeFbnBXCDahrXm1A==-H7deC+LxBI8=&mid=247&cid=28&nm=318
[20] SDK- Sigorta Denetleme Kurulu, 2010 yılı Türkiye' de sigortacılık ve bireysel emeklilik faaliyetleri hakkında rapor, (2010): http://www.hazine.gov.tr/default.aspx?nsw=BKsmUPQeFbnBXCDahrXm1A==-H7deC+LxBI8=&mid=247&cid=28&nm=318#
[21] http://www.cigna.com.tr/tr/html/why/about/index.html.
[22] http://www.sigortacigazetesi.com.tr/haberler/81-haberler/1611-sigortann-ustalar-antalyada-bulutu.html.
[23] http://www.metlife.com.tr/tr/Bireysel/Duyurular-ve-Basin-ultenleri/DenizEmeklilikin-adi-MetLife-oldu---2-Nisan-2012.html.