A Model for Estimating the Value Added of the Life Insurance Market in Egypt: An Empirical Study

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Abstract

The paper is an attempt to develop a model for estimating the value added in the life insurance activity. It uses an extended version of Cobb-Douglas production function to measure efficiency of the life insurance companies in Egypt during the 1995 – 2008. The proposed model is used to examine the effects of the political and economic changes, which occurred during this period, on the efficiency of the industry. It is also utilized to rank the major Egyptian life insurance companies according to their efficiency. The study has five sections: First an introduction to the problem of the research. Second section is a review of the relevant literature. The third presents the proposed model and the explanatory variables relevant to the life insurance activity. The fourth section deals with empirical results of the model at the level of the individual companies and the market as a whole. Last section is the conclusion of the study. The empirical results show that the proposed model fits quite well in explaining the changes in the value added at both levels, the individual companies the market as a whole. The volume of the life insurance companies' investment portfolio has positive effect on the value added. Also the labor factor has the same effect, this dismiss the claim that this sector has excessive employment, especially in the publicly owned companies. Thus, the labor factor does not represent a burden to this sector, since labor elasticity is 0.202. Another conclusion is that, the political and economic changes that occurred after September 11, have great negative effect on the insurance industry in Egypt. This effect might be due to the increase in the prices and the costs of the insurance services in addition to the decline in the rate of return from investments.

Introduction and the Problem of the Study

Recently the world has witnessed many political and economic changes. This was due to the events of September 11, general movement to globalization, and the Gulf war in the Middle East. The changes might result in an increase in the revenues of large insurance companies at the expense of small ones, which lose its ability to compete in the market. For that reason there is a need to evaluate the performance of the life insurance companies, from time to time, to see any effects that result from these local or global changes. The efforts and efficiency of any firm could be measured through many different measures. Estimating the value added is one of the important and informative measures in this respect. Estimating the value added, generally, requires some accounting steps and procedures, which sometimes results in biased results. So we feel that there should be some objective method or model to judge the efficiency of life insurance companies and allow explaining the effects of any changes in the political and economic situation.

The main purpose of the study is to develop a model for measuring the efficiency of the life insurance sector in Egypt and extend it to capture the effect of the different events that occurred lately the Middle East. For that reason, the proposed model will be extended to explain the effects of changing prices on the value added in this sector of economic activity. The paper has five sections; the first section presents methodology and the limits of the study. The second is a review of the literature. The third deals with the model and the different explanatory variables used to estimate the model. Section four presents the empirical results of the model. The fifth is the conclusion and some recommendations.

I - Methodology and Limitations of the Study

The study utilizes an extended Cobb-Douglas production function to estimate the value added in the life insurance activity in Egypt. This is done at two levels: the individual life insurance companies, and the economy as a whole.

We used a log linear form of the Cobb-Douglas production function after extending it to include some extra explanatory variables. We added to the function a total cost variable to capture the effect of changing the general price level on the value added. In addition t we included some dummy variables to present the different individual life insurance companies, this helps to rank these companies according to their efficiency. We also, divided the period of study into two sub periods, one before the event of September 11 (1995 – 2001), the second period (2002 – 2008) and included another dummy variable to differentiate between the two sub periods. Due to the fact that the number of the companies in the Egyptian economy is small we use cross section and time series data. The data is taken from the" The Yearly Statistics Book" issued by the Egyptian Authority for Supervising and Controlling life Insurance Companies in Egypt.

II- Review of the Literature

There is a difference between the two concepts: "Efficiency" and "Productivity". Efficiency means the effectiveness and performance of any activity at a given level of technology, while productivity measures the performance of the activity taking into account any advance in the technology used1. Generally the efficiency concept depends on two elements namely: inputs and output of the activity. Efficiency is affected by many different related factors; consequently the effect of any single factor depends, to a large extent, on all other factors. All these factors, along with the interaction among them, are known as the determinants of efficiency.

Since insurance is a service industry, it has its own special characteristics which make it a unique case. It has special determinants that might differ from other economic activity. The main determinants of efficiency in such industry can be summarized as: its financial capability, the nature of the insurance services it offers, the marketing policies it uses, the strong relation between its prices and its previous experience, the relation of revenues with the past policies contracted, and not with the financial year. In addition it is subject to some kind or regulations and controls.

One of the most commonly used methods to study efficiency is Cobb-Douglas function and Translog function offered by Christensen R. and others 1. The function assumes that any function could be expressed with a Taylor Series of one or more variables. In its general form the Translog function could take the following form:

$$\mathrm{Ln}\mu_i = \propto_0 + \sum_{i=1}^{n} \propto_1 \mathrm{Ln}\ \times_i + \frac{1}{2}\sum_{i=1}^{n} \beta_1\ (\mathrm{Ln}\ \times_i)^2 + \sum \mathrm{C}_{iN}\ (\mathrm{Ln}\ \times_i)(\mathrm{Ln}\ \times_N) + \varepsilon_i$$

Where: u represents the quantity of output, X represents the quantity of different inputs, $\propto_0$, $\propto_1$, β_1, C_{iN} are the different coefficients.

In that function the coefficients are estimated for every output separately, then the values of the estimated outputs is computed by using their prices. Then the efficiency ratio is estimated for every company by dividing the sum of the actual values of output by the estimated values.

Efficiency Score $= \frac{\mu_i p_i}{\hat{u} P_i}$

μ_i = Actlual Values

$\hat{u}$ = Estimated Values

In this model the function should include two terms of error: one for the random error and one for the efficiency error term. These entire models have strict assumptions, which need to be verified,making using it a difficult task.

There are other methods for evaluating efficiency such as: "The Modified Programming Approach" which depends on solving some mathematical equations to present the optimal production curve and compute the variations between the points on that curve and points on the actual production curve. Also we find in the literature the "Statistical Frontier Approach" which depends on some statistical methods in estimating the optimal production curve. The methods used in this respect are either the Corrected Ordinary Least Square (COLS) or the Maximum Likelihood (ML). The Statistical Frontier could be either Stochastic or Deterministic. Some other methods could be found such as the "Index Number Approach" which reflect the changes in inputs and output between two different periods of time. Farrell introduced "The Pure Programming Approach "in 1957 and developed further by Copoer and Charnes4.

Now we turn to the value added as a measure of efficiency for the insurance companies. The value added of any sector in the economy is an indicator to the contribution of that sector to the Gross Domestic Product (GDP).

Consequently the value added for any life insurance firm consists of the total income from premiums and any commissions received from reinsurance with other insurance firms plus income from different investments minus all the different expenses and commissions paid for reinsurance for other firms and any compensations paid to policies' holders The value added could be computed, from the accounting perspective, using the following steps:

1. Computing the total value of the production during the financial period usually the calendar year. This consists of: a) all insurance premiums collected or in the process of collection b) the value of any services rendered to others c) any returns from any other activity which uses p art of the factors of production utilized by the firm
2. Computing the total value of the production of any other firms used as inputs to produce the output of the first step. This consists of a) all costs of production, such as commissions paid to agents...etc. b) the value of any services received from any other firm c) any beginning balances of the technical reserves and beginning balances of premiums under collection.
3. Subtracting the value of step 2 from that of step 3 we get the gross value added.
4. Subtracting the value of the total assets' depreciation expense for the year from the gross value added we reach the net value added which represents the contribution to GDP during the period under consideration.

From the previous analysis, we can summarize the four factors of the value added as main sources of income:

- Capital return (interest).
- Labor return (wages and salaries).
- Organization return (profit)
- Any other return (rent, patient rights…etc.)

Due to the special nature of the insurance activity, we have to take into account the technical reserves such as the actuarial reserves. These kinds of reserved funds represent an obligation or a liability to the insurance firm and should be as a part of expenses. Therefore we find that the accounting procedure in estimating the value added for life insurance companies involves some kinds of subjective judgments when dealing with some variables.

III –A Model for Estimating the Value Added for Life Insurance Companies

Generally the activity of the insurance industry can be summarized in the following:

a) Rendering the insurance services.
b) Investment.

The main service of insurance firms is to render protection to individuals and properties. So, they offer a very important product to individuals and communities. On the other hand they invest their accumulated funds through different portfolios to meet their future potential obligations. Usually these firms own and manage huge funds invested in different kinds of financial assets, which alleviate the stock exchange market activity. Thus, they play an important role in financing economic plans especially in developing countries.

Regarding life insurance, policies usually extend for long periods of time, and this gives life insurance companies more flexibility in managing their portfolios of investments. Most of the life insurance policies contain a saving element, because the premiums collected for any policy are relatively high at the beginning of the policy. Insurance companies keep this extra money in what is called actuarial reserves. These technical reserves are invested outside the firm to meet any potential obligations.

Before developing the model of the value added, first we have to deal with the different elements of the output and inputs of the life insurance industry.

The Output of Life Insurance Activity

Empirically, there are many views regarding measuring the output of life insurance activity5. Some studies measure the output as the value of premiums and pensions payments6.. Others considered it as premiums plus technical reserves. The problem with this measurement: technical reserves change during the term of the insurance policies and it represent the changes in the obligations of the insurance company and not the effort of the agents. Some other studies 7 measured the output by differentiating between two kinds of services offered by life insurance firms. The first is related to bearing the risk of different policies, the second is the value of intermediation's service.

That part related to risk is measured by the insurance benefits offered by the different life policies, while the part related to intermediation is measured by the additions to the actuarial reserve during the period.

If we look carefully into the insurance benefits we find that these benefits represent obligations committed in the past, at the time of contracting the different policies. Consequently it does not measure the current output. In fact it measures the output accumulated in the past.

Since the activity of the life insurance companies is to cover a certain risk and collect premiums on due dates, and pay the amount of the contracted policy when the risk accord. Consequently, firms accumulate huge amounts of premiums and actuarial reserves which are invested to bring in returns. This is the main financial and investment role for Insurance companies. Therefore we can state that the real output (value added) of these companies as follows:

Value Added = net premiums + net income from investment – (net compensations paid + any dividends paid to policies 'holders.

Inputs of Life Insurance Activity

The factors of production represent the inputs in this industry as any other activity. These factors are: capital, labor, and organization.

1. Capital: the total value of assets represents the capital of life insurance firms, almost all the assets of these firms are in the form of investments. For instance during the year 2006-2007 the balance sheets of the largest life insurance companies in Egypt showed a large percentage of their total assets in the form of investments . These percentages reached 96% and 89% for the Misr Insurance Company and El-Shark Company respectively. So we will use the total amounts of investments of life insurance firms as a measure of capital input.
2. Labor: this represents the human resources employed by the insurance sector. Thus, we use the number of employees in the life insurance companies as the labor input. This was computed by multiplying the total numbers of labor force in the insurance sector by the ratio of life insurance premiums/total insurance premiums.
3. Organization: for the life insurance sector this factor is twofold and represents the effort of two levels of management and administration of the insurance activity. The first is the management of the life insurance companies themselves. The second is the effort and the work of the regulatory authorities that monitor and regulate the life insurance industry. In this regard we are using the following ratios to reflect the effect of the organization factor:

Total premiums / shareholders' Equity Ratio: This sometimes called the overall ratio and indicates the capability of the insurance firm to meet any risks. It one of the important indicator in what is known as Insurance Regulatory Information System (IRIS), and used by the regulatory authorities for moderating and controlling insurance firms. Here we denote it as (OR).

Current Assets / Current Liabilities Ratio: This is a commonly used ratio in any firm to evaluate the capability of the firm to meet its current obligations (Liabilities) depending on its current assets. For insurance firms current obligations consist of short term liabilities and short term obligations toward policy holders. WE denote this ratio as (LR).

Actuarial reserves + Capital / Premiums Ratio: This gives an indication of the strength of the firm to cover any unforeseen risks. We will denote this ratio as (AR).

Now we turn the model used in the study to estimate the value added as a measure of efficiency in the Egyptian life insurance market. The model is a Cobb-Douglas production function in its log leaner form as follows:

$$\text{Ln } Vnt = A + \alpha_0 \text{ Ln Int} + \alpha_1 \text{ Ln Lnt} + \alpha_2 \text{ Ln OR} + \alpha_3 \text{ Ln LRnt} + \alpha_4 \text{ Ln TRnt} + \varepsilon \quad \ldots(1)$$

Where: n refers to the individual firm. n = 1, 2, 3,……..6 firms
t refers to the year
V = the value Added L = Labor
OR = Premiums / Shareholders' Equity Ratio.
LR = Current Assets / Current Liabilities Ratio.
TR = Actuarial reserves + Capital / Premiums Ratio.
ε = Error term.
A is the constant, and α_0, α_1, α_2, α_3, α_4 are the coefficients.

To capture the effect of increasing prices on the value added, we include a cost variable to the previous model. We also added to the model a dummy variable to differentiate between two sub periods in the study. The first period is (1995 – 2001) and the second period is (2002 - 2008) to capture the effects of the September 11 and the Golf War on the insurance activity. So the equation becomes:

$$Ln\ Vnt = A + \alpha_0\ Ln\ Int + \alpha 1\ Ln\ Lnt + \alpha_2\ Ln\ OR + \alpha_3\ Ln\ LRnt + \alpha_4\ Ln\ TRnt + \alpha_5 LnTCni + \alpha_6\ \Theta + \varepsilon \quad \ldots\ldots(2)$$

Where: TC is total costs, and a dummy variable Θ equals (0) for the first period and (1) to the second.

IV – Estimation Results

First: results for the individual firms

To estimate the value added at the level of individual firms, equation (2) was applied to the three publicly owned firms (Misr, Elshark, Elahlia) and the biggest three private firms (Canal Sues, Elmohands, E ldelta). The results are presented in Table No.1

Table No 1 Estimation results for the individual firms

Companies		**The variables**								**Statistics**			
		Constant	I	L	OR	LR	TR	CO	DU	R	SE	F	DW
MISR	Coefficient	1.621	0.217	1.025	0.235	0.088	-1.73	0.174	0.002	0.97	0.39	24.19	2.94
	t statistic	0.184	0.463	0.74	0.25	0.066	-2.79	0.33	0.025				
ALSHARK	Coefficient	-5.25	-0.348	0.475	0.407	2.049	-0.435	1.223	0.032	0.99	0.024	54.75	1.95
	t statistic	-1.2	-0.66	0.806	0.845	2.48	-0.86	3.66	0.88				
Al AHLIA	Coefficient	-5.9	-4.32	7.34	4.92	16.63	4.49	-0.95	0.584	0.724	0.238	1.125	3.72
	t statistic	-1.1	-0.96	2.66	0.85	0.752	1.35	-0.57	1.6				
AL DELTA	Coefficient	2.589	4.315	-2.67	-0.42	-4.44	1.883	1.32	-1.31	0.713	0.316	1.419	1.71
	t statistic	0.102	1.12	-1.07	-0.137	-0.541	0.598	0.289	-2.36				
Al MOHANDS	Coefficient	0.639	0.835	0.534	0.073	-2.13	1.044	-0.43	-0.02	0.996	0.018	121.03	2.99
	t statistic	0.153	4.58	2.4	0.156	-1.1	2.28	-1.4	-0.47				
SUIZ CANAL	Coefficient	1.737	2.6	-0.57	0.319	-0.95	-1.2	-0.96	-0.16	0.982	0.036	33.3	2.07
	t statistic	0.992	3.88	-1.61	1.01	-1.41	-3.5	-2.69	-2.5				

With respect of the capital factor, the elasticity of this factor was positive for Eldelta Company (4.315), for Canal Sues Company (2.6). While in Elshark and Elahlia Companies the effect of this factor is negative, elasticities reached (-0.148) and (-4.32) respectively. In Misr Company the elasticity was also low (0.217). One reason for these results may be due to the fact that the publicly owned companies reached the size were they lost economies to scale, while the other relatively small private companies still have this advantage.

The labor factor has different effects for the different companies. The elasticity of labor is 0.475 in Elshark Company, 0.534 in Elmohands Company, 1.024 in Misr Company, and 7.34 in Elahlia Company. The elasticities were negative for the other two Companies.

Also we got mixed results for the total cost factor; the effect was positive for some companies and negative for others.

Regarding the three ratios which measure the effect of the organization factor, we find that Elahlia Company has the highest effect with the three ratios of performance. The effects reached in this Company 4.92, 16.63, and 4.49 for the ratios respectively.

The economic and political changes that occurred after September 11 have negative effect at the value added especially in the privately owned small companies. Its effects were mild in the large publicly owned companies; with exception of Elahlia Company the effect was positive.

Second: results for the insurance market as a whole

Before estimating the value added at the market level the model was modified by adding dummy variables to represent the individual companies. The model becomes:

$$Ln\ Vnt = A + \alpha_0\ Ln\ Int + \alpha 1\ Ln\ Lnt + \alpha_2\ Ln\ OR + \alpha_3\ Ln\ LRnt + \alpha_4\ Ln\ TRnt + \alpha_5 LnTCni + \sum cn + \Theta + \varepsilon \quad \ldots\ldots(3)$$

Where Cn refers to a dummy variable for firm n

Since we have 6 firms we refer to them by the following:

C1 Misr Company C4 Canal Suez Company
C2 Elshark Company C5 Elmohands Company
C3 Elahlia Company C6 Eldelta Company

The previous equation was estimated twice, the first without the total cost variable, and the second with it. Table No. 2 below shows the results of the estimation without the cost variable:

Table No. 2: Estimating the Value Added ar the Market Level without the Total Cost Variable

Variable	Coefficient	t-statistic	
constant	**-5.213**	**-1.27**	
I	**1.26**	**4.101**	
L	**0.202**	**0.483**	
OR	**0.822**	**1.685**	
LR	**0.872**	**0.602**	
TR	**-0.103**	**-0.251**	
C1	**0.175**	**1.139**	
C2	**0.197**	**0.905**	
C3	**0**	**0**	
C4	**0.439**	**0.977**	**R^2 = 0.926**
C5	**0.422**	**1.359**	**F = 67.421**
C6	**0.495**	**1.394**	**SE = 0.1701**
DU	**-0.123**	**-0.123**	**DW = 1.1953**

The results show that the model fits the Egyptian life insurance market quit well as reflected by the high value of R2 which reached 0.926. The explanatory variables explain almost all the changes in the value added.

The Capital factor elasticity reached 1.126, in general the increase in the assets invested will increase the value added in the life insurance industry as a whole. Also the labor factor, even its elasticity is small, but still its effect is positive. This factor does not represent a burden on this sector, this dismiss the allegations that the publicly owned firms are employing too much of human resources. With regard of the three ratios which measure the performance of the sector, the first two ratios have positive effect while that ratio has a negative effect. The estimation result shows that the economic changes after September 11 have a negative effect on the industry in Egypt. This might be due to the increase in the prices of the insurance service on one hand, and the decline in the returns on investments on the other hand.

The estimated results provide a ranking of the different companies according to their efficiency. This ranking appears from the coefficients' values of the dummy variables of the different companies:

The Company	Coefficient	Rank
Aldelta	**C_6 = 0.495**	**1**
Canal Suez	**C_4 = 0.439**	**2**
Almohandes	**C_5 = 0.422**	**3**
Alshark	**C_2 = 0.197**	**4**
Misr	**C_1 = 0.175**	**5**
Alahlia	**C_3 = 0.000**	**6**

The same equation was estimated, once more, after including a total cost variable. The equation becomes as follows: The results are shown in table No. 3 below.

Table No. 3: Estimating the Value Added at the Market Level after including g the total Cost Variable

Variables	Coefficients	t statistic	
Constant	**-5.598**	**-1.226**	
I	**1.076**	**3.256**	
L	**0.164**	**0.37**	
TC	**0.106**	**0.271**	
OR	**0.804**	**1.625**	
LR	**0.835**	**0.569**	
TR	**-0.049**	**-0.106**	
C1	**0.144**	**0.741**	
C2	**0.16**	**0.616**	
C3	**0**	**0**	**R2 = .926**
C4	**0.424**	**0.93**	**SE = 1715**
C5	**0.409**	**1.239**	**F = 0.839**
C6	**-0.129**	**-1.778**	**DW = .94**

The results presented in table No. 3 confirm the previous results, before including the cost variable. All the changes in the coefficient reflect the effect of the cost variable which is positive in increasing the value added. Consequently, this leads to a decline in the elasticity of other inputs. The cost elasticity is 1.05 which means increasing this factor through more advertising and agents' incentives will increase the value added by more than the increase in costs. This effect will appear in the value added by small private life insurance firms, since they are ranked higher than other firms.

Conclusion

The proposed model for estimating the value added by the life insurance sector fits quite well the Egyptian market. It explained the changes in the value added whether at the level of individual firms or at the market level as a whole. The model consists of three explanatory values; namely capital, labor, and organization. At the market level capital turned to have positive effect, and if it increased by a certain percent it will increase the value added by more than that percent. Labor has also a positive effect and the labor employed in this sector does not represent a burden. This result dismisses the claim that the sector is employing too much people especially in the publicly owned firms. Regarding the three ratio used to present organization proved to have positive effects except the last ratio (technical reserves + capital /net premiums) which has a negative effect at the market level. The estimation results indicate that the political and economic changes that occurred after September 11 and the Gulf War have a negative effect at the market level. This might be due to the increase in the cost of the insurance service and the decline in the returns of investments. The model allows ranking the life insurance firm according to their efficiency. This might be of some help to the monitoring and controlling authorities. Generally, we conclude that increasing the utilization of the factor of production in this sector will increase the value added in the as a whole even the effect might be negative for some firms.

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