

The Advantages of Using Efficiency in the Regulation of Life Insurance

William Wise¹

Abstract: The financial sector is significant in the economic development of any country. Consequently life insurance is a vital segment of the economy of most countries and hence it is paramount to determine accurately how well life insurance companies (LICs) perform for the benefit of other industries and national economies. As a key purpose of life insurance regulation is to make such determinations this research paper explores using efficiency within. The result is an improvement in the life insurance industry and the financial system and so a benefit to overall economies. No efficiency paper considers exploiting efficiency in the life insurance regulation. This article is the first to demonstrate the advantages of doing so, using calculations and model offices. Findings include efficiency tracking LIC financial outcomes with greater accuracy than does expenses per premium, considered important in regulation. This study also describes how existing methods and ideas employed in regulation are lacking as it could be improved by using efficiency. Such improvement would occur in both the overall financial system and the life insurance industry.

Keywords: Life Insurance; Regulation; Efficiency

JEL Classification: G22; H21; G28

1. Introduction

The role of the financial sector in the economic development of any country is very significant (Janjua & Akmal, 2015) and so an effective and productive insurance sector ultimately contributes to a nation's economic growth (State Bank of Pakistan, 2005; Insurance Europe, 2015). Consequently life insurance is a vital segment of the economy of most countries and hence it is paramount to determine accurately how well life insurance companies (LICs) perform and how viable they are for the benefit of other industries and indeed national economies.

No life insurance efficiency paper explores the feasibility of exploiting efficiency measures as a tool in the regulation of the life insurance industry. This article is the first to do so by using calculations and model offices and demonstrating some of the advantages of including efficiency in the regulation of life insurance. Now, several authors note that efficiency is an appropriate concept to employ with respect to

¹ Corresponding author: bill1612018@mail.com.

investigating business in general and accordingly should be utilized in insurance regulation. For example, Fried, Lovell & Schmidt (2008, p. 11) points out that in the examination of commerce any influence of the business environment is eliminated with the use of efficiency and as depicted in studies, for instance Greene & Segal (2004), Karim & Jhantana (2005), Liu (2007) and Alhassan & Addison (2013), it has a great effect on the profit and thus the endurance of life insurers. Therefore as its key objectives include solvency, policyholder security and the soundness of the financial system (Edwards, 2003; Sufian & Habibullah, 2014) seemingly efficiency should be included in life insurance regulation.

Nevertheless efficiency is not incorporated in the existing regulation in many jurisdictions. This can be seen in *The New York Insurance Law*, Canada's *Insurance Companies Act* and *Winding-up and Restructuring Act (1985)* and Australia's *Life Insurance Act (1995)*. Consequently by looking into the feasibility of drawing upon efficiency assessments as a tool in the regulation of life insurance this research demonstrates the advantages of doing so.

Section 2 gives a review of the relevant literature while Section 3 shows why efficiency should be included in life insurance regulation. Section 4 relates efficiency to LIC regulation and Section 5 scrutinizes two model offices to give an idea of how including efficiency in life insurance regulation improves it. Section 6 concludes.

2. Literature Review

Not many papers have been written regarding efficiency and financial institution regulation. The earliest observed is Cebenoyan, Cooperman & Register (1993) which describes how efficiency appeared to determine which savings and loans (S&Ls) were closed by regulators. The data applied was from 1988 for 551 S&Ls in the southwest United States with the result of inefficiency being a chief factor of closure.

Barr, Seiford & Siems (1994) illustrates how data envelope analysis (DEA) can evaluate the efficiency of bank management in the United States. Specifying 930 banks over the period of 1984-88 the authors find that efficiency scores for surviving banks are statistically higher than those for failed (or near-failure) banks. From this they decide that management quality of banks is critical to their continuance and that it is possible to establish which banks will fail in the near future. Hence the implication is that efficiency should be included in bank regulation.

Bauer, Berger, Ferrier & Humphrey (1998) suggests a set of six conditions that efficiency methods should exhibit to be credible and useful to financial institution regulators. Exploiting the parametric methods of stochastic frontier analysis, the distribution free approach and thick frontier analysis along with the nonparametric

DEA on 683 United States banks (from 1977-88) the article discovers inconsistent outcomes. The first three conditions are designed to appraise if the efficiency methods are mutually consistent and the results are that the parametric methods are such with each other as are the nonparametric. However there was no consistency between the two sets of methods with the DEA methods 1) computing lower efficiency scores than and 2) ranking the banks differently from the parametric methods.

The second three conditions are meant to see if the efficiency scores generated are believable or realistic. Here the parametric methods seemed to do much better. The overall conclusion of the study is that regulators should exercise care when deciding upon policy as the efficiency method employed can largely influence the outcomes.

Choi & Weiss (2005) decides which of three hypotheses, structure-conduct-performance (SCP), relative market power (RMP) or efficient-structure (ES) predominates in general insurance in the United States. The answer then governs where regulators should best focus their activity. The results support the SCP and ES but not the RMP hypothesis. This means that when considering general insurance regulators should pay added attention to efficiency and market concentration, not market power.

3. Why Efficiency Should Be Included In Regulation

As has been mentioned above efficiency has a great influence on the profit and accordingly the viability of life enterprises. Plus even though various jurisdictions have guaranty associations which help protect policyholders with respect to their vulnerabilities, the associations only account for part of the promised payment thus policyholders can still be hurt badly in the event of a bankruptcy (Assuris, 2017; National Association of Insurance Commissioners (NAIC), 2017b). Therefore protecting policyholders against insolvency is a primary insurance regulation goal (Lorson et al., 2012; Yasui, 2001). A life insurer bankruptcy can also harm the policyholders of the remaining entities as they have to pay part of the subsequent cost (Barrese & Nelson, 1994; Yasui, 2001). Hence LIC sustainability is important to both a nation's overall economy and individual policyholders.

As well as the aforementioned Fried et al. (2008) some agree affirming that efficiency should be employed in insurance regulation as efficiency is an apposite concept to utilize in inspecting business. Leverty & Grace (2010, p. 1522) note that current regulation implies that the purpose of insurers is to "produce solvency" whereas high efficiency scores seem to be a more appropriate target. In addition Choi & Weiss (2005, p. 635) remarks that the "implications of [their] research are that regulators should be more concerned with efficiency (both cost and revenue) rather than the market power that arises from the consolidation activity taking place in

insurance” and Berger, Cummins & Weiss (1997, p. 517, fn. 1) asserts that insurance “inefficiencies should be disciplined.”

Bauer et al. (1998, p. 86) goes further in announcing that “regulatory authorities should be aware whether the observed managerial inefficiency they may observe could raise the probability of financial institution failure substantially” while Nakamura (1990) recommends incorporating efficiency when deciding upon the non-viability of banks. Indeed Berger & Humphrey (1992a), Cebenoyan, Cooperman & Register (1993) and Hermalin & Wallace (1994) investigated banks, S&Ls and thrifts, respectively and ascertained that inefficient firms had a larger chance of becoming insolvent. Moreover having efficiency be a part of insurance regulation is proper as a justification for regulation is to lessen the capability of establishments to misrepresent their products, financial position or activities (Castagnolo & Ferro, 2013; Sufian & Habibullah, 2014; Uche, 2001).

4. Efficiency and Life Insurance Company Regulation

4.1 Some Features of Past Financial Institution Regulation

Most researchers once estimated efficiency by examining simple financial ratios (such as labor productivity, capital intensification, expense or claims ratios, solvency margin or ROA) and these are (still) thought important in current life insurance regulation. Nonetheless exploiting simple financial ratios in this manner led to several deficiencies. First and foremost these numbers may be deceptive regarding efficiency as they do not take into account product mix, input prices or other exogenous factors (Bauer et al., 1998; Berger & Humphrey, 1992b). A second objection to incorporating simple ratios is that it is unlikely that they will all show the same decision making units (DMUs) as most efficient meaning that it will be difficult to recognize the best practice ones (Diacon et al., 2002; Thanassoulis et al., 1996). Yet other difficulties are that simple ratios 1) may not determine similar performance outcomes within a DMU leading to a problem in understanding its overall proficiency (Thanassoulis et al., 1996) and 2) can not distinguish between X-efficiency gains versus scale and/or scope efficiency gains as simple ratios will not allow for easy identification of inefficiency sources (Berger & Humphrey, 1992b; Diacon et al., 2002).

Specifically, a fundamental shortcoming of cost and profit ratios is that they do not control for input prices as their denominator is an unsophisticated indicator of entity size. Without such a price control the reason for a cost or profit change is unknown as it could be from perhaps 1) a quantity change for a given vector of input and output prices or 2) a price change (Akhavein et al., 1997). Therefore as “frontier efficiency methods ... control for differences in input usage and output production in multi-

input, multi-output firms using a rigorous approach derived from micro-economic theory” (Erhemjants & Leverty, 2010, p. 1014) they seem superior.

A different technique that was once applied to monitor financial institution behavior was portfolio theory, elements of which most jurisdictions still employ (see Section 4.2). Portfolio theory explores enterprises not as producers but only as rational investors. This procedure is not satisfactory because the production and cost constraints under which financial ventures operate are ignored in verifying their best output combination, scale and size. Using portfolio theory was improved upon by describing financial establishment (mostly commercial bank) operations via the theory of the firm, again elements of which most jurisdictions still employ (see Section 4.2). This again was not a satisfactory model of financial businesses as incorrect conclusions were being reached as to best financial entity activity and structure.¹ Accordingly using efficiency in insurer regulation would seem to be an improvement over using portfolio theory or the theory of the firm.

4.2. Life Insurance Regulation

As seen in Section 5.1 below the simple ratio of expenses per premium (EPP) is believed to be an essential area to inspect within life insurance regulation. For life insurance regulation, in addition to the reasons preceding, it is better to draw upon efficiency rather than simple ratios because over time the best-practice concerns tend to continue to be ranked with larger efficiency (Bauer et al., 1998). Barr, Seiford & Siems (1994) and Kramer (1997) cite that using efficiency improves the capacity of models to foretell insolvency and thus might be useful for regulators to look at.

That the current regulation could be strengthened by incorporating efficiency can be illustrated, for instance, by Section 1309 of *The New York Insurance Law* which proclaims that an insurer will be designated insolvent “[w]henver the superintendent finds from a financial statement or report on examination that an authorized insurer is unable to pay its outstanding lawful obligations as they mature in the regular course of business, as shown by an excess of required reserves and other liabilities over admitted assets.” Likewise paragraphs d) and e) of Section 136 of Australia’s *Life Insurance Act (1995)* list as grounds for a show cause notice (to paraphrase) 1) an expense to premium ratio that is too high and 2) the utilization of an inequitable income or expense apportionment (method) and paragraph a) of Section 136 lists the inability of a LIC to meet its liabilities. For these jurisdictions applying efficiency rather than simple income, expenses or associated ratios as an evaluation would be more accurate and encompassing. Section 3c) of Canada’s *Winding-up and Restructuring Act (1985)* is similar in that it affirms that a “company is deemed insolvent if it exhibits a statement showing its inability to meet its liabilities” or “is unable to pay its debts as they become due.” Expenses are a liability

¹ This paragraph is inspired by Sealey & Lindley (1977).

as in these legislative items so it is evident that efficiency can be drawn upon to gain a greater understanding of life insurer viability.

Concerning insights associated with portfolio theory, virtually all jurisdictions have minimum capital requirements for insurance ventures licensed therein. For example Section 1322 of *The New York Insurance Law* elucidates that an LIC's mandatory risk based capital "shall take into account ... [t]he risk with respect to the insurer's assets" and the "interest rate risk with respect to the insurer's business." Similar legislation exists in Canada with Section 515 (1) of the *Insurance Companies Act* (1991 c.47) announcing that it is compulsory for a LIC to "maintain adequate capital and adequate and appropriate forms of liquidity" plus comply with any relevant regulations. In Australia Section 9 of the *Prudential Standard LPS 110 Capital Adequacy* points out that "a life company must ... [have] capital that is adequate for the scale, nature and complexity of its business and its risk profile, such that it is able to meet its obligations under a wide range of circumstances." Because, as expressed in the foregoing, simply employing risk versus return concepts leads to an inferior outcome compared to including efficiency, it may be that including efficiency is furthermore desirable in the area of capital requirements.

Ideas associated with the theory of the firm are additionally within insurance regulation with Section 1101 of *The New York Insurance Law* defining 1) what constitutes doing insurance business as including issuing insurance, collecting premiums and 2) the treatment of profit and marketing. The *Insurance Companies Act* Sections 440 and 441 also define what constitutes insurance commerce including the provision of financial and real estate services and (the support of) sales. In addition Sections 473 through 475 list restrictions placed on Canadian life enterprise activities. In Australia *Prudential Standard LPS 340 Valuation of Policy Liabilities* dictates that a "profit carrier" has to be designated for insurance products so that their (theoretical) profit emerges over their life. Consequently as readings exemplifying financial institution operations specifying the theory of the firm were unsatisfactory, including efficiency may improve the standard of regulation in this aspect as well.

As has been seen prior efficiency is considered to have larger accuracy and encompassment of an entity to investigate than does firm theory, expense ratios, income or similar notions. Nevertheless efficiency is not included in life insurance regulation whereas concepts associated with firm theory, expense ratios and income are. Hence as "the economic efficiency approach is superior to conventional measurement techniques such as the analysis of expense ratios and net income because it sums the firm's performance in a single statistic that takes into account differences among firms in product and input mix in a sophisticated multidimensional framework" (Klumpes, 2006, p. 6) and risk assessment processes and instruments need to be always evolving (Davidson, 2001) it may not be unreasonable to integrate efficiency within life insurance regulation.

Further regarding simple ratios, it appears reasonable to incorporate efficiency within life insurer legislation when scrutinizing both the Spearman rank correlation coefficient and the *t*-distribution score based on it. As seen in Section 4.1 expenses per premium (EPP) is believed to be an essential area to inspect within life insurance regulation.

Now, in research done previously by this author utilizing Canadian LIC data from 2000 - 2012, the company-by-company and company/year-by-company/year¹ rankings of the efficiency scores versus the EPP rankings give an indication of whether it is credible to exploit efficiency in life insurance regulation. For company/year-by-company/year the Spearman coefficient for (non-)standard profit efficiency² is (-0.125) -0.088 and the *t*-distribution score is (-3.206) -2.251. The corresponding company-by-company scores for (non-)standard profit efficiency are (-0.235 and -2.116) -0.198 and -1.771. As all of the scores are significant to a 5% with both company/year-by-company/year versus non-standard profit efficiency values significant to a 1% level they illustrate that there seems to be a negative correlation between both profit efficiency scores and EPP. Notwithstanding the lack of exhibition of correlation between the cost efficiency rankings and the EPP rankings (using data from 2000 - 2015) overall these results indicate that efficiency is indeed credible to examine within life insurance legislation.

The above shows that applying efficiency to appraise financial institution health and sustainability is better than existing procedures. As a purpose for a financial system is to advance its efficiency (Uche, 2001) it seems that drawing upon efficiency in life insurance regulation in particular would improve it.

5. Life Insurance Company Model Offices

To demonstrate how including efficiency can improve regulation of life insurance regarding expenses, it is possible to show that model offices of life insurers are improved by including efficiency within. Some life insurance model offices include expenses, mortality, lapses, interest rates, etcetera but they do not consider efficiency. By excluding efficiency these models omit certain specific elements of the operation of the life entities. One such component is the fact that by making an assumption with respect to the future expenses, inflation, mortality and the like a certain degree of efficiency being maintained is assumed.

¹ The company-by-company efficiency scores are calculated via an average over the applicable years (as in Kumbhakar and Lovell (2000)) thus the corresponding EPP numbers are the average over these same years. The company/year-by-company/year efficiency scores are those calculated for each year for each company individually.

² For a description of standard and non-standard profit efficiency as well as cost efficiency see Berger & Mester (1997).

One more trait of life insurance that is overlooked by excluding efficiency is the influence on profits and other financial outcomes. As observed in Greene & Segal (2004), Karim & Jhantasana (2005), Liu (2007) and Alhassan & Addison (2013) this effect can be crucial. Hence it is essential to take both present and future efficiency into account in model offices to help ensure good financial consequences because, as seen in Section 3, bad financial results can have a devastating effect on a country's economy, individual policyholders and others depending upon life insurer viability.

Sections 1304 and 4217 of *The New York Insurance Law* stipulate the methods and assumptions to be utilized for valuing policies; The *Standards of Practice* of Canada's Actuarial Standards Board prescribes that best estimate assumptions, provision for adverse deviations and assumption scenario testing be incorporated for valuing policies and "Best Estimate Assumptions" are employed in both pricing and valuation in Australia (as per *Prudential Standard LPS 340*). Such legislation implies that efficiency should be included in models of life insurers.

5.1. Including Efficiency in Model Offices

As displayed in Section 4.2 expenses is regarded as a key area to investigate in legislation with EPP especially considered to be. For instance Sections 4228 and 4309 of *The New York Insurance Law* limits the expenses that may be incurred by life companies partially based as percentage of premium; Sections 686 and 687 of Canada's *Insurance Companies Act* define expenses concerning LIC bankruptcies partly as EPP and Section 136(d) of Australia's *Life Insurance Act (1995)* list as a grounds for a show cause notice an expense to premium ratio that is too high. Thus it is possible to scrutinize how the condition of an institution varies with changes in expense rates and how including efficiency can give a better insight into existing circumstances.

Of the life insurance models found in the literature important in actuarial education literature is Bowers, Jr., et al. (1997) which, in its Chapter 15 (Insurance Models Including Expenses), applies such a model. As to the model it is remarked that "it is assumed that the expenses incurred in connection with each policy are known for certainty." This means that the concept of efficiency is not examined.

The model of Chapter 15 of Bowers, Jr. et al. (1997) is a "3-year annual premium endowment insurance, issued to (x) with level benefits and premiums." The actual calculations of premiums, reserves and (hence) income when including expenses for both single and double decrements are illustrated as well. So obviously analyzing efficiency can alter the results of the chapter as when including efficiency there is the potential of neither the premiums nor the reserve levels held being adequate in the long run (For a full description of the assumptions utilized leading to them see Chapter 15 of Bowers, Jr. et al., 1997).

The “base case” income statements reproduced in Table 2 are shown for ten insureds initially:

Table 2. Income Statements as in Bowers, Jr. et al. (1997) Chapter 15 Model of a Three Year Endowment Insurance Base Case

During first year		During second year		During third year	
Revenue		Revenue		Revenue	
Premium	3423.50	Premium	3081.15	Premium	2738.80
Investment income	548.82	Investment income	912.89	Investment income	1283.59
Expenses		Expenses		Expenses	
% premium	684.70	% premium	184.87	% premium	164.33
Per policy	80.00	Per policy	18.00	Per policy	16.00
Claims (1)	1000.00	Claims (1)	1000.00	Claims (8)	8000.00
Reserve increase	1965.67	Reserve increase	2507.58	Reserve increase	-4473.25
Net income	241.95	Net income	283.58	Net income	315.31
Total net income	840.85				
Insureds @ Boy	10	Insureds @ Boy	9	Insureds @ Boy	8
Assets @ Year end	3207.62	Assets @ Year end	5998.79	Assets @ Year end	1840.85

From this a measurement of cost and non-standard profit efficiency (CE and PE)¹ using claims, acquisition and operating expenses as inputs along with both life insurance and investment income output leads to 69.768% and 61.878%, respectively. The average EPP is 11.835%.

Now, as compared to the base case, if the operating expenses increase by 10% in each of the second and third years the CE, PE, EPP and total net income change to 68.637%, 59.141%, 12.274% and 793.28, respectively. Therefore as a proportion of the base case these numbers changed by -1.62%, -4.42%, 3.71% and -5.66%, respectively. The equivalent consequences for other changes inspected are exhibited in Table 3:

Table 3. Bowers, Jr. et al. (1997) Model of a Three Year Endowment Insurance Comparison of Income, Efficiency and Earnings Per Premium Changes from Changes to Various Elements in the Model

Element Changed	Change	Net Income: % Change	CE: % Change	PE: % Change	EPP: % Change
Operating Expenses	10% increase in years 2 & 3	-5.66	-1.62	-4.42	3.71
Claims	10% increase in years 1 & 2	-19.40	-8.77	-22.48	0.00
Life Insurance Output	5% decrease in years 2 & 3	-40.38	-15.35	-38.30	0.17

¹ The efficiency scores in this model and that below are calculated using stochastic frontier analysis with a Cobb-Douglas functional form (see Musaba & Mseteka (2014) for a description).

Life Insurance Output	10% increase in years 2 & 3	80.76	12.40	46.69	-0.30
Investment Income Output	5% decrease in years 2 & 3	-13.84	-2.40	-11.20	0.00
Investment Income Output	10% increase in years 2 & 3	27.91	4.61	18.83	0.00

A life insurance model office with more complexity than the preceding can be constructed. Again said model can demonstrate how incorporating efficiency therein gives a more accurate picture of the situation of a life enterprise with respect to both viability and safety. As an example a model office of a whole life policy is built and an evaluation of CE and PE using claims, surrender values, acquisition and operating expenses, the price of servicing assets as inputs along with both life insurance and investment income output is explored.

First consider the “base case” of thirty years of experience of a life insurer which gives CE and PE scores of 69.768% and 61.878%, respectively with the average EPP after stabilization being 47.551%. For the same type of changes from this base case as illustrated earlier the results after stabilization are found in Table 4:

Table 4. Constructed Model of Whole Life Insurance Comparison of Income, Efficiency and Earnings Per Premium Changes from Changes to Various Elements in the Model

Element Changed	Change	Avg ROA: % Change	CE: % Change	PE: % Change	EPP: % Change
Operating Expenses	10% increase in all years	-0.73	-0.57	-0.06	6.61
Acquisition Expenses	10% increase in all years	3.49	-0.46	0.27	3.29
Claims	10% increase in all years	-0.26	0.22	-0.73	0.00
Life Insurance (LI) Output	10% decrease in all years	-1.55	-1.50	-1.22	8.69
Life Insurance Output	10% increase in all years	0.81	0.80	0.06	-7.11
Investment Income Output	10% decrease in all years	-1.06	-0.07	-0.08	0.00
Investment Income Output	10% increase in all years	1.06	0.07	0.08	0.00
Servicing Assets	10% increase in all years	-0.003	-0.08	-0.0002	0.00
Operating & Acquisition Exps	10% increase in all years	3.13	-1.15	0.25	9.90
Life Insurance & Investment Income Output	10% increase in all years	1.84	0.85	0.14	-7.11
Operating Expenses Increase & LI Output Decrease	10% in all years	-2.95	-2.60	-0.23	16.01

For both of these model offices the outcomes show that ignoring the possibility of efficiency changes can lead to the problem of a loss of income for and potentially

threaten the continuance of a LIC. Consequently efficiency should be included in model offices. Additionally, from Table 3 it can be observed that for every change other than that for operating expenses the efficiency results are closer to the change in net income than is the EPP result. From Table 4 it can be seen that for every change other than that for claims the efficiency results are closer to the change in net income than is the EPP result. Accordingly the results make it evident that efficiency has greater accuracy than EPP when determining the financial health of a life insurance firm.

The foregoing shows that as 1) efficiency is a better and more comprehensive concept than most of those drawn upon in LIC model offices and 2) including efficiency in these model offices will change their results concerning amounts such as premiums or ROA; one can deduce that efficiency should be exploited as a regulatory or warning sign as to life entities. The notion is valid despite the fact that efficiency may have extra difficulty versus simply utilizing expense ratios as including efficiency leads to a better model of life insurers being manufactured that incorporates accuracy and safety.

6. Summary and Conclusions

This paper has related how regulation of the financial system is essential to promote its soundness and prevent trouble therein. In addition this study has described how existing methods and ideas employed in regulation are lacking in that it could be improved with the application of efficiency. Such an improvement would occur in both the financial system in general and the life insurance industry in particular.

Further, by investigating model offices of life insurance companies this research demonstrated that, with respect to EPP (considered important within life insurance regulation) including efficiency in life insurance regulation improves it. This is as efficiency tracks life business financial outcomes with greater accuracy than does EPP at least for the example from literature and the simple model constructed. Therefore it is obvious that if efficiency is ignored it is easily possible that the results generated by LIC model offices will be misleading and thus potentially lead to financial stress or ruin for the places using said deficient model offices.

Bowie et al. (1996) states that “[a] model is a self-contained theoretical world, defined by assumptions and not by reality.” A properly formulated and calibrated model can be exploited to help understand reality. The article also points out “that difficulty with the computational tool is not a good reason to dismiss the model.” Accordingly a better method of analysis, modeling and regulation of life insurance is created, even though the effect may be added complexity or may increase needed effort, if efficiency is incorporated within. Consequently this can be deemed both desirable and necessary.

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