
A Life Insurance Efficiency Paper Survey: Methods, Aspects and Trends

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Abstract

This paper explores studies that determine life insurance efficiency, an area that is gaining in recognition as being important to investigate. As well as scrutinization and exploration of the numbers and recent trends of methods and some aspects of life firm efficiency measurement is implemented. In its overview of life company efficiency items written since 1982 this project shows how the most fundamental elements of life enterprise efficiency estimation, for example the set-up and form of outputs and inputs, have been coped with. Therefore an assessment of the overall results of efficiency studies is possible. Similarly ideas for potential further research are portrayed. One conclusion drawn from the results of this project is that the steady increase in both the volume and scope of pieces scrutinizing life firm efficiency means that it is being perceived as being of greater and greater importance. Consequently this review will be of value to both practitioners and regulators concerned with this subject in that it will enable an assessment of which aspects of this field of study need more research and which are otherwise worth developing

Keywords: survey, life insurance, efficiency, inputs/outputs, literature review

1. Introduction

This paper explores studies that determine life insurance efficiency, an area that is gaining in recognition as being important to investigate. It is an update of a previous paper, the quantity of readings considered having increased from 198 to 515, a growth of 160%. Additionally more details and improvements are contained regarding 1) profit efficiency, 2) allocative efficiency, 3) the services that life insurers provide, 4) pieces treating life insurance and general insurance totally together with respect to efficiency calculations and 5) articles using greater than one method of appraising efficiency (the latter within Section 8.2).

As well a scrutinization of the numbers and recent trends of methods and some aspects of life firm efficiency measurement is implemented. This research enhances and improves upon smaller works such as Berger and Humphrey (1997), Cummins and Weiss (2000), Eling and Luhnen (2010a), Wu and Zhao (2010), Jarraya and Bouri (2013), Bu and Wang (2014), Pawar Waghavkar and Sananse (2015) and Zinyoro and Aziakpono (2023). In its overview of life company efficiency items written since 1982 this project shows how the most fundamental elements of life enterprise efficiency estimation, for example the set-up and form of outputs and inputs, have been coped with. Therefore an assessment of the overall results of efficiency studies

is possible. Similarly ideas for potential further research are portrayed. Consequently this review will be of value to both practitioners and regulators concerned with this subject.

This article continues with Section 2, a review of the pertinent literature, and Section 3 showing the method of sourcing the germane research. Section 4 discusses profit efficiency while Section 5 looks at allocative efficiency. Section 6 probes the services delivered by life insurers and Section 7 exhibits the shortcomings with treating life insurance and general insurance totally together in efficiency writings. Section 8 illustrates the numbers and trends of pieces, methods utilized to quantify efficiency, output proxies and input proxies. Section 9 concludes and postulates insights for possible further research.

2. Literature Review

A number of previous surveys of life insurance efficiency papers have been found. Berger and Humphrey (1997) is the earliest of these. The authors look at one hundred and thirty items that consider the efficiency of several types of financial institutions spread over twenty-one nations. Only five of the pieces involve life insurance companies. Conclusions reached include that insurance entities (i.e. all of them including general insurers) in the United States have about the same efficiency as do United States banks and that the rankings of enterprises by efficiency are closer within the parametric and non-parametric methods than between them. Due to the small number of (life) insurance companies considered by the paper, none of its overall conclusions are especially applicable to said companies.

The next reading seen is Cummins and Weiss (2000) which considers twenty-four works, eighteen of which involve life insurance. The survey section begins by looking at outputs and inputs used by both life and general insurance. For life the paper mentions that for outputs some articles use premiums, some use claims (possibly plus change in reserves) and some use quantities while for inputs virtually all use labor and capital. The paper next displays counts of pieces 1) employing parametric and non-parametric methods and 2) looking at cost, technical, profit and revenue efficiency. The counts are followed by some reasoning as to why profit efficiency is better to probe than are technical or cost efficiency. Additionally an amount of analysis regarding the life insurance efficiency scores deduced by the works is presented and subsequently likewise a listing of the scale and scope economies scores and total factor productivity increases. The survey section finishes with a discussion of how various facets of life insurance such as organizational form and distribution systems affect efficiency. The reading declares no real conclusions, only a summary of the findings of the survey.

Eling and Luhn (2010a) has a survey of ninety-five insurance efficiency papers where sixty-eight consider life insurance.¹ The paper describes some of the different methods for measuring efficiency along with a brief listing of their (dis)advantages along with some innovations applied regarding them (until then). Some of the ways seen to proxy inputs are portrayed while for outputs two of the approaches (value-added, intermediation) used plus the (dis)advantages of the

¹ This includes one paper that only looks at health insurance.

ways utilized to proxy them are shown. The authors further mention the disagreement regarding whether using premiums or claims as an output is superior. Counts are also given regarding the methods, inputs and outputs employed in the surveyed items. The last area of analysis concerns ten aspects of life insurance in which efficiency studies are utilized. The aspects are described and some results of papers applying efficiency to them are presented. Some of the paper's conclusions are that 1) DEA is used most frequently to calculate efficiency, 2) for inputs most studies employ labor and capital, 3) there is a general disagreement as to whether premiums or claims is better to incorporate as the basic output and 4) the range of nations covered by such research has been increasing. However these are not material conclusions but simply a summary of the results of the survey.

Wu and Zhao (2010) examines more than one hundred and twenty insurance efficiency projects. It investigates the methods used to assess efficiency, input and outputs, the elements of insurance to which efficiency is applied and the conclusions that the various studies reach.

Jarraya and Bouri (2013) lists and defines some aspects of efficiency such as their types, functions drawn on to appraise efficiency along with inputs and outputs. The authors then delve into some of the main features of insurance, such as mergers and acquisitions and regulation issues, accentuated in efficiency studies. For each feature the paper gives instances of works that explore it and some of the conclusions reached. The latter is the survey trait of this article but it does not provide any counts so in this respect it is lacking. Additionally the article is lacking in that it does not present any particular conclusion.

Bu and Wang (2014) inspects articles that explore the efficiency of PRC insurers. The authors present a table of the articles it considers however it does not include all of those in the text or reference list. The table shows fifty-one articles but has the shortcoming that no counts are shown.

The discussion begins by looking at some papers measuring efficiency of insurance companies and how efficiency is affected by some features such as the organizational form or the ownership of the company. The results of the papers, which include general insurance firms, are stated. The authors next investigate how the efficiency of insurers is impacted by elements by dividing them into internal, external and a combination thereof. The conclusions of the paper are that the overall efficiency of PRC insurance companies has upgraded but there is a flaw in that there is uneven efficiency due to ownership form and region. It is key to note that the conclusions are from the observed results of the papers surveyed and not actually those of the survey authors. Views regarding future research, such as more could be done examining life insurance companies alone or how external elements affect efficiency are provided.

Pawar Waghavkar and Sananse (2015) is a short survey. It deals with thirty-five studies in the form of a literature review in that it gives a short summary of what each looks at and some of the parameters, such as inputs and outputs, utilized. The survey does not elucidate the conclusions reached by all of the pieces observed. One characteristic of the survey is that, despite its title,

four of the items scrutinized deal exclusively with general insurance. The paper has the flaws of no counts being presented and the short conclusion not truly conveying anything.

Zinyoro and Aziakpono (2023) writes that it performs a survey of seventy-one life insurance papers even though the actual number is seventy. It begins with a quick description of life insurance company services most especially capital accumulation and financial security. The next topic delved into is how the life insurance industry is important to national economies and individual's financial well-being and how some elements, such as regulation innovations, of life insurance have recently changed.

Concerning specific readings the authors point out that previous studies have concentrated on efficiency but in their opinion this has been insufficient as life insurance companies should also be evaluated in terms of their claims-paying ability, solvency and shareholder value. Hence they explore pieces based on five characteristics of insurer proficiency namely efficiency, accounting, market, rating, and insolvency measures. A table is given showing the efficiency articles surveyed with various characteristics thereof such as the number of insurers covered and the methods, inputs and outputs employed. For efficiency studies the authors present a count of the methods used but the other counts shown take into account all five characteristics seen above. Likewise all five characteristics are considered in the discourse monitoring how "firm-level" (i.e. internal) and external elements affect life insurance company proficiency.

The conclusions of the survey include which internal and external facets have the most influence on life insurer success, but it should be noted that the deductions are from an examination of the research surveyed and not really deduced by the authors. Recommendations are then listed relating to actions that should be taken by policymakers and/or regulators to help life insurance companies but these recommendations are obvious. Finally the paper points out some gaps implemented in the research even though filling those gaps may not be possible.

3. Methodology

There were several sources for the research used including Google Scholar, articles cited in other such surveys, basic internet search engine(s), the CNKI website and the Academia website. The applicable search parameters employed were "life insurance efficiency" and "life insurer efficiency." Papers not written in English were included as much as possible and translated via Google Translate.

Readings excluded from this survey were those that only dealt with reinsurance or general insurance, academic theses, ones that do productivity as opposed to efficiency, obvious duplicates of works that were published earlier, those that were just a survey and ones that do not calculate efficiency *per se*. The data and trends were compiled by the author.

4. Profit Efficiency

As profit maximization is the primary goal of the majority of business entities (or all of them)² profit efficiency is a significant item for any efficiency paper to examine. For instance Berger, Hancock and Humphrey (1993), the earliest reading seen to draw on profit efficiency, states that “it is surprising that” profit efficiency has “been used so sparingly” due to its advantages. One advantage that the work cites is that “it may reduce problems associated with misspecification and mismeasurement” and it “allows the researcher to pinpoint better the *sources* of inefficiency.”³ Moreover profit efficiency enables a better determination of the causes of any inefficiency plus conceivably decreasing any flaws stemming from estimation or misspecification issues (Berger, Hancock and Humphrey (1993)). Likewise it is plausible that profit maximization is better versus cost minimization to evaluate when analyzing company expertise (Berger and Mester (2003)). Correspondingly profit efficiency has the advantages of including and being more general than cost efficiency (Akhavain, Berger and Humphrey (1997)) in that it explores challenges relating to both outputs and inputs (Berger and Mester (1997)). This last advantage is augmented in that cost efficiency simply assumes that companies “take current input prices and output quantities as given, then seek to minimize costs” with the best level of inputs (DeYoung and Nolle (1996)).

In addition profit efficiency can be considered to be overall efficiency, such that if a firm is efficient in terms of its profits, it will be efficient in terms of its costs and also its scale of production (Fitzpatrick and McQuinn (2008)). For example an institution can be currently cost efficient yet not so at its optimal output. Hence, as profit efficiency encompasses output as well as input levels, it is able to detect what is necessary for the institution to achieve its optimum and thus appraising profit efficiency is far more vital for businesses and managers than the partial view explained through inspecting cost efficiency (Maudos and Pastor (2001)).

Problematically the percentage of projects that have scrutinized profit efficiency is minimal with only thirty of the four hundred and forty applicable such (about 6.8%) monitored doing so. When disallowing duplication of authors only twenty-six studies have investigated profit efficiency. Figure 1 below which shows the number of all of the articles looking into profit efficiency year-by-year (starting in 2000):

² Life insurance companies may have solvency as the primary goal, although their shareholders would believe it is profit maximization.

³ The emphasis is in the original.

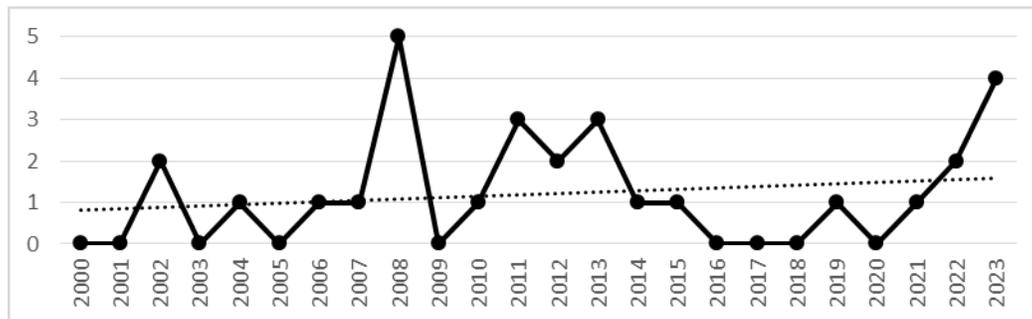


Figure 1. Number of Life Insurance Efficiency Studies Investigating Profit Efficiency (Year-by-Year) with Trend Line

As only eight were written since 2015 it seems clear that greater attention should be paid to profit efficiency in life insurer efficiency papers.

5. Allocative Efficiency

An entity can be 1) technically efficient due to its being on the best technology production frontier nonetheless 2) not allocatively efficient as they are on a point on said frontier that is not on the minimum cost frontier. This means that allocative efficiency with respect to inputs is a computation, given a set input prices, of the chosen mix of inputs against the optimal (i.e. cost minimizing) such mix.⁴ Accordingly allocative efficiency is an essential topic for any efficiency piece to take into account as in order to be cost efficient an enterprise must be both technically/technologically and allocatively efficient.

However only a negligible volume of life insurer efficiency items have probed allocative efficiency as only thirty-five of the one hundred and twenty papers incorporating input prices (about 29.2%) depict allocative efficiency outcomes.⁵ Eight other works mention and/or define allocative efficiency but nothing else whereas two other readings state it is possible to obtain the allocative efficiency scores from their cost and technical efficiency scores, though has no calculations thereof displayed. Figure 2 following shows the number of projects examining allocative efficiency year-by-year (beginning in 1995):

⁴ Another perspective is that allocative efficiency is an assessment of how efficiently the mix of inputs is chosen, given input prices.

⁵ One of those not showing allocative efficiency results assumes it has no allocative inefficiency. For one other study whether allocative efficiency results are demonstrated is not extant.

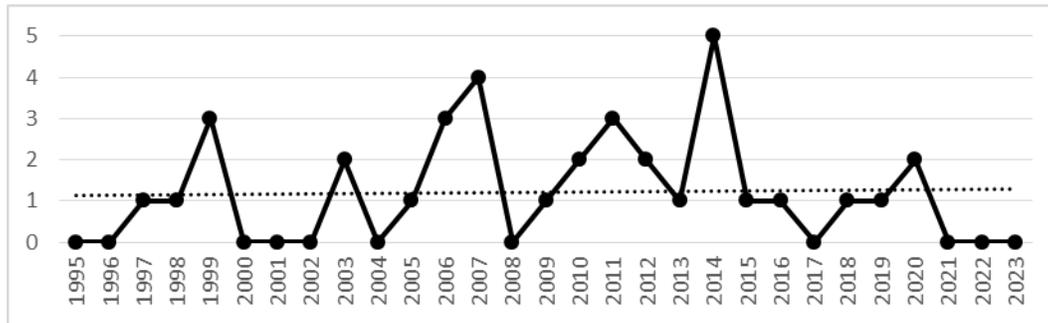


Figure 2. Number of Life Insurance Efficiency Studies Investigating Allocative Efficiency (Year-by-Year) with Trend Line

Because only five of these are from after 2015 evidently more exploration should be accorded to the crucial element of allocative efficiency in life firm efficiency research.

6. Services Provided by Life Insurance Companies

As Cummins and Weiss (2000) conveys, insurers are analogous to other businesses in the financial sector of the economy in that their outputs consist primarily of services, many of which are intangible. Therefore accurate evaluation of life institution efficiency requires identifying output and input proxies that concord to the services that life entities furnish. However “measurement of output volume is a difficult problem as services are not directly observable” (Tone and Sahoo, ((2005), Weiss (1986)) and consequently “are hard to pin down” (Mahlberg and Url (2000)). Nevertheless Kim (2002) determines that “[t]he output of a life insurance firm should be measured by services provided to insured.” Accordingly life enterprise efficiency studies should describe the assumed services implied by their outputs.

A shortcoming with life business efficiency writings is that they adopt a varying range of different services as offered via insurers, so many as to make it complicated to compare said writings. Similarly a substantial proportion of articles, do not declare services employed therein. Of the four hundred and eighteen applicable papers only one hundred and forty-six (about 34.9%) do so. Apparently the items that do not fail to consider life institution services and hence may not properly account for the fact that the outputs exploited should be linked appropriately to the defined services delivered.

An extremely central flaw with pieces that list services is that in many of them the services listed are not actually measured (i.e. the entity output measures are not matched to them). This is a deficiency because, as Cummins, Weiss, Xie and Zi (2010) and Greene and Segal (2004) deduce, these matches present a much closer approximation to the true efficiency of the life firms considered. Here there are one hundred and forty-six germane works with only eighty-five portraying total matching (about 58.2%) and only sixteen (about 11.0%) partial matching of any kind. For instance a common group of outputs utilized is incurred benefits (i.e. payments to the policyholders in the current year) plus reserve increases matched to the two services of risk-pooling/bearing and real financial services relating to insured losses. Nonetheless none of the

thirty projects discovered adopting these outputs use measures that capture their separation into these two very diverse services.⁶

A further trouble regarding services is that virtually no readings analyze new business acquisition services (especially new policy set-up) separately or in any other way.⁷ Indeed only three studies have been found that inspect these services in any manner with just one drawing upon total matching and the other two only partial matching. Operations with respect to existing business and new business acquisition are vastly distinct activities. Carr (2004) asserts this point by expounding the latter as including marketing, advertising, underwriting, new policy set-up, activities concerning sale e.g. advice and activities connected with sales offices. On the other hand operations as to existing business encompasses premium collection, claims processing, record keeping, dividend payment, financial statement preparation and activities associated with home offices.⁸ Thus a separation of the two (as opposed to simply labelling them all as for instance administration or “real” services) is needed.

Therefore because 1) comparatively few articles designate services at all, 2) there are many disparate collections of services elucidated across items that do proclaim any, 3) services often are not actually transformed into empirical measures (i.e. matched) suitably and 4) specific services are not scrutinized appositely; the literature on life insurance efficiency pieces is confusing to analyze with the resultant deductions difficult to evaluate.

From the discussions of Sections 4, 5 and 6 one conclusion is that investigating the trends regarding profit efficiency, allocative efficiency and services may conceivably aid in revealing where to emphasize further research.

7. Works Appraising Life Insurance and General Insurance Efficiency Totally Together

Treating life insurance and general insurance totally together may be a problem in that the two industries are inherently distinct for example (among many other reasons) 1) general insurance claims are repeatable whereas with life insurance this is mostly not true, 2) a substantial part of life insurance business is annuities which involves payment without the occurrence of a contingent event while this type of payment is much smaller for general insurance, 3) life insurance business tends to be long-term, conversely general insurance business tends to be short term 4) income earned from investments is of much greater significance for life insurance and 5) the regulations, capital requirements, etcetera of the two are (vastly) dissimilar.⁹

Perhaps the most essential reason is that the method(s) and elements considered and accounted for in determining reserves, which is regarded as the most important financial value for insurance

⁶ Of the thirty relevant projects discovered none illustrate such a separation.

⁷ Only three studies have been found that inspect these services in any manner, one draws upon total matching and the other two only partial matching.

⁸ Both lists are certainly not exhaustive. See Carr (2004), pp. 13-20 – 13-22 for more details.

⁹ Among (many) other reasons.

enterprises, are hugely different. Reserves are even more prominent in the context of this survey as a large percentage of papers use reserves as an output proxy (see Table 5 below). As well, of the two hundred and sixty-eight applicable creations published commencing in 2011 nineteen use reserves as an input and a further five do so indirectly.

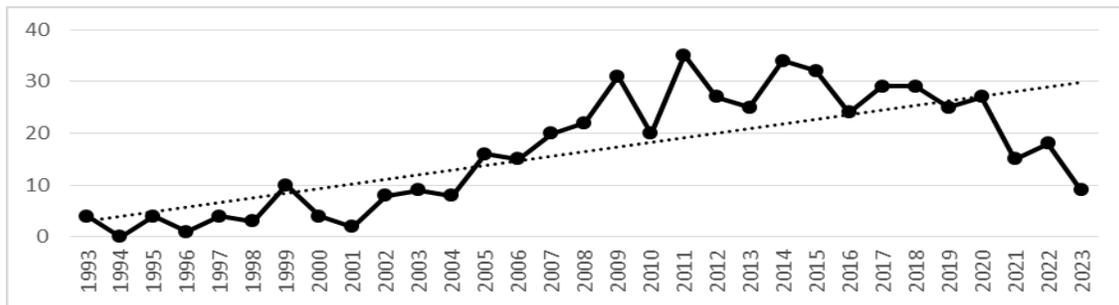
Another fundamental distinction is the accounting rules used. Life insurance accounting rules are geared to maintaining the solvency of the company conversely general insurance accounting rules focus on computing the profit of the company. Hence the purpose of the former is to protect the policyholders and that of the latter is to evaluate gains to shareholders. One vital distinction here is the treatment of acquisition expenses which are spread over the life of the policy in general insurance but are all brought up-front in life insurance.

Now, relating to articles in the survey of 2011 and later there are one hundred and eighteen fitting that encompass both life insurance and general insurance. Of these one hundred and ten assess the two totally¹⁰ together whereas only eight deal with them separately. Clearly given the foregoing no efficiency item should evaluate life insurance and general insurance totally together and the conclusions of those that do are decidedly questionable. Moreover given that the one hundred and eighteen readings are of two hundred and sixty-eight potential (about 44.0%) so it appears that a large proportion of life insurance efficiency pieces scrutinize at both life insurance and general insurance. Given that one hundred and ten of the one hundred and eighteen treat life insurance and general insurance totally together it is possible to deduce that the overall credibility of life insurance efficiency research is questionable.

8. Counts and Trends

8.1 Number of Papers

The number of papers that have probed life enterprise efficiency has been steadily enhanced as depicted in Figure 3 beneath which exhibits the number of works in the survey year-by-year (starting in 1993):



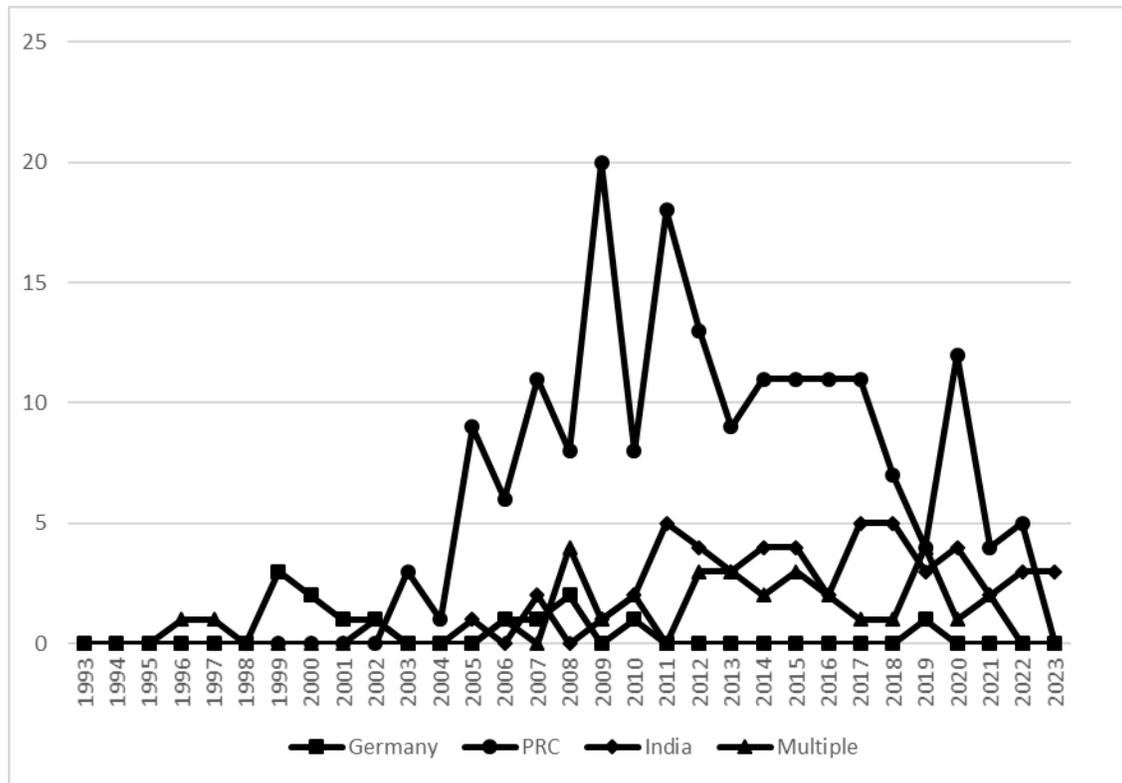
One paper from 1983 and two from 2024 also in the survey. Additionally there are two for which the year is not extant.

Figure 3. Number of Life Insurance Efficiency Studies (Year-by-Year) with Trend Line

¹⁰ One of these treats life insurance companies and banks totally together, equally problematic.

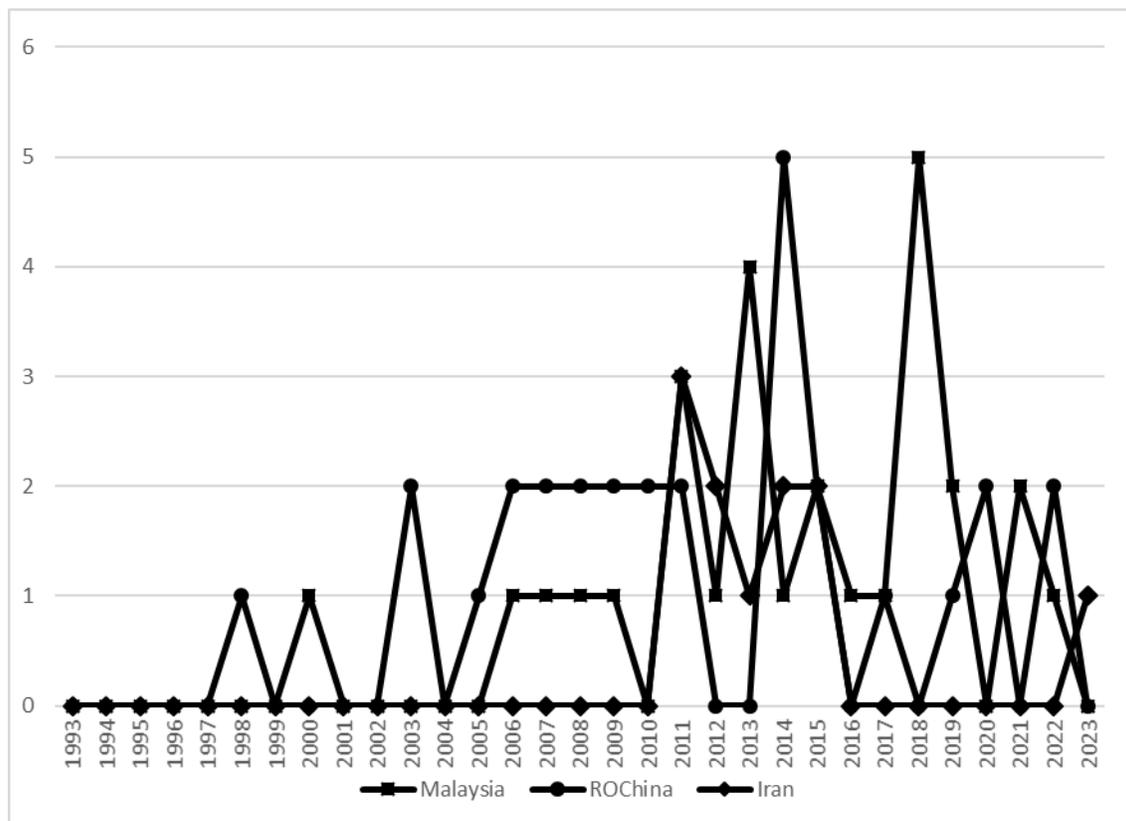
The steady surge in research monitoring life insurance efficiency displays that it is being thought of as being of greater criticality in both the life insurance industry and the financial services industry as a whole. Another trait the escalation demonstrates is the growing attention paid to the efficiency and competitiveness of life institutions in the international arena (Eling and Luhnen (2010b)).

For readings that calculate life entity efficiency, the focus of those looking at three countries or fewer has changed over the years. When research began in the early 1990s the preponderance examined the efficiency of life firms in the United States whereas the late 1990s saw the same trend while the emphasis on Germany was augmented. Initiating in the mid-2000s the PRC and the ROChina along with the United States became the spotlight of a higher quantity of life insurer efficiency projects than other nations. In the early 2010s Asia became the main area of attention, particularly the PRC, India, the ROChina and Malaysia. In the late 2010s that endured but with the addition of Indonesia. In the early 2020s the equivalent trend continued with a large emphasis on Indonesia. The number of studies of the most concentrated upon nations year-by-year (beginning in 1993) are shown in Figures 4, 5 and 6 below:



One 2024 paper from the PRC also in the survey

Figure 4. Number of Life Insurance Efficiency Studies Regarding Germany, the PRC, India and Multiple Nations (Year-by-Year)



One 2024 paper from Iran also in the survey. Additionally there is one paper from Iran for which the year is not extant.

Figure 5. Number of Life Insurance Efficiency Studies Regarding Malaysia, the ROChina and Iran (Year-by-Year)

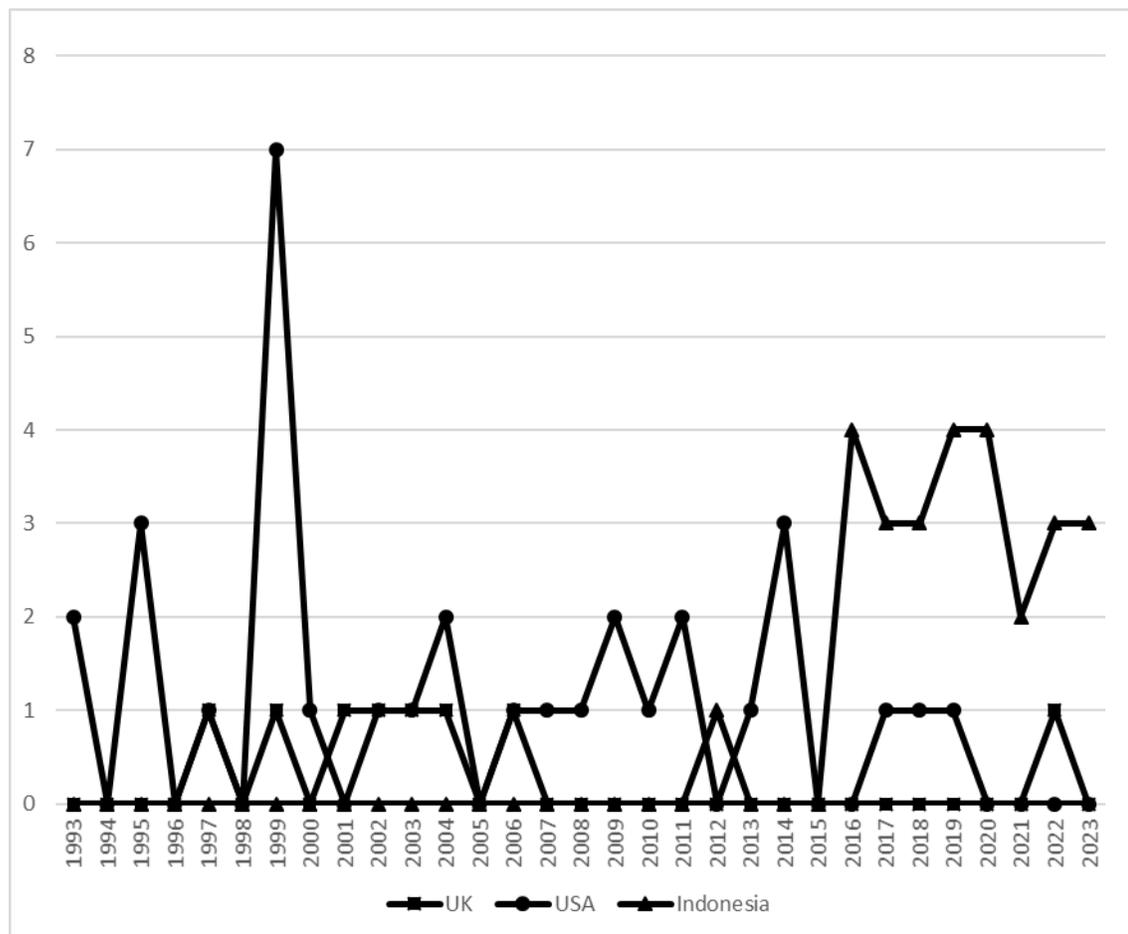
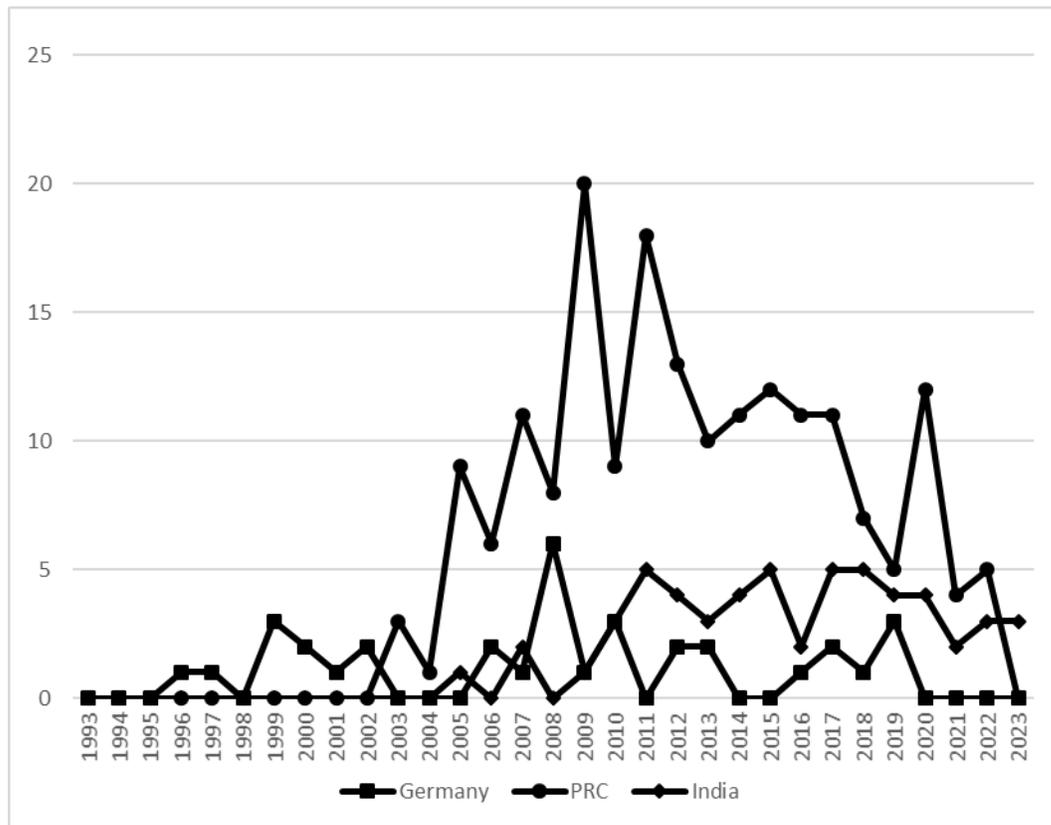


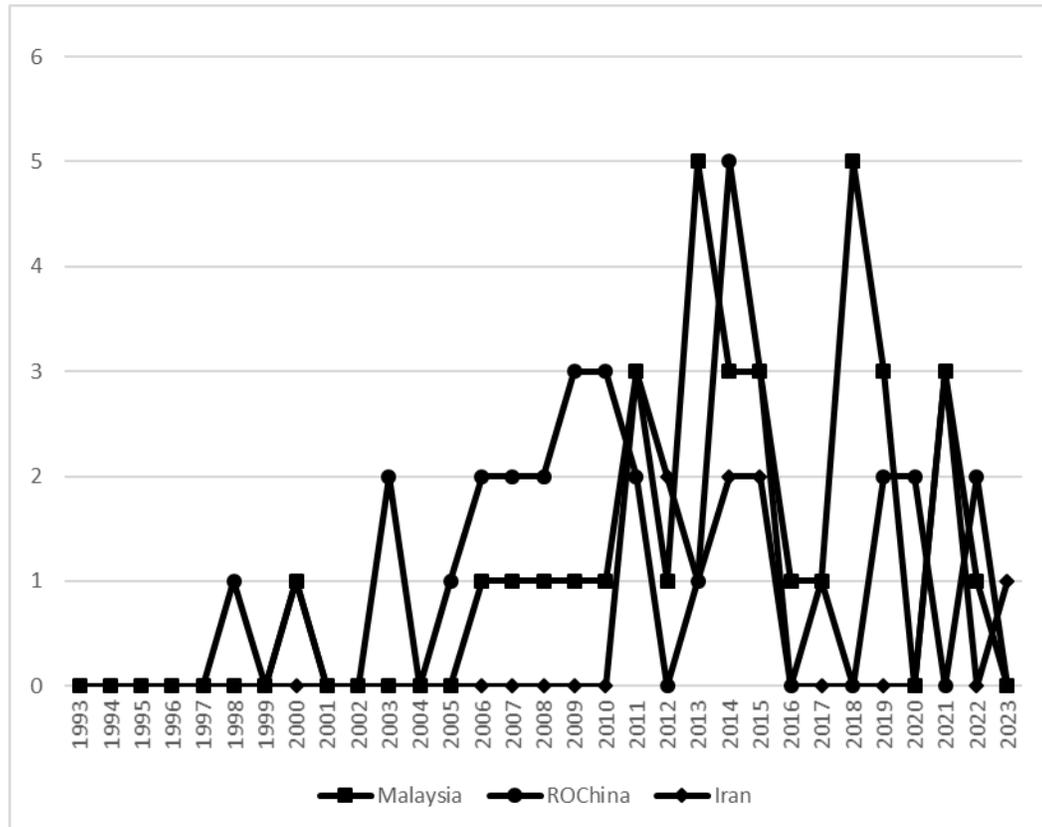
Figure 6. Number of Life Insurance Efficiency Studies Regarding The UK, the USA and Indonesia (Year-by-Year)

When exploring research concerning more than three nations the trends are exactly alike as described prior for articles considering less than four nations. The number of items of the nations the most focused on year by year (commencing in 1993) are illustrated in Figures 7, 8 and 9 following:



One 2024 paper from the PRC also in the survey

Figure 7. Number of Life Insurance Efficiency Studies When Taking Multiple Nation Studies into Account Regarding Germany, the PRC and India (Year-by-Year)



One 2024 paper from Iran also in the survey. Additionally there is one paper from Iran for which the year is not extant.

Figure 8. Number of Life Insurance Efficiency Studies When Taking Multiple Nation Studies into Account Regarding Malaysia, the ROChina and Iran (Year-by-Year)

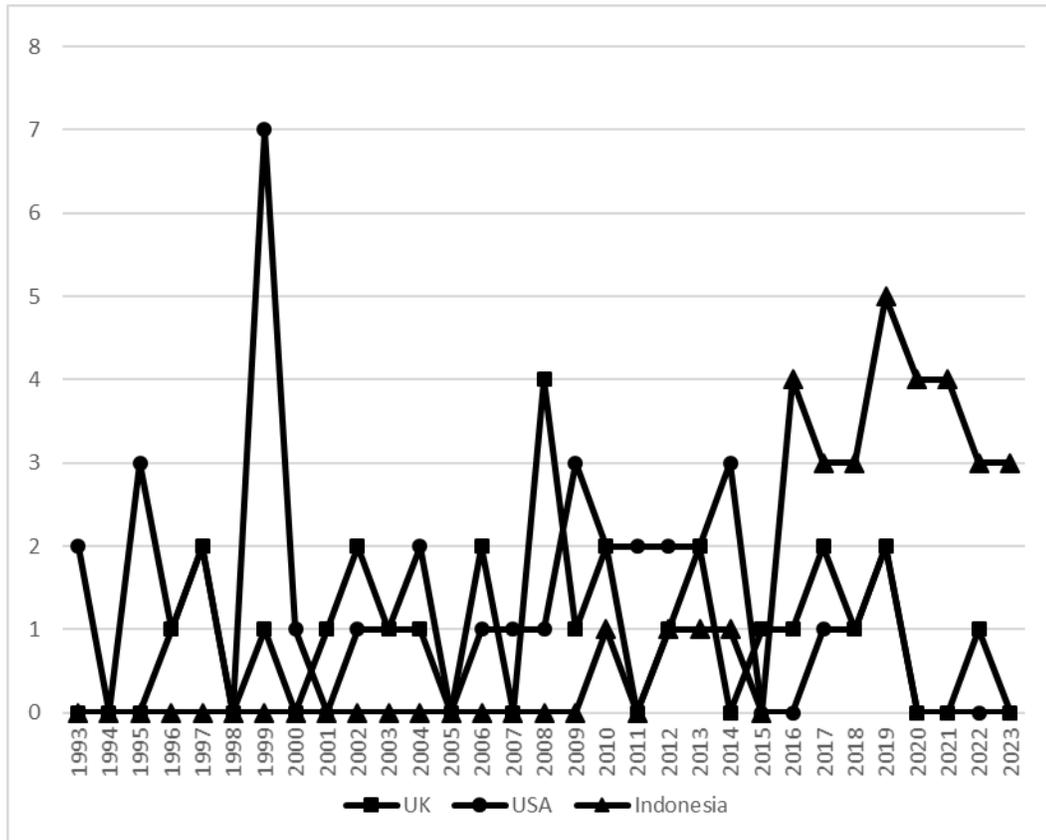


Figure 9. Number of Life Insurance Efficiency Studies When Taking Multiple Nation Studies into Account Regarding the UK, the USA and Indonesia (Year-by-Year)

The fact that, regarding life enterprise efficiency, there has been a greater diversity of nations inspected seems to indicate a higher awareness of its importance. The trend also probably reflects a larger access to information and funds to be able to perform research.

8.2 Methods of Determining Efficiency

The seven most common methods utilized to determine life insurance efficiency comprise two non-parametric, three parametric, one semi-parametric and the Bayesian approaches.¹¹ The two non-parametric methods are, data envelopment analysis (DEA) and free disposal hull (FDH), the three parametric techniques are stochastic frontier analysis (SFA), thick frontier analysis (TFA) and the distribution-free approach (DFA). The semi-parametric method employed the most is the Fourier Flexible (FF). The counts of methods are portrayed in Table 1 underneath (note that there is an overlap between the groups of authors as well as for Tables 4, 5, 6, 7 and 8).

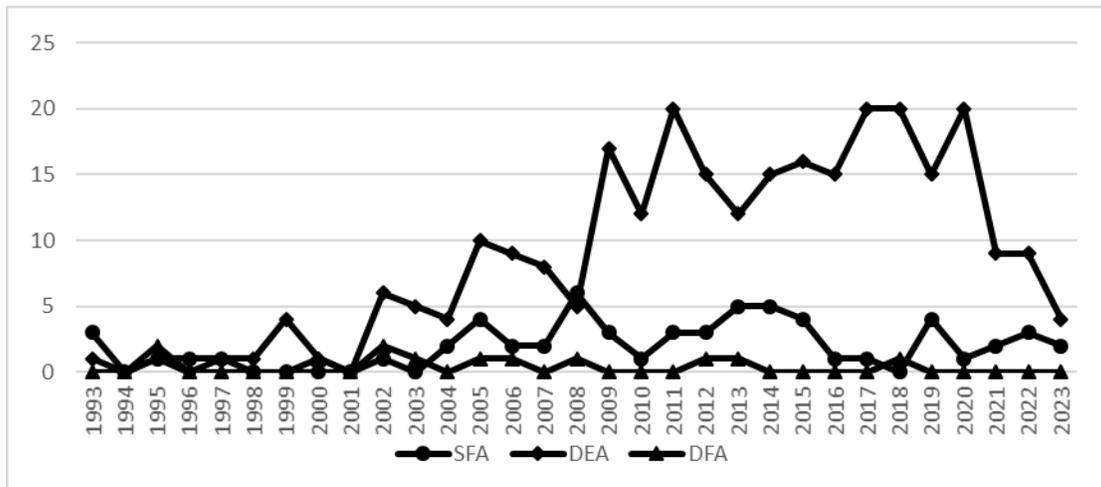
¹¹ See Wise (2017) for a description of along with some of the key advantages and disadvantages of these techniques.

Table 1 Counts of Methods of Determining Efficiency

Method	Number of Papers with no Author Duplication	Number of Papers
DEA	279	431
SFA	61 (2 use FF)	76 (5 use FF)
DFA	12 (1 uses FF)	14 (1 uses FF)
FDH	4	5
Bayesian	1 (uses SFA)	1 (uses SFA)
Other	1	1
Not Applicable	3	3

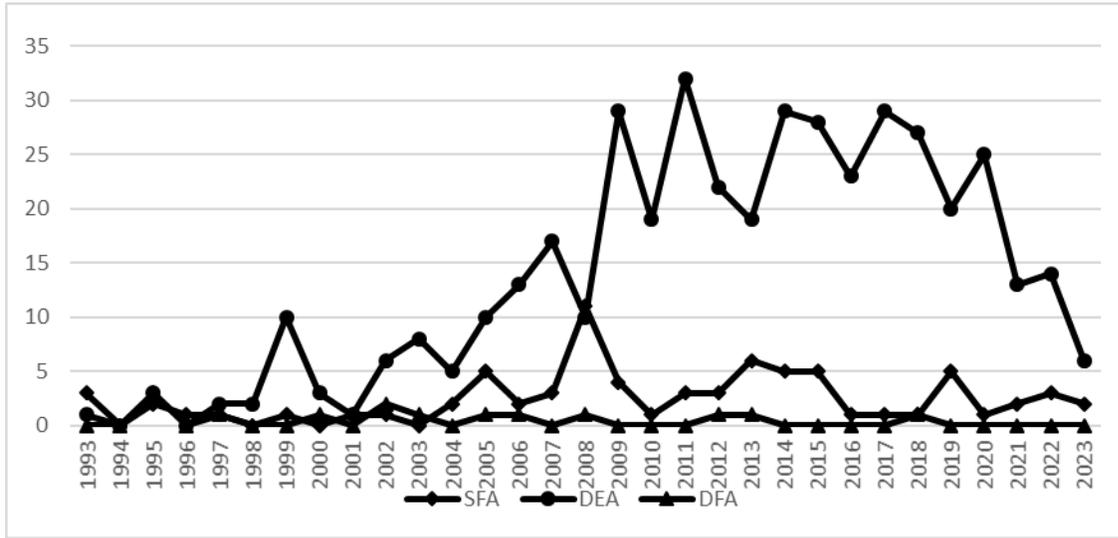
a: There are three papers for which the method of determining efficiency is unknown

Relating to the number of papers both disallowing and with author duplication the trend has been that a greater volume have exploited DEA than SFA in almost all years. The number of studies utilizing the varied methods of assessing efficiency year-by-year (beginning in 1993) are conveyed in Figure 10 and Figure 11 beneath:



Two 2024 papers using DEA also in the survey. Additionally there is one paper using DEA for which the year is not extant.

Figure 10. Number of Life Insurance Efficiency Studies Using Different Methods of Determining Efficiency with no Author Duplication (Year-by-Year)



Two 2024 papers using DEA also in the survey. Additionally there are two papers using DEA for which the year is not extant

Figure 11. Number of Life Insurance Efficiency Studies Using Different Methods of Determining Efficiency (Year-by-Year)

Twelve papers draw upon at least two methods (i.e. each applied in a separate project) of computing efficiency scores as provided in Table 2 below:

Table 2 Papers Specifying More Than One Method of Determining Efficiency

Methods	Number of Papers	Elements Compared
DEA & SFA	7	1: efficiency scores by company (only eight companies) 3: efficiency scores by company characteristics e.g. company size and organizational form
		1: only overall inefficiency score obtained from the two methods 2: what is actually implemented is not extant
DEA & DFA	1	only overall inefficiency score obtained from the two methods
DEA & FDH	1	efficiency scores by company (only five companies)
DEA, SFA & FDH	1	efficiency scores by company characteristics e.g. as company size and organizational form
DEA, SFA, DFA & FDH	2	efficiency scores by company characteristics e.g. company size and organizational form

Of the twelve papers six display a comparison of the efficiency scores by institution characteristics such as size and organizational form and two only present an overall inefficiency

score obtained from the two methods. Only two reveal a company-by company contrast of efficiency scores, which could be construed as the most useful results, and those writers only incorporated eight and five companies. Given the small amount that so execute, it appears clear that more research should employ both SFA and DEA and distinguish the outcomes derived, especially on a company-by-company basis, as it is plausible that they will differ significantly. Such a dissimilarity may lead to (fundamentally) disparate conclusions being drawn from the work. At the very least said conclusions could be confirmed.

Now, as to using non-parametric approaches there is an issue of whether enough decision making units (DMUs) (here insurers) are applied versus the quantity of inputs and outputs. If the number of DMUs is low when against that of the inputs and outputs a high proportion will achieve an efficiency score of 100% as they will be difficult to match in all dimensions. Similarly sufficient DMUs permits for an adequate volume of linear combinations thereof to result in meaningful comparisons (Bauer, Berger, Ferrier and Humphrey (1998), Thanassoulis, Portel and Despic (2008), Sarkis (2002)). Dyson, Allen, Camanho, Podinovski, Sarrico and Shale (2001) notes that if exploiting DEA an item should contain a quantity of DMUs that is at least as large as twice the product of that of the inputs and that of the outputs while Cooper, Li, Seiford, Thrall and Zhu (2001) remarks that the number of DMUs should be at least three times the sum of said two values. The numbers of papers utilizing a non-parametric approach with enough DMUs, not enough DMUs, a volume of DMUs so that such a sufficiency is questionable, and it is unknown¹² whether an adequate quantity are specified is cited in Table 3 following:

Table 3 Papers Incorporating Non-Parametric Approaches Number of DMUs Versus Number of Inputs and Outputs

Category	Number of Papers
Enough	244
Not Enough	51
Questionable	22
Unknown	117

a: Four papers employ both DEA and FDH nevertheless only get counted once in Table 3.

b: One paper is just a survey so has no study, One as having a questionable number of DMUs twice and enough once as it has three disparate studies, one paper as consisting of enough DMUs but uses neither DEA nor FDH as it exploits an “other” non-parametric process.

Scrutinizing the quantities of DMUs, inputs and outputs, for the three hundred and seventeen fitting cases involving a non-parametric approach looked at fifty-one (about 16.1%) do not seem to comprise sufficient DMUs to have credibility. A further twenty-two (about 6.9%) appear questionable.

Associated with the idea of utilizing a parametric approach is which functional form should upon to obtain the efficient frontier. Necessities include that the function can perform well over a

¹² The majority of cases here are due to the manner in which the efficiency results are presented.

range of data points (Caves and Christensen (1980)), be parsimonious in parameters and tolerate zero outputs (Caves, Christensen and Trethway (1980)). Common functional forms incorporated are the Cobb-Douglas, Box-Cox, translog and the Fourier Flexible (Sun and Zhong (2011) with others suggested being the Leontief and the quadratic (Caves and Christensen (1980)) along with the constant-elasticity-of-substitution (CES) and linear functions. The choice of functional form implies the shape of the isoquants (here representing the combinations of inputs resulting in the same output) and likewise the values of elasticities of factor demand and factor substitution (Greene (2008)).

Each functional form has its strengths and weaknesses. For example, with greater than one output a Cobb-Douglas cost function can give rise to all of the potential frontiers being convex instead of concave which implies only a few outputs being specialized by all DMUs (Greene (2008)). It also results in constricting scale properties on the frontier which can lead to substitution elasticities not equalling one being confused with inefficiency (Knox Lovell (1993)). Another shortcoming with the Cobb-Douglas, along with the Leontief, CES, and linear functional forms, is the consequence of possible production factor substitution being constrained again with the outcome of substitution elasticities not equalling one being confused with inefficiency (Knox Lovell (1993), Segal (2003)). The quadratic has the weakness of not allowing for price linear homogeneity.

To avoid the preceding deficiencies flexible functional forms began to be employed with the translog most often, perhaps as it needs few confining assumptions concerning the technology (Kasman and Turgutlu (2009)). As well both the translog and the Fourier Flexible functional forms generate a high volume of interaction terms and accordingly potentially describe a larger part of the deterministic relationships within the data than does the Cobb-Douglas (Ward (2002)). Nonetheless these functional forms contain flaws for instance as not being monotonic or globally convex; both attributes the Cobb-Douglas cost function exhibits (Greene (2008)) and that the interaction terms can result in a multicollinearity being of greater potential and hence a corresponding lower capacity to know what causes costs or profits (Ward (2002)). Additionally the translog and Fourier Flexible have no allowance for output values of zero. Plus the translog may not effect a good fit with data far away from the average of the size or mix of outputs therefore to correct for this defect the Fourier Flexible is suggested (Berger and Mester (1997)).

It should be noted that some of the studies draw upon more than one functional form thus the totals of the parametric approaches in Table 1 above do not match the total number of papers here. The counts of functional forms are expounded in Table 4 underneath:

Table 4 Counts of Functional Forms: Papers Employing a Parametric Approach

Functional Form	Number of Papers with no Author Duplication	Number of Papers
Translog	49 (4 use FF)	62 (7 use FF)
Cobb-Douglas	15	15
Composite	5	5
Other	2	2
Unknown	6	6

a: The unknown papers consist of five papers where the functional form is not shown, and one where only the fact that SFA is applied has been observed.

8.3 Output Proxy Sets

Weiss (1986) observes, that “to measure output volume, the services provided to insureds must be expressed in measurable and identifiable units.” Problematically as the output for life insurance is in the nature of intangible services, the amount of output is obliged to be approximated by proxies (Erhemjamts and Leverty (2009), Leverty, Lin and Zhou (2004), Weiss (1986)). Consequently as any efficiency scores obtained can be “misleading or meaningless” if outputs and inputs are not defined suitably (Cummins and Weiss (2000), Jarraya and Bouri (2013)) it is mandatory to utilize appropriate and quantifiable units for both outputs and inputs. Indeed, “careful analysis is required to isolate measurable factors that are directly proportional to the services provided;” (Weiss (1986)) especially for the value-added procedure (which most life entity efficiency studies incorporate) as the goal is to determine which activities add worth.¹³

One of the eighty total papers (that is permitting for author duplication) applying both output types comprise three studies altogether, with two of the three studies including premium(-type) outputs and the other reserve(-type) outputs. One other of the eighty employ two studies, with one of the studies encompassing premium(-type) outputs and the other reserve(-type) outputs. Two other of the eighty total papers consist of two studies, each study with both premium(-type) outputs and reserve(-type) outputs. One of these latter two papers uses the two studies only to assess which method (SFA or DEA) is best to incorporate to calculate efficiency. The other has two completely separate studies (i.e. with distinct enterprises). The other seventy-six papers of the eighty total have one study which utilizes both premium(-type) outputs and reserve(-type) outputs. The counts of output proxy sets, where they are known, are illustrated in Table 5 below:

¹³ See Wise (2017) for a discussion and evaluation of output and input proxies drawn on in life insurance efficiency works.

Table 5 Counts of Output Proxy Sets

Output Proxy Set	Number of Papers with no Author Duplication	Number of Papers
(Akin to) Premiums and Number of Policies	187	264
(Akin to) Claims and (Change in) Reserves	111	191
Both (within the above)	58	80
Other:		
Investment Income	122	162
Assets	55	92
Sum Insured	7	12
Dividends ^a	5	8
Profit or Income ^b	77	94
Loans	3	3
Other ^c	27	29
Not Applicable ^d	2	3

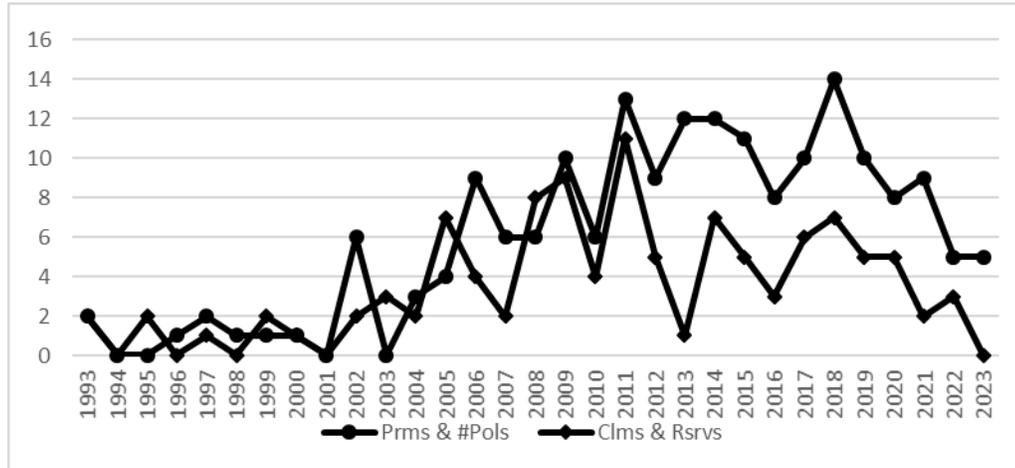
a: Policyholder or shareholder

b: Of all kinds

c: The papers with author duplication represent an author specifying the same “other” output in more than one paper.

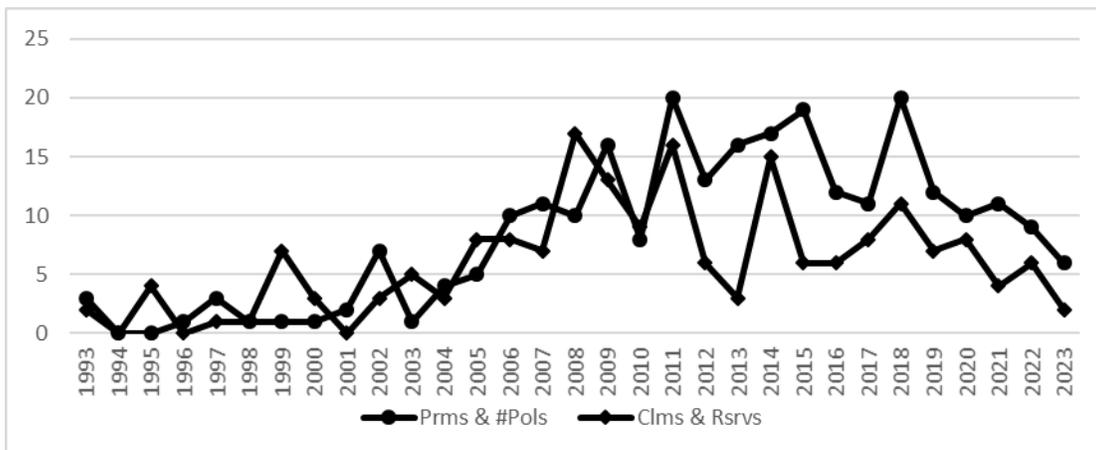
d: Two of these do not comment upon which output proxies are exploited, the third is just a survey hence has no efficiency appraisal.

When monitoring the number of readings without author duplication the recent trend has been that more have utilized output proxies (akin to) premiums and number of policies. Going by a straight number of articles the recent trend is similar. The volume of projects incorporating the disparate groups of output proxies year-by-year (starting in 1993) are portrayed in Figure 12 and Figure 13 beneath:



One 1983 and one 2024 paper using Premiums & #Policies also in the survey. Additionally there is one paper using both Premiums & #Policies and Claims & Reserves for which the year is not extant.

Figure 12. Number of Life Insurance Efficiency Studies Using Different Output Proxy Sets with no Author Duplication (Year-by-Year)



One 1983 and one 2024 paper using Premiums & #Policies also in the survey. Additionally there is one paper using both Premiums & #Policies and Claims & Reserves and another using just Premiums & #Policies for which the years are not extant.

Figure 13. Number of Life Insurance Efficiency Studies Using Different Output Proxy Sets (Year-by-Year)

A majority of writings using an output proxy (akin to) premiums employ only (earned) premiums. Six items conclude that it is better not to draw upon such an output proxy though do for various reasons. Only a few apply premiums combined with a corresponding value.

Related to the notion of specifying an output proxy (akin to) premiums is that of exploiting the number of policies. Motives given include that premium increases influence the output amounts (Bernstein (1998)); premiums are not quantity of output as they are the product of price and quantity (and thus are revenue) (Cummins and Zi (1997), Leverty, Lin and Zhou (2004)); and there can be premium differences between large and small insurers (Boonyasai, Grace and Skipper, Jr (2002); Yuengert (1993)).

The counts of output proxies utilized in papers incorporating those (akin to) premiums are revealed in Table 6 following:

Table 6 Counts of Output Proxies: Papers Using Premiums

Output Proxy	Number of Papers with no Author Duplication	Number of Papers
Premiums Only ^a (not Earned Premiums)	161	217
Earned Premiums	27	37
Number of Policies Only	6	7
Premiums and Number of Policies	7 (1 uses EPs)	7 (1 uses EPs)

a: Six papers (five when disallowing author duplication) state that employing premiums is inappropriate.

8.4 Form of Input Proxies

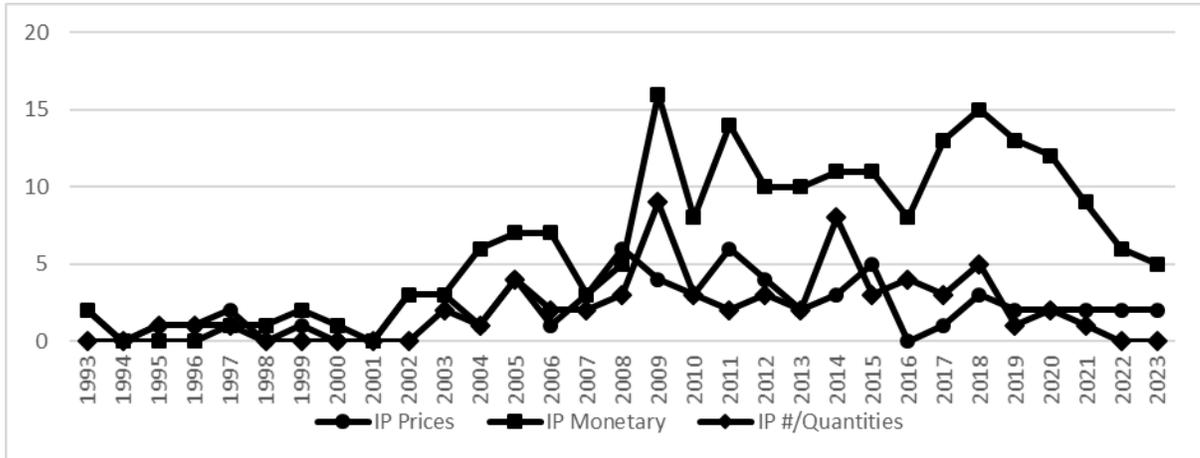
One aspect of the inputs drawn on in life institution efficiency research is the form of the inputs. The two most prevalent forms are input prices and input monetary values. The articles incorporating quantities of inputs e.g. the number of employees, do so in combination with monetary values (except in one case). The counts of input proxy forms utilized, where they are known, are declared in Table 7 underneath:

Table 7 Counts of input proxy forms

Input Form	Number of Papers with no Author Duplication	Number of Papers
Prices	70	119
Monetary Values	206	307
Numbers/Quantities	64	86
Ratio	7	7
Other	1 (is input variance/ratios)	1

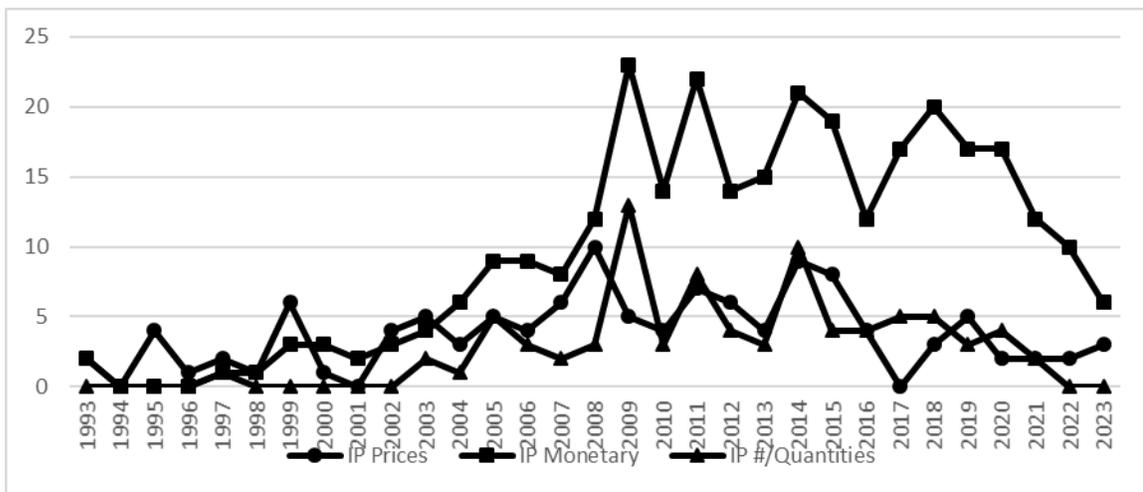
When probing the volume of papers both without and with author duplication the trend has been that more have exploited input monetary values as an input proxy recently. The quantity of

projects using the diverse input proxy forms year-by-year (initiating in 1993) are conveyed in Figure 14 and Figure 15 below:



One 1983 paper using IP prices and IP monetary values, one 2024 paper using IP monetary values and one 2024 paper using IP monetary values and IP quantities also in the survey. Additionally there is one paper using IP monetary values for which the years are not extant.

Figure 14. Number of Life Insurance Efficiency Studies Using Different Input Proxy Forms with no Author Duplication (Year-by-Year)



One 1983 paper using IP prices and IP monetary values, one 2024 paper using IP monetary values and one 2024 paper using IP monetary values and IP quantities also in the survey. Additionally there are two papers using IP monetary values for which the years are not extant.

Figure 15. Number of Life Insurance Efficiency Studies Using Different Input Proxy Forms (Year-by-Year)

A fundamental feature of life business efficiency pieces specifying input prices is the idea of drawing on ones that are common (by year) across companies. Papers utilizing input prices that are partly common and partly not are utilized in twenty-seven are labelled as Mixed in Table 8 which elucidates the counts of commonality of input prices:

Table 8 Counts of Input Price Commonality: Papers Exploiting Input Prices

Price Commonality	Number of Papers with no Author Duplication	Number of Papers
All Common	24	46
Mixed	27	37
All Not Common	30	34

a: Note three overall papers have unknown commonality and one paper is in two categories.

As can be seen in Table 8 more than seventy percent of the studies those specifying input prices seen use some common input prices (by year) across companies. Of these over fifty-five percent only have input prices that are common (by year) across companies. This is a shortcoming because different insurers pay different prices for inputs such as wages, materials and capital. For the case of equity capital as life insurers have diverse asset sets clearly they have different costs of capital hence the assumption that said cost is common is inaccurate. As to the price of labor insurers have even more different rosters of employees than asset sets so assuming they have a constant labor cost is definitely inaccurate. So more researchers need to put forth the effort to ensure that they use uncommon input prices.

When examining the research with author duplication in general there were more papers with prices being common until 2012 and afterward there has been no trend. For papers without author duplication there has been no trend taking into account whether the most works have specified common, not common or mixed input prices.

9. Conclusions and Further Research

This paper has built upon previous studies for instance Berger and Humphrey (1997), Cummins and Weiss (2000), Eling and Luhn (2010a), Jarraya and Bouri (2013), Bu and Wang (2014), Pawar Waghavkar and Sananse (2015) and Zinyoro and Aziakpono (2023) to enumerate and explore the techniques incorporated the most in over 510 works to determine life insurance efficiency. This paper has also inspected the numbers and recent trends of methods and some aspects of life entity efficiency estimation.

One conclusion drawn from the results of this project is that the steady increase in both the volume and scope of pieces scrutinizing life firm efficiency means that it is being perceived as being of greater and greater importance. However it seems that more attention should be paid to both the profit and allocative efficiency of and the services provided via life insurers. In addition due to the large percentage of life insurance efficiency items treating life insurance and general

insurance totally together it is conceivable to conclude that the overall credibility of life insurance efficiency research is questionable.

Considering the methods employed to calculate efficiency scores many more could and should apply at least two and compare the outcomes derived, especially on a company-by-company basis. Such a difference may result in (significantly) different conclusions being drawn from the piece. At the very least the conclusions of the project could be confirmed. For non-parametric approaches specifically greater care could be utilized in ensuring that a sufficient quantity of DMUs versus that of input and outputs is used.

There are many potential directions for further research in life insurance efficiency. One prospect is more articles with a focus on 1) countries with an increasing GDP and 2) countries with a reasonably high life insurance premium per capita value for which little has been done. With respect to the former Brazil, Mexico and the KSA are fitting, for the latter Chile, the UAE and Uruguay are apt.¹⁴ A deduction from this study is that to what is perhaps the most crucial possibility of profit efficiency more attention should be paid. Less than 7% of the readings looked at have incorporated profit efficiency. Likewise a key potential for further research is allocative efficiency; being analyzed in less than 3.8% of relevant articles written since 2015.

As well further research can be undertaken regarding the manners exploited to compute life enterprise efficiency. It appears clear that more papers should draw upon both a parametric and nonparametric approach (only 12 of the 505 applicable do so) and compare the results derived as they may differ significantly. Similarly a larger proportion of works employing both approach types could display a company-by-company comparison of the scores obtained from them. Additionally creations might try varied methods, such as DFA and FDH. Plus a higher quantity of authors applying a (semi-) parametric approach can utilize more than one functional form and compare outcomes as they may equally diverge extensively. The identical remarks relating to exploiting both a parametric and nonparametric method and can be said with respect to the two basic sets of prevalent output proxies 1) reserves (or their change) and claims and 2) premiums and policy numbers.

Additional directions for further research include splitting the companies in diverse ways instead of just investigating them as a whole. Two splits are splitting the institutions by service and line of business. Another split is to monitor business written within each company domestically versus outside of the country of domicile. Any of these splits would be useful in that it will indicate on which specific areas life entities might concentrate.

Further research opportunities concerning efficiency include probing it as to 1) reinsurance which will allow for an examination of the effect of reinsurance on life firm efficiency, 2) how efficiency is affected through company expansion or the volume of business written and 3) how

¹⁴ In this survey only one individual nation reading takes into account Brazil along with it being in two multiple country items. For Mexico the corresponding values are three and two, for the KSA one and five, for Chile zero and three, for the UAE two and fourteen and for Uruguay zero and two.

efficiency is influenced via product development. In addition an analysis of the trends explored in this article may help show which are the best directions to take further research.

As life insurance efficiency is a subject gaining in recognition as being critical to analyze it can be important to both practitioners and regulators. Therefore those concerned with life insurance efficiency can potentially find this project useful as it will enable an assessment of which aspects of this field of study need more research and which are otherwise worth developing.

References

- Abbas. M., Khan A. B., Abbas, S. and Mahmood, Z. (2018), “Determinants of Cost Efficiency of Takaful and Conventional Insurance Firms of Pakistan”, *Review of Economics and Development Studies*,4(2), 331-340.
- Abduh, M., Omar, M. A. and Tamrizi, R. M. (2012), “The Performance of Insurance Industry in Malaysia: Islamic vis-à-vis Conventional Insurance”, *Journal of Islamic Banking and Finance*, 29(4), 40-49.
- Afifah, S. I. and Suwanda, S. (2023), “Analisis Pengukuran Tingkat Efisiensi Perusahaan Menggunakan Metode *Stochastic Frontier Analysis* (SFA) (Analysis of Measuring the Level of Company Efficiency Using the *Stochastic Frontier Analysis* (SFA) Method)”, *Bandung Conference Series: Statistics*, 3(2), 459-465.
- Afsordeh, M. and Moridipour, H (2014), “Performance Evaluation of Representatives of Insurance Companies in Iran Using Analytic Network Process (ANP) and Data Envelopment Analysis (DEA)”, *Euro-Asian Journal of Economics and Finance*, 2(4), 316-323.
- Afza, T. and Jam-e-Kausar Ali Asghar, M. (2010), “Efficiency of the Insurance Industry in Pakistan: An Application of Non-parametric Approach”, *Interdisciplinary Journal of Contemporary Research in Business*, 2(8), 84-98.
- Ahmad, A. A. and Suharko, A. B. (2023), “Comparative Analysis of the Efficiency of the Top Ten Conventional Joint Venture Life Insurance Companies in Indonesia in the Period Before and During the Covid-19 Pandemic Using the Data Envelopment Analysis Method”, *Journal of Digital Economics and Business*, 2(3), 899-914.
- Ahmad, W. M. A. W., Nawi, A. M. A. A., and Aleng, N. A. (2013), “Relative Efficiency Analysis Industry of Life and General Insurance in Malaysia Using Stochastic Frontier Analysis (SFA)”, *Applied Mathematical Sciences*, 7(23), 1107-1118.
- Ajlouni, M. M. and Tobaishat, S. (2009), “The Effect of Technical Efficiency in Insurance Companies on Stock Performance: Data Envelopment Analysis Evidence from Jordanian Companies Listed in Amman Stock Exchange During the Period (2000-2006)”, in A. Ahmed (ed.), *World Sustainable Development Outlook 2009: The Impact of the Global Financial Crisis on the Environment, Energy and Sustainable Development*, World Association for Sustainable Development, London, UK.
- Akhavain, J. D., Berger, A. N., and Humphrey, D. B. (1997), “The Effects of Megamergers on Efficiency and Prices: Evidence from a Bank Profit Function”, *Review of Industrial Organization*, 12(1), 95-139.

- Akhtar, M. H. (2018), "Performance analysis of Takaful and Conventional Insurance Companies in Saudi Arabia", *Benchmarking: An International Journal*, 25(2), 677-695.
- Al-Amri, K. (2015), "Takaful insurance efficiency in the GCC countries", *Humanomics*, 31(3), 344-353.
- Al-Amri, K., Cummins, J. D. and Weiss, M. A. (2014), "Economies of Scope, Organizational Form, and Insolvency Risk: Evidence from the Takaful Insurance Industry (Fox School of Business Research Paper, #15-050)", Temple University, Philadelphia, PA.
- Al-Amri, K., Gattoufi, S., and Al-Muharrami, S. (2012), "Analyzing the technical efficiency of insurance companies in GCC", *The Journal of Risk Finance*, 13(4), 362-380.
- Alhassan, A. L. and Addison, G. K. (2013), "Market Structure, Efficiency and Performance: Empirical Evidence from the Ghanaian Life Insurance Market", paper presented at the First University of Ghana Business School Conference and Development in Africa, Accra, Ghana held April 8-9, 2013.
- Alhassan A. L., Addison G. K. and Asamoah, M. E. (2015), "Market structure, efficiency and profitability of insurance companies in Ghana", *International Journal of Emerging Markets*, 10(4), 648-669.
- Alhassan, A. L. and Afua Baokye, M-A. (2020), "Board characteristics and life insurance efficiency in South Africa", *Pacific Accounting Review*, 32(2), 217-237.
- Almulhim, T. (2019), "Analysis of Takaful vs. Conventional insurance firms' efficiency: Two-stage DEA of Saudi Arabia's insurance market", *Cogent Business & Management*, 6(1).
- Alshammari, A. A., Alhabshi, S. M. b. S. J. and Saiti, B. (2019a), "The impact of competition on cost efficiency of insurance and takaful sectors: Evidence from GCC markets based on the Stochastic Frontier Analysis", *Research in International Business and Finance*, 47, 410-427.
- Alshammari, A. A., Alhabshi, S. M. b. S. J. and Saiti, B. (2019b), "The impact of oil prices and the financial market on cost efficiency in the insurance and Takaful sectors: Evidence from a stochastic frontier analysis", *Economic Systems*, 43(3-4).
- Amirteimoori, A., Allahviranloo, T. and Arabmaldar, A. (2024), "Scale elasticity and technical efficiency measures in two-stage network production processes: an application to the insurance sector", *Financial Innovation*, 10.
- Ansah-Adu, K., Andoh, C. and Abor, J. (2012), "Evaluating the cost efficiency of insurance companies in Ghana", *The Journal of Risk Finance*, 13(1), 61-76.
- Antonio, M. S., Ali, M. M. and Akbar, N. (2013), "A comparative analysis of the efficiency of takaful and conventional insurance in Malaysia", *The International Journal of Excellence in Islamic Banking and Finance*, 3(1), 1-13.
- Aoba, N. (2006), "Efficiency in the Japanese Life Insurance Industry: Dramatic Change", paper presented at the American Risk and Insurance Association 2006 Annual Meeting, Washington, DC held August 6-9, 2006.
- Aprilia, R., Mahri, A. J. W. and Cakhyaneu, A. (2022), "Efficiency of Sharia Life Insurance in Indonesia and Malaysia: The Effect of Profitability and Firm Size", *Indonesian Journal of Economics and Management*, 3(1), 1-16.

- Ardianto, M. I. R. and Sukmaningrum, P. S. (2020), “Analisis Efisiensi Asuransi Jiwa Syariah di Indonesia dan Takaful Family di Malaysia Dengan Metode Data Envelopment Analysis (Studi Kasus Pada Koperasi Jasa Keuangan Syariah Al Abrar) (An Efficiency Analysis of Shariah Life Insurance in Indonesia and Family Takaful in Malaysia Using the Data Envelopment Analysis Method (Case Study on Al Abrar’s Shariah Financial Service Cooperative))” *Jurnal Ekonomi Syariah Teori dan Terapan (Journal of Islamic Economics Theory and Application)*, 7(2), 319-331.
- Ashiagbor, A. A., Dziwornu, R., Gbade, A. V., Offei-Kwafo, K. and Liticia, G. (2023), “Measuring efficiency and productivity changes: A non-parametric analysis of Ghanaian life insurance industry”, *Cogent Economics & Finance*, 11(1).
- Ashraf, S. H. and Kumari, N. (2015), “An Evaluation of Investment Performance of Private Life Insurance Industry in India”, *International Journal of Accounting Research*, 3(2).
- Astuti, Y. F. and Suprayogi, N. (2017), “Perbedaan Efisiensi Perusahaan Asuransi Jiwa Syariah dan Konvensional di Indonesia Dengan Metode DATA ENVELOPMENT ANALYSIS (DEA) (Differences in Efficiency of Sharia and Conventional Life Insurance Companies in Indonesia Using the DATA ENVELOPMENT ANALYSIS (DEA) Method)”, *Jurnal Ekonomi Syariah Teori dan Terapan (Journal of Islamic Economics Theory and Application)*, 4(8), 668-683.
- Athawale, S. and Fernandes, P. (2016), “An Analysis of Efficiency Performance of Private life Insurance”, *International Journal of Recent Research in Commerce Economics and Management*, 3(3), 48-56.
- Aziz, N. A. A., Mahad, N. F., Mahyideen, J. M. and Kasim. E. S. (2021), “Incorporating Expert Judgement into Life Insurance and Life Takaful Companies’ Efficiency Measurement Through DEA-AR/FAHP Approach”, *International Journal of Academic Research in Business and Social Sciences*, 11(11), 202–221.
- Babatunde, J. H. and Haron, R. (2015), “Technical Efficiency of Nigerian Insurance Companies: A Data Envelopment Analysis and Latent Growth Curve Modelling Approach”, *International Journal of Data Envelopment Analysis*, 3(2), 659-677.
- Badunenko, O., Grechanyuk, B., and Talavera, O. (2006), “Development under regulation: The way of the Ukrainian insurance market”, German Institute for Economic Research Discussion Paper 644.
- Baharin, R. and Isa, Z. (2007), “Kajian Terhadap Tahap Kecekapan Syarikat Insuran Hayat am Menggunakan Analisis Perbatasan Stokastik (APS) (A Study of the Efficiency Level of General and Life Insurance Companies Using the Stochastic Frontier Analysis Technique)”, *Journal of Quality Measurement and Analysis*, 3(1), 111-119.
- Baharin, R. and Isa, Z. (2013), “The Efficiency of Life Insurance and Family Takaful in Malaysia: Relative Efficiency Using the Stochastic Cost Frontier Analysis”, *Insurance and Takaful Journal*, 4, 25-35.
- Bai, X., Wu, J. and Yan, W. (2011), “Relative Efficiency and Competition Landscape of Life Insurance Companies in China-An Analysis Based on Scenario-dependent DEA Model”, *Research on Financial and Economic Issues*, 2011(7).

- Bakhouché A., Sibanda W., AlChaar, R., Boulkeroua, M. and Zabalawi, E. (2020), "Analysis of cost efficiency in GCC and Jordan's insurance sectors: DEA approach", *International Journal of Business Performance Management*, 21(3), 290-328.
- Bansal, R. and Singh, D. (2021), "Efficiency drivers of insurers in GCC: an analysis incorporating company-specific and external environmental variables", *Cogent Economics & Finance*, 9(1).
- Bao, J., Wang, Y. and Xu, L. (2016), "An empirical analysis of the capital utilization efficiency of life insurance companies in China-based on the three-stage DEA model", *Financial Theory & Practice*, 2016(2).
- Bao, N. J., Ramlan, R., Mohamad, F. and Yassin, A. M. (2018), "Performance of Malaysian Insurance Companies Using Data Envelopment Analysis", *Indonesian Journal of Electrical Engineering and Computer Science*, 11(3), 1147-1151.
- Barros, C. P., Barroso, N. and Borges, M. R. (2005a), "Evaluating the Efficiency and Productivity of Insurance Companies with a Malmquist Index: A Case Study for Portugal", *The Geneva Papers on Risk and Insurance-Issues and Practice*, 30(2), 244-267.
- Barros, C. P., Barroso, N. and Borges, M. R. (2005b), "Measuring Efficiency in the Life Insurance Industry with a Stochastic Frontier Model", paper presented at the 28th International Congress of Actuaries, Paris, France held May 28-June 2, 2006.
- Barros C. P., Caporale, G. M. and Ibiwoye, A. (2008), "A Two-stage efficiency analysis of the insurance industry in Nigeria", Department of Economics and Finance, Working Paper 08-17, Brunel University, London, UK.
- Barros, C. P., Caporale, G. M. and Ibiwoye, A. (2008), "A two-stage efficiency analysis of the insurance industry in Nigeria", Centre for Empirical Finance (CEF), Uxbridge, UK.
- Barros, C. P., Dumbo, S. and Wanke, P. (2014), "Efficiency Determinants and Capacity Issues in Angolan Insurance Companies", *South African Journal of Economics*, 82(3), 455-467.
- Barros, C. P., Nektarios, M. and Assaf, A. (2010), "Efficiency in the Greek insurance industry", *European Journal of Operational Research*, 205(2), 431-436.
- Barros, C. P. and Obijiaku, E. L. (2007), "Technical Efficiency of Nigerian Insurance Companies", School of Economics and Management Working Paper 018/2007/DE/UECE, Technical University of Lisbon, Lisbon, Portugal.
- Barros, C. P. and Wanke, P. (2014), "Insurance companies in Mozambique: a two-stage DEA and neural networks on efficiency and capacity slacks", *Applied Economics*, 46(29), 3591-3600.
- Bauer, P. W., Berger, A. N., Ferrier, G. D. and Humphrey, D. B. (1998), "Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods", *Journal of Economics and Business*, 50(2), 85-114.
- Bawa, S. K. and Bhagat, N. (2015), "Efficiency of Life Insurance Companies Operating in Punjab", *Pacific Business Review International*, 7(9), 76-85.
- Bawa, S. K. and Verma, R. (2011), "Efficiencies of health insurance business in India: An application of DEA", *American Journal of Social and Management Sciences*, 2(2), 237-247.

- Benarda, B., Sumarwan, U. and Hosen, M. N. (2016), Tingkat Efisiensi Industri Asuransi Jiwa Syariah Menggunakan Pendekatan Two stage Data Envelopment Analysis (Level of Efficiency of Sharia Life Insurance Industry Using Two Stage Data Envelopment Analysis Approach), *Jurnal Aplikasi Bisnis dan Manajemn (Journal of Business and Management Applications)*, 2(1), 64-72.
- Benyoussef, S. and Hemrit, W. (2019), “Measuring the relative efficiency of insurance companies in Saudi Arabia: The case study of Takaful vs cooperative industries”, *Cogent Economics & Finance*, 7(1).
- Berger, A. N., Cummins, J. D., Weiss, M. A. and Zi, H. (1999), “Conglomeration versus Strategic Focus: Evidence from the Insurance Industry”, Working Paper.
- Berger, A. N., Hancock, D. and Humphrey, D. B. (1993), “Bank efficiency derived from the profit function”, *Journal of Banking & Finance*, 17(2-3), 317-347.
- Berger, A. N. and Humphrey, D. B. (1997), “Efficiency of Financial Institutions: International Survey and Directions for Future Research”, *European Journal of Operational Research*, 98(2), 175-212.
- Berger, A. N. and Mester, L. J. (1997), “Inside the black box: What explains differences in the efficiencies of financial institutions?”, *Journal of Banking & Finance*, 21(7), 895-947.
- Berger, A. N. and Mester, L. J. (2003), “Explaining the dramatic changes in performance of US banks: technological change, deregulation, and dynamic changes in competition”, *Journal of Financial Intermediation*, 12(1), 57-95.
- Bernier, G. and Sedzro, K. (2003), “An Intertemporal Analysis of Efficiency Using DEA: The Case of the Canadian Life Insurance Industry Prior to 2000”, paper presented at the American Risk and Insurance Association 2003 Annual Meeting, Denver, CO held August 10-13, 2003.
- Bernstein, J. I. (1998), “Total Factor Productivity Growth in the Canadian Life Insurance Industry: 1979-1989”, National Bureau of Economic Research (NBER) Working Paper 6475, NBER, Cambridge (suburb of the Boston-Worcester-Providence CSA), MA.
- Bertoni, F. and Croce, A. (2010), “The productivity of European life insurers: best-practice adoption vs. innovation”, Working Paper.
- Bhatia, A. and Mahendru, M. (2023), “Efficiency Appraisal of Life Insurance Industry in India- Public Versus Private Players”, *The Review of Finance and Banking*, 15(1), 65-81.
- Bian, W. and Wang, X. (2014), “The Effects of Human Capital on Cost and Profit Efficiency for China’s Life Insurance Companies”, *Insurance Studies*, 2014(11), 103-111.
- Biener, C. and Eling, M. (2012), “Organization and efficiency in the international insurance industry: A cross-frontier analysis”, *European Journal of Operational Research*, 221(2), 454-468.
- Biener, C., Eling, M. and Jia, R. (2015), “Globalization of the Life Insurance Industry: Blessing or Curse?”, Working Paper.
- Biener, C., Eling, M. and Wirfs, J. H. (2014), “The Determinants of Efficiency and Productivity in the Swiss Insurance Industry”, paper presented at the 41st Seminar of the European Group of Risk and Insurance Economists, St. Gallen, Switzerland held September 15-17, 2014.

- Bikker, J. A. (2012), "Performance of the life insurance industry under pressure: efficiency, competition and consolidation", Working Paper No. 357, De Nederlandsche Bank NV, Amsterdam, The Netherlands.
- Bikker, J. A. and van Leuvensteijn, M. (2008), "Competition and Efficiency in the Dutch Life Insurance Industry", *Applied Economics*, 40(16), 2063-2084.
- Boonyasai, T., "The Effect of liberalization on Thai life insurer efficiency", Symposium of Chulalongkorn University, Bangkok, Thailand.
- Boonyasai, T., Grace, M. F. and Skipper, Jr., H. D. (2002), "The Effect of Liberalization and Deregulation on Life Insurer Efficiency", Center for Risk Management and Insurance Research Working Paper No. 02-2, Georgia State University, Atlanta, GA.
- Borges, M. R., Nektarios, M. and Barros, C. P. (2008), "Analysing The Efficiency Of The Greek Life Insurance Industry", *European Research Studies*, 11(3), 35-52.
- Brockett, P. L., Chang, R. E., Rousseau, J. J., Semple, J. H. and Yang, C. (2004), "A Comparison of HMO Efficiencies as a Function of Provider Autonomy", *Journal of Risk and Insurance*, 71(1), 1-19.
- Bu, Z. and Wang, Y. (2014), "Literature Review of the Study on the Efficiency of China's Insurance Institutions", *Financial Development Research, Issue (2014)*, 11, 3-10
- Cabanda, E. and Viverita, D. (2012), "Managerial efficiency, innovation, and productivity of the Indonesian life insurance industry during the global financial crisis", *Journal of International Business and Economics*, 12(5), 32-39.
- Camino-Mogro, S. and Bermudez-Barrezueta, N. (2019), "Determinants of profitability of life and non-life insurance companies: evidence from Ecuador", *International Journal of Emerging Markets*, 14(5), 831-872.
- Cao, M, Zhang, B. and Luo, J. (2008), "Core Competence of Small & Medium-Sized Insurance Enterprises Based on DEA Model", *Journal of Xidian University (Social Science Edition)*, 18(3), 54-60.
- Cao, Q. (2006), "Efficiency Evolution of Chinese Insurance Industry: A Study Based on DEA and MI Models", *Journal of Guangdong University of Finance*, 21(5), 69-74.
- Cao, Q. and Du, W. (2009), "Evaluation on Scale Efficiency and Scale Economy of China's Insurance Industry", *Journal of Shanghai Finance University*, 2009(2), 7-11.
- Carr, P. S. (2004), *The Practice of Life Insurance in Australia*, Institute of Actuaries of Australia, Sydney, NSW.
- Carr, R. M., Cummins, J. D. and Regan, L. (1999), "Efficiency and competitiveness in the US life insurance industry: corporate, product, and distribution strategies", in J. D. Cummins and A. M. Santomero (eds.), *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer Academic Publishers, Norwell (suburb of the Boston-Worcester-Providence CSA), MA.
- Caves, D. W. and Christensen, L. R. (1980), "Global Properties of Flexible Functional Forms", *The American Economic Review*, 70(3), 422-432.
- Caves, D. W., Christensen, L. R. and Tretheway, M. L. (1980), "Flexible Cost Functions for Multiproduct Firms", *The Review of Economics and Statistics*, 62(3), 471-481.
- Chadwick, C. and Cappelli, P. (1999), "Strategy, Human Resource Management, and the Performance of Life Insurance Firms", in J. D. Cummins and A. M. Santomero (eds.),

Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management, Kluwer Academic Publishers, Norwell (suburb of the Boston-Worcester-Providence CSA), MA.

- Chaffai, M. E. and Ouertani, M. N. (2002), Technical efficiency in the Tunisian insurance industry: A comparison of parametric and non parametric time variant models, Research Unit on Production Econometrics Working Paper, Sfax University, Sfax, Tunisia.
- Chakraborty, J. (2016), "Efficiency Analysis of Indian Life Insurance Firms: A DEA Investigation", *SCMS Journal of Indian Management*, XIII(3), 5-24.
- Chakraborty, J. and Sengupta, P. P. (2012), "Measuring Performance and Efficiency Growth of the Selected Indian Life Insurance Companies: A Total Factor Productivity Approach", *Arth Prabhand*, 1(6), 1-20.
- Chakraborty, K. and Harper, R. K. (2017), "Dynamic Productivity Analysis of Insurance Firms-The Effect of Firm-Specific and Macroeconomic Characteristics", *International Journal of Applied Economics*, 14(2), 37-55.
- Chakraborty, K., Sengupta, R. P. and Dutta, A. (2011), "Efficiency and Productivity of Indian Life Insurance Industry After Deregulation", *Global Conference on Business and Finance Proceedings*, 6(1), 77-89.
- Chandrasekaran, R., Madhanagopal, R. and Karthick, K. (2013), "A Stochastic Frontier Model on Investigating Efficiency of Life Insurance Companies in India", *International Journal of Mathematics Trends and Technology*, 4(10), 207-215.
- Chen, B., Powers, M. R. and Qiu, J. (2008), "Development of the Chinese life insurance industry: An efficiency analysis", *The Capco Institute: Journal of Financial Transformation*, 22, 123-130.
- Chen, B., Powers, M. R. and Qiu, J. (2009), "Life-insurance Efficiency in China: A Comparison of Foreign and Domestic Firms", *China & World Economy*, 17(6), 43-63.
- Chen, H., Du, X. and Wang, L. (2019), "A Study on Enterprise Risk Management's Impacts on Operating Efficiency-An Empirical Research Based on 45 Life Insurance Companies". *Insurance Studies*, 2019(2).
- Chen, K-C. and Lin, C-I. (2020), "Studies on the Determinants of Efficiency in Taiwanese Life Insurance Industry-Application of Bootstrapped Truncated Model", *Journal of Applied Finance & Banking*, 10(1), 65-86.
- Chen, L. (2005), "An Analysis of Malmquist Index: Efficiency of Insurance Industry in China", *Modern Economic Science*, 27(5), 39-44.
- Chen, L. (2006), "A Study of the Relationship between the Market Structure and the Performance of the Insurance Industry", *Economic Perspectives*, 2006(6), 32-34.
- Chen, L. (2007), "An Empirical Analysis of the Efficiency of Insurance Companies in China country and Its Influencing Factors", *Productivity Research*, 2007(3).
- Chen, L, Eckles, D. L. and Pottier, S. W. (2013), "Ownership Form and Efficiency: The Coexistence of Stock and Mutual Life Insurers", *The Journal of Insurance Issues*, 36(2), 121-148.
- Chen, L. R. and McNamara, M. J. (2014), "An Examination of the Relative Efficiency of Fraternal Insurers", *The Journal of Insurance Issues*, 37(1), 1-31.

- Chen, M. S. and Chang, P. L. (2010), "Distribution channel strategy and efficiency performance of the life insurance industry in Taiwan", *Journal of Financial Services Marketing*, 15(1), 62-75.
- Chen, T-Y. (1998), "Determining the Comparative Efficient Units of Insurance Industries Through DEA", *Journal of Professional Services Marketing*, 18(2), 105-118.
- Chen, Y. and Ge, J. (2020), "The Effect of Ownership Structure on the Operating Efficiency of Bank Life Insurance Companies-Based on the Analysis of the DEA-Tobit Two Step Method", *Journal of Financial Development Research*, 2020(6).
- Chiang, K. F. and Cheng, S. W. (2009), "An efficiency comparison of direct and indirect channels in Taiwan insurance marketing", *Direct Marketing: An International Journal*, 3(4), 343-359.
- Chu, C. (2014), "Research on Total Factor Productivity of Life Insurance Industry in China-Analysis of DEA and Malmquist Model", *Science & Technology Information*, 2014(34).
- Chu, K-J. (2015), "A Productivity Analysis of Life Insurance Companies based on Malmquist Index and its Decomposition", *The Journal of Jinan University (Philosophy and Social Sciences)*, 37(7), 133-142.
- Chu, L-P. and Su, F. (2013), "Measurement and Improvement of Financing Efficiency for Life Insurers in China", *Insurance Studies*, 2013(10), 19-31.
- Chuang, C. C. and Tang, Y. C. (2014), "Asymmetric Dependence between Efficiency and Market Power: Longitudinal Perspective of the Taiwan Life Insurance Industry", *International Journal of Applied Mathematics and Statistics*, 52(8), 144-151.
- Çiftçi, H. (2004), "Türk Sigorta Sektörünün Sorunları; DEA Analizi ile Türk Sigorta Şirketlerinin Etkinlik Düzeylerinin Belirlenmesi (Problems of the Turkish Insurance Sector; Determination of the Efficiency Levels of Turkish Insurance Companies With DEA Analysis)", *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi (Çukurova University Social Sciences Institute Journal)*, 13(1), 121-149.
- Cooper, W. W., Li, S., Seiford, L. M., Thrall, R. M. and Zhu, J. (2001), "Sensitivity and stability analysis in DEA: Some recent developments", *Journal of Productivity Analysis*, 15(3), 217-246.
- Copeland, M. K. and Cabanda, E. (2018), "Efficiency Analysis of the U.S. Publicly Held Insurance Industry: A Two-Stage Efficiency Model", *International Journal of Information Systems in the Service Sector*, 10(1), 1-15.
- Coskun, A., Habibniya, H. and Keceli, Y. (2021), "An Efficiency Analysis of Takaful Insurance Industry: A Comparative Study", *Journal of Asian Finance, Economics and Business*, 8(7), 111-120.
- Cummins, J. D. (1999), "Efficiency in the US life insurance industry: Are insurers minimizing costs and maximizing revenues?", in J. D. Cummins and A. M. Santomero (eds.), *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer Academic Publishers, Norwell (suburb of the Boston-Worcester-Providence CSA), MA.
- Cummins, J. D., Eckles, D. L. and Zi, H. (2006), "Exporting best practices: Are foreign-owned insurers more efficient in the US Life Insurance Market?", Working paper.

- Cummins, J. D. and Rubio-Misas, M. (2001), “Deregulation, Consolidation and Efficiency: Evidence From the Spanish Insurance Industry”, The Wharton Financial Institutions Center Working Paper 02-01, University of Pennsylvania, Philadelphia, PA.
- Cummins, J. D. and Rubio-Misas, M. (2016), “Integration and Efficiency Convergence in European Life Insurance Markets”, Working Paper.
- Cummins, J. D., Rubio-Misas, M. and Zi, H. (2004), “The effect of organizational structure on efficiency: Evidence from the Spanish insurance industry”, *Journal of Banking & Finance*, 28(12), 3113-3150.
- Cummins, J. D., Tennyson, S. and Weiss, M. A. (1999a), “Consolidation and efficiency in the US life insurance industry”, *Journal of Banking & Finance*, 23(2-4), 325-357.
- Cummins, J. D., Tennyson, S. and Weiss, M. A. (1999b), “Life insurance mergers and acquisitions”, in J. D. Cummins and A. M. Santomero (eds.), *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer Academic Publishers, Norwell (suburb of the Boston-Worcester-Providence CSA), MA.
- Cummins, J. D., Turchetti, G. and Weiss, M. A. (1996), “Productivity and Technical Efficiency in the Italian Insurance Industry”, The Wharton Financial Institutions Center Working Paper 96-10, University of Pennsylvania, Philadelphia, PA.
- Cummins, J. D. and Weiss, M. A. (1998), “Analyzing Firm Performance in the Insurance Industry Using Frontier Efficiency Methods”, The Wharton Financial Institutions Center Working Paper 98-22, University of Pennsylvania. Philadelphia, PA.
- Cummins, J. D., Weiss, M. A., Xie, X. and Zi, H. (2010), “Economies of scope in financial services: A DEA efficiency analysis of the US insurance industry”, *Journal of Banking & Finance*, 34(7), 1525-1539.
- Cummins, J. D., Weiss, M. A. and Zi, H. (2003), “Economies of Scope in Financial Services: A DEA Bootstrapping Analysis of the US Insurance Industry”, paper presented at the 4th International Symposium on DEA, Birmingham, UK held September 4-6, 2004.
- Cummins, J. D. and Xie, X. (2009), “Market values and efficiency in US insurer acquisitions and divestitures”, *Managerial Finance*, 35(2), 128-155.
- Cummins, J. D. and Zi, H. (1997), “Measuring Cost Efficiency in the U.S. Life Insurance Industry: Econometric and Mathematical Programming Approaches”, The Wharton Financial Institutions Center Working Paper 97-03, University of Pennsylvania, Philadelphia, PA.
- Cummins, J. D. and Zi, H. (1998), “Comparison of Frontier Efficiency Models: An Application to the U.S. Life Insurance Industry”, *Journal of Productivity Analysis*, 10(2), 131-152.
- Dalkılıç, N. and Ada, A. A. (2014), “Efficiencies of Life/Pension Insurance Industry in Turkey: An Application of Data Envelopment Analysis”, *Journal of Applied Finance and Banking*, 4(1), 181-191.
- Danquah M., Otoo, D.M. and Baah-Nualoh, A. (2016), “Cost efficiency of insurance firms in Ghana”, *Managerial and Decision Economics*, 39(2), 213–225.
- Dash, M. and Muthyala, A. (2018), “Cost Efficiency of Indian Life Insurance Service Providers using Data Envelopment Analysis”, *Asian Journal of Finance & Accounting*, 10(1), 59-80.
- Davutyan, N. and Klumpes, P. J. M. (2008), “Consolidation and Efficiency in the Major European Insurance Markets: A Non Discretionary Inputs Approach”, paper presented at

- the Risk Management Laboratory-Uses of Frontier Efficiency Methodologies for Performance Measurement in the Financial Services Sector, Imperial College Business School, London, UK held July 4-5, 2008.
- Deng, Q. (2006), "Performance Analysis of Life Insurance Companies Based on a Super Efficiency DEA Evaluation Model", *Qiusuo*, 2006(2).
- Dewi, N. and Murni, A. (2016), "Data Envelopment Analysis Efficiency Assessment of Islamic Life Insurance (*Takaful*) in Indonesia", *Journal of Global Business and Social Entrepreneurship*, 2(5), 35-43
- DeYoung, R. and Nolle, D. (1996), "Foreign owned banks in the US: Earning market share or buying it?", *Journal of Money, Credit, and Banking*, 28(4 Part1), 622-636.
- Diacon, S. R., Starkey, K. and O'Brien, C. (2002), "Size and Efficiency in European Long-term Insurance Companies: An International Comparison", *The Geneva Papers on Risk and Insurance-Issues and Practice*, 27(3), 444-466.
- Diboky, F. and Ubl, E. (2007), "Ownership and Efficiency in the German Life Insurance Market: A DEA Bootstrap Approach", paper presented at the American Risk and Insurance Association 2007 Annual Meeting, Quebec City, QC held August 5-8, 2007.
- Ding, L., Zhao, Z., Xue, Y. and Zheng, H. (2021), "Is There Heterogeneity in the Technological Progress of Chinese Life Insurance Industry?-from the Perspective of Factor Bias", *Journal of Insurance Professional College*, 35(1).
- Donni, O. and Fecher, F. (1997), "Efficiency and Productivity of the Insurance Industry in the OECD Countries", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 22(4), 523-535.
- Donni, O. and Hamende, V. (1993), "Performance des Societies Belges D'Assurance: Comparaison des formes institutionnelles (Performance of Belgian Insurance Companies: Comparison of Institutional Forms)", *Annals of Public and Cooperative Economics*, 64(3), 419-438.
- Du, Y. (2020), "A study on the operating performance of bank-affiliated life insurance companies in China", *Journal of Insurance Professional College*, 34(1).
- Dudeja, G. and Chaudhry, A. (2022), "Efficiency Analysis of Indian Insurance Sector: Technical Efficiency, Pure Technical Efficiency and Scale Efficiency", in B. B. Bodla and R. Sharma (eds.), *Contemporary Issues in Banking, Insurance and Financial Services*, Institute of Management Studies, Kurukshetra University, Kurukshetra, India.
- Duric, Z., Jaksic, M. and Krstic, A. (2020), "DEA Window Analysis of Insurance Sector Efficiency in the Republic of Serbia", *Economic Themes*, 58(3), 291-310.
- Dutta, A. (2013), "Impact of Privatization on Productivity: A Non-Parametric Analysis of Indian Insurance Sector", *Global Business Review*, 14(2), 297-314.
- Dutta, A. and Sengupta, P. P. (2010), "Impact of Technological Innovation on Efficiency – An Empirical Study of Indian Life Insurance Industry", paper presented at the 2010 International Conference on Education and Management Technology, Cairo, Egypt held November 2-4, 2010.
- Dutta, A. and Sengupta, P. P. (2011), "Efficiency Measurement of Indian Life Insurance Industry in Post-Reforms Era", *Global Business Review*, 12(3), 415-430

- Dyson, R. G., Allen, R., Camanho, A. S., Podinovski, V. V., Sarrico, C. S. and Shale, E. A. (2001), "Pitfalls and protocols in DEA", *European Journal of Operational Research*, 132(2), 245-259.
- Eling, M. and Jia, R. (2018), "Business failure, efficiency, and volatility: Evidence from the European insurance industry", *International Review of Financial Analysis*, 59, 58-76.
- Eling, M. and Jia, R. (2019), "Efficiency and profitability in the global insurance industry", *Pacific-Basin Finance Journal*, 57
- Eling, M. and Luhn, M. (2010a), "Frontier efficiency methodologies to measure performance in the insurance industry: Overview, systemization and recent developments", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 35(2), 217-265.
- Eling, M. and Luhn, M. (2010b), "Efficiency in the international insurance industry: A cross-country comparison", *Journal of Banking & Finance*, 34(7), 1497-1509.
- Eling, M. and Schaper, P. (2017), "Under pressure: how the business environment affects productivity and efficiency of European life insurance companies", *European Journal of Operational Research*, 258(3), 1082-94.
- Ennsfellner, K. C., Lewis, D. and Anderson, R. I. (2004), "Production Efficiency in the Austrian Insurance Industry: A Bayesian Examination", *Journal of Risk and Insurance*, 71(1), 135-159.
- Erhemjamts, O. and Leverty, J. T. (2009), "The Demise of the Mutual Organizational Form: An Investigation of the Life Insurance Industry", Working Paper.
- Erhun, M. and Li, X. (2003), "Insurance company efficiency analysis based on DEA method", *Modern Management Science*, 2003(3), 7-8.
- Fan, Q., Jia, R. and Sun, Q. (2017), "The impact of life insurance supply-side indicators on life insurance consumption-Based on the perspective of life insurance supply quality, momentum and efficiency", *Journal of Financial Research*, 2017(9).
- Faruk, O. and Rahaman, A. (2015), "Measuring Efficiency of Conventional Life Insurance Companies in Bangladesh and Takaful Life Insurance Companies in Malaysia: A Non-Parametric Approach", *Management Studies and Economic Systems*, 2(2), 129-144.
- Fauziah, N., Mulyati, H. and Ermawati, W. J. (2020), "The Measurement of Efficiency and Factors that Affect Indonesia Sharia Insurance Efficiency", *Journal of Applied Management*, 18(2), 219-231.
- Fecher, F., Kessler, D., Perelman, S. and Pestieau, P. (1993), "Productive performance of the French Insurance Industry", *Journal of Productivity Analysis*, 4(1/2), 77-93.
- Feng, B-X. (2013), "The empirical analysis of DEA Efficiency and its influencing factors of China's insurance companies", *Journal of Baoji University of Arts and Sciences (Social Sciences)*, 33(5).
- Fenn, P., Vencappa, D., Diacon, S. R., Klumpes, P. J. M. and O'Brien, C. (2008), "Market structure and the efficiency of European insurance companies: A stochastic frontier analysis", *Journal of Banking & Finance*, 32(1), 86-100.
- Fiordelisi, F. and Ricci, O. (2011), "Bancassurance efficiency gains: evidence from the Italian banking and insurance industries", *The European Journal of Finance*, 17(9-10), 789-810.
- Fitzpatrick, T. and McQuinn, K. (2008), "Measuring bank profit efficiency", *Applied Financial Economics*, 18(1), 1-8.

- Fu, H. (2022), "DEA Analysis on the Implementation Efficiency of Industry Finance Integration of Life Insurance Companies under FSSC Mode", *Economic Research Guide*, 2022(15).
- Fuentes, H., Grifell-Tatjé, E. and Perelman, S. (2001), "A Parametric Distance Function Approach for Malmquist Productivity Index Estimation", *Journal of Productivity Analysis*, 15(2), 79-94.
- Fuentes, H., Grifell-Tatjé, E. and Perelman, S. (2005), "Product Specialization, Efficiency and Productivity Change in the Spanish Insurance Industry", Centre de Recherche en Economie Publique et de la Population (Research Center on Public and Population Economics) HEC-Management School Working Paper 0506, University of Liege, Liege, Belgium.
- Fukuyama, H. (1997), "Investigating productive efficiency and productivity changes of Japanese life insurance companies", *Pacific-Basin Finance Journal*, 5(4), 481-509.
- Gaganis, C., Hasan, I. and Pasiouras, F. (2013), "Efficiency and stock returns: evidence from the insurance industry", *Journal of Productivity Analysis*, 40(3), 429-442
- Gan, Q. and Hu, S. (2007), "Operating Efficiency of Life-Health Insurance Industry and Contribution of Bancassurance", *Finance & Economics*, 2007(9), 32-36.
- Gan, X. (2008), "An Empirical Research on the Efficiency of China Insurance Industry", *Journal of Quantitative and Technical Economics*, 2008(7), 92-105.
- Gao, M. and Xie, B. (2010), "Analysis of Malmquist Index of Production Efficiency Changes of Life Insurance Companies in China", *Science and Technology Management Research*, 2010(9).
- Gao, S. and Xu, H. (2018), "Analysis of total factor productivity and its differences of insurance companies", *Finance and Accounting Monthly*, 2018(22).
- Gao, X-Y. and Han, D-D. (2021), "Research on the Operating Efficiency of Life Insurance Companies from the Perspective of Insurance Technology", *Management & Technology of SME*, 2021(5).
- Gardner, L. A. and Grace, M. F. (1993), "X-Efficiency in the US life insurance industry", *Journal of Banking & Finance*, 17(2-3), 497-510.
- Ghimire, R. (2016), "Efficiency of Nepalese Life Insurance Companies Using DEA. ELK Asia", *Pacific Journal of Finance and Risk Management*, 7(4).
- Ghoni, A. and Arianty, E. (2021), "The Impact of Spin-off Policy on the Efficiency of Sharia Insurance in Indonesia using DEA approach", *Journal of Islamic Economics Lariba*, 7(1), 47-66.
- Ghosh, A., Sarkar, A., Dey, M., Guha, B., Jana, S. and Ghorui, N. (2021), "Analyzing Efficiency of Indian Life Insurance Companies using DEA and SEM", *Turkish Journal of Computer and Mathematics Education*, 12(12), 3897-3919.
- Giantsios, D. G. and Noulas, A. G. (2019), "Efficiency and Convergence in the European Life Insurance Industry", *Multinational Finance Journal*, 24(1/2), 65-91.
- Golden, L. L. and Yang, C. C. (2019), "Efficiency Analysis of Health Insurers' Scale of Operations and Group Affiliation with a Perspective toward Health Insurers' Mergers and Acquisitions Effects", *North American Actuarial Journal*, 23(4), 626-645.

- Gowd, N. (2017), "Effect of Claim Settlement Practices on the Operating Efficiency and Profitability of Life Insurance Companies of India-A Comparative Study of Public and Select Private Sector", *Asian Journal of Management*, 8(4), 1207-1215.
- Grace. M. F., Leverty, J. T, Phillips, R. D. and Shimpi, P. (2014), "The Value of Investing in Enterprise Risk Management", *The Journal of Risk and Insurance*, 82(2), 289-316.
- Greene, W. H. (2008), "The Econometric Approach to Efficiency Analysis", in H. O. Fried, C. A. Knox Lovell and S. S. Schmidt (eds.), *The Measurement of Productive Efficiency and Productivity Growth*, Oxford University Press, New York, NY.
- Greene, W. H. and Segal, D. (2004), "Profitability and Efficiency in the U.S. Life Insurance Industry", *Journal of Productivity Analysis*, 21(3), 229-247.
- Grmanová, E. (2015a), "Efficiency of National Life Insurance Markets in Europe", in V. Kajurova and J. Krajicek (eds.), *European Financial systems 2015, Proceedings of the 12th International Scientific Conference*, Masaryk University Brno, Czechia June 18-19, 2015, Masarykova univerzita (Masaryk University), Brno, Czechia.
- Grmanová, E. (2015b), "Efficiency in Two-stage Data Envelopment Analysis: An Application to Insurance Companies", in V. Kajurova and J. Krajicek (eds.), *European Financial systems 2015, Proceedings of the 12th International Scientific Conference*, Masaryk University Brno, Czechia June 18-19, 2015, Masarykova univerzita (Masaryk University), Brno, Czechia.
- Grmanová, E. and Jablonský, J. (2009), "Analýza efektívnosti slovenských a českých poisťovní pomocou modelov analýzy obalu dát (Analysis of Efficiency of Slovak and Czech Insurance Companies by Data Envelopment Analysis Models)", *Ekonomický časopis (Economic magazine)*, 57(9), 857-869.
- Grmanová, E. and Pukala, R. (2018), "Efficiency of insurance companies in the Czech Republic and Poland", *Oeconomia Copernicana*, 9(1), 71-85.
- Grmanová, E. and Strunz, H. (2017), "Efficiency of Insurance Companies: Application of DEA and Tobit Analyses", *Journal of International Studies*, 10(3), 250-263.
- Guan, R. Chen, Y., Zheng, H., Zhang, W. and Wei, Y. (2020), "Efficiency and Total Factor Productivity of China's Insurance Companies under Loss Ratio Constraint", *Management Review*, 32(1).
- Guha Majumder, M., Sinha, R. P. and Cvetkoska, V. (2023), "Unveiling Productivity Growth in Indian Life Insurance Firms Through Data Envelopment Analysis", *Yugoslav Journal of Operations Research*, 34(3), 499-514.
- Guo, F. and Guo, R-C. (2016), "An empirical study on the operating efficiency of listed insurance companies in China", *Science Economy Society*, 34(1).
- Gupta, S. D., Thapa, K., Banskar, H. and Misra, S. (2019), "Profit Efficiency of Insurance Sector using DEA: Evidence from Emerging Markets", *Adalya Journal*, 8(12), 409-429.
- Han, S. and Wang, D-L. (2009), "Efficiency analysis on Chinese insurance industry: 2003-2007", *Insurance Studies*, 2009(6), 20-28.
- Hao, C. and Li, H. (2018), "Research on the Efficiency Evaluation of Life-insurance Companies in China and the Influencing factors", *Journal of Insurance Professional College*, 32(3).

- Hao, J. C. (2003), "X-Efficiency in the Taiwan Life Insurance Industry", paper presented at the American Risk and Insurance Association 2003 Annual Meeting, Denver, CO held August 10-13, 2003.
- Hao, J. C. (2005), "Comparison of Efficiency Estimation Models-The Case in Taiwan's Life Insurance Industry", paper presented at the World Risk and Insurance Economics Congress Inaugural Meeting, Salt Lake City, UT held August 7-11, 2005.
- Hao, J. C. (2008), "Measuring Cost Efficiency in the Taiwan Life Insurance Industry", *International Journal of Management*, 25(2), 279-286.
- Hardwick, P. (1997), "Measuring cost efficiency in the UK life insurance industry", *Applied Financial Economics*, 7(1), 37-44.
- Hardwick, P., Adams, M. B. and Zou, H. (2003), "Corporate Governance and Cost Efficiency in the United Kingdom Life Insurance Industry", European Business Management School Working Paper No. EBMS/2003/1, EBMS, Swansea, UK.
- He, H. and Yan, B. (2009), "An empirical study on the operating efficiency of life insurance companies based on DEA and SFA methods", *Shanghai Finance*, 2009(7), 88-92.
- He, J. and Li, C. (2005), "An Empirical Study about Chinese Insurance Companies' Technical Efficiency Based on Stochastic Frontier Analysis", *Journal of Xiangfan Vocational and Technical College*, 4(4), 60-62.
- He, W. and Liu, Z. (2020), "Analysis on the Dynamic Change of Production Efficiency in China's Insurance Industry", *Journal of Weinan Normal University*, 35(1).
- He, X. and Xie, W. (2013), "An Empirical Study on the Efficiency of Joint Venture Life Insurance Companies in China-Based on Tobit's Generalized Linear Model", *The Theory and Practice of Finance and Economics*, 34(181).
- He, Y. and Ye, Y. (2007), "Comparison of the efficiency of Chinese and foreign (joint venture) insurance companies based on DEA method", *South China Finance*, 2007(6).
- Hitt, L. M. (1999), "The impact of information technology management practices on the performance of life insurance companies", in J. D. Cummins and A. M. Santomero (eds.), *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer Academic Publishers, Norwell (suburb of the Boston-Worcester-Providence CSA), MA.
- Hong, W. (2010), "Development Path of Small-and-Medium-sized Insurance Companies in China-Based on Efficiency and Total Factor Productivity", *Journal of Xidian University (Social Science Edition)*, 20(1), 58-63.
- Hsiao, S-H. (2005), "A Study of Investment Performance and Overall Financial Performance for Life Insurers in Taiwan", Working Paper.
- Hu, G. (2016), "A Study on the Effectiveness of the Operating Performance of Life Insurance Companies in China", *Financial Theory & Practice*, 2016(9).
- Hu H., Li, W. and Zhao, W. (2014), "Research on the Efficiency Evaluation of China's Insurance Industry Based on the Three-stage DEA Model", *Macroeconomics*, 2014(4)
- Hu, J., Zhang, Z. and Zhu, X. (2014), "Comparison of the investment efficiency of life insurance industries on both sides of the Taiwan Strait: Application of Stochastic Boundary Analysis", *Soochow Journal of Economics and Business*, 85, 41-62.
- Hu, J-L. and Yu, H-E. (2015), "Risk, Capital, and Operating Efficiency: Evidence from

- Taiwan's Life Insurance Market", *Emerging Markets Finance & Trade*, 51, S121–S132.
- Hu, X. (2012), "A Study on the Operating Efficiency of Listed Insurance Companies in China", *Northern Economy*, 2012(20).
- Hu, X., Zhang, C., Hu, J-L. and Zhu, N. (2009), "Analyzing efficiency in the Chinese life insurance industry", *Management Research News*, 32(10), 905-920.
- Hu, Y. and Ye, Y-G. (2008), "An Empirical Study on Factors Influencing the Efficiency of Insurers in China", *Journal of Jinan University (Philosophy and Social Science)*, 30(4), 28-34.
- Hu, Y. and Ye, Y-G. (2009), "A Study on Efficiency of China's Insurance Industry Based on Risk Factors", *Journal of Guangdong University of Business Studies*, 2009(4).
- Huang, L-Y., Hsiao, T-Y. and Lai, G. C. (2007), "Does Corporate Governance and Ownership Structure Influence Performance? Evidence from Taiwan Life Insurance Companies", *Journal of Insurance Issues*, 30(2), 123-151.
- Huang, T-H., Kao, T-L., Chiang, L-C. and Liang, J-H. (2010), "A Study of Technical Efficiency and Productivity Change on Taiwan's Life Insurance Companies with Quasi-fixed Inputs", *Soochow Journal of Economics and Business*, 68, 1-38.
- Huang, T-H., Lin, Y-C., Kuo-Jui Huang, K-J. and Liao, Y-W. (2022), "Comparing Cost Efficiency Between Financial and Non-financial Holding Banks and Insurers in Taiwan Under the Framework of Copula Methods and Metafrontier", *Asia-Pacific Financial Markets*, 29(4), 735-766.
- Huang, T-S., Lin, C-I. and Wu, R-C. (2019), "Assessing the Marketing and Investment Efficiency of Taiwan's Life Insurance Firms under Network Structures", *The Quarterly Review of Economics and Finance*, 71, 132-147.
- Huang, W. (2006), "Efficiency of China's Insurance Industry: A Stochastic Frontier Analysis Approach", *Nankai Economic Studies*, 2006(5), 104-115.
- Huang, W. (2007), "Efficiency in the China Insurance Industry: 1999-2004", paper presented at the American Risk and Insurance Association 2007 Annual Meeting, Québec City, QC held August 4-7, 2007.
- Huang W. (2007), "An empirical study on the efficiency of Chinese insurance institutions based on the data envelopment analysis method", *Economic Review*, 2007(4), 111-116.
- Huang, W. (2008), "Risk-Adjusted Efficiency Analysis of the Chinese Insurance Industry: A Stochastic Frontier Approach", *The Journal of Quantitative & Technical Economics*, 2008(12), 111-123.
- Huang, W. (2009), "Efficiency of Insurance Fund Utilization in China's Insurance Companies: A Resource-Based Two-Stage DEA Model", *Economic Research*, 2009(8), 37-49.
- Huang, W. (2009), "An empirical study on the efficiency of China's insurance industry: Considering the impact of environmental factors", *Statistical Research*, 26(6), 29-37.
- Huang, W. (2011a), "How Foreign Capital Affects the Efficiency of Chinese Life Insurance Companies", *Journal of Financial Research*, 2011(3), 72-85.
- Huang, W. (2011b), "Enterprise Risk Management and Operational Efficiency: Evidence from the Insurance Industry of China", *Management Review*, 23(10), 36-42.
- Huang, W. and Paradi, J. C. (2011), "Risk-adjusted efficiency of the insurance industry: evidence from China", *The Service Industries Journal*, 31(11), 1871-1885.

- Huang, W. and Yang, F. (2012), "On the Marketing Efficiency Evaluation of the Chinese Life Insurance Industry", *Journal of Financial Research*, 2012(2), 113-126.
- Huang, X., Chu, Y., Zheng, J. and Wang, X. (2019), "A Study on the Operating Efficiency of China's Listed Insurance Companies Based on the DEA-Malmquist Index Model", *Journal of Insurance Professional College*, 33(2).
- Huang, X. and Peng, X. (2017), "Comprehensive Operation, Financial Licenses and Operating Efficiency of Insurance Companies", *Insurance Studies*, 2017(7).
- Hussels, S. and Ward, D. R. (2004), "Cost Efficiency and Total Factor Productivity in the European Life Insurance Industry: The Development of the German Life Insurance Industry Over the Years 1991-2002", School of Management Working Paper No. 04/05, University of Bradford, Bradford, UK.
- Hussels, S. and Ward, D. R. (2006), "The Impact of Deregulation on the German and UK Life Insurance Markets: An Analysis of Efficiency and Productivity Between 1991-2002", paper presented at the Dynamics of Insurance Markets: Structure, Conduct, and Performance in the 21st Century, A Journal of Banking and Finance Conference, Wharton School, University of Pennsylvania, Philadelphia, PA held May 4-5, 2006.
- Hwang, T. and Gao, S. S. (2005), "An empirical study of cost efficiency in the Irish life insurance industry", *International Journal of Accounting, Auditing and Performance Evaluation*, 2(3), 264-280.
- Indrarni, R., Canggih, C. and Rusmita, S. A. (2019), "Efficiency Determinants of Islamic Insurance in Indonesia", in The 2nd International Conference on Islamic Economics, Business, and Philanthropy (ICIEBP) Theme: "Sustainability and Socio Economic Growth", Knowledge E Social Sciences, Dubai, UAE.
- Islam, J., Rahman, A. and Bhuiyan, Z. H. (2013), "Measures of Efficiency in the Takaful Industry of Bangladesh-A Non-Parametric Approach", *Islamic Management and Business*, 5(11), 163-173.
- Ismail, N., Alhabshi, D. S. O. and Bacha, O. I. (2011), "Organizational Form and Efficiency: The Coexistence of Family Takaful and Life Insurance in Malaysia", *Journal of Global Business and Economics*, 3(1), 122-137
- Ismail, N., Alhabshi, D. S. O. and Bacha, O. I. (2013), "Cost Efficiency and Investment Performance: Mutual and Stock Form in Malaysian Insurance Industry", paper presented at the 15th Malaysian Finance Association Conference, International Centre for Education in Islamic Finance, Kuala Lumpur, Malaysia held June 2-4, 2013.
- Jaloudi, M. M. (2019), "The efficiency of Jordan insurance companies and its determinants using DEA, slacks, and logit models", *Journal of Asian Business and Economic Studies*, 26(1), 153-166.
- Jaloudi, M. M. and Bakir, A. (2019), "Market Structure, Efficiency, and Performance of Jordan Insurance Market. International", *Journal of Business and Economics Research*, 8(1), 6-13.
- Janjua, P. Z. and Akmal, M. (2015), "A Comparative Analysis of Economic of Conventional and Islamic Insurance Industry in Pakistan", *Pakistan Business Review*, 17(1), 21-44.
- Jarraya, B. and Bouri, A. (2013), "Efficiency concept and investigations in insurance industry: A survey", *Management Science Letters*, 3(1), 39-54.

- Jedidia, L. B. and Medhioub, I. (2015), "The Efficiency of Saudi Arabia Insurance Companies", *Management Sciences*, 5(3), 237-248.
- Jeng, V. and Lai, G. C. (2008), "The Impact of Deregulation on Efficiency: An Analysis of Life Insurance Industry in Taiwan from 1981 to 2004", *Risk Management and Insurance Review*, 11(2), 349-375.
- Jeng, V., Lai, G. C. and McNamara, M. J. (2007), "Efficiency and Demutualization: Evidence from the U.S. Life Insurance Industry in the 1980s and 1990s", *The Journal of Risk and Insurance*, 74(3), 683-711.
- Jiang, C-F. (2017), "Research on the Market Openness and Efficiency of the Life Insurance Industry", *The Theory and Practice of Finance and Economics*, 38(6).
- Jiang, C-F. and Chen, S. (2014), "Efficiency Analysis using DEA on Life Insurance Companies' Performance", *The Theory and Practice of Finance and Economics*, 35(190), 27-32.
- Jiang, C-F. and Chen, S. (2015a), "A Study on the Correlation Between Life Insurance Market Structure, Efficiency and Performance", *China Soft Science*, 2015(2), 74-84.
- Jiang, C-F. and Chen, S. (2015b), "Chinese Life Insurance Scale Efficiency Based on a Three-Stage DEA Model", *Systems Engineering*, 33(2), 9-18.
- Jiang, M-M., Du, C-Y. and Chang, X-L. (2015), "A Study on the Relationship Between China's Life Insurance Companies Ownership Structure and Cost Efficiency", *Statistics & Information Forum*, 30(6), 67-72.
- Jiang, T., Fan, L. and Jing, P. (2015), "Operating Efficiency Evaluation and Improvement for China's Life Insurance Companies under the Two-stage Perspective-Based on the network SBM model and DEA window analysis method", *Insurance Studies*, 2015(10), 33-43.
- Jin, X. and Lee, K-S. (2019), "DEA-based Comparative Analysis on the Efficiency of Asset Management of Life Insurance Companies in Korea and China", *Asia-Pacific Studies*, 26(2), 229-257.
- Jurcevic, B. and Zaja, M. M. (2013), "Banks and Insurance Companies Efficiency Indicators in the Period of Financial Crisis: The Case of the Republic of Croatia", *Ekonomska Istraživanja (Economic Research)*, 26(1), 203-224.
- Kang, J. (2015), "The cost efficiency analysis of Korean life insurance companies by data envelopment analysis", *Journal of the Korean Data & Information Science Society*, 26(6), 1523-1535.
- Karadag Erdemir, O. and Tatlidil, H. (2017), "Data Reduction in Data Envelopment Analysis: A Research on Efficiency of Insurance Companies", *Journal of Current Researches on Business and Economics*, 7(1), 65-78.
- Karim, M. and Jhantasana, C. (2005), "Cost Efficiency and Profitability in Thailand's Life Insurance Industry: A Stochastic Cost Frontier Approach", *International Journal of Applied Econometrics and Quantitative Studies*, 2(4), 19-36.
- Kasman, A. and Turgutlu, E. (2009), "Cost efficiency and scale economies in the Turkish insurance industry", *Applied Economics*, 41(24), 3151-3159.
- Kellner, S. and Mathewson, G. F. (1983), "Entry, Size Distribution, Scale, and Scope Economies in the Life Insurance Industry", *The Journal of Business*, 56(1), 25-44.
- Kessner, K. (2001), "Ein Effizienzvergleich deutscher und britischer Lebensversicherungen (An Efficiency Comparison of German and British Life Insurance Companies)", in

- Markttransparenz und Produktionseffizienz in der deutschen Lebensversicherung (Market Transparency and Production Efficiency in German Life Insurance), Ludwig-Maximilians University, Munich, Germany.
- Kessner, E. and Polborn, M. (1999), "Eine Effizienzanalyse der deutschen Lebensversicherer-die Best Practice Methode (An Efficiency Analysis of German Life Insurers-the Best Practice Method)", *Zeitschrift für die gesamte Versicherungswissenschaft (Journal for Insurance Science)*, 88(2), 469-488.
- Khan, A. and Noreen, U. (2014), "Efficiency measure of insurance v/s Takaful Firms using DEA approach: a case of Pakistan", *Islamic Economic Studies*, 22(1), 139-158.
- Khan, P. C. and Mitra, D. (2015), "A Study on Technical Efficiency of Life Insurance Companies Operating in India in the Post Liberalised Regime. A Dynamic Panel Approach", *The Indian Journal of Commerce*, 68(3), 16-27.
- Kholis, N. and Afifah, Y. N. (2022), "Measuring Financial Efficiency of Insurance Company in Indonesia Using Stochastic Frontier Analysis Approach: A Comparison Between Islamic and Conventional Insurances", *Journal of Islamic Economics Lariba*, 8(1), 196-212.
- Kim, H. and Grace, M. F. (1995), "Potential Ex Post Efficiency Gains of Insurance Company Mergers", Center for Risk Management and Insurance Research Working Paper No. 95-4, Georgia State University, Atlanta, GA.
- Kim, M-K., Park, H-J. and Kang, H-J. (2014), "Relative Efficiency and Productivity of Life Insurance Industry to Pre and Post-execution of Capital Market Law", *Journal of the Korean Contents Society*, 14(8), 394-405.
- Kim, Y-D. (2002), "WTO Negotiations, Financial Crisis, and Efficiency and Productivity in the Korean Insurance Market" [PowerPoint slides], College of Business and Economics, Seoul, ROK, Soongsil University.
- Klumpes, P. J. M. (2004), "Performance Benchmarking in Financial Services: Evidence from the UK Life Insurance Industry", *The Journal of Business*, 77(2), 257-273.
- Klumpes, P. J. M. (2006), "Consolidation and Efficiency in the Major European Insurance Markets", paper presented at the Dynamics of Insurance Markets: Structure, Conduct, and Performance in the 21st Century, A Journal of Banking and Finance Conference, Wharton School, University of Pennsylvania, Philadelphia, PA held May 4-5, 2006.
- Knezevic, S., Markovic, M. and Brown, A. (2015), "Measuring the Efficiency of Serbian Insurance Companies", *Acta Oeconomica*, 65(1), 91-105.
- Knox Lovell, C. A. (1993), "Production Frontiers and Productive Efficiency", in H. O. Fried, C. A. Knox Lovell and S. S. Schmidt (eds.), *Measurement of Productive Efficiency: Techniques and Applications*, Oxford University Press, Oxford, UK.
- Krupa, T., Farbarzevics, K. and Salame, B. (2019), "Investment Efficiency of Life Insurance Companies in Germany: Application of a Two-Stage SBM", *Contemporary Economy*, 10(1), 79-91.
- Kweh, Q. L., Lu, W-M., Wang, W-K. and Su, M-H. (2014), "Life Insurance Companies' Performance and Intellectual Capital: A long-term perspective", *International Journal of Information Technology & Decision Making*, 13(4), 755-777.

- Lai, G. C., Chou, L-Y. and Chen, L. R. (2015), "The Impact of Organizational Structure and Business Strategy on Performance and Risk-taking Behavior in Insurance Industry", *Applied Finance and Accounting*, 1(2), 107-128.
- Latif, H. (2011), "Studying the Structure of Ownership and Efficiency of Insurance Companies in Iran", *Middle-East Journal of Scientific Research*, 9(5), 675-681,
- Latif, H. (2014), "Market Structure and Efficiency of Insurance Companies in Azerbaijan Republic", *Indian Journal of Scientific Research*, 7(1), 114-120.
- Lee, C-A., Shyu, M-K. and Chiu, Y-H. (2017), "Evaluating the Operational Efficiency of Life Insurance Companies in Taiwan-An Application of the Dynamic Network SBM Model", *Applied Economics and Finance*, 4(1), 18-33.
- Lee, H. S., Cheng, F. F., Nassir, A. M. and Razak, N. H. A. (2018), "Does Efficiency Promote Competitiveness of the Insurance Industry?", *Journal of Business Economics and Management*, 19(4), 566-591.
- Lee, H. S., Cheng, F. F., Har, W. M., Nassir, A. M., Hisyam, N. and Razak, A. (2019), "Efficiency, firm-specific and corporate governance factors of the Takaful Insurance", *International Journal of Islamic and Middle Eastern Finance and Management*, 12(3), 368-387.
- Lee, H-S. and Kim, K-S. (2008), "Decompensation and Super-efficiency in the Korean Life Insurance Industry Employing DEA", *International Journal of Contents*, 4(3), 1-9.
- Lee, Y-C. and Yang, Y. (2014), "Data envelopment analysis with missing data: An application to Life insurance industry in Taiwan", *Journal of Economic & Financial Studies*, 2(6), 43-52.
- Lei, D., Deng, J., Zhao, X-N. and Yu, X-W. (2012), "Evaluation of the Efficiency of the Chinese Life Insurance Industry-Based on a Combined Two-Stage DEA Model", *Chinese Journal of Management Science*, 2012(11), 859-864.
- Leverly, J. T., Lin, Y. and Zhou, H. (2004), "Firm Performance in the Chinese Insurance Industry", Center for Risk Management and Insurance Research Working Paper No. 04-10. Georgia State University, Atlanta, GA.
- Leverly, J. T., Lin, Y. and Zhou, H. (2009), "WTO and the Chinese Insurance Industry", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 34(3), 440-465.
- Li, C-H. and Zhang, W. (2005), "Size Vs Efficiency of the Firm: An Empirical Research with DEA Method on Insurance Firms in China", *Systems Engineering*, 23(9), 37-41.
- Li, H. and Zhang, L. (2011), "Analysis of the Super Efficiency of Chinese Life Insurance Companies Using a Non-Radial SE-BCC Model", *Modern Finance & Economics*, 31(3), 88-93.
- Li, K. (2005), "An empirical analysis of the operating efficiency of domestic life insurance companies", *Insurance Studies*, 2005(2).
- Li, L. (2011), "Efficiency Analysis of Life Insurance Companies in Thailand.", School of Business, University of the Thai Chamber of Commerce, Bangkok, Thailand.
- Li, S. and Tong, Z. (2024), "Operational Efficiency, Imbalance Degree, and Influencing Factors of Chinese Life Insurance Companies", *Review of Economy and Management*, V(n), 5-16.
- Li, X. and Yun, M. (2003), "Efficiency Analysis of Insurance Companies Based on a DEA Method", *Modern Management Science*, 2003(3).

- Li, Y. (2018), "Efficiency Analysis of Insurance Asset Allocation in China", *Information Systems Engineering*, 2018(5).
- Li, Y-H. and Wu, C. (2009), "An Experimental Study on the Efficiency of Chinese Insurance Industry", *Humanities & Social Sciences Journal of Hainan University*, 27(3), 310-316.
- Li, Y-Z. and Hu, X. (2013), "Comparative Study on China's Domestic and Foreign Life Insurers' Operating Efficiency", *Collected Essays on Finance and Economics*, 2013(1), 47-53.
- Liang, P. and Liang, P-Y. (2011), "Study of X-Efficiency Based on SFA in Chinese Insurance", *Journal of Applied Statistics and Management*, 30(1), 144-153.
- Liang, Q. (2016), "A comparative study on the operating efficiency of life insurance companies in China and Japan", *Social Science Front*, 2016(2).
- Liang, Q. and Lu, J. (2011), "Study on the Efficiency of Life Insurance Industry in China Based on Threestage Data Envelopment Analysis", *Economic Management*, 33(7), 149-155.
- Lim, Q-M., Lee, H-S. and Har, W-M. (2021), "Efficiency, productivity and competitiveness of the Malaysian insurance sector: an analysis of risk-based capital regulation", *The Geneva Papers on Risk and Insurance-Issues and Practice*, 46(1), 146-172.
- Lin, H-D., Lee, Y-H. and Shih, M-L. (2011), "A Study on Technical Efficiency and Productivity Changes of Taiwan's Life Insurance Industry", *Journal of Global Business Management*, 7(2), 1-8.
- Lin, F. (2012), "An empirical analysis of changes in the production efficiency of China's life insurance industry-Based on the MALMQUIST index", *Special Zone Economy*, 2012(6), 259-263.
- Lin, L. (2003), "The Impact of Deregulation on the Efficiency of Taiwan Life Insurance Industry", paper presented at the International Conference of Pacific Rim Management, Seattle, WA held August 1-3, 2003.
- Lin, Q. (2011), "An empirical analysis of the operating efficiency of China's life insurance industry-based on a three-stage DEA model", *Fujian Finance*, 2011(5), 24-29.
- Liu, B. (2007), "Empirical Research of the Market Structure, Efficiency and Performance of Life Insurance Industry in China", *Industrial Economics Research Journal*, 2007(4), 19-26.
- Liu, D. and Li, S. (2015), "Research on the Efficiency Measurement of Reinsurance Companies in China-Analysis Based on the Three-stage DEA Model", *The Theory and Practice of Finance and Economics*, 36(196).
- Liu, H. and Ren, J. (2012), "Technical Efficiency Evaluation of Life Insurance Companies in China-Based on the SFA Method", Shaanxi Insurance Academic Excellent Papers Collection (2011-2012), Shaanxi Federation of Social Sciences Special Data Collection.
- Liu, J-F. and Wang, H. (2005), "An Analysis of the Correlation between Market Structure and Performance of China's Insurance Industry", *Soft Science*, 19(5), 14-16.
- Liu, L. and Kubo, H. (2011), "Empirical Study on Efficiency of Japanese Life Insurance Industry: 1998-2008", *Mathematics in Practice and Theory*, 41(23), 62-71.
- Liu, W. and Wei, Z. (2015), "Evaluation and comparison of efficiency differences between Chinese and foreign-funded life insurance companies", *China Management Informationization*, 18(23).
- Liu, X. and Liu, W. (2013), "Research on the efficiency of the capital utilization of life insurance companies", *Modern Management Science*, 2013(4).

- Liu, X., Qiu, G. and Hu, Y. (2008), "The Efficiency of Life Insurance Industry in China: Based on the DEA Theory", *Contemporary Economy & Management*, 30(1), 71-76
- Liu, Y. (2015), "An Exponential Analysis of the Impacts of Internet Insurance Development on the Operational Efficiency of Insurance Companies", *Insurance Studies*, 2015(9), 104-116.
- Liu, Y. and Liu, Y. (2014), "Research on the Evaluation of Cost and Profit Efficiency of Life Insurance Companies", paper presented at the Comprehensively Deepen Reform: Strategic Thinking and Path Selection-The 11th Peking University CCISSR Forum, Beijing, PRC held April 18, 2014.
- Liu, Y. M. and Liu, X-H. (2010), "Empirical Analysis on Operation Efficiency and Efficiency Continuity of China's Life Insurance Companies", *Journal of Qingdao University (Natural Science Edition)*, 23(3), 69-74.
- Lu, T., Zhang, X. and Zhou, X. (2017), "Analysis of Economic Efficiency of Xinjiang Insurance Market-Discussion on Structural Reform of Supply Side of Insurance Industry", *Financial Development Review*, 2017(11).
- Lu, W-M., Wang, W-K. and Kweh, Q. L. (2014), "Intellectual capital and performance in the Chinese life insurance industry", *Omega*, 42(1), 65-74.
- Lu, X. (2007), "An Experimental Analysis of Macro Efficiency of Insurance Industry of China from 1999 to 2004: Based on DEA Method", *Statistical Research*, 24(1).
- Lu, X. (2009), "Malmquist Index Analysis of Total Factor Productivity Changes in China's Insurance Industry-A New Perspective", *Insurance Studies*, 2009(9), 42-51.
- Lu, Y. (2009), "Research on the Governance of Chinese Insurance Companies Based on Data Envelopment Analysis", *Insurance Studies*, 2009(4).
- Lu, Y. (2011), "An empirical analysis of the operating efficiency of my China's life insurance industry", *Market Modernization*, 2011(10).
- Lu, Z. (2007), "Research on the Measurement of Insurance Company Efficiency", *Financial Horizons*, 2007(7).
- Luan, X-Y. and Li, M-M. (2013), "Study on the Economic Efficiency of China's Life Insurance Companies by DEA", *Value Engineering*, 176-177.
- Lukic, R., Sokic, M. and Vojteski Kljenak, D. (2018), "Analysis of insurance companies' efficiency in the Republic of Serbia", *Economic and Environmental Studies*, 18(1), 249-264.
- Ma, J., Shang J., Chen, Y. and Ren, Y. (2012), "The World Insurance Industry Efficiency Analysis after the Financial Crisis", *Science and Management*, 2012(6), 69-72.
- Mahlberg, B. (1999), "Effizienzmessung österreichischer und deutscher Versicherungen-Ein Vergleich (Measuring the Efficiency of Austrian and German Insurance Companies-A Comparison)", *Wirtschaftspolitische Blätter (Economic policy papers)*, 46(4), 400-406.
- Mahlberg, B. (2000), "Efficiency Progress and Productivity Change in Germany's Insurance Industry", *Jahrbücher für Nationalökonomik und Statistik (Yearbooks of Economics and Statistics)*, 220(5), 565-591.
- Mahlberg, B. and Url, T. (2000), "The Transition to the Single Market in the German Insurance Industry", Austrian Institute for Economic Research (WIFO) Working Paper 131. WIFO, Vienna, Austria.

- Mahlberg, B. and Url, T. (2003), "Effects of the single market on the Austrian insurance industry", *Empirical Economics*, 28(4), 813-838.
- Mahlberg, B. and Url, T. (2010), "Single Market effects on productivity in the German insurance industry", *Journal of Banking & Finance*, 34(7), 1540-1548.
- Mamatzakis, E., Staikouras, C., Triantopoulos, C. and Wang, Z. C. (2022), "Measuring the efficiency and productivity of U.K. insurance market", *International Journal of Finance & Economics*, 29(1), 1097-1114.
- Manel, R., Nejib, O. M. and Nejib, H. (2016), "What Drives the Technical Inefficiency in the Tunisian Insurance Industry", *Journal of Economics Studies and Research*, 2016.
- Mansor, S. A. and Radam, A. (2000), "Productivity and Efficiency Performance of the Malaysian Life Insurance Industry", *Jurnal Ekonomi Malaysia*, 34, 93-105.
- Marie, A., Rao, A. and Kashani, H. (2009), "Cost Efficiency and Value Driver Analysis of Insurers in an Emerging Economy", *Managerial and Decision Economics*, 30(4), 265-280.
- Martinez, J. and Estrada, D. (2009), "Efficiency and Productivity Change in the Colombian Insurance Market", Working Paper.
- Masud, M. M., Rana, M. S., Mia, M. A. and Saifullah, M. K. (2019), "How Productive Are Life Insurance Institutions in Malaysia? A Malmquist Approach", *Journal of Asian Finance, Economics and Business*, 6(1), 241-248.
- Maudos, J. and Pastor, J. M. (2001), "Cost and profit efficiency in banking: an international comparison of Europe, Japan and the USA", *Applied Economics Letters*, 8(6), 383-387.
- Meador, J. W., Ryan, Jr., H. E. and Schellhorn, C. D. (1997), "Product Focus versus Diversification: Estimates of X-Efficiency for the US Life Insurance Industry", The Wharton Financial Institutions Center Working Paper No. 97-16, University of Pennsylvania, Philadelphia, PA.
- Medved, D. and Kavcic, S. (2012), "An Empirical Study of Efficiency in Croatia and Slovenia in Insurance Markets", *Ekonomika istraživanja (Economic Research)*, 25(1), 105-120.
- Miniaoui, H. and Anissa, C. (2014), "Technical Efficiency of Takaful Industry: A Comparative Study of Malaysia and GCC Countries", Working Paper 2014-055, IPAG Business School, Paris France.
- Mitrović, Đ., Trifunović, D. and Randelović, S. (2020), "Measuring Efficiency of Serbian Insurance Companies Using Network Data Envelopment Analysis", in J. Kočović, T. Rakonjac-Antić, B. Jovanović Gavrilović and B. Boričić, (eds.), *Insurance Market After Covid-19*, Faculty of Economics-University of Belgrade, Belgrade, Serbia.
- Mousavia, M. and Jafari, S. M. (2015) "Measuring the relative efficiency of insurance industry: Evidence from Tehran Stock Exchange", *Management Science Letters*, 5(11), 999-1004.
- Musa, M., Alhabshi, S. M. and Haron, R. (2022), "Optimization of solvency margin in family Takaful and Life Insurance Institutions in Malaysia: Application of Data Envelopment Analysis", *Journal of Islamic Accounting and Finance Research*, 4(1), 155-182.
- Naini, S. G. J. and Nouralizadeh, H. R. (2012), "A Two-Stage DEA to Analyze the Effect of Entrance Deregulation on Iranian Insurers: A Robust Approach", *Mathematical Problems in Engineering*, 2012, 1-24.

- Nalimae, N., Wamugo, L. and Siliyu, E. (2020), "Firm Characteristics and Revenue Efficiency of Selected Insurance Companies in Kenya", *IOSR Journal of Business and Management*, 22(6), 26-33.
- Nandi, J. K. (2014), "Relative Efficiency Analysis of Selected Life Insurers in India using Data Envelopment Analysis", *Pacific Business Review International*, 6(8), 69-76.
- Nasution, Z. (2021), "Sharia insurance efficiency in Indonesia and Malaysia using the stochastic frontier approach analysis", *Asian Journal of Islamic Management*, 3(2), 123-136.
- Naushad, M., Faridi, M. R. and Faisal, S. (2020), "Measuring the Managerial Efficiency of Insurance Companies in Saudi Arabia: A Data Envelopment Analysis Approach", *Journal of Asian Finance, Economics and Business*, 7(6), 297-304.
- Nektarios, M. and Barros, C. P. (2010), "A Malmquist Index for the Greek Insurance Industry", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 35(2), 309-324.
- Ngo, T. (2017), "Efficiency of Vietnam's Insurance Market: A DEA Approach", in T. Amornpetchkul, et al. (eds.), *Proceedings of the NIDA International Business Conference 2017-Innovative Management Bridging Theory and Practice*, NIDA Business School, Bangkok, Thailand.
- Nguyen, B. N. and Nguyen, P. A. (2022), "An Investigation of the Efficiency of Insurance Companies in Vietnam-Using Data Envelopment Analysis and Malmquist Index", *Journal of Asian Finance, Economics and Business*, 9(7), 261-271.
- Noreen U. and Ahmad S. (2016), "Cost Efficiency and Total Factor Productivity: An Empirical Analysis of Pakistan's Insurance Sector", *The Lahore Journal of Economics*, 21(1), 123-150.
- Noronh, M. R. and Shinde, S. R. (2012), "A Comparative Study of Cost Efficiency of Life Insurance Companies in India", *Ganpat University (Kherva, India) Faculty of Management Studies Journal of Management and Research (GFJMR)*, 4, 1-14.
- Nourani M., Chandran, V. G. R., Kweh, Q. L. and Lu, W-M. (2018), "Measuring Human, Physical and Structural Capital Efficiency Performance of Insurance Companies", *Social Indicators Research*, 137(1), 281-315.
- Nourani, M., Devadason, E. S. and Chandran, V. G. R. (2018), "Measuring technical efficiency of insurance companies using dynamic network DEA: An intermediation approach", *Technological and Economic Development of Economy*, 24(5), 1909-1940.
- Nourani, M., Devadason, E. S., Kweh, Q. L. and Lu, W-M. (2017), "Business excellence: the managerial and value-creation efficiencies of the insurance companies", *Total Quality Management & Business Excellence*, 28(8), 879-896.
- Ogieva, O. F. and Omoregbe, O. (2017), "Measuring the Efficiency and Performance of Quoted Insurance Companies in Nigeria: Data Envelopment Analysis (DEA) Approach", *Annals of the University of Petroșani, Economics*, 17(1), 187-208.
- Ortynski, K. and Woloszyn, J. (2022), "Structure of technical efficiency of insurers in the life insurance industry in Poland", *Central European Review of Economics & Finance*, 39(4), 24-38.
- Ouyang, Q-D. and Zou, P-F. (2008), "An Empirical Analysis on the X-Efficiency and Scale Efficiency of Chinese Life Insurance Industry", *Journal of Xiangtan University (Philosophy and Social Sciences)*, 32(2), 29-34.

- Paradi, J. C. (2002), "Profit Efficiency-Health Insurance", in N. K. Avkiran, (ed.), *Productivity Analysis in the Service Sector: with Data Envelope Analysis*, N. K. Avkiran, Camira (suburb of Brisbane), Qld.
- Parida, T. K. and Acharya, D. (2017a), "Analysing the Technical Efficiency and Productivity Change of Life Insurance Companies in India", in T. K. Parida and D. Acharya (eds.), *The Life Insurance Industry in India: Current State and Efficiency*, Palgrave Macmillan, Singapore, Singapore.
- Parida, T. K. and Acharya, D. (2017b), "Life Insurance in India: Efficiency and Profitability", in T. K. Parida and D. Acharya (eds.), *The Life Insurance Industry in India: Current State and Efficiency*, Palgrave Macmillan, Singapore, Singapore.
- Pawar Waghavkar, M. S. and Sananse, S. L. (2015), "DEA in Health and Life Insurance Companies: A Review", *International Journal of Innovative Research in Science, Engineering and Technology*, 4(12), 12626-12631.
- Pawar Waghavkar, M. S. and Sananse, S. L. (2018), "Using data envelopment analysis to measure, relative efficiency of public and private life insurance companies in India", *International Journal of Statistics and Applied Mathematics*, 3(1), 173-176.
- Peng, J-L., Chen, R-L. and Liu, W. P. (2014), "The Bancassurance Cooperation Strategy and Efficiency of Life Insurance Companies", *Academia Economic Papers*, 42(2), 235-269.
- Pervan, M., Curak, M. and Kramarić, T. P. (2021a), "A comparative analysis of the efficiency of life and non-life sectors in selected CEE countries", *Ekonomski Vjesnik/Econviews-Review of Contemporary Business, Entrepreneurship and Economic Issues*, 34(2), 279-290.
- Pervan, M., Curak, M. and Kramarić, T. P. (2021b), "Has Accession to the European Union Affected the Efficiency of Croatian Insurance Companies? Zagreb International", *Review of Economics & Business*, 24(1), 67-98,
- Pottier, S. W. (2011), "Life insurer efficiency and state regulation: evidence of optimal firm behaviour", *Journal of Regulatory Economics*, 39(2), 169-193.
- Purwaningrat, P. A. (2018), "Efficiency Insurance Companies in Indonesia, Malaysia and Singapore", *International Journal of Research in Commerce & Management*, 9(3), 27-35.
- Qiu, S. and Chen, B. (2006), "Efficiencies of Life Insurers in China: An Application of Data Envelopment Analysis", paper presented at the 2006 China International Conference in Finance, Xi'an, PRC held July 17-20, 2006.
- Rahman, A. (2013), "Comparative Study on the Efficiency of Bangladeshi Conventional and Islamic Life Insurance Industry: A Non-Parametric Approach", *Asian Business Review*, 2(3), 88-99.
- Rahmani, I., Barati, B., Majazi Dalfard, V. and Hatami-Shirkouhi, L. (2014), "Nonparametric frontier analysis models for efficiency evaluation in insurance industry: a case study of Iranian insurance market", *Neural Computing & Applications*, 24(5), 1153-1161.
- Rai, A. (1996), "Cost Efficiency of International Insurance Firms", *Journal of Financial Services Research*, 10(3), 213-233.
- Rao, A., Kashani, H. and Marie, A. (2010), "Analysis of managerial efficiency in insurance sector in the UAE: an emerging economy", *International Journal of Managerial Finance*, 6(4), 329-343.

- Rees, R., Kessner, E., Klemperer, P. and Matutes, C. (1999), "Regulation and Efficiency in European Insurance Markets", *Economic Policy*, 14(29), 363-397.
- Ren, Y-Y. and Ma, J. (2013), "Analysis of Influencing Factors of Chinese Life Insurance Companies' Scale Efficiency-On the Basis of Panel Threshold Regression Model", *Journal of Applied Statistics and Management*, 32(4), 740-748.
- Reyna, A. M. and Fuentes, H. J. (2014), "A cost efficiency analysis of the Insurance Industry in Mexico", Working Paper
- Reyna, A. M. and Fuentes, H. J. (2018), "A cost efficiency analysis of the insurance industry in Mexico", *Journal of Productivity Analysis*, 49(1), 49-64.
- Reyna, A. M., Fuentes, H. J. and Nunez, J. A. (2022), "Response of Mexican life and non-life insurers to the low interest rate environment", *The Geneva Papers on Risk and Insurance-Issues and Practice*, 47(2), 409-433.
- Roy, M. N. and Saha, S. S. (2018), "Efficiency of Domestic and Indo-foreign Life Insurance Companies during Post-Global Recession Period: A DEA Approach", *Business Studies*, XXXIX(1&2), 32-46.
- Rusydiana, A. S. and Nugroho, T. (2017), "Measuring Efficiency of Life Insurance Institution in Indonesia: Data Envelopment Analysis Approach. Global Review of Islamic", *Economics and Business*, 5(1), 12-24.
- Ryan, Jr., H. E. and Schellhorn, C. D. (2000), "Life Insurer Cost Efficiency Before and After Implementation of the NAIC Risk-Based Capital Standards", *Journal of Insurance Regulation*, 18(3), 362-382.
- Saad, N. M. and Idris, N. E. H. (2011), "Efficiency of Life Insurance Companies in Malaysia and Brunei: A Comparative Analysis", *International Journal of Humanities and Social Science*, 1(3), 111-122.
- Saad, N. M., Majid, M. S. A., Yusof, R. M., Duasa, J. and Rahman, A. R. A. (2006), "Measuring Efficiency of Insurance and Takaful Companies in Malaysia Using Data Envelopment Analysis (DEA)", *Review of Islamic Economics*, 10(2), 5-26.
- Sabet, R. J. and Fadavi, A. (2013), "Performance measurement of insurance firms using a two-stage DEA method", *Management Science Letters*, 3, 305-308.
- Sabiti, M. B., Effendi, J. and Novianti, T. (2017), "Efisiensi Asuransi Syariah di Indonesia dengan pendekatan *Data Envelopment Analysis* (Islamic Insurance Efficiency in Indonesia using a Data Envelopment Analysis Approach)", *Jurnal Al-Muzara'ah (Al-Muzara'ah Journal)*, 5(1), 69-87.
- Sadeghi, E., Lavasani, M. M., Malkhalife, M. R. and Khanmohamadi, M. (2023), "Evaluating the Performance of Iranian Insurance Companies Using Efficiency Measurement Method Based on Modified Slack-Based Measure in The Network Data Envelopment Analysis Approach", *International Journal of Finance and Managerial Accounting* 8(29), 25-41.
- Saeidy, P. and Kazemipour, S. A. (2011), "Compare the Performance of Private and Public Insurance Companies in Using Data Envelope Analysis", *World Applied Sciences Journal*, 13(5), 988-992.
- Sahoo, B. K. and Mohanty, A. R. (2022), "Testing the Impact of Input and Output Substitutability in Nonparametric Production Analysis: Evidence from Life Insurance Industry in India", *Journal of the Operations Research Society of Japan*, 65(4), 172-197.

- Sajedi, S. and Kandelousi, N. S. (2015), "An Assessment on Insurance Companies Efficiency Using Double-Stage Data Envelopment Analysis", *International Journal of Review in Life Sciences*, 5(9), 448-456.
- Sanei, R., Faleh, M., Lotfi, F. H. and Sobhani, F. M. (2024), "Evaluating the financial performance of insurance companies in Iran using the two-stage data envelopment analysis technique", *Quarterly Journal of Financial Engineering and Securities Management*, 48(1).
- Santhimol, M. C. and Shaju, M. J. (2018), "Concentration, Competition, Profitability and Performance Efficiency of Select Life Insurers in Kerala", *International Journal of Research in Management, Economic sand Commerce*, 8(3), 55-61.
- Saputra, M., Arfan, M. and Zahara, N. (2020), "A Comparative Study of Conventional and Shariah Life Insurance Efficiency Using Data Envelopment Analysis", *Jurnal Ekonomi dan Keuangan Islam (Journal of Islamic Economics and Finance)*, 9(2), 110-137.
- Sarah M., Mahri, A. J. W. and Cakhyaneu, A. (2019), "Efficiency of Tabarru' Fund Management at Islamic insurance Companies in Indonesia", in The 2nd International Conference on Islamic Economics, Business, and Philanthropy (ICIEBP) Theme: "Sustainability and Socio Economic Growth", Knowledge E Social Sciences, Dubai, UAE.
- Sarkis, J. (2002), "Preparing Your Data for DEA", in N. K. Avkiran, (ed.), *Productivity Analysis in the Service Sector: with Data Envelope Analysis*, N. K. Avkiran, Camira (suburb of Brisbane), Qld.
- Savitha, B., Banerjee, S. and Shetty, A. (2019), "Product diversification versus technical efficiency of conglomerate life microinsurance companies: evidence from India", *The Geneva Papers on Risk and Insurance-Issues and Practice*, 44(3), 527-547.
- Saxena, C., Singh, S., Kumar, P. and Arora, R. (2020), "Efficiency Analysis of Insurance Companies using Malmquist-DEA: A Comparison of LIC with Selected Private Sector Life Insurers of India", *Test Engineering and Management*, 83, 16681-16691.
- Segal, D. (2002), "An Economic Analysis of Life Insurance Company Expenses", *North American Actuarial Journal*, 6(4), 81-94.
- Segal, D. (2003), "A Multi-Product Cost Study of the U.S. Life Insurance Industry", *Review of Quantitative Finance and Accounting*, 20(2), 169-186.
- Sen, S. (2020), "Analysis of Cost Efficiency of Indian Life Insurers: A comparison of Quantity vs Value based DEA Approach", *Asia-Pacific Journal of Risk and Insurance*, 14(1),
- Seth, P. and Patel, G. N. (2014), "Measuring the Efficiency of Rashtriya Swasthaya Bima Yojana (National Health Insurance Scheme) using Data Envelopment Analysis Approach", *Journal of Health Management*, 16(2), 199-215.
- Shahroudi, K., Taleghani, M. and Mohammadi, G. (2011), "Efficiency Decomposition in Data Envelopment Analysis: An application to Insurance companies in Iran", *Interdisciplinary Journal of Contemporary Research in Business*, 3(4), 676-684.
- Shahroudi, K., Taleghani, M. and Mohammadi, G. (2012), "Application of Two-Stage DEA Technique for Efficiencies Measuring of Private Insurance Companies in Iran. International", *Journal of Applied Operational Research*, 1(3), 91-104.
- Shao, Q. (2009), "Application of the DEA method to analyze the value chain of insurance companies in China", *Inquiry into Economic Issues*, 2009(4).

- Sharma, G. and Sharma, D. (2017), "Technical and Scale Efficiency of Selected Insurance Companies in India International Journal of Engineering Technology", *Management and Applied Sciences*, 5(7), 154-60.
- Shen, Y. (2017), "An empirical study on the technical efficiency of China's life insurance industry based on the DEA model", *Productivity Research*, 2017(3).
- Shetty, A. and Basri, S. (2018), "Assessing the Technical Efficiency of Traditional and Corporate Agents in Indian Life Insurance Industry: Slack-based Data Envelopment Analysis Approach", *Global Business Review*, 21(1), 1-17.
- Shi, L., Zhao, L., Zhang, M. and Lu, Y. (2019), "Research on the efficiency of capital utilization of life insurance companies-taking 37 life insurance companies as the research object", *Journal of Hubei University of Economics (Humanities and Social Sciences)*, 16(4).
- Shieh, H-S., Hu, J-L. and Ang, Y-Z. (2020), "Efficiency of Life Insurance Companies: An Empirical Study in Mainland China and Taiwan", *SAGE Open*, 10(1).
- Shieh, H-S., Li, Y., Hu, J-L. and Ang, Y-Z. (2022), "A Comparison of Efficiency of Life Insurance Companies in Mainland China and Taiwan Using Bootstrapped Truncated Regression Approach", *Cogent Economics & Finance*, 10(1).
- Siddiqui, S. A. (2020a), "Evaluating the Efficiency of Indian Life Insurance Sector", *Indian Journal of Economics and Development*, 16(1), 72-80.
- Siddiqui, S. A. (2020b), "Evaluating the Efficiency of Stand-Alone Health Insurance Companies in India", *The Indian Journal of Commerce*, 73(3), 14-26.
- Siddiqui, S. A. (2021), "Total Factor Productivity Growth of Indian Life Insurance Companies: A Malmquist Approach", *Indian Journal of Economics and Development*, 17(1), 479-483.
- Siddiqui, S. A. (2022), "How efficient is Indian health insurance sector: An SBM-DEA study", *Managerial and Decision Economics*, 43(4), 950-962.
- Siddiqui, S. A. and Das, S. (2019), "Evaluating the efficiency of leading Indian life insurance companies", *Indian Journal of Economics and Development*, 7(7).
- Siddiqui, S. A. and Shaddady, A. (2023), "How Profit Efficient is Indian Life Insurance Industry: A DEA Study", *SAGE Open*, 13(4).
- Singh, A. and Zahran, Z. (2013), "A Comparison of the Efficiency of Islamic and Conventional Insurers", Towers Watson Perspectives, 2013. Towers Watson, New York, NY.
- Singh, D., Stakic, N. and Fida, B. A. (2018), "Comparing the Efficiency of National and Foreign Health Insurers in Oman", in A. M. Al Ghassani, A. M. Al Lawati and Ananda S. (eds.), *Financial Sector in Oman: Developments, Issues and Prospects*, College of Banking and Financial Studies, Muscat, Oman.
- Sinha, A. (2013), "Efficiency Analysis of Private Life Insurers in India: An Application of Data Envelopment Analysis", *Pacific Business Review International*, 5(9), 37-48.
- Sinha, R. P. (2007a), "Operating Efficiency of Life Insurance Companies: An Assurance Region Model", *Artha Vijjana*, 49(3-4), 305-320.
- Sinha, R. P. (2007b), "Premium Income of Indian Life Insurance Industry-A Total Factor Productivity Approach", *The IUP Journal of Financial Economics*, 5(1), 61-69.
- Sinha, R. P. (2010), "Revenue Maximizing Efficiency of Life Insurance Companies: Some Indian Evidence", *The IUP Journal of Risk & Insurance*, 7(3), 19-37.

- Sinha, R. P. (2012), "Are Indian Life Insurance Companies Cost Efficient? Some Recent Empirical Evidence", *Prajnan*, XLI(3), 181-201
- Sinha, R. P. (2014a), "Policy Lapsation Risk and Technical Efficiency: Evidence from Indian Life Insurance Sector", *The IUP Journal of Financial Risk Management*, 11(1), 25-33.
- Sinha, R. P. (2014b), "Technical Efficiency of Indian Life Insurance Companies-A Bootstrap DEA Approach", *International Journal of Financial Management*, 4(4), 32-42.
- Sinha, R. P. (2015), "A Dynamic DEA Model for Indian Life Insurance Companies", *Global Business Review*, 16(2), 1-12.
- Sinha, R. P. and Chatterjee, B. (2009), "Are Indian Life Insurance Companies Cost Efficient?", paper presented at the 11th Annual Conference on Money and Finance, Indira Gandhi Institute of Development Research, Mumbai, India held January 23-24, 2009.
- Sinha, R. P. and Chatterjee, B. (2011), "Technical Efficiency Behaviour of Life Insurance Companies. A Dynamic Panel Approach", *The Indian Economic Journal*, 59(1), 146-161.
- Škrinjarčić, T. (2017), "Analiza Relativne Efikasnosti Industrije Osiguranja Europskih Zemalja Korištenjem Analize Omeđivanja Podataka (Analysis of the Relative Efficiency of the Insurance Industry of European Countries Using Data Envelopment Analysis)", *Ekonomski Pregled (Economic Review)*, 67(1), 3-26.
- Su, F. and Chu, L. (2015), "An Analysis of Differences and Trends in the Efficiency of Funds Used by China's Insurance Industry", *Insurance Studies*, 2015(8).
- Subagyo, H. (2022), "Is Islamic More Efficient than Conventional Life Insurance Performance During 2014-2021?", *Jurnal Personalia Financial, Operasional, Marketing dan Sistem Informasi (Journal of Financial, Operational, Marketing and Information Systems Personnel)*, 29(1), 26-39.
- Sun, F. (2005), "Several factors Affecting the Efficiency of Insurance Companies", *China Insurance*, 2005(7), 8-12.
- Sun, G. and Liu, L. (2010), "An Empirical Study on the Efficiency Change of China's Life Insurance Industry-Based on the Data Envelopment Analysis (DEA) Method", *Research on Financial and Economic Issues*, 2010(5).
- Sun H. and Chen, J. (2007), "Research on the application of DEA in the evaluation of operating efficiency of life insurance companies", *Enterprise Economy*, 2007(9).
- Sun, J., Zhang, C., Liu, C. and Jiang, X. (2014), "Market Structure, Efficiency and Performance of the Chinese Insurance Sector", *Journal of Nanjing Audit University*, 2014(1).
- Sun, L. and Li, G-J. (2005), "DEA Method in Competition Ability Analysis of Insurance Companies", *Journal of Xihua University (Philosophy & Social Sciences)*, 6(3), 61-63.
- Sun, M., Ping, H. and He, T. (2022), "Research on Insurance Technology, Operating Efficiency, and Transmission Mechanism", *East China Economic Management*, 36(1).
- Sun, Q. (2017), "Analysis of the operating efficiency of life insurance companies from the perspective of premium marketization-Comparative analysis based on SFA and DEA", *Insurance Studies*, 2017(6)
- Sun, W. and Zhong, C. (2011), "Cost X-efficiency in China's insurance companies: A stochastic frontier approach", *African Journal of Business Management*, 5(30), 11916-11924.
- Sun, Z. (2020), "Research on the Factors Affecting the Total Factor Productivity of Chinese Life Insurance Companies", *Archives of Business Research*, 8(1), 38-50.

- Sunarsih, S. and Fitriyani, F. (2018), “Analisis efisiensi asuransi syariah di Indonesia tahun 2014-2016 dengan metode *Data Envelopment Analysis* (DEA) (Analysis of the efficiency of Islamic insurance in Indonesia in 2014-2016 using the *Data Envelopment Analysis* (DEA) method)”, *Jurnal Ekonomi & Keuangan Islam (Journal of Islamic Economics & Finance)*, 4(1), 9-21.
- Suryoaji, O. and Cahyono, E. F. (2019), “Komparasi Efisiensi & Produktivitas Perusahaan Asuransi Jiwa Konvensional dan Syariah di Indonesia Pada Tahun 2014-2017, Dengan Pendekatan DEA & Indeks Malmquist (Comparison of Efficiency & Productivity of Conventional and Shariah Life Insurance Companies in Indonesia in 2014-2017, Using DEA Approach & Malmquist Index)”, *Jurnal Ekonomi Syariah Teori dan Terapan (Journal of Theory and Applied Sharia Economics)*, 6(9), 1877-1893.
- Taib, C. A., Ashraf, M. S., and Razimi, M. S. B. A. (2018), “Technical, Pure Technical and Scale Efficiency: A Non-Parametric Approach of Pakistan’s Insurance and Takaful Industry”, *Islamic Banking and Finance*, 22.
- Tan, H-B., Wong, M-F. and Law, S-H. (2009), “The Effect of Consumer Factors and Firm Efficiency on Malaysian Life Insurance Expenditure”, *International Journal Business and Society*, 10(1), 59-73.
- Tang, J. and Li, M. (2022), “Empirical Study on the Impact of InsurTech on the Operating Efficiency of Insurance Companies”, *Journal of Insurance Professional College (Bimonthly)*, 36(1).
- Tang, X. and Su, F. (2015), “Measurement, Difference and Convergence Analysis for Capital Efficiency of the Chinese Finance Industry”, *The Journal of Quantitative & Technical Economics*, 2015(10).
- Tejani, R. (2011), “Efficiency of Private Sector Life Insurance Companies in India-An Application of Data Envelopment Analysis”, *Prestige International Journal of Management and Research; Indore*, 3/4 (2/1), 50-56.
- Thanassoulis, E., Portel, M. C. S. and Despic, O. (2008), “Data envelope analysis: The Mathematical Programming Approach to Efficiency Analysis”, in H. O. Fried, C. A. Knox Lovell and S. S. Schmidt (eds.), *The Measurement of Productive Efficiency and Productivity Growth*, Oxford University Press, New York, NY.
- Tian, X-M. and Li, X-Y. (2013), “Analysis on the Operating Efficiency of Chinese Insurance Industry from Microspective Perspective”, *Research on Economics and Management*, 2013(4), 88-94.
- Tone, K. and Sahoo, B. K. (2005), “Evaluating cost efficiency and returns to scale in the Life Insurance Corporation of India using data envelopment analysis”, *Socio-Economic Planning Sciences*, 39(4), 261-285.
- Trigo Gamarra, L. (2008), “The Effects of Liberalization and Deregulation on the Performance of Financial Institutions: The Case of the German Life Insurance Market”, Institut für Volkswirtschaftslehre (Institute of Economics) Working Paper No. 93, University of Rostock, Rostock, Germany.
- Trigo Gamarra, L. and Growitsch, C. (2008) “Single-versus Multi-Channel Distribution Strategies in the German Life Insurance Market”, paper presented at the Risk Management Laboratory-Uses of Frontier Efficiency Methodologies for Performance Measurement in

- the Financial Services Sector, Imperial College Business School, London, UK held July 4-5, 2008.
- Tuffahati, H., Mardian, S. and Suprpto, E. (2016), “Pengukuran Efisiensi Asuransi Syariah Dengan Data Envelopment Analysis (DEA) (Measuring Efficiency of Sharia Insurance With DEA)”, *Jurnal Akuntansi dan Keuangan Islam (Journal of Islamic Accounting and Finance)*, 4(1).
- Tuffour, J. K., Ofori-Boateng, K., Ohemeng, W. and Akuaku, J. K. (2021), “Life Insurance Companies: Determinants of Cost Efficiency and Profitability”, *Journal of Accounting, Business and Management*, 28(2), 1-19.
- Tyas, A. A. (2023), “The Efficiency of Islamic Life Insurance in Indonesia: A Two-stages DEA”, *Tamkin Journal*, 2(2).
- Učkar, D. and Petrović, D. (2022), “Efficiency of Insurance Companies in Croatia”, *Ekon. Misao i Praksa (Economics Thought and Practice)*, 31(1), 49-79.
- Ulansari, D. W. and Septiarini, D. F. (2020), “A comparative study of the efficiency of conventional and Sharia insurance in Indonesia”, *Jurnal Keuangan dan Perbankan (Journal of Finance and Banking)*, 24(2), 202-213.
- Vencappa, D., Fenn, P. and Diacon, S. R. (2008), “Parametric Decomposition of Total Factor Productivity Growth in the European Insurance Industry: Evidence from Life and Non-Life Companies”, Centre for Risk and Insurance Studies, Nottingham University Business School Working Paper, Nottingham University, Nottingham (suburb of Nottingham Urban Area), UK.
- Vencappa, D., Fenn, P. and Diacon, S. R. (2013), “Productivity Growth in the European Insurance Industry: Evidence from Life and Non-Life Companies”, *International Journal of the Economics of Business*, 20(2), 281-305.
- Verma, R. (2012), “A Study of Perceptive and Productivity of Health Insurance Business in India with Reference to Key Determinants”, *International Journal of Research in IT & Management*, 2(2), 868-881.
- Viverita, D. (2018), “Efficiency Analysis of Private Insurance Firms Before and After The Application of BPJS Regulations”, paper presented at the Advances in Economics, Business and Management Research (89)-1st Asia Pacific Business and Economics Conference (APBEC 2018), Jakarta, Indonesia held January 17-19, 2018.
- Viverita, D., Wulandari, S. and Cabanda, E. (2016), “Determinants of Cost Efficiency and Productivity Growth of the Indonesian Insurance Industry”, *International Journal of Knowledge-Based Organizations*, 6(2), 70-82.
- Wang, C. and Ouyang, Q. (2008), “An Empirical Analysis of Insurance Industry Efficiency Considering Risk Taking and Capital Structure”, *Journal of Jiangxi University of Finance and Economics*, 2008(4).
- Wang, D. (2016), “Research on the efficiency and influencing factors of insurance fund utilization of Chinese life insurance companies-Empirical analysis based on DEA model”, *Journal of Insurance Professional College*, 30(4), 9-14.
- Wang, H. and Rong, X. (2012), “Research on the efficiency of life insurance companies in China with risk factors added-DEA and economic capital method”, paper presented at the Deepen

- reform, seek progress in stability: the perspective of insurance and social security-the 9th Peking University CCISSR Forum, Beijing, PRC, held April 26, 2012.
- Wang, J-H., Lu, Z-F. and Xue, W. (2009), "An Efficiency Analysis of Life Insurance Companies Based on Correlative Analysis and DEA Models", *Mathematics in Practice and Theory*, 39(20) 26-30.
- Wang, J. L., Jeng, V. and Peng, J. L. (2007), "The Impact of Corporate Governance Structure on the Efficiency Performance of Insurance Companies in Taiwan", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 32(2), 264-282.
- Wang, J. L., Peng, J-L. and Chang, Y-H. (2006), "The Impact of Bancassurance on the Efficiency Performance of Life Insurance Companies in Taiwan", *National Taiwan University Management Review*, 17(1), 59-90.
- Wang, J-T. and Zhao, L. (2009), "The Empirical Analysis on the Dynamic Changes and Measure of Efficiency of China's Life Insurance Companies", *Collected Essays on Finance and Economics*, 2009(2), 46-53.
- Wang, S. (2021), "Research on the Growth Efficiency of Foreign-funded Life Insurance Companies under Different Equity Ratios", *Journal of Insurance Professional College (Bimonthly)*, 35(4).
- Wang, W. and Tian, M-X. (2020), "An Empirical Study on the Evaluation of the Governance Efficiency of China's Life Insurance Companies", *Insurance Research*, 2020(12).
- Wang, X. (2017), "Research on the Development Efficiency of Insurance Companies in China-Based on DEA-Malmquist Index and Tobit Two-step Analysis", *Fujian Finance*, 2017(8).
- Wang, X-N. (2018), "Geographically Weighted Stochastic Frontier Efficiency: A Study of the Life Insurance Industry in China", *Journal of Applied Statistics and Management*, 37(5).
- Wang, Y. (2014), "Comparative Study of China's Domestic and Foreign Life Insurers' Operating Efficiency Based on DEA", *Journal of Finance and Economics*, 29(3), 107-117.
- Wang, Y. (2016), "A Study on the Efficiency and Influencing Factors of Insurance Funds Utilization of Chinese Life Insurance Companies-An Empirical Analysis Based on a DEA Model", *Journal of Insurance Professional College*, 30(4).
- Wanke, P. and Barros, C. P. (2016), "Efficiency drivers in Brazilian insurance: A two-stage DEA meta frontier-data mining approach", *Economic Modelling*, 53, 8-22.
- Ward, D. R. (2002), "The costs of distribution in the UK life insurance market", *Applied Economics*, 34(15), 1959-1968.
- Wasseja, M. M. and Mwenda, S. N. (2015), "Analysis of the Efficiency of Life Assurance Companies in Kenya Using the DEA-Model", *American Journal of Mathematics and Statistics*, 5(2), 60-71.
- Wei, H-L. and Zhang, S. (2011), "Comparative Study of Business Efficiency of Chinese and Foreign (Joint)-Funded Insurance Companies in China: 2006-2009", *Insurance Studies*, 2011(5), 68-76.
- Weiss, M. A. (1986), "Analysis of Productivity at the Firm Level: An Application to Life Insurers", *Journal of Risk and Insurance*, 53(1), 49-84.
- Wicaksono, R. and Mulyaningsih, T. (2019), "Does Ownership Structure Matter? A Cost Efficiency Study of Life Insurance Firms in Indonesia", *Bulletin of Monetary Economics and Banking*, 22(3), 367-382.

- Wise, W. (2017), "A survey of life insurance efficiency papers: Methods, pros & cons, trends", *Accounting*, 3(3), 137-170.
- Wise, W. (2018), "The importance of efficiency for life insurer profit: A study of Canadian life insurance companies", *Theoretical and Applied Economics*, XXV(4), 179-204.
- Wise, W. (2023), "The Importance of Efficiency for Life Insurer Profit Regarding Canadian Life Insurers", *Journal of Economics, Finance and Accounting*, 10(3), 121-136.
- Wongchai A. (2017), "The Operational Efficiency Analysis of Insurance Companies in Thailand", *Advanced Science Letters*, 23(12), 10632-10635.
- Wu, W-C and Li, C-H (2020), "An Evaluation of the Operating Efficiency of Life Insurance Companies and Comparison between Chinese and Foreign Companies in a Recent Ten Years: A Case of Life Insurance Application Based on DNSBM Model", *Journal of Central University of Finance & Economics*, 2020(2).
- Wu, D., Yang, Z., Vela, S. and Liang, L. (2007), "Simultaneous analysis of production and investment performance of Canadian life and health insurance companies using data envelopment analysis", *Computers & Operations Research*, 34(1), 180-198.
- Wu, H. and Zeng, X-F. (2011), "Application of Computer Technology in Efficiency Analysis of China Life Insurance Company", *Journal of Computers*, 6(9), 1832-1841.
- Wu, H. and Zhao, G. (2010), "Review on Efficiency Research and Prospect on Future Study in Insurance Industry", *Chinese Review of Financial Studies*, 2010(1).
- Wu, S., Cao, Z., Qin, K., Lang, W. and Zhang, R. (2012), "Empirical Analysis of the Operating Efficiency of China's Insurance Industry", *Interdisciplinary Journal of Contemporary Research in Business*, 4(8), 12-28.
- Wu, X. and Ma, D. (2015), "Research on Human Resource Allocation Efficiency and Evaluation of Chinese Life Insurance Companies", *China Labor*, 2015(20).
- Wu, X-Y. (2011), "Factors Influencing the Efficiency of Five Coastal Cities' Life Insurance Industry: An Approach of Panel Data DEA Malmquist Index", *Journal of Jimei University Philosophy and Social Sciences*, 14(1), 41-46.
- Wu, Y-C., Kweh, Q. L., Lu, W-M. and Azizan, N. A. (2016), "The impacts of risk-management committee characteristics and prestige on efficiency", *Journal of the Operational Research Society*, 67(6), 813-829.
- Wu, Y-M., Li, C-P. and He, J. (2005), "Efficiency Appraisal of China Insurance", *Statistics & Information Tribune*, 20(5), 56-70.
- Xie, Q. and Li, X-F. (2009), "The Comparison on Insurance Group Operating Efficiency and the Analysis of its Influencing Factors-Based on the Data from America, Europe, Japan and China Taiwan", *Journal of Jiangxi University of Finance and Economics*, 2009(5), 41-47.
- Xie, S., Lu, C. and Sun, K. (2018), "Efficiency Analysis of Marketing Channels of Chinese Life Insurance Companies", *Journal of Insurance Professional College*, 32(4).
- Xie, T. (2018), "Research on Operating Efficiency and Influencing Factors of Health Insurance in China", *Journal of Dongguan University of Technology*, 25(4).
- Xie, X., Lu, W., Reising, J. and Stohs, M. H. (2011), "Demutualisation, Control and Efficiency in the U.S. Life Insurance Industry", *The Geneva Papers on Risk and Insurance-Issues & Practice*, 36(2), 197-225.

- Xiong, L. (2012), "An Analysis of Productivity in China's Life Insurance Industry-An Empirical Study Based on the Malmquist Index", *Journal of Financial Development Research*, 2012(5).
- Xu, J. and Li, D. (2010), "Research on the efficiency of life insurance companies: an analysis method based on the DEA model", *Exploration of Economic Issues*, 2010(2), 179-86.
- Xu, J. and Yu, Y. (2011), "A Comparative Study on the Operating Efficiency of Chinese and Foreign Life Insurance Companies in China", *Journal of Insurance Professional College*, 25(6).
- Xu, M. and Jiang, Y. (2014), "Research on the Evaluation of the Operating Efficiency of Chinese Insurance Companies Based on the Network SBM Model", *South China Finance*, 2014(7).
- Xu, X. and Hao, C. (2013), "An Empirical Study on the Cost Efficiency of Insurance Company Grouping", *The World of Survey and Research*, 2013(2).
- Xu, X. and Wang, Z. (2020), "Research on the Influence of Bancassurance Business Scale on the Efficiency of Life Insurance Companies and the Threshold Effect", *Journal of Insurance Professional College*, 34(3).
- Yakob, R., Yusop, Z., Radam, A. and Ismail, N. (2014), "Kaedah DEA Dua-Peringkat dalam Mengenal Pasti Faktor Luaran Terhadap Kecekapan Pengurusan Risiko dan Pelaburan Penanggung (Two-Stage DEA Method in Identifying the Exogenous Factors of Insurers' Risk and Investment Management Efficiency)", *Sains Malaysiana (Malaysian Science)*, 43(9), 1439-1450.
- Yakob, R., Yusop, Z., Radam, A. and Ismail, N. (2015), "The relative efficiency of investment management of life insurers and takaful operators", *Investment Management and Financial Innovations*, 12(1), 78-89.
- Yakob, R. and Isa, Z. (2008), "Kesolvenan dan Kecekapan Teknikal Syarikat Insurans Hayat di Malaysia (Solvency and Technical Efficiency Life Insurance Company in Malaysia)", *International Journal of Management Studies*, 15(Bumper Issue), 177-97.
- Yan, B. and Wanyan, R-Y. (2011), "An Empirical Analysis of China's Insurance Enterprise Efficiency", *Journal of Central University of Finance and Economics*, 2011(10), 72-77.
- Yan, Q. and Xi, A. (2017), "Study on the Investment Efficiency of Life Insurance Companies and the Influencing Factors", *Journal of Insurance Professional College*, 31(1).
- Yang, C. C. (2014), "Health Care Reform, Efficiency of Health Insurers, and Optimal Health Insurance Markets", *North American Actuarial Journal*, 18(4), 478-500.
- Yang, C. C. and Wen, M-M. (2017), "An Efficiency-Based Approach to Determining Potential Cost Savings and Profit Targets for Health Insurers: The Case of Obamacare Health Insurance CO-OPs", *North American Actuarial Journal*, 21(2), 305-21.
- Yang, M-M. (2010), "On the Efficiency of China's Insurance Industry after Foreign Insurance Entering", *Journal of Yunyang Teachers College*, 30(4), 94-97.
- Yang, L. and He, B. (2017), "An Analysis on the Influence Factors of Technical Progress Rate for Insurance Companies in China: Based on a Malmquist Index and Random-effect Panel Data Model", *Journal of Zhejiang University (Humanities and Social Sciences)*, 2017(4).
- Yang, X. (2018), "Will Bank Shareholders' Background Affect the Efficiency of Life Insurance Companies? A Study Based on the Comparison between Bank-Related and Non-Bank-

- Related Life Insurance Companies in China”, *Journal of Jiangxi University of Finance and Economics*, 2018(4), 72-83.
- Yang, X. Wang, Z. and Wang, L. (2016), “A comparative study on the operating efficiency of bank-affiliated and non-bank-affiliated life insurance companies”, *Financial Theory & Practice*, 2016(3).
- Yang, Y. (2013), “An empirical analysis of the impact of the degree of participation in the bancassurance business of the life insurance industry on its operating efficiency”, *Finance & Economy*, 2013(6).
- Yang, Z. (2006), “A two-stage DEA model to evaluate the overall performance of Canadian life and health insurance companies”, *Mathematical and Computer Modelling*, 43(7-8), 910–919.
- Yao, S., Feng G. and Han, Z. (2005), “An empirical analysis of the efficiency of China's insurance industry”, *Economic Research*, 2005(7), 56-65.
- Yao, S., Han, Z. and Feng, G. (2007), “On technical efficiency of China's insurance industry after WTO accession”, *China Economic Review*, 18(1), 66-86.
- Ye, C-H. and Chen, X-A. (2012), “Analysis on the Influence of the Manager's Payment on the Efficiency of Chinese Listed Insurance Company-Based on the Empirical Study Method of Stochastic Frontier Analysis (SFA)”, *Insurance Studies*, 2012(8), 29-38.
- Yoshihiro, A., Noriyoshi, Y., Kei, T. and Junya, O. (2004), “The Efficiency and Productivity of Life Insurance Industry in Japan”.
- Yi, Y. and Song, X. (2010), “Efficiency Analysis of China's Life Insurance Industry Based on a DEA Method”, *China Insurance*, 2010(6).
- Yin, C., Ye, X. and Yin, Q. (2022), “Research on Funds Utilization Efficiency and Influencing Factors of Life Insurance Companies-A Perspective of China's Insurance Solvency Supervision Reform”, paper presented at the 2022 China International Conference on Insurance and Risk Management, Changsha, PRC held July 13-16, 2022.
- Yu, M., Zeng, X-F. and Dai, B. (2011), “An Analysis of DEA Efficiency of China's Life Insurance Companies”, *Business Economy*, 2011(2), 13-15.
- Yuan, Y. and Phillips, R. D. (2008), “Financial Integration and Scope Efficiency in U.S. Financial Services Post Gramm-Leach-Bliley”, The Wharton Financial Institutions Center Working Paper 08-32, University of Pennsylvania, Philadelphia, PA.
- Yuengert, A. M. (1993), “The measurement of efficiency in life insurance: Estimates of a mixed normalgamma error model”, *Journal of Banking & Finance*, 17(2-3), 483-496.
- Yusop, Z., Radam, A., Ismail, N. and Yakob, R. (2011), “Risk management efficiency of conventional life insurers and Takaful operators”, *Insurance Markets and Companies: Analyses and Actuarial Computations*, 2(1), 58-68
- Zanghieri, P. (2009), “Efficiency of European Insurance Companies: Do Local Factors Matter?”, Research Department, Association of Italian Insurers (ANIA), Working Paper, ANIA, Rome, Italy.
- Zhang, C. (2012), “An Empirical Study on the Efficiency of Chinese Life Insurance Companies”, *Times Finance*, 2012(4).
- Zhang, K. and Jiang, C-F. (2016), “An Empirical Study on the Market Efficiency of the Life Insurance Industry”, *Times Finance*, 2016(5).

- Zhang, T. and Jiang, X. (2016), "Research on the Efficiency of Life Insurance Companies' Funds from the Perspective of Rate Marketization", *Journal of Nanjing University (Philosophy, Humanities and Social Sciences)*, 2016(6).
- Zhang, W. (2009), "An Analysis of Economic Efficiency of Jiangsu Insurance Market", *Financial Perspectives Journal*, 2009(6).
- Zhang, W., Guo, J. and Zhang, X. (2006), "Empirical Perspective on Scale Efficiency and Embedded Values of Chinese Life Insurance Companies", *Finance and Trade Economics*, 2006(3), 41-46, 79.
- Zhang, X. (2016), "Analysis of investment efficiency of universal life insurance in China based on a DEA model", *China Market*, 2016(37).
- Zhao, G-Q. (2009), "The efficiency of China's life insurance companies and an analysis on influencing factors-Based on modified two-stage DEA method", *Insurance Studies*, 2009(10), 38-44.
- Zhao, G-Q. and Wu H. (2010), "The Empirical Analysis of Slack-Based-Measure Efficiency in China's Insurance Industry-Based on Modified Three-stage Data Envelopment Analysis", *Journal of Financial Economics*, 25(5), 72-84.
- Zhao, K. and Wang, Y. (2017), "A Study on the Efficiency of Funds Utilization of Insurance Companies Based on DEA-Malmquist Model", *Times Finance*, 2017(10).
- Zhao, M. and Zhang, X. (2017), "Comparative Analysis of the Efficiency of Life Insurance Companies and Property Insurance Companies in China", *Journal of Shandong University of Science and Technology (Social Sciences)*, 19(2).
- Zhao, X. (2003), "An empirical analysis of market behavior and market performance of Chinese insurance companies", *Economic Review*, 2003(4), 118-122.
- Zhao, X. (2007), "The Empirical Analysis of Productivity of the Insurance Industry of China Based on Malmquist Index Approach", *Industrial Economics Research*, 2007(2), 8-13.
- Zheng, R. (2020), "Research on the efficiency and influencing factors of insurance fund utilization of life insurance companies in China-empirical analysis based on a DEA model", *Marketing Research*, 2020(6).
- Zhengyin, W., Yan W. and Yuna, M. (2020), "Research on Total Factor Productivity of Chinese and Foreign Life Insurance Industry-Analysis Based on DEA and Malmquist Model", *IETI Transactions on Social Sciences and Humanities*, 6(3), 19-28.
- Zhi, Y. (2009), "Research on the Efficiency of Life Insurance Industry in China", *Economic Theory and Economic Management*, 2009(6), 59-64.
- Zhi, Y. (2012), "The Research on China's Life Insurance Industry's Efficiency and TFP under the Consideration of Claims-Based on the Analysis of SBM Directional Distance Function", *Insurance Studies*, 2012(8), 46-52.
- Zhi, Y. and Hu, J-L. (2011), "A cross-strait comparative study of efficiency of life insurance companies: An application of the input slack adjustment approach", *African Journal of Business Management*, 5(14), 5746-5752.
- Zhi, Y., Hu, J-L. and Zhu, Z-Y. (2009), "A Cross-Strait Comparative Study of the Efficiency of Life Insurance Companies: An Application of the Input Slack Adjustment Approach", *Business Management Journal*, 31(5), 29-35.

- Zhong, F. (2009), "Investment returns, operating efficiency and market performance of life insurance companies", *Insurance Studies*, 2009(8), 33-38.
- Zhou, L., Chen, Z. and Shen, M. (2012), "Research on the Index System for Efficiency Measurement of China's Life Insurance Industry: Based on the Canonical Correlation Analysis Method", *Statistical Theory and Practice*, 2012(9).
- Zhou, S., Dong, X., Yuan, Z. and Deng, Y. (2021), "An empirical analysis of the operating efficiency of 14 life insurance companies in China-based on the DEA-Malmquist model", *Shanghai Insurance Monthly*, 2021(4).
- Zhu, H. and Wang, Y. (2020), "Evaluation of the Enterprise Efficiency and Social Efficiency of Commercial Health Insurance Operations-An Empirical Analysis Based on Super-efficiency SBM", *Shanghai Finance*, 2020(1).
- Zhu, M. and Li, X. (2012), "Study on the Operational Efficiency of Foreign-Funded Insurance Companies-Analysis of WTO Entry Effect Based on Non-equilibrium Data at Company Level", *Journal of Jiangxi University of Finance and Economics*, 2012(1), 67-72.
- Zhu, Y. (2016), "Research on the efficiency of local corporate life insurance companies based on the DEA-Tobit model", *Journal of Insurance Professional College*, 30(1), 25-30.
- Zinyoro, T. and Aziakpono, M. J. (2023), "Performance determinants of life insurers: A systematic review of the literature", *Cogent Economics & Finance*, 11(2).