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Evaluating Technical Efficiency of Insurance Firms Operating in Jordan and Palestine



Mohammad Rida Hirzallah, Abdulnaser Ibrahim Nour , Gassan Daas, and Mahmoud Ibrahim Nour

Abstract The purpose of this research is to evaluate the technical efficiency of the insurance firms operating in Jordan and Palestine markets and examine the factors that affect this efficiency. Using a data of 26 insurance firms over the period 2016–2020, data envelopment analysis (DEA) was used to evaluate efficiency score, and panel data analysis was employed to identify the major factors affecting the technical efficiency of the listed insurance firms in Jordan and Palestine stocks exchange markets. The data envelopment analysis shows that the listed insurance firms in Palestine Exchange Market (PSE) are more efficient than those listed in Amman Stock Exchange Market (ASE). Panel data regression analysis shows that capital structure and firm size have both a negative effect on technical efficiency. However, both market share and ROA affect technical efficiency in a positive way. From these results management of firms could raise capital through issuing bonds instead of common stocks, and might not expand largely in company size without sufficient planning. Regularity body might issue laws and regulation which control how firms finance its assets in order to prevent an exaggerated increasing in firm's total assets, and control the competition in order to avoid illegal collusion between firms.

Keywords Efficiency · Technical efficiency · Insurance · Jordan · Palestine · DEA

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1 Introduction

Brief About Palestine and Jordan

Insurance companies offer economies with outstanding financial services that are required for development and growth. Those services are varied enough to include a wide range of options, including the underwriting or risks involved in economic activities, the transfer of funds through premiums for long-term investments. Even more, the key role of insurers, which is mainly the absorption of risks, enhances the financial stability of financial markets and creates a peaceful atmosphere for economic entities. Without insurance, businesses would be unsustainable given that businesses classified as risky might not be able to take responsibility of any risk in a constantly changing global economy [27]. Insurance companies offer a variety of contracts to the insured to cover any potentially incurred damage. They issue documents that contain the premium that has to be paid by the insured in exchange of the insurer's coverage. Those companies are then committed to compensate the insured against damage once it takes place. It was at this stage that countries from all over the world started to gradually notice the significance of this sector. They were also inspired to begin supervising the firms that operate in this field through the enactment of a set of laws and regulations to govern this industry [10]. From an economic perspective, the significance of insurance lies in the functions of its mediation, risk-pooling and real financial services. It is through these functions that insurance is seen as an indispensable agent and a target for economic development in contemporary economies [11]. According [28], the means necessary for development in emerging economies is the creation of a highly-developed insurance sector. This is because insurance offers long term- funds for both social and physical infrastructures while at the same time enhancing risk-taking abilities [11]. Palestine, as any other country, got influenced by the emergence of the insurance sector regardless of its weak economic system. It is worthy of mentioning here that the Palestinian insurance sector is newly established. When the Palestinian Authority returned in 1994, it became the legal body that is responsible for supervising the insurance sector. However, the sector was still in a bad place due to the lack of management control and organization over its work and the expansion of the culture of insurance at the needed level, resulting in a weak and unorganized insurance sector for almost ten years [17]. This was the case until the Palestine Capital Market Authority (PCMA) was established in 2004. [6], which became the authorized legal body to supervise, manage and control the insurance sector and play great role in the issuance of the Palestinian Insurance Law in 2005 [26]. Regarding the Jordanian situation, the insurance sector is suffering there too. Many Jordanian insurance firms are faced with a lot of performance-related troubles, and the insurance sector has been incurring financial losses due to the difficult existing circumstances [4]. Jordan currently has 20 listed insurance companies in ASE, in addition to a number of firms that have been liquidated due to financial troubles. This is considered to be a huge number for a country as small as Jordan which has a relatively small insurance market compared with its neighboring

countries, contributing to about 3% of the gross written premiums of the MENA region [25].

In spite of the potential need for consolidation, the business has been free of acquisitions and mergers for more than twenty years. Since the majority of the market is focused on third-party vehicle insurance the premiums of which are set by the government, merging two motor-focused firms into a larger one is pointless. Additionally, some firms have lacked the solvency margin since 2015 without being warned and without taking legal action to correct the situation [23]. It is quite unbelievable that some insurance firms there, which are six in fact, have exceeded the solvency margin stated by the 2002 regulations which have specified explicitly that the solvency margin for the companies that operate in this sector must not fall below 150% of the capital required. This primarily means that there are firms operating in this sector without possessing the required amount of capital for meeting any potential needs, obligations or commitments they may have to deal with [3, 5]. Efficiency, which is an indicator of a firm's performance, is enhanced by reducing costs during the production process. It is considered as one of the main foundations that guide insurance firms in ensuring health and safety conditions in such firms [27]. The issue of efficiency has become a major interest in the insurance industry since it aids in identifying efficient and inefficient firms in the market with the intention of enhancing profitability and competition and increasing policyholders' trust. Insurers' technical efficiency refers to their ability to produce a certain group of outputs through the use of inputs [18].

Not long ago, efficiency measurement has received much attention, and the insurance sector specifically has witnessed an extreme growth in the number of studies which apply frontier efficiency methods. These methods measure company performance relative to best practice frontier comprised of the leading firm in the industry. Data envelopment analysis (DEA) is the most frequently used method of frontier efficiency analysis in the insurance sector. DEA measures the relative performance of firms by constructing a comparison between a set of inputs and outputs and developing benchmarks which are related to industry best practices, relying on the notion that the widespread application of these could enhance performance throughout the entire industry [7]. It is of significance here to highlight the reason why Jordan and Palestine were chosen in the first place for this study, and why a comparison was struck between them. The issue of technical efficiency in insurance companies has not been thoroughly researched in Jordan and not at all in Palestine. Further, the two countries, geographically and culturally speaking, are of close proximity with each other. It is worth mentioning here that the West Bank was annexed to Jordan from 1950 and 1967 [15], which gave rise to the implementation of the Jordanian Law in the West Bank. It is for these reasons that the study combined the two countries and compared the technical efficiency of the listed insurance firms in Amman Stock Exchange and Palestine Exchange Market.

2 Literature Review and Hypothesis Development

2.1 *Firm Size*

Firm size was one of the most significant factors affecting efficiency, according to [2, 18, 19, 21, 29] who studied the relation between efficiency and firm size in different economic environments. Their findings were that firm size has a positive relationship with efficiency. According to them, this is attributed to economies of scale. In other studies, however, firm size was found to have a negative relation with efficiency according to [8, 11, 14] with diseconomies of scale being the reason for this, which increases the production volume leading to an increase in production costs per unit. The discrepancy of the results serves as an encouraging motive to study the relation between firm size and technical efficiency in the Palestinian and Jordanian insurance markets. By looking into the related previous literature, the following hypothesis can be generated: H1: There is positive a relationship between firm size and technical efficiency of the listed insurance companies in PEX and ASE.

2.2 *Capital Structure*

There is a good number of studies which have discussed the effect of capital structure on technical efficiency. For instance, [2, 11] examined the effect of capital structure on technical efficiency for the insurance companies operating in Ghana and found that equity capital affects technical efficiency in a negative way. The results of their studies were consistent with [20] who studied the effect of capital structure on efficiency in Turkish insurance firms and [8] who studied the effect of capital structure on insurance firms in Nigeria. The results of these studies indicate that companies which raised the portion of their assets owned by shareholders reduced their cost efficiencies via the dividends and other agency related problems. Equity capital holdings relative to total assets limited resources allocation to producing output, generated expenses for the insurance companies and led to the reduction of efficiency. These studies suggested that insurance companies could use less equity and/or more debt to finance its capital in order to achieve better efficiency. From the above the following hypothesis can be developed: H2: There is a positive relationship between capital structure and technical efficiency of the listed insurance companies in PEX and ASE.

2.3 *Profitability*

Profitability is of crucial importance when it comes to insurance companies, for it reflects performance and is closely associated with efficiency since both are significant in achieving the company's goals. ROA is employed to express profitability.

Jaloudi [18], Grmanová and Strunz [16], Diacon [12] have found that profitability and technical efficiency have a positive relationship, [22] studied the technical efficiency for Pakistani banks and its determinants found the same results. They concluded that the increase in the firms' profit leads to a reduction in the inputs required in production as the firm is generating more outputs (profit) from their given inputs.

From the abovementioned, the following hypothesis can be generated: H3: There is a positive relationship between profitability and technical efficiency of the listed insurance companies in PEX and ASE.

2.4 Type of Insurance

The type of business provided by insurance companies can have an impact on its efficiency. By way of example, [11] found that the type of insurance is a key factor in determining cost efficiency. Abor et al. [2] and Danquah et al. [11] found that life insurance companies were costly efficient compared with non-life companies. According to them, this result can be explained by the people's limited knowledge of non-life insurance companies' products, and the fierce competition in the life insurance business as opposed to that of non-life. From here, the following hypothesis can be developed: H4: There is a positive relationship between type of insurance and technical efficiency of the listed insurance companies in PEX and ASE.

2.5 Market Share

According to the previous literature that examined the relation between market share and efficiency, it has been observed that the results varied across the selected previous studies. For instance, [8] who studied the efficiency of Nigerian insurance firms found this relation to be positive, which goes in line with the results of [2] who studied the technical efficiency of Ghana's insurance firms. Both of these studies employed the same methodology which is data envelopment analysis (DEA), and regression analysis. They explained their findings in light of traditional structure conduct-performance hypothesis. On the other hand, there are other studies in which the relation between market share and efficiency proved to be negative, such as [14] who studied the relationship between market structure and European insurance firms, using data envelopment analysis and [11] who studied the efficiency of insurance firms operating in Ghana using the methodology of stochastic frontier analysis. According to them, the relationship was found to be negative due to the fierce competition in the insurance industry because of which companies spend more compared with what they received from premium revenues [1]. This leads to the development of the fifth hypothesis in this research which reads:

H5: There is a positive relationship between market share and the technical efficiency of the listed insurance companies in PEX and ASE.

3 Data and Methodology

The study uses panel data for 6 out of 10 insurance firms listed in Palestine Exchange Market, and all the 20 listed insurance firms in Amman Stock Exchange Market. The excluded firms are so due to the unavailability of data covering the entire period of study. This conforms to the DEA convention requiring that the minimum number of DMUs is three times greater than the number of inputs plus outputs [2]. In this study, quantitative research design will be employed by relying on secondary data obtained from the annual financial statements of the insurance firms listed in the stocks exchange markets of Palestine and Jordan over the period (2016–2020).

3.1 Data Envelopment Analysis

Data envelopment analysis, which is known as DEA, is a linear programming technique that was brought about through the works of Cooper, Charnes and Rhodes (1978). This technique is non-parametric and is employed in the evaluating of the functions of production. It has also been extensively used to evaluate measures of technical efficiency in multiple industries [18]. This approach is empirically employed to measure the productive efficiency of decision-making units (DMUs). The method is also employed for benchmarking in operations management, where a specific group of measures is chosen to benchmark the performance of service operations and manufacturing. In benchmarking, the DMUs that are efficient according to DEA are not necessarily supposed to form a production frontier, rather, they are supposed to lead to a ‘best-practice’ frontier [19] (Tables 1 and 2).

According to Erdemir and Tatlidil [13] the model of input oriented CCR can be defined as:

$$\max h_k = \frac{\sum_{r=1}^s u_{rk} Y_{rk}}{\sum_{i=1}^m V_{ik} X_{ik}}$$

$$\frac{\sum_{r=1}^s u_{rk} Y_{rk}}{\sum_{i=1}^m V_{ik} X_{ik}} \leq 1; j = 1, \dots, n$$

Table 1 Inputs and outputs for technical efficiency (dependent variable)

| Inputs | Reference | Output | Reference |
|----------------------|--------------------------------------|--|--------------------------------------|
| Total operating cost | [2, 18] (Ajlouni and Tobaishat 2010) | Profit or loss | [2] |
| Total capital | [2] | Investment income | [2, 18] (Ajlouni and Tobaishat 2010) |
| Net incurred claims | [16] | Net earned premiums before commissions | [18] |

Table 2 Measurements of inputs and outputs for dependent variables

| Variables | Description |
|--|--|
| Total operating cost | Include allocated employee benefits expense, allocated administrative and general expense, unallocated employee benefits, and unallocated administrative and general expense |
| Total capital | Include paid in capital, reserves and retained earnings |
| Net incurred claims | Include paid-up claims, reinsurer's share of paid up claims, change in reserve of outstanding and unreported claims, and reinsurer's share of change in reserve of outstanding and unreported claims |
| Profit or loss | Include net income after taxes from all operations of company |
| Investment income | Include profits arising from financial investments as well as the interest on deposits in banks and interest on bonds owned by the firm |
| Net earned premiums before commissions | Include gross written insurance premiums, change in unearned premiums, gross reinsurers' premiums, and reinsurers' share of change in unearned premiums |

$$u_{rk} \geq 0; r = 1, \dots, s$$

$$V_{ik} \geq 0; i = 1, \dots, m$$

- X shows the Ith input variable which is used by Jth decision making units.
Y shows the rth output variable which is used by Jth decision making units.
N the number of decision-making units, minimum number of DMU must be greater three times than number of inputs plus outputs [2].
 u_{rk} and V_{ik} represents the weights for input I and output r (divided by total assets) for kth decision-making unit.

Where $0 < I \leq m$ and $0 < r \leq s$.

3.2 Panel Data Regression

Random-effect regression is used in order to see the effect of all of all independent factors on dependent variables, after that Hausman test applied in order to decide which type of regression to take based on the result we use (Table 3).

Table 3 Independent variables measurement

| Independent variable | Measurement | Resources |
|----------------------|---|--------------------|
| • Size | Logarithm of total assets | [2] [8] [18] |
| • Type | 1 compound firms/0 for otherwise | [18] |
| • Return on Assets | Net income/total assets | [18] |
| • Market share | Firms gross premium/total gross premium | [2] [8] |
| • Capital structure | Equity/total assets | [2] [8] |

Research Model

The suggest model is as follow:

$$Y_{it} = a + B1\log(\text{firm size})_{it} + B2(\text{capital structure})_{it} + B3(\text{ROA})_{it} + B4(\text{type})_{it} + B5\log(\text{market share})_{it} + e_{it}$$

| | |
|-------------------|---|
| Y | Technical efficiency |
| a | Constant |
| Size | Logarithm of total assets |
| Capital structure | Logarithm of equity to total invested assets |
| ROA | Return on assets |
| Type | Dummy variable, 1 for compound / 0 for non-life |
| Market share | Logarithm market share of insurance firms in its market |
| B | Parameters |
| e | Random error |
| i and t | indicator for individuals and time |

4 Data Analysis and Findings

4.1 DEA Results

Table 4 and 5 show the average of technical efficiency per year for the listed insurance firms in PEX and ASE during the period (2016–2020). Five years for each insurance firm.

The results of DEA show a slight decrease in technical efficiency of the listed insurance firms in PEX, as it was 61.9% in 2016 and decreased to 61.4% in 2020. The year 2020 witnessed the lowest level of technical efficiency as it was 61.4%. From the results, the insurance sector in Palestine is not considered to be fully efficient.

Table 4 Average technical efficiency per year for insurance firms listed in PEX

| Year | Average |
|------|---------|
| 2016 | 0.619 |
| 2017 | 0.618 |
| 2018 | 0.616 |
| 2019 | 0.615 |
| 2020 | 0.614 |

Table 5 Average technical efficiency per year for the listed insurance firms in ASE

| Year | Average |
|------|---------|
| 2016 | 0.594 |
| 2017 | 0.592 |
| 2018 | 0.592 |
| 2019 | 0.592 |
| 2020 | 0.592 |

There is room for enhancement to be done; the sector as a whole is not mixing its inputs in the best way possible to get certain outputs.

The results show that the average technical efficiency of the listed insurance firms in ASE during the period 2016–2020 were constant at 59.2 percent which is lower than that of the listed insurance firms in PEX for each year, which indicates that the insurance firms operating in Palestine are more efficient than the insurance firms operating in Jordan. This could be attributed to the difference in the nature of insurance environment between the two countries. The insurance sector in Jordan is bigger than that of Palestine, therefore the number of the insurance firms operating in Jordan is larger compared to those operating in Palestine, which leads to a higher completion in Jordan. It is due to this highly completion that the listed insurance firms in ASE cannot mix their inputs and outputs in the best way.

Tables below show the average technical efficiency during 2016–2020 for each of the insurance firms listed in PEX and ASE.

Tables 6 and 8 show that 9 firms have efficiency score between 70 and 79%, 14 firms have efficiency score in a range of 50–67%, and 3 firms within 20–38%. These results show that there are no firms in the sample that are considered to be fully efficient. Most of the results flow in a range of 50–67%, and these firms have large inputs so they should have the same outputs by significantly reducing their inputs and making a better combination between inputs and outputs.

It is observed from Table 6 that four of the listed insurance firms in PEX have highest technical efficiency scores over the period (2016–2020) which give an impression that the listed insurance firms in PEX are more efficient than those listed in ASE. The highest technical efficiency score was for AL-TAKAFUL INSURANCE with a score 79.51%. This could be due to strategic planning, decision of management, and training of employees which in turn lower the inputs needed in the process of pre producing outputs. One noticeable point about this firm is that it does not have

Table 6 Technical efficiency scores ranking for listed insurance firms in PEX

| Company name | DEA score (Average) (%) | DEA score rank |
|--------------|-------------------------|----------------|
| TIC | 79.51 | 1 |
| PICO | 78.82 | 2 |
| GUI | 77.47 | 3 |
| MIC | 76.43 | 4 |
| Trust | 66.29 | 11 |
| NIC | 63.31 | 15 |

the highest profit nor the highest premium compared with the other listed firms. Further, it does not have the highest market share, which did not increase over the period covered by the study, meaning that TIC is combining its inputs better than its competitors when producing its outputs (Table 7).

The results of Trust insurance firm efficiency score were noticeable, sine it has the largest amount of assets and market share among the insurance firms in Palestine, and it has the largest number of agents who provide its insurance services. It also has a very good reputation in the Palestinian market. However, its average efficiency score for the five years was 66.3% which puts it in the 5th place compared to the

Table 7 Technical efficiency scores ranking for listed insurance firms in ASE

| Company name | DEA score (Average) (%) | DEA score rank |
|--------------|-------------------------|----------------|
| ARGR | 74.81 | 5 |
| AMMI | 72.25 | 6 |
| JOFR | 71.11 | 7 |
| ARAS | 70.45 | 8 |
| MDGF | 70.40 | 9 |
| MIIC | 66.38 | 10 |
| AIUI | 65.61 | 12 |
| NAAI | 64.73 | 13 |
| UNIN | 63.43 | 14 |
| AICJ | 60.69 | 16 |
| JERY | 59.01 | 17 |
| AAIN | 57.86 | 18 |
| GIGJ | 57.37 | 19 |
| JOIN | 56.16 | 20 |
| PHIN | 55.84 | 21 |
| DICL | 54.18 | 22 |
| TIIC | 53.00 | 23 |
| MEIN | 38.26 | 24 |
| FINS | 34.67 | 25 |
| JJJC | 21.88 | 26 |

Table 8 Technical efficiency scores for non-life insurance firms listed in PEX

| Company | Efficiency score (%) | Rank |
|----------------------|----------------------|------|
| Palestine Insurance | 78.82 | 2 |
| Al Mashreq Insurance | 76.43 | 4 |
| Average | 77.6 | |

listed insurance firms in PEX, and in the 11th place of the 26 firms chosen as sample. This points that Trust insurance firm does not mix its input in an efficient way as its competitors PICO, GUI and MIC do. These have lower assets, profit, and market share, but they combine their inputs efficiently. Another unexpected result was for NIC, since it is considered to be the most profitable insurance firm in Palestine in the last 5 years and it has the second largest market share after Trust insurance firm. Its technical efficiency score was 63.31% putting it in 15th place of 26, and in the last position of the six listed insurance firms in PEX. The most efficient insurance firm listed in ASE was the Arab Jordanian Insurance Group (ARGR) with an efficiency score 74.81% putting it in 5th place of 26. ARGR which is considered to be a small firm compared to its competitors in Jordan, which means that this firm has a good balance between its inputs and outputs. The lowest efficient firm was Newton Insurance JIJC with an efficiency score of 21.8% which is very low compared to the other companies. This mean that this firm has poor management and it does not combine its inputs and outputs in efficiency way. Its cost of production is high and this could be due to the non-add value process. The technical efficiency scores for AMMI, JOFR, ARAS, and MDGF were between (70–72%). Five of the listed insurance firms in ASE had technical efficiency scores between (60–66.4%), and seven firms were between (53–59%). MEIN and FINS firm's technical efficiency score were at 30%.

The following table shows the technical efficiency scores for non-life listed insurance firms in PEX:

The following table shows the technical efficiency scores for non-life listed insurance firms in ASE:

Table 8 shows that the highest technical efficiency for the non-life insurance firms listed in PEX is Palestine Insurance and AL Mashreq Insurance with an average 78.82% and 76.43% respectively. Table 9 shows that the highest technical efficiency for the listed non-life insurance firms in ASE was that of the Arab Assurers Company with an average of 70.45% and the lowest one was that of Pliadelphia with an average of 55.84%. Pliadelphia company has a problem with mixing its inputs and outputs, and has a poor management decision and planning. However, the results indicate that the listed non-life insurance firms in PEX are mixing their inputs and outputs better than the ones listed in ASE. This might be due to the competition between the insurance firms that operate in Jordan which is higher compared to the competition between the insurance firms operating in Palestine, which leads to a waste of resources and poor decisions on the part of the management at some time.

The table below shows technical efficiency scores for compound listed insurance firms in PEX.

Table 9 Technical efficiency scores for non-life insurance firms listed in ASE

| Company | Efficiency score (%) | Rank |
|--|----------------------|------|
| The Arab Assurers Company | 70.45 | 8 |
| The Mediterranean and Gulf Insurance Co | 70.40 | 9 |
| ALMANARA Insurance | 66.38 | 10 |
| Arab Union International Insurance Company | 65.61 | 12 |
| Gulf Insurance Group | 57.37 | 19 |
| Pliadelphia Insurance Company | 55.84 | 21 |
| Average | 61.2 | |

Table 10 shows that the highest average of the technical efficiency scores for compound insurance firms listed in PEX is that of TIC with an average of 79.51% followed by Global United insurance with an average of 77.47%. However, the lowest average of technical efficiency is that of NIC which is 63.31%. This could be caused by the high amount of inputs NIC uses to produce its outputs; it needs to use less resources to produce the same amount of outputs. The Table 11 represent technical efficiency scores for compound listed insurance firms in ASE.

Table 11 shows that the highest technical efficiency for compound insurance firms listed in ASE is that of Arab Jordanian Insurance Group with an average of 74.81% followed by Euro Arab Insurance group. However, the lowest average is that of Newton insurance with an average of 21.88%. The average score of technical efficiency of non-life insurance firms listed in PEX and ASE is higher than the average score of technical efficiency of compound insurance firms listed in PEX and ASE. This is because when firms compete, they focus on non-life insurance more than life insurance. The market shares of life insurance in Jordan and Palestine have not seen any major change in their structure over the period covered by this study. So non-life insurance firms are combining their inputs and outputs better than insurance firms which provide life and non-life. The latter should reduce their inputs in order to raise their technical efficiency score.

Table 10 Technical efficiency scores for compound insurance firms listed in PEX

| Company | Efficiency score (%) | Rank |
|----------------------------|----------------------|------|
| AL-TAKAFUL INSURANCE | 79.51 | 1 |
| Global United Insurance | 77.47 | 3 |
| TRUST PLAESTINE | 66.29 | 11 |
| NATIONAL INSURANCE COMPANY | 63.31 | 15 |
| Average | 0.613 | |

Table 11 Technical efficiency scores for compound insurance firms listed in ASE

| Company | Efficiency score (%) | Rank |
|-------------------------------------|----------------------|------|
| Arab Jordanian Insurance Group | 74.81 | 5 |
| Euro Arab Insurance Group | 72.25 | 6 |
| JORDAN FRENCH INSURANCE Co. (P.L.C) | 71.11 | 7 |
| National Insurance Company WATANIA | 64.73 | 13 |
| UNITED INSURANCE | 63.43 | 14 |
| ARABIA Insurance Company—JORDAN | 60.69 | 16 |
| JERUSALEM INSURANCE | 59.01 | 17 |
| Al-Nisr Al-Arabi Insurance | 57.86 | 18 |
| Jordan Insurance Company | 56.16 | 20 |
| Delta Insurance | 54.18 | 22 |
| Islamic Insurance Company | 53.00 | 23 |
| Middle East Insurance Co | 38.26 | 24 |
| First Insurance (SOLIDARITY) | 34.67 | 25 |
| Newton Insurance (JIJC) | 21.88 | 26 |
| Average | 0.584 | |

4.2 Panel Data Analysis

Hausman test

Prob > chi2 = 0.1973.

(V_b-V_B is not positive definite).

From Hausman test since Prob > ch12 = 0.1973 is larger than 5% the random-effect regression GLS is used.

H1: Table 12 shows a negative effect of firm size on the technical efficiency of the listed insurance firms in PEX and ASE. Since P value is less than 5% and B has negative value. So H1 is rejected. These results are similar to [8, 11, 14]. This negative effect might be explained by diseconomies of scale, as the increase in the production volume leads to an increase in production costs per unit.

H2: GLS shows a negative effect of capital structure on the technical efficiency of the listed insurance firms in PEX and ASE. Since P is less than 5% and B has a negative value, H2 is rejected. The results are similar to those of [2, 8, 11, 20]. This negative effect can be interrupted in light of agency problem as equity capital holdings relative to total assets limits resources distribution to produce the desired output, which generates costs for the insurance companies reduces efficiency.

H3: From Table13, a positive effect of ROA on the technical efficiency of the listed insurance firms in PEX and ASE was found. Since P value is less than 5% and B has a positive value. So H3 is accepted. The results matched those of [12, 16, 18, 22]. As profits for insurance firms increase, less inputs for the production process are needed.

Table 12 Methods comparisons

| Fixed methods | | Random methods | |
|-------------------|-----------------------|-------------------|-----------------------|
| Variables | Model | Variables | Model |
| Firms Size | – 0.000 (0.000) | Firms size | – 0.000*** (0.000) |
| Capital Structure | – 0.882*** (0.104) | Capital structure | – 1.041*** (0.074) |
| ROA | 1.797*** (0.113) | ROA | 1.895*** (0.107) |
| Type | – (0.021) | Type | – 0.003 (0.021) |
| Market share | 0.483* (0.248) | Market share | 0.541*** (0.163) |
| Constant | 0.866*** (0.047) | Constant | 0.978*** (0.029) |
| Observations | 130 | Observations | 130 |
| Number of coid | 26 | Number of coid | 26 |
| R-squared | 0.719 | R-squared | 0.856 |

Standard errors in parentheses

***p < 0.01, **p < 0.05, *p < 0.1

H4: Panel data analysis shows that the type of insurance has no effect on the technical efficiency of the listed insurance firms in PEX and ASE. Since P value is more than 5%, H4 is rejected. These results are different from the results of [11]. This could be attributed to the fact that there is a small share of life insurance premium in Palestine and Jordan due to religious reasons, most of the insurance premiums are for non-life insurance. It is for this reason that no effect of insurance type was found.

H5: Table 13, shows that market share has a positive effect on the technical efficiency of the listed insurance firms in PEX and ASE. Since P value is less than 5% and B has a positive value, H5 is accepted. The results are similar to [2, 8] but are inconsistent with the traditional structure conduct hypothesis.

5 Conclusions and Recommendations

EA shows that the insurance firms listed in PEX were more efficient than these listed in ASE during the period covered by the study (2016–2020). This can be attributed to several reasons. First, the Jordanian insurance market is larger than the Palestinian insurance market as the total written premiums in Palestine during 2020 were (286,142,525) and in Jordan were (593,442,124), and the number of firms operating in the Jordanian insurance market is more than the Palestinian insurance firms,

Table 13 Sample of the study

| No. | Company name | Market |
|-----|--|-----------|
| 1 | NATIONAL INSURANCE COMPANY (NIC) | Palestine |
| 2 | Al Mashreq Insurance | Palestine |
| 3 | TRUST PLAESTINE | Palestine |
| 4 | Palestine Insurance | Palestine |
| 5 | Global United Insurance | Palestine |
| 6 | AL-TAKAFUL INSURANCE | Palestine |
| 7 | Middle East Insurance Co | Jordan |
| 8 | Al-Nisr Al-Arabi Insurance | Jordan |
| 9 | Jordan Insurance Company | Jordan |
| 10 | ARABIA Insurance Company—JORDAN | Jordan |
| 11 | Delta Insurance | Jordan |
| 12 | JERUSALEM INSURANCE | Jordan |
| 13 | UNITED INSURANCE | Jordan |
| 14 | JORDAN FRENCH INSURANCE Co. (P.L.C) | Jordan |
| 15 | ALMANARA Insurance | Jordan |
| 16 | Arab Orient Insurance | Jordan |
| 17 | Pliadelphia Insurance Company | Jordan |
| 18 | Arab Union International Insurance Company | Jordan |
| 19 | National Insurance Company WATANIA | Jordan |
| 20 | Newton Insurance | Jordan |
| 21 | Euro Arab Insurance Group | Jordan |
| 22 | Islamic Insurance Company | Jordan |
| 23 | The Arab Assurers Company | Jordan |
| 24 | Arab Jordanian Insurance Group | Jordan |
| 25 | The Mediterranean and Gulf Insurance Co | Jordan |
| 26 | First Insurance (SOLIDARITY) | Jordan |

which makes competition between Jordanian insurance companies more complicated compared to the Palestinian insurance market. This indicates that firms spend their resources in the wrong way while trying to beat their competitors. Second, the cancellation of the Jordanian insurance authority in 2014 left the Jordanian insurance market without a legal supervisor while in the Palestinian insurance market, the PCMA has been supervising the sector and protecting the insurance firms operating in Palestine from wasting their resources. DEA also shows that the listed non-life insurance firms have an average technical efficiency higher than the listed compound insurance firms in PEX and ASE. This is because the culture of Palestine and Jordan is affected by Islam which prohibits life insurance. Therefore, the market share of life insurance is limited in both countries and the firms can spend their resources used for life insurance to other insurance branches. DEA also shows that the listed

non-life insurance firms have an average technical efficiency higher than the listed compound insurance firms in PEX and ASE. This is because the culture of Palestine and Jordan is affected by Islam which prohibits life insurance. Therefore, the market share of life insurance is limited in both countries and the firms can spend their resources used for life insurance to other insurance branches. GLR analysis shows that firm size has a negative effect on the technical efficiency of the listed insurance firms in PEX and ASE. This result matches the results of [8, 11, 14]. This negative effect is caused by diseconomies of scale, which happen when a company grows very largely, making its cost per unit increases. Capital structure also was found to have a negative effect on technical efficiency. These results are similar to [2, 8, 11, 20]. This implies that firms which finance their assets with shareholder capital will decrease their technical efficiency through dividends issues and other agency problems. Type of insurance has no effect on technical efficiency. Profitability which is represented in ROA and affects technical efficiency in a positive way, matching results of [16, 18] and [22]. As profits for insurance companies increase less resources is needed for the production.

Recommendation

As reflected by the results, capital structure has a negative effect on technical efficiency. The managements of the listed insurance firms in PEX and ASE could finance the assets of firms through debts and bonds more than common stocks. As for firm size, it also negatively affects the technical efficiency of the listed insurance firms in Palestine and Jordan stocks exchange markets, hence the managements of these firms should consider making strategic planning before increasing the total assets of their firms in order to avoid diseconomies of scale. Market share on the other hand seems to have a positive influence on technical efficiency. Therefore, managements could take decisions aimed at increasing their firms' market share through advertising, sales panels and sales. Additionally, the managements of these firms might better extend their efforts to increase their profits by increasing their revenues and reducing their costs. This could be achieved by eliminating non-added value processes in their operations. An important point to mention here concerns the regulatory bodies who could issue laws and regulations controlling how firms finance their assets in order to prevent an exaggerated increase in firms' total assets and control the competition to avoid illegal collusion between firms or any price leading which could affect the market share of some firms and cause a drop in their profits. Finally, as the technical efficiency of the insurance firms listed in the Palestine and Jordan stocks exchange markets was examined by DEA and regression analysis, future researches could be done by implying other analysis techniques or by examining other types of efficiency. By way of example, researchers may study the efficiency of the Palestinian and Jordanian insurance markets and compare their results with the findings of this study to come up with more recommendations that could improve the efficiency of the insurance sector in Palestine and Jordan. Further, they could use factors in the macro level to influence the dependent variable.

Contributions/Practical Implications

The research makes significant theoretical and empirical contributions to literature regarding evaluating the technical efficiency of the insurance firms operating in Jordan and Palestine markets and other countries and examine the factors that affect this efficiency. The research results might help both decisions makers' and practitioners in insurance companies to be more ready to understand the components and principles of technical efficiency and effectiveness of information technology governance in insurance companies. The management should focus on how to manage resources and wealth; therefore, it should be taken into serious consideration when formulating their strategy. This strategy formulation process can be enhanced by fully integrating and their indicators into management practices to improve their performance and should assign scales for each of such perspectives.

Appendix

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