Market Structure, Efficiency and Performance: Empirical evidence from South Africa's Healthcare Insurer Market.

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Abstract

This study assessed the relationship between market structure, conduct and performance in the South African healthcare insurer market for the period 2011 to 2017 using data obtained from the Council of Medical Schemes. Three hypotheses were tested: the structure-conduct-performance (SCP) paradigm, the relative market power (RMP) paradigm and the efficient structure (ES) hypothesis. The empirical evidence reveals that both the SCP and ES hypotheses can be rejected in relation to South African medical schemes. The empirical evidence reveals support for differing hypotheses for open and restricted medical schemes. Moreover, the empirical results suggest that the market for restricted medical schemes is highly concentrated and operating under a reduced efficiency level which produces less than desirable outcomes. In regard to open medical schemes, the empirical results reveal strong support for the RMP hypothesis which suggests that open medical schemes with more differentiated product and/or service offerings will achieve higher market share, be in a position to exercise market power and thus able to set higher prices and earn higher profit.

Keywords: Healthcare Insurance, DEA, Competition, Market Structure, Market Conduct, Market Performance, South Africa

JEL Classification: L00, L11, L22

1. Introduction

After the Introduction of the Medical Schemes Act No. 131 of 1998 (Medical Scheme Act) in 2000, there has been considerable consolidation in South Africa's healthcare insurer market. The South African Competition Commission (SACC) conducted a market inquiry into South Africa's Healthcare Industry and found that in terms of South Africa's healthcare insurer market, they were, "*consistently high market shares for some players and high concentration levels for both open and restricted medical schemes, the HMI is concerned with whether there are barriers to entry and expansion. Barriers to entry, by creation and reinforcing the market power of large firms, tend to lead to high prices, lower levels of quality and a less competitive*

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market".[2] Indeed, South Africa's Health Market Inquiry (HMI) revealed concerns regarding the structure and potential performance of South Africa's healthcare insurer market as the SACC found that both markets for open and restricted medical schemes appeared to be concentrated and thus raised concerns around the level of competition within these market structures. These concerns are valid as economic theory suggests that competition in highly concentrated markets tends to be less vigorous. However, others argue that a smaller number of firms will lead to the achievement of economies of scale and scope which leads to better efficiencies and better performance.

More so, there appears to be a debate on whether competition truly improves efficiency and performance. To this score, there are five hypotheses which aim at explaining the structure-performance relationship. The aim of this study was to assess whether any of those hypotheses are supported by empirical evidence in terms of South Africa's healthcare insurer market. This will further assist in informing policy and reforms as the HMI submitted that "*Healthcare markets everywhere suffer from failures on both the demand and supply side. These failures can drive up healthcare costs beyond what would prevail in a well-functioning and competitive market and can limit access. As a consequence, healthcare markets are universally (structurally) regulated in one form or another. Market failures peris where regulation is incomplete or compliance with regulation is inadequately enforced*." [3]

Effective reforms and policy however would depend on a comprehensive understanding of firm behaviour and the market and/or the industry in which those firms operate. Therefore, before the formulation and implementation of new reforms and regulations in South Africa's healthcare insurer market, it is critical to first understand the current structure and performance of South Africa's healthcare insurer market.

1.1 Industry overview

South African medical schemes are governed by the Medical Schemes Act and regulated by the Council of Medical Schemes (CMS), which is a statutory body mandated in terms of the Medical Scheme Act. Medical schemes play a crucial role in South Africa, in terms of providing healthcare financing for private healthcare.

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[2] See Competition Commission Health Market Inquiry provisional report, para 34, page 83.
[3] See Competition Commission Health Market Inquiry provisional report, para 57, page 87

Accordingly, scheme members pay monthly contributions to their chosen medical schemes which have the function of financing beneficiary expenses. Two types of medical schemes are prominent in South Africa. First, there are open medical schemes which are legally obligated to accept anyone who wishes to join. Second, there are restricted medical schemes which are only open to members of a particular employer, union or industry.

According to the HMI[4], South African medical schemes cover approximately 8.88 million lives which translates to 15.9% of South Africa's total population. This figure has remained rather consistent over the past two decades as in 1997, 16.9% of South Africa's total population belonged to a medical scheme.[5] Table 1 below reflects the percentage of South Africans who belonged to medical schemes for the years 2011 to 2017.

Table 1: South Africans belonging to a medical scheme

Year	2011	2012	2013	2014	2015	2016	2017
Percentage	16.4%	16.4%	16.3%	16.2%	15.9%	15.8%	15.6%

Importantly, the South African medical scheme industry has seen significant consolidation. In 2000, they were 163 medical schemes which consisted of 47 open, 97 restricted and 19 exempted medical schemes. In 2017 there were 81 medical schemes which comprised 21 open and 60 restricted medical schemes.[6] Further, the industry has been limited in terms of new entrants. Tables 2 and 3 below show historic market shares for open and restricted medical schemes in South Africa for the period 2011 to 2017.

Table 2: Open scheme market share

Medical Scheme	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Discovery Medical Scheme	49%	52%	53%	54%	55%	55%	56%
Bonitas Medical Fund	13%	13%	13%	13%	13%	15%	15%
Medihelp	5%	5%	5%	5%	4%	4%	4%
Medshield Medical Scheme	5%	4%	4%	3%	3%	3%	3%
Momentum Health	4%	4%	4%	5%	5%	5%	6%
Other	24%	23%	21%	20%	20%	17%	16%

[4] See Competition Commission Health Market Inquiry final report, para 4.3, page 33.
[5] See Competition Commission Health Market Inquiry final report, para 16, page 79
[6] See Competition Commission Health Market Inquiry final report, para 12, page 105.

Table 3: Restricted scheme market share

Medical Scheme	2011	2012	2013	2014	2015	2016	2017
Government Employees Medical Scheme (GEMS)	44%	46%	47%	47%	46%	47%	46%
South African Police Service Medical Scheme (POLMED)	13%	13%	13%	13%	13%	13%	13%
Bankmed	5%	5%	5%	5%	6%	5%	6%
LA Health Medical Scheme	2%	3%	3%	3%	4%	4%	4%
Other	35%	34%	32%	32%	32%	31%	31%

As shown above, it appears that the Discovery medical scheme has consistently been the largest open medical scheme, attaining a market share of between 49% and 56% for the period 2011 to 2017. Similarly, GEMS appears to be the largest restricted medical scheme attaining a market share of between 44% and 47% for the period 2011 to 2017. These according to the HMI are signs of uncompetitive market structures, as in competitive market structures medical schemes should be competing to attract more business in the form of new members into the market as well as competing for members of other medical schemes.[7]

Indeed, in a competitive market structure, more variance should be evident in market shares which would provide evidence that medical schemes are competing effectively and hence would gain and lose market share. However, the above market share estimates reveal consistently high market shares for both Discovery Health and GEMS which could point to a lack of effective competition in both open and restricted medical scheme markets.

Given the above, this study assessed the relationship between the market structure, efficiency, and performance of South Africa’s healthcare insurer market. This paper is structured as follows: Section 2 discusses the literature which outlines the four hypotheses regarding market structure, conduct and performance. Section 3 outlines the estimation methodology and the conditions needed to test each hypothesis and also identifies the data used. Section 4 presents the empirical results and discussion of those results. Section 5 concludes the paper.

2. Literature Review

2.1 Theoretical review

This section outlines the four hypotheses which relate to market structure, conduct and performance. Section 2.1.1 relates to the structure-conduct-performance hypothesis; Section

[7] See Competition Commission Health Market Inquiry final report, para 26, page 81

2.1.2 relates to the efficient structure hypothesis. Section 2.1.3 outlines the relative market power paradigm, whereas Section 2.1.3 outlines the quiet life hypothesis.

2.1.1 The structure-conduct-performance hypothesis

The structure, conduct and performance (SCP) hypothesis originates from the work of Mason (1939) and Bain (1951). According to Mason (1939), the extent of the relative size of a selling unit will be determined by the structure of a particular market. The market structure in which a firm operates will influence its policies and practices. Given this hypothesis, Mason (1939) indicated that a firm of a given size, relative to the market in which it operates will follow different price and production strategies given different market conditions. More so, Bain (1951) postulated that firms operating in highly concentrated markets will be able to earn higher profit rates than firms operating in less concentrated markets.

Indeed, Bain (1951) suggested that "*a single firm monopolist or a group of oligopolists operating with effective express or tactic collusion should approach a conventional maximization solution and realize in long-run equilibrium the maximum excess profit aggregate which is permitted by the relation of the industry demand curve to the costs of production and selling and by the conditions of selling and by conditions of entry*". Further, firms operating in more competitive markets or oligopolists operating without coordination will not be able to maximise the excess profit aggregates and will tend to sell their goods and/ or services at a lower price and thus earn lower profits.

One can determine that the central hypothesis of the work of Mason (1939) and Bain (1951) is that the structural characteristics of a particular market will determine the behaviour of firms operating in that market which affects overall market performance. Therefore, it is safe to conclude that the SCP hypothesis assumes a one-way relationship between structure, conduct and performance (Church & Ware, 2000).

A number of studies support this notation, with Smith and Trigeorgis (2004) indicating that conditions of supply and demand in a particular industry will determine its structure. Further, the competitive conditions of a particular market structure will dictate the behaviour of firms operating within that market structure which will in turn dictate the performance of that market. Sathye (2005) also added that the degree of market concentration will influence overall output as a highly concentrated market structure will produce more effective collusive outcomes.

Carlton and Perloff (2000) also postulated that market structures characterised by many firms supplying similar products and/or services, which are relatively equal in size, can be defined as competitive markets that generate greater market performance.

This implies that there is a direct relationship between the degree of market concentration and the level of competition among firms. The SCP hypothesis postulates that market concentration and the degree of competition are inversely related as concentration encourages collusion (Edwards, Allen & Shaik, 2006). Therefore, firms which operate in highly concentrated markets will tend to have a higher return than those that operate in less concentrated markets.

Tucker (2010) indicated that conceptually, a market structure is a classification system used to characterise key traits of markets which include the number of firms, the similarity of goods sold and the ease at which firms can enter and exit the market. Shepherd (1986a) stated that market structures range from monopolies to perfectively competitive markets. Therefore, for purposes of the SCP hypothesis, market structure includes a set of variables which are seen to be stable over time and affect the conduct of sellers and/or buyers.

Market conduct can be understood as a set of strategies used by sellers to attract buyers to their business (Moore, 1998). This includes various price competition methods and non-price inducements. More so, Purcell (1973) indicated that market conduct refers to the actions of firms and their behaviour given a market structure. Therefore, various strategic pricing policies, non-price competition policies are activities of market conduct.

Market conduct within the SCP paradigm can then be understood as how firms set their prices, whether independently or in a collusion with other firms in the market and how firms take decisions about their advertising and research budgeting (Ferguson & Ferguson, 1994).

Market performance can be understood as the economic results that flow from the system in terms of pricing efficiency and the flexibility of adapting to changing situations (Bain, 1968). Market performance is the economic result of market structure and conduct. According to Narver and Savitt (1971), market performance is the net result of conduct and can be measured in terms of net profits, rate of return on owners' equity, and the efficiency with which plant equipment and other resources were used.

Furthermore, Neuberger (1997) suggested that market performance can be measured through comparing the results of firms within the industry in terms of price, quantity, product quality, resource allocation and production efficiency.

2.1.2 Efficient structure hypothesis

An alternative to the SCP hypothesis is the efficient structure (ES) hypothesis which postulates that market concentration arises from competition from firms that enjoy low cost structures that increase profits by reducing their prices (Smirlock, 1985). Demsetz (1973) suggested that better performance from firms arises from the efficiencies that they enjoy. This hypothesis in in stark contrast to the SCP hypothesis which assumes a positive relationship between market concentration and performance.

The ES hypothesis postulates that the huge gains in market share enjoyed in some firms are a result of superior efficiencies (Lelissa, 2018). Indeed, this suggests that highly concentrated markets are a result of superior practices and policies from more efficient firms. More so, the work of Molyneux and Forbes (1995) indicates that higher profits are not a result of collusion among firms but are credited to superior management or production technologies that have lower costs.

Further, Sathye (2005) suggested that more efficient firms will tend to win more competition and grow to become large, obtain greater market share and thus earn higher profits. As a result of this phenomenon, efficiencies enjoyed by firms lead to highly concentrated markets.

According to Berger and Hannan (1993), testing the ES hypothesis requires testing two efficiency elements. First, one can test X-efficiency where firms are seen to have lower costs, higher profits and thus larger market share as a result of having greater ability in limiting their costs to produce any given outputs. Second, one can test scale efficiency which sees more scale efficient producing at or close to their minimum average cost point (Berger & Hannan, 1993).

2.1.3 Relative market power hypothesis

Shepherd (1986b) postulated that only those firms with large market shares and differentiated products and/or services will have the ability to exercise market power in regard to pricing and, hence earning supernormal profits. Maudas and Fernández-de-Guevara (2007) further indicated that market shares tend to capture the influence of factors which are unrelated to efficiency such as market power and/or product differentiation and hence under the relative market power hypothesis, individual market share can be considered as a proxy for assessing market power.

2.1.4 Quiet life hypothesis

According to Hicks (1935), a relationship exists between market concentration and the level of overall efficiency in a market. This hypothesis is referred to as the quiet life (QL) hypothesis which postulates that monopolies prefer a quiet life free from competition and hence limit their initiatives for improving efficiencies (Lelissa, 2018). The QL hypothesis suggests that firms with market power operating in highly concentrated markets will limit competition and will tend to operate under a reduced efficiency level.

2.2 Empirical review

The empirical literature on the market power hypothesis spans over a number of industries, with one particular study that focused on the banking sector being the work of Evanoff and Fortier (1988). In this particular study, the researchers used data of more than 6300 American banks in 30 States to assess the effect of regulation on bank performance by dividing the market into those with high entry barriers and those with low entry barriers. The researchers found that in markets that have high entry barriers, market share will have a strong impact on profitability. Yet, in markets with low entry barriers, market growth has a negative effect on profitability.

Choi and Weiss (2005) studied the relationship between market structure and performance in the insurance industry in the United States of America over the period of 1992–1998. Utilising data from company group level, the researchers formulated a structure-conduct-performance, relative market power and efficient structure framework. The researchers found evidence supporting the efficient structure hypothesis.

Relevant to this study is the work of Dranove, Gron and Mazzeo (2003). The researchers employed a methodology inspired by the work of Bresnahan and Reiss (1991) and Mazzeo (2002) to investigate competition amongst Health Maintenance Organizations (HMO). Using data for the year 1997, on the number of HMOs in local markets in which they distinguish between HMOs that are national and those that are regional. Estimating threshold ratios for all HMOs, the researchers found that the profits for local HMOs were unaffected by the number of national HMOs, and vice versa. The results indicate that there is substantial competition in American HMO markets but also substantial product differentiation.

3. Methodology and Data

This section details the methodology used in this study. Section 3.1 outlines the procedure to estimate efficiency scores. Section 3.2 details the input and output variables used. Section 3.3 outlines the concentration measure employed. Section 3.4 outlines the empirical model used. Section 3.5 describes the data used.

3.1 Data envelopment analysis

In order to estimate technical and scale efficiency, this study used a technique referred to as data envelopment analysis (DEA). This technique was introduced by Charnes, Cooper and Rhodes (1978) based on the work of Farrell (1957). The DEA technique estimates the relative performance of firms through comparing multiple inputs and outputs and thus gives out an efficiency score. This efficiency score is the estimated ratio of the weighted sum of outputs to weighted sum of inputs. Next is a brief discussion on technical efficiency, scale efficiency and pure technical efficiency.

3.1.1 Technical efficiency

The Farrell efficiency measure developed by Farrell (1957) can be understood as the inverse of the Shepard (1953) distance function. Given this, the efficiency problem can be understood as:

$$F^t(y_i^t, x_i^t) = [D^t(y_i^t, x_i^t)]^{-1} = \min\, [\lambda_i^t : \lambda_i^t x_i^t \epsilon L^t(y^t)] \qquad (1)$$

Where $D^t(y_i^t, x_i^t)$, the distance function, defines the contraction of x^t that would take an inefficient observation for any firm i, to a point on the frontier, and the minimised parameter λ, determines the factor in which the observed input combination can be reduced. It is understood that the efficiency measure takes a value of 1 for efficient firms which will be on the frontier, and between 0 and 1 for less efficient firms on the frontier.

For clear illustration of the above, assume that there are K inputs and corresponding M outputs for each of N firms. X would be the matrix of inputs and would have size $(K \times N)$. Further, Y would be the matrix of outputs and would have size $(M \times N)$.

Given this, for the ith firm, the input and output data can be represented by column vectors, xi and yi. Thus, the technical efficiency score (θ) for the ith can be estimated by solving the following linear programming problem:

$$\begin{aligned} & Min_{\theta,\lambda}\lambda && (2) \\ & subject\ to\ \ -y_i + Y\lambda \geq 0 \\ & \qquad \theta x_i - X\lambda \geq 0 \\ & \qquad N1'\lambda = 1 \\ & \qquad \lambda \geq 0 \end{aligned}$$

Where $N1$ can be understood as a $(N \times 1)$ vector of ones and λ can be understood as $(N \times 1)$ vector of constants. Furthermore, it is indicated that the linear programming must be solved N times in order to get a value of for each firm in the sample. As already indicated, the value of each θ must be less than 1, suggesting a point on the frontier and thus a technically efficient firm (Farrell, 1957).

3.1.2 Scale efficiency

The linear programming problem outlined above allows for the constructed production frontier to possess increasing, constant or decreasing returns to scale. If it is found that the convexity constraint ($N1'\lambda = 1$) is omitted from equation [x] above then the technical efficiency estimate can be calculated under the assumption of constant returns to scale allowing the decomposition of the technically efficiency measure into two measures of pure technical and scale efficiency.

3.1.3 Pure technical efficiency

Pure technical efficiency can be estimated by dividing technical efficiency by scale efficiency. Pure technical efficiency can be understood to represent efficiency regardless of scale of firms and reflects management skills and the technology applications of firms.

3.2 Input and output variables

Based on the services provided by medical schemes in the form of real services, risk pooling, risk bearing and intermediation functions, the input variables used in this study were labour and capital inputs. Due to data availability, these inputs were Non-Relevant Healthcare Expenses, Relevant Healthcare Expenses and Medical Scheme Year-end reserve position.

In regards to the output variable, this study followed the suggestions of Leverty, Lin and Zhou (2004) and used Net Contribution Income which is the net premiums paid by members instead of using claims incurred as the choice output. This is because outputs need to be desirable and no medical scheme would want to maximise incurred losses. Therefore, the efficiency scores were estimated based on the assumption that medical schemes aim to maximise net contributions/premiums and profits to be able to provide cover for any incurred losses.

3.3 Herfindahl Hirschman index

Existing literature identifies several metric measures to measure the market structure of a particular industry (Alhassan & Addison, 2013). For the purpose of this research study, the Herfindahl Hirschman index (HHI) and concentration ratios (4-firm CR) were used to measure the structure of South African healthcare insurance market.

The HHI is calculated as the sum of squares of the market share of firms within an industry as shown below:

$$\boldsymbol{HHI_t = \sum_{i=1}^{n} ms_i^2} \quad (3)$$

Where ms_i^2 is the market share of medical scheme i.

Concentration ratios measure the degree to which the few dominant firms within a particular industry account for the greater portion of economic activities of that particular industry (Alhassan & Addison, 2013). This study used 4-firm (CR4) concentration ratios.

3.4 Econometric model

Given the above discussed hypotheses, this study attempted to estimate the following model:

$$\pi_{it} = \beta_0 + \beta_1 CONC_t + \beta_2 MS_{it} + \beta_3 XEFF_{it} + \beta_4 SEFF_{it} + \sum \beta_j Z_{it} \quad (4)$$

Where π_{it} represents the performance of medical scheme "i" in period "t", $CONC_t$ reflects market concentration in period "t", MS_{it} represents the market share of medical scheme "i" in period "t", $XEFF_{it}$ represents the pure technical efficiency of medical scheme "i" in period "t", $SEFF_{it}$ reflects the scale efficiency of medical scheme "i" in period "t", whereas Z_{it} is a vector of control variables for medical scheme "i" in period "t".

In testing for endogeneity, the researcher further introduced the following equations:

$$CONC_t = a_1 + a_2 XEFF_{it} + a_3 SEFF_{it} \quad (5)$$

$$MS_{it} = b_1 + b_2 XEFF_{it} + b_3 SEFF_{it} \quad (6)$$

$$XEFF_{it} = c_1 + c_2 CONC_t + c_3 MS_{it} + \sum c_j Z_{it} \quad (7)$$

$$SEFF_{it} = d_1 + d_2 CONC_t + d_3 MS_{it} + \sum d_j Z_{it} \quad (8)$$

Importantly, if the SCP hypothesis holds, market concentration should have a positive impact on medical scheme performance. Moreover, scale efficiency and technical efficiency should also be seen to have no significant impact on concentration (Qichang, Zongling & Fang, 2012). More so, if the RMP hypothesis holds, market share should have a positive impact on medical scheme performance. Likewise scale efficiency and technical efficiency should have no significant impact on market share (Qichang et al., 2012). Further, if the RES hypothesis holds, technical efficiency should a positive impact on medical scheme performance. More so, technical efficiency should have a significant impact on both on market concentration and market share (Qichang et al., 2012). Lastly, if the SES hypothesis holds, scale efficiency should have a positive impact on medical scheme performance. Furthermore, scale efficiency should have a significant impact on both market concentration and market share (Qichang et al., 2012). The above discussed equations assisted in testing the five hypotheses tabulated below:

Table 4 Summary of hypotheses

Hypothesis	Conditions
SCP	$\beta_1 > 0, and\ a_2, a_3\ both\ equal\ to\ zero$
RMP	$\beta_2 > 0, and\ b_2, b_3\ both\ equal\ to\ zero$
RES	$\beta_3 > 0, and\ a_2 > 0\ and\ b_2 > 0$
SES	$\beta_4 > 0, and\ a_3 > 0\ and\ b_3 > 0$
Quiet Life	$All\ c_2, c_3, d_2 and\ d_3\ are\ negative\ and\ significant$

3.5 Data

This study used data for the period 2011 to 2017, obtained from the Council of Medical Schemes. The researcher was able to gather information on all South African medical schemes. This data was subject to the econometric analysis discussed above. Below is a tabulated summary of the variables that were used.

Table 5: Variable description

Variable	Description
ROA	Return on assets = Net income/total assets
XEFF	Pure technical efficiency
SEFF	Scale efficiency
TEFF	Technical efficiency
MS	i th medical scheme market share
CR4	concentration ratios
HHI	calculated as the sum of squares of the market share of medical schemes
Net Contribution Income	Net Contribution Income (ZAR)
Non-Relevant Healthcare Expenses	Non-Relevant Healthcare Expenses (ZAR)
Relevant Healthcare Expenses	Relevant Healthcare Expenses (ZAR)
Medical Scheme Year-end reserve position	Medical Scheme Year-end reserve position (ZAR)
Control variables	
Size	Natural logarithm of total assets
Scheme Beneficiaries	Natural logarithm of the number of beneficiaries
Leverage	Liabilities to assets ratio
GDP	GDP growth rate
Inflation	Inflation rate

4. Results and Discussion

This section displays and discusses the empirical results. Tables 6 and 7 present descriptive statistics for both open and restricted medical scheme regression model variables. There are 162 observations for open schemes and 439 observations for restricted schemes. The return on assets for open medical schemes has a mean of 1.96 whereas a mean of 1.3 for restricted schemes. Further, the concentration ratios for the four largest open medical schemes were 53%, whereas the concentration ratios for the four largest restricted medical schemes were 51%. In regard to efficiencies, open schemes had an average pure technical efficiency score of 0.94, an average scale efficiency score of 0.98 and a technical efficiency score of 0.92. Restricted schemes achieved on average a pure technical efficiency score of 0.87, a scale efficiency score of 0.98 and a technical efficiency score of 0.85. In general, South African medical schemes appear to be rather efficient. In regard to the macroeconomic variables used as control variables, GDP growth and the inflation rate were on average 6.4% and 5.6% respectively.

Table 6: Descriptive statistics open medical schemes

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
ROA	162	1,96	1,20	0,45	6,03
Technical Efficiency	162	0,92	0,06	0,76	1,00
Scale Efficiency	162	0,98	0,03	0,82	1,00
Pure Technical Efficiency	162	0,94	0,06	0,76	1,00
Market Share (%)	162	0,04	0,11	0,00	0,56
HHI	162	0,31	0,02	0,27	0,34
CR4	162	0,53	0,01	0,51	0,54
Net Contribution Income	162	3110000000,00	7600000000,00	35500000,00	48700000000,00
Relevant Healthcare Expenses	162	2680000000,00	6440000000,00	32300000,00	41800000000,00
Non-Relevant Healthcare Expenses	162	422000000,00	1080000000,00	5156274,00	5990000000,00
Medical Scheme Year-end reserve position	162	1050000000,00	2410000000,00	15400000,00	16400000000,00
Leverage	162	5,81	5,37	1,60	41,20
GDP growth (%)	162	0,06	0,06	0,01	0,17
Inflation rate (%)	162	0,06	0,01	0,05	0,07
Size	162	1540000000,00	3600000000,00	23600000,00	25700000000,00
Scheme Beneficiaries	162	210424,70	529855,70	2514,00	2777946,00

Table 7: Descriptive statistics restricted medical schemes

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
ROA	439	1,30	0,91	0,13	6,17
Technical Efficiency	439	0,85	0,08	0,49	1,00
Scale Efficiency	439	0,98	0,03	0,78	1,00

Pure Technical Efficiency	439	0,87	0,08	0,52	1,00
Market Share (%)	439	0,02	0,06	0,00	0,47
HHI	439	0,24	0,01	0,22	0,25
CR4	439	0,51	0,01	0,50	0,52
Net Contribution Income	439	890000000,00	3400000000,00	5127313,00	34700000000,00
Relevant Healthcare Expenses	439	821000000,00	3140000000,00	4316009,00	29800000000,00
Non-Relevant Healthcare Expenses	439	65000000,00	212000000,00	763437,00	1980000000,00
Medical Scheme Year-end reserve position	439	349000000,00	647000000,00	6571160,00	5400000000,00
Leverage	439	10,37	13,30	0,00	120,30
GDP growth (%)	439	0,06	0,06	0,01	0,17
Inflation rate (%)	439	0,06	0,01	0,05	0,07
Size	439	481000000,00	909000000,00	7386833,00	8520000000,00
Scheme Beneficiaries	439	62043,69	231639,10	703,00	1853252,00

Tables 8 and 9 below reflect the concentration ratios for both open and restricted schemes for the years 2011 to 2017. The concentration ratios for the largest open medical schemes range from 51% to 54% whereas the concentration ratios for the four largest restricted medical schemes range from 50% to 52%. It appears that open schemes are slightly more concentrated than restricted schemes. Moreover, the HHI reflects the number and dispersion of medical schemes in a market. A market is believed to be unconcentrated if the HHI is below 0.1, moderately concentrated if the HHI is between 0.1 and 018 and highly concentrated if the HHI is over 0.18.[8] Given this, it appears that both the markets that open and restricted medical schemes operate in are highly concentrated.

Table 8: HHI and CR4 results for open medical schemes

Year	HHI	CR4
2011	0.2724701	0.5127709
2012	0.2952967	0.5382341
2013	0.3078535	0.5329762
2014	0.316833	0.5340824
2015	0.3264828	0.5403655
2016	0.3390621	0.5215679
2017	0.3449507	0.5231237

8 See US Department of Justice Guidelines.

Table 9: HHI and CR4 results for restricted medical schemes

Year	HHI	CR4
2011	0.2193158	0.4959274
2012	0.2367863	0.5229118
2013	0.2455902	0.5249857
2014	0.2438871	0.5194117
2015	0.2360733	0.5042425
2016	0.2421723	0.5060427
2017	0.2382731	0.4960145

Tables 10 and 11 reflect the efficiency scores for both open medical schemes and restricted medical schemes. The results below indicate that both open medical schemes and restricted medical schemes were able to achieve modest efficiency scores for the period 2011 to 2017.

Table 10: Efficiency results for open medical schemes

Year	Technical Efficiency	Scale Efficiency	Pure Technical Efficiency
2011	0.93190689	0.97598407	0.95532698
2012	0.92027633	0.97297726	0.94649522
2013	0.90953762	0.97681814	0.93145766
2014	0.90752973	0.97729105	0.92859434
2015	0.92143482	0.9821534	0.93850296
2016	0.91864272	0.9831096	0.93491234
2017	0.92356983	0.98523682	0.93760313

Table 11: Efficiency results for restricted medical schemes

Year	Technical Efficiency	Scale Efficiency	Pure Technical Efficiency
2011	0.8500416	0.97677231	0.87047843
2012	0.84865734	0.9764483	0.86908677
2013	0.85117622	0.97928416	0.86922833
2014	0.84207369	0.97935849	0.85998856
2015	0.85243174	0.97975564	0.87018395
2016	0.84518145	0.97926336	0.86344498
2017	0.85309092	0.9781872	0.87267331

Table 12 below displays the results for equation 4 for both open and restricted medical schemes. The results indicate that high levels of market concentration are not associated with greater profitability. This is reflected in both coefficients of market concentration being negative.

However, the CR4 measure for open medical schemes does not seem to be statistically significant. Given this, the SCP hypothesis can be rejected for both open and restricted medical schemes.

Table 12: Results for equation 4

	Open Medical Schemes	Restricted Medical Schemes
VARIABLES	**ROA**	**ROA**
CR4	-1.303	-5.718***
	(2.040)	(0.839)
Market Share	8.369**	5.798
	(3.953)	(5.176)
Pure Technical Efficiency	0.612	0.105
	(0.642)	(0.223)
Scale Efficiency	3.301**	0.280
	(1.507)	(0.715)
Leverage Ratio	-0.0114**	-0.00126
	(0.00802)	(0.00223)
Size	-1.464***	-0.941***
	(0.133)	(0.0503)
Scheme Beneficiaries	1.156***	0.711***
	(0.103)	(0.0827)
GDP Growth Rate	-1.217***	-1.675***
	(0.395)	(0.168)
Inflation Rate	-1.865	4.608***
	((3.000)	(1.498)
Constant	15.39**	14.74***
	(3.314)	(1.275)
Observations	162	439
Number of Medical Schemes	26	75
R-squared	0.686	0.518

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Further, the coefficients for market shares are positive and statistically significant (at 5%) only for open medical schemes and statistically insignificant for restricted medical schemes. This implies that, for open medical schemes, an increase in market shares will lead to an increase in profitability. Moreover, the scale efficiency coefficients are positive for both open and restricted medical schemes but only statistically significant for open medical schemes. In regard to the pure technical efficiency, the coefficients are positive for open and restricted medical schemes but statistically significant for both open and restricted medical schemes.

The size coefficients appear to be negative and significant for both open and restricted medical schemes, implying a decline in total asset size will lead to a decline in profitability. Similarly, the leverage coefficients are both negative; however, the negative coefficient is only significant for open medical schemes, suggesting a decline in the leverage ratio of open medical schemes will lead to a decline in profitability. Importantly, the results reveal that an increase in medical scheme members will lead to high profitability as shown by the scheme beneficiary coefficient being both positive and statistically significant for both open and restricted medical schemes.

Table 13 below displays the results for equation 5. The coefficients for both pure technical and scale efficiency for both open schemes and restricted schemes do not appear to be statistically significant. This implies that efficiencies are not leading to concentration in both open and restricted medical scheme markets. Given this the efficiency hypothesis can be rejected. Further, it appears that the high concentration ratios found in both markets for open and restricted medical schemes are not a result of the ES hypothesis but more likely support the RMP hypothesis. The positive and significant market share coefficient in relation to open medical schemes, found in in Table 12 above, also seems to support this view.

Table 13: Results for equation 5

	Open Medical Schemes	**Restricted Medical Schemes**
VARIABLES	**CR4**	**CR4**
Pure Technical Efficiency	-0.0372	-0.0153
	(0.0265)	(0.0164)
Scale Efficiency	-0.0353	-0.00716
	(0.0630)	(0.0518)
Constant	0.598***	0.530***
	(0.0693)	(0.0539)
Observations	162	439
Number of Medical Schemes	26	75
R-squared	0.016	0.002

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 14 below shows the results for equation 6. The coefficients for pure technical efficiency appear to be positive yet statistically insignificant for both open and restricted medical schemes. Moreover, the coefficients for scale efficiency appear to be significant but negative for both open and restricted medical schemes. This suggests that efficiencies do not result in high market shares for both open and restricted medical schemes which provides further evidence to reject the ES hypothesis.

Table 14: Results for equation 6

	Open Medical Schemes	Restricted Medical Schemes
VARIABLES	**Market Share**	**Market Share**
Pure Technical Efficiency	0.0155	0.00330
	(0.0151)	(0.00263)
Scale Efficiency	0.0372	-0.00600
	(0.0358)	(0.00830)
Constant	-0.00780	0.0190**
	(0.0394)	(0.00864)
Observations	162	439
Number of Medical Schemes	26	75
R-squared	0.014	0.006

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 15 reflects results for equation 7. The concentration ratio coefficients appear to be negative for both open and restricted medical schemes. However, the concentration ratio coefficients are statistically insignificant for both open and restricted medical schemes.

Table 15: Results for equation 7

	Open Medical Schemes	Restricted Medical Schemes
VARIABLES	**Pure Technical Efficiency**	**Pure Technical Efficiency**
CR4	-0.369	-0.156
	(0.279)	(0.169)
Market Share	0.429	1.393
	(0.490)	(1.050)
Constant	1.116***	0.925***
	(0.149)	(0.0877)
Observations	162	439
Number of Medical Schemes	26	75
R-squared	0.019	0.007

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 16 below shows the results for equation 8. The concentration ratio coefficients for both open and restricted medical schemes are both positive and statistically insignificant. More so, the market share coefficients are negative and statistically insignificant for both open and restricted medical schemes. Similar to the results above, the results below support the quiet life hypothesis.

Table 16: Results for equation 8

	Open Medical Schemes	Restricted Medical Schemes
VARIABLES	**Scale Efficiency**	**Scale Efficiency**
CR4	-0.0431	-0.00292
	(0.118)	(0.0535)
Market Share	0.189	-0.280
	(0.208)	(0.333)
Constant	0.993***	0.984***
	(0.0633)	(0.0278)
Observations	162	439
Number of Medical Schemes	26	75
R-squared	0.007	0.002

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. Robust Analysis

The Hausman Test

In considering the most appropriate efficient estimators, the Hausman (1978) specification test was utilised. The results of this test are shown below in Tables 17 and 18. As reflected below, the Hausman test favoured the fixed effects model. The null hypothesis, which suggests that the random effects model is the most appropriate model, can be rejected for both open and restricted medical schemes as the P-value for both is significantly less than 5%.

Table 17: Hausman test results for open medical schemes

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed Effects	**Random Effects**	**Difference**	**S.E.**
CR4	-1.303466	-1.069981	-0.2334854	
Market Share	8.369097	0.6849812	7.684116	3.820542
Pure Technical Efficiency	0.6118805	0.7298243	-0.1179439	0.1858488
Scale Efficiency	3.300794	4.506779	-1.205985	0.3647249
Leverage Ratio	-0.0114467	-0.0179775	0.0065308	0.0025995

Size	-1.46381	-1.457241	-0.0065686	0.1045737
Scheme Beneficiaries	1.15621	1.356647	-0.2004367	0.0650871
GDP Growth Rate	-1.21712	-1.23962	0.0224992	0.1302076
Inflation Rate	-1.864723	-1.600292	-0.2644311	

Prob>chi2 = 0.0153

Table 18: Hausman test results for restricted medical schemes

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed Effects	**Random Effects**	**Difference**	**S.E.**
CR4	-5.717754	-5.313644	-0.4041095	
Market Share	5.798129	6.907215	-1.109086	5.039568
Pure Technical Efficiency	0.1045915	0.1530704	-0.0484789	0.0590847
Scale Efficiency	0.2803101	0.6853607	-0.4050505	0.2157784
Leverage Ratio	-0.0012552	-0.0038834	0.0026282	0.0009547
Size	-0.9413692	-0.8510565	-0.0903127	0.026011
Scheme Beneficiaries	0.71122	0.7755054	-0.0642854	0.061869
GDP Growth Rate	-1.674848	-1.51895	-0.1558986	0.036357
Inflation Rate	4.608237	4.29853	0.3097071	

Prob>chi2 = 0.0008

6. Conclusion

This study assessed the relationship between market structure, efficiency and medical scheme performance in South Africa for the period 2011 and 2017. Through empirically assessing the SCP and ES hypotheses on South African medical schemes, this study offers an understanding on medical scheme behaviour in both the markets for open and restricted medical schemes with could assist in informing regulatory and competition policies. The empirical evidence reveals that both the SCP and ES hypotheses can be rejected in relation to South African medical schemes. The empirical evidence reveals support for differing hypotheses for open and restricted medical schemes. Moreover, the empirical evidence suggests that the market for restricted medical schemes is highly concentrated and operating under a reduced efficiency level which produces less than desirable outcomes. Given this, policy should be formulated to deconcentrate this market and improve efficiency outcomes.

In regard to open medical schemes, the empirical results reveal strong support for the RMP hypothesis which suggests that medical schemes with more differentiated product and/or service offerings will achieve higher market share, be in a position to exercise market power and thus able to set higher prices and earn higher profits. Given this, policymakers should focus on policies which would encourage competition and aim at deconcentrating the market for open medical schemes as it too appears to be highly concentrated, with market power at the hands of a few medical schemes. This will prevent prices at higher than competitive levels, low levels of quality product and/or service offerings and a less competitive market structure.

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