

An investigation into the existence of Underwriting Cycles in the South African Primary Marine Insurance Market: 1925-2006

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Declaration

I hereby declare that this is my own unaided work, the substance of or any part of which has not been submitted in the past or will be submitted in the future for a degree in to any university and that the information contained herein has not been obtained during my employment or working under the aegis of, any other person or organization other than this university.

(Name of candidate)

Signed

Signed this day of 2008 at Johannesburg.

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Abstract

This research report analyses net of reinsurance underwriting data drawn from the South African primary marine insurance market with the aim of demonstrating the presence of insurance underwriting cycles over the period 1925 to 2006. Furthermore, the theories of underwriting cycles and factors that influence these cycles are discussed.

1. Introduction

Empirical evidence suggests the presence of underwriting cycles in short-term insurance markets (Klein, 2003). This phenomenon of underwriting cycles is simply the “recurring pattern of increases and decreases in insurance prices and profits” (Meier and Outreville, 2003).

This research report seeks to establish if there are any underwriting cycles in the primary South African marine insurance market. A review of the factors most frequently cited by authors as the causes of underwriting cycles is also done.

The causes of underwriting cycles are based on several different theories namely the extrapolation hypothesis (Venezian, 1985); the rational-expectations/ institutional-intervention hypothesis (Cummins and Outreville, 1987); the fluctuations-in-interest-rates hypothesis (Doherty and Kang, 1988; Doherty and Garven, 1995); the capacity-constraint hypothesis (Winter, 1988, 1989; Gron, 1994a); and the changes-in-expectations hypothesis (Lai and Witt, 1990, 1992). Other causes such as disequilibrium between supply and demand, external shocks and general business influences are discussed as causes of the underwriting cycle.

From all the research conducted around insurance cycles, it is evident that no single factor in isolation can cause the development of underwriting cycles.

The existence of underwriting cycles in direct insurance markets have been demonstrated in several markets including the United States, Europe, Asia, Australia and Africa (Meier and Outreville, 2006; Chen et al, 1999; Lamm-Tennant & Weiss, 1997;

Harrington, 2004). Research attempting to demonstrate the existence of underwriting cycles in the South African insurance market, has been conducted by Leshilo (2007) and Markham (2006).

The paper is organized as follows. The first section outlines insurance and in particular Marine Insurance and the Marine Insurance market in South Africa. The second section deals with underwriting cycles. Underwriting cycles are defined, the factors that influence these cycles are discussed and the theories behind underwriting cycles are reviewed. The third section is the empirical analysis of the South African Marine Insurance Data. The data is analysed and the search for the presence of underwriting cycles is conducted. The next section summarises findings and concludes the argument.

2. Marine Insurance

2.1) Marine Insurance – Pure Marine

Several researchers have proven that marine insurance is the oldest form of insurance (Barth and Grace, 1993). Nelli (1972) states that the oldest insurance policy is a marine policy dated 13 February 1343. Although the earlier marine insurance policies were not as sophisticated as the ones of today or even drafted by legislators, those policies still provided some sort of protection against the risks or perils of the sea with the premium taking on the form of a cash equivalent, an exchange or a maritime loan (Holdsworth, 1917).

The insurer in a marine insurance contract agrees to take a portion of the marine risks associated with a vessel and/or cargo in exchange for a premium. Marine cover can be arranged for a single voyage or for a period of time (Kingston, 2004).

Archer-Lock et al (1994) and Wiley InterScience (2008) suggest that marine insurance business is divided into four categories: hull, cargo, liability and offshore/ energy.

Hull revolves around the vessel (conveyance, ship or aircraft) and covers total loss, particular average, general average, general average contributions, collision liability and charges for salvage, and sue and labour (Archer-Lock et al, 1994).

According to Wiley InterScience (2008), the Institute Time Clauses (Hulls) stipulate cover for hull.

Cargo includes all goods and/or property and/or merchandise carried by a conveyance for the purpose of earning remuneration referred to as freight (Archer-Lock et al, 1994). Cargo insurance protects the policyholder against loss of cargo whilst being transported from one place to another. Transit may be by various different means such as rail, road, or air and not just ship. Cargo insurance encompasses loss of or damage to merchandise caused in any manner, but it should be noted that this insurance is subject to certain named exclusions. General average losses may also be indemnified. Certain extraordinary cover such as rejection, deterioration, and/or consequential loss may also be arranged. Cargo insurance usually attaches from the time goods leave the warehouse or place of storage, continues during the ordinary course of transit and terminates on the earlier of delivery to the final destination or the expiry of 60 days after discharge at the final port or any other point where the ordinary course of transit is interrupted (Archer-Lock et al, 1994).

Cargo cover and exclusions are stipulated in terms of clauses commonly referred to as the Institute Cargo Clauses (Trafalgar International Ltd., 2008). There are many variations of cover (Trafalgar International Ltd., 2008), but the three most common is the Institute Cargo Clauses (A), Institute Cargo Clauses (B), and Institute Cargo Clauses (C). The “A Clauses” provide “all risk” type cover, with “B Clauses” and “C Clauses” offering restricted cover (Trafalgar International Ltd., 2008). Cover in terms of the Institute Cargo Clauses (C) is the most restricted (Trafalgar International Ltd., 2008).

Marine liability insurance indemnifies shipowners and/or charterers and covers various forms of liability associated with transportation insurance. Proprietary insurance companies, Lloyd’s syndicates and mutual associations (the P&I Clubs) generally provide Marine Liability. Generally the larger risks are insured through the P&I Clubs, with smaller risks covered by insurers and the Lloyd’s market (Archer-Lock et al, 1994).

Energy includes cover for Onshore and Offshore exposed property such as container terminals, ports, oil platforms, pipelines, rigs, etc. Cover is provided for property damage; removal of wreck or debris; control of well; business interruption and loss of production; war, strikes, political and terrorist risks; increased cost of production; cargo and equipment; and various liabilities, but cover generally depends on the specific type of project (Archer-Lock et al, 1994).

2.2) Marine Insurance / Business defined:

The best known laws governing marine insurance is set out in the English Marine Insurance Act, 1906. In South Africa, the rules controlling insurance has always been codified in the prevailing Insurance Act. The first such Act was the Insurance Act no. 37 of 1923, which was later repealed by the Insurance Act no. 27 of 1943, which in turn was also repealed by the Short Term Insurance Act no. 53 of 1998.

Section one of the English Marine Insurance Act 1906 defines marine insurance as follows:

“A contract of marine insurance is a contract whereby the insurer undertakes to indemnify the assured, in manner and to the extent thereby agreed, against marine losses, that is to say, the losses incident to marine adventure.”

The English Marine Insurance Act 1906 expressed the fact that marine insurance business is agreed upon in a contract, which protects “the assured against losses on inland waters or on any land risk which may be incidental to any sea voyage.” Marine adventures and maritime perils are defined in the English Marine Insurance Act 1906. The English Marine Insurance Act 1906 also applied (as far as is applicable) to ships in the course of building, as well as ships being launched.

During the 1920s, insurance in South Africa and Britain was governed by the same Act. The applicable Act was The Insurance Act no. 37 of 1923.

The Insurance Act no. 37 of 1923 defines marine insurance as follows:

“Marine insurance business shall mean the issue of or the undertaking of liability under policies of insurance against loss or damage to goods, wares, merchandise or property of any kind in transit by water and land.”

The Insurance Act no. 37 of 1923 was replaced by The Insurance Act no. 27 of 1943.

The Insurance Act no. 27 of 1943 defines marine business as follows:

“**marine business**” means the business of insuring persons against—

- (a) loss of or damage to any vessel, including a barge and a dredger; or
- (b) loss of or damage to goods during their conveyance by land, air or water, and whether inclusive or exclusive of loss of or damage to such goods while they are being stored, treated or handled in connection with such conveyance or intended conveyance; or
- (c) loss of freight for any such conveyance; or
- (d) any other loss in connection with any vessel or any such goods or freight, against which an insurance may be lawfully effected:

Provided that for the purposes of this Act the expression “**marine business**” shall not include—

- (i) any transaction in connection with a policy lawfully issued before the commencement of this Act, whereby the insurer concerned insured any person against any such loss or damage as aforesaid, in connection with the conveyance of goods otherwise than by water, if the insurer is not registered under section *three* or *four* for the purpose of carrying on marine business; or

- (ii) the business of ensuring travellers against loss of or damage to their luggage if such business is carried on independently of and not in conjunction with marine business; or
- (iii) the business of insuring persons against any such loss or damage as aforesaid in connection with the conveyance of goods otherwise than by water, if the insurer concerned has, before engaging in such business, obtained from the registrar permission in writing to carry on such business as an insurance business other than marine business and the registrar has not withdrawn that permission

The Insurance Act no. 27 of 1943 was replaced by two Acts – one for short term insurance and one for long term insurance.

The Short Term Insurance Act no. 53 of 1998 defines the transportation policy as follows:

A “transportation policy” shall mean “a contract in terms of which a person, in return for a premium, undertakes to provide policy benefits if an event, contemplated in the contract as a risk relating to the possession, use or ownership of a vessel, aircraft or other craft or for the conveyance of persons or goods by air, space, land or water, or to the storage, treatment or handling of goods so conveyed or to be so conveyed, occurs; and includes a reinsurance policy in respect of such a policy.”

From the aforementioned, it is clear that the scope of cover afforded under marine insurance has broadened tremendously over the 92-year period from 1906 to 1998.

Firstly, the English Marine Insurance Act 1906 covered losses specifically related to sea voyages or adventures. The Insurance Act no. 37 of 1923 covered loss and damage to property carried over land and waters. The Insurance Act no. 27 of 1943 covered loss of or damage to the hull (vessel, barge or dredger), goods (cargo), and freight for land, sea and air voyages. The Short Term Insurance Act no. 53 of 1998 covers transportation insurance, which indemnifies the insured for risks “relating to the possession, use or

ownership of a vessel, aircraft or other craft or for the conveyance of persons or goods by air, space, land or water, or to the storage, treatment or handling of goods so conveyed or to be so conveyed, occurs; and includes a reinsurance policy in respect of such a policy”.

Over the years the definition of marine insurance was broadened because different modes of transit and different perils / risks were incorporated into the definition. Today the line of business is no longer referred to as marine insurance, but transportation insurance or in some instances marine, aviation and transportation insurance. Legislation however refers to transportation insurance.

3. Underwriting Cycles

3.1) The underwriting cycle defined

According to the Oxford Dictionary (AskOxford, 2008), a cycle is defined as follows:

1. a series of events that are regularly repeated in the same order, and
2. a complete sequence of changes associated with a recurring phenomenon such as an alternating current, wave, etc.

Just like the definition of a cycle above, the general economy displays patterns of upswing (expansion) and downswing (contraction) over time (South African Reserve Bank, 2008). All industries experience some periods of boom and some of bust. Due to the fact that insurance is a business, which operates in the general economy, cycles also occur in the insurance business (Barth and Grace, 1993). The repetitions in an insurance cycle may not be exact replicas, because like any business, insurance is unpredictable (Markham, 2006). The insurance cycle is also known as the underwriting cycle (Jones and Ren, 2006; Outreville, 1990; Wilson, 1981) and it has been defined as a “series of events occurring regularly leading back to a stationary point” (Grace and Barth, 1993).

Fitzpatrick (2004) defines the underwriting cycle as follows:

“The tendency of short-term insurance premiums, insurers’ profits the availability and quality of coverage to rise and fall with some regularity over time. A cycle can be said to begin when insurers tighten their underwriting standards and sharply raise premiums after a period of severe underwriting losses. Stricter standards and higher premium rates often bring dramatic increases in profits, attracting more capital to the industry and raising underwriting capacity. On the other hand, as insurers strive to write more premiums at higher levels of profitability (following a hard market), premium rates may be driven down and underwriting standards relaxed in the competition for new business. Profits may erode and then turn into losses if more lax underwriting standards generate mounting claims. The stage would then be set for the cycle to begin again”.

Klein (2003) states that property-casualty insurance is known to display patterns of increases and decreases in the prices and supply of coverage. Insurance professionals refer to this series of growths and declines as the “underwriting cycle”.

The underwriting cycle consist of soft and hard markets (Klein, 2003; Jones & Ren, 2006).

During soft markets, underwriters have the aim of writing more business as is reflected in “lower prices, relaxed underwriting standards and more generous coverage provisions” (Klein, 2003). According to Jones and Ren (2006), a soft market occurs when the sum of premium goals for all companies operating in a given market is greater than the amount of insurance desired by all potential insureds in that market. Leshilo (2007) and Markham (2006) refer to the soft market as the period during which premiums are low, capital base is high and competition is high.

On the other extreme is the hard insurance market where underwriters quote increased prices, are stricter with regards to underwriting standards and decreases the extent of the cover afforded under their policies (Klein, 2003). According to Jones and Ren (2006), a hard market occurs when the sum of premium goals for all companies operating in a given market is less than the amount of insurance desired by all potential insureds in that market.

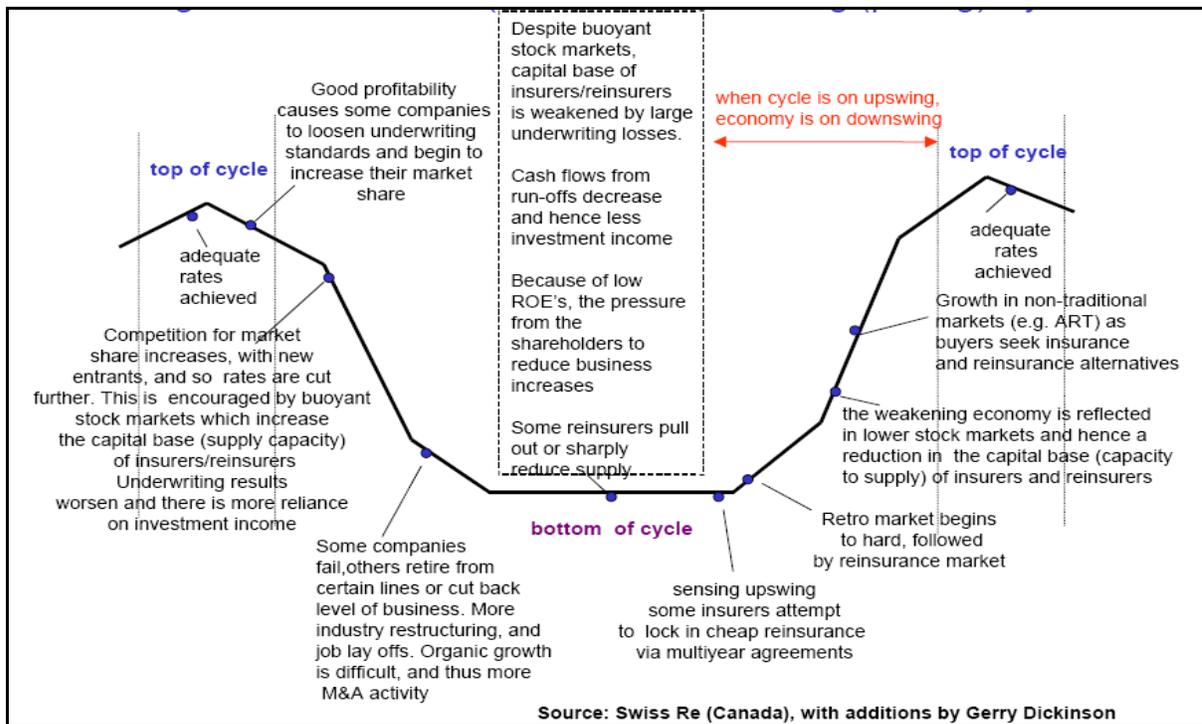


Figure 1: Stages of the short-term insurance pricing cycle
Source: Parsons (2003)

Insurance underwriting cycles consist of four different stages, each showing different movements in price, quantity and reported profits (Gron, 1994b). The phases of the insurance cycle are shown in figure 1. The first stage shows the 'soft market'. The characteristics of the soft market are described in figure 1. After the soft market phase, there is a change in the graph with an upswing. This second phase is known as the 'hard market'. The characteristics of the hard market are also described in figure 1. The hard market occurs when the economy is down (Parsons, 2003). This is why this phase is often referred to as the liability crisis. In the third phase, profitability is high but it is no longer increasing. This phase has the following characteristics: relatively low availability, high premiums and high profitability (Leshilo, 2007). In the fourth stage, profitability steadily decreases as the industry returns to low profitability. This decline in profitability is accompanied by decreasing prices and eased availability restrictions (Gron, 1994b; Leshilo, 2007).

Klein (2003) finds cycle length by measuring graphs from peak to peak. This is basically from the first top of the cycle in Figure 1 to the second top of the cycle in Figure 1.

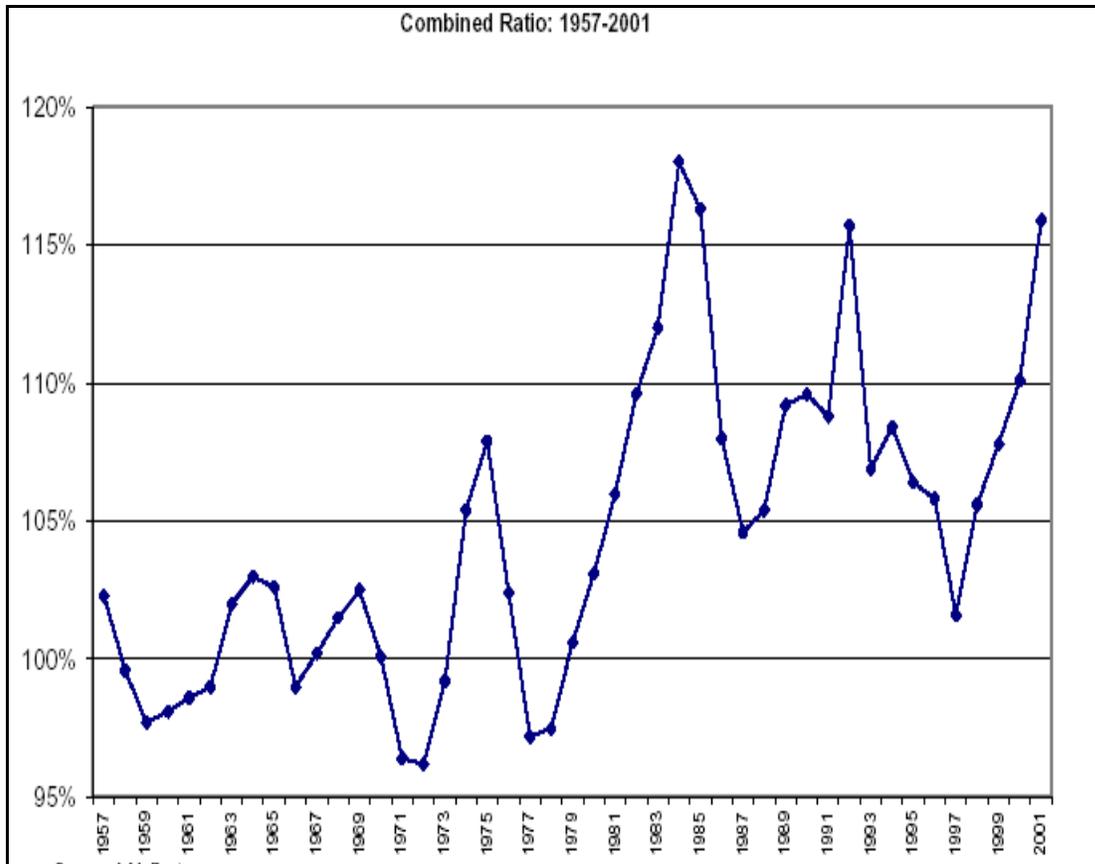


Figure 2: United States Combined Ratio: 1957-2001
Source: Klein (2003)

Klein (2003) states that there is no single measure / indicator used to show the presence of underwriting cycles in an insurance industry’s financial results. Klein (2003) goes on to say that cyclicity could be evident in the rate of premium growth or the combined ratio. Figure 2 shows the combined ratio for the US property/casualty industry for the period 1957 to 2001. When measured from peak to peak, it is clear that the US property/casualty combined ratio displays six distinct cycles for the period 1957-2001 (Klein, 2003). Figure 2 depicts a rather haphazard graph, although it does alternate upwards and downwards. The “peak to peak” test for cyclicity however holds because the graph has peaks after about every 7 years (Klein, 2003).

Research into the existence of cycles, the causes of cycles and the impact of cycles on other business practices has been conducted before (Leshilo, 2007). The cyclical periods is widely believed to last for about six years (Harrington, 2004; Venezian, 1985; Cummins and Outreville, 1987; and Doherty and Kang, 1988).

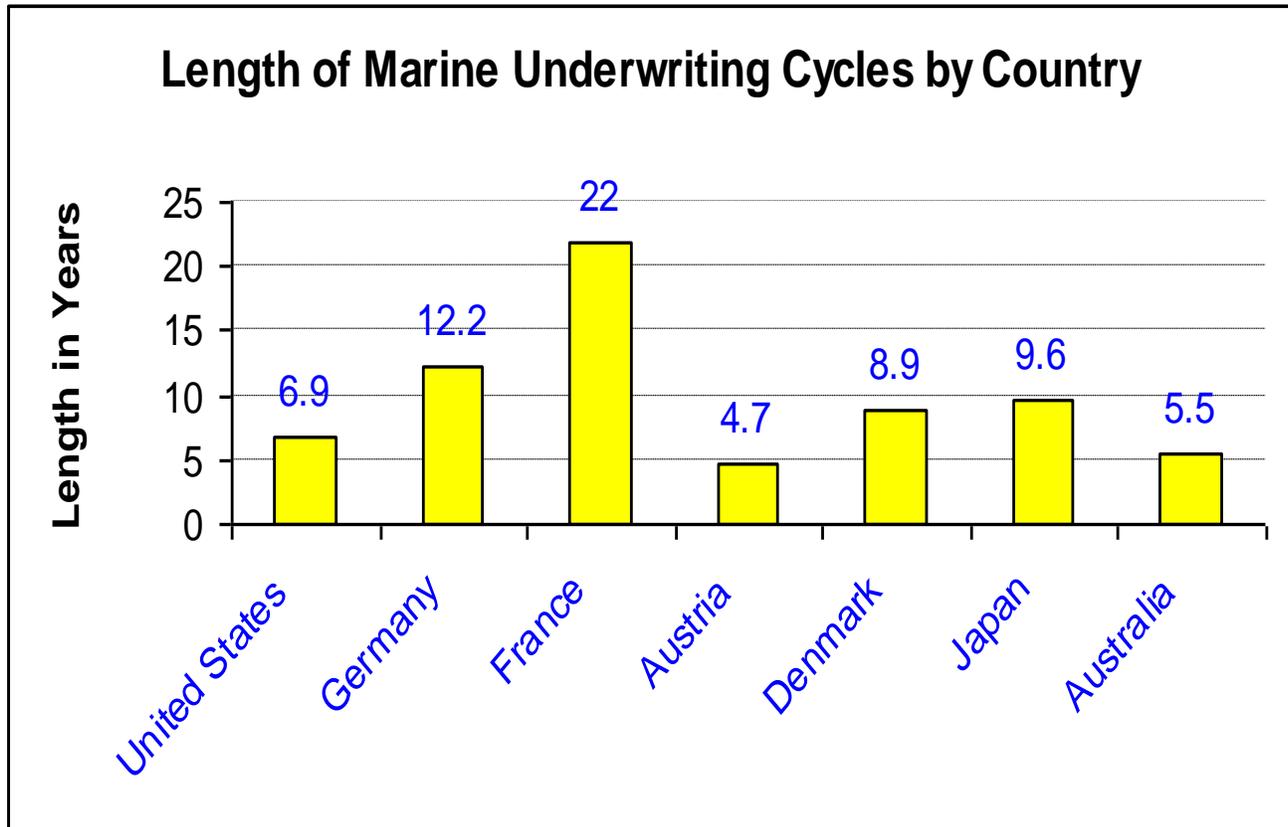


Figure 3: The length of marine underwriting cycles by country.

Source: Lamm-Tennant & Weiss, International Insurance Cycles: Rational Expectations/ Institutional Intervention (1997)

Underwriting cycles have been researched in a number of countries (Harrington, 2004; Cummins and Outreville, 1987; Lamm-Tennant & Weiss, 1997; Chen et al, 1999). Figure 3 shows marine underwriting cycles in different countries and how the underwriting cycle length varies between the countries.

What is interesting to note is that although underwriting cycle lengths differ across different countries, most of the underwriting cycles have lengths between five and seven years. This is consistent with research done by Harrington (2004); Venezian (1985); Cummins and Outreville (1987); and Doherty and Kang (1988).

3.2) Factors that influence underwriting cycles

The factors that can influence underwriting cycles have been researched by Venezian (1985); Cummins and Outreville (1987); Doherty and Kang (1988); Harrington and Danzon (1994); and Doherty and Garven (1995).

There is no general consensus regarding the causes of the underwriting cycle, but Meier and Outreville (2003) summarize the reasons into three main schools of thought, which is discussed below.

3.2.1) Disequilibrium between supply and demand:

- *Competition-driven prices*

Numerous authors are of the opinion that the underwriting cycle is mainly caused by competition on prices because of the high degree of standardization in property-liability insurance business. Insurers show irrational behavior when they try to maintain or increase their market share, whilst the degree of standardization in property-liability insurance is high. Insurers deviate from their usual pricing practices by using information on the behavior of competitors. Initially all competitors engage in excessive price competition, which is eventually followed by cutbacks in supply (Wilson, 1981; Harrington & Danzon, 1994; Meier & Outreville, 2003).

- *Capacity constraints*

Other researchers do not believe the assumption that insurers decide to decrease prices or increase rates. Further research attributes the existence of underwriting cycles to insurer capacity constraints in their ability to supply insurance at a particular time. The price of insurance not only depends on expected future losses, but also on present and past values of surplus and capital. When there are unexpected losses and surplus is reduced, insurers find it difficult to raise external capital due to the costs associated with raising new capital. So, capital shocks in effect affect the supply of insurance in the short run. (Miller & Witt, 1981; Urrutia & Witt, 1983; Harrington, 1984; Outreville, 1990; Tennyson, 1991; Meier & Outreville, 2003).

- *Naïve rate-making process*

The naïve rate-making processes which insurers use also cause insurance cycles. A strong relationship exist between premiums and lagged losses and extrapolative models tend to over or under-forecast the expected future losses. The amount of losses paid depends on the nature of the business written and ratemaking processes for long tail business tend to have significant measurement errors (Outreville, 1981; Smith, 1984; Venezian, 1985; Berger, 1988; Niehaus & Terry, 1993; Meier & Outreville, 2003).

3.2.2) External shocks:

- *Interest rates*

Interest rates could be a cause of insurance cycles because premiums are the outcome of discounted future losses and any changes in the interest rates would bring about changes in premiums. There is no proof that interest rates themselves display cycles over time but interest rate variances may create external shocks which could result in an underwriting cycle (Wilson, 1981; Doherty & Kang, 1988; Smith, 1989; Fields & Venezian, 1989; Doherty & Garven, 1992; Haley, 1993; Lamm-Tennant & Weiss, 1997; Fung et al, 1998; Meier & Outreville, 2003).

- *Regulatory and accounting lags*

Some authors contend that the underwriting cycle is caused by external factors such as data collection lags, regulatory lags and accounting rules (Cummins and Outreville, 1987; Lamm-Tennant & Weiss, 1997; Chen et al, 1999; Meier & Outreville, 2003).

- *Catastrophic losses*

Unexpected catastrophic losses in a market will lead to increases in premiums that exceed the discounted value of expected costs. Unexpected claim payments resulting from catastrophes causes capital shocks, which exhausts insurers' capital and decrease supply in the short run. If insurers struggle to raise capital at a relatively low cost, they can either face high probabilities of insolvency or reduce the amount of coverage for any given price. This situation tends to be temporary and adjustments create shocks, which could result in an underwriting cycle (Cummins et al, 1991; Harrington & Niehaus, 1999; Meier & Outreville, 2003).

3.2.3) General business influences:

- *General business cycle*

Several studies look at the relationship between the general condition of the economy and the underwriting cycle. Property-liability insurance business is linked to the performance of the national economy and may be related to changes in real prices or real GDP (Chen et al, 1999; Meier, 2001; Leng & Meier, 2002; Meier & Outreville, 2003).

- *Business practices*

Greater risk management practices would be expected to reduce the effects of shocks and the shifts in demand and supply that may cause variability in the underwriting results. Possible evolution of the regulatory environment at national or international (global) level also has an impact on business, capital requirements and pricing policies (Cummins et al, 1991; Winter, 1991).

3.3) Theories around the existence of underwriting cycles:

Empirical work from the 1990's shows that property-liability underwriting returns are cyclical. These studies provide evidence that underwriting-profit rates follow a second order autoregressive process (Chung et al, 1993). Although there are several theories explaining the existence of underwriting cycles, to date there is little agreement with respect to which theory best explains the underwriting cycle. It seems that no single theory in isolation can completely explain and account for the existence of underwriting cycles (Browne & Ju, 2007).

According to Chung et al (1993), the causes of underwriting cycles are based on the following different hypotheses:

3.3.1) the extrapolation hypothesis by Venezian (1985);

3.3.2) the rational-expectations/institutional-intervention hypothesis by Cummins and Outreville (1987);

3.3.3) the fluctuations-in-interest-rates hypothesis suggested by Doherty and Kang (1988) and Doherty and Garven (1992);

3.3.4) the capacity-constraint hypothesis by Winter (1988, 1989), Cummins and Danzon (1991) and Gron (1994a);

3.3.5) and the changes-in-expectations hypothesis by Lai and Witt (1990, 1992).

3.3.6) The Winner's Curse

3.3.1) The extrapolation hypothesis by Venezian (1985)

Venezian (1985) contends that institutional rigidities contribute to the cycle. Venezian (1985) introduced the extrapolation hypothesis when he observed that regression results derived from past losses are used to some extent by insurers and rating bureaus when current premiums are set. The basis of the extrapolation hypothesis is that current premiums or net underwriting results are determined from past premiums or underwriting results. He noted that premiums set in this way creates "a quasi-cyclical pattern" of underwriting profit margins and his empirical research support the argument that underwriting profits follow a second-order autoregressive process with cycles of approximately six-years in length (Browne & Ju, 2007). Thus, it can be said that the rational expectations framework explains premiums being forecast with lags and institutional factors because of measurement errors using past losses (Chung et al, 1993).

3.3.2) The rational-expectations/institutional-intervention hypothesis by Cummins and Outreville (1987)

The rational expectations theory is based on the hypothesis that premiums are informationally efficient predictors of future losses. Numerous financial models used in insurance pricing suggest that premiums manifest the present value of expected losses in a rational expectations context (Chung et al, 1993). It can thus be hypothesized that current premiums are informationally efficient predictors of future losses.

3.3.3) The fluctuations-in-interest-rates hypothesis suggested by Doherty and Kang (1988) and Doherty and Garven (1992)

Models and analyses in a rational expectations context asserts that premiums encompasses the present value of expected losses and other expenses (Cummins, 1991). All things being equal, a higher discount rate implies a lower premium. Smith (1989) suggested a theory similar to this, but Doherty and Kang (1988) proposed that changes in interest rates results in insurance price cycles. The theory revolves around the idea that higher interest rates results in increased investment income, and this excess investment income gives underwriters leeway to lower premiums. The opposite also holds true (Chung et al, 1993).

3.3.4) The capacity-constraint hypothesis by Winter (1988, 1989)

Winter's (1988 and 1989) capacity constraint theory is based on the assumption that external equity is more expensive than internal equity. Myers and Majluf (1984) advises that insurers will not immediately change their surpluses after it was reduced by negative outside shocks e.g. catastrophes. The quantity of insurance available to an insurer is constrained by the insurer's equity or capacity. After adverse shocks like catastrophes, the insurer's equity or capacity is greatly reduced. This explains why prices increase when the insurer's capacity or equity declines. The exact opposite occurs where the insurer has excess capacity – the supply of insurance available to the insurer exceed the amount demanded by the market, therefore prices are forced downward under competitive market conditions (Chung et. al., 1993).

3.3.5) The changes-in-expectations hypothesis by Lai and Witt (1990, 1992)

Lai and Witt (1990) constructed a pricing model under conditions of uncertainty. Their model shows that premiums are a function of variances in losses and interest rates as well as the expected value of losses and interest rates. The model suggests a positive relationship between underwriting expenses and premiums; when insurers' expectations about future underwriting expenses are high then premiums will tend to be high, all other things being equal (Fung, Lai et al, 1998).

3.3.6) The Winner's Curse

The fact that insurers cannot calculate 'cost of goods' which they sell makes insurance fundamentally different from other markets trading economic goods. Insurance is also the least understood by consumers. This 'pricing problem' guarantees that pricing volatility and periodic limitations in supply will be inevitable in the insurance market, as insurers inevitably react to unforeseen changes in the underlying liability environment that affect policies written in earlier periods, or simply to have 'guessed wrong' in their pricing in a stable liability environment (Fitzpatrick 2004).

Harrington and Danzon (1994) hypothesise that underwriters estimate and form expectations of future losses based on of public and private information available. Underwriter expectations are rational as they are correct on average. There is however some underwriters who, in any given period, estimate too low. Then there are others who estimate too high. Thus in a competitive market, the 'winning' insurers who estimated too low will gain more market share at the expense of the insurers who estimated too high, but the 'winning' insurers will sustain excessive underwriting losses and fail to earn a fair return on equity. This is what is referred to as the 'winner's curse' (Klein 2003).

Harrington and Danzon (1994) assume that some insurers' engage in disproportionate risk taking such as 'go for broke' behaviour. They (Harrington and Danzon, 1994) hypothesize that insurers with low levels of capital are more likely to partake in excessive risk taking. Established, well-operating insurers with sufficient capital may decide to cut prices below optimal levels in order to retain their market share and compete with insurers who set their prices too low due to lack of experience or intentional risk taking. This may lead to increased pricing errors and contribute to the price/availability crises.

The economic theory known as the Winner's Curse hypothesize that the winner in an auction usually pays too much for the auctioned item(s). When this theory is applied to insurance, it is observed that the 'winner' will charge too little to win a client. This is evident in the insurance market - particularly in 'long tailed' lines of business – is particularly fertile ground for the instances of the Winner's Curse (Fitzpatrick 2004).

The presence of adverse selection and information asymmetries will exacerbate the 'winner's curse'. For example, an insurer who wins a high market share by offering low premiums may find itself with a 'winner's curse'; its success in attracting buyers means that the insurer was overly optimistic about the prospect of losses. When this is recognized, the insurer will try to rectify the problem by cutting back on the amount of insurance offered (Winter 1991).

Fitzpatrick (2004) defines the 'Winner's Curse' as insurers who repeatedly rob "the Peter of the present risk pool, to pay the Paul of some prior year's pool, whose premiums turned out to be insufficient to fund its liabilities".

4. South African Marine Insurance Market

According to Renasa (2008), the current South African marine market consists mainly of cargo, goods in transit and hull albeit limited to small crafts and small yachts as any other hull covers are extremely specialized and usually placed in markets with more capacity and expertise.

The South African primary marine insurance market consists of buyers and sellers of marine insurance covers.

Buyers include, but are not limited to, small craft owners, fishing vessel owners, importers, exporters, manufacturers that transport goods locally, local and foreign buyers of cargo. The assured / buyer pays premiums to the insurer, who provides cover i.e. the right to claim should losses or damages occur as a result of a risk covered under the particular policy (King, 2008).

The South African market consists of several insurance brokers that act as agent in the transaction between buyers and sellers of marine insurance. The broker is the intermediary between the assured and the underwriter. The marine insurance broker has expertise in his field and assists his clients to obtain enough of the correct cover at a reasonable price (King, 2008).

According to Renasa (2008), sellers in the marine market include marine departments of the large insurers, underwriting management agencies and brokers who either specialize in transit only or who might offer most marine classes. King (2008) states that all marine underwriters in South Africa belong to a body called the Association of Marine Underwriters in South Africa (AMUSA). This association standardizes technical issues in the South African marine insurance market (King, 2008).

Marine insurance is usually placed with local underwriters, but there are circumstances where the risk may be placed outside of South Africa e.g. where the capacity is too large for local underwriters – as is mostly the case with large hull and liability cover (King, 2008).

5. Empirical Analysis on the South African Marine Insurance Data

5.1) Data and Period:

The data that was used to test for the presence of underwriting cycles in the South African primary marine insurance market was extracted from various annual South African insurance reports¹.

Reports prior to 1999 show Marine Insurance data but those reports after 1999 display data for Transportation Insurance – this is a direct result of the change in insurance legislation – the introduction of the Short Term Insurance Act no. 53 of 1998 which expressly refers to Transportation Insurance (see section 2.2 above).

Data used relates to the periods 1925 to 2006.

It should be noted that data from 1925 to 1960 was expressed as Pounds – data for the period 1961 to date are recorded in South African Rands. Due to the fact that ratios were used to test for the presence of insurance cycles, this has no relevance.

¹ Sources: 1925-1940: Summaries of returns deposited with the Treasury by Insurance Companies.
 1944-1997: Annual Reports of the Registrar of Insurance
 1998-2006: Annual Reports of the Registrar of Short Term Insurance

Data was extrapolated for 1985 and 1986 as no data was available.

No data is available for the period 1940 to 1943.

Ratios were calculated using annual written premiums, annual claims incurred, annual commissions, and annual management expenses.

The annual written premium is recorded as “Premiums received and Outstanding” in certain annual reports (1961 to 1989 reports).

When the annual claims incurred data was recorded for certain years, the following formula was used:

Claims incurred = Claims provision at end of financial year + Claims paid - Claims provision at beginning of financial year.

5.2) Data Analysis

According to Klein (2003), various ratios can be used to establish if underwriting cycles are present in a specific line of business / market segment or an entire market. In this research report, the loss ratio, the combined ratio and the underwriting profit/loss as a percentage of net written premiums are interpreted.

5.2.1) The loss ratio:

The loss ratio is the ratio of losses to premiums in percentage terms (Nathanson, 2004). Berger et al (1992) expresses the loss ratio as losses incurred divided by written premium.

$$\text{Loss ratio} = \frac{\text{Incurred Claims}}{\text{Net Written Premiums}} \times 100\%$$

A loss ratio equal to 100% means that for every one rand spent on losses/claims, one rand was written in terms of premium income.

If the incurred claims exceed the net written premiums, then the loss ratio will exceed 100%. This indicates an underwriting loss (Dismukes et al, 2006).

A loss ratio below 100% means that the net written premiums exceed the incurred claims. This indicates an underwriting profit (Dismukes et al, 2006).

Data for the periods 1925 to 1940, and 1952 to 1960 was recorded as “premiums after deduction of commission, returns, brokerage, and discount”; “claims paid and outstanding” (which is incurred claims); and “expenses of management. The loss ratio cannot be calculated because premium data includes the aforementioned deductions. Loss ratios were calculated and graphed for the periods 1944 to 1951; and 1961 to 2006.

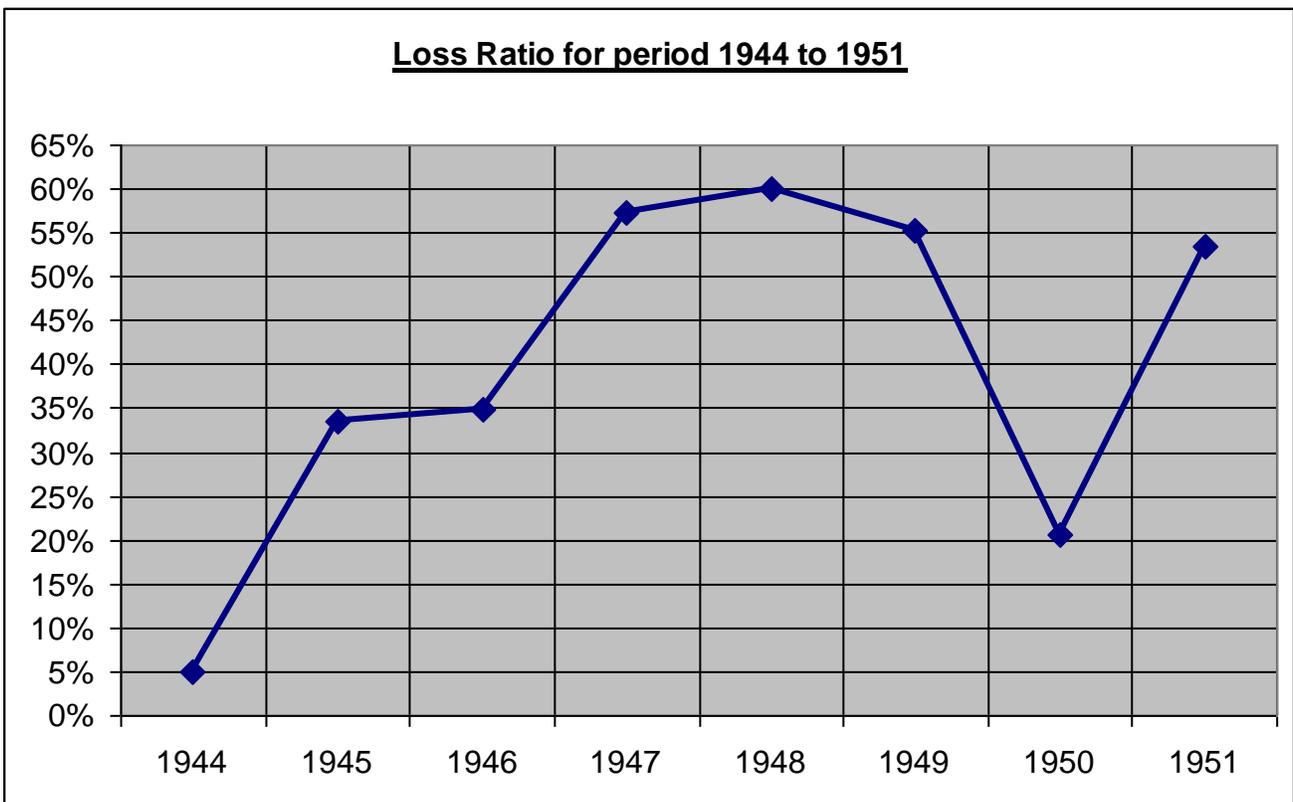


Figure 4: SA primary marine insurance market loss ratio: 1944-1951

Figure 4 shows the loss ratio is well below 100% over the period 1944 to 1951. This means that the marine insurance market made underwriting profits over this period i.e. the net written premiums exceeded the incurred claims.

There is evidence of an underwriting cycle present in the primary marine insurance market for the period 1944 to 1951. The period 1940 to 1943, had no data due to World War two. There is a definite cycle from about 1944 through to 1950. This cycle has a length of six years.

In order to get a clearer view of the cyclicity in the loss ratios, the three-year and five-year smoothed loss ratio graphs are interpreted.

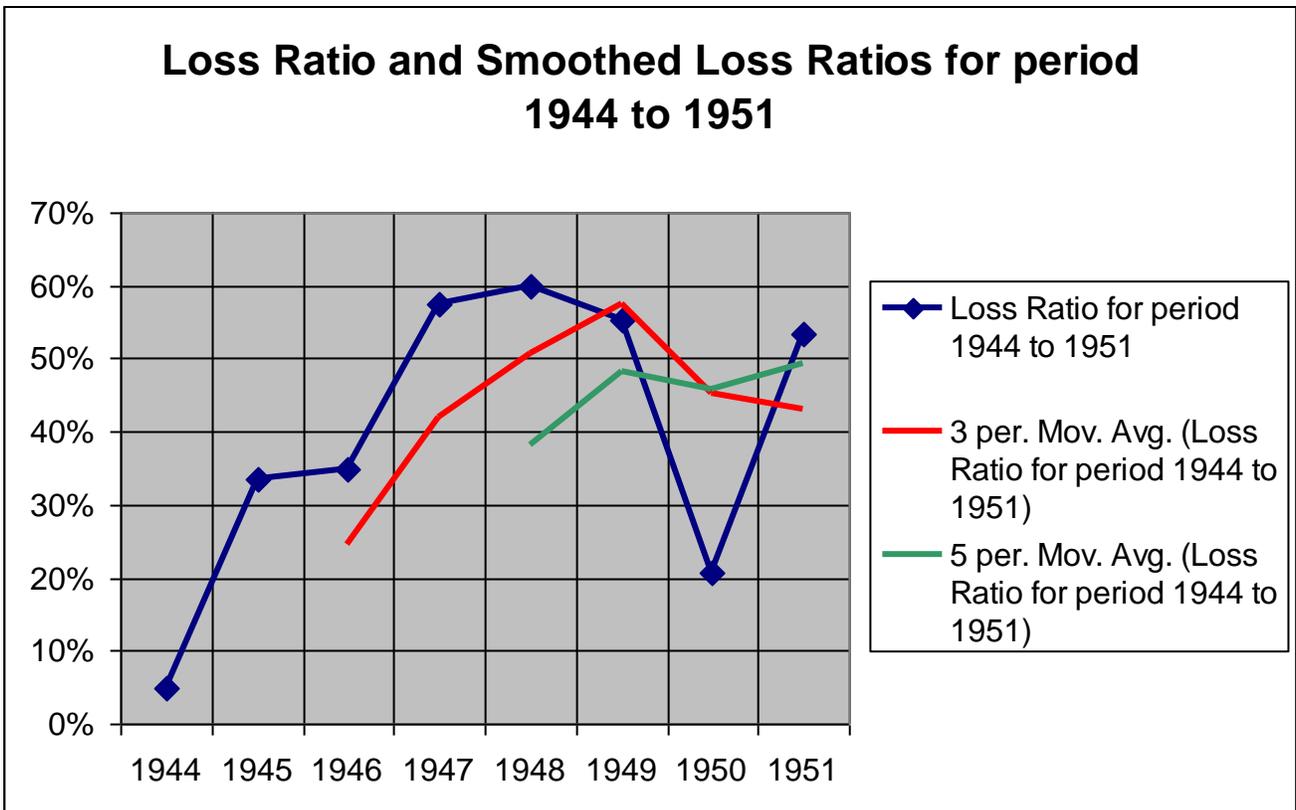


Figure 5: SA primary marine insurance market loss ratio, 3 year smoothed loss ratio and 5 year smoothed loss ratio: 1944-1951

In figure 5, the three-year smoothed loss ratio graph definitely shows cyclicity between 1946 and 1951.

The five-year smoothed loss ratio is not spread over a sufficient period to be analysed.

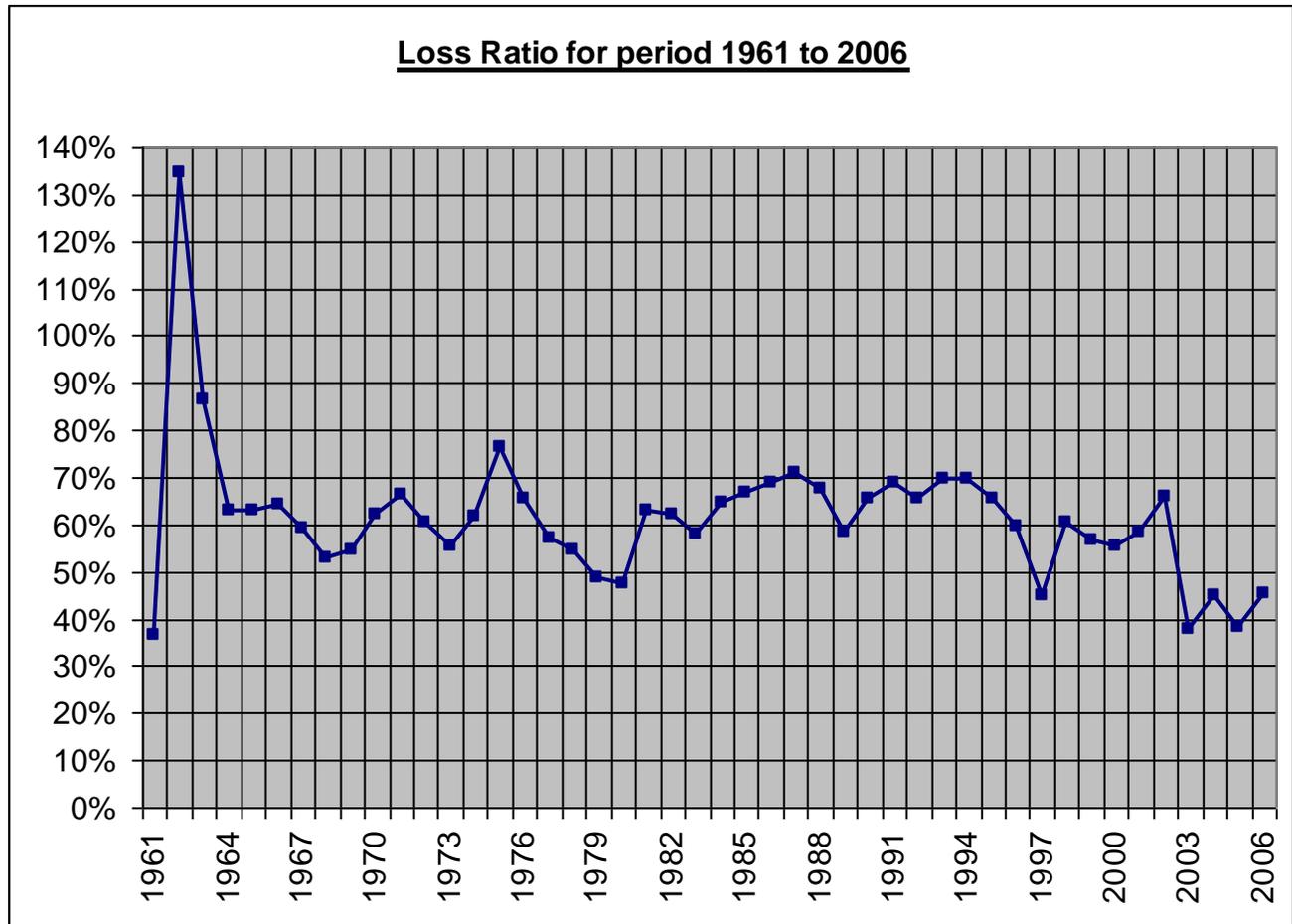


Figure 6: SA primary marine insurance market loss ratio: 1961-2006

As seen in figure 6, the loss ratio falls mostly between 30% and 100 % for the period 1961 to 2006. Only 1962 has a loss ratios in excess of 100%. This loss ratio could be attributed to a large amount of smaller losses / claims from fishing vessels and/or freighters carrying cargo insured in the South African primary marine insurance market. Extremely large losses would not affect the loss ratios of primary insurers, because reinsurers would respond to these larger losses (Liebenberg, 2008). Appendix 1 and appendix 2 show various freighter and fishing vessel casualties for the period 1956 to 1962. Due to the fact that there was not a marked increase in losses during 1962 (Appendices 1 and 2), one can only assume that the magnitude of losses rose substantially.

Figure 6 was used to test for the presence of underwriting cycles in the loss ratio over the period 1961 to 2006. Figure 6 shows that there are several underwriting cycles present in the loss ratio data.

Cycles that goes up first and then comes down (upswing/downswing cycles), occur over the following periods 1968 to 1973; 1973 to 1980; 1983 to 1989; and 1989 to 1997 would have been an underwriting cycle had it not been for a slight decrease in 1992.

Cycles that goes down first and then up (downswing/upswing cycles), occur over the following periods 1966 to 1971; 1975 to 1981; 1981 to 1987; 1987 to 1991 and 1994 to 1998.

See appendix 3 for the loss ratio underwriting cycle lengths.

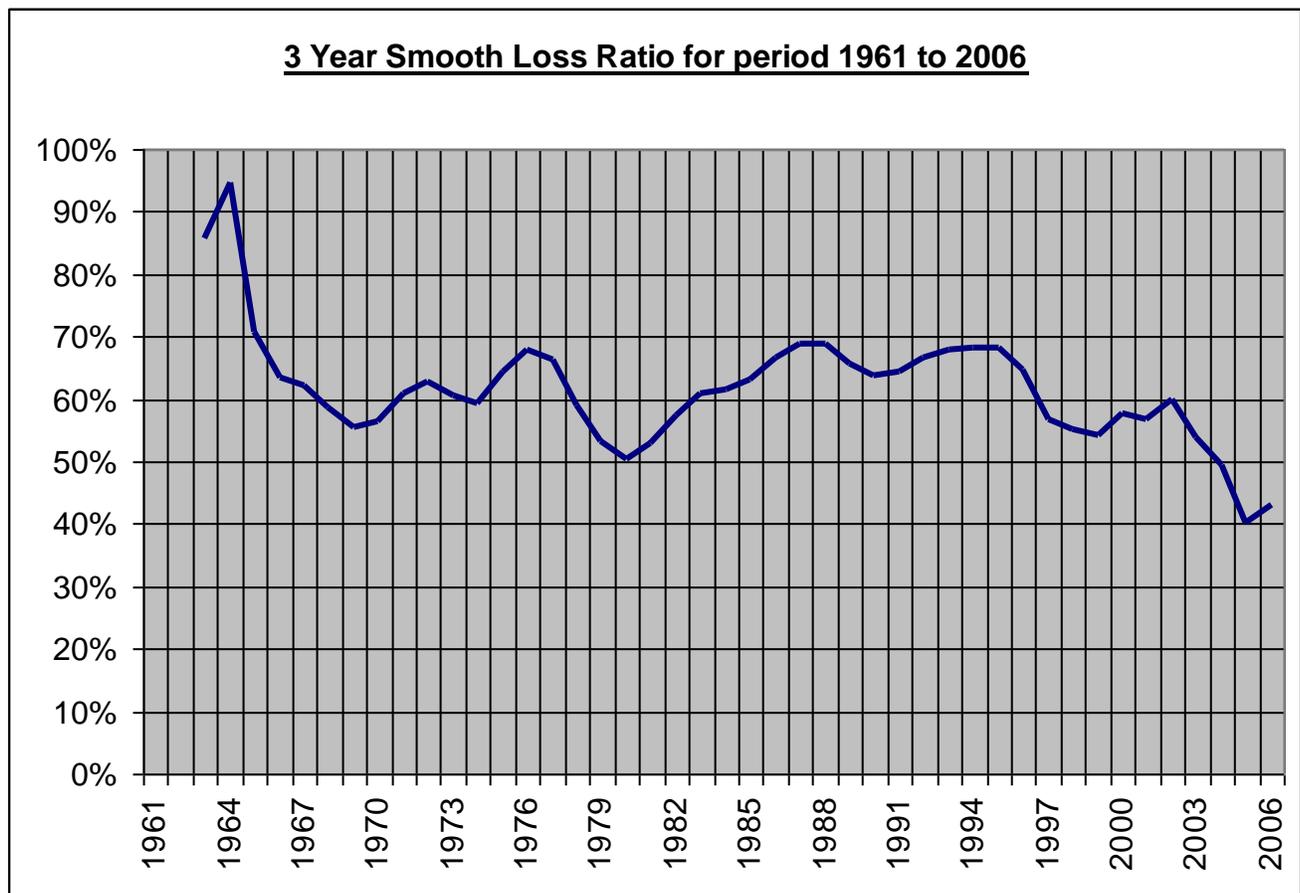


Figure 7: SA primary marine insurance market 3 year smoothed loss ratio: 1961-2006

Figure 7 shows cyclicity over the following periods: 1969 – 1974; 1974 – 1980; 1983 – 1990; 1990 – 1997; and 1999 – 2005. There are at least five cycles present in this graph, with an average length of about 6 years.

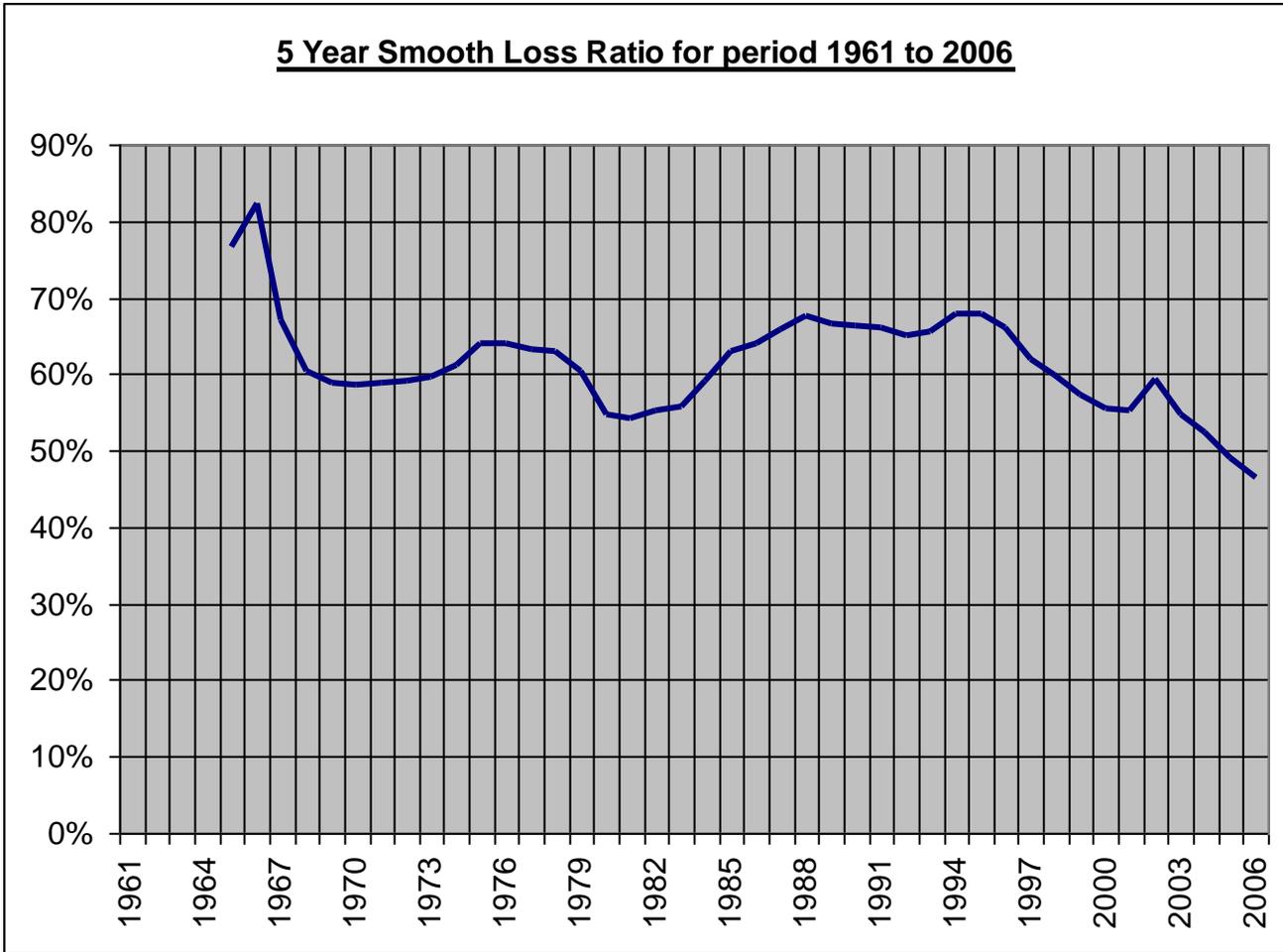


Figure 8: SA primary marine insurance market 5 year smoothed loss ratio: 1961-2006

Figure 8, the five-year smoothed loss ratio graph, shows cycles over the following periods: 1966-1975, 1973-1980, 1978-1985, 1985-1992, 1988-1994 and what can be interpreted as a cycle from about 1991 to about 1997.

5.2.2) The combined ratio:

Profitability in the insurance industry is measured using the combined ratio. The combined ratio represents the percentage of each rand collected (as premium) spent on claims, legal expenses, and underwriting costs (Nathanson, 2004). The combined ratio is a combination of two ratios, the loss ratio (as described above), and the expense ratio (including commission), which is underwriting costs as a percentage of premium (Nathanson, 2004).

From Nathanson (2004), we get the following two equations:

$$\text{Combined Ratio} = \text{Loss Ratio} + \text{Expense Ratio}$$

$$\text{Combined Ratio} = \frac{\text{Incurred Claims}}{\text{Net Written Premium}} + \text{Expense Ratio}$$

For this dissertation, the combined ratio is calculated as the total sum of incurred claims, commissions and management expenses, expressed as a percentage of earned premiums. The combined ratio is calculated using the following formula:

$$\text{Combined ratio} = \frac{\text{Incurred claims} + \text{Commissions} + \text{Management expenses}}{\text{Written premiums}}$$

In the absence of investment income, the combined ratio is a measure of profitability or loss (Nathanson, 2004).

A combined ratio of 100% is seen as a “break-even” point for underwriters or in this case, the entire primary marine insurance market (Nathanson, 2004; Berger et al, 1992). A combined ratio below 100% means that the underwriter(s) are writing business at profitable levels. This indicates a net profit in a company or line of business (Nathanson, 2004).

A combined ratio above 100% shows that underwriters are writing business that cannot reasonably cover claims, commissions and management expenses. So where the combined ratio exceeds 100%, the business is being written at unprofitable levels. Combined ratios above 100% indicate net losses (Nathanson, 2004).

Data for the periods 1925 to 1940, and 1952 to 1960 was recorded as “premiums after deduction of commission, returns, brokerage, and discount”; “claims paid and outstanding” (which is incurred claims); and “expenses of management. The combined ratio can be calculated for these periods.

Combined ratio data is available from 1961 onwards because reports from 1961 onwards display all the necessary figures required to calculate the combined ratio.

SA Primary Marine Insurance Combined Ratio 1925 to 1940

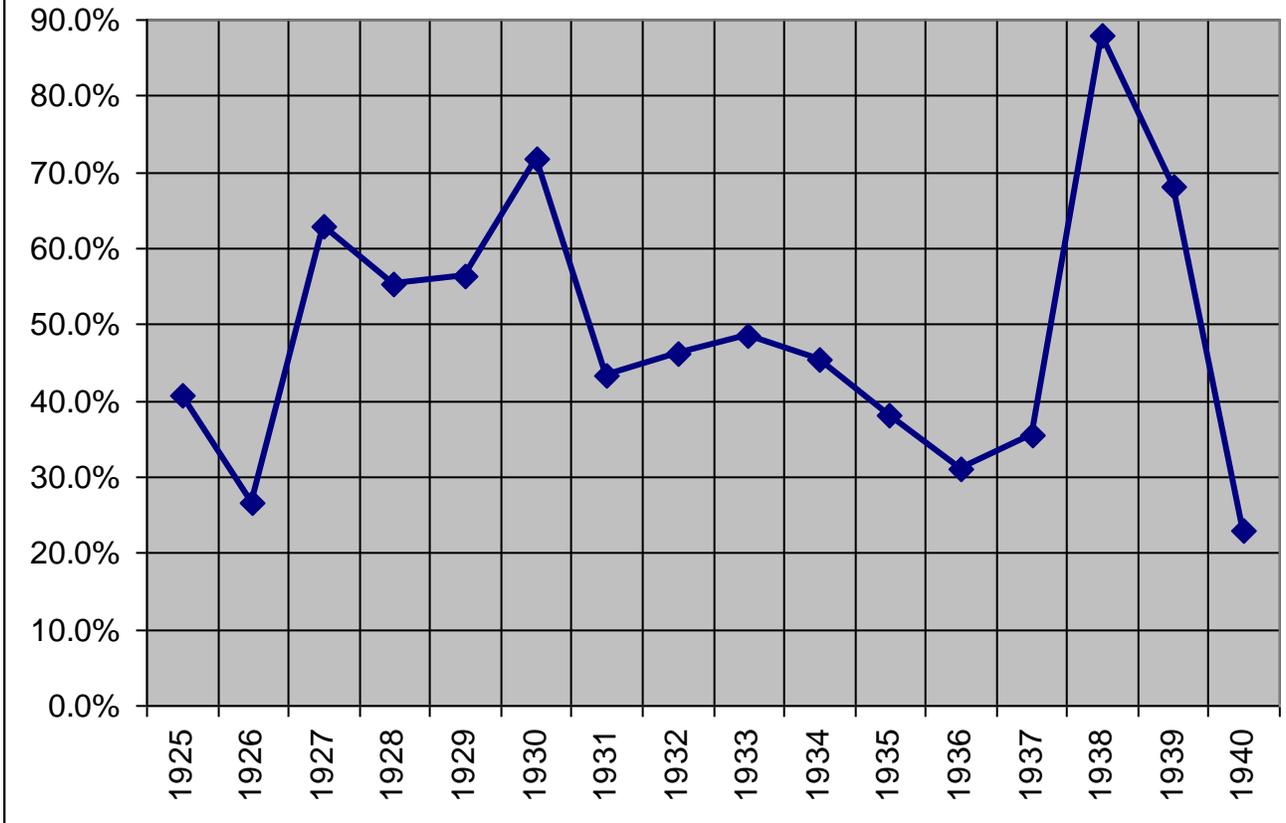


Figure 9: SA primary marine insurance market combined ratio: 1925-1940

Figure 9 shows the combined ratio for the period 1925 to 1940. Figure 9 shows that the combined ratio was below 100% for the period 1925 to 1940. This indicates that the primary marine insurance market was making net profits for the fifteen-year period.

Figure 9 seems to show an upswing/downswing cycle between 1931 and 1936, and a downswing/upswing cycle between 1933 and 1938. In order to see the true cyclical impact, the combined ratio was graphed between 1930 and 1938 - see figure 10.

SA Primary Marine Insurance Combined Ratio 1930 to 1938

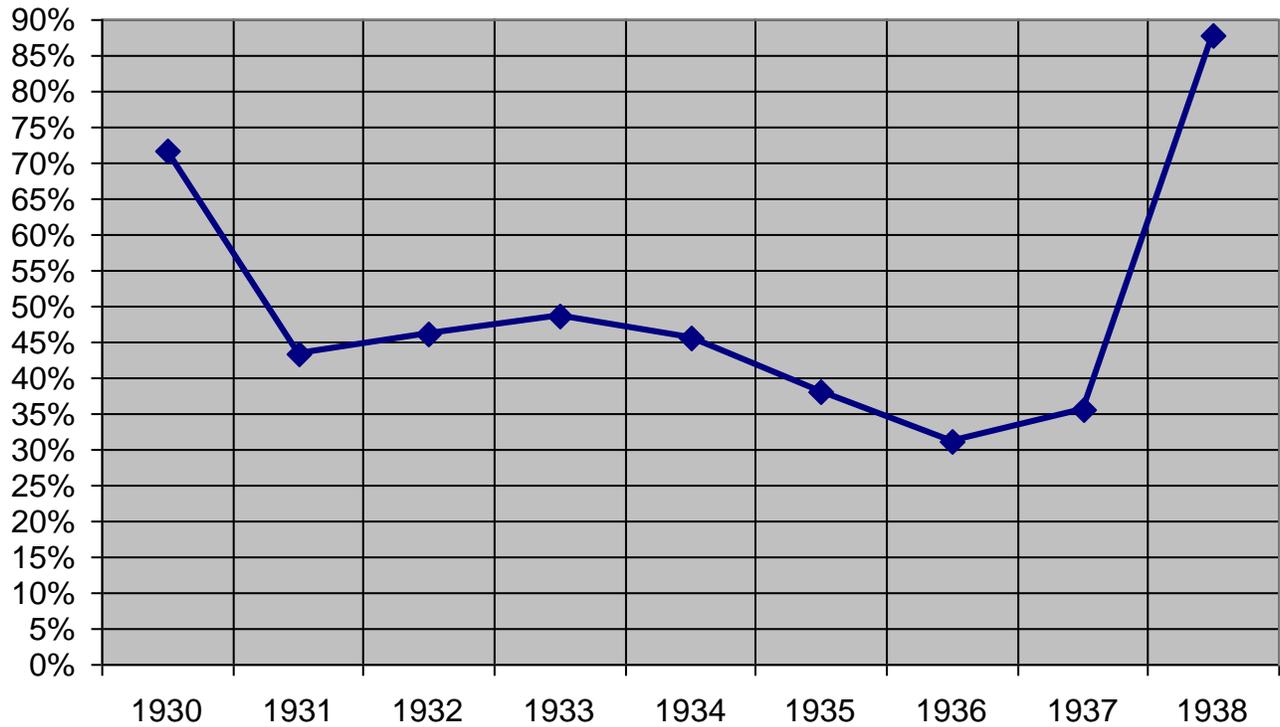


Figure 10: SA primary marine insurance market combined ratio: 1930-1938

Figure 10 shows that there is a cycle from 1931 to 1936. The cycle length over this period is five years, which is in line with previous research (Harrington, 2004; Venezian, 1985; Cummins and Outreville, 1987; and Doherty and Kang, 1988).

**SA Primary Marine Insurance 3 year & 5 year
Smoothed Combined Ratios 1925 to 1940**

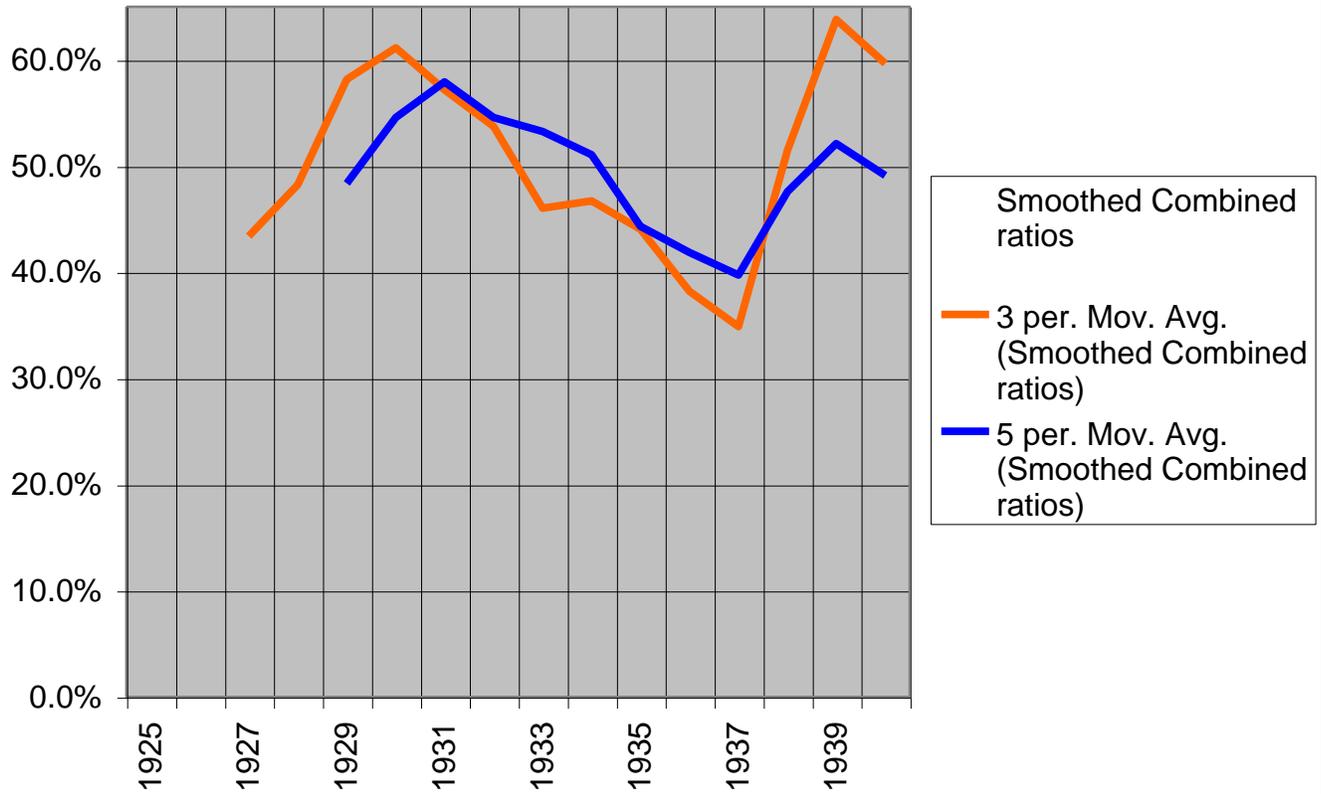


Figure 11: SA primary marine insurance market 3 year and 5 year smoothed combined ratios: 1925-1940

Figure 11 shows cyclical patterns in the three-year and five year smoothed combined ratios. The three-year smoothed combined ratio shows cycles from 1927 to about 1933 and from about 1934 to 1939. The five-year smoothed combined ratio shows cycles from 1929 to about 1934 and from 1934 to about 1939. These cycles are about 5 years in length, which is in line with previous research (Harrington, 2004; Venezian, 1985; Cummins and Outreville, 1987; and Doherty and Kang, 1988).

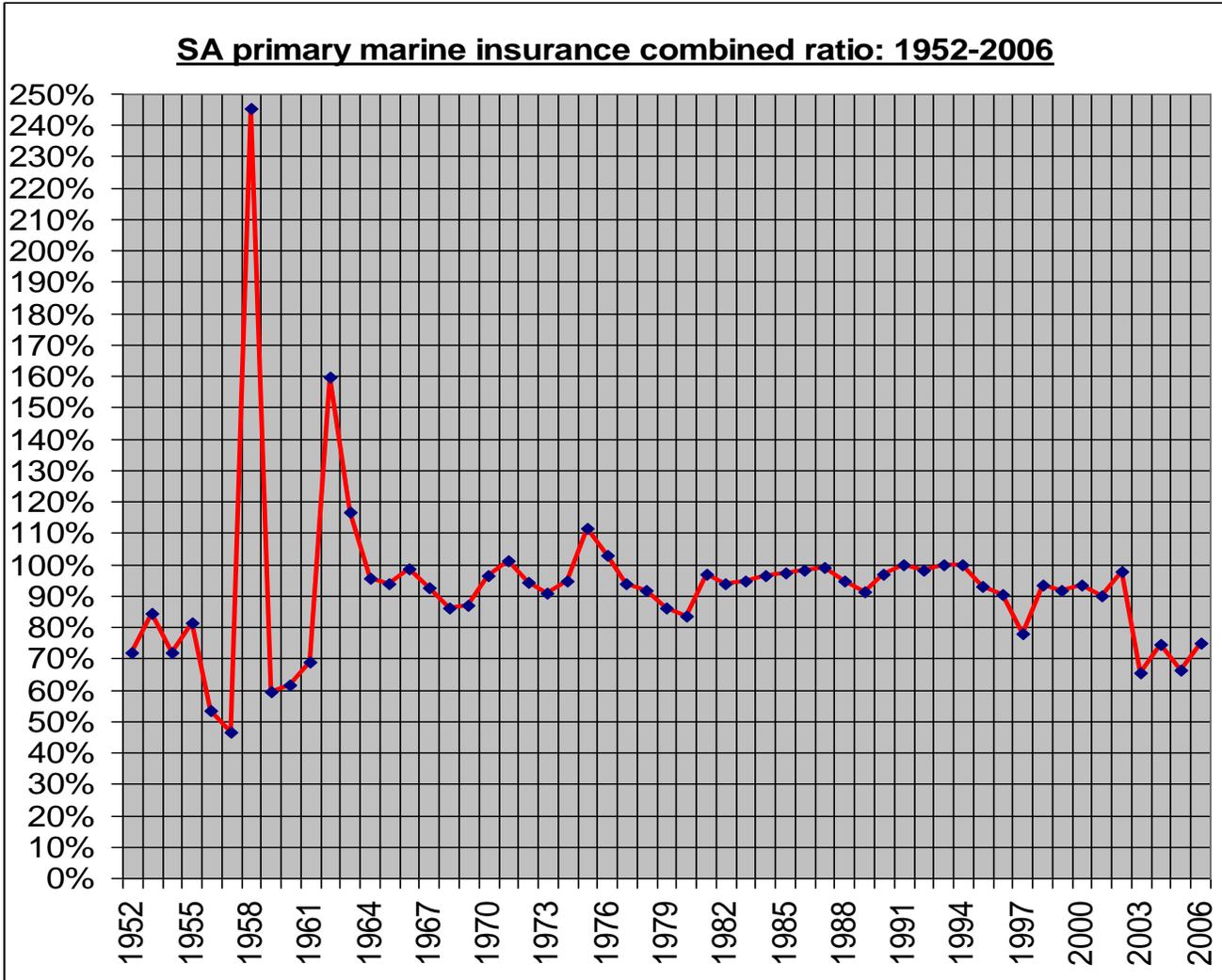


Figure 12: SA primary marine insurance market combined ratio: 1952-2006

Figure 12 show that the combined ratio exceeds 100% on six occasions – 1958, 1962, 1963, 1971, 1975 & 1976. This is a rather good record considering that there were six unprofitable years over the periods 1925 to 1940 and 1952 to 2006 – a period of sixty nine years. The combined ratio is very close to 100% for several years, including but not limited to 1966, 1970, 1986, 1987, 1991, 1992, 1993, 1994 and 2002. For the years where the combined ratio is so closely below 100%, the market is making profits, albeit rather small.

Table 1: Table showing profits/losses for the period 1956-2006

Year	Underwriting profit/loss
1956	£80,765
1957	£189,623
1958	-£1,136,467
1959	£51,015
1960	£37,158

Year	Underwriting profit/loss
1961	R 206,927.00
1962	R -505,000.00
1963	R -141,000.00
1964	R 47,000.00
1965	R 102,000.00
1966	R 43,000.00
1967	R 370,000.00
1968	R 790,000.00
1969	R 1,078,000.00
1970	R 361,000.00
1971	R -145,000.00
1972	R 761,000.00
1973	R 1,338,000.00
1974	R 1,071,000.00
1975	R -2,655,000.00
1976	R -705,000.00
1977	R 1,671,000.00
1978	R 2,355,000.00
1979	R 4,356,000.00

Year	Underwriting profit/loss
1980	R 6,023,000.00
1981	R 1,534,000.00
1982	R 2,915,000.00
1983	R 2,418,000.00
1984	R 2,221,000.00
1985	R 1,740,333.33
1986	R 1,259,666.67
1987	R 779,000.00
1988	R 4,693,000.00
1989	R 9,975,000.00
1990	R 4,035,000.00
1991	R 259,000.00
1992	R 3,019,000.00
1993	R 297,000.00
1994	R 279,000.00
1995	R 20,784,000.00
1996	R 29,980,000.00
1997	R 78,146,000.00
1998	R 27,725,000.00
1999	R 27,903,000.00
2000	R 28,340,000.00
2001	R 44,446,000.00
2002	R 11,505,000.00
2003	R 220,621,000.00
2004	R 166,388,000.00
2005	R 266,022,000.00
2006	R 216,401,000.00

According to Nathanson (2004), combined ratios above 100% show that business is written at unprofitable levels. Comparing table 1 and figure 12, it is evident that the periods with underwriting losses are the same as the periods with combined ratios above 100%.

SA primary marine insurance market combined
ratio: 1952-1966

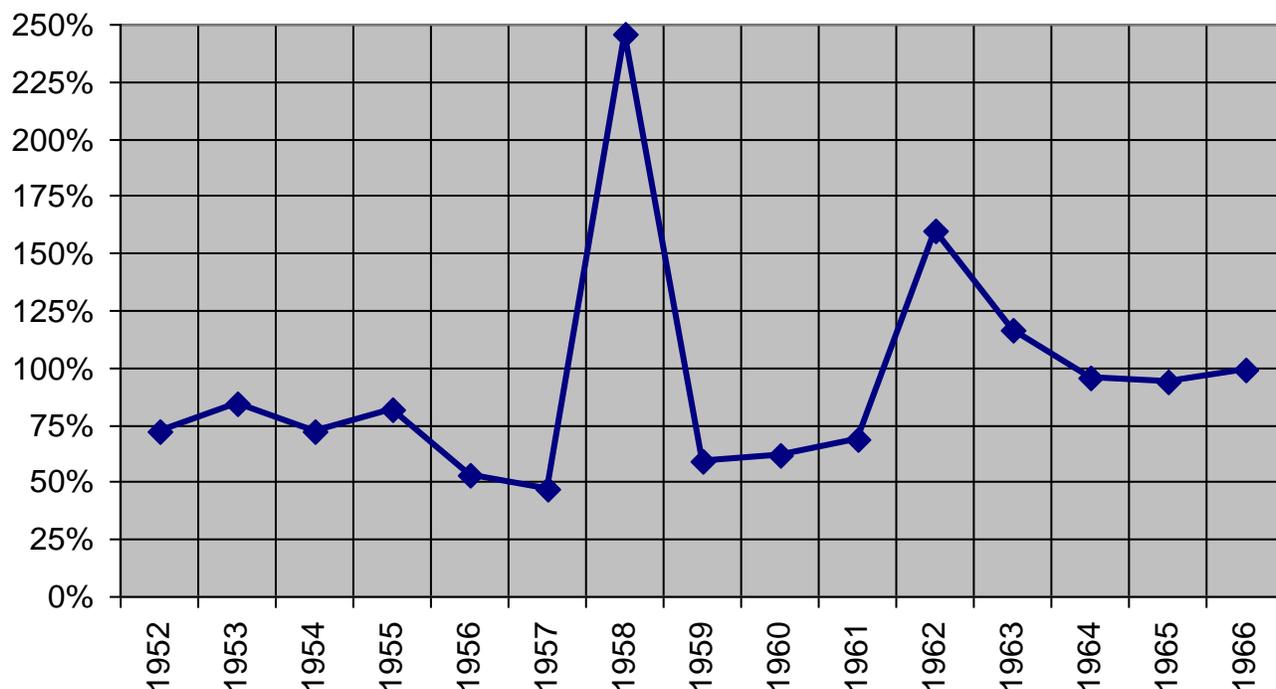


Figure 13: SA Primary Marine Insurance Market combined ratio: 1952-1966

From figure 13 it is evident that the primary marine insurance market displays a downward/upward cycle from 1958 to 1962.

Table 1 shows that 1958 had an underwriting loss of £1,136,467. This large loss is largely due to incurred claims amounting to £1,742,714. From table 1, it is seen that 1962 and 1963 also had underwriting losses. Figure 13 shows that the combined ratio is above 100% for the years 1958, 1962 and 1963. This is in line with Nathanson (2004) who believes that the commission will be above 100% when business is written at unprofitable levels. Appendix 1 and appendix 2 show various freighter and fishing vessel casualties for the years 1958, 1962 and 1963. Cargo on some of these vessels and smaller fishing vessels which suffered casualties may have been insured in the local market, meaning that these losses contributed to the combined ratio exceeding 100% as depicted in figure 13.

SA primary marine insurance combined ratio: 1961-2006

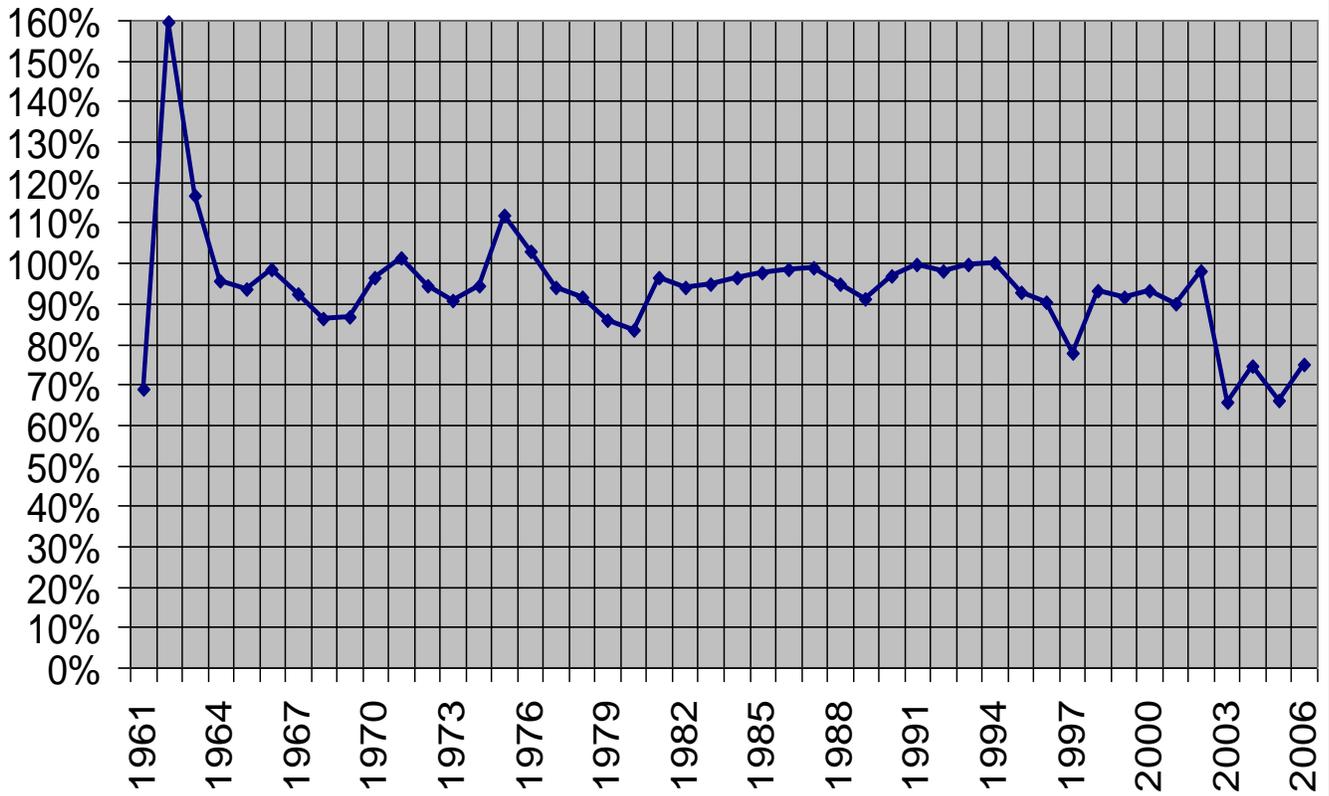


Figure 14: SA primary marine insurance combined ratio: 1961-2006

Figure 14 shows upswing/downswing cycles over the following periods:

1968-1973, 1973-1980, 1982-1989, and signs of cyclicity for the period 1989-1997.

Figure 14 shows downswing/upswing cycles over the following periods:

1966-1971, 1971-1975, 1975-1981, 1987-1991 and 1994-1998.

SA primary marine market: Underwriting Profit as a percentage of Net Written Premium

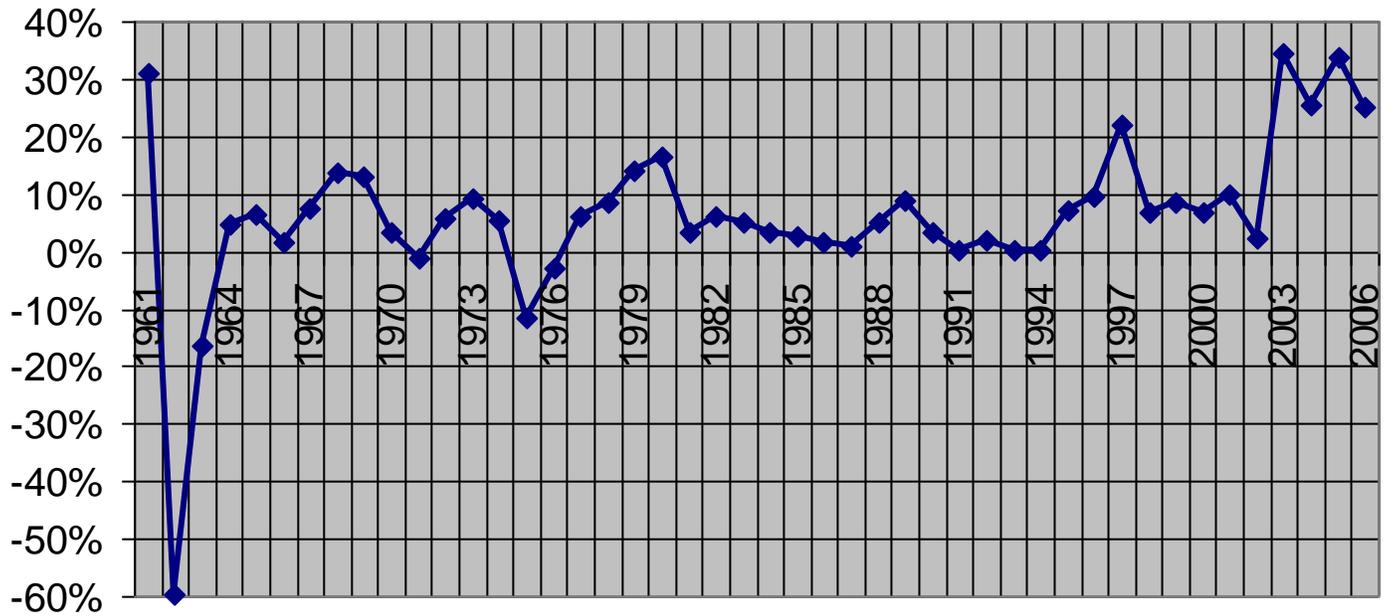


Figure 15: Underwriting Profit as a Percentage of Net Written Premiums: 1961 - 2006

Figure 15 graphs the underwriting profit as a percentage of net written premiums for the period 1961 to 2006. This ratio is often referred to as the “underwriting profit ratio”.

Underwriting profit is calculated as follows: net written premium – incurred claims – commission – management expenses.

According to GIS (2008) the underwriting profit ratio is the complement of the combined ratio. This graph (figure 15) is the inverse of the combined ratio graph (figure 14) because the sum of the underwriting profit ratio and the combined ratio is 100%. As discussed under the combined ratio graph, underwriting losses were achieved for 5 years (during 1962, 1963, 1971, 1975, and 1976). By looking at figure 15, these 5 years all fall below the 0% line, indicating underwriting losses.

Figure 15 depicts several cycles, which will be the same as the cycles of the combined ratio, because these two ratios are inverses of each other. Refer to appendix 4 for cycle lengths and periods. The only difference between the two ratios is that the upswing/downswing and downswing/upswing phases will interchange.

In figure 15, 1962 to 1964 sees an increase in the underwriting profit ratio. This could be attributed to the decrease in losses / the loss ratio over the same period (see figure 6).

In figure 15, 1994 to 1997 sees an increase in the underwriting profit ratio. This could be due to South Africa's re-admittance into the global economy, which directly increased importing and exporting activity (Renasa, 2008).

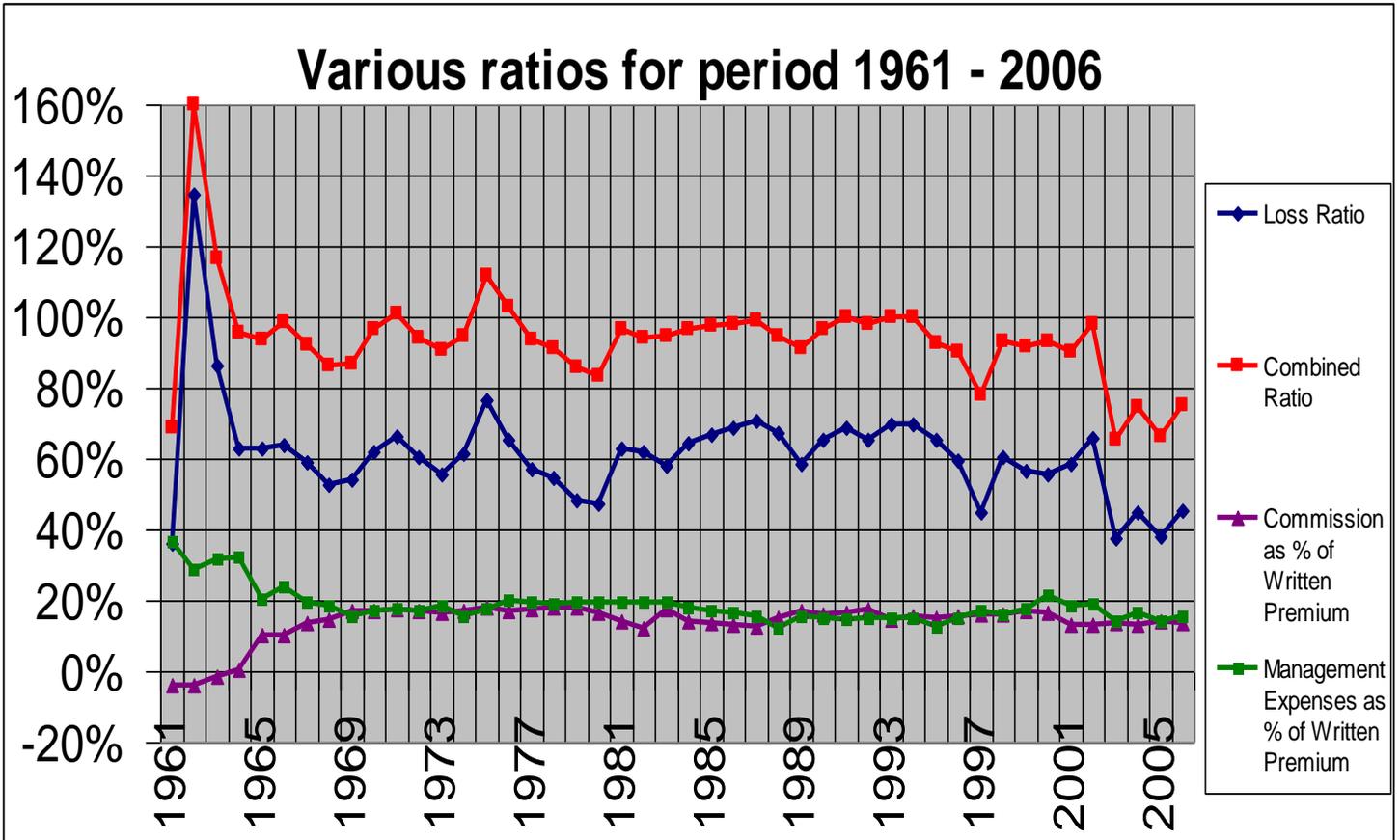


Figure 16: Comparison of various ratios: 1961-2006

Figure 16 graphs the combined ratio, loss ratio, commission as a percentage of written premiums, and management expenses as a percentage of written premiums.

The sum of the loss ratio, commission as a percentage of written premiums, and management expenses as a percentage of written premiums is the combined ratio.

From figure 16, it is clear that the loss ratio graph and the combined ratio graph follow very similar patterns. This is inevitable unless the commissions and expenses vary a lot.

What is also striking is that for the five unprofitable years (1962, 1963, 1971, 1975 and 1976) the loss ratio is also high. It is clear that whatever losses caused the high loss ratios also caused the high combined ratios.

The commission as a percentage of written premium is below zero in the earlier years. This is so because the primary marine insurers made losses on commission i.e. the commissions paid over to brokers exceeded commissions received from reinsurers (Liebenberg, 2008).

Although commission as a percentage of written premiums, and management expenses as a percentage of written premiums contribute to the combined ratio, the contribution is rather small when compared to the loss ratio's contribution – especially when the contributions of the two ratios are added together where it averages about 30%.

The loss ratio graph and the combined ratio graph show the same cycles i.e. cycles mentioned above in the interpretation of the combined ratio. This is consistent with Klein (2003), because Klein (2003) states that several ratios can be used to find cycles.

6. Conclusion

The purpose of this study is to establish whether or not any underwriting cycles are present within the South African primary marine insurance market for the period 1925 to 2006. By interpreting loss ratios, combined ratios, and underwriting ratios, it is concluded that underwriting cycles do exist in this market for the period 1925 to 2006.

The lengths of marine underwriting cycles in the South African primary insurance market are documented in appendix 3 and 4. The cycle lengths are not consistent with most literature, but certain authors prove that cycles have different lengths (Lamm-Tennant & Weiss, 1997, and Meier & Outreville, 2006).

7. Future Research

This thesis only demonstrates the existence of underwriting cycles in the primary marine insurance market.

There is thus potential for future research, in line with this thesis, to be conducted.

The various causes of underwriting cycles can be applied to the cycles identified in this thesis, and the relationships can be analyzed.

The nature of the underwriting cycles identified in this thesis can be analyzed.

The presence of underwriting cycles within the secondary marine insurance market, that is the reinsurance market, should be investigated.

Various investigations can also be conducted on marine reinsurance data.

Further research can be done on the theories of underwriting cycles and applied to South African primary marine insurance data in order to determine which of the theories explains the underwriting cycles most effectively.

Different ratios can be used to test cyclicity. Swiss-Re (Leshilo, 2007) proposed using the economic combined ratio as it takes economic factors, which the combined ratio ignores, into account.

Reference List:

Archer-Lock, P, Ball, A, Cresswell, C, Gedalla, B, Lyons, G, Malde, S, Miranthis, C, Morgan, K, Rice, H, Sanders, D, Shore, A and Willis, K (1994). 'Marine Insurance', Insurance Convention Paper. Glasgow.

Ask Oxford, (2008), URL http://www.askoxford.com/concise_oed/cycle?view=uk
AskOxford.com (accessed 01 October 2008).

Barth, M and Grace, M (1993). 'The Regulation and Structure of Nonlife Insurance in the United States', Working Paper Financial Sector Development Department of the World Bank.

Berger, L (1988). 'A model of the underwriting cycle in the property-liability Insurance industry', *The Journal of Risk and Insurance*, 55 (2): 298-306.

Berger, L, Cummins, J and Tennyson, S (1992). 'Reinsurance and the Liability Insurance Crisis', *Journal of Risk and Uncertainty* 5: 253-272

Browne, M and Ju, L (2007). 'Contingent Commissions and Market Cycles', Working Paper.

Casual Actuarial Society, (2008), 'Revisions in Loss Reserving Techniques Necessary to Discount Property-Liability Loss Reserves' URL <http://www.casact.org/pubs/forum/87forum/index.cfm?fa=87fftoc> (accessed 01 October 2008).

Chen, R, Wong, K and Lee, H (1999). 'Underwriting cycles in Asia', *The Journal of Risk and Insurance*, 66 (1): 29-47.

Chung, R, Fung, H-G, Lai, G and Witt, R (1993). 'Causal Relationships between Premiums and Losses, and Causes of the Underwriting Cycles', Working Paper.

Cummins, J. David (1991), "Statistical and Financial Models of Insurance Pricing and the Insurance Firm", *The Journal of Risk and Insurance*, 58: 261-302.

Cummins, J and Outreville, J (1987). 'An international analysis of underwriting cycles in property- liability insurance', *The Journal of Risk and Insurance*, 54 (2): 246-262.

Cummins, J, Harrington, S & Klein, R (1991). 'Cycles and crises in property-casualty insurance: causes and implications for public policy, 1991', *Journal of Insurance Regulation*, Fall: 50-93.

Dismukes, R, Glauber, J, Miranda, M and Vedenov, D (2006). 'Portfolio Allocation and Alternative Structures of the Standard Reinsurance Agreement', *Journal of the Agricultural and Resource Economics*, 3 (1): 57-73.

Doherty, N and Garven, J (1992). 'Insurance cycles: interest rates and the capacity constraint model', *Journal of Business*, 68: 383-404.

Doherty, N and Garven, J (1995). 'Insurance cycles: Interest rates and the capacity constraint model', *The Journal of Business*, 68 (3): 383- 404.

Doherty, N and Kang, H (1988). 'Interest Rates and Insurance Price Cycles', *Journal of Banking and Finance*, 12: 199-214.

English Marine Insurance Act, 1906.

Fields, J and Venezian, E (1989). 'Interest rates and profit cycles: A disaggregated approach', *The Journal of Risk and Insurance*, 56 (2): 312-319.

Financial Services Board Annual Report (1944-1997) 'Annual Reports of the Registrar of Insurance' Financial Services Board.

Financial Services Board Annual Report (1952-2005) 'Annual Reports of the Registrar of Short Term Insurance' Financial Services Board.

Fitzpatrick, S (2004). 'Fear is the key: A behavioural guide to underwriting cycles', Connecticut Insurance Law Journal Association.

Fung, H-G, Lai, G, Patterson, G and Witt, R (1998). 'Underwriting Cycles in Property and Liability Insurance: An Empirical Analysis of Industry and By-Line Data', *The Journal of Risk and Insurance*, 65 (4): 539-561.

GIS, (2008), 'The Structure of Private and Commercial Auto Liability', URL <http://gis.esri.com/library/userconf/proc98/PROCEED/TO600/PAP559/P559.HTM> (accessed 16 October 2008).

Grace, M and Barth, M (1993). 'The Regulation and Structure of Nonlife Insurance in the United States', Working Paper Financial Sector Development Department of the World Bank.

Gron, A (1994a). 'Capacity constraints and cycles in Property- Casualty Insurance markets', *The RAND Journal of Economics*, 25 (1): 110- 127.

Gron, A (1994b). 'Evidence of Capacity Constraints in Insurance Markets', *Journal of Law and Economics*, 37 (2): 349-377.

Haley, J.D. (1993). 'A cointegration analysis of the relationship between underwriting margins and interest rates: 1930-1989', *Journal of Risk and Insurance*, 60 (3): 480-93.

Harrington, S (1984). 'The impact of rate regulation on prices and underwriting results in the property-liability insurance industry', *Journal of Risk and Insurance*, 51: 577-623.

Harrington, S (2004). 'Tort liability, Insurance rates, and the Insurance cycle', The paper was prepared for the Brookings-Wharton Conference on Public policy issues confronting the insurance industry.

Harrington, S and Danzon, P (1994). 'Price Cutting in Liability Insurance Markets', *The Journal of Business*, 67 (4): 511-538.

Harrington, S and Niehaus, G (1999). 'Volatility and underwriting cycles', in Dionne, G (Eds), *Handbook of Insurance*, Boston, MA: Kluwer Academic Publishers.

Holdsworth, W.S (1917). 'The Early History of the Contract of Insurance', *Columbia Law Review*, 17 (2): 85-113.

Insurance Act no. 37 of 1923.

Insurance Act no. 27 of 1943.

Jones, B and Ren, J (2006). 'Underwriting cycle and ruin probability', Department of Statistical and Actuarial Sciences, University of Western Ontario.

King, D (2008) Interview – 23 October 2008.

Kingston, C (2004). 'Marine Insurance in Britain and America, 1720-1844: A comparative institutional Analysis', *The Journal of Economic History*, 67 (2): 379-409.

Klein, R.W (2003). 'The Underwriting Cycle', Georgia State University.

Lai, G and Witt, R (1990). 'A Microeconomic Theory of the Commercial Liability Insurance Crisis Under Uncertainty', Working Paper, Department of Finance, University of Texas at Austin.

Lai, G and Witt, R (1992). 'Changed Insurer Expectations: An Insurance Economics View of the Commercial Liability Insurance Crisis', *Journal of Insurance Regulation*, 10(3): 342-393.

Lamm-Tennant, J and Weiss, M (1997). 'International insurance cycle: Rational expectations/ Institutional intervention', *The Journal of Risk and Insurance*, 64 (3): 415-439.

Leng, C and Meier, U (2002). 'Analysis of multi-national underwriting cycles in property-liability insurance', Working Paper.

Leshilo, T (2007). 'An Inquiry into the existence of Underwriting Cycles in the South African Reinsurance Market 1964 to 2005', University of the Witwatersrand: Unpublished Honours Research Report.

Liebenberg, F (2008). Interview – October 2008.

Lloyd's, (2008), 'EU: Insurance Guarantee Schemes in the European Union', URL http://www.lloyds.com/Lloyds_Worldwide/International_compliance_news/EU_Insurance_Guarantee_Schemes_in_the_European_Union.htm (accessed 23 April 2008).

Markham, F.J (2006). 'An Investigation into Underwriting Cycles in the South African Short-Term Insurance Market for the Period 1975 to 2006' University of the Witwatersrand: Unpublished Honours Research Report.

Meier, U (2001). 'Multi-National Underwriting Cycles in Property-Liability Insurance', Paper presented at the EGRIE meeting in Strasbourg, France.

Meier, U and Outreville, F (2003). 'The reinsurance price and the insurance cycle', Working Paper.

Meier, U and Outreville, J (2006). 'Business cycles in insurance and reinsurance: the case of France, Germany, and Switzerland' *The Journal of Risk Finance*, 7 (2): 160-176.

Miller, H. and Witt, R.C. (1981). 'Price competition, regulation and systematic underwriting risk in automobile insurance markets', *CPCU Journal*, 34: 174-89.

Myers, S and Majluf, N (1984). 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics*, 13: 187-221.

Nathanson, M (2004). 'It's the Economy (and Combined Ratio), Stupid: Examining the Medical Malpractice Litigation Crisis Myth and the Factors Critical to Reform' *Penn State Law Review*, 108 (4): 1077-1122.

Nelli, H.O (1972). 'The Earliest Insurance Contract. A New Discovery' *The Journal of Risk and Insurance*, 39 (2) : 215-220.

Niehaus, T and Terry, A (1993). 'Evidence on the time series properties of insurance premiums and causes of the underwriting cycle: new support for the capital market imperfection hypothesis' *The Journal of Risk and Insurance*, 60 (3): 466-479.

Outreville, J (1981). 'Les opérations des compagnies d'assurances IARD: identification de modèles et simulation d'hypothèses de conjoncture économique', *Geneva Papers on Risk and Insurance*, 6 (October): 34-50.

Outreville, J (1990). 'Underwriting cycles and rate regulation in automobile insurance markets', *Journal of Insurance Regulation*, 8: 274-86.

Parsons, C (2003). 'An analysis of current problems in the UK liability insurance market' Prepared for the Office of Fair Trading.

Renasa, (2008), 'Marine Insurance – Intermediaries opportunity to open up new markets', URL
<http://www.renasa.co.za/admin/htmledit/files/articles/marine%20article%20ph.doc>
(accessed 22 September 2008).

Short Term Insurance Act no. 53 of 1998.

Smith, M (1984). 'Property-Liability Insurance markets, Taxation and Interest Rates: Preliminary findings' Proceedings International Insurance Seminar New Orleans, Los Angeles.

Smith, M.L. (1989). 'Investment returns and yields to holders of insurance', *Journal of Business*, 61 (1): 81-98.

South African Reserve Bank, (2008), 'Business Cycles',
<http://www2.resbank.co.za/internet/Glossary.nsf/b551f2529ff409b742256b41004c6a7e/84ff85e908c555d942256b43002f22e9?OpenDocument> (accessed 20 October 2008).

Tennyson, S (1991). 'The effect of rate regulation on underwriting cycles', *CPCU Journal*, 44: 33-45.

Trafalgar International Ltd., (2008), 'A Glossary of Insurance Terms', URL <http://www.trafalgar-intl.com/definitions3.htm> (accessed 23 September 2008).

Treasury Department Annual Reports (1925-1940) 'Summaries of Returns Deposited with the Treasury by Insurance Companies' Treasury Department.

Urrutia, J and Witt, R (1983). 'Price competition, regulation and systematic risk in automobile insurance', *Geneva Papers on Risk and Insurance*, 8: 403-29.

Venezian, E (1985). 'Ratemaking methods and profit cycles in property and liability insurance' *The Journal of Risk and Insurance*, 52 (3): 477-500.

Wiley InterScience, (2008), 'Marine Insurance', URL <http://mrw.interscience.wiley.com/emrw/9780470012505/eas/article/tam003/current/pdf> (accessed 25 June 2008).

Wilson, W.C. (1981). 'The underwriting cycle and investment income', *CPCU Journal*, 34: 225-32.

Winter, R (1988). 'The Liability Crisis and the Dynamics of Competitive Insurance Markets', *Yale Journal on Regulation*, 5:455-499.

Winter, R (1989). 'The Insurance Cycle', *Working Paper*, Department of Economics, University of Toronto.

Winter, R (1991). 'The liability insurance market' *The Journal of Economic Perspectives*, 5 (3): 115-136.

Appendices

Appendix 1 - Table of marine losses around the South African coastline (from Geocities)

Year	Vessel Name	Vessel Type	Position of Vessel	Type of Casualty
1956	Adelfotis	Freighter	Quoin Point	Grounded, lost
1956	Blaaukrantz	Fishing Vessel	Gaansbaai quayside	Sank, was refloated and rebuilt
1956	Capitaine Heusers	Freighter	West of Luderitz	Fire in Sisal cargo, extinguished
1956	Duineveld	Fishing Vessel	Chapmans Peak	Grounded, lost
1956	George D Gratsos	Freighter	Off the Cunene River	Lost propeller, towed to Cape Town
1956	Goiania	Tanker	Mocambique Channel	Fire in the engine room, extinguished
1956	King Neptune	Freighter	Ichabo Island	Grounded, refloated
1956	Luabo	Freighter	North of Durban	Sank
1956	Wilfred Fernhead	Fishing Vessel	10 miles South of Durban	Fire, extinguished
1957	Elgaren	Freighter	Durban harbour	Explosion, repaired
1957	Frontier	Freighter	20 miles South of East London	Grounded, lost
1957	Largs Bay	Freighter	Off Durban	Power failure, returned to Durban
1957	Leningrad	Tanker	Off Durban	Power failure, repaired in Durban
1957	Munsterland	Tanker	Durban harbour	Power failure, repaired
1957	World Grandeur	Tanker	400 miles South of Mombasa	Power failure, proceeded to Mombasa
1958	Congella	Freighter	Durban harbour	Fire in accomodation area, extinguished
1958	Erica	Fishing Vessel	Robben Island	Grounded, lost
1958	Forresbank	Freighter	20 miles South of Post St Johns	Fire in engine room, grounded and lost
1958	Kendall Fish	Freighter	Durban harbour	Fire in the Sulphur cargo, extinguished
1958	Masashima Maru	Fishing Vessel	8 miles South of Port St Johns	Hull damaged, proceeded to Durban
1958	Ovambo Coast	Freighter	Marcus Island	Grounded, lost
1958	Shamrock	Fishing Vessel	Lamberts Bay	Grounded, lost
1958	St Andrew	Fishing Vessel	Durban Quayside	Sank, refloated
1958	Windsor Castle	Passenger Liner	Durban harbour	Electrical fire, extinguished
1958	Zaandam	Fishing Vessel	Cape Point	Sank
1959	Atlantic Clipper	Tanker	Durban harbour	Fire in cargo tank, extinguished
1959	Five Brothers	Fishing Vessel	Conception Bay	Grounded, refloated
1959	J D White	Tug	NE of Durban, aiding Kingsbridge	Power failure, towed to Durban
1959	Kingsbridge	Freighter	75 miles North East of Durban	Power failure, towed to Durban
1959	Lubeck	Freighter	South Africa East Coast	Hull damage, proceeded to Port Elizabeth
1959	Oribi	Freighter	10 miles North of Luderitz	Hull damage, repaired in Cape Town
1959	Rebecca	Fishing Vessel	Robben Island	Grounded, lost
1959	Tina Onassis	Tanker	Off West Africa	Propeller damaged, replaced in Cape Town
1959	Tryme	Fishing Vessel	Slangkop	Grounded, lost
1959	Zuiderkruis	Fishing Vessel	Walker Bay	Grounded, lost
1960	Bulby	Fishing Vessel	Table Bay	Collision, proceeded
1960	Cape Matapan	Fishing Vessel	Table Bay	Collision, sank
1960	Gos 10	Fishing Vessel	Antarctica	Hull damage, towed to Cape Town
1960	President Brand	Fishing Vessel	South of Kommetjie	Grounded, refloated
1960	Schouten	Freighter	Mauritius	Grounded, refloated
1961	Beachwood	Freighter	Durban harbour	Grounded, refloated

Appendix 1 (continued)

Year	Vessel Name	Vessel Type	Position of Vessel	Type of Casualty
1961	Cassian	Freighter	West of Cape Point	Hull damage, repaired in Cape Town
1961	Groot Constantia	Fishing Vessel	Cape Town harbour quayside	Sank, refloated
1961	Hokkai Maru	Freighter	Off Mauritius	Lost a propeller, towed to Port Louis
1961	Konan Maru 23	Fishing Vessel	Antarctica	Power failure, towed to Durban
1961	Naess Spirit	Tanker	South African South Coast	Power failure, towed to Cape Town
1961	Polam Hall	Freighter	Off Walvis Bay	Power failure, towed to Walvis bay
1961	Robin Locksley	Freighter	80 miles West of Cape Town	Power failure, towed to Cape Town
1961	Save	Freighter	200 miles North of Beira	Grounded, refloated. Caught fire, lost
1961	Simferpol	Fishing Vessel	6 miles South of Pelican Point	Grounded, refloated
1961	Skaukar	Tanker	Off Durban harbour entrance	Grounded, refloated
1961	Southern Author	Fishing Vessel	Dassen Island	Grounded, lost
1961	Toshi Maru 1	Fishing Vessel	Antarctica	Power failure, repaired in Durban
1962	Berea	Freighter	60 miles North of Inhambane	Grounded, lost
1962	Caravella	Tanker	Off West Africa	Power failure, repaired in Cape Town
1962	Cassiopeia	Bulk Carrier	South African West Coast	Power failure, repaired in Cape Town
1962	Curllew	Fishing Vessel	20 miles North of Swakopmund	Power failure, proceeded to Walvis Bay
1962	Diplomat	Freighter	Maputo	Rudder damaged, escorted to Durban
1962	Factor	Freighter	Beira	Hull damage, repaired in Durban
1962	Hoegh Rider	Tanker	Port Elizabeth quayside	Accommodation fire, extinguished
1962	La Cruz	Tanker	Off West Africa	Hull damage, repaired in Cape Town
1962	Lumane	Freighter	Quelimane	Grounded, refloated, repaired in Durban
1962	Mormacwave	Freighter	Beira	Grounded, refloated
1962	Naess Spirit	Tanker	Rio de Janeiro	Propeller damaged, towed to Cape Town
1962	Narra	Fishing Vessel	Walvis Bay	Collision with barge, repaired
1962	Olandia	Freighter	Beira	Hull damage, repaired in Durban
1962	Patria	Tanker	North Indian Ocean	Explosion, repaired in Durban
1962	Protea	Fishing Vessel	Cape Town harbour quayside	Sank, refloated
1962	Rocktail	Fishing Vessel	Maputo	Power failure, towed and beached, repaired
1962	Rooiberg	Fishing Vessel	Kommetjie	Grounded, hauled ashore, repaired
1962	Ross Bay	Tanker	28 miles North West of Maputo	Power failure, repaired in Maputo
1962	Ryuzan Maru	Freighter	Beira	Lost bot anchors, rode out the hurricane
1962	Sir James Clark Ross	Fishing Vessel	Antarctic	Hull damage, repaired in Cape Town
1962	South African Vanguard	Freighter	Beira	Hull damage, repaired in Durban
1962	Talassa	Freighter	Maputo inner roadstead	Grounded, refloated
1962	Tjikampek	Freighter	Beira	Hull damage, repaired in Durban
1962	Toshi Maru 2	Fishing Vessel	Antarctica	Propeller damage, repaired in Durban
1962	Tsamma	Fishing Vessel	15 miles off Cape Frio	Power failure, towed to Walvis Bay
1962	Valhalla	Fishing Vessel	Pelican Point	Grounded, refloated

Source: <http://www.geocities.com/Heartland/Ridge/2216/text/MARITIME.TXT> (2008)

Appendix 2 - Table of marine losses around the South African coastline (from SA Shipwrecks)

SHIP'S NAME	DATE	TYPE	PLACE	CASUALTY
ADELFOVIS	1956	COSTA RICAN STEAMER	0.5NM S. OF QUOIN POINT	WRECKED, IN FOG AND MODERATE S.E. WIND.
DUINEVELD	1956	S.A. FISHING VESSEL	CHAPMANS PEAK	GROUNDED.
LUABO	1956	PORTUGUESE FREIGHTER	N. OF DURBAN (ZULULAND COAST)	FLOODED IN BAD WEATHER, SANK.
ARUM	1957	S.A. FISHING VESSEL, L=35m, B=6,74m, D=3,65m	ALGOA BAY	SCUTTLED.
DELVER	1957	BUCKET DREDGER		SCUTTLED BY VAMPIRE JETS OF THE S.A.A.F.
FREAN	1957	DUTCH COASTER ON CHARTER TO THESENS	PORT NOLLOTH	LOST.
FRONTIER III	1957	SINGLE-SCREW STEAM-COASTER	NEAR KIDD'S BEACH 32Km S.W. OF EAST LONDON, NCERA RIVER	WRECKED, STILL VISIBLE.
JOAN OF ARC	1957		4.3NM OF VONDELING ISLAND (ST. HELENA BAY)	
KAYENA	1957		OFF FLAT ROCKS, N. OF CAPE RECIFE, POSITION IS APPROX.	
STEENBOK	1957	S.A. FISHING VESSEL, L=10m	CAPE AGULHAS	
DISA	1958	S.A.FISHING VESSEL, L=35m, B 6,74m, D 3,65m	ALGOA BAY	SCUTTLED.
ERICA	1958	S.A. FISHING VESSEL	ROBBEN ISLAND, TABLE BAY	GROUNDED.
FLORENCE BRIERLEY	1958	STEAM VESSEL, L=42.5m	306 DEG, 7.4NM FROM SLANGKOP POINT LIGHTHOUSE	SCUTTLED.
FORRESBANK	1958	BRITISH TWIN SCREW FREIGHTER, L=129m, B=16,6m, D=8m	20.8NM 224,5 DEG OF PORT ST JOHNS, N.E. OF MTAKATYE RIVER, TRANSKEI	WRECKED AFTER CATCHING FIRE.
HELDERBERG	1958	WOODEN AUXILIARY MOTORSHIP	SALDANHA BAY	DRIFTED ONTO THE ROCKS AFTER BREAKING HER MOORINGS.
MORANO	1958	HULK	266 DEG 9.1NM FROM CAPE POINT	SCUTTLED.
OVAMBO COAST	1958	S.A. COASTER	MARCUS ISLAND, OFF SALDANHA BAY	WRECKED IN FOG.
SHAMROCK	1958	S.A. FISHING VESSEL, L=15m	LAMBERTS BAY	GROUNDED.
STORK	1958	S.A.PLEASURE STEAMER, L=35m, B=7m	OFF DURBAN	SCUTTLED.
SWAZI COAST	1958	S.A. COASTER	W. OF HOUT BAY	SCUTTLED BY THE S.A.N. AND S.A.A.F.
ZAANDAM	1958	S.A. FISHING VESSEL, L=16m	CAPE POINT	SANK.

Appendix 2 (continued)

SHIP'S NAME	DATE	TYPE	PLACE	CASUALTY
REBECCA	1959	S.A. FISHING VESSEL	ROBBEN ISLAND, TABLE BAY	GROUNDING.
STEENBERG	1959	S.A.FISHING VESSEL, L=35,8m, B=7,4m, D=3,9m	SALAMANDER BAY	BEACHED TO PREVENT HER SINKING AT HER MOORINGS.
STELLENBERG	1959	S.A.WHALER, L=35,8m, B=7,4m, D=3,9m	SALDANHA BAY	WRECKED WHEN SHE BROKE ANCHOR AND WENT ASHORE IN HEAVY WEATHER.
TRYME	1959	S.A. FISHING VESSEL, L=16.3m	SLANGKOP	GROUNDING.
ZUIDERKRUIS	1959	S.A. FISHING VESSEL	WALKER BAY	GROUNDING.
BLUE BIRD	1960		ELANDS BAY	
CAPE MATAPAN	1960	S.A. FISHING VESSEL, L = 46m,B = 22m	TABLE BAY	COLLIEDED WITH BULBY IN FOG, SANK.
CAPENSIS	1960	S.A. TRAWLER	NEAR ST. CROIX ISLAND	SUNK BY GUNFIRE, OFFERED FOR SALE BY LIQUIDATORS, BUT NO BIDDERS.
KOODOO	1960	PILOT TUG	EAST LONDON	SCUTTLED.
MARY	1960	PILOT TUG	EAST LONDON	SCUTTLED.
MOSSEL	1960	S.A.FISHING VESSEL, L=34m, B=6,7m, D=4m	SOUTH JETTY, PORT ELIZABETH HARBOUR	RAISED BY SAS SOMERSET, SCUTTLED IN GIVEN POS ON 19-02- 1961.
S.B.A.305	1960	BARGE,L=18.5m	102 DEG (T) .48NM FROM QK FL LIGHT ON RAILWAY JETTY SALDANHA BAY	WRECKED IN UNFAVOURABLE WEATHER.
CLARA	1961	S.A.DREDGER, L=35m, B=7m	OFF ROBBEN ISLAND, TABLE BAY	SCUTTLED.
DIANA	1961	MOTOR VESSEL	QUOIN POINT	
H.C. HULL	1961	PILOT TUG, L=23.1m, B=5.4m	OFF BRENTON ISLAND, ALGOA BAY	SCUTTLED.
JOHN WILLIAMSON	1961	CORVETTE	UMHLANGA BEACH	WRECKED, STILL VISIBLE AT LOW TIDE.
NERINE	1961	S.A.FISHING VESSEL, L=35m, B=6,74m, D=3,65m	OFF ROBBEN ISLAND	SCUTTLED.
SOUTHERN AUTHOR	1961	S.A. WHALE CATCHER	0.97NM FROM DASSEN ISLAND, BOWS UPSIDE DOWN ON ROCKS	WRECKED, BOW SECTION STILL VISIBLE 1996.
ST GEORGE	1961	S.A. FISHING VESSEL, L=14.8m	KAJIM ROCKS, BETWEEN MFAZAZANA AND TURTON, S. OF DURBAN	WRECKED, STILL VISIBLE.
UNI I	1961	S.A. WHALE CATCHER	OFF ROBBEN ISLAND, TABLE BAY	SCUTTLED.

Appendix 2 (continued)

SHIP'S NAME	DATE	TYPE	PLACE	CASUALTY
UNKNOWN	1961	SMALL WOODEN DINGHY	GRANGER BAY	CAPSIZED BY WAVE, WRECKED, OUTBOARD MOTOR SALVAGED.
VIKING	1961	TWIN-SREWED FISHING VESSEL	LOOK OUT ROCKS, PLETTENBERG BAY	WRECKED.
ADELAAR	1962	S.A. COASTER	OFF ROBBEN ISLAND, TABLE BAY	SCUTTLED.
ORVILLE	1962		NATAL COAST	

Source: www.sashipwrecks.com (2008)

Appendix 3

Loss Ratio: Cycle length table

Upswing/downswing cycles

Period in terms of years	Cycle Length
1944-1950	6
1968-1973	5
1973-1980	7
1983-1989	6

Downswing/upswing cycles

Period in terms of years	Length
1966-1971	5
1975-1981	6
1981-1987	6
1987-1991	4
1994-1998	4

Appendix 4

Combined Ratio & Underwriting Ratio: Cycle length table

Upswing/downswing cycles in terms of combined ratio

Period in terms of years	Cycle Length
1931-1936	6
1959-1964	5
1968-1973	5
1973-1980	7
1982-1989	7

Downswing/upswing cycles in terms of combined ratio

Period in terms of years	Length
1933-1938	5
1958-1962	4
1966-1971	5
1971-1975	4
1975-1981	6
1987-1991	4
1994-1998	4