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Performance drivers of JSE-listed gold mining companies

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ABSTRACT

Several researchers and practitioners have claimed that economic value added is superior to traditional accounting measures in driving shareholder value. Other researchers have refuted these claims by supplying data in support of traditional accounting indicators such as EPS and ROE.

In light of these contradicting findings, the paper endeavoured to analyse the results of JSE-listed gold mining companies. The share price was correlated to EVA, ROE, EPS, CFG and gold price. Using simple and multiple regression analyses, the paper established the strength of correlation between these different performance drivers with the share price. It also established the impact of gold price on the correlation to share price.

The results suggested that EVA had the strongest correlation with the share price, with a coefficient of determination r^2 = 45%. It was followed by EPS which had a positive correlation, CFG and ROE. Results also revealed that the gold price had a positive and moderate influence on the share price. Not only that the gold price affected the share price moderately, the study found that it also affected the correlation between EVA, ROE, EPS, and CFG with the share price. The impact increased in magnitude from CFG, EVA, and ROE to EPS.

DECLARATION

I declare that this research project is my own, unaided work. It is submitted in partial fulfilment of the requirements of the degree of Master of Business Administration for the Goldon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university.

…….. Date: ……

Philippe B. Muteba

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DEDICATION

To you my beloved children Jonathan Muteba, Dan Muteba and Prisca Muteba, I dedicate this work. May this work be a source of inspiration for greater things to come in your lives.

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LIST OF ABBREVIATIONS AND SYMBOLS

CFG	:	Cash Flow Growth
EPS	:	Earnings per Share
EVA	:	Economic value added
GP	:	Gold Price
JSE	:	Johannesburg Stock Exchange
MVA	:	Market Value Added
NPV	:	Net Present Value
ROE	:	Return on Equity
α	:	Statistical significance level
r	:	Coefficient of determination

1 INTRODUCTION TO RESEARCH PROBLEM

1.1 Research Problem

1.1.1 Role of financial statements

Financial statements are designed to assist users in identifying key relationships and trends. It is argued that these statements provide investors with essential information to evaluate their investment decisions. Since the work of Ball and Brown (1968) and Beaver (1968), many researchers have focused their work on the importance of financial statement information. The association between stock returns and financial ratios was first tested by Ou and Penman (1989) who used statistical procedures to identify the most relevant financial ratios. This study was extended by Holthausen and Larcker (1992) who identified value-relevant fundamental factors in the context of a return-fundamentals relationship. Afterwards, Riahi-Belkoui (1997) presented empirical evidence of the relevance of common financial ratios to equity valuation, both unconditional and conditional on inflation rate. Later in 1997, Mramor-Kosta (1997) and Mramor and Pahor (1998) showed that a linear relationship might not exist. Recently, Omran and Ragab (2004) suggested that non-linear relationships exist and are more descriptive of the behaviour of the share prices.

1.1.2 Value-Based Management

Value-Based Management (VBM) is a management philosophy that uses analytical

tools and processes to focus an organisation on the single objective of creating shareholder value. Studies of VBM methods were initially conducted when academics theorised that traditional financial ratios were inadequate measures of a firm's performance (Athanassakos, 2007). Economic Value Added (EVA) was among the first VBM methods to be studied with discrepancies between studies. This measure, proposed by Stern Stewart Management Services, has been promoted as a measure of economic profit since 1982 (Stewart, 1992). Researchers since then have examined the model and its computation. De Villiers (1997) and Prober (2000) examine problems associated with EVA's computation. Bacidore, Boquist, Milbourn and Thakor (1997), Zwell and Ressler (2000) and Kramer and Peters (2001) look at the shortcomings and virtues of the EVA model. Farsio, Degel and Degner (2000) and Garvey and Milbourn (2000) examine the case for forecasting stock performance based on EVA. Biddle, Bowen and Wallace (1997) compare EVA to other measures of performance.

1.1.3 Gold mining shares and gold price

Gold continues to be a popular investment. Many investment advisors routinely suggest that investors keep from 10% to 25% of their long-term investment portfolio in gold bullion and gold related investments (Blose, 1995). Because of transactions costs associated with purchasing gold bullion and gold coins, gold mining shares have become popular with investors who want to include a moderate amount of gold price risk in their portfolio while incurring low transaction costs.

An investor who invests in gold mining shares is concerned with the extent to which changes in gold price are reflected in the returns of mining shares. The financial literature is divided on the question. Some analysts argue that mining shares represent a levered investment in gold price and that percentage changes in the value of the mining shares will be greater than the percentage changes in the value of gold (Rolo, 1975; Ozanian, 1987; Schiffres, 1987; Panchapakesan, 1993). Others argue that gold mining shares incorporate risks that are uncorrelated with the price of gold. For example, Khoury (1984) argues that unstable dividends, political risks, currency exchange risks and business risks such as those related to changes in market conditions and mining technology, disrupt the influence of gold price risk in the returns of the securities. He points out that in bull markets, the appreciation potential of gold shares is not as high as that of gold bullion and coins. Rock (1988) asserts that mining shares and the funds that invest in them are probably the worst way to buy gold because of the non-price risk associated with the mining shares. Oeshsle (1976) and Train (1978) also argue that gold shares are not a good alternative for investing in gold.

1.1.4 Problem Identification

Most studies conducted either on financial ratios or on VBM methods seem contradictory, or more industry specific. As, to the best of the Author's knowledge, little has been done in the gold mining industry in the South African market, it was thought to be of great importance to test all the assumptions concerning the dependency of share price on financial and economic measures in the gold mining

industry, especially at the time that the gold price is favourable. This paper determines the extent to which the share price of gold mining companies is correlated to EVA, Return on Equity (ROE), Earnings per Share (EPS) and cash flow growth (CFG).

Furthermore, in light of the above conflicting arguments around the impact of gold price on the share performance of gold mining companies, this paper aims to study the link between the average mining share price and the gold price. To elaborate more on the dependency of share price on the price of the product sold, the paper analyses the impact of gold price on the correlations between EVA, ROE, EPS and CFG with the share price of JSE-listed gold mining firms.

1.2 Research Objectives

The objectives of the research are twofold.

- The first is to build on the work done by many researchers (e.g., Stern (1993), Biddle *et al.* (1997), etc.) and to determine the correlations between EVA, ROE, EPS and CFG with the share price in the gold mining industry. These correlations are taken in conjunction with the changing gold price.
- The second is to show, through test results, if there is a significant difference in the correlations between EVA, ROE, EPS and CFG and the share price as gold price continues to change.

1.3 Relevance of the research

1.3.1 Introduction

Gold price is predicted to continue increasing in the next few years as the resources are being depleted and as gold is increasingly being trusted as a better investment in the face of a weaker US Dollar (Sarfaraz & Afsar, 2005). As a result, more people will be interested to invest in gold mining companies, as these will be perceived to be a source of sustainable returns.

Alongside the need to contribute to the current debate on the correlation between share price and financial and economic measures, this research is an important guide to managers and directors of gold mining firms and to potential investors in gold mining stocks.

1.3.2 Managers and Directors

There is near unanimity in belief that performance-based compensation is a critically important corporate governance mechanism. For managers and executives to maximise shareholders value consistently, they must be offered compensation contracts that are tied to shareholder wealth changes (Bacidore *et al*., 1997).

Opinions on how to design the compensation contract differ widely. Some argue that managers should simply be paid according to the share price performance

(Milbourn, 1996; Jensen and Murphy, 1990 and Rappaport, 1986). However, others argue that a share-based compensation imposes excessive risk on the manager, owing either to market-wide movements (Sloan, 1993) or because even firm-specific returns reflect factors beyond managers' control. Paul (1992) points out an additional weakness with share prices that they tend to aggregate relevant information inefficiently for compensation purposes. These latter arguments imply that firms may be able to improve incentives by relying directly on other measures of performance, which more accurately reflect the manager's marginal contribution to firm value. But which measures accomplish this task, and how should they be combined to produce the best possible incentive contract?

The results of this study would be of interest to financial managers and directors because a way to identify drivers of value with the strongest impact on the share price may be extremely valuable in developing financial strategies that can optimise value creation for shareholders. Not only that the paper could provide drivers of value to include in the manager's compensation contracts, it could also provide the changing weighting of these parameters in the contracts as the gold price changes.

1.3.3 Investors

The paper establishes the degree to which EVA, ROE, EPS and CFG are related to share price. These parameters are not the only ones that help in predicting the stock performance, but when coupled with gold business analysts' reports and

some non-financial measures, they could assist in predicting the behaviour of share prices of gold mining companies more accurately.

The rest of the paper is structured as follows. Chapter two provides a detailed review of literature relevant to the current academic debate on the topic. Chapter three describes specific research hypotheses. Chapter four provides details of and defence of the methodology used to test the various hypotheses raised. In chapter five, results of the research are presented clearly and concisely, with only sparse commentary. Chapter six discusses results in terms of research hypotheses and in terms of literature. Chapter seven highlights the main findings of the research.

2 THEORY AND LITERATURE REVIEW

2.1 Introduction

There is a large number of studies done on the association between share prices and various financial performance measures. The theory that is reviewed in this section defines and describes parameters that are related to share price and the extent of their association with the share price is predicted, based on previous studies. Factors affecting gold price are also reviewed.

2.2 Economic value added

2.2.1 Introduction

Dissatisfaction with traditional accounting-based performance measures has spawned a number of alternatives of which Economic Value Added (EVA) is currently the most prominent. Stern Stewart Management Services has gone so far as to trademark the concept, though many academics challenge it as a knock-off of residual income. Stern Stewart has, however, been successful touting the measure as the best measure of business performance and management discipline. Fortune Magazine annually publishes a list of top companies complete with and EVA numbers and rankings, crediting the measure for the creation (or destruction) of shareholder wealth. The journal of Applied Corporate Finance annually publishes the EVA for the Stern Stewart Performance 1000, citing EVA as

the critical driver of a company's stock performance (Farsio *et al*., 2000). Successful corporations are increasingly turning to EVA to measure performance. In turn, investors and analysts are now scrutinising company EVA just as they historically observed EPS and PE ratios.

This section gives a brief review of what EVA is, how it is computed and interpreted, its advantages and disadvantages, its link to Market Value Added (MVA) and its association with share price.

2.2.2 EVA Computation

Stewart (1992) defines EVA as the net operating profit minus an appropriate charge for the opportunity cost for all capital invested in an enterprise. Hence, EVA provides a measure of economic profits (Griffith, 2004). It can be computed using the formula below:

$$EVA = NOPAT - (WACC \times K) \qquad (1)$$

where EVA = Economic Value Added

NOPAT = Net Operating Profit After Tax

WACC = Weighted Average Cost of Capital

K = Capital stock at the beginning of the year.

In Equation (1), NOPAT is defined as reported net operating profits plus increase in bad debt reserve plus any increase in the LIFO reserve plus amortisation of

goodwill plus any increase in net capitalised R&D plus other operating income (including passive investment income) minus cash operating taxes. In short, NOPAT is given by the equation below:

$$NOPAT = EBIT \times (1 - T) \qquad (2)$$

where EBIT = Earnings Before Interest and Tax

T = Tax rate

A firm's weighted-average cost of capital in Equation (1) is derived from the following formula:

$$WACC = \frac{Em}{Dm + Em} \times k_E + \frac{Dm}{Dm + Em} \times k_D \times (1-T) \qquad (3)$$

where Dm = Market value of the firm's total debt

Em = Market value of the firm's total equity

k_D = Pre-tax cost of debt

T = Tax rate

k_E = Cost of equity

The most widely accepted method of estimating the cost of equity is based on the capital asset pricing model (CAPM) (Ward & Price, 2006). By the CAPM, the cost of equity is calculated as follows:

$$k_E = R_f + \beta \times (R_m - R_f) \quad (4)$$

where R_f = Risk –free investment rate

R_m = Expected return on a market portfolio

$(R_m - R_f)$ = Market risk premium: MRP

β = The company risk index

A firm's net asset base equation (1) is defined by a company's total assets minus non-interest-bearing current liabilities. That is, net assets represent the total economic book value of the firm's assets in place

Calculation of EVA requires both NOPAT and the capital charge. According to Stewart (1992), NOPAT restates the operating profits of the company so that net income (NI) reflects the current economies of the business. Major adjustments are made to NI and to assure the proper matching of revenues and expenses when calculating EVA and taxes, non-recurring events and securities accounting. An additional assumption is that a firm must generate enough revenues to reward shareholders for their risk exposure.

2.2.3 EVA and Market Value Added

MVA measures the value created by the company for its shareholders over and above the amount of Capital employed. MVA is equivalent to the present value of all future expected EVA.

Since EVA is currency-based, the maximisation of EVA correlates with wealth maximisation. Shrieves and Watchowiez (2001) demonstrate the equivalence of EVA and NPV. According to Stern (1993), Uyemura, Kantor and Pettit (1996) and Milunovich & Tsuei (1996), EVA has the strongest correlation with MVA of the variables they tested. Kramer & Peters (2001) find that EVA provides an unbiased proxy for MVA across industries.

∆MVA measures the difference between a company's current MVA and MVA three years prior to current. The measure tells us how much wealth the company has created or destroyed over the period, and indicates any change in investor expectations about the company. A decline in MVA suggests that an investor has lowered expectations for the company. The three-year change in EVA indicates the trend in economic performance. A positive change in EVA may result from reducing costs, better management of assets or the redeployment of capital, investing in positive NPV projects and reducing the cost of capital.

In most studies reviewed, MVA is used as the best proxy of value creation to shareholders. Table 1 gives a summary of coefficients of determination (r^2) in the correlation between MVA and various financial performance measures as provided by Stern (1993), Uyemura *et al*. (1996) and Milunovich *et al*. (1996)

Table 1: Correlation of different performance measures with shareholder wealth

Correlation with MVA	Coefficient of determination (r^2)		
	Stern (1993)	Uyemura *et al*.(1996)	Milunovich *et al*. (1996)
EVA	50%	40%	42%
ROA		13%	
ROE	25%	10%	29%
CFG	22%		
EPS	18%	6%	34%
Net Income (amount)		8%	
Asset Growth	18%		
Dividend Growth	16%		
Turnover Growth	9%		

2.2.4 Advantages and Disadvantages

A good financial performance measure should ask how well the firm has generated operating profits, given the amount of capital invested to produce those profits. This idea is that the firm's financiers are free to liquidate their investment in the firm and invest the liberated capital elsewhere. Thus, the financiers must earn at least their opportunity cost of capital on the invested capital. This condition implies that this cost of capital must be subtracted from operating profits to gauge the firm's financial performance. EVA, for this reason, has the advantage over traditional accounting measures that measure economic performance but ignore the cost of the capital. Including the cost of capital, as EVA does, reveals whether any economic value was created. This forces management to focus on managing the company's assets as well as creating income.

However, the major disadvantage of EVA, as described by Bacidore *et al*. (1997) is that it uses the economic value book of assets when capital charge for the firm is

derived from a market-based WACC. To make inferences about changes in shareholder wealth, a market-derived cost of capital should be applied to the market value of the firm's assets. Furthermore, the determination of cash flows can rely on subjective judgements.

2.2.5 EVA versus share price

There is currently a heated debate among practitioners about whether EVA has a higher correlation with stock values and their returns than traditional accounting measures. Many studies undertaken on the importance of EVA and its relationships with the share price led to opposing conclusions.

Anderson and Bey (1998) state that EVA varies over time and, it is significantly correlated with accounting variables. Contracting this is O'Byrne's (1997) study which shows that changes in EVA explain more of the variation in ten-year stock returns than changes in earnings, and significantly more of the variation in five-year returns.

Appleby (1997) states that EVA is a lagging indicator that looks into a company's past performance; it provides no indication of the company's performance in the future. In contrast, Chamberlain and Campbell (1995) indicate that EVA allows management to quickly see in which way a company is heading and that EVA serves as a good predictor of future performance. This last study confirms the findings of the work by Stern (1993), Uyemura *et al*. (1996) and Milunovich *et al*.

(1996) that state that EVA is the most correlated measure to the share price, with coefficients of determination displayed in table 1.

Furthermore, Wallace (1998) asserts that EVA's most powerful feature is its suitability to management compensation systems. On this front, a recent study by Griffith (2004) assesses the performance of companies that had implemented the EVA-based compensation system and finds that such companies did not outperform the market. In 1995, Daniel Saint of Chrysler stated that as a single period measure of financial performance, EVA's contribution is minimal and not much different from return on equity or other traditional accounting measures (Kramer and Pushner, 1997).

In light of these contradicting findings, this paper purported to examine the relationship between EVA and share prices in the gold mining industry. The paper determined the correlation coefficient between EVA and share prices and investigated the impact of gold price on this coefficient.

2.3 Return on equity

2.3.1 Definition

The return on equity (ROE) measures the rate of return on the ownership interest of the common stock owners. It is viewed as one of the most important financial ratios. It measures a firm's efficiency at generating profits from every unit of

currency of net assets and shows how well a company uses investment money to generate earnings growth.

2.3.2 ROE Computation

Shareholders are concerned about their return on investment. The best accounting ratio to measure this is return on equity (Ward *et al.*, 2006). ROE is computed by dividing the net profit after tax by equity as given in the formula below:

$$ROE = \frac{Net\ profit\ after\ tax}{Equity} \qquad (5)$$

2.3.3 ROE Interpretation

To understand the factors affecting a firm's ROE, including its trend over time and its performance relative to competitors, analysts often decompose ROE into the product of a series of ratios. This kind of decomposition of ROE is often called the DuPont system (Bodie,Kane & Marcus, 2008)

$$ROE = \underbrace{\frac{Net\ Income}{Sales}}_{(a)} \times \underbrace{\frac{Sales}{Total\ Assets}}_{(b)} \times \underbrace{\frac{Total\ Assets}{Average\ Stockholder\ Equity}}_{(c)} \qquad (6)$$

Essentially, ROE will equal net margin (a) multiplied by asset turnover (b) multiplied by financial leverage (c). Splitting return on equity into three parts makes

it easier to understand changes in ROE over time. For example, if the net margin increases, every sale brings in more money, resulting in a higher overall ROE. Similarly, if the asset turnover increases, the firm generates more sales for every dollar of assets owned, again resulting in a higher overall ROE. Finally, increasing financial leverage means that the firm uses more debt financing relative to equity financing. Interest payments to creditors are tax deductible, but dividend payments to shareholders are not. Thus, a higher proportion of debt in the firm's capital structure leads to higher ROE. Financial leverage benefits diminish as the risk of defaulting on interest payments increases. So if the firm takes on too much debt, the cost of debt rises as creditors demand a higher risk premium, and ROE decreases. Increased debt will make a positive contribution to a firm's ROE only if the firm's return on assets (ROA) exceeds the interest rate on the debt (Bodie *et al*., 2008).

Not all high-ROE companies make good investments. Some industries have high ROE because they require no assets, such as consulting firms. Other industries require large infrastructure builds before they generate a profit, such as mining firms or oil refiners. One cannot conclude that consulting firms are better investments than mining firms just because of their ROE. As with many financial ratios, ROE is best used to compare companies in the same industry. To this end, the use of ROE in this paper is justified by the fact that companies that are the basis of this study operate all in the same industry, the gold mining industry.

2.3.4 ROE versus share price

In the study conducted by Omran *et al.* (2004), it was found that ROE is the only significant common financial ratio to be the most linked to the share price. This study resonates well with the findings of Stern (1993) and Milunovich *et al*. (1996) that state that, apart from EVA, ROE is the second most correlated parameter to the share price (MVA), with coefficients of determination of 25% and 29% respectively, as shown in table 1. However, defenders of VBM, such as Stephens and Bartunek (1997) believe that ROE and EPS have no significant link to the share price as changing the firm's accounting methods or the capital structure of the firm can alter their values.

In this study, ROE of JSE-listed gold mining companies and its correlation to share price were examined. Furthermore, the impact of gold price on the correlation was investigated.

2.4 Earnings per share

2.4.1 Definition and Computation

The term earnings per share (EPS) represents the portion of a company's earnings, net of taxes and preferred stock dividends, which is allocated to each share of common stock. The figure can be calculated simply by dividing net income

earned in a given reporting period (usually quarterly or annually) by the total number of shares outstanding during the same term. Because the number of shares outstanding can fluctuate, a weighted average is typically used.

EPS is calculated using the following equation:

$$EPS = \frac{NPAT}{Total\ Shares\ in\ issue} \qquad (7)$$

where NPAT = Net profit after tax

2.4.2 Interpretation

EPS can be calculated via two different methods: basic and fully diluted. Fully diluted EPS - which factors in the potentially dilutive effects of warrants, stock options, and securities convertible into common stock - is generally viewed as a more accurate measure and is more commonly cited.

EPS can be further subdivided according to the time period involved. Prior (trailing) earnings, recent (current) earnings, or projected future (forward) earnings can assess profitability. Though EPS is widely considered to be the most popular method of quantifying a firm's profitability, it is important to remember that earnings themselves can often be susceptible to manipulation, accounting changes, and restatements. For that reason, free cash flow is seen by some to be a much more reliable indicator than EPS. Nevertheless, EPS remains the industry standard in determining corporate profitability for shareholders.

2.4.3 EPS versus share price

EPS is a carefully scrutinized metric that is often used as a barometer to gauge a company's profitability per unit of shareholder ownership. As such, EPS is a key driver of share prices. It is also used as the denominator in the frequently cited P/E ratio.

O'Hanlon and Peasnell (1996) find that EPS encourages shortsighted behaviour and causes managers to believe that shareholders are a costless source of funds. O'Byrne (1997) indicates that five-year changes in earnings explained only 24 per cent of the changes in market value. These studies indicate therefore that there is a moderate positive influence of EPS on the share price. This corroborates the findings of the work done by Omran *et al.* (2004). Stern (1993), Uyemura et al. (1996) and Milunovich et al. (1996) add that the coefficients of determination in the correlation between EPS and the value creation proxy (MVA) are 18%, 6% and 34% respectively as shown in table 1.

This study correlated EPS to the share price of JSE-listed gold mining companies. It also evaluated the impact of gold price on this correlation.

2.5 Cash flow

2.5.1 Introduction

Cash flow (also called net cash flow) is the balance of the amounts of cash being received and paid by a business during a defined period of time, sometimes tied to a specific project. Measurement of cash flow can be used

- to evaluate the state or performance of a business or project.
- to determine problems with liquidity. Being profitable does not necessarily mean being liquid. A company can fail because of a shortage of cash, even while profitable.
- to generate project rate of returns. The time of cash flows into and out of projects are used as inputs to financial models such as internal rate of return, and net present value.
- to examine income or growth of a business when it is believed that accrual accounting concepts do not represent economic realities. Alternately, cash flow can be used to validate the net income generated by accounting.

2.5.2 Computation

Cash flows can be classified into:

- Operational cash flows: Cash received or expended as a result of the company's core business activities.
- Investment cash flows: Cash received or expended through capital expenditure, investments or acquisitions.
- Financing cash flows: Cash received or expended as a result of financial activities, such as interests and dividends.

All three together - the net cash flow - are necessary to reconcile the beginning cash balance to the ending cash balance.

The net cash flow can be calculated by adding to the difference between the net assets at the beginnings of a period (ONA) and those at the end of a period (CNA), retained earnings (RE) and proceeds from sale of new equity (NE) (Ward *et al.*, 2006), as summarised in the formula below:

$$\textit{Net Cash Flow} = \textit{ONA} - \textit{CNA} + \textit{RE} + \textit{NE} \qquad (8)$$

2.5.3 Interpretation

The cash flow statement is one of the four main financial statements of a company. The cash flow statement can be examined to determine the short-term sustainability of a company. If cash is increasing (and operational cash flow is positive), then a company will often be deemed to be healthy in the short-term. Increasing or stable cash balances suggest that a company is able to meet its cash

needs, and remain solvent. This information cannot always be seen in the income statement or the balance sheet of a company. For instance, a company may be generating profit, but still have difficulty in remaining solvent.

2.5.4 Cash versus share price

If the net cash flow grows, the market may perceive that the company is in a healthy financial position; as a result, this can have an impact on the share price. However, Stern (1993) predicts that the influence of CFG on MVA is only moderate, with a coefficient of determination 22%.

In this paper, after computing cash flow growth of JSE-listed gold companies, its relationship to the share price was determined and the impact of the gold price on this dependency was evaluated.

2.6 Gold price

2.6.1 Gold uses

Gold is an ancient metal of wealth, commerce and beauty, but it also has a number of unique properties that make it invaluable to industry.

Gold's superior electrical conductivity, malleability, and resistance to corrosion have made it vital to manufacture of components used in a wide range of electronic

products and equipment, including computers, cellular telephones and home appliances.

Gold has extraordinary high reflective powers that are relied upon in the shielding that protects spacecrafts and satellites from solar radiation and industrial and medical lasers that use gold-coated reflectors to focus light energy. And because gold is biologically inactive, it has become a vital tool for medical research and is even used in the direct treatment of arthritis and other intractable diseases.

The demand for gold in industry is steady and growing. The supply from stored inventory and from mining operations is limited and will remain so. Demand from investors who want to possess this precious metal is steady, and increases during periods of world crises or instability. The result is a market with much more upside potential than down (Sarfaraz *et al*., 2005).

Gold is an excellent hedge against inflation, and protects earnings for the future. Modern investor can invest in gold the traditional way – by purchasing gold bullion in the form of bars or coins – or they trade in gold futures electronically, or by investing in gold mining or refining companies (Ranson & Wainwright, 2005).

2.6.2 Factors affecting gold price

The price of gold is an amalgam of diverse and changing influences, from currencies to jewellery, from investors to speculators. From Asia, to India, to

Australia, to Canada, to South Africa, to the USA and to Asia, the gold price is of interest to all. It cannot be seen as a metal, but must be understood as a global thermometer measuring monetary, political, economic stability (Sarfaraz *et al*., 2005).

A number of drivers collectively support the gold price. However, Sarfaraz *et al*. (2005) argue that the economic environment surrounding the US economy, in particular the strength of the US Dollar, the oil and commodity prices and the diminishing supply of gold and increasing investment demand will ultimately impact on the gold price.

The economic environment in the USA was recently jolted by subprime losses, the tightening of the credit market and the lowering of interest rates. These factors combined have resulted in a weakening of the US Dollar, which in turn has put pressure on the gold price as investors see gold as a safe-haven.

The oil price is currently hovering at record high. This high oil price results likely in inflationary pressures, which in turn result likely in upward pressure on the gold price because of gold's use as an inflation hedge (Ranson *et al*., 2005).

2.6.3 Gold price versus share price of gold mining companies

Tufano (1998) studies the exposure of North American gold mining firms to changes in the price of gold. He concludes that the average mining share moves

two percent for each 1 percent change in gold prices, but exposures vary considerably over time and across firms. As predicted by valuation models in the work by Tufano (1998), gold firm exposures are significantly negatively related to the firm's hedging and diversification activities and to gold prices and gold return volatility, and are positively related to firm leverage. This work supports the findings of the work done by Blose (1995) that conclude that the value of gold mining firm is shown to be a function of the return on gold, production costs, the level of gold reserves, and the proportion of assets held by the firm that are unrelated to gold mining stock. Blose (1995) argues that, assuming that forward gold prices are the market's unbiased expectations of future spot prices, if a company's assets are comprised primarily of operating gold mines, then the return on an investment in the company will be greater than an investment in gold (i.e. , the gold price elasticity of the mining stock is greater than 1).

The author, to the best of his ability, never found in the literature the association between gold price with EVA and with financial measures. However, since gold price affects the share price of gold mining companies and since there is a link between the share price and economic and financial measures, it is then possible to link the gold price to these measures and this paper investigated this association.

3 RESEARCH HYPOTHESES

The research question was formulated as follows: Is the correlation between EVA, ROE, EPS and CFG with the share price of JSE-listed gold companies influenced by the changing gold price? This research question led to the following to two groups of hypotheses, which were tested in this study.

3.1 Hypotheses related to correlation to share price

The correlation of EVA, ROE, EPS, CFG and GP to share price was tested by the following five hypotheses.

3.1.1 Hypothesis 1

The null hypothesis (H_o) states that there is no correlation between EVA and the share price (SP) of JSE-listed gold companies.

The alternative hypothesis (H_A) states the there is a correlation between the EVA and SP of JSE-listed gold companies

Stated differently: $H_o: b_1 = 0$ $H_A: b_1 \neq 0$

where b_1 is the regression coefficient in the simple regression of SP to EVA

3.1.2 Hypothesis 2

The null hypothesis (H_o) states that there is no correlation between ROE and the share price (SP) of JSE-listed gold companies.

The alternative hypothesis (H_A) states the there is a correlation between ROE and SP of JSE-listed gold companies

Stated differently: $H_o: b_2 = 0$ $H_A: b_2 \neq 0$

where b_2 is the regression coefficient in the simple regression of SP to ROE

3.1.3 Hypothesis 3

The null hypothesis (H_o) states that there is no correlation between EPS and the share price (SP) of JSE-listed gold companies.

The alternative hypothesis (H_A) states the there is a correlation between EPS and SP of JSE-listed gold companies

Stated differently: $H_o: b_3 = 0$ $H_A: b_3 \neq 0$

where b_3 is the regression coefficient in the simple regression of SP to EPS

3.1.4 Hypothesis 4

The null hypothesis (H_o) states that there is no correlation between CFG and the share price (SP) of JSE-listed gold companies.

The alternative hypothesis (H_A) states the there is a correlation between CFG and SP of JSE-listed gold companies

Stated differently: $H_o: b_4 = 0 \quad H_A: b_4 \neq 0$

where b_4 is the regression coefficient in the simple regression of SP to CFG

3.1.5 Hypothesis 5

The null hypothesis (H_o) states that there is no correlation between the gold price (GP) and the share price (SP) of JSE-listed gold companies.

The alternative hypothesis (H_A) states the there is a correlation between GP and SP of JSE-listed gold companies

Stated differently: $H_o: b_5 = 0 \quad H_A: b_5 \neq 0$

where b_5 is the regression coefficient in the simple regression of SP to GP

3.2 Hypotheses related to the impact of gold price on the correlation to share price

3.2.1 Hypothesis 6:

The null hypothesis (H_o) states that the correlation coefficient between EVA and the share price (SP) of JSE-listed gold companies, r(EVA,SP) is not correlated to by gold price (GP).

The alternative hypothesis (H_A) states that the correlation coefficient between EVA and SP, r(EVA,SP), is correlated to GP.

Stated differently: $H_o: b_6 = 0$ $H_A: b_6 \neq 0$

where b_6 is the regression coefficient in the simple regression of r(EVA,SP) to GP

3.2.2 Hypothesis 7:

The null hypothesis (H_o) states that the correlation coefficient between ROE and the share price (SP) of JSE-listed gold companies, r(ROE,SP) is not correlated to by gold price (GP).

The alternative hypothesis (H_A) states that the correlation coefficient between ROE and SP, r(ROE,SP), is correlated to GP.

Stated differently: $H_o: b_7 = 0$ $H_A: b_7 \neq 0$

where b_7 is the regression coefficient in the simple regression of r(ROE,SP) to GP

3.2.3 Hypothesis 8:

The null hypothesis (H_o) states that the correlation coefficient between EPS and the share price (SP) of JSE-listed gold companies, r(EPS,SP) is not correlated to by gold price (GP).

The alternative hypothesis (H_A) states that the correlation coefficient between EPS and SP, r(EPS,SP), is correlated to GP.

Stated differently: $H_o: b_8 = 0$ $H_A: b_8 \neq 0$

where b_8 is the regression coefficient in the simple regression of r(EPS,SP) to GP

3.2.4 Hypothesis 9:

The null hypothesis (H_o) states that the correlation coefficient between CFG and the share price (SP) of JSE-listed gold companies, r(CFG,SP) is not correlated to by gold price (GP).

The alternative hypothesis (H_A) states that the correlation coefficient between CFG and SP, r(CFG,SP), is correlated to GP.

Stated differently: $H_o: b_8 = 0$ $H_A: b_8 \neq 0$

where b_9 is the regression coefficient in the simple regression of r(CFG,SP) to GP

4 RESEARCH METHODOLOGY

4.1 Introduction

In his study on the correlation between various financial and economic ratios and the market value added, Stern (1993) concluded that EVA, ROE, EPS and CFG were the most correlated variables to the share price. This paper purported to verify the validity of these findings in the gold mining industry. As a result, the paper used EVA, ROE, EPS, CFG and GP as independent variables and attempted to correlate them to the share price (SP) of JSE-listed gold companies as a dependent variable. In addition, the paper determined the impact of gold price on the correlation between SP with EVA, ROE, EPS and CFG. In this regard, it correlated r(EVA,SP), r(ROE,SP), r(EPS,SP), and r(CFG,SP) individually as dependent variables to GP as an independent variable.

4.2 Proposed methodology

This study was performed on historical data. The research methodology therefore consisted of a quantitative analysis of secondary data. An inherent disadvantage of secondary data, as stated by Zikmund (2003), is that these data were not designed specifically to meet the researcher's needs. To this end, only data from JSE-listed gold companies were considered. The rationale of selection was that these data were collected for the same financial purposes and that; they were all audited

according to rules clearly set by JSE. However, this paper did not check the validity of data.

Zikmund (2003) adds that when using secondary data, the time period must be consistent with the researcher's needs. All data were analysed for the same period of time, which started from January 1999 till December 2007. This period was carefully selected to permit the collection of a statistically significant amount of data. The period was also chosen to clearly study the impact of gold price, which changed significantly during this period. A caution was taken to have all similar data expressed in the same unit of measurement.

Unless otherwise specified, all data were considered annually. As far as gold prices and share prices were concerned, a yearly average was computed from daily data provided for the purpose of the analysis.

4.3 Population of relevance

The study was conducted on financial data of gold mining companies listed on the JSE. The population of relevance was therefore gold mining firms that were listed on the JSE from January 1999 to December 2007. This population has been chosen because of the relative ease with which data could be obtained. The population excluded all other gold companies, big or small, that were either private or listed on a different stock exchange during the period of study.

4.4 Sampling

The population of relevance contained fifteen companies. Given the population size, the paper proposed a census study of all fifteen companies.

The list of all JSE-listed gold mining firms is given in the following table 2.

Table 2: List of JSE-listed gold mining companies

No.	*Company Name*	*Company Code*
1	AFLEASE GOLD LIMITED	AFGOLD
2	ANGLOGOLD ASHANTI LIMITED	ANGGOLD
3	CENTRAL RAND GOLD LIMITED	CENRAND
4	DRDGOLD LIMITED	DRDGOLD
5	GOLD FIELDS LIMITED	GFIELDS
6	GREAT BASIN GOLD LIMITED	GB GOLD
7	HALOGEN HOLDINGS SOCIETE ANONYME	HALOGEN
8	HARMONY GOLD MINING COMPANY LIMITED	HARMONY
9	JCI LIMITED	JCI 2
10	PAMODZI GOLD LIMITED	PZGOLD
11	RANGOLD & EXPLORATION COMPANY LIMITED	RANGOLD
12	SIMMERS & JACK MINES LIMITED	SIMMERS
13	STILFONTEIN GOLD MINING COMPANY LIMITED	STILFTN
14	VILLAGE MAIN REEF GOLD MINING COMPANY LIMITED	VILLAGE
15	WITWATERSRAND CONS GOLD RESOURCES	WITS GOLD

4.5 Unit of analysis

The unit of analysis was the individual gold company listed on the JSE.

4.6 Research data

4.6.1 Introduction

Data collected consisted of various financial ratios and market information of companies to be analysed. These included data of EVA, ROE, EPS, CFG, GP and share prices. All raw data needed for this research were either collected as such from the McGregor BFA database and I-Net Bridge database; or they were calculated to suit the requirements of the research. Procedures concerning their calculations are given in the section below. However, all collected row data are given in appendices A to F.

4.6.2 ROE and EPS data

ROE and EPS data were retrieved from the McGregor BFA database, without any modifications. They are presented in appendix A and appendix B respectively.

4.6.3 CFG data

Unlike ROE and EPS data, CFG data were computed from information obtained from the cash flow statements. The formula below was used to calculate the CFG.

$$CFG = \frac{CFt - CFt^*}{|CFt^*|} \qquad (9)$$

where CFG = Cash Flow Growth in the year t

CFt = Cash flow in the year t

CFt* = Cash flow a year prior to year t

The absolute value was applied to correct all negative values which, if not corrected would make an increase in cash flow look like a decrease and vice versa. The CFG figures are given in appendix C

4.6.4 EVA data

In the McGregor database, EVA values for gold mining companies were not given, nor were they given in the I-Net Bridge database. EVA values were computed from information retrieved from the following sources, still collected from the McGregor BFA database:

- The income statements
- The balance sheet statements

The author had made the following assumptions before calculating EVA values:

- The market premium rate of six percent was used across companies for the whole period of study

- The risk-free rate and risk index values as provided by the McGregor BFA database were used
- The equity market value used in the calculation of the WACC, as provided by the McGregor BFA database,
- Since the cost of debt was not provided for each individual company, the author used the prime rate for the corresponding year and added one percent. Mining houses are regarded as capital-intensive investments. As a result, they are heavy borrowers of banks funds. This allows them to hold an important power to negotiate their cost of debt close to the prime-lending rate. One percent was therefore considered a reasonable premium above the prime-lending rate. The same cost of debt was applied across companies.
- Bacidore *et al*. (1997) state that the weakness of EVA is the use of capital asset book value. Therefore, for lack of market value of the capital employed, the total asset book value was used in the computation of EVA values

Combining results obtained from the application of equations (2), (3) and (4) concerning NOPAT, WACC and k_E, EVA values were calculated and they are presented in appendix D.

4.6.5 Gold prices and share prices

Market information was collected from two different sources. Share prices were collected from the McGregor BFA database whereas gold prices were collected from the I-Net Bridge database. These data were provided on a daily basis from which annual averages were computed. Appendix E and appendix F present share price and gold price figures respectively.

4.6.6 Missing data

A firm was removed from the data set for a particular year if the required financial or economic information was missing. The firm otherwise remained in the sample. Reasons for missing data were of various natures. However, this paper never undertook to investigate those reasons, as their impact on the overall result was rather insignificant, given their low proportion.

4.6.7 Data integrity

Most data were collected from the McGregor database and no adjustments were made to them. To verify the accuracy of data, the researcher conducted a random check of data against data obtainable from the I-Net Bridge database or from data published on the website of any random company in question. No case was reported where data differed from these different sources.

4.7 Data analysis approach

4.7.1 Introduction

There are two general categories of research objectives for secondary data research: fact finding and model building (Zikmund, 2003). Since this paper was about establishing the extent to which EVA, ROE, EPS, CFG and GP influenced individually or collectively the share price, a model building was applied while using statistical inference to analyse the data.

4.7.2 Correlation and Regression analysis

The following steps were applied to perform a regression analysis:

- A simple regression analysis was used to determine the correlation between the share price of JSE-listed gold mining companies and each one of the independent variables, EVA, ROE, EPS, CFG and GP.
- To double check simple regression results, a multiple regression analysis was used to determine the collective correlation of EVA, ROE, EPS, CFG and GP with the share price of JSE-listed gold mining companies.
- Multicollinearity can distort the standard error of estimate, and may therefore lead to incorrect conclusions as to which independent variables are statistically significant (Lind, Mason & Marchal, 2000). As a result, a

4.7.3 Hypothesis testing

4.7.3.1 Hypotheses related to correlation to share price

All simple regression equations were given in the form as follows:

$$Share\ Price = a + b.x \qquad (10)$$

where a is the intercept, b is the slope and x is an independent variable.

To establish if the dependency exists between the share price and x, a two-tailed t-test was conducted, using a 95% confidence. This helped to establish whether or not the coefficient b in equation (7) could be zero.

A similar test was run on multiple regression coefficients to further ascertain the validity of findings from the simple regression.

4.7.3.2 Hypotheses related to the impact of gold price on the correlation to share price

Relevant data were collected from January 1999 to December 2000. For each year, given the number of companies, it was possible to run regression analyses.

Hypotheses related to the impact of gold price on the correlation to share price were tested as follows:

Use EVA, ROE, EPS and CFG as dependent variables and correlate them individually to the gold price in a simple regression. Then use a two-tailed t-test as explained in paragraph 4.7.3.1.

4.8 Research limitations

The research conducted had, *inter alia*, the following limitations:

- It reviewed the impact of gold price on the correlations to share prices only in the recent years where there had been a significant change in the gold price trends;
- It only considered gold companies listed on the JSE and was, therefore, not representative of unlisted gold companies or gold companies that were listed on other stock exchanges;
- It only correlated variables that are the most correlated to the share price and can't be extended to all financial ratios.
- It was only limited to gold mining industry and could not be generalised to all sectors.

5 PRESENTATION OF RESULTS

5.1 Introduction

Data concerning the share prices of all fifteen companies for the 9 years of study gave a distribution with a standard deviation of 7027, an average of 3863. Given this wide range of values, the author decided to use a logarithmic scale of share prices in lieu of absolute values to decrease the standard deviation. In all analyses described below, share prices were used in their logarithmic forms.

Three sets of results are presented in this section. First, the results of simple regression analyses are presented, and then those of the multiple regression analysis. Finally, results of simple regression between correlation coefficients and gold price are reported. Solutions to hypotheses raised are given alongside these results.

5.2 Simple regression analyses

The general simple regression equation is given by the equation (10) where a stands for the intercept and b is the slope or regression coefficient. The coefficient b has an index corresponding to the hypothesis number, like b_1 for hypothesis 1. Hypothesis testing, using a t-test, was conducted to determine whether or not the regression coefficient could be zero. The following table 3 summarises results of simple regression analyses.

Table 3: Simple regression results

Predictor	Intercept (a)	Slope (b)	t-value	p-value	Correlation coefficient r	Reject Ho
EVA	5.8900	0.0000	-6.0725	0.0000	-0.5546	Yes
ROE	6.3792	0.0000	0.2997	0.7651	0.0311	No
EPS	6.4942	0.0011	2.8189	0.0060	0.2878	Yes
CFG	6.5818	0.0000	0.2538	0.8003	-0.0282	No
GP	4.9975	0.0030	1.9652	0.0521	0.1901	No

5.2.1 Share price versus EVA: Hypothesis 1

Table 3 shows that EVA was negatively correlated to the share price. Its coefficient of determination r^2= 0.3076 was the highest of all independent variables in the dataset. This means that the change in EVA contributed by over 30% to the change in share price.

A significance test that the slope b_1 = 0 resulted in a t-value of –6.0775. The significance level of this test was 0.0000. Since 0.0000 < 0.05 (the α-value corresponding to the 95% confidence interval), the hypothesis that the slope was zero was therefore rejected. This signifies that the share price was invariably dependent to some extent on the EVA.

5.2.2 Share price versus ROE: Hypothesis 2

Results in table 3 indicate that the share price had a positive correlation with the ROE ratio. This weak correlation had a coefficient of determination r^2= 0.001. Only 0.1% of change in share price could be related to the change in the ROE.

However, when running the significance test that the regression coefficient $b_2 = 0$, it was found that the t-value is high; this made the probability of not rejecting the null hypothesis higher than the α-level. Consequently, the statement that b_2 could be zero could not be rejected. This means that despite the existence of a coefficient of correlation between the share price and ROE, the correlation was so weak that sometimes, it could be inexistent.

5.2.3 Share price versus EPS: Hypothesis 3

EPS ratio had the highest positive correlation to the share price as shown in table 3. Its coefficient of determination (r^2= 0.0828) was the second largest, after that of the EVA. This indicated that the change in EPS accounted for about 8.28% of the change in the share price of JSE-listed gold mining companies.

The hypothesis testing of the possibility of b_3 to be equal to zero resulted in a t-value of 2.8189. This value lied far in the rejection region of the null hypothesis. This was further confirmed by the p-value of 0.006 which was below the acceptable significance value of α=0.05. As a result, the regression coefficient b_3 could not be zero as there was not enough evidence to support the rejection of the alternative hypothesis.

5.2.4 Share price versus CFG: Hypothesis 4

Table 3 shows that CFG had a slight negative correlation to the share price, with a coefficient of determination of only r^2= 0.0008, the smallest of all independent variables studied. All changes in CFG accounted only for slightly below 0.1% of change in the share price.

A significance test that the slope b_4 = 0 resulted in a t-value of -0.2538. The significance level of this test was 0.8003. Since 0.8003 > 0.05, the hypothesis that the slope was zero could be rejected. This means that the share price did not always depend on the CFG.

5.2.5 Share price versus GP: Hypothesis 5

The gold price had a positive correlation with the share price. Given its r^2= 0.0361, only slightly below 4% of the share price changes could be attributed to the change in the gold price.

The hypothesis testing that the slope was zero resulted in a t-value of 1.9652 and a p-value of 0.0521. Since 0.0521 > 0.0500, the null hypothesis was not rejected, that means that the regression coefficient b_5 could be zero. However, if the interval of confidence were slightly widened to 96%, the share price would invariably be dependent on the gold price.

5.3 Multiple regression analysis

Hypothesis testing was repeated while using the multiple regression analysis. Table 4 below gives all the results of analysis.

Table 4: Multiple regression results

i	Predictor	Regression Coefficient b_i	t-value to test Ho: bi=0	p-value to test Ho: bi=0	Reject Ho
1	EVA	0.0000	0.0000	1.0000	No
2	ROE	0.0003	0.8250	0.4123	No
3	EPS	0.0016	4.8990	0.0000	Yes
4	CFG	0.0000	0.3030	0.7626	No
5	GP	0.0009	0.6400	0.5242	No

The multiple regression equation is given by the equation below:

$$ln(SP) = 5.5820 + 3.2033*10^{-04}*ROE + 1.5565*10^{-03}*EPS + 2.02121*10^{-05}*CFG + 9.2287*10^{-04}*GP - 6.2815*10^{-07}*EVA \quad (11)$$

All results of simple regression analyses were confirmed, except the correlation to the EVA, which the hypothesis testing revealed that, sometimes, the share price could be totally independent of EVA. The collective coefficient of regression is r^2 = 0.4887. This means that, nearly 49% of changes in share prices were due to the collective influence of changes in EVA, ROE, EPS, CFG and GP.

A multivariate analysis was also conducted to determine the interdependency of all independent variables, which could have an impact on the results of the multiple regression analysis. The following Table 5 gives the correlation matrix.

Table 5: Correlation matrix

	EVA	ROE	EPS	CFG	SP
EVA	1				
ROE	0.00326	1			
EPS	0.18529	-0.09151	1		
CFG	0.07552	0.00496	-0.05025	1	
SP	-0.31892	-0.17045	-0.25077	-0.14557	1

It transpires from table 5 that EPS and EVA were the most positively correlated whereas SP and EVA were the most negatively correlated.

5.4 The impact of gold price on correlation coefficients

5.4.1 Correlation Coefficients

Results from correlation coefficients, obtained by running simple regression of the share price and each one of EVA, ROE, EPS and CFG, taken individually as independent variables, for each year of the period of study are given in the following table 6.

Table 6: Coefficients of correlation to share price

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**Av.**
ROE	0.118	0.069	0.042	0.264	0.382	0.358	0.315	0.544	0.216	0.256
EPS	0.593	0.342	0.564	0.712	0.778	0.088	-0.513	-0.244	-0.357	0.466
CFG	-0.504	0.567	-0.152	-0.348	0.208	0.534	0.467	0.356	-0.145	0.365
EVA	-0.655	-0.795	-0.731	-0.347	-0.301	-0.831	-0.831	-0.836	-0.735	-0.674

The average in the last column considered absolute values in the case of EPS and CFG as the values change signs. Taken separately per year, EVA still maintained the lead of negative correlation, with an average r^2 = 0.45 whereas EPS maintained the lead of positive correlation with r^2= 0.22. Altogether, values of correlation seemed higher than when the regression was run for the entire period.

Table 7 summarises the findings of coefficients of determination from simple regression analyses as performed either for the entire period of study or as an average of year-on-year values.

Table 7: Summary of coefficients of determination

Correlation to Share Price	Coefficient of determination (r^2)	
	Entire Period	Year-on-year
EVA	30.76%	45.36%
ROE	0.10%	6.58%
EPS	8.28%	21.68%
CFG	0.08%	13.29%
SP	3.61%	

5.4.2 Simple regression between correlation coefficients and gold price

The general regression equation was of the form:

$$r(y) = a + b*SP \qquad (12)$$

where y is any one of EVA, ROE, EPS and CFG. a is the intercept and b is the slope or the regression coefficient. Results of analyses conducted are given in the following table 8.

Table 8: Simple regression between correlation coefficients and gold price

Predictor	Intercept (a)	Slope (b)	t-value	p-value	Correlation coefficient r	Reject Ho
r(EVA)	278.5554	-43.7307	-0.5052	0.6289	-0.1876	No
r(ROE)	281.7480	102.2867	0.9787	0.3603	0.3469	No
r(EPS)	321.8617	-63.8985	-2.2551	0.0588	-0.6487	No
r(CFG)	309.4132	-13.0352	-0.2896	0.7805	-0.1088	No

5.4.3 r (EVA, SP) versus GP: Hypothesis 6

The gold price was negatively correlated to r(EVA, SP). The coefficient of determination attested that the correlation was so weak that the gold price only accounted for 3.52% of the change in r(EVA, SP).

The t testing of the hypothesis that b_6 could be equal to zero yielded a t-value of -0.5052 as shown in table 12. The probability level p = 0.6289 was much bigger than 0.05. Consequently, the null hypothesis could not be rejected, i.e. r(EVA, SP) was not always correlated to share price.

5.4.4 r(EPS, SP) versus GP: Hypothesis 7

Of all of the dependent variables, the gold price correlated positively only with r(ROE, SP). The gold price accounted for 12.03% of the change in r(ROE, SP). Using the hypothesis testing for $b_7 = 0$, the t-value and the p-value were equal to 0.9787 and 0.3469 respectively. The latter was bigger than 0.05, therefore the null hypothesis could be rejected.

5.4.5 r(EPS, SP) versus GP: Hypothesis 8

The negative correlation between r(EPS, SP) and GP is the highest, with the gold price controlling over 42% of change in r(EPS, SP).

The t testing of the hypothesis that b_8 could be equal to zero resulted in a t-value of -2.2551 as shown in table 12. The probability level p = 0.0588 was much larger than 0.05. As a result, the null hypothesis could not be rejected.

5.4.6 r(CFG, SP) versus GP: Hypothesis 9

The gold price influenced 1.18% of changes in r(CFG, SP). This value was the least of all values in the dataset. With a t-value of -0.2896 corresponding to a p-value of 0.7805, there was not enough evidence to reject the null hypothesis. b_9 could be zero.

6 DISCUSSION OF RESULTS

6.1 Introduction

This study aimed at determining the extent to which the share price of gold mining companies listed on the JSE South Africa is correlated to EVA, ROE, EPS, CFG and GP. The paper also proposed to determine the impact that gold price has on the correlation coefficient between the share price and EVA, ROE, EPS, and CFG. Results of the study are presented in chapter 5.

The aim of this chapter is to discuss the results of the research in light of the literature reviewed in chapter 2 and in light of the hypotheses raised in chapter 3.

6.2 Hypotheses related to the gold price

Since 1999, gold price has been on the rise until the end of this research's period. This is indicated in appendix F. Sarfaraz *et al.* (2005) argue that the economic environment surrounding the US economy, in particular the strength of the US dollar, the oil and commodity prices and the diminishing supply of gold and increasing investment demand will ultimately impact the gold price. All these elements mentioned have been in favour of the gold price recently. Gold mines are getting deeper and deeper; this in turn decelerates the rate of producing gold in large quantities, as safety increasingly becomes a serious limiting factor.

The economy in the USA has been deteriorating in the past two years and this contributes to the increase in gold price.

What does this mean for gold mining stocks? Would they follow suit and if yes, what is the degree of influence the increasing gold price will have on gold mining stocks? All these questions have been answered, and the results are presented in table 3. Gold price has a positive correlation with the share price of gold mining companies listed on the JSE. Approximately 4% of change in the stock price is attributed to the change in gold price. This resonates well with the work conducted by Tufano (1998) on the exposure of North American gold mining firms to changes in the gold price.

Tufano (1998)'s work and this study have both confirmed that there is a positive correlation between gold price and the share price, however the difference lies in the magnitude of influence. Tufano (1998) concludes that the average mining share moves 2% for each 1% change in gold prices, but this paper found that, by comparing the results presented in appendices E and F, that for every 1% increase in gold price, the share prices increase by 0.95%.

This difference in the magnitude is likely attributed to the difference in exposures South African mines have as compared to mines in North America. Blose (1995) states that the value of a gold mining firm is shown to be a function of the return on gold, production costs, the level of gold reserves, and the proportion of assets held by the firm that are unrelated to gold mining stock. The author believed that all

these drivers of gold mining value differ significantly between the two continents and for these reasons, the degree of influence of the gold price is different.

In hypothesis 5, the null hypothesis states that there is no correlation between the gold price and the share price of JSE-listed gold companies. A weak correlation exists. At 95% confidence, the null hypothesis could not be rejected, but at 96% one could confirm that there is enough statistical evidence to state that the share price is invariably dependent on the gold price.

6.3 Hypotheses related to EVA

There has been a heated debate in the literature concerning the influence that EVA has on the share price or its best proxy MVA. Defenders of EVA like Stern (1993), Uyemura *et al*. (1996) and Milunovich *et al*. (1996) have provided empirical evidence that EVA is the most correlated measure to the value creation proxy of all variables they tested. This is shown in table 1. However, other authors think differently. Kramer and Pushner (1997), in their correlation study of EVA to MVA, find that only 10% of change in MVA could be attributed to the change in EVA. Biddle *et al*. (1999) find no support for the contention that EVA outdoes earnings in terms of its relevance for value, since its coefficient of determination to share returns is simply 6% while that of residual income is 7%.

To add to the debate, this paper undertook to run a correlation analysis between share price and EVA of gold mining companies that are listed on the JSE from

January 1999 to December 2007. Results obtained, which are presented in table 7, supported the claim that EVA is the most correlated financial performance measure in creating value for shareholders. The simple regression using all observations for the full period of study confirmed that changes in EVA could explain up to 30.76% of changes in share prices. Year-on-year average results of simple regressions supported EVA as the best performance measure of all variables studied, with a r^2 = 45%. These values are in sync with those provided in table 1, from previous studies. There are some differences in values; the author proposed that they are due to different proxies used to represent shareholders wealth creation. In this study, the natural logarithm of the share price was used whereas in other studies, MVA is used.

Most studies have found a positive strong correlation between EVA and the value creation proxy, this study however found a negative correlation in all cases. By analysing data in appendix D, one could find that the average EVA was negative for every single company studied for the period in consideration. This means that gold mining companies have been destroying value. This negative correlation translates the fact that they destroy values as the absolute value of the EVA increases. Should EVA values be considered in absolute values, the correlation would be reversed to a positive value.

In hypothesis 1, the null hypothesis states that there is no correlation between EVA and the share price of JSE-listed gold mining companies. This could be translated into stating that the regression correlation was equal to zero. In testing this to 95%

confidence, the result presented compelling evidence in support of the alternative hypothesis, thus rejecting the null hypothesis. Results were rather opposite when looking at the testing from the multivariate analysis point. The testing testified that the null hypothesis could not be rejected. These strange findings led the author to conduct year-on-year regression analyses. Results of these analyses are presented in appendix G. Appendix G reveals that regression coefficients could not be zero every year. In years 1999, 2002 and 2003, there was no evidence to support the alternative hypothesis, therefore for these years, the null hypothesis could not be rejected as far as hypothesis 1 was concerned. The combined effect of all years supported the findings of simple regression. The multiple regression findings were a result of outliers.

Furthermore, the results of the year-on-year analyses justified why there are such opposing conclusions about EVA in the literature. They also supported the findings of Anderson *et al*. (1998) that state EVA varies greatly over time. As EVA changes, it leads to varying conclusions concerning its correlation to share price, as a result, this heats up the debate between its defenders and those who oppose it.

In hypothesis 6, the null hypothesis states that there is no correlation between r(EVA, SP) and gold price. The hypothesis was tested; it was found that the null hypothesis could not be rejected. There is not always a correlation between the two, all times there is, it is however a negative correlation.

6.4 Hypotheses related to ROE

Most of the defenders of EVA have concluded that, despite the superiority of EVA over accounting variables, ROE is the financial ratio most correlated with the value creation proxy, whether MVA or share returns. Stern (1993) concludes that ROE is correlated to the MVA at an r^2= 22%, Milunovich *et al*. (1996) found an r^2 =29%. In addition, Omran *et al*. (2004) find that ROE is the only financially ratio the most correlated to share price, with a coefficient of determination r^2 between 18% and 28% for the two methods used.

Since the literature reported a considerable level of correlation between ROE and the value creation, this paper purported to investigate this relationship in the gold mining industry. Of all variables analysed in this study, ROE was the least correlated to the share price, with a coefficient r^2 = 0.10%. This weak correlation corroborated the results of analysis conducted by De Wet (2005) on South African industrial companies listed on the JSE, which state that the correlation between ROE and standardised MVA has a r^2 that is as low as 1%. These findings suggest that ROE does not play a role in investment decision in the South African market in general, and in the gold mining in particular.

In hypothesis 2 the null hypothesis states that there is no correlation between ROE and the share price of JSE-listed gold mining companies. This hypothesis was tested using t testing; it was found that there is no compelling evidence not to reject the null hypothesis. Using a year-on-year analysis as shown in appendix G, the null

hypothesis could not be rejected for every single year studied. As a result, one could confirm that the share price is not always correlated with ROE in the gold mining industry in South Africa. The author attributes this poor correlation to the rather weak correlation that ROE has with the best driver of share price (EVA), as shown in table 5.

In hypothesis 7 the null hypothesis states that there is no correlation between r(ROE) and gold price. Testing of this hypothesis showed that there is a slight negative correlation; however, this correlation is so weak that it is inexistent sometimes.

6.5 Hypotheses related to EPS

There are mixed findings in the literature about which financial ratio best predicts the behaviour of stock prices. As far as the accounting measures are concerned, some provide evidence that ROE is the best predictor (Stern, 1993 and Omran *et al*., 2004), yet others argue that EPS is the best predictor (Milunovich *et al*., 1996).

This paper proposed to examine the relationship that EPS has with the stocks of gold mining companies listed on the JSE. The findings supported Milunovich *et al*. (1996) in that EPS proved to be the best correlated accounting measure with a coefficient of determination r^2 = 22% for the year-on-year analyses. This is true because PE ratios are much used in South African markets and EPS is the

denominator in the PE ratio. Furthermore, EPS was the most correlated accounting measure to the EVA, which in turn is the best driver of share prices.

The null hypothesis 3 states that there is no correlation between EPS and share price. The testing of this hypothesis at 95% confidence provided no evidence to reject the hypothesis. However, with a slightly larger confidence interval of 96%, the testing provided enough evidence in support of the alternative hypothesis.

In hypothesis 8 the null hypothesis states that the correlation coefficient between EPS and the share price is not correlated to the share price. The test revealed that despite a negative strong correlation between the two variables (r=-0.6487), the null hypothesis cannot be rejected at 95% confidence. However, by widening the confidence interval to 96%, there would be enough evidence to reject the null hypothesis. The gold price always has an impact on r(EPS) at 96% confidence
This strength of correlation is impacted, firstly by a moderate negative correlation between the gold price and EPS; secondly by the considerable impact gold price has on the share price.

6.6 Hypotheses related to CFG

Stern (1993) state that CFG is the second best accounting measure in predicting share prices. Its r^2 was established to be 22%, this was higher that the r^2 between EPS and share price. In the face of this moderate correlation, this paper purported

to investigate the relationship between share price and CFG in the gold mining industry. The highest r^2 obtained was 13.29% which is quite a significant number.

In hypothesis 4 the null hypothesis states that there is no correlation between CFG and share price. This hypothesis was tested a 95%, it was found that there is no evidence in support of the alternative hypothesis. As result, investors in the gold mining industry are not always concerned about the cash flow growth. The author thinks that investors believe that mines will never be unable to repay dividends, in the worse case, if they are liquidated, because they hold massive assets, these can still be sold to repay their equities.

It was stated in the null hypothesis 9 that there is no correlation between r(CFG) and the share price. The regression analysis showed that the correlation was so weak (r=-0.1876) that the hypothesis testing found no evidence to reject the null hypothesis. This confirms further why there is a weak correlation between share price and CFG.

6.7 Multiple regression

Results of simple regression analyses revealed that the combined influence of all parameters used was higher than 50% for year-by-year analyses. However, after running the multiple regression analysis, it was established that the collective influence of all parameters studied on the share price is only 49%. This could be explained by interdependency that exists between these value creation predictors.

Most of them are correlated with one another as shown in table 5 on correlation matrix. This supported the findings of Anderson *et al*. (1998) that state that EVA can't be superior to accounting variables in predicting the value creation because it is itself significantly correlated with accounting variables. In addition, EVA and EPS have the strongest positive correlation, is there any wonder why they are both best predictors of stock price.

By the 1990s, the focus of academic debate had shifted away from the econometric analyses of time series on prices, dividends and earnings toward developing models of human psychology as it relates to financial markets (Shiller, 2003). Since the share price of companies is not correlated to 100 percent to the financial and economic measures, like it is the case in this study, it is obvious that the factors other than financial and economic measures also can explain the stock performance such as human factors.

The author strongly believes that the other factors that account for the remaining 51% of the changes in share prices could likely be found in behavioural finance. Either by feedback models or by contrarian approaches (Shiller, 2003), the share prices of gold mining companies listed on the JSE is partly influenced by the behaviour of investors in their stocks.

7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

A review of research to date on the relationship between any proxies of share price or value creation (MVA, Share returns, etc.) has shown mixed results. Some initial studies indicated that EVA does indeed have greater power to explain value creation than other traditional accounting measures do. However, subsequent studies have contradicted these findings and have produced findings that support the claim that traditional accounting indicators are superior to EVA in explaining changes in share price.

This study, based on data of gold companies listed on the JSE in South Africa for the period from 1999 to 2007 revealed that, when data were considered for the full period of study, EVA showed the strongest correlation with the share price, with a coefficient of determination r^2 = 30.76%. It was followed by EPS which had a positive correlation with r^2= 8.28%. CFG and ROE had a weak correlation characterised by an r^2= 0.1% and an r^2= 0.1% respectively. Results also revealed that the gold price had a positive influence on the share price, which was estimated at an r^2 = 3.61%, more than the influence of ROE. For every 1% increase in gold price, the share prices increased by 0.95%.

When data were considered on a year-on-year basis, the order of strength remained the same. However, the degree of correlation changed for average

values, with the coefficient of determination between each one of the independent variables EVA, EPS, CFG and ROE being 45%, 22%, 13% and 7 % respectively. The strength of correlation was further tested using t testing. Only EVA was found to invariably influence the share price at 95% confidence. When enlarging the confidence interval to 96%, EPS could also invariably correlate to the share price. These findings revealed that despite the existence of some degree of correlation between share price and all the variables studied, only EVA and EPS influence the investment decision in the gold mining sector at the JSE in South Africa.

Furthermore, this paper purported to determine the influence of gold price on the correlation between gold price and correlations between EVA, ROE, EPS and CFG to the share price. The paper found that coefficients of determination in the correlation between r(EVA), r(ROE), r(EPS) and r(CFG) with the gold price were 3.52%, 12%, 42% and 1.18% respectively. The strengths of these correlations were tested and no compelling evidence was found to support the claim that the gold price would always have an influence on these correlations.

7.2 Recommendations

7.2.1 Recommendations to stakeholders

Chapter 1 established that there are two groups of people that have stake in the findings of this study. The first group consists of managers and directors and the second group consists of investors.

The first group is interested in the performance drivers that can be included in the performance contracts of managers in order to maximise value for shareholders. If contracts have to be renewed every year, the author suggests that they consider results given on a year-on-year basis. All four measures should be included in the performance contracts, but they ought to be used in the same proportion as their degree of correlation to share price. Consequently, the author suggests the following weighting, if only these four measures are used: 52% EVA, 25%EPS, 19%CFG or 8% ROE. The gold price should not be included as it is out of control of managers and directors. Its influence on the weighting does not weigh much, as a result it can be left out.

As far as the second group is concerned, investors should monitor closely the evolution of EVA, EPS before making their decisions to invest in gold mining stocks at the JSE. They could also examine the evolution of CFG and the share price if they wish to predict the behaviour of stock price to about over 40%. To make the prediction more accurate, investors should follow trends of stocks closely to detect elements of behavioural factors that yield insights into subsequent movement of stock prices. Most of these could be read in analysts' reports.

7.2.2 Recommendations for future research

The major gold companies analysed in this study have a global footprint. These are AngloGold Ashanti, Gold Fields and Harmony. These companies are also listed on different stock exchanges around the world. This study could be completed by

looking at the performance drivers of gold stocks across the globe or by comparing the rest of the world to South Africa. However, the author suggests that in conducting such studies, other proxies of value creation such as MVA or stock returns are considered. Furthermore, a full spectrum of accounting measures should be included as they may shed more light into the topic.

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Appendix A: ROE figures of JSE-listed gold mining companies [%]

Firms	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
AFGOLD	(0.46)	(0.79)	(0.59)	(1.36)	(1.90)	(9.64)	(338)	(13.11)	(34.13)
ANGGOLD	27.09	10.14	17.71	27.83	21.48	3.11	(7.61)	(2.81)	(26.85)
CENRAND									(4.02)
DRDGOLD	(6.57)	(198)	(53.54)	(117)	123.41	(175)	(112)	(14.08)	(657)
GFIELDS	7.89	7.92	(12.81)	27.69	26.14	5.13	1.14	7.58	6.63
GB GOLD									(17.78)
HALOGEN	3.83	(0.92)	13.98	(6.31)	10.46	(1.45)	(0.42)	(0.30)	2.61
HARMONY	9.92	12.66	1.58	21.10	7.41	(2.52)	(15.60)	(2.26)	1.44
JCI 2	(0.50)	(45.01)	(38.20)	(115)	24.40	(7.88)			
PZGOLD								(6.78)	(590.5)
RANGOLD	4229	72.39	(42.70)	70.36	17.34				
SIMMERS	(37.69)	(9.78)	(4.04)	(0.86)	3.53	(531)	115.98	0.94	(17.03)
STILFTN	(3.09)	(32.64)	4.78	(1.04)	(34.89)	3.03			
VILLAGE	(1.77)	(1.11)	(0.89)	1.01	(1.06)	(5.81)	(119)	(14.03)	(14.85)
WITS GOLD								(7.14)	(4.09)

Appendix B: EPS figures of JSE-listed gold mining companies [0.01 ZAR/ share]

Firms	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
AFGOLD				(0.8)	(1.1)	(4.5)	(37.7)	(5.2)	(15.7)
ANGGOLD	2485.0	1658.0	2311.0	1767.0	1068.0	280.0	(273.0)	(307.0)	(1470.)
CENRAND									(167.1)
DRDGOLD	(89.0)	(255.0)	(201.0)	(306.0)	217.0	(328.0)	(114.0)	(110.0)	(87.0)
GFIELDS	247.0	156.0	173.0	662.0	507.0	157.0	59.0	270.0	392.0
GB GOLD									(31.0)
HALOGEN	101.8	(58.0)	(189.2)	(136.8)	(76.4)	13.0	(56.2)	(57.1)	(70.4)
HARMONY	255.7	435.4	253.7	1316.0	661.0	(308.0)	(408.0)	(269.0)	43.0
JCI 2	(10.7)	(20.9)	(25.1)	(24.5)	5.1	(10.6)			
PZGOLD								(48.8)	(500.0)
RANGOLD	(675.4)	(2049.)	(168.0)	895.0	(12.0)				
SIMMERS	(41.0)	(9.3)	(2.0)	(0.1)	0.6	(14.6)	(12.8)	(11.1)	(17.0)
STILFTN	(4.0)			(1.0)	(24.8)	2.2			
VILLAGE	0.6	(0.9)	(0.7)	0.8	(0.8)	(4.4)	(41.0)	(4.8)	(4.4)
WITS GOLD								(13.8)	2.8

Appendix C: CFG figures of JSE-listed gold mining companies [%]

Firms	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
AFGOLD	76.10	(152)	34.15	(152)	(51.10)	(1055)	1.41	(693)	(303)
ANGGOLD	(1892)	18.07	127	204.27	(144)	(163)	34.62	162	(271)
CENRAND									
DRDGOLD	1.98	(178)	85.37	(547)	20.27	(76.96)	55.86	27.37	(21.13)
GFIELDS	(116)	238	(189)	(608)	184	(409)	60.31	(211)	(466)
GB GOLD									
HALOGEN	886	(285)	27.56	73.58	1763	(169)	107	(144)	(1212)
HARMONY	(103)	(18.11)	(805)	(64.76)	74.06	(34.34)	127.27	(431)	(54.16)
JCI 2									
PZGOLD									(442)
RANGOLD	42.87	139.41	59.41	(101)	18896				
SIMMERS			31.01	143	(317)	(351)	84.14	(3891)	(11.55)
STILFTN		(774)	(222)	147	74.16	(66.37)	(164)		
VILLAGE	16078	(107)	(281)	89.89	0.00	(835)	5.49	31.80	(148)
WITS GOLD									(536)

Appendix D: EVA figures of JSE-listed gold mining companies [Million ZAR]

Firms	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
AFGOLD	-5.92	-6.01	-6.30	-6.11	-4.19	-6.23	-20.73	-31.96	-165
ANGGOLD	-1253	-1947	-1318	191	-358	-5138	-6811	-7796	-11684
CENRAND									
DRDGOLD	-226	-848	-372	-701	109	-365	-517	-309	-1137
GFIELDS	-2032	-1952	-2470	-86	475	-2447	-3301	-2538	-5197
GB GOLD									
HALOGEN	-16.92	-8.70	11.78	-7.35	47.44	-4.03	-3.50	-3.06	8.87
HARMONY	-448	-749	-1168	-772	-1236	-4580	-7377	-4975	-5319
JCI 2									
PZGOLD								-71.86	-243
RANGOLD	-791	-123	-165	50.89	-72.37				
SIMMERS	0.00	-20.06	-20.31	-8.97	-24.63	-31.04	0.99	-170.1	-264.9
STILFTN	0.00	13.01	-2.89	0.12	-1.25	2.28	1.95		
VILLAGE	-0.84	-0.99	-0.81	-0.75	-0.60	-0.70	-2.29	-0.61	-0.54
WITS GOLD									-7.48

Appendix E: Share price figures of JSE-listed gold mining companies [0.01 ZAR]

Firms	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
AFGOLD	11	7	12	15	35	75	111	246	307
ANGGOLD	14273	13864	14628	26814	26442	24005	23772	32316	30753
CENRAND									1686
DRDGOLD	1190	753	899	3620	2192	1620	729	945	531
GFIELDS	2439	2545	3691	11358	9444	7909	7858	13662	11978
GB GOLD									1787
HALOGEN	358	380	611	741	859	1239	1328	1055	1138
HARMONY	3086	3586	4526	13454	10528	8138	5794	10067	8995
JCI 2	85	49	45	40	68	50	22	16	16
PZGOLD								1898	1758
RANGOLD	635	677	777	1663	3165	1877	1022	890	890
SIMMERS	20	13	16	24	21	28	61	266	599
STILFTN	59	29	31	136	70	91	79	72	72
VILLAGE	48	45	45	38	33	41	41	92	118
WITS GOLD								6475	10894

Appendix F: Gold price figures [US Dollar]

	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
Gold Prices	278.98	279.11	271.04	309.73	363.38	409.72	444.74	603.41	695.39

Appendix G: Results of simple regression analysis year by year

	1999		2000		2001		2002		2003		2004		2005		2006		2007	
	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho	t-value	Reject Ho
EVA	-2.122	No	-3.710	Yes	-3.027	Yes	-1.048	No	-0.893	No	-3.946	Yes	-3.952	Yes	-4.027	Yes	-3.069	Yes
ROE	0.357	No	0.207	No	0.126	No	0.820	No	1.238	No	1.085	No	0.814	No	1.836	No	0.700	No
EPS	2.080	No	0.963	No	1.809	No	3.041	Yes	3.709	Yes	0.250	No	-1.464	No	-0.713	No	-1.209	No
CFG	-1.431	No	1.822	No	-0.435	No	-1.049	No	0.600	No	1.672	No	1.396	No	0.932	No	-0.416	No