MAF004 An analysis of the price sales ratio as a share selection tool for shares listed on the Johannesburg Stock Exchange

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Abstract

This research investigates the relationship between the Price-Sales ratio (PSR) and future share returns of companies listed on the Johannesburg Stock exchange (JSE) over the period 1 January 2002 to 31 December 2013. The study controls for survivorship bias and as such the sample size changed from month to month. On average 254 companies were included in the study with a total of 560 companies included across the whole period. The portfolio analysis approach was used to identify whether the PSR is a good share selection tool. Furthermore, the performance of the PSR was compared to three other company-specific variables; Market Value (MV) as a proxy for size, the Debt/Equity (DE) ratio and the Book value/Market value ratio (BVMV).

The results of the portfolio analysis indicate that the PSR is a superior share selection tool where portfolios are rebalanced monthly. Furthermore, low PSR share portfolios outperformed high PSR share portfolios. Investors in South Africa and international investors looking to invest in shares listed on the JSE should benefit from the findings.

Keywords: Price-Sales Ratio, JSE, Johannesburg Stock Exchange, share selection, investing, debt/equity ratio, book value/market value ratio, market value, PSR, Finance.

1. Introduction

The Price-Sales ratio (PSR) came to the forefront after the academic and investor Kenneth Fisher published a book called *Super Stock* in 1984. In this book, Fisher reported the use of the PSR as a superior share-screening tool. He considers the PSR to be a perfect indicator of a share's current popularity which is an important indicator for value investors. The sales amount used in the ratio is inherently more stable than earnings which can move from one extreme to another from one reporting period to another.

This led to some researchers specifically including the PSR in their cross-section of future share returns research. A number of studies reported a significant relationship between SP or PSR and future share returns or PSR, however, the extent of this explanatory power varies from country to country. One can therefore not assume that the same relationship will exist in South Africa. Indeed, three unpublished master studies (Fricker, 1996; Mouton, 1998; Russel, 2004) in South Africa reported that the SP does not have significant explanatory power.

It is the objective of this study to extend the research on the PSR within the South African context, more specifically those companies listed on the Johannesburg Stock Exchange (JSE). The specific research question is:

1) Is the PSR a good share selection tool?

This research question will be answered by a popular approach within this area of research; the portfolio grouping method (see for example Fama & French, 1992).

This study differentiates itself from other studies in that the analysis is performed on a period independent to the periods used in the previous studies, effectively being an out-of-sample confirmation of prior studies' results. The analysis was performed over the period 1 January 2002 to 31 December 2013, a total of twelve years or 144 months.

This study is the first to control for a survivorship bias by choosing the sample prospectively and including companies that delist during the sample period. Survivorship bias is when the companies for the study are selected in the present day and the performance of these companies is determined retrospectively across the period of the study. By doing this one would exclude any companies that delisted or went bankrupt and effectively only include those companies that were successful. This could result in an upward bias in performance results. In total 560 companies were included in the study across the twelve years. This translated into an average of 254 companies per month in the sample compared to Fricker (1996) who tested 186 companies and Russel (2004) who tested 76 companies.

The portfolio analysis reported that portfolios formed using PSR gave the best results. These results substantiate Fisher's theory that the PSR is an initial indicator of a share's popularity but one needs to do a thorough analysis before making a final decision to invest.

As with most research some questions were answered and more were created. The following areas were identified as possible future research areas:

- Why does the PSR perform so well in the portfolio analysis? How can we identify individual companies with low PSRs that will do well?
- Will the result be different for different sectors?
- What will the performance be if the share are invested for a longer period?
- Is the PSR a good predictor of future excess returns?

It is anticipated that investors in South Africa will benefit from this research. Investors invest in order to grow and preserve their capital. In order to do this, investors need to be able to identify shares that will maintain their value and provide returns in excess of inflation. An understanding of the PSR's role in predicting future share returns will aid the investment decision.

The next section of this paper, section 2, includes a literature review on the cross-section of returns and various fundamental variables with a focus on the PSR ratio.

Section 3 will present the research design and the methodology used. section 4 will give a description of the data used in this study. The results of the research question will be presented in section 5 and are discussed in section 6 together with the limitations of the study. Finally, a conclusion is made in section 7.

2. Literature review[13]

The objective of the literature review establishes to what extent the explanatory power of the PSR or SP has been established around the world and more specifically in South Africa. This is done in order to identify where one can improve and add to this area of research.

This will be followed by an overview of the PSR and the origins of its use as a stock selection tool. The results of empirical studies in developed financial markets will be documented followed by the results of empirical studies in emerging financial markets and lastly identifying research done in South Africa.

The chapter closes with a summary of the findings and an identification of the areas where this study can extend the research on the PSR in a South African context.

2.1 The Price-Sales ratio

The PSR is a market value ratio that in its simplest form is computed by dividing the company's market capitalisation by the revenue in the most recent year. It can also be calculated by dividing the share price by the revenue per share.

The PSR is mostly used as a relative valuation ratio. It is a less commonly used ratio than the PBR or PER for the following reasons:

- Sales is the top line item of the Income Statement. It does not reflect cash flow or profits. The company's operating efficiency or lack thereof is not shown by the sales amount.
- The PSR is not comparable across industries and can differ substantially from one industry to another.
- It does not take into account the capital structure of the company.

The PSR is a useful measure to compare companies in cyclical industries. In these industries net income and EBIT are frequently negative during the down part of an industry cycle. It is also a useful measure for young companies, which typically have lower margins and invest more than the companies earn in the first years in order to ensure future growth. It is therefore not surprising that the PSR became very popular during the rise of technology and internet shares in the mid- and late 1990s. However, its popularity declined after the dot.com bubble burst.

A major advantage of the PSR is that companies with negative earnings, which result in a nonsensical PE ratio, can be included in the screening process (Leledakis, Davidson, & Karathanassis, 2003; Leledakis & Davidson, 2001). For example, Gharghori, Stryjkowski and Veeraraghavan (2013) reported that 50% of the companies included in their study had negative earnings or cash flow. Many studies exclude companies reporting negative earnings due to the difficulty this introduces. For instance, it is not possible to calculate a meaningful growth rate from period to period where the earnings move from a negative number to a

[13] Extracts of this literature review have been presented as a separate paper at the SAAA regional conference 2014 and published in the conference proceedings.

positive number (Lakonishok, Shleifer, & Vishny, 1994; Lev, 1989). On the other hand, companies who report zero Sales will be problematic. This is especially prevalent among resource and biotech companies who do not have Sales in the first years of the company's existence. Gharghori, Stryjkowski and Veeraraghavan (2013) reported that 28% of the companies included in their study had zero Sales.

Another disadvantage of PSR is there is a looser theoretical link between sales and value than between earnings or dividends and value. A company can have strong sales growth yet be destroying value.

2.2 The PSR as an investment strategy

Kenneth Fisher, an investment manager, is the founder, chairman, and CEO of Fisher Investments. He is on Forbe's list of 400 richest Americans with an estimated net worth of $2.3 billion. As of 2010, Fisher's firm managed $41.3 billion in 38,521 customer accounts. He has written numerous best-selling investment books, is a contributor to Forbes magazine and has been for the last 29 years. He has written numerous academic articles published in highly regarded journals such as the Financial Analyst Journal, Journal of Portfolio Management and the Journal of Investing.

Kenneth Fisher is considered to be the founder of the PSR investing strategy. This strategy is championed in his best-selling book, *Super Stock* (1984). Fisher considers himself a value investor and believes that a share's fair price should be determined by considering what someone would pay for the business as a whole. Part of the process of determining this is considering how much business a company does and the basic cost structure associated with the business (Fisher, 1984:71). In order to do this one must examine the sales of the company as well as the profit margins.

Another reason why Fisher focused on the PSR was that he considered it to be the most perfect measure of popularity (Fisher, 1984:74). PSR measures popularity relative to business size. The PSR indicates how much the market is willing to pay for one Rand of sales. Lastly, the sales amount used in the ratio is inherently more stable than earnings. Earnings can move from one extreme to another from one reporting period to another.

His PSR strategy consisted of three rules:

1. Avoid shares with PSRs greater than 1.5. Never buy shares with a PSR greater than 3.
2. Aggressively seek 'Super' companies at a PSR of less than 0.75.
3. If you have acquired shares in a 'super' company, sell these when the PSR rises to between 3.0 and 6.0 (Fisher, 1984:86).

A "super share" is the share of a company where the share:

- can generate internally funded future long-term average growth of approximately 15% - 20% in share price;
- will generate future long term average after-tax profit margins above 50%; and
- is bought at a PSR of 0.75 or less (Fisher, 1984:74).

Companies selling at high PSRs indicate that investors have high expectations of these companies. Therefore, Fisher uses the PSR to identify companies that have fallen out of

favour with investors and the market due to what he called a "glitch". A "glitch" is an event where the management of a company makes a mistake which affects earnings negatively. However, management learns from this mistake and corrects it which results in earnings increasing again.

In research conducted by Fisher, he noted the following:

- Big companies tended to have lower PSRs than did smaller companies.
- The bulk of the surprises, where high abnormal returns were obtained, came from shares starting at PSRs lower than 1.0.
- Most disappointments came from shares sporting the highest PSRs just prior to poor results.

Fisher uses the PSR as a guide to determine whether share prices are high or low relative to their intrinsic value. This idea echoes Francis Nicholson's conclusion of his study performed in 1968, "Price ratios in relation to investment results". Investing successfully depends mostly on whether a share is bought at an advantageous price. The rest of this section will review academic research that has been done on the PSR or including the PSR first in the USA, then in other developed markets, and lastly in emerging markets.

2.2 Emperical studies on the PSR or SP

After the publishing of *Super Stock* (Fisher, 1984), two major USA studies were undertaken by Senchack and Martin (1987) and Jacobs and Levy (1988).

Senchack and Martin (1987) tested Fisher's claim that the PSR investing strategy is superior to the PER investing strategy during the period 1976 to 1984. The sample included approximately 400 to 450 companies per quarter. The study documented that low PSR shares exhibit both higher absolute risk-adjusted returns and produced superior returns compared to higher PSR shares. However, the study reported that low PER shares perform better than low PSR shares on both an absolute and risk-adjusted basis. It was found that for the annual holding periods low PSR shares generated excess returns of 3.45% whilst low PER shares generated an excess return of 7.1%. As such the study shows that the PSR can be used to determine those companies that would provide higher share returns showing it has some predictive qualities. However, PER is a better risk-adjusted measure to use.

This is contrary to other studies performed on the two ratios such as Jacobs and Levy (1988) and Barbee (1989). It is also contrary to Fisher's viewpoint that the PSR is superior to the PER as a share selection tool. There might be several reasons for the difference. Firstly, the holding period might be too short. Fisher advocated in his book that shares should be held for a longer term. Furthermore, Fisher makes it clear that the PSR should not be used on its own in determining which shares to buy. The PSR optimally leans on an understanding of profit margin analysis (Fisher, 1984:74). Nathan, Sivakumar and Vijayakumar, (2001) used similar methods than that of Senchack and Martin (1987), but for the period 1990 to 1996, and reported very different results to Senchack and Martin (1987). This study demonstrated that using the PSR as a trading strategy resulted in consistently higher excess (risk-adjusted) returns when compared to PER and that this result was robust across different exchanges (Nathan et al., 2001). Nathan, Sivakumar and Vijayakumar's (2001) study is different to Senchack and Martin (1987) in that they calculated excess returns using the standard market

model methodology using beta as a measure of risk whereas Senchack and Martin (1987) used absolute returns and other risk measures such as Jensen, Treynor and Sharpe ratios.

Jacobs and Levy (1988) studied the PER, size, DY, BVMV, S/P (inverse of PSR), beta and CFP along with factors such as earnings surprise, the "earnings torpedo" effect and the January effect. The study was performed over the period January 1978 to December 1986 utilising the portfolio analysis approach as well as cross-sectional regression analysis (using generalised least-squares regression). Amongst the study's findings was that the S/P investment strategy produced a significant pay-off at 17% above normal market returns and this result was significant at the 1% level and had a statistically significant coefficient of 0.15.

Barbee, Mukherji, and Raines (1996) empirically tested Fisher's theory. The study analysed returns in the USA and over the time period of 1979 to 1991 and it focused on the explanatory power of the S/P compared to DE, BVMV and MV. Their methodology involved monthly regressions of share returns on financial data from the previous year. Returns were calculated for both individual shares as well as for portfolios based on the different multiples as screening methods. The results of the study indicated that the S/P and DE have a strong correlation with share returns (significant at the 1% level), stronger than that of BVMV.

Dhatt, Kim and Mukherji (1999) performed a study on the Russell 2000 Index, which is a commonly used U.S. small-cap benchmark. This study was performed during the 1979 to 1997 period on a sample of 1,981 companies (99% of the companies on the Russell 2000 Index). It was indicated that value shares outperformed growth shares regardless of which measure is used. Most importantly PSR was a better indicator of value than the other variables.

Similar studies were conducted in other developed markets. Bird and Whitaker (2003) conducted a study across several European markets (Germany, France, Italy, Netherlands, Spain, Switzerland and the United Kingdom) over the period of 1990 to 2002 and had a combined average sample size of 2,219 companies. The authors argue that BVMV and S/P are *"purer measures of value as they are more difficult to manipulate"* (Bird & Whitaker, 2003:229). The highest S/P portfolio outperformed the lowest SP portfolio. In this case, however, the S/P provided lower returns than the BVMV, making the BVMV the superior measure.

Suzuki (1998) conducted a study in Japan in order to determine whether the PSR is an efficient share selection tool thus providing superior share returns. The study was conducted for the period 1982 to 1994 utilising the portfolio analysis approach. The 100 shares on the Tokyo Stock Exchange with the lowest PSRs, PERs and PBRs were selected in each fiscal year. The study identified one of the advantages of the PSR to be that the PSR allows for investors to choose from a wider range of industries. The study established that the PSR is especially meaningful during periods of economic recovery.

Leledakis and Davidson (2001) conducted a study in the United Kingdom over the period 1980 to 1996. Two methodologies were employed in the study: the portfolio analysis approach as used by Fama and French (1992) and a cross section regression analysis

approach as used by Fama and Macbeth (1973). The variables tested were BVMV, MV, S/P and DE on a sample of 1,420 non-financial companies. The portfolio analysis revealed a positive relationship between average share returns and the S/P with a return differential of 18.6% per annum between the smallest S/P portfolio and the largest S/P portfolio.

Vanstone and Agrawal (2006) conducted a study in Australia. Each variable was studied on its own rather than comparing the variables to each other and determining the best variable. As such the study only considered the Annual Portfolio Return (APR) as well as the Sharpe Ratio. For the PSR four portfolios were built: Large Cap High PSR, Large Cap Low PSR, Not Large Cap High PSR and Not Large Cap Low PSR. The study's results reported that low PSR shares performed better, especially the Not Large Cap Low PSR portfolio, achieving an annual portfolio return of 7.97% compared to the Large Cap High PSR with a return of -0.35%.

The research on the PSR extended to emerging economies, but this area has received much less attention to date. Research has been performed in countries such as Taiwan (Chou & Liao, 1996), Brazil (Halfeld, 2000), Greece (Leledakis et al., 2003), and South Korea (Mukherji, Dhatt & Kim, 1997)

Chou and Liao (1996) conducted a study on the performance of the PSR and PER screening tools on the Taiwan Stock Exchange.

From this study the following conclusions were drawn:

- The low PSR portfolios achieved superior returns compared to the high PSR portfolios.
- Including shares with both negative and positive earnings made no difference in performance, proving that this is not an advantage of the PSR.
- A low PER strategy can provide the equivalent performance of a low PSR strategy, indicating that the PSR is not superior to the PER (Chou and Liao, 1996).

Mukherji, Dhatt and Kim (1997) performed a fundamental analysis of Korean share returns. The purpose of the paper was to challenge the capital asset pricing model (CAPM) hypotheses which states that investors price only systematic risk as measured by beta. The motivation for such a study came from the empirical studies of USA shares which documented that severable variables, other than beta, explain share returns better. The study was performed in South Korea, an emerging market, which at the date of the study was considered to be the 10th largest share market by capitalisation. The returns of portfolios based on various different variables indicated that BVMV and S/P are more efficient indicators of value for Korean shares.

For Malaysia over the period 2002 to 2008 Brahmana and Hooy (2011) reported that of the three variables, PER, BVMV and PSR, the PER was the superior screening tool.

Leledakis, Davidson and Karathanassis (2003), performed a study on the Athens Stock Exchange, Greece. The study ran across a period of ten years, 1990 to 2000, on a sample of 203 non-financial companies. Some of the variables tested were MV, BVMV, S/P, DE, E/P and DY. The portfolio analysis approach reported a strong relationship between average share returns and MV, BVMV, and DE with no clear relationship between average share returns and S/P.

There are three unpublished doctoral thesis which analyses the cross-section of equity returns on the JSE based specifically looking at the SP ratio. Fricker (1996) analyses the power of the Sales-to-price ratio in explaining the share returns on the JSE. It was found that the S/P appeared to be most effective in explaining share returns on the JSE when the S/P calculation was lagged by two to three years which is similar to the findings of Barbee (1989) and Fisher (1984). A similar study was performed by Mouton (1998) over the period 1986 to 1996. Mouton found MV to be the dominant variable of the combination of variables S/P, MV, BVMV and DE (as reported by Russel, 2004). Russel (2004) conducted a similar study across a 17-year period from 1985 to 2002. 76 companies were included in the sample. Once again the variables S/P, MV, BVMV and DE were included in the study. The results of the correlation matrix revealed a strong positive relationship between S/P and BVMV and a strong negative relationship between S/P and MV. This means there was a strong negative relationship between PSR and BVMV and a strong positive relationship between PSR and MV. A regression model where all the variables were included showed that BVMV had the highest coefficient followed by DE. Out of all four variables only MV was statistically significant.

2.4 Conclusion

This literature review has studied the evidence and documents how the explanatory power of the Price-Sales ratio (or its inverse Sales-Price ratio) have been tested in developed and emerging markets. In aggregate, all these studies support the notion that the PSR is useful in predicting future share returns meaning it has explanatory power. The extent of the usefulness seems to differ from market to market. There is growing evidence that alternative measures may be superior to Beta and BVMV as advanced by Fama and French (1992).

Furthermore three studies have attempted to establish the explanatory power of the SP ratio in South Africa. None of those studies have found a statistically significant result. Since the explanatory power of the PSR has not been established in South Africa this dissertation will attempt to do just that. This study can add to this area of research by addressing some of the limitations of the other studies:

- Conduct the study over a longer period.
- Include more companies in the sample.
- Control for survivorship bias.
- Use the portfolio analysis approach to test the PSR as a share selection tool.
- Consider different rebalancing periods for forming portfolios.
- These extensions were incorporated into the design of the research methodology which is discussed in the next chapter.

3. Research methodology

It is standard practice to empirically study return premiums by compiling portfolios based on certain company specific variables and compare the returns of these. This approach effectively considers what an investor's share returns would have been had he used a certain fundamental variable as a share selection tool. The fundamental variable with the highest risk-adjusted returns is considered to be the superior share selection tool.

Shares are sorted into five portfolios based on the firm-specific fundamental variables. There is no theoretical underpinning for this number. The studies reviewed either grouped shares into five portfolios (for example, Senchack & Martin, 1987; Nathan, Sivakumar & Vijayakumar, 2001) or ten portfolios (for example, Leledakis & Davis, 2001; Gharghori, Stryjkowski & Veeraraghavan, 2013). The portfolios are determined at year t based on a key variable and the returns for each portfolio are determined at year t + 1.

For example, on the last day of the month the PSR[14] is determined of each company included in the sample during the period under consideration. The companies are then ranked from those with the lowest PSRs to those with the highest PSRs. The sample is divided into five portfolios with portfolio 1 including the companies with the lowest PSRs and portfolio five including the companies with the highest PSRs. The returns of the portfolios are then determined by adding the returns of the individual companies within the portfolios. Each share is given an equal weighting within the portfolio as was done by Chan, Hamao and Lakonishok (1991). The portfolios are rebalanced every period and the process is repeated. The time-series average for each portfolio is then calculated and reported as the average annual return for the portfolio. This process was repeated for all four company variables analysed in the study. In effect what one is doing is saying, "If we can go back in time and select shares in our portfolio using a company specific variable, what returns will we get?"

Among the studies that used this methodology were Senchack and Martin (1987), Nathan, Sivakumar and Vijayakumar (2001), Fama and French (1992), Lakonishok, Shleifer and Vishny (1994), Leledakis and Davidson (2001), Leledakis, Davidson and Karathanassis, (2003) and Gharghori, Stryjkowski and Veeraraghavan (2013).

The Sharpe ratio developed by Sharpe (1966) will be used to ascertain whether superior returns were obtained by taking higher risks. This ratio measures the return obtained for each additional unit of risk. Risk is measured by standard deviation. This measure was also used by Senchack and Martin (1987), Graham and Uliana, (2001), Nathan, Sivakumar and Vijayakumar (2001) and Vanstone and Agrawal (2006). These studies used the 90 day governmental T-bill rate as the risk free rate. This ratio measures the absolute risk and not that of a diversified portfolio, which is appropriate as no attempt was made to diversify portfolios. The Sharpe ratio is calculated as follows:

$S_n = (R_n - RFR) / SD_n$

Where:

S_n = Sharpe portfolio performance measure

R_n = average rate of return for portfolio n

RFR = average risk free rate for the period

SD_n = standard deviation of returns for portfolio n.

[14] An explanation of how the PSR is determined is given in chapter 4.

4. Data collection

In this chapter the setting of the study and the process of collecting the data are described. The rationale for choosing those specific company variables included in the study is given and these company variables are defined. A number of biases were reported in the literature which is discussed here and the steps to avoid these biases are described.

The empirical analysis is performed on a monthly basis from January 2002 to December 2013. Companies listed on the main board of the Johannesburg Stock Exchange (thus excluding the Alt-X, Venture Capital and Development Capital boards) were included in the sample and subject to further analysis. The alternative exchanges were excluded as they tend to be small and illiquid.

Companies that delisted during the sample period were included in the sample in order to control for survivorship bias (Banz & Breen, 1986; Kothari, Shanken, & Sloan, 1995). Survivorship bias can occur where the sample is defined retrospectively as those companies that survived and prospered, which will result in those companies that went bankrupt and failed being excluded from the sample. This will cause the results to be biased upwards. The returns of companies that delisted were determined by treating the share as if they were sold within the month of delisting.

Many studies excluded companies in the financial sector as these companies have high gearing levels (Fama & French, 1992; Leledakis & Davidson, 2001). This study will include companies from all the sectors as was done by Auret and Sinclaire (2006), Hoffman (2012) and van Rensburg and Robertson (2003).

Once the list of companies to be included in the sample was finalised the share price, the market return history and the financial variables were obtained from Reuter's Datastream International (known as Datastream). The data obtained from Datastream was verified by comparing a sample of companies' financial data to the Annual Financial Statements found on McGregor BFA. The full sample was limited to the number of companies for which accounting information was available.

The variables are defined and calculated as follows:

MV: a measure of size; the market value of equity of the company (ordinary share outstanding multiplied by the market price of the share). The company's market value at the end of each month was used. The data was obtained from Datastream and calculated as current price multiplied by the common shares outstanding. Common shares outstanding represent the number of shares outstanding at the company's year-end. It is the difference between issued shares and treasury shares.

BVMV: the ratio between the book value of equity of the company at the fiscal year-end that fell in year t-1 and the company's MV.

PSR: the ratio between the annual sales of a company at the fiscal year-end that fell in year t-1 and the company's MV. Company month observation for which no sales data exists are

included as zero. Sales/Revenue was obtained from Datastream as the gross sales and other operating revenue less discounts, returns and allowances.

DE: the ratio between the book value of the debt of a company at the fiscal year-end that fell in year t-1 and the company's MV. The book value of debts is defined as the book value of total assets minus the book value of common equity similar to Leledakis and Davidson (2001).

MONTHLY RETURN: Monthly return for each share included in the sample was obtained from Datastream. The return is calculated as the growth in value of a shareholding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. It was calculated based on the daily closing price.

The data was controlled for "look-ahead" bias. A "look-ahead" bias occurs when one makes use of data which would not have been available at the specific point in time. This typically happens as a result of companies' financial reports only being available a number of months after the actual fiscal year end. The JSE requires that all listed companies distribute annual financial statements to shareholders within six months of the company's fiscal year-end. Provisional reports are submitted within 3 months of the company's financial year end. These reports do not have to be audited and comply with the requirements of interim reports. In order to control for the "look-ahead bias" all variables were lagged by three months which follows the example of van Rensburg and Robertson (2003), Jacobs and Levy (1988), Senchack and Martin (1987), Barbee, Mukherji and Raines (1996) and Nathan, Sivakumar and Vijayakumar (2001). Thus for a company with a December financial year end the PSR as of April 2012 was calculated using its price as of 31/3/2012 and its Sales/Revenue as of 12/31/2011.

The companies on the JSE have different year-ends. Many studies only include companies with December year-ends (see for example, Senchack and Martin (1987), Fama and French (1992), Barbee, Mukherji and Raines (1996), and Nathan, Sivakumar and Vijayakumar (2001)). As the number of companies on the JSE is already much smaller than on other exchanges it was decided to include all companies regardless of year-ends. The financial data used was lagged appropriately for each year-end.

A thin trading filter was applied to the sample to ensure that the shares are traded at least once in a particular month. This method is suggested by van Rensburg and Robertson (2003). A turnover ratio is applied which measures the average monthly trading volume to the total number of shares outstanding (van Rensburg & Robertson, 2003). All shares with a turnover ratio of less than 0.01% on the last day of the previous month were excluded. The trading volume was obtained from Datastream as the data type Turnover by volume. This shows the number of shares traded for a stock on a particular day. The figure is always expressed in thousands.

Monthly observations were winsorised to avoid giving extreme outliers heavy weight. The procedure used by Fama and French (1992) of setting the smallest and largest 1 percent of the

values for BVMV, S/P, and DE equal to the values corresponding to those at the 0.01 and 0.99 levels was used in this study. This method was also used by van Rensburg and Robertson (2003) and Gharghori, Stryjkowski and Veeraraghavan (2013).

A total of 561 companies were included in the sample with the average number of companies equating to 254 per month.

5. Results

In this chapter the results of the data analysis is presented. The data was collected and analysed in response to the research question posed in chapter 3.

Panel A of Table 1 reports the results for portfolios that were formed using PSR to sort the shares. Portfolio 1 includes the companies with the lowest PSR and portfolio 5 includes the companies with the highest PSR. As was predicted by the literature review, portfolio 1 outperformed portfolios 2-5. Furthermore, the Sharpe ratio indicates that the excess return was not gained from taking on additional risk. Table 1 reports that PSR has two portfolios in the top five performing portfolios in terms of risk-return rewards (see Table 2). The returns of the PSR ratio drop substantially from portfolio 3 onwards. Portfolio 3 has an average PSR of 1.10. This is a possible indication that the PSR effect is strong in the South African market.

Panel B of Table 1 reports the results for portfolios that were formed using BVMV to sort the shares. It shows that the highest absolute return was made on portfolio 5. Portfolio 5 also gave the best return considering the risk associated with the portfolios as it has the highest Sharpe ratio and it is the second best performing portfolio overall (see Table 2). Portfolio 1 was the worst performing portfolio. BVMV has a smaller variation between portfolio 1 and 5 when compared to PSR and DE (Table 3). The results show a positive relationship between BVMV and average annual returns.

Panel C of Table 1 reports the results for portfolios that were formed using DE to sort the shares. It shows that the highest absolute return was made on portfolio 5. The middle three portfolios have roughly the same returns. However, portfolio 2 gives the best risk-return reward. This portfolio had the 4th best performance overall in terms of risk-return reward as shown by Table 2. The results show clearly that companies with little debt provide the lowest returns which are also in line with finance theory. DE has the largest difference between portfolio 1 and 5 but the middle 3 portfolios are close to each other in terms of absolute returns. DE is the only variable where investors would have to take on more risk in order to achieve a higher return. There is no clear relationship between DE and average annual returns.

Panel D of Table 1 reports the results for portfolios that were formed using MV to sort the shares. It shows that the highest absolute return was made on portfolio 4. If we consider the Sharpe ratio we see that portfolio 3 performed the best in terms of the risk-reward relationship. This portfolio was also the 5th best performing portfolio in terms of risk-return reward as shown by Table 2. It is interesting to note that portfolio 1 did not give the highest return. Furthermore there is small variation of the returns between the different portfolios. This is highlighted in Table 3. There seems to be a U-shaped relationship between average annual returns and MV.

In addition to reporting relationships between the company-specific variables and average annual return, Table 1 also reports a relationship between certain of the variables. It is clear that PSR is negatively related to DE and to some extent to BVMV (Panel A). MV is negatively related to DE and BVMV (Panel D). There is no clear relationship between PSR and MV (Panel D). DE and BVMV have a positive relationship (Panel B and C).

Table 1 Rebalanced monthly: Average return, average variable and Sharpe ratio.

Panel A

Price sales	Return	Sharpe	PSR	DE	MV	BVMV	# Co
Portfolio 1	24.27%	2.99	0.21	3.70	1 977 454	2.73	52
Portfolio 2	23.34%	2.96	0.53	1.63	5 460 028	1.05	51
Portfolio 3	18.99%	1.98	1.10	1.80	10 935 442	0.77	51
Portfolio 4	19.20%	2.23	2.67	0.79	17 697 535	0.66	51
Portfolio 5	17.33%	1.74	33.15	0.42	34 627 637	0.60	51

Panel B

BVMV	Return	Sharpe	PSR	DE	MV	BVMV	Avg Co
Portfolio 1	17.79%	1.60	16.61	0.56	38 196 670	0.13	52
Portfolio 2	19.09%	2.06	4.61	0.86	14 127 079	0.35	52
Portfolio 3	20.38%	2.37	7.10	1.43	10 579 935	0.59	52
Portfolio 4	21.41%	2.73	3.81	1.62	4 432 233	0.97	52
Portfolio 5	23.46%	2.98	2.98	3.60	1 526 022	4.09	51

Panel C

DE	Return	Sharpe	PSR	DE	MV	BVMV	Avg Co
Portfolio 1	15.02%	0.94	26.80	0.08	33 229 255	0.53	53
Portfolio 2	21.76%	2.93	3.78	0.29	12 510 177	0.60	53
Portfolio 3	21.38%	2.75	2.33	0.63	6 814 413	0.77	53
Portfolio 4	21.52%	2.75	1.68	1.27	4 908 529	1.14	53
Portfolio 5	22.86%	2.56	1.04	6.07	10 396 145	2.97	53

Panel D

MV	Return	Sharpe	PSR	DE	MV	BVMV	Avg Co
Portfolio 1	20.62%	2.44	7.67	2.95	98 657	2.98	53
Portfolio 2	19.05%	1.93	4.74	1.63	600 510	1.19	53
Portfolio 3	21.71%	2.76	8.74	1.09	1 936 988	0.77	53
Portfolio 4	21.97%	2.67	6.09	1.17	6 617 817	0.62	53
Portfolio 5	18.89%	2.13	8.69	1.42	59 187 518	0.39	53

Notes: Table 1 reports the average annual returns and average variable for portfolios 1 to 5 where the portfolios are rebalanced monthly. The table also reports the Sharpe ratio. Panel A to Panel D reports these measures for each instance where the share selection of the portfolios was determined using the four different variables.

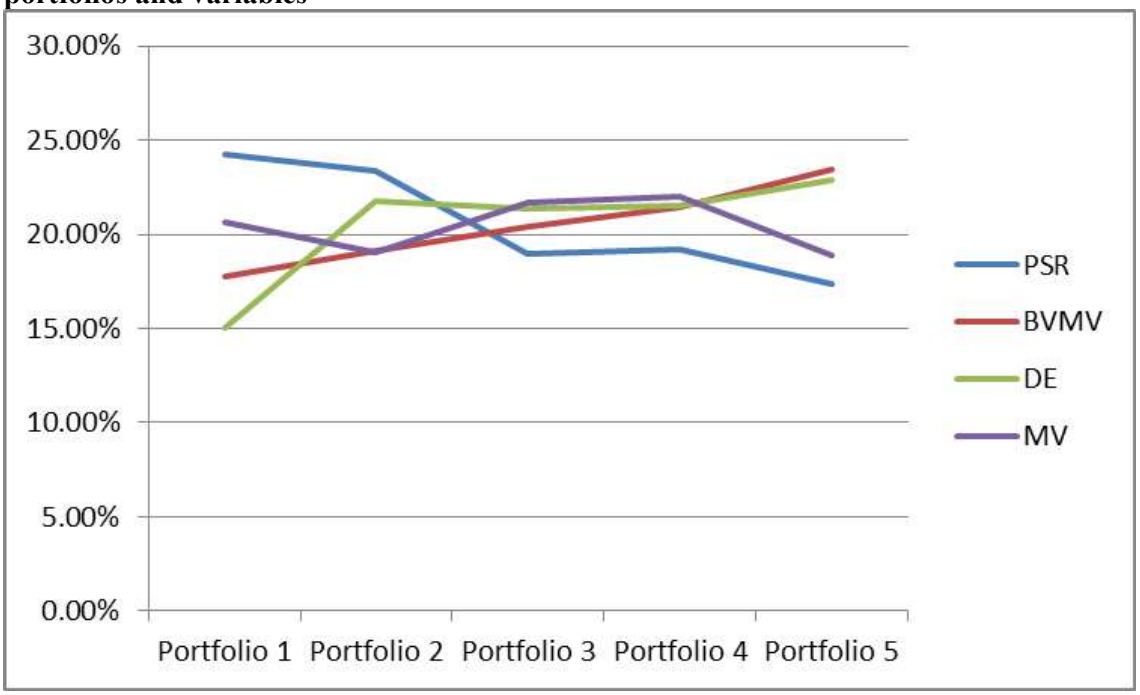
Table 2 Rebalanced monthly: Top performing portfolios risk-adjusted

Rank	Portfolio	Sharpe
1	PSR 1	2.99
2	BVMV5	2.98
3	PSR 2	2.96
4	DE 2	2.93
5	MV 3	2.76

Table 3 Rebalanced monthly: Spread between portfolio 1 and 5

	PSR	BVMV	DE	MV
Difference 1-5	6.94%	5.67%	7.84%	1.73%

Graph 1 Rebalanced monthly: Comparison of average annual returns across all portfolios and variables



Where portfolios were rebalanced monthly, Portfolio 1 of PSR outperformed all other portfolios at an average annual absolute return of 24.27%. This is 0.81% higher than the next best portfolio, which is portfolio 5 of BVMV.

6. Discussion of results and limitations

The portfolio analysis indicates that PSR is the superior share selection tool of the four variables included in the study as the highest returns were made by PSR portfolios. A concern for every investor is the risk he or she has to take to obtain superior returns. Modern finance theory postulates that one should need to take more risk to increase one's return. However,

when the Sharpe ratio was calculated for the different portfolios it was found that one could obtain superior returns using PSR as a portfolio selection tool without taking on additional risk. A limitation here is that the risk of the market portfolio is not known and it is not known to what extent risk of the PSR strategy compares to the market. This study only compares the risk of a PSR strategy to that of the other three variables included in the study. It is worth quantifying this risk differential between a PSR strategy and the market portfolio in future research.

So how do the results compare to Fisher's strategies? Let us recall what his PSR strategy entails. Fisher considers a "super" share to be a share where the average US returns are approximately 15%-20% per annum over the long term (Fisher, 1984). If we consider fluctuation in the exchange rates we find that over the same period the South African Rand appreciated against the US Dollar by 8.11% (Exchange rate at 1/1/2002: R10.49, 12/12/2013: R9.63). Therefore an equivalent range in South Africa over the sample period would be 13.78% - 18.38%. The share should also be bought at a PSR of 0.75 or less. The results of the portfolio analysis demonstrates that the lower PSR portfolios, portfolio 1 and 2, have on average (monthly) a PSR below 0.75 and are the highest performing portfolios. Thus this is solid proof for Fisher's strategy.

PSR, DE and BVMV demonstrate a clear linear relationship with average annual returns whereas MV does not have any clear relationship and a U-shaped relationship was observed.

The portfolio analysis showed that if one was to use any of the four variables to select a portfolio of shares one would outperform the market 64% of the time. Therefore sorting portfolios in this one-dimensional way using the four company specific variables MV, BVMV, PSR and DE can be useful to an investor.

The return differential between the small portfolios and large portfolios of all the variables were not as pronounced as in other markets. Table 20 below demonstrates the difference in results between this study and three other markets.

Table 4 A comparison of return differential between smallest and largest portfolio

	SP/PSR	BVMV	DE	MV
This study	6.94	5.67	7.84	1.73
Gharghori et al.	4.39	27.68	15.42	44.34
Leledakis et al. 2003	11.16	31.56	41.64	61.32
Leledakis et al. 2001	18.60	18.84	15.24	21.60

This leads us to believe that the effects of the variables analysed in this study is not as strong in the South African market as in other markets. The size effect and BVMV effect is not very strong. This does support the results of the regression analysis where the coefficients of the company specific variables are smaller than what was reported by, for instance, Leledakis and Davidson (2001).

7. Conclusion

The aim of this study was to extend the research that has been performed on the PSR or S/P in South Africa. Three unpublished master studies (Fricker, 1996; Mouton, 1998; Russel, 2004) reported that S/P did not have significant explanatory power for future share returns in South Africa. However, these studies were performed over short periods and there is a possibility that the results were period specific. This is especially so because the results are so different to other markets such as the United States of America and the United Kingdom. One could argue that, as the Johannesburg Stock exchange and the South African market matures, the results will converge with the developed markets' results.

As such this study adds to the research in that it is the first study to do an extensive portfolio analysis especially on the PSR ratio as a share selection tool. This study is the first to control for a survivorship bias by choosing the sample prospectively and including companies that delist during the sample period. The sample size was extended to include an average of 254 companies per month in the sample compared to Fricker (1996) who tested 186 companies and Russel (2004) who tested 76 companies.

The portfolio analysis reported that portfolios formed using PSR gave the best returns. These results substantiate Fisher's theory that the PSR is an initial indicator of a share's popularity but one needs to do a thorough analysis before making a final decision to invest. The portfolio analysis points to the fact that the PSR is a good indicator of value investments, in other words those investments where the shares are currently undervalued by the market. This is in line with Fisher's theory.

In general there was a positive relationship between DE and share returns and BVMV and share returns. There was a negative relationship between MV and share returns as well as PSR and share returns.

As with most research, some questions were answered and more were created. The following areas were identified as possible future research areas:

- Why does the PSR perform so well in the portfolio analysis? How can we identify individual companies with low PSRs that will do well?
- Will the result be different for different sectors?
- Is the PSR a good predictor of future excess returns?

A limitation to this study is that a lot of information is lost in the process of determining annual average returns and variables. We recommend that more sophisticated statistical methods be used to gain more insight into the behaviour of the variables and returns generated.

In conclusion, the results of the portfolio analysis indicate that PSR is a superior share selection tool as the highest returns were made by low PSR portfolios. It is believed that this study will be useful to investors and asset managers, whether from South Africa or abroad, and that the study adds to the literature on the PSR in South Africa.

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