Earnings thresholds in South Africa listed enterprises: Manipulating research and developmental expenditures

Introduction

Stakeholders generally focus on performance, whereas enterprise managers generally pursue long-term profits, with the return on assets, return on equity, and earnings per share considered to be the main targets. The data of these indicators are based on earnings.

Managers maintain competitiveness and improve the performance of enterprises by influencing operations through research and developmental (R&D) activities. Governments in various countries often provide R&D grants or implement R&D tax-saving policies to support R&D activities. Nevertheless, R&D activities may be limited regarding funding and are not guaranteed to bring substantial benefits. These activities are dependent on expenditures, therefore managers may manipulate earnings through R&D expenditures (Canace, Jackson & Ma 2018; Hsiao et al. 2017; Le & Lee 2021; Seybert 2010; Sun 2021; Yang et al. 2022; Zhang & He 2013; Zhu et al. 2015).

The literature indicates that managers are likely to manipulate earnings to avoid having to report losses and declining earnings, or to meet analyst forecasts (Bissessur & Veenman 2016; Byun & Roland 2022; Carvajal, Coulton & Jackson 2017; Choi, Choi & Lee 2016; Griffin & Lont 2021; Rennekamp, Rupar & Seybert 2020; Shin 2019). However, the literature does not reveal how R&D expenditures are manipulated to achieve earning thresholds.

According to Kahneman and Tversky’s prospect theory (1979), managers tend to pursue risk to avoid expected losses when enterprise performance is below the target level. By contrast, when
Earnings thresholds through manipulating research and developmental expenditure

Earnings management involves changing reported figures or performance according to managers’ subjective judgement, and adjustment of transaction matters (Healy & Wahlen 1999). Cohen, Dey and Lys (2008) report that managers mislead report users by adjusting real activities to pursue personal interests, because real activities cannot easily be observed by auditors or the relevant authorities. Habib et al. (2022) demonstrate that information asymmetry is present between enterprises and external investors. Thus, managers manipulate earnings through real activities and distort actual performance to meet earnings thresholds and pursue their personal interests. The literature indicates that managers are also motivated to manipulate earnings to maintain earnings thresholds. Enterprises are reported to manipulate earnings to avoid reporting losses (Hansen 2010) and earnings in decline (Kama & Weiss 2013).

Research and developmental expenditures involve spendings related to business activities (e.g. materials, personnel salaries, bonus, and leases for R&D activities) and have the characteristics of working capital. Research and developmental activities may take years to bring benefits; therefore, managers may manipulate earnings through R&D activities to apparently improve performance (Zhang & He 2013). Managers also manipulate R&D expenditures to meet earnings thresholds (Dumas 2017; Tami, Kang & Schultze 2016). Dumas (2017) discovers that managers may avoid reporting losses and earnings in decline by manipulating R&D expenditures. Accordingly, we propose the following hypotheses:

H1: South African listed enterprises tend to adjust R&D expenditures as a form of earnings manipulation to avoid showing losses.

H2: South African listed enterprises tend to adjust R&D expenditures as a form of earnings manipulation to avoid showing a decline in earnings.
Tversky and Kahneman (1974) report that when actual performance is below the target level, decision-makers tend to engage in risky activities to gain profits. According to Kahneman and Tversky’s prospect theory (1979), managers make decisions on the basis of their specific target levels and attach importance to value (i.e. the gain or loss experienced after a decision is executed). Losses occur when the actual performance is below decision-makers’ target level which may negatively affect utility and cause the value function to be S-shaped. Therefore, managers pursue risk when faced with losses but avoid risk when faced with gains. Wealth increases most and the value-added is higher when personal wealth is transformed from losses to gains. Shen and Chih (2005) report that the prospect theory may be used to explain the motivations for earnings management. Managers may manipulate earnings to meet specific earnings thresholds to obtain rewards. Managers may manipulate earnings to avoid reporting losses or declining earnings. When manipulating earnings to achieve goals, managers give higher value for the enterprise they belong to, which is consistent with the prospect theory. Accordingly, we propose the following hypotheses and establish our theoretical framework (Figure 1):

H3: The prospect theory may explain why managers of South African listed enterprises use R&D expenditures to manipulate earnings to avoid having to show losses.

H4: The prospect theory may explain why managers of South African listed enterprises use R&D expenditures to manipulate earnings to avoid having to show earnings in decline.

Methodology

We gathered 379 annual samples, reported by 62 South African listed enterprises (excluding banks, investment companies, and insurance companies), in 2011–2019. These listed enterprises in South Africa are classified into the following primary sectors: Industrials (25.81%); Materials (20.97%); Consumer Staples (17.74%); Information Technology (16.13%); Health Care (8.06%); Communication Services (4.84%); Consumer Discretionary (4.84%); Energy (1.61%). This is an unbalanced panel. The data are collected from the S&P Capital IQ database. Research and developmental expenditures not disclosed in the financial statements or database are regarded as missing values. Cross-sectional data are employed for linear regression to calculate discretionary R&D expenditures. The models and variables employed are as follows:

Discretionary research and developmental expenditures

Discretionary R&D expenditures (Zhu et al. 2015) are calculated using the following model:

$$\frac{TRD_{it}}{ASSETS_{it-1}} = a_0 + a_1 \left( \frac{1}{ASSETS_{it-1}} \right) + a_2 \left( \frac{SALES_{it-1}}{ASSETS_{it-1}} \right) + a_3 ROA_{it} + \epsilon_{it}$$

[Eqn 1]

Where $TRD_{it}$ is the $t$ year R&D expenditure, $ASSETS_{it}$ is the $t$-1 year assets, $SALE_{it-1}$ is the $t$-1 year sales revenue, $ROA_{it}$ is the $t$ year earnings divided by the $t$-1 year assets, $c_p$ is the residual value of the $t$ year and model multiplied by the $t$-1 year assets to estimate the discretionary R&D expenditures (i.e. earnings management behaviour), and the $t$ year earnings before R&D expenditure manipulation is earnings minus discretionary R&D expenditures.

Earnings thresholds

The earnings thresholds are measured using the model of Gunny (2010) and two types of histograms.

Avoid earnings loss

If the $t$ year manipulated earnings are more than, or equal to 0, the earnings threshold of avoiding reporting losses is met.

Avoid earnings decreases

If the $t$ year manipulated earnings are more than or equal to those in the $t$-1 year, the earnings threshold of avoiding having to show decreased earnings is met.

We analyse whether enterprises manipulate reports to meet earnings thresholds. Our samples include data on earnings before manipulation and manipulated earnings. The distribution approach proposed by Degeorge, Patel and Zeckhauser (1999) is used to test whether earnings manipulation is the most effective means of meeting earnings thresholds. The earnings before manipulation and the manipulated earnings are each divided by the assets in the previous period. As suggested by Gunny (2010), we set the interval width to 0.01 and perform an analysis of the frequency distribution within the interval width. The frequency of managers manipulating earnings to meet earnings thresholds is distributed on the right side of the histogram, whereas the frequency of managers not manipulating earnings to meet earnings thresholds is distributed on the left of the histogram.

Explanation of the motivation for earnings management through the prospect theory

On the basis of the relationship between risk and return, Shen and Chih (2005) apply the prospect theory to analyse the behaviour of earnings management. The model is as follows:

R&D, research and development.

FIGURE 1: Theoretical framework.
$RISK_{it,j} = a_{it,j} + a_{it,j} \times RETURN_{it,j} + \epsilon_{it,j}$ is high (H) earnings groups

$RISK_{it,j} = a_{it,j} + a_{it,j} \times RETURN_{it,j} + \epsilon_{it,j}$ is low (L) earnings groups

where $RISK_{it,j}$ is the standard deviation of each enterprise’s earnings or change in earnings after manipulation during the sample period, and $RETURN_{it,j}$ is the means of each enterprise’s earnings or change in earnings after manipulation during the sample period. The samples are divided into two groups: high earnings (H), that is, earnings above zero or a change in earnings exceeding those in the previous period after manipulation during the sampling period, and low earnings (L), that is, earnings below zero, or a change in earnings lower than those in the previous period after manipulation.

If $a_{it,j}$ is negative, $a_{it,j}$ is positive, and the absolute value of $a_{it,j}$ is larger than the absolute value of $a_{it,j}$, the relationship between risk and return is considered to be verified, indicating that the prospect theory does explain earnings thresholds being the target levels for enterprise decision-making. The model also reveals how variables, such as leverage (Díez-Esteban et al. 2017), size (Gupta 2017), growth ( Ferreira, Zanini & Alves 2019), enterprise age (Gupta 2017), and industry (Munoz et al. 2020), control the relationship between risk and return:

$RISK_{it,j} = a_{it,j} + a_{it,j} \times RETURN_{it,j} + a_{it,j} \times LEV_{it,j} + a_{it,j} \times SIZE_{it,j} + a_{it,j} \times GROWTH_{it,j} + a_{it,j} \times AGE_{it,j} + a_{it,j} \times INDU_{it,j} + \epsilon_{it,j}$

[Eqn 2]

$RISK_{it,j} = a_{it,j} + a_{it,j} \times RETURN_{it,j} + a_{it,j} \times LEV_{it,j} + a_{it,j} \times SIZE_{it,j} + a_{it,j} \times GROWTH_{it,j} + a_{it,j} \times AGE_{it,j} + a_{it,j} \times INDU_{it,j} + \epsilon_{it,j}$

[Eqn 3]

We define the control variables with reference to Díez-Esteban et al. (2017), Munoz et al. (2020), Ferreira et al. (2019), and Gupta (2017) as follows: $LEV_{it,j}$ is the t year debt divided by the t year assets, $SIZE_{it,j}$ is the natural logarithm of the t year assets, $GROWTH_{it,j}$ is (the assets in the t year minus the t-1 year assets)/the t-1 year assets, $AGE_{it,j}$ is the number of years from the establishment of the enterprise to the t year, and $INDU_{it,j}$ is a dummy variable. The $INDU_{it,j}$ for enterprises related to pharmaceutical preparation, computer office equipment, electronic equipment, and industrial equipment is set to 0, and that for other enterprises is set to 1.

**Empirical results**

**Descriptive statistics**

Table 1 presents the results of the model of Zhu et al. (2015), which is used to estimate R&Ds expenditures. Table 2 presents the descriptive statistics of the model (the residuals of the model all passed the t test), including the earnings before R&D expenditure manipulation and manipulated earnings, as determined by the net profit in the income statement.

The mean discretionary R&D expenditure is US$24 million, indicating that South African listed enterprises tend to reduce earnings by manipulating R&D expenditures.

**Empirical test**

We use histograms to determine the distribution of the manipulated earnings. The frequency distribution results presented in Figure 2 and Figure 3 have normal distributions, which is consistent with the results of El-Sayed Ebaid (2012). The frequency distribution results presented in Figure 4 and Figure 5 are also consistent with the results of El-Sayed Ebaid (2012), and have normal distributions. The distribution of the manipulated earnings is skewed to the right and higher than the earning threshold. This indicates that most of the sample enterprises have earnings above zero and do not have declining earnings before R&D expenditure manipulation. Only 63 of the samples have earnings below zero before manipulation; 181 samples have declining earnings before manipulation. Therefore, hypotheses 1 and 2 are not supported. Potential reasons therefore are as follows: (1) South African listed enterprises do not focus on R&D activity, and thus, R&D activity has a smaller effect on earnings thresholds. (2) Managers use other methods to manipulate earnings to meet earnings thresholds; manipulating R&D expenditures to meet earnings thresholds is not always employed as an accounting policy. (3) External investors only value performance and do not consider earnings, which reduce manager motivation to manipulate earnings. (4) Because enterprises are evaluated by analysts or investors, they must disclose more true information. Therefore, if the earnings before manipulation exceed the earnings threshold, this is considered good news. However, if the earnings before manipulation are below the earnings threshold, this is bad news. When earnings meet the threshold before manipulation,
the information asymmetry between enterprises and external investors is reduced, and a low earnings threshold may indicate that an enterprise’s future investment plans are not supported by a sufficient cash flow. (5) Earnings may be highly related to stock prices if investors value earnings. To pursue the overall interests of their enterprises, managers are likely to ensure that earnings are above zero, or avoid earnings in decline before they manipulate R&D expenditures, which may have a more positive effect on stock prices than losses or declining earnings do.

According to Kahneman and Tversky’s prospect theory (1979), managers make decisions on the basis of their specific target levels. When the actual performance is below the target level, loss occurs and managers are more likely to pursue risk. When the actual performance is above the target level, gains occur and managers tend to avoid risk. Shen and Chih (2005) conduct a study on the basis of the prospect theory and report that personal gains or losses are influenced by the target level. Earnings management is risky; therefore, earnings below the target level are more likely to prompt managers to manipulate earnings to meet thresholds and pursue their personal interests. Accordingly, specific earnings thresholds may be considered manager target levels.

As indicated in Table 3, to avoid losses (earnings ≥ 0), \( a_{1,t} \) should be negative, \( a_{2,t} \) should be positive, and the absolute value of \( a_{1,t} \) lower than \( a_{2,t} \), respectively. This indicates that...
enterprises tend to pursue risk when earnings are above zero and avoid risk when earnings are below zero, and that the earnings thresholds to avoid losses cannot be considered manager target levels, whereas the prospect theory cannot explain how the manipulation of earnings through R&D expenditures of South African listed enterprises affects behaviour related to avoiding reporting losses. Hypothesis 3 is not supported.

To avoid showing earnings in decline (change in earnings \( \geq 0 \)), \( a_{\text{hij}} \) and \( a_{\text{ij}} \) should be positive, and the absolute value of \( a_{\text{hij}} \) more than \( a_{\text{ij}} \) respectively. This indicates that enterprises tend to pursue risk when earnings are above the previous period but avoid risk when earnings are no longer maintained and that the earnings thresholds, to avoid having to report declining earnings, cannot be considered the manager’s target levels, while the prospect theory can also not explain how the manipulation of earnings through R&D expenditures of South African listed enterprises affects behaviour related to avoiding showing earnings in decline. Hypothesis 4 is not supported. In summary, the prospect theory cannot explain the behaviour of South African listed enterprises related to manipulating R&D expenditures to meet earnings thresholds.

As recommended in the literature, we incorporate variables such as leverage (Diez-Esteban et al. 2017), size (Gupta 2017), growth (Ferreira et al. 2019), enterprise age (Gupta 2017), and industry (Munoz et al. 2020) to control for the relationship between risk and return. The results reveal that regardless of whether R& D expenditures are manipulated to meet earnings thresholds, the debt ratio (i.e. leverage) is not significantly positively correlated with risk. When the manipulated earnings meet, or not the earnings thresholds, the risk an enterprise runs, increase with the debt ratio. Regardless of whether R&D expenditures are manipulated to meet earnings thresholds, enterprise size is significantly positively correlated with risk. When manipulated earnings do not meet earnings thresholds, enterprises of a larger size encounter greater risk. When earnings are manipulated to avoid a decline in earnings, the growth of the enterprise is significantly negatively correlated with risk, although this correlation is non-significant when the earnings remain below zero after manipulation, and the particular industry is not significantly correlated with risk.

**Conclusion**

Research and developmental expenditures play a crucial role in enterprise operations. Because R&D activities are dependent on expenditures, managers are likely to manipulate R&D expenditures to meet specific earnings thresholds. In the present study, we collected 379 annual samples reported by 62 South African listed companies in 2011-2019 to analyse the behaviour of managers of probably manipulating R&D expenditures to meet earnings thresholds.

The results reveal that most samples have earnings above zero, and therefore have no need to show declining earnings or manipulate R&D expenditures. A possible reason for this is that South African listed enterprises do not focus on R&D activity, do not consider the effect of R&D expenditures on profits, and are not influenced by

\[
\text{INTERVAL WIDTHS}
\]

**FIGURE 5:** Histogram of earnings thresholds indicating whether declining earnings are avoided after the manipulation of research and developmental expenditures (sample = 379).

**TABLE 3:** Testing the prospect theory as motivation to manage earnings.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Threshold: earnings ( \geq 0 ) (avoiding earnings loss)</th>
<th>Threshold: Change in earnings ( \geq 0 ) (avoiding earnings decreases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High earnings group</td>
<td>Low earnings group</td>
</tr>
<tr>
<td>Intercept</td>
<td>-1.27553***</td>
<td>-2.93053***</td>
</tr>
<tr>
<td>RETURN</td>
<td>0.36815***</td>
<td>-0.13939</td>
</tr>
<tr>
<td>LEV</td>
<td>176.1628</td>
<td>77.25333</td>
</tr>
<tr>
<td>SIZE</td>
<td>39.6754***</td>
<td>70.16178***</td>
</tr>
<tr>
<td>GROWTH</td>
<td>-78.0869</td>
<td>-13.1916</td>
</tr>
<tr>
<td>AGE</td>
<td>-14.1651***</td>
<td>-0.955555</td>
</tr>
<tr>
<td>INDU</td>
<td>-81.6531</td>
<td>9.863462</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.35125</td>
<td>0.483342</td>
</tr>
<tr>
<td>( F ) value</td>
<td>28.79364***</td>
<td>11.4466***</td>
</tr>
</tbody>
</table>

\( LEV \) is the year debt divided by the year assets, \( SIZE \) is the natural logarithm of the year assets, \( GROWTH \) is the assets in the year minus the previous year assets, \( AGE \) is the number of years from the establishment of the enterprise to the year, and \( INDU \) is a dummy variable: the enterprises related to pharmaceutical preparation, computer office equipment, electronic equipment, and industrial equipment is set to 0, and that for other enterprises is set to 1.
other financial incentives. The aforementioned findings indicate that these companies do not have the need or the tendency to manipulate earnings through R&D expenditures to achieve earnings above zero or avoid showing a decline in earnings.

According to Shen and Chih (2005), the prospect theory indicates that decisions are made using various reference points. The decisions directly affect their personal losses or gains. They explore how the prospect theory supports the fact that managers manipulate earnings to meet earnings thresholds and pursue their personal interests and how this relates to the relationship between risk and return. However, the results of the present study indicate that South African listed enterprises do not have a tendency to achieve an earning above zero or avoid reporting earnings in decline by manipulating R&D expenditures and, therefore, do not support the proposal of Shen and Chih (2005). The findings of the present study also do not support the view that earnings management behaviour could be explained by the prospect theory.

The contributions of this study are as follows: (1) We explore whether South African listed enterprises manipulate earnings to achieve earnings above zero or avoid reporting declining earnings through R&D expenditures, which is not yet discussed in the literature. (2) We fail to determine the motivation for South African listed enterprises to manipulate earnings to achieve earnings above zero or avoid declining earnings through R&D expenditures by using the prospect theory.

The results we present may serve as a reference for investors, managers, relevant authorities, researchers, and auditors. Investors may estimate the future prospects of enterprises and managers’ abilities with reference to our findings. Managers may evaluate target earnings, or implement other earnings management strategies (e.g. investment in non-R&D expenditures or other operative activities) to meet specific earnings thresholds. The relevant authorities and researchers may redefine R&D expenditure or formulate stricter accounting standards for R&D expenditure and establish a more comprehensive tax system to reflect real R&D activities. Investors and the relevant authorities are advised to use more precise methods to investigate the relationship between R&D expenditure and earnings management. Auditors could also use such methods to determine the intention of new customers to manipulate R&D expenditures as a form of earnings management.

This study has the following limitations: (1) We do not analyse the R&D expenditures of all listed enterprises; hence, the results may not reflect the overall situation of South African listed enterprises or be applicable to non-listed enterprises. (2) Research and developmental expenditures are mostly derived from the processes of manufacturing products, providing services, and obtaining intellectual property rights. Accountants record these activities as capitalised R&D expenditure or R&D expenditure according to the situation. However, we are unable to divide the data collected from the database into different categories. (3) The model for R&D expenditure manipulation may be further improved in future studies. (4) The literature indicates that the overall economy or economic uncertainty affects enterprise operations. Future studies are recommended to analyse how overall economic factors affect enterprises manipulating earnings to meet specific earnings thresholds.

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Competing interests

The author(s) declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Author’s contributions

Z.L. is the sole author of this article.

Ethical considerations

The School of Accounting and Finance, Tan Kah Kee college, Xiamen University, China, approved this study. They declared that ethical clearance was not needed.

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Data availability

Data supporting the findings of this study are available from the corresponding author Z.L. on request.

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References


