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Firms' Investment Level and (In)Efficiency: The Role of Accounting Information System Quality

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Abstract: We investigate whether accounting information system quality has an impact on the level and efficiency of firms' investments. While firms' growth depends on investment and financing decisions, accounting information is fundamental for the decision-making of several stakeholders. We assess the accounting information system quality by discretionary accruals, whereas the investment inefficiency is estimated by the residuals of an investment regression for a sample of 3073 Portuguese SMEs from 27 industries, over the period from 2016 to 2021 using a panel regression analysis. The empirical evidence suggests that firms exhibiting higher accounting information system quality tend to invest more. In addition, firms with a lower accounting information system quality have more inefficient investments, as they tend to engage in more overinvestment, although this is not significant for underinvestment. Therefore, this study provides new evidence regarding the impact of accounting information systems on investment that may be useful for several stakeholders, such as managers, creditors, regulators, and academics, by providing evidence for SMEs, where empirical studies are scarce.

Keywords: accounting information system quality; accruals; investment efficiency; overinvestment; underinvestment

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1. Introduction

Accounting information system quality is essential to accurately communicate the current and expected financial/economic position of firms. Financial statements are the main source of information for stakeholders to make decisions (Francis et al. 2004; Yuan et al. 2022). Therefore, it is essential that the information disclosed is transparent and reflects the true and fair view of the firm. Bhattacharya et al. (2013) for the United States and Cerqueira and Pereira (2015) for Europe find empirical evidence that the quality of accounting information contributes to mitigating information asymmetry which in turn means a reduction in the cost of raising funds. Therefore, prior literature has investigated factors that may lead to activities that degrade accounting information system quality, aiming at creating mechanisms to mitigate those activities, thereby improving accounting information system quality. However, Jones (1991) argues that these activities are not easy to detect.

In the context of agency theory and stakeholder theory, the decision-making of investors and creditors depends on the quality of the accounting information system, as mentioned by McNichols and Stubben (2008) and Biddle and Hilary (2006). In the case of investment, it is a fundamental factor for the sustainability and growth of firms, which implies attracting investors and/or obtaining funding from banks. Firms have assets available to develop their economic activities due to their investment ability, affecting their intrinsic value. In addition, Alkafaji et al. (2023) emphasize that investment in information technology tends to reduce the cost of producing accounting information and increases

its reliability. The efficiency of a firm's investment directly affects its survival and development and, in macroeconomic terms, the allocation of resources in society. However, investment inefficiency is usually observed in most firms, specifically overinvestment or underinvestment. Therefore, Ma and Jeong (2022) argue that it is necessary to promote the efficiency of firms' investment. In the same vein, Gaio et al. (2023) and Lambert et al. (2007) suggest that the increase in the quality of financial reports leads to relevant economic implications in firms, such as the efficiency of investments made. Moreover, Pereira et al. (2023a) find empirical evidence that Portuguese small and medium entities (SMEs) with higher levels of investment tend to have a more conservative accounting practice to capture investors' confidence.

Therefore, this paper aims to analyse the impact of accounting information system quality on the investment level, that is, whether firms that exhibit a higher accounting information system quality have higher/lower investment amounts. Furthermore, we contribute by investigating if accounting information system quality affects investment efficiency, that is, if it has led to an increasing/decreasing trend of overinvestment and underinvestment for the Portuguese SMEs, which are the most representative firms in the Portuguese market, over the period from 2016 to 2021. To estimate accounting information system quality, the econometric model proposed by Jones (1991) is used, modified by Dechow et al. (1995) and Kothari et al. (2005). The impact of accounting information system quality on the level of investment was analyzed using a multivariate model based on the article by Ma and Jeong (2022). Furthermore, to study the relationship between earnings management and investment efficiency, multivariate models are developed based on the study by Biddle et al. (2009) and with the contribution of Linhares et al. (2018) and Cardoso (2019).

Given that it is not clear in the literature if accounting information system quality is associated with the level and efficiency of investment, this article aims to fill this gap by analyzing this specific relationship within SMEs. Overall, this paper contributes by providing evidence about the role of accounting information system quality on both the investment level and efficiency for SMEs where studies are scarce; it may be useful for several stakeholders, such as owners, creditors, academics, and regulators.

The remainder of the article is organized as follows: Section 2 presents a literature review and the underlying research hypotheses. Section 3 contains the empirical research design. Section 4 documents the results and their discussion. Section 5 highlights the concluding remarks.

2. Literature Review

2.1. Accounting Information System Quality

While accounting information system quality is a broad concept, it can be harmed by earnings management activities. For some authors, earnings management may be seen as a form of fraud; for others, earnings management should only be that which takes place within the accounting principles. Despite these divergences, Vila (2012) argues that those definitions have a common feature which refers to a manipulation of accounting information systems to achieve a certain goal. Therefore, Dechow et al. (2010) mention that the information provided regarding the characteristics of a firm's financial performance is relevant for making a specific decision, as long as there is an earnings quality, which is a function of the fundamental performance of the firm.

In addition, George et al. (2016) argue that the two main purposes of international financial reporting standards (IFRS) are to improve the comparability of financial statements across countries and to enhance the quality of financial reporting. While IFRS are expected to promote greater comparability and transparency, they allow earnings management activities, given their flexibility as Toumeh and Yahya (2019) noticed. Based on positive accounting theory (PAT), the accounting practice is selected over another taking into account the personal interests of the individuals involved. In addition, PAT aims at explaining and predicting accounting practices, rather than prescribing them. In the same vein, Queiroz and de Almeida (2017) argue that managers are influenced by incentives when making

accounting decisions, which may affect the quality of accounting information. According to the PAT, accounting choices are not neutral, so it is important to analyze the quality of the accounting information system to reduce the information gap between the firm's insiders and external investors (Queiroz and de Almeida 2017). This, in turn, reduces potential conflicts of interest that can arise when there is information asymmetry. In this sense, Alkafaji et al. (2023) emphasize the role of information technology to enhance accounting information, namely, these authors find that blockchain technology has positively and significantly impacted the quality of accounting information.

To assess accounting information system quality, several proxies have been developed, as mentioned by Dechow et al. (2010) and Schipper and Vincent (2003). There are proxies based on the time-series characteristics of reported earnings, such as persistence, smoothness, and timely loss recognition, and those that assess the extent to which earnings map onto cash flows, such as discretionary accruals and accruals quality.

In the Dechow et al. (1995) study, the authors focus on the accruals component of earnings because this is where there is a greater probability of earnings management. Accruals arise when there is a mismatch between the moment of recognition of income and the moment of cash flow (Ronen and Yaari 2008). In accruals, there is a discretionary component that is not explained by the firm's economic activity and aims to manage earnings, while non-discretionary accruals are inherent to the firm's activities (Jones 1991; Dechow et al. 1995; Cerqueira and Pereira 2017; Paulo 2007). To estimate the discretionary accruals component, Jones (1991) developed a linear regression. This model, as well as its modified version proposed by Dechow et al. (1995), has been the most discussed in the literature.

2.2. Investment Efficiency

According to neoclassical theory, firms invest until the marginal benefit equals the additional cost, to maximize profit as mentioned by Yoshikawa (1980).

According to Gomariz and Ballesta (2014), in perfect financial markets, all projects whose net present value (NPV) is positive must be financed and carried out. However, Gomariz and Ballesta (2014) emphasized that there are studies that challenge this assumption, stating that market imperfections, information asymmetries, and agency costs can lead firms to accept negative NPV projects (overinvestment) and to reject positive NPV projects (underinvestment).

The efficiency of a firm's investment is a fundamental issue because it directly affects the firm's survival and development. In this sense, Salehi et al. (2022) find evidence that investment efficiency has a positive impact on firm value and that institutional ownership and board independence moderate this impact.

While overinvestment can lead to a waste of resources and factors of production, underinvestment causes firms to miss out on some quality investments, thus hampering growth, development, and the interests of investors as stated by Ma and Jeong (2022). In addition, Biddle and Hilary (2006) identify two imperfections that can deviate from the optimal level of investment: moral hazard and adverse selection. Both imperfections are related to the asymmetry of information between managers and creditors/investors, which can affect capital efficiency.

Different authors have developed several ways to measure inefficient investment. Investment inefficiency is defined as the difference between actual investment and theoretical investment, the latter corresponding to the prediction of an empirical investment function. Once the investment function is estimated, the residuals represent overinvestments and underinvestments relying on Shen et al. (2015). Consistent with this approach, Biddle and Hilary (2006) developed an investment model based on growth opportunities (measured by sales growth) and used residuals as a firm-specific indicator for deviations from expected investment. The inefficiency of the investment was measured by Shen et al. (2015), from the subtraction of the investments of the industries to the investments of the firms.

2.3. Role of Accounting Information System on Investment Efficiency

Building on agency theory, the relationship between investment decisions and the quality of accounting information systems may be analyzed, and this is addressed by Biddle and Hilary (2006), Verdi (2006), and Bushman et al. (2011). According to Biddle and Hilary (2006) and Verdi (2006), superior accounting information reduces information asymmetry between managers and creditors, leading to more efficient investments. In the same vein, Yuan et al. (2022) find that firms with a higher accounting information quality reduce underinvestment and overinvestment due to mitigating financial constraints and agency conflict for a sample of Chinese listed firms. Lei et al. (2022) provide empirical evidence that accounting information quality enhances investment efficiency, which is stronger for firms with financial difficulties and agency conflicts.

In this way, earnings management has an impact on the decisions taken by managers, investors, and regulators. Investment decisions depend on expectations about the benefits that an investment brings, which in turn depend on expectations of the demand for products or services and future growth. Meanwhile, future growth expectations are calculated from an accounting information system that includes earnings. Based on McNichols and Stubben (2008), earnings management hides the real performance of firms, thus allowing the occurrence of overestimations of earnings and revenues, changing growth expectations on the part of those who are not aware that the information is not true. In the same vein, Bar-Gill and Bebchuk (2002) predict that inefficient investments are more likely to occur in firms that incorrectly declare their earnings.

In a study based on Portuguese SMEs, Pereira et al. (2023b) find empirical evidence that firms with higher levels of investment tend to have a more conservative accounting practice to obtain investor confidence. According to these authors, conservative financial reporting promotes more efficient investments by limiting the opportunistic activity of managers. Therefore, it is expected that the greater the amount of investment in firms, the greater the quality of accounting information systems. Relying on this literature review, the first research hypothesis is formulated:

H1: *A better accounting information quality system produces a positive impact on the investment level*.

To further develop this research, we focus on investment (in)efficiency. The evidence that Verdi (2006) found shows that the quality of accounting reports is negatively associated with overinvestment and underinvestment. In the same vein, the results of McNichols and Stubben (2008) suggest that earnings management can lead to a direct cost for investors, in the form of inefficient investments. In addition, Bushman et al. (2011) reported that the timely accounting recognition of economic losses makes managers less involved in investment projects with a negative NPV, limiting overinvestment in the face of declining investment opportunities. McNichols and Stubben (2008) assessed whether earnings management has an impact on investment decisions. These authors conclude that regardless of the reason for overinvestment, reporting without resorting to earnings management could prevent overinvestment. In addition, they expect that if firms overinvest during the manipulation period because of the distortion of accounting information, they will stop overinvesting as soon as the communicated information becomes true. Once the capital markets and the board of directors are aware of the true financial situation of the firm, it is to be expected that they will not allow the overinvestment to continue. In addition, according to them, the explanation for the relationship between earnings management and investment is that managers with profitable investment projects facing funding constraints may perform earnings management practices to obtain less expensive external financing, so they then use this financing to invest. Therefore, it would be expected that there would be overinvestment only for firms that resorted to external financing. Conversely, overinvestment may lead to earnings manipulation, i.e., firms that invest in excess are more likely to subsequently manage their earnings to cover up lower returns (McNichols and Stubben

2008). By contrast, assessing earnings quality by conservatism, Pereira et al. (2023b) argue that conservatism allows for reducing overinvestment because when firms report all losses, it leads to them being more selective in investments, increasing their efficiency. In the same sense, Ma and Jeong (2022) state that conservatism can reduce overinvestment by controlling the performance of managers and shareholders regarding investment activities. Consistently, Laux and Ray (2020) find that more conservative accounting increases incentives for innovation. In the same vein, the results of Costa et al. (2021) indicated a positive relationship between earnings quality and investment efficiency, in particular by mitigating overinvestment. Yuan et al. (2022) find that accounting information quality reduces labor investment inefficiency, both overinvestment and underinvestment. Therefore, the second research hypothesis is posited:

H2: *Poor accounting system quality has a positive impact on overinvestment.*

In addition, according to Biddle et al. (2009), a possible explanation for the negative relationship between the quality of accounting reporting and underinvestment may be the firm's ability to obtain debt and/or equity. In that sense, firms with a low accounting information system quality would have difficulties obtaining additional funds to support the investment projects. In the same vein, Gaio et al. (2023) find empirical evidence that a higher earnings quality mitigates investment inefficiencies, both underinvestment and overinvestment. However, the findings of Rahman et al. (2013) suggest that earnings management among underinvesting firms reduces information asymmetry. Therefore, underinvestment motivates managers to convey informational earnings management. In addition, Pereira et al.'s (2023a) results suggest that firms engage in earnings management practices to have a better performance, namely to have access to more credit for investing. Furthermore, Laux and Ray (2020) and Roychowdhury (2010) argue that more accounting conservatism makes the innovation investment less attractive, which enhances investment efficiency in the case of overinvestment but decreases investment efficiency in the case of underinvestment. From this literature review emerges the third hypothesis:

H3: *Poor accounting system quality has a positive impact on underinvestment.*

3. Results

3.1. Descriptive Statistics

The descriptive statistics of the variables used in Equation (3), which allow for the testing of the first hypothesis, are documented in Table 1. Given that the sample had some outliers, the descriptive statistics of these variables are presented after applying the winsorization technique. This technique involves replacing extreme values with less extreme values, called winsorized values. It implies replacing the lowest and highest extreme values in the sample with the lowest p-percentile (0.01 percentile) and the highest 1-p-percentile (0.99 percentile) values.

Table 1. Descriptive statistics for determinants of investment level.

Variables	Observations	Mean	Median	Std. Deviation	Maximum	Minimum
INV	18.438	0.0154	−0.0015	0.0735	0.4008	−0.1187
DAC	18.438	0.000	−0.0037	0.1137	0.3878	−0.3467
Size	18.438	8,986,813	6,366,345	7,163,233	34,699,529	2,214,733
Growth	18.438	0.0635	0.0439	0.2576	1.1365	−0.6362
Debt	18.438	0.2358	0.2117	0.1958	0.7756	0.0000
ROA	18.438	0.0374	0.0262	0.0654	0.2731	−0.1656

INV, DAC, growth, and debt are scaled by the total assets of the previous year. Source: authors' calculations.

The mean value of Portuguese SMEs' investment is low, representing 1.5% of the total assets. The mean value of DAC relative to total assets is close to zero, as expected, although the standard deviation of the statistic is high, with a maximum value of 39% and a negative

minimum value of similar amplitude. In addition, we can see a high degree of volatility in the variables, as their standard deviations are very close to or above their mean values.

Table 2 presents the descriptive statistics of the regression variables for Model 1, when the values of the overinvestment (panel A), underinvestment (panel B), and efficient investment (panel C), are obtained through the quartiles of the residuals in Equation (4).

Table 2. Descriptive statistics for efficiency investment—Model 1.

Panel A: Firms That Overinvest						
Variables	**Observations**	**Average**	**Median**	**Std. Deviation**	**Maximum**	**Minimum**
Audit	4610	0.0737	0.000	0.26139	1.00000	0.0000
DAC	4610	0.0016	0.0017	0.10979	0.3650	−0.3722
Loss	4610	0.1883	0.000	0.39098	1.0000	0.000
OverInv	4610	0.2778	0.2432	0.1334	0.7911	0.1280
Panel B: Firms That Underinvest						
Audit	4610	0.1176	0.0000	0.3221	1.0000	0.0000
DAC	4610	0.0018	−0.0024	0.1246	0.4179	−0.4293
Loss	4610	0.1299	0.0000	0.3362	1.0000	0.0000
UnderInv	4610	−0.2348	−0.2068	0.0875	−0.1456	−0.5713
Panel C: Firms with Efficient Investment						
Audit	9218	0.0716	0.0000	0.2578	1.0000	0.0000
DAC	9218	−0.0022	−0.0078	0.1114	0.3823	−0.32475
Loss	9218	0.1316	0.0000	0.3380	1.0000	0.0000
EfficientInv	9218	−0.0229	−0.02884	0.1114	0.12213	−0.14230

Source: authors' calculations.

The number of observations in the efficient investment sample is about twice that of the overinvestment and underinvestment sample, which is because efficient investment corresponds to the second- and third-quartile residuals, whereas underinvestment and overinvestment only correspond to the residuals of one quartile from the extremities, that is, the first and the fourth quartile, respectively.

The average number of firms audited by a Big4 firm is higher in the sample of firms that underinvest relative to those that overinvest and those that have an efficient investment. Regarding the DAC variable, this shows positive averages in the samples of firms that overinvest and underinvest, but a negative average in firms that invest efficiently, indicating that there is less earnings management compared to when they are inefficient. The loss average presents the highest value in the sample of firms that overinvest and the lowest value in those that underinvest. Regarding the dependent variables, the overinvestment varies between positive limits with a greater amplitude, and underinvestment varies between negative limits with a lower amplitude, while efficient investment oscillates between 0.1423 and 0.1221, the balance of which justifies the average null value.

Given that the models are estimated by the ordinary least squares method, this requires the absence of multicollinearity between the variables, that is, the lack of correlation between the independent variables. Then, Pearson's correlation values are calculated because they measure the degree of linear relationship between each pair of variables.

Table 3 documents the Pearson correlations between the variables included in the model described by Equation (3).

The correlation between the independent variables is significant at the 0.1% and 10% levels. When the Pearson correlations are greater than 0.60, it may indicate the existence of multicollinearity. As shown in the table, all correlation coefficients are below 0.3, making it possible to state that there are no multicollinearity issues.

Table 4 contains Pearson's correlations regarding to the overinvestment, underinvestment, and efficient investment, both for Model 1 (quartiles) and Model 2 (median).

Table 3. Correlations for the level of investment (Equation (3)).

	Size	Growth	Debt	DAC	ROA	INV
Size	1.000					
Growth	0.034 ***	1.000				
Debt	0.057 ***	0.038 ***	1.000			
DAC	0.035 ***	0.066 ***	0.041 ***	1.000		
ROA	0.026 ***	0.237 ***	−0.286 ***	0.091 ***	1.000	
INV	0.039 ***	0.097 ***	0.007	−0.058 ***	0.072 ***	1.000

Source: authors' calculations. *** indicates significance at the 0.1% levels, respectively.

Table 4. Correlations for investment efficiency (Equation (3)).

Panel A: Firms That Overinvest								
	Model 1				**Model 2**			
	Audit	DAC	Loss	OverInv	Audit	DAC	Loss	OverInv
Audit	1.000				1.000			
DAC	−0.013	1.000			−0.033 **	1.000		
Loss	0.117 **	−0.042 **	1.000		0.114 **	−0.075 **	1.000	
OverInv	0.089 **	0.004	0.047 **	1.000	0.048 **	0.023 *	0.072 **	1.000
Panel B: Firms That Underinvest								
Audit	1.000				1.000			
DAC	−0.035 *	1.000			−0.022 *	1.000		
Loss	0.069 **	−0.083 **	1.000		0.073 **	−0.093 **	1.000	
UnderInv	0.012	−0.026	−0.069 **	1.000	−0.049 **	−0.028 **	−0.034 **	1.000
Panel C: Firms with Efficient Investment								
Audit	1.0000							
DAC	−0.032	1.000						
Loss	0.092	−0.109	1.000					
EfficientInv	−0.019	−0.011	0.041 **	1.000				

**, * indicate significance at the 1%, 5% levels, respectively.

The correlations between the independent variables are significant at the 1% and 5% levels. As these correlations are all under 9%, then it is not expected to have multicollinearity issues.

3.2. Econometric Results and Discussion

To test the first hypothesis, we estimate econometric regression with pooled OLS method on Equation (3) and results are documented in Table 5.

The estimated results for the individual coefficients show the significance of the explanatory variables, at least at the 5% level. The value of the F statistic is 51.8487, for a significant level of 0.1%, which allows us to conclude that at least one of the explanatory variables is statistically significant at the 0.1% level. The R^2 indicates that the independent variables globally explain 2.04% of the variation in the INV of Portuguese SMEs.

The estimated coefficient of the main explanatory variable to test the first hypothesis, the DAC variable (β1), is statistically significant at 0.1% with a negative sign, as expected, showing that when discretionary accruals increase (accounting information system quality decreases), the level of investment tends to decrease. This evidence supports our Hypothesis H1. In terms of economic interpretation, given that discretionary accruals are a negative proxy of accounting information system quality, firms with fewer discretionary accruals tend to gain the trust of stakeholders, namely creditors who may grant better terms for investment financing.

Table 5. Accounting information system quality's role in investment levels.

Variables	Expected Sign	Coefficients
Intercept		−0.081 *** (−6.230)
DAC	−	−0.047 *** (−7.039)
Size	+	0.0057 *** (6.861)
Growth	+	0.0239 *** (9.712)
Debt	−/+	0.0080 * (2.205)
ROA	+	0.0707 *** (6.665)
No. observations	18.438	
R^2	0.0204	
R^2 adjusted	0.0201	
F Test	51.8487 (***)	
	$INV_{i,t} = \beta_0 + \beta_1 DAC_{i,t} + \beta_2\ Size_{i,t} + \beta_3 Growth_{i,t} + \beta_4 Debt_{i,t} + \beta_5 ROA_{i,t} + \mu_{i,t}$	

***, * Indicate significance at the 0.1% and 5% levels, respectively, (t-statistics). Source: authors' calculations.

Regarding the coefficient of the variable size (β2), it is statistically significant at 0.1% with a positive sign, which is consistent with Ma and Jeong (2022), suggesting that Portuguese SMEs tend to increase their investments as they grow in size.

The coefficient of the Growth variable (β3) is statistically significant at 0.1% and its sign is positive, consistent with Ma and Jeong (2022), denoting that an increase in sales contributes to an increase in the amount invested by firms in the sample. In the case of debt, the estimator (β4) is statistically significant at the 5% level, and positive. This result is opposite to the evidence of Ma and Jeong (2022), who find a negative relationship for this parameter. This positive sign may be because when firms obtain additional funds from their creditors, it gives them more capital available to carry out investment projects.

The coefficient of the ROA variable (β5) is statistically significant at the 0.1% level and positive, as expected, showing that firms with a higher return on assets invest more.

To test Hypotheses 2 and 3, from Models 1 and 2, we estimate regressions using the pooled OLS method. The results are shown in Table 6.

In panel A, Model 1, the value of the F statistic is 3.6168 which corresponds to a *p*-value of 0.01. Since the *p*-value is less than 0.05, the null hypothesis is rejected and it is concluded that at least one of the explanatory variables is statistically significant at this level of significance. In the Model 2 version, the value of the F statistic is 8.41513, which corresponds to a *p*-value of 0.00001477; then, the same is concluded for a significance of 0.1%. The R^2 is 0.9%, in Model 1, meaning that the variables together explain 0.9% of the variation in overinvestment for the sample of the firms. Other studies that aim to explain the overinvestment also have a low R^2 (around 5%), such as Linhares et al. (2018) and Cardoso (2019) with an R^2 of 5%. The R^2 is 0.76%, in Model 2, maintaining the same logic explained for Model 1.

While in Model 1 the DAC variable is not statistically significant, in Model 2 it is significant at a 5% level, exhibiting a positive sign, suggesting that when discretionary accruals increase, this enhances overinvestment, and this in turn means that overinvesting tends to increase for firms that have a lower accounting information system quality in accordance to Gaio et al. (2023), Yuan et al. (2022), Lei et al. (2022), Cardoso (2019), Linhares et al. (2018), and Biddle et al. (2009). Model 2 allows us to support our H2. This evidence is consistent with having a lower accounting information quality due to the need for exhibiting a better financial performance to capture investors' confidence and more creditors' funds to finance investments, which may lead to overinvestment, namely investing in projects with a negative NPV.

Table 6. Accounting information system quality's role in investment (in)efficiency.

Panel A: Firms That Overinvest			
		Model 1	**Model 2**
	Expected sign	Coefficient	Coefficient
Intercept		0.2722 ***	0.1534 ***
Audit	+	0.0432 **	0.0240
Loss	−	0.0126	0.0282 ***
DAC	+	0.0083	0.0421 *
Observations		4.610	9.219
R^2		0.0092	0.0076
R^2 adjusted		0.0086	0.0073
F-statistic		3.6168 *	8.4151 **
$\mathbf{OverInv_{i,t}} = \beta_0 + \beta_1\mathbf{DAC_{i,t}} + \beta_2\mathbf{Loss_{i,t}} + \beta_3\mathbf{Audit_{i,t}} + \mu_{i,t}$			
Panel B: Firms That Underinvest			
		Model 1	**Model 2**
Intercept		−0.2328 ***	−0.1589 ***
Audit	−	0.0043	−0.0153 *
Loss	+	−0.0189 **	−0.0099 *
DAC	+	−0.0220 *	−0.0262 **
Observations		4.610	9.219
R^2		0.0060	0.0043
R^2 adjusted		0.0053	0.0040
F-statistic		3.7148 *	6.74264 **
$\mathbf{UnderInv_{i,t}} = \beta_0 + \beta_1\mathbf{DAC_{i,t}} + \beta_2\mathbf{Loss_{i,t}} + \beta_3\mathbf{Audit_{i,t}} + \mu_{i,t}$			

***, **, * indicate significance at the 0.1%, 1%, and 5% levels, respectively. Source: authors' calculations.

In Model 1, the loss variable is statistically significant at 10% with a positive sign, implying an increase in overinvestment for firms with losses. In Model 2, the statistical significance improves by 0.1%, maintaining the positive sign. These results contrast with others, namely those of Biddle et al. (2009), Linhares et al. (2018), and Cardoso (2019) who found a negative sign for this variable.

Regarding the estimated coefficient of the audit variable (β_3) in Model 1 is statistically significant at a 1% level and positive, indicating that the analysis of a firm's accounts by a Big4 firm is associated with an increase in overinvestment. A similar result is obtained in Model 2, however, with a statistical significance of 10%. This evidence is in line with Linhares et al. (2018), who state that when a firm is audited by one of the Big4, it tends to deviate from the expected level to an excessive level of investment, compared to those that are not audited by the Big4, which can be explained by the agency problem.

Panel B focuses on underinvesting firms. In Model 1, the F-statistic is statistically significant at the 5% level and in Model 2 at the 1% level, which allows us to conclude that at least one of the explanatory variables is statistically significant in each of the models. The R^2 is 0.6% for Model 1 and 0.4% for Model 2, meaning that the variables together explain less than 1% of the variation in underinvestment. Studies that aim to explain underinvestment also have a low (4% to 5%) R^2, such as Cardoso (2019) and Linhares et al. (2018).

The DAC variable has a 5% and 1% level of significance in Model 1 and Model 2, respectively, with negative signs in both models, so a lower accounting information system quality tends to decrease underinvestment. These results do not support our H3 nor are they supported by more recent literature, where the sign of this variable is positive, such as Gaio et al. (2023), Yuan et al. (2022), Lei et al. (2022), and Linhares et al. (2018).

The loss variable is statistically significant at the 1% level and 5% level in Model 1 and Model 2, respectively. In both models, the coefficient is negative, which means that when a firm has losses it tends to decrease the underinvestment compared to firms with positive net earnings. These results contrast with Biddle et al. (2009), Linhares et al. (2018), and Cardoso (2019) that find a positive signal.

In Model 1, the audit variable has no statistical significance, while in Model 2 it has 5% significance with a negative sign as expected. Therefore, when a firm is audited by a Big4 firm, it is associated with a decrease in underinvestment. These findings are in line with Linhares et al. (2018) who show that firms audited by a Big4 firm do not tend to underinvest.

For future research, it will be important to assess the relationship between earnings management and the level and efficiency of investment in large Portuguese firms. Although the largest representation of the Portuguese business is seen for SMEs, the firms that have the most impact in terms of investment are the large ones. It might even be interesting to carry out a comparative study of the relationship between investment and earnings management between SMEs and large firms. Finally, on an international level, the present study is made for several countries and only uses in the sample the sectors of activity that present the highest level of investment.

4. Materials and Methods

4.1. Sample Selection

Data were collected from the Iberian Balance Sheet Analysis System[1] (SABI) database, for the period between 2016 and 2021, because in 2016 the SNC (Portuguese accounting standards system) came into force to transpose Directive 2013/34/EU (2013). It is worth noting that the SNC prescribes a similar accounting report to the IASB standards from 1 January 2010 (Pinheiro 2013). In addition, we focused on SMEs because these are the majority of Portuguese entities. In addition to following the SNC, two criteria to select SMEs were defined in the SABI database, namely the total balance sheet value ranging from EUR 2 million to EUR 43 million and the number of employees ranging from 10 to 250 people. Following Fama and French (1997), who argue that the selected industries should have at least 20 observations and aim at reducing dispersion, the industries selected have at least 40 firms and a maximum of 300 observations each year. Under this procedure, 27 industries were selected for the empirical study. Lastly, firms were excluded if they had no data available in any variable, with no activity, or in the case of having negative equity, as well as those firms belonging to the financial and insurance industries because they follow specific rules. After the selection procedures, the sample size consists of 3073 entities, with a total of 18,438 firm-year observations.

4.2. Empirical Model

We use a negative proxy of accounting information system quality, which is discretionary accruals (DA). This proxy is obtained through the residuals of Jones (1991) regression model, modified by Dechow et al. (1995) and Kothari et al. (2005). Equation 1 is estimated in cross-section to obtain the residuals, assuming that accruals are similar within an industry. The residuals are taken as the discretionary accruals:

$$TCA_{i,t} = \beta_0 + \beta_1\left(\frac{1}{Size_{i,t-1}}\right) + \beta_2(\Delta Sales_{i,t} - \Delta AC_{i,t}) + \beta_3 PPE_{i,t} + \beta_4 ROA_{i,t-1} + \mu_{i,t} \quad (1)$$

where

i, t corresponds to firm i and year t;
TCA is the total accruals scaled by the lagged total assets;
SIZE is the total assets of firm I;
ΔSales is the change in sales from the previous to the current year, scaled by the lagged total assets;
ΔAR is the change in accounts receivable from the previous to the current year, scaled by the lagged total assets;
PPE is the net property, plant, and equipment scaled by the lagged total assets;
ROA represents a return on assets in the previous period, computed by EBIT scaled by the total assets.

The residuals of Equation (1) represents the component of total accruals left after controlling for firm performance, firm economic activity, and investment in plant, property, and equipment.

According to Dechow et al. (1995), the dependent variable $TCA_{i,t}$ indicated in Equation (1) is calculated from Equation (2):

$$TCA_{i,t} = \Delta AC_{i,t} - \Delta LC_{i,t} - \Delta Cash_{i,t} + \Delta STD_{i,t} - \Delta DDA_{i,t} \quad (2)$$

where

i, t corresponds to firm i and year t;
AC is the current assets;
LC is the current liabilities;
Cash represents both cash and bank deposits;
STD corresponds to the short-term debt;
DDA represents the depreciation and amortization costs.

All of these variables are considered in terms of their changes from the previous to the current year.

The dependent variable TCA can also be calculated from the difference between earnings before interest and taxes (EBIT) and operating cash flows, but, as a significant number of firms contained in the SABI database do not have information on cash flows, we decided to calculate the TCA by the balance sheet approach as indicated in Equation (2).

To test the first hypothesis, the impact of earnings management on the level of investment, we have developed the multivariate model, represented in Equation (3), based on the contribution of the authors Ma and Jeong (2022), Bushman et al. (2011), Richardson (2006), and Skaife et al. (2004):

$$INV_{i,t} = \beta_0 + \beta_1 DAC_{i,t} + \beta_2\, Size_{i,t} + \beta_3 Growth_{i,t} + \beta_4 Debt_{i,t} + \beta_5 ROA_{i,t} + \mu_{i,t} \quad (3)$$

where

i, t corresponds to firm i and year t;
INV represents the change in value of the investment from the previous to the current year over total assets in the previous year, with the investment value being calculated through the sum of changes in tangible fixed assets and intangible assets;
DAC corresponds to the estimated discretionary accruals, obtained by estimating the error term of Equation (1).

According to Hypothesis H1, it is expected that firms that invest more need to capture the confidence of creditors and investors to obtain additional funds to finance their investment activities, which in turn means providing more transparent and reliable information, therefore developing less earnings management practices.

Based on prior literature, the following four variables were chosen because they are the most commonly mentioned as affecting the level of firms' investment:

Size is calculated through the natural logarithm of the total assets of the current year. In the study by Ma and Jeong (2022), this variable has a positive sign, whereby an increase in size implies an increase in the dependent variable, that is, when firms increase their size they tend to invest more.

Growth is calculated as the ratio of the year-on-year change in sales to the previous year's assets. In the study of Ma and Jeong (2022), this variable has a positive sign, then an increase in the variable growth implies an increase in the dependent variable, that is, firms that improve their business tend to increase the amount of their investment.

Debt is calculated as the ratio between the firm's debt and total assets in the previous year. Total debt encompasses current and non-current financing obtained by the firm. Ma and Jeong (2022) find empirical evidence that this variable has a negative sign, so the higher this ratio, the greater the financial risk of a firm, resulting in a reduction in its investment levels, to the extent that creditors will have more reserves on the transfer of capital.

ROA is defined above and it has a positive expected sign due to firms with a better performance being willing to make more investments. In the case of Udoayang et al. (2020), the authors find evidence that supports a significant positive relationship between the level of investments and asset returns.

Regarding the second and third hypotheses, their objectives are to analyze the impact of accounting information systems quality on overinvestment and underinvestment.

For that purpose, we obtain the residuals which are used as a proxy of the investment inefficiency of the following regression estimation, for each industry-year based on the economic activity code classification, for industries and the sample selection criteria:

$$Inv_{i,t} = \beta_0 + \beta_1 SalesGrowth_{i,t-1} + u_{i,t} \quad (4)$$

where

Inv is the total investment, calculated through the sum of tangible and intangible fixed assets;
SalesGrowth is the percentage change in sales from the previous to the current year.

To analyze the determinants of investment inefficiency, the magnitude of the residual is used by Biddle et al. (2009) as a dependent variable defining the following groups: Firm-year observations in the bottom quartile (i.e., the most negative residuals) are classified as underinvestment. Observations in the top quartile (i.e., the most positive residuals) are classified as overinvestment. The observations in the two middle quartiles are considered as the reference group that corresponds to the variable efficient investment. This corresponds to Model 1 of the present study.

From a robustness perspective, to have a greater number of observations, in addition to the quartile classification, the residuals were also divided between underinvestment and overinvestment, through the median. Values above the median of the residuals in Equation (4) are considered as overinvestment and values below the median of the residuals as underinvestment. This corresponds to Model 2.

Then, we test the impact of accounting information system quality on investment efficiency by estimating the following two regressions:

$$OverInv_{i,t} = \beta_0 + \beta_1 DACt_{i,t} + \beta_2 Loss_{i,t} + \beta_3 Audit_{i,t} + \mu_{i,t} \quad (5)$$

and

$$UnderInv_{i,t} = \beta_0 + \beta_1 DACt_{i,t} + \beta_2 Loss_{i,t} + \beta_3 Audit_{i,t} + \mu_{i,t} \quad (6)$$

DAC is the discretionary accruals that correspond to the regression residuals of Equation (1) and it represents an inverse proxy of accounting information system quality. Linhares et al. (2018) find that there is a positive relationship between earnings management, overinvestment, and underinvestment. These results are corroborated by Biddle et al. (2009) and Cardoso (2019), which suggest that firms with a superior quality in accounting information are less likely to deviate from the optimal degree of investment. In addition, according to Linhares et al. (2018), the probability of underinvestment is greater than the probability of overinvestment in firms that use earnings management practices. Thus, the efficiency of investments is related to the higher quality of financial reports, as defended by Lambert et al. (2007), Healy and Palepu (2001), and Bushman and Smith (2001).

Loss is a dummy variable that has a value of 1 for companies that have a negative net income and 0 for those that have a positive net income. The results of Linhares et al. (2018) show that the relationship between overinvestment and loss is negative; that is, there is no probability that firms that show losses invest above the level considered optimal. This article also demonstrated that the relationship between underinvestment and loss has a statistically significant positive sign. The studies of Biddle et al. (2009) and Cardoso (2019) reached the same conclusions.

Audit is a dummy variable that has a value of 1 for firms audited by the Big4 and 0 for those that are not audited by the Big4. Linhares et al. (2018) state that the relationship of this

variable with overinvestment and underinvestment is different. The relationship obtained was statistically significant positive for overinvestment; that is, if the firm is audited by one of the Big4, it has a higher probability of deviating from the expected level of investment and investing in excess compared to firms that are not audited by the Big4. This conclusion can be explained by the reliability and the agency problem, leading managers to invest above the current need. Regarding the relationship between audit and underinvestment, Linhares et al. (2018) find no statistical significance.

5. Conclusions

This study analyzes the effect of accounting information system quality on the investment level and investment efficiency of Portuguese SMEs. From the empirical evidence obtained in this study, it is possible to conclude that firms with a higher accounting information system quality have a greater tendency to invest. This can be explained by the fact that these firms with a higher accounting information system quality exhibit more reliable and transparent financial statements, so they convey greater confidence to investors and banks, and it is possible to attract more financing that can be subsequently allocated to investment in fixed assets.

To further develop the analysis, the association of accounting information system quality with investment (in)efficiency is analyzed. The results suggest that a lower accounting information system quality enhances the trend of overinvestment. In this sense, managers tend to report a better financial performance to capture more funds for financing investments. Therefore, if the financial statements do not report the true and fair view of the firms, managers may fall into the error of overinvestment, namely in projects with a negative NPV, which in turn may lead to a waste of resources and affect the survival and growth of the firms. Regarding the underinvestment, the lower quality the accounting information system, the lower the tendency for underinvestment. This result is the opposite to Linhares et al. (2018) and Verdi (2006) and may be explained by the fact that even if financial statements give the true situation, shareholders may not invest, even with positive NPV opportunities, if the indebtedness level is high, as it would imply that most of the benefits would be captured by the creditors (Pereira et al. 2023a).

This study contributes to deepening knowledge and discussion on the importance of financial statement quality and its impact on investment decisions, as well as investment inefficiency, specifically in the context of SMEs, which are the most representative entities in the Portuguese context. Furthermore, international empirical evidence is still scarce regarding the study of unlisted SMEs in small economies.

The results provide evidence that more accounting information system quality mitigates information asymmetry between insiders and outsiders due to more relevant and reliable financial statements which allows them to convey greater confidence to stakeholders, namely banks, which provide them with financing on better conditions to be allocated for investments in tangible fixed assets and intangible assets.

This evidence is useful for holding managers in terms of investment decisions and for reducing agency problems in terms of information guarantees from their creditors.

As a limitation of the study, we highlight the relatively smaller size of Portuguese SMEs compared to the majority of European SMEs, which will be able to convey greater confidence to creditors/investors and therefore present higher levels of investment.

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Note

[1] https://login.bvdinfo.com/R0/SabiNeo (accessed on 15 May 2023).

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