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EARNINGS MANAGEMENT IN CONSTRUCTION CONTRACTS: PREDICTING DISCRETIONARY ACCOUNTING

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Orientador: Prof. Dr. José Carlos Tiomatsu Oyadomari

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Tese apresentada ao Programa de Pós-Graduação em Controladoria, Finanças e Tecnologias de Gestão da Universidade Presbiteriana Mackenzie, como requisito parcial à obtenção de título de Doutor em Controladoria, Finanças e Tecnologias de Gestão.

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Resumo: Esta tese propõe novos modelos para testar e prever a ocorrência de gerenciamento de resultados, mas a partir da perspectiva interna da empresa, observando particularmente os contratos de construção. A tese inova ao investigar e determinar modelo de predição para a ocorrencia de Gerenciamento de Resultados, que, apesar de extenso trabalho, foca principalmente nas demonstrações financeiras da empresa. O tema Contratos de Construção é uma prática contábil amplamente utilizada por empresas que prestam serviços de construção por meio de contratos complexos e de longo prazo a seus clientes. No método contábil em questão, as receitas e os custos são reconhecidos com base nos custos incorridos e envolvem estimativas de custos a incorrer, as quais possuem certo grau de discricionariedade, permitindo uma fonte de assimetria de informações que pode beneficiar o desempenho dos projetos e daqueles que os gerenciam. Consistente com as teorias relevantes de gerenciamento de resultados, os gerentes de projetos podem usar essa assimetria de informações a seu favor, como melhores incentivos, reconhecimento profissional e menor atenção aos seus projetos. Foram revisadas descobertas teóricas recentes em gerenciamento de resultados que, combinadas com a experiência prática do autor, apoiam o desenvolvimento de algumas hipóteses testadas com uma base de dados interna de uma empresa europeia listada em bolsa. Os resultados apontam para a identificação do gerenciamento de resultados nos projetos, especificamente para a identificação de quais eventos ocorrem durante esse gerenciamento de resultados. Os resultados contribuem para a academia ao aplicar modelos de gerenciamento de resultados estabelecidos na literatura, mas a partir de uma perspectiva interna, e ao propor novos eventos que também podem ser úteis para os profissionais, pois lhes permitiriam identificar a probabilidade de ocorrência do gerenciamento de resultados, identificando aqueles eventos que são comuns em empresas deste tipo de modalidade de gerenciamento de projetos.
Palavra-chaves: gerenciamento de resultados, contabilidade de projetos, fraudes contábeis, contratos de construção, contingencia de riscos em projetos, F-score e modelo de predição em contabilidade.

Abstract: This thesis proposes new models to test and predict the occurrence of earnings management, but from the company's internal perspective, particularly observing construction contracts managed by project managers. The thesis fills a gap in the research on Earnings Management, which, despite extensive work, only focuses on the company's financial statements. The topic of Construction Contracts is an accounting practice widely used by companies providing construction services through complex and long-term contracts to their clients. In the accounting method in question, revenues and costs are recognized based on the cost incurred and involve estimates of the cost to be incurred, which have a degree of discretion, allowing a source of information asymmetry that can benefit the performance of projects and consequently, project managers. Consistent with the relevant theories of earnings management, project managers can use this information asymmetry to their advantage, such as better incentives, professional recognition, and reduced attention to their projects. Recent theoretical findings in earnings management were reviewed, which, combined with the author's practical experience, support the development of some hypotheses tested with an internal database of a European company listed on the stock exchange. The results point to identifying earnings management in projects, specifically to identifying which events occur during this earnings management. The results contribute to academia by applying earnings management models established in the literature but from an internal perspective and by proposing new events that may also be useful for practitioners, as they would enable them to identify the probability of earnings management occurring by identifying those events that are common in this type of project management modality companies.

Keywords: earnings management, accounting, fraud, project accounting, construction contracts, and project risk contingencies.

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ABBREVIATIONS

AIC: Akaike Information Criterion

BOP. Beginning of period

CEO: chief executive officer

GLM: general linear model

IFRS: International Financial Reporting Standards

IPO: Initial Public Offering

PoC: percentage of completion

RC: Risk contingency

RSS: Residual sum of squares

SEC: Securities and Exchange Commission

SOX: Sarbanes-Oxley Act

VAR: value at risk

1. INTRODUCTION

Earnings management is a research topic widely explored by academic research and is an essential subject for business leaders, regulators, shareholders, and stakeholders (Dechow & Skinner, 2000). However, the focus of this research subject is company financial statements. It was vastly investigated in the last two decades, but mainly after the famous accounting frauds in the 2000s, which led to a profound change in regulators' approach to accounting, with the Sarbanes-Oxley Act the notable result (Richardson et al., 2006). After two decades of the SOX implementation, the SEC still requires various companies to correct earnings related to some evidenced earnings management, suggesting that, till now, despite all efforts generated by the new law, companies are still engaged in earnings management (Core et al., 2008). Every year, regulators worldwide investigate companies accused of violating accounting standards rules to present them better to shareholders and financial markets (Dechow et al., et al. 2011). It is the so-called *window dressing* behavior. Somehow, managers cross the line and start managing earnings, affecting transparency and the future cash flow profiles for various reasons (Mcnichols &Wilson, 1988; Degeorge et al., 1999; Barth et al., 2001).

This study aims to conclude that the actors within a company are an essential source of causes and consequences for earnings management. In that case, the primary asymmetric information relationship happens among statutory managers, shareholders, and the financial market, the most important stakeholder. Nevertheless, upper management from large corporations sometimes acts in a holding position with minimal arm's length to be involved in every operational detail or project. Therefore, the upper and middle management relationship is a company's second critical information asymmetry level.

This research investigates whether middle management uses the same asymmetrical problem to avoid bringing bad earnings news to their bosses, manipulating project planning under their influence, particularly in companies using the construction contract accounting method, due to specific embedded management judgment patterns this kind of transaction has.

Companies acting in markets such as constructing plants, ships, equipment, factories, hydroelectric plants, power plants, and infrastructure projects use the construction contract method. It requires a complex offering of services that include cost of goods and materials, cost of employees, project management, etc., in a long-term relationship with customers and conjoint responsibility; such a situation creates much special effort to transform the operational view into accounting.

It has a relevant number of management judgments and carries the previously mentioned information asymmetry (Beneish, 1997; Adeleye et al., 2013).

The earnings management phenomenon inside the company, happening among middle managers and those in charge of statutory responsibility, should have equal importance in the field of study because it can distort financial statements.

Identifying internal earnings management would aid internal controls and audit professionals in developing mechanisms to mitigate information asymmetry and curb financial statement fraud. To avoid the dysfunctional use of management judgment, companies develop internal auditing mechanisms, which external auditors and the supervisory board then double-check. However, what is seen in the end are quarterly announcements covered by misinterpretation of possible future gains, poorly managed projects leading to earnings adjustment, and all sorts of poorly managed risks (Gleason et al., 2008; Desai et al., 2006).

The project accounting method follows the Revenue Method IFRS 15 or US GAAP, Topic 606. It is usually based on recognizing revenues according to the evolution of the project's costs or deliveries (in IFRS—performance obligations).

This study's added contributions may be applied to other sources of earnings management within business transactions other than construction contracts. It would be interesting to mention two specific patterns replicated in other accounting competencies to clarify the issue.

Noteworthy examples are topics related to accounting management judgment when managers must decide about increasing or decreasing provision or risk contingency level, taking as a basis the future project risks, which carry a high level of subjectivity (Hollmann, 2009). Such accounting assumptions will influence figures all around, revenues, cost of goods sold, assets, and liabilities, and the only way to verify the accuracy of such risks is by comparing the project timely flow with project results to bring to light if management judgments make sense and are reliable (Klakegg et al., 2016).

The project time series financial outcomes, meaning revenues, cost, assets, and liabilities, are estimated based on the project's expected future returns. Once more, it involves a higher level of subjectivity since managers need to estimate future returns based on their knowledge about the contract, customer, and country situation, which can also be classified as a management judgment. This information asymmetry may invariably lead to fable accounting control and give an earnings management advantage to project managers (Stubben, 2010).

That said, such examples illustrate that the findings from this study may help clarify earnings management weaknesses into other accounting competencies, which could also be tested, and new study fields are being unveiled (Bernard & Skinner, 1996).

Significantly, according to the researcher's experience with project accounting, misuse of management judgment and future planning to manage earnings on a micro level produce terrible consequences to the organization and its financial employees over time; some of these results can be described:

First, figures purposedly misstated generate a lack of work motivation, anxiety, and feelings of lousy behavior, which is therefore not beneficial for the company, its management, and its employees (Lindquist & Goldberg, 2009).

Second, this “lie net” creates animosity within the organization since in a well-structured company, earnings management is always a source of audits and accounting tests, and as a result, employees involved in such acts, although persuaded by their bosses, have to confirm over and over something that in truth is false, once more motivation is affected and considering that such behavior can be against employees personal beliefs (Ming-Chia & Chieh-Wen, 2013), firm is no longer attractive for employees (Gadgil & Sockin, 2020).

Third, earnings management within projects has a perverse effect over time. When the “lie net” is depleted, project margin adjustments must be made, and suddenly, corporate units and company results are strongly affected. It generates a confidence and transparency crisis, which is challenging to manage since companies can not clarify those substantial project variations due to disclosure restrictions (Noor & Tichacek, 2009).

Fourth, due to the same lack of transparency and future uncertainty, upper managers decide to stop investments in countries, businesses, or with customers where bad accounting events occur. However, these opportunities would bring positive outcomes from a strategic point of view. In the long run, such management movements hinder the company's new positive cash flow returns because of earnings management. Such investment restrictions after manipulation

are already identified by companies under SEC scrutiny (Biddle & Hilary, 2006; McNichols & Stubben, 2008)

The lack of interaction between public information and what happens inside the company is a missing link within the theory (Dechow et al., 2000; Bhattacharya et al., 2003; Bhattacharya et al., 2007).

Earnings management occurrence in companies is tested using published financial statements. Nevertheless, to the best of our knowledge, no study has been found to date that applies earnings management theory and models to verify internal relationships from a specific company.

Considering the vast number of accounting and decision-making processes within an international organization, the decision was to focus on an established accounting process grounded on management judgment and a clear information asymmetry situation, where the agent has more information than the other parts, as the construction contract accounting method.

This study follows some recommendations of Alvesson and Sandberg (2023), which suggest combining pre-understanding, empirics, and theory to construct interesting research phenomena.

To add knowledge to the earnings management field of study, this study aims to understand the occurrence frequency and suggest a hypothesis of events related to earnings management across the project management accounting, specifically on projects managed under the construction contract accounting method, considered for contracts signed between buyer and seller, which includes an extended delivery plan and vast contractual clauses with various accounting implications and level of judgment.

1.1. RESEARCH QUESTIONS

The research question hierarchy is as follows:

A: Do *project managers use construction contracts accounting methods judgments to manage earnings on their projects?*

The research on Question A aims to identify project financial misstatements during the development of construction contract accounting.

B: *What mechanisms manage earnings in construction contracts accounting methods?*

The research on Question B aims to validate the hypothesis about how the manipulation process occurs.

C: *Can replicable data models be developed to test earnings management using construction contracts time series?*

Research on Question C aims to predict earnings management using the outcome of Question B as response variables, with all variables available on project databases as background.

Research questions are supported by four hypotheses to be applied to a project sample from a specific listed company.

The research aims to strengthen control mechanisms and governance processes, avoiding the destruction of relevant value through limited accounting procedures and earnings management.

The study uses tested hypotheses about the earnings management relationship among company management, shareholders, and financial markets. Still, it now applies moderators and mediators according to company project accounting related to complex projects and the relationship between project managers and upper management.

Introducing the earnings management internal view to the academy will open new study fields, among them middle management incentives, possible additional accounting audit tests, and relevant theory about project accounting rules and guidelines, which are limited in really controlling managers in comparison with other accounting methodologies (Colson et al., 2010).

The contribution to practice is particularly relevant for audit companies and professionals related to internal auditing. External auditors can benefit from conclusions, which can enforce additional tests on project accounting in audited companies and reduce the scope limitation when confronted with management judgments affecting project earnings.

The research aims to strengthen control mechanisms and governance processes, avoiding the destruction of relevant value through limited accounting procedures and earnings management.

2. LITERATURE REVIEW AND THEORETICAL MODEL

This literature review presents the crucial milestones from earnings management years to date and the specific literature about project management and its risk assessment.

The literature review focuses on accounting earnings management, its countermeasures, and the difficulties presented in other studies related to this theoretical field. This part of the literature review will provide the elements to build the theoretical framework for the hypothesis and the research design with already tested and successful theoretical models to identify earnings management at the company level. Consequently, accounting standards and corporate roles need to be figured out in the literature review to determine the extent of their influence on earnings management.

This literature review extensively discusses project management, project accounting, and project risk management and the different views about them. It is also important to highlight that findings correlating earnings management and project management from the company's

internal view have yet to be found. Moreover, project accounting methodology is a scarce theoretical field in accounting.

2.1. EARNINGS MANAGEMENT

According to the literature, earnings management may occur on a corporate level in the following aspects, not limited to those (Lewitt, 1998; Dechow. Weili & Schrand, 2010):

- New managers or transition managers use restructuring opportunities to be very conservative on cost recognition and accrual "Big baths," aiming to make their life easier in the future, the so-called "Cookie jar effect" (Dechow, 2004);

- Managers prefer a zero or minimal profit instead of a loss. Therefore, they manage results through accruals, provisions, and revenue recognition to avoid explaining losses (Beneish, 1997).

- Managers act opportunistically during special events, such an IPO, secondary equity offer, or fiscal year-end, because presenting adequate financial information at the event may create some personal advantage, such as a higher share price or bigger corporate bonus. During this period, accounting rules and governance are more relaxed (Burgstahler, 1997; Skinner & Myers, 2007; Suk & Jin, 2009).

- Managers do not show negative plan deviations to maintain their jobs and status; therefore, early huge loss recognition is avoided (Elizabeth & Chong, 2010). Managers avoid giving bad news and holding negative information inside the company until there is no more possibility to hide it. The impacts of such bad news on the company will not be avoided by company figures (Kothari et al., 2005). This situation is exacerbated when manager incentives are linked with future earnings-out over equity (Martin et al., 2019). Managers avoid discontinuing a failing R&D project that has been partially

capitalized to prevent impairment, especially if incentives (personally and from their superior) are linked to short-term results (Brink et al., 2020). Powerful managers abuse their company and operational knowledge to withhold bad news as much as possible (Kothari et al., 2009), which drives the company to stock price crash when information is brought to light (Balachandran et al., 2020).

- Managers avoid frustrating analysts' quarterly earnings forecasts to maintain or increase the enterprise value expectation and consequently earn bonuses (Chu et al., 2019). The so-called "beat the analysts" phenomenon starts after management is not able to keep beating expected earnings and first, push management guidance down to strike it after; second, by "in the GAAP" earnings management, by using management judgment and interpretation to beef up earnings and third "outside the GAAP" fraud measures (considering an SEC mandate to investigate accounting manipulation), based on its overconfidence on company future earnings.

Other aspects, such as concentrated ownership in a few shareholders, positively correlate with increased earnings management since controlling shareholders use their inside information to manipulate market reactions towards company shares and favor seasoned equity offerings. They benefit from earnings management mechanisms; having other significant shareholders, including those with board membership, helps control shareholder's share reputational burdens and pecuniary losses (Martin et al., 2019). While benefits are enjoyed, costs are shared, according to the so-called "cost-sharing hypothesis."

Sayal and Singh (2020) tested this in a controlled study with MBA students. In this study, individual intentions to engage in earnings management are influenced by the ease of engaging (lack of control), favorability to his benefit when engaging, and acceptance from superiors of

their engagement (culture). However, engagement is reduced if they are suspicious of getting caught, lack trust in other team members, and exhibit unethical behavior that yields no benefit.

The field of study is related to the earnings management theory, which is divided into "accounting earnings management" and "real earnings management" (Ewert & Wagenhofer, 2005; Cohen et al., 2008).

Accounting earnings management refers to decisions to change the accounting impact of events for their benefit, such as bonuses, job safety, or pure vanity. Many countries and regulators are working on accounting regulation amendments to reduce accounting earnings management in favor of more transparent and value-driven accounting (Ecker et al., 2006).

On the other hand, real earning management refers to business decisions aiming to generate present profits at the expense of future benefits for the company. It involves a high level of judgment regarding company assets, market conditions, customer preferences, and others and is, therefore, very difficult to identify (Burgstahler & Eames, 2006).

2.2. ACCOUNTING STANDARDS

Companies acting on financial markets are governed by accounting standards, which regulators settle with the intention of creating a minimum level of transparency for those investing in companies without full access to the internal view of those firms. These standards are usually represented by accepted accounting practices followed by companies and audited for (Healey & Wahlen, 1999). It is how management will communicate its financials and all relevant information that may affect the company's going concern, as well as possible effects from the company strategy on future earnings and cash flow. Additionally, it is a framework that auditors and regulators can enforce while managers provide uniform information to interested

capital providers and stakeholders. Standards provide comparability, easing the capital resource allocation and stakeholders' decisions.

2.2.1. IFRS guideline on construction contracts

Until 2018, the IFRS (International Financial Reporting Standard) chapter is dedicated to project accounting, the so-called construction contract accounting method. Construction contracts methodology has a specific regulation and is described per guideline IAS11 (Annex I).

"*A construction contract is specifically negotiated for the construction of an asset or a group of interrelated assets.*" [IAS 11.3]

Nevertheless, long-term contracts have been a controversial topic within accounting since the timeframe of a long-term contract is longer than a fiscal year, which means that the project evolves inside the company, consuming resources and capital without physical delivery to the customer. On the other hand, the customer only assumes goods transfer at the project's end. The discussion is not new,

"The difficulty in accounting for long-term construction-type contracts arises because such contracts produce an apparent conflict between two important accounting principles. On the one hand, the ordinary rule that income is recognized only when the right to full payment has become unconditional requires that no income on a long-term contract be recognized before the final acceptance of the work. On the other hand, the underlying objective of a periodic accounting system, that each period fairly reflects the results of operations during that period, points toward an allocation of the profit on a long-term contract in some ratable fashion among the periods in which the work on the contract is performed." (Herwitz 1957)

Companies reporting under the IFRS standard must follow the recommendations made by IAS11 (until 2018) to ensure financial report compliance. External and internal auditors used the standard when auditing projects accounted under construction contracts.

2.2.2. Revenues recognition

The purpose of the guideline is to define the accounting components of such a construction contract and how they influence the overall company accounting closing. As with any other contract signed with a third party buying equipment or services, according to IAS 11, a contract has a sales line agreed upon between customer and supplier, and this is for the seller, the revenue line. The supplier must be able to estimate reliably all project costs, according to signed contract conditions with the buyer. If such an estimation is impossible, the company responsible cannot use IAS 11 as an accounting principle but consider all costs as immediate expenses on its accounting reports. *"To be able to estimate the outcome of a contract reliably, the entity must be able to estimate total contract revenue, the stage of completion, and the costs to complete the contract."* [IAS 11.23-24]

The completion stage for a construction contract is the basis for revenue recognition. It is an important measure that will affect project and company figures. Considering the extended execution profile of such projects, as the time between project start and project end may take several years, the completion stage influences the acceleration or delay from revenue recognition and, as a result, the presentation of project margin and consequently affects the company earnings. According to IAS 11, the stage of completion can be measured in the following ways:

i. The contract costs incurred for work performed to date are proportional to the total planned cost at completion.

In that case, progression can only be considered for costs related to activities already performed. For example, advanced payments to suppliers without the respective production activity cannot be deemed incurred costs since their benefits will come in the future. In that case, planned cost accuracy is mandatory since revenue will be recognized based on the total project planned cost. Revenue will be wrongly recognized if the total planned cost basis is wrong. It is the "cost-to-cost" type of percentage of completion.

ii. Surveys of work carried out.

Although project managers may have scientific ways to evaluate the work progression within a construction contract, such methodology involves a high degree of subjectivity and the settlement of some internal guidelines for technical progression for each project family. Additionally, every customer has some special requests that influence the project costs and execution and, invariably, the progression of work performed.

iii. Completion of a physical proportion of the contract work.

The so-called "units of delivery" type of construction contract divides the delivery from a specific construction contract into different delivery elements. It follows the revenue and cost recognition from those elements.

The accounting committee decides the accounting type using the construction contract method, which usually applies to all contracts within an entity. The chosen methodology should be disclosed in the company's financial reports and to independent auditors.

After 01/01/2018, the IASB finished a lengthy study to unify all types of revenue recognition and released the IFRS 15 normative, which technically replaced the IAS11.

> *"The objective of IFRS 15 is to establish the principles that an entity shall apply to report useful information to users of financial statements about the nature, amount,*

timing, and uncertainty of revenue and cash flows arising from a contract with a customer." (IFRS15)

However, no relevant changes occurred in construction contracts accounting since the interplay among revenue recognition, contract assets, and contract liabilities, based on total project planned costs, including the risk contingency, remains the same (Napier & Stadler, 2020). Most construction contracts represent one performance obligation that remains performed over time (until final acceptance).

Construction contracts are usually rich in legal boundaries for buyers and sellers, especially because of all collaterals provided by third parties around the contract, either financial institutions or insurance companies. Therefore, the IFRS compliance of a contract is straightforward in bringing all elements of an over-time performance obligation as per IFRS 15: i. Identify the contract(s) with a customer; ii. Identify the performance obligations in the contract; iii. Determine the transaction price; iv. Allocate the transaction price to the performance obligations in the contract; v. Recognize revenue when (or as) the entity satisfies a performance obligation (Coetsee & Van Wyk, 2020).

Contract revenue includes the initial contract plus or minus changes requested by the customer and accepted by the selling company, considering that all of them can be measured reliably. For earnings management studies, managers may find potential for discretionary revenues in the form of creating revenue positions to increase project margin, but considering that the construction contract is always executed based on a commercial valid contract, revenue value is always derived based on the contract, and this calculation is also made by auditors, which in that case, reduce the information asymmetry between the project managers, upper management and auditors.

Contract costs, which this study calls “project costs,” include all direct costs and expenses necessary for project completion. Contract costs can be charged to the customer under the contract terms. They must be directly related to the contract scope implementation. Otherwise, they cannot be considered contract costs and are, therefore, not relevant for revenue recognition.

In some extreme cases, where project costs exceed project revenues and, as a result, the project has a negative margin, according to IFRS15, the company must create an accrual for loss on the construction contract since instead of having expected future benefits, the contract negatively affects the company's future cash outcomes. An accrual is accounted for, so the accounting information is aligned with the company's cash and profit generation profile.

2.3. CORPORATE ACTORS

Financial markets are fueled by investors seeking companies with favorable going concern profiles based on future return expectations. Future expectations are related to the company's capability to be financially transparent, have a robust business model, and have good governance in place (Core et al., 1999; Bowen et al., 2008).

Managers want to secure their jobs and present themselves as successful people to the financial community. A third independent party shall attest to the financial statement's reliability, adding credibility to information generated by the company. Auditors are independent advisors hired by companies to express an independent opinion about the company’s financial situation and governance maturity and present a reliable company financial view to shareholders and stakeholders. Considering that auditors use accounting standards guidelines to audit a company’s financial statements, they shall verify occurrences of earnings management attempts and propose corrections to maintain its reputation through avoidance of corporate

misconduct. Therefore, auditors have a relevant role in avoiding and signaling earnings management (Boone et al., 2012).

Managers are classified at different organizational levels, but this study describes them as insiders. They possess unlimited access to the company's inside information and are mandated to decide on the company's strategies on behalf of the supervisory board. Managers receive incentives to increase the company's future constantly discounted cash flows.

For this study, managers will be divided into upper management and middle management. Middle managers are responsible for the company's operational activities, such as long-term projects. As they are assigned as project responsible, considering an expert project team for each situation, the specialized literature calls them “project managers.” Upper managers are those responsible for the company towards the external market and stakeholders, assuming personal responsibility concerning company acts triggered by them. Middle management has the support of employees, and their decisions are more likely to be accepted by teams, as initiatives are not seen as a top-down approach (Heyden et al., 2017). This legitimation can be misused in the case of earnings management in projects.

Both managers prefer short-term results over long-term results, which can be explained by three factors (Simpson, 2013): i. They have a limited timeframe within the company and, therefore, will not personally profit from very long-term actions; ii. Equity incentives linked with short-term vesting options to make remuneration attractive; iii. High stock prices reduce the cost of capital due to better financial comparison of own and debt cash injections and because the company has more money to invest in growth initiatives.

The supervisory board, which consists of individuals chosen by shareholders, is responsible for hiring managers, defining the alignment of managers' incentives and value generation, foreseeing company strategies, and driving the company's governance principles. The

supervisory board is also responsible for the reliability and the corporate governance process. Creating sound corporate governance and presenting it appropriately to financial markets has been proven to bring additional corporate liquidity and incremental value (Bar-Yosef & Principe, 2013).

The supervisory board is also responsible for nominating the audit committee, verifying the audit results performed by external auditors, and discussing outcomes and accounting adjustments indicated by auditors and questioned by managers. Some studies show such a committee is an important mechanism to reduce earnings management occurrence; however, under such conditions, the audit committee is more effective, like having members with financial backgrounds capable of questioning audit reports in detail and having independent members with no further relation with the company (Bedard et al., 2004).

Regulators are government institutions responsible for controlling financial markets' adherence to accounting standards, investigating fraud related to conduct that deviates from such standards or the country's sovereign law system, and representing the country's interests on topics related to financial markets. Industries with efficient regulation reduce the space for earnings management (He & Yang, 2014).

Each actor influences the occurrence or non-occurrence of earnings management in some way. The countermeasures to earnings management are widely discussed in the literature and will be presented in the following chapter.

2.4. EARNINGS MANAGEMENT COUNTERMEASURES

Using the company-level earnings management studies as a proxy, some practical solutions have been identified to cope with earnings management.

One is related to independent professionals accessing audit reports and deciding about audit procedures. (Klein 2002). When companies establish independent audit committees with no previous relationship with the audit company and the managing board, earnings management in discretionary accrual is reduced. However, in the year when companies take independence from the audit committee in the form of reduced independent members, for example, discretionary accruals grow, presenting a negative correlation between the independence of audit committees and earnings management.

Audit committees have been proven to reduce earnings management occurrence by reducing discretionary accruals when the audit committees are settled under some circumstances. (i) Audit committee members considered outsiders but hold industry knowledge are much more effective than outside generalists; (ii) Audit committees with a relevant quantity of financial specialists able to discuss the company accounting and financial topics (He & Yang, 2014).

Accounting enforcement laws, such as the SOX and lousy publicity for prosecuted companies, have been proven to reduce accounting earnings management from public companies (Cohen et al., 2008). Security class action also prevents overconfident CEOs from overestimating future returns of specific projects and underestimating possible risks by influencing this behavior via accrual management (Banerjee et al., 2018).

On the enterprise level, companies are monitored periodically by investors representing investment funds, which are considered “high quality” firms and have a lower occurrence of earnings management (Wongsunwai, 2013). Considering the investment fund industry's success relies on reputation, the simple fact that some discovered earnings management within the invested firms might bring side effects more substantial than the benefits from earnings management is, per se, an essential explanation for the lower earnings management level.

Some researchers also show that earnings management is strictly linked to management financial incentives. The supervisory board that prioritizes monetary incentives with short-term realizing options for its managers is responsible for increasing managers' willingness to manage earnings (Bedard et al., 2003).

Investors' sentiments also influence earnings management (Simpson, 2013). Managers use earnings management methods more when investors' sentiments are optimistic, though they target achieving analysts' forecasts. The consequence is even more applicable for companies with a higher correlation between share value and market sentiment. Therefore, the supervisory board must position its company against market sentiment and increase controls on those moments to avoid accounting fraud and impaired signaling to the market (Skinner & Myers, 2007).

Although all countermeasures are identified at the company level, the principles can be applied when looking at the internal relations within company managers. In a sequence, strategies made to reduce the occurrence of earnings management need to focus on:

i. independent financial control.

ii. Internal accounting regulations focused on each industry where projects are being developed with their respective specifications.

iii. Financial and work perspective incentives that will not allow managers to achieve using aggressive accounting, accounting creativity, or real earnings management for short-term cash generation will affect final project value.

iv. Auditors and audit committees cannot relax control during market momentum but strengthen it since research shows that momentum is a vital moderator for earnings management.

2.5. EARNINGS MANAGEMENT MODELS

The literature presents various earnings management detection models, primarily based on identifying discretionary accruals. Those models are described below:

2.5.1. Jones Model

The Jones model was developed in 1990 to identify earnings management for a specific purpose: import duties relief policy (Jones, 1991). Following previous models, Jones also identified residual accruals as the central point of the model. At that point, the model was built and calculated based on the total value of accruals, not segregating the possible different account types. In that model, total accruals are calculated as the change in non-cash working capital before income taxes payable less total depreciation expense.

The model assumption is that all cash a company generates must follow an equal earnings representation, which means that after certain events, managers will release/increase the discretionary accruals and reach an equal situation. Therefore, the Jones model compares the accruals development with:

1. Company revenues increase. With revenue increases, considering all other factors equal, companies must improve their accrual position.

2. Gross property, plant, and equipment because it relates to non-discretionary depreciation expenses.

3. Net cash flow as the final benchmark for the total earnings.

Jones could demonstrate the model's effectiveness by considering the three variables, the time series, and the narrow scope of the earnings management test (for import duty relief purposes).

It was possible to simulate a usual scenario without earnings management since the incentive to do so was assumed to be the import relief audit.

Some critics of the model were later adapted into other models. Jones considered revenues directly related to non-discretionary accruals, meaning there is no earnings management on revenues (Dechow et al., 1995). Another criticism is that the model considers the total discretionary accrual for the analysis, not separately. Years later, it was identified that separating accruals makes models more robust; those models will be described later (Burgstahler & Leuz, 2006).

In 1995, Dechow, Sloan, and Sweeney suggested a "modified Jones" model, where the mathematical model would also consider the existence of discretionary revenue, trying to solve one of the models' pitfalls. In their conclusion, such a model would be the best fit to identify earnings management activity compared to companies under SEC investigation.

Some adapted modified Jones models were widely used to predict future cash flows based on disaggregated accruals, contrasting with aggregated earnings analysis (Barth et al., 2001; Dechow & Dichev, 2002). The authors aggregated accruals within six groups: change in accounts receivable, change in accounts payable, change in inventory, depreciation, amortization, and other accruals. Depending on the industry, such accrual variations influence the future cash flow prediction at a higher or lower intensity.

2.5.2. Performance matching model

Kothari, Leone, and Wasley (2005) introduced a model also based on discretionary accrual, but this time, they modeled discretionary accrual as a performance function. The model is an adapted version from the modified Jones model but considers two more variables, the first being performance, calculated via the return on assets from the previous period, which brings

the main argument that earnings management is linked with the performance matching behavior; the second variable is the change on current accruals, to capture the manipulation of current discretionary accruals. Some researchers argue that it exacerbates the effects of discretionary accruals, which are also not statistically appropriate (Dechow et al., 2012).

2.5.3. Discretionary revenues

Discretionary accruals are still the primary way of testing for earnings management. Nevertheless, some studies use revenue manipulation to increase success when testing for earnings management. According to SEC investigation, the main field of manipulation is the anticipation of revenue, which happens in many different forms (Stubben, 2010). As in discretionary accrual studies, such models aim to separate the level of receivables generated by non-discretionary revenues and the "discretionary receivables." These approaches are interesting because they are independent of accrual models, and they set the trend to start using other income statement/balance sheet positions to test for earnings management, not only the standard accrual tests. The model can also be used conjointly with the discretionary accruals test.

2.5.4. Build / Reverse discretionary accrual model.

Dechow et al. (2012) unveiled a new approach for identifying earnings management based on the modified Jones model but with special consideration. In their opinion, it significantly increases the model's power to predict. The "build/reverse discretionary accrual model" is the first to use not only the variation of discretionary accruals as a test for earnings management but also the nature of its reversal. The model is based on the same empirical test from the modified Jones model that working capital accruals negatively correlate with cash flow from operations positions. This means that when regressions among discretionary accruals and cash flow from operations have low residual errors to be explained, the earnings are of exceptionally

high quality, meaning a low probability of earnings management. Additionally, it models the discretionary accruals reversal pattern (Dechow et al., 2012). According to Dechow et al. (2012), incorporating discretionary accrual reversals on the model brings the following managerial benefits:

"1) So long as the hypothesized determinant of earnings management is present in less than half the total available firm-years, incorporating reversals increases test power.

2) So long as any correlated omitted nondiscretionary accruals do not happen to reverse in the same period that the earnings management is hypothesized to reverse, incorporating reversals mitigates correlated omitted variables bias." (Dechow et al. 2012)

Interestingly, it incorporates the accrual reversal and is successful during the re-test. It brings a new model variable that reduces the model residuals. Nevertheless, from a practical point of view, it is difficult for researchers to make this reversal segregation without having internal information and more details about it. It also makes data mining more costly since clarifications of reversals are usually in footnotes, and compiling all this information takes a long time.

2.6. DIFFICULTIES FOUND IN PREVIOUS STUDIES

As already stated, the earnings management hypothesis was calculated based on the variance of discretionary accruals over the years and the development of correlations with company performance indicators, such as profit and cash flow, and with regulator investigations over earnings management. Although described as a powerful earnings management test and widely used, there are other ways to bring more accuracy to models, for example, looking into different types of accruals and their release time (Dechow et al., 2012), which means that tests are unable to distinguish low- or high-quality accruals, the first related to earnings management actions and the second as a result of the company operation (Wysocki, 2009).

Additionally, benchmarks for “manipulating companies” studies are current earnings management accusations from financial market regulators.

Identified misstatements are a particular sort of data. They may limit conclusions because regulators cannot find 100% of companies managing earnings, and some of these actions may not be relevant enough to call regulators' attention (Dechow et al., 1996).

On the other hand, the actual earnings management literature has not presented a benchmark proxy for a company free of earnings management so far. Therefore, most studies hypothesized earnings management occurrences, with a few proving earnings management in a specific context (McNichols, 2000).

3. CONTEXT OF EARNINGS MANAGEMENT APPLIED TO PROJECT ACCOUNTING

This chapter brings together the economics of construction contracts and aims to present the boundaries of project accounting.

3.1. FUNDAMENTALS OF CONSTRUCTION CONTRACT ACCOUNTING

Planned revenues are the sum of all values invoiced to the customer until the project is concluded in exchange for the final deliverable (performance obligation). Manipulation in this position is risky since the overall value must match the estimated customer contract and deliveries and its payment schedule; there is no objective judgment from the project manager's side.

Planned project costs are all direct costs associated with project delivery, from project start to project close, and do not include the probable occurrence of project risks (risk contingencies) because one will not contract costs before risks materialize. Information asymmetry benefits

project managers and manipulation is possible because the project manager and project team hold all relevant information about the project's cost breakdown and the complexity of the deliverable and can “manage” cost estimations to achieve their expected, planned contribution margin.

Project Risk contingency addresses risk and influences the project contribution margin based on its probability of materializing until the project ends. Manipulation is possible, and like planned project costs, it can underrepresent or overrepresent costs to influence the planned project contribution margin.

The planned project contribution margin results from planned revenues minus planned contract costs and risk contingencies. It should not change along the project cycle except for customer price corrections or changes in contract scopes.

To address research question “A,” this study aims to statistically differentiate projects with contribution margin changes and their correlation to project costs or risk contingency changes.

This can be visualized in Figure 1.

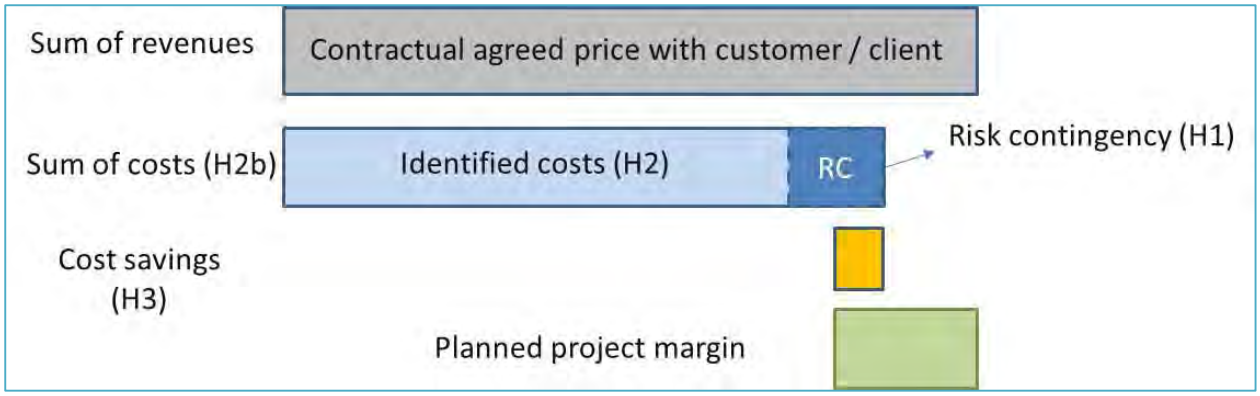

Figure 1: Construction contracts economics: Revenues, project costs, savings, and gross margin

3.2 RISK CONTINGENCY IN PROJECT ACCOUNTING

As the construction contract method requires reliable cost estimation as a mandatory condition for its application on project accounting, project managers are needed to consequently determine risks related to the project and its execution through a methodical risk analysis process accepted within the company from the seller perspective, which will be financially calculated with the purpose of accounting those risks at project costs (Karlsen & Lereim, 2005).

The risk perspective depends on the relationship between the seller and buyer. The buyer may decide to transfer all contractual risks to its seller. In that case, the risk perspective changes, and the project manager from such a contract must always be able to evaluate risks from the respective perspective (Smith, Bohn 1999).

The risk analyses on such projects are usually made through specialist workshops within the project team and internal stakeholders with project involvement. Those analyses will cover all risks according to benchmark projects as well as project-specific "taboos" (Schoemaker & Tetlock, 2012), stress testing all failure possibilities within the project qualitatively, no matter the risk probability (Cioffi et al.; H., 2009). The result of such workshops is then mathematically transformed into cost estimation that will be later part of the project cost basis. The way such transformation should be done is subject to discussion within project management academics (Karlsen & Lereim, 2005; Noor & Tichacek, 2009). It can be estimated through statistical models such as the Montecarlo approach or more simple ways, such as assigning occurrence probabilities to each risk, which, in the end, will be summed up as the project contingency.

When deciding on the risk amount and its probabilities, project managers need to define a sufficient amount to cover the costs or time required to avoid the risk, transfer the risk to a later phase, and mitigate the risk via countermeasures, which will also imply mitigation costs, or bear the realization of risks (Noor & Tichacek, 2009).

Some studies suggest applying econometric models, such as the value at Risk method (VAR), for contingency calculation. Applying such a model to project management raised some criticisms, such as the need for a historical risk and returns database. This is problematic since projects are customarily executed differently, and final delivery has customized specifications per customer. Secondly, VaR assumes a normal distribution within the population, an assumption not widely accepted by researchers (Xie et al., 2011). Additionally, VaR is used by financial markets with unlimited information about companies, shares, expert analysis, and other parameters. According to the author, project managers may not find all the necessary information to model volatility and enough data to realize essential tests within a project or an organization comprised of many different projects. Furthermore, project managers will use risk analysis methods to understand the situation better and control it. In that sense, Value at risk has no room for interpretation, making the risk analysis process mechanic.

3.3 HYPOTHETICAL EARNINGS MANAGEMENT IN CONSTRUCTION CONTRACTS

For the earnings management study purpose, on the project cost side, project managers and the project team familiar with the project information and the project's future developments can estimate the total project costs. This situation favors information asymmetry among different organization levels and within corporate units, such as those responsible for signing high-level accounting statements required by Security Exchange Committees. This would be the end line for penalties when accounting frauds are identifiable or when future accounting deviations are discounted negatively by the financial market.

Projects necessarily have an end, which means that earnings management activities during the project cycle need to be resolved at least by the end of the project. This makes its detection empirically possible at the end of the project cycle.

History shows that companies with businesses as suppliers or executors of infrastructure projects suffer severe “one-time impacts” periodically on their financial performance (Schieg, 2008), mainly accounting for the lack of necessary management attention on their project management. The situation affects the ability of financial analysts representing shareholders to have a transparent view of the company and, therefore, discount the company’s future cash flows negatively in comparison with its peers (Fischer & Stocken, 2004).

Three new earnings management models applied to project accounting were developed based on adaptation from accepted earnings management models based on discretionary reported values, which will be described below.

3.4 STUDY HYPOTHESES

Research question “B” will be addressed based on current knowledge of earnings management theory and the mathematical models described previously.

Accounting manipulation of earnings management in projects takes various forms, including real manipulation, aggressive accounting assumptions, and overconsumption, which aim to relax upper management control and scrutiny.

“A fundamental element of any test for earnings management is a measure of management's discretion over earnings” (McNichols, 2000).

i. Discretionary risk contingency: Risks identified by the project management and project team that will not impact the project's final costs at all or as planned. Nevertheless, this contingency is a future source for managers to increase timely project margins and benefit from showing a project with better results (*cookie jar effect*).

ii. Discretionary project planned cost: Cost estimation at project completion is not expected to occur but is presented by the project manager as a terrible cost situation as

a starting point. The project manager uses the improvement potential to his benefit, which is no improvement but an artificial cost calculation to facilitate project execution and defocus upper management on scrutiny initiatives.

iii. Discretionary planned cost savings: Managers aggressively consider cost savings measures in projects with margin deterioration that are not proven to bring benefits at the end of the project. These aggressive planned cost savings are used, for example, to avoid projects reaching negative margins and, therefore, source for additional accruals. Ultimately, managers try to keep margins around 0% or very low and avoid further scrutiny.

Verifying the above-described phenomenon will evidence the occurrence of earnings management within projects, using already tested models previously applied on the corporate level.

The study hypothesis below represents the questions related to accounting earnings management in projects and will be tested on the available sample and represented by the research and models.

Hypothesis 1: Project managers use the risk contingency cost element to smooth earnings; therefore, a decrease in risk contingency positively correlates with a gross profit increase.

Project managers and the project team have a periodic obligation to perform specific risk analysis within each project and, based on the qualitative assessment, determine the financing/monetary impact of such risks. The sum of those verified risks has a reduction effect on the planned project costs. Considering that the study is based on projects under the percentage of completion revenue recognition methodology, the amount of risk contingency directly impacts revenue recognition and, more acutely, the project margin.

As a qualitative decision embedded in inside information that only the project manager and the project team can access, the author has seen that project managers abuse this information asymmetry to use the risk contingency as an earnings management instrument. When having an earlier revenue recognition and project margin is necessary to achieve upper management-given targets, the risk contingency is decreased accordingly, easing the target achievement but not generating any operational improvement for the company.

Hypothesis 2: Managers are conservative on project planning costs. Therefore, planned project costs are reduced over time until the project ends.

Following the same principle as hypothesis 1 but now applying to planned cost positions, the test aims to identify whether project managers are overly conservative when planning costs for a project and under which conditions they do so.

Hypothesis 2a: Project managers use discretionary risk contingency and discretionary planned costs to manage earnings until the project ends.

This hypothesis formulation aims to confirm that managers engage in earnings management; if discretionary risk contingencies and discretionary planned costs are identified, accounting mistakes and lousy planning are not probable. Therefore, the test of this hypothesis can bring precision to state that managers use over-conservative project accounting decisions for their benefit, affecting transparency and hindering upper management from the opportunity to set more ambitious targets within the organization.

Weak project management, inexperience, and workload may also influence accounting mistakes that seem to be earnings management but are only process failures. Therefore, it is necessary to test the variables twice in time, checking the sequence pattern on earnings management activity, giving them more reliability on the manipulation confirmation. Such a

process was also used when evaluating earnings management occurrence within listed companies (Ibrahim, 2009). In that specific case, discretionary accrual analysis was mixed with changes in inventories and reduction of discretionary costs, such as Research and development and Marketing and Selling expenses, to test when managers make use of different accounting processes to manage earnings, like releasing a provision (that can be related to many facts) and additionally inflating inventories to achieve a more negligible average cost of goods sold.

Studies testing the overly conservative use of accruals on the company level have proven that big baths happen when a new CEO assumes the mandate and pursues accrual of all possible future costs. Later, the market showed improvements using discretionary accruals.

Hypothesis 3: Project managers avoid planned costs that lead to a negative project margin (Revenues minus project costs); therefore, they manipulate the planned project costs to have a minimally acceptable project margin (around 0%).

Project managers avoid presenting their projects with margin levels that would bring more scrutiny, revisions, and audits. A negative margin, for example, is considered a bad sign in projects; therefore, upper management would require more information and increase its focus on such projects. Project managers can also fear loss of reputation or even loss of job due to the perception that the project has terrible results because of bad management. Last, aligned with earnings management studies, bad news substantially affects reputation more than good news because good news leaks. At the same time, managers hold bad news, hoping to find other possibilities to cover bad news losses (Schrand & Zechman, 2012).

Managers manage project margins in such situations by assuming aggressive planned cost savings, abusing the information asymmetry among the project team, upper management, and other controlling instances within the company.

Hypothesis 4: Year closings are management-important events; therefore, they moderate the relationship between time and delta real project costs—forecasted project costs.

All defined hypotheses will be tested among time series, which involves the analysis of all variables through time and sequence. Some time series elements, such as the year closing, are essential in this analysis. At that point, listed companies must present a wholly disclosed financial and accounting report, which is the utmost figure used for variable compensation and benchmark analysis within competitors. Therefore, the study proposes that year closings are moderator variables for discretionary variance among risk contingency, project planned costs, and planned cost savings.

In the earnings management literature, companies planning to make secondary equity offers have abnormal earnings periods before the share sales. This demonstrates that managers use discretionary accruals to present a better situation to the stakeholders (Teoh et al., 1998). This example highlights the importance of events and their effects on management's willingness to engage in earnings management (Dechow et al., 2000).

3.5 MODEL OF DISCRETIONARY RISK CONTINGENCY

The risk contingency represents all identified risks within a project and shall be discussed quarterly by the project team. After the Risks review meeting, a probability is assigned to each risk. After the probability definition, participants should determine possible risk reduction measures and their costs and the foreseen reduction of risk probability after those countermeasures. In the end, the calculated total risk amount times each risk probability after measures represent the overall project risk exposure, and this value is expected to be realized during the project duration, which means that risk contingency will increase total cost by the end of the project, and that is the reason why its reduce expected project margin and therefore

on a percentage of completion revenue recognition method, delays or accelerate revenue recognition according to risk realization.

This empirical model derived from the discretionary accrual earnings management detection will support this study in answering the "B" research question.

The reported risk contingency in a quarter (RCit) is the sum of the non-discretionary risk contingency (RCUM) in a project and the discretionary risk contingency (Driskcont). Equations 1 and 2 below give the mathematical model to be applied.

Equation 1: Reported quarterly risk contingency

$RC_{it} = RC^{UM} + Driskcont$

At the project end, RC^{UM} should represent a cost increase ($Cost^{RC}$) for the project, while Driskcont is the quarterly discretionary risk contingency used to manipulate margin increase along the project.

The discretionary risk contingency identification follows the below equation:

Equation 2: Quarterly Discretionary risk contingency

$Driskcont = \Delta PlanCost^{UM} - \Delta RC_{it}$ where:

$\Delta PlanCost^{UM}$: a variation on contract costs in a projected quarter

ΔRC_{it}: a variation on risk contingency in a projected quarter

One possible criticism of the model is that project managers may use the discretionary risk contingency to cover unexpected risks on other project cost accounts not identified by the risk reviews and the non-discretionary risk contingency. Nevertheless, considering that project managers have complete information about the project and that the project team is part of the risk contingency decision and additionally, the responsible middle managers periodically review such projects, the model assumes that the non-discretionary risk contingency captures

all possible cost increase threatens as well as the underlying probability. Therefore, the non-realized risk contingency is the risk contingency portion that management uses to manage earnings on its benefit.

3.6 MODEL OF DISCRETIONARY PROJECT COSTS

Project costs are all costs necessary to fulfill a contract specification signed between the company and its customer.

Project costs shall be revised periodically, with different revision periods following project risks and size, with a quarterly stretched revision period. The same guideline requires that project managers assigned to a project have proven capability and experience managing such projects. Every project has an assigned team, including a controlling expert responsible for financial transparency on revenue and cost planning.

Therefore, the project manager and team have the means and knowledge to access all costs for the project's full implementation. A non-discretionary cost increase is accompanied by a decrease in risk contingency, meaning that a planned risk occurred or a cost-saving opportunity occurred, which would reduce total cost, which is also documented.

As a result, it is expected that reported contract planned costs ($PlanCost_{it}$) are the sum of non-discretionary project planned costs ($PlanCost^{UM}$) and discretionary project planned costs (Dprojcost):

Equation 3: Contract planned costs

$$PlanCost_{it} = PlanCost^{UM} + Dprojcost$$

The discretionary contract costs are the difference from changes in contract costs impacting the gross profit in the quarter, not explained by the risk materialization (non-discretionary risk contingency). The model can be represented as follows:

Equation 4: Discretionary contract planned costs

$$Dprojcost = \Delta PlanCost_{it} - \Delta PlanCost^{UM} - \Delta RC_{it}$$

3.7 MODEL OF DISCRETIONARY PROJECT PLANNED COST SAVINGS

Project costs can be influenced by cost savings measures to improve the margin at the end of the project. It is an essential lever in project management, but those savings can only be considered when project managers are 100% certain that such cost-saving measures will be achieved. As an exemplification of a cost-saving measure, if a project manager can renegotiate a service price with its service supplier, the benefits from such a cost reduction can only be considered a cost-saving after a final agreement between parts is signed. Otherwise, it cannot be regarded as a cost reduction.

Reported planned cost savings (Sav_{it}) is the sum of non-discretionary planned cost savings (Sav^{UM}) and discretionary planned cost savings (Dprojsavings):

Equation 5: Planned cost savings

$$Sav_{it} = Sav^{UM} + Dprojsavings$$

Representing the variables at the end of the project, the adjusted project cost, which is the planned project cost less the planned cost savings, will be equal to the project's actual cost. Therefore, this relation can be represented as:

Equation 6: Discretionary cost savings

$$Adj.Plancost_{it} = Plancost^{UM} - Sav_{it}$$

$$Project\ Costs_{it} = Proj\ costs^{UM} - (Sav^{UM}) + (Dprojsavings)$$

The discretionary cost savings are the residual value from this model (Dprojsavings) on the quarter.

Managers may be incentivized to use discretionary planned cost savings to avoid showing negative results on the project margin line, smoothing the planned margin close to zero, and being extremely aggressive with possible savings along the project.

As in earnings management on the company level, managers are aggressive in accounting when the company is in a demanding operational situation, seeking to avoid presenting negative earnings and instead showing little profit or zero. On the other hand, managers wait for the problem to improve, confident that the aggressive accounting will be compensated for later by other savings measures.

This proxy can also be applied on the project management level, as described here. The project managers may have the same motivation as managers not to present negative margins to avoid being the focus of upper management scrutiny and internal and external audits.

3.8 CONSIDERATIONS OF THE SUGGESTED MODELS

The author has access to the creation and reversion from the discretionary variables described above for the sample of projects to be used; the decision is clear about using as a proxy the models described by Dechow et al. (2012) that suggest the use of reversals. However, some additional remarks indicate a more robust model since the author can access internal information. Those remarks are:

- When incorporated into the tests, prior information about the timing of reversals from earnings management improves the specification. In this study, it is not necessary to assume that the discretionary variables will reverse in the subsequent year/period since the project duration and contribution each year until project completion are clear.

- Researchers improve their model accuracy when choosing nondiscretionary accruals to model that makes economic sense to the business characteristics. Once more, this study

aims to identify all discretionary variables that affect estimated project costs and, therefore, margin because the hypothesized earnings management occurs on expected project cost, accumulating or anticipating revenues through the manipulation of the percentage of completion from the project (if planned costs are higher than the actual costs, revenue will be delayed / if planned costs are lower than actual costs, revenue will be anticipated).

An additional benefit from the model is a direct benchmark, which is the actual cost at completion for project cases when a project is already finished. The discretionary value effect can then be compared to the benchmark, increasing its accuracy and possibly finding other vital variables to the discretionary error.

On the other hand, there is little room for discretionary revenue since the contract price is fixed and revenue is a function of cost (according to the performance obligation accounting method); the application of the discretionary model is simple without the already discussed problems when discretionary revenue can also influence the model and, therefore, transform discretionary accruals into non-discretionary accruals "alike."

4. EMPIRICAL METHODOLOGY

4.1 DATA AND SAMPLE DESCRIPTION

The database consists of 8 consecutive quarter closings of secondary data from a European-listed multinational company.

It holds data from 543 construction contract projects distributed into 2514 quarterly project entries.

Table 1 describes relevant information regarding the database and aspects to be evaluated.

Projects are defined as construction contracts under IAS 11 and fall into the IFRS 15 category: "Customer controls the asset as it is created or enhanced."

Table 1: Database basic information

Type of data	# per entry line	General comment
A – Descriptive	3	Project information
B - Primary quantitative	11	Primary project financial information
C - Calculated quantitative	24	Author secondary calculation based on B.
D - Dependent variable	3	Author empirical derivation of discretionary results
E - Normalized total revenue	14	Selected primary and secondary data divided by lifetime project revenue
F - Normalized quarter revenue	7	Selected primary and secondary data divided by project quarter revenue

4.2 DESCRIPTIVE ANALYSIS

Table 2 presents explanatory descriptions of each variable included in the database and primary or secondary data.

Table 2: Variables explanation and Descriptive statistics

Exhibit A: Secondary project data

Project KPI	KPI description	Mean	Std dev	Lower quartile	Median	Upper quartile	0.01	0.99	Skewness	Kurtosis
project_end_planned_revenue	Total revenue at project end	84,972.47	307,004.81	6,480.59	17,073.16	47,716.83	1,422.15	1,265,530.38	10.8	148.0
project_end_planned_costs	Total planned costs at project end	75,001.20	275,583.79	4,828.29	13,620.37	39,631.84	952.10	1,148,472.20	10.8	146.9
project_end_planned_gross_profit	Total gross profit at project end	9,975.24	40,926.21	953.23	2,624.75	6,872.50	-31,132.97	183,204.54	5.9	68.5
project_effective_revenue	Effective revenue to date	36,481.63	102,965.09	2,509.53	6,833.65	21,666.69	31.46	560,129.83	6.4	55.1
project_effective_costs	Effective cost to date	32,637.71	94,821.30	1,896.26	5,570.97	18,853.48	30.77	499,381.27	6.4	53.7
project_effective_gross_profit	Effective gross profit to date	3,743.83	22,937.78	225.37	1,004.00	3,343.21	-34,350.29	83,182.24	0.3	60.7
project_risk_contingency	Risk contingency at date	5,107.79	25,994.59	181.10	558.05	1,852.89	0.18	95,661.39	13.0	199.8
project_end_planned_costs_bop	Total planned cost beginning of period	74,164.34	271,015.87	4,755.05	13,489.50	39,324.58	951.51	1,147,338.36	10.6	144.5
project_effective_quarter_revenue	Quarter revenue	3,041.23	9,338.93	158.44	594.09	1,923.94	-445.39	42,998.29	6.8	61.5
project_effective_quarter_gross_profit	Quarter gross profit	404.16	2,105.00	12.54	115.34	380.08	-2,821.74	8,107.39	0.6	129.6
project_cost_completion	Cost completion	0.54	0.33	0.21	0.55	0.86	0.01	1.00	-0.1	-1.4
project_cost_completion_bop	Cost completion beginning of quarter	0.48	0.34	0.13	0.47	0.82	-	1.00	0.1	-1.5
project_rc_bop	Risk contingency beginning of quarter	5,158.66	25,697.34	194.28	583.50	1,908.79	0.48	99,750.94	12.8	193.9
Project Cost to complete	Cost to complete (planned cost at end minus current costs)	42,363.50	234,045.27	1,265.80	4,220.71	14,707.76	4.05	556,108.17	13.6	211.2
project_cost_to_complete_bop	Cost to complete beginning of period	44,163.70	232,238.33	1,567.21	5,067.16	16,513.51	24.95	627,690.83	13.3	205.1
project_plan_cost_q_variation	Plan cost quarter variation	836.86	17,657.20	-0.77	0.22	135.97	-6,519.31	19,963.29	29.7	1,241.4
project_end_gross_profit_q_variation	Plan gross profit quarter variation	166.63	4,969.08	-0.80	0.28	76.48	-6,193.77	7,177.34	14.1	416.0
project_rc_quarter_variation	Risk contingency quarter variation	-121.98	2,726.10	-38.00	-	-	-4,960.84	3,056.01	-2.8	292.1
discretionary_project_rc	Discretionary project risk contingency	77.63	1,029.80	-	-	-	-	1,318.00	36.6	1,563.2
discretionary_project_plan_cost	Discretionary project plan cost	364.75	4,878.62	-	-	0.16	-	4,912.21	31.9	1,244.9
project_savings_reversals	Project savings reversals	313.43	2,417.16	-	-	0.80	-	6,193.77	15.2	266.3

Exhibit B: Project KPIs divided by project revenue

Project KPI	KPI description	Mean	Std dev	Lower quartile	Median	Upper quartile	0.01	0.99	Skewness	Kurtosis
project_margin_percentil	Percentil project margin quality	17.18%	19.30%	10.93%	17.95%	27.80%	-51.02%	51.77%	-1.67	6.23
project_margin_percentil_bop	Percential project margin quality beginning of period	17.34%	18.43%	11.18%	17.75%	27.50%	-50.96%	51.60%	-1.52	5.35
%_project_effec-gp_su-gp	% of project effective gross profit from total effective gross profit superior unit	16.41%	177.68%	0.35%	1.51%	5.68%	0.01%	134.86%	26.76	827.62
%_project_effec-rev_su-rev	% of project effective revenue from total effective revenue superior unit	8121.56%	407153.05%	0.05%	0.20%	0.76%	0.00%	14.32%	50.14	2514.00
Project_su_margin_difference_in_%	% margin difference from project to superior unit	2.91%	18.95%	-4.96%	2.93%	14.72%	-65.80%	42.15%	-1.18	4.13
%_rc-bop_ctc_bop	Risk contigency bop divided by cost to complete bop	41.04%	589.75%	6.26%	11.05%	23.28%	0.24%	132.95%	32.79	1161.56
% planned costs	divided by project planned revenue	82.82%	19.30%	72.20%	82.05%	89.07%	48.23%	151.02%	1.67	6.23
% effective revenue	divided by project planned revenue	53.32%	33.40%	20.81%	55.30%	85.73%	0.37%	100.00%	-0.13	-1.43
% effective cost	divided by project planned revenue	45.23%	32.08%	16.78%	42.31%	69.19%	0.43%	132.07%	0.61	0.16
% effective gross margin	divided by project planned revenue	8.10%	15.78%	1.65%	7.50%	15.49%	-48.75%	44.92%	-1.35	7.09
% Risk contingency	divided by project planned revenue	4.72%	4.52%	1.87%	3.77%	6.18%	0.00%	20.48%	3.42	26.25
% planned revenue bop	divided by project planned revenue	81.86%	21.32%	71.40%	81.50%	88.17%	39.75%	150.96%	3.13	33.86
% quarter revenue	divided by project planned revenue	6.36%	9.89%	1.13%	3.52%	8.02%	-3.39%	44.32%	3.04	26.31
% quarter gross profit	divided by project planned revenue	4393.23%	217918.40%	9.74%	19.93%	35.29%	-660.59%	494.90%	50.13	2513.14
% risk contingency bop	divided by project planned revenue	4.92%	4.62%	2.00%	3.97%	6.40%	0.00%	20.86%	3.47	24.67
% Cost to complete	divided by project planned revenue	37.60%	27.92%	11.26%	35.31%	61.67%	0.04%	94.91%	0.34	-0.99
% Cost to complete bop	divided by project planned revenue	41.76%	29.63%	14.56%	41.07%	66.04%	0.19%	98.23%	0.88	5.79
% planned cost quarter variation	divided by project planned revenue	-4308.71%	216392.89%	-0.53%	0.02%	12.00%	-851.16%	1459.31%	-50.12	2512.39
% planned gross profit quarter variation	divided by project planned revenue	4297.65%	216372.31%	-0.18%	0.09%	10.72%	-867.31%	682.76%	50.13	2513.16
% Risk contingency quarter variation	divided by project planned revenue	3.30%	663.33%	-2.63%	0.00%	0.00%	-184.39%	204.60%	13.15	695.22
DiscRiskCont	divided by project planned revenue	0.17%	1.70%	0.00%	0.00%	0.00%	0.00%	3.26%	22.36	576.45
DiscProjCost	divided by project planned revenue	0.58%	6.31%	0.00%	0.00%	0.00%	0.00%	9.83%	27.00	836.36
DiscProjSavings	divided by project planned revenue	0.65%	3.38%	0.00%	0.00%	0.01%	0.00%	13.40%	10.72	146.12

4.3 DATA ANALYSIS STEPS

First, discretionary risk contingency, project costs, and project savings were calculated for each dataset according to the previously described models.

Second, values were classified into positive and zero discretionary values: positive misstatements and zero non-misstatements.

Third, positive values were distributed in a logarithmic scale to “add” to negative values as those close to zero (below -6 on the log scale)

Fourth, all quantitative variables were normalized by dividing them by the variable project revenue.

Fifth, a multiple regression was performed to identify variables explaining the three types of discretionary accounting.

Sixth, a logistic regression was developed conjointly with the F-Score methodology (Dechow, 2012) to identify future risk cases.

Seventh, based on the F-Score, the accuracy of the F-Score model was tested to identify misstatement.

5. ANALYSIS AND DISCUSSION OF THE RESULTS

5.1. ANSWERS TO RESEARCH QUESTIONS AND HYPOTHESES

The analysis results show that 80% of project data entries have changes in risk contingency, project costs, or project savings that influenced the project's gross profit positively or negatively. This confirms the discretionary aspect of these three project variables and the presence of judgment on those figures.

Research question A is answered, which should concern each company engaged in complex project business linked to construction contracts methodology.

This work introduced earnings management mechanisms: discretionary risk contingency, discretionary project costs, and discretionary project savings. Table 3 presents the number of discretionary values per variable, considering the size of the projects (Exhibit A), Quarters (Exhibit B), and superior units (Exhibit C). The data identified all three discretionary factors.

Research question B is partially answered considering the occurrence of these three types of discretionary cost planning and, therefore, earnings management. “Partially” because further research could find other misstatements related to project accounting.

Table 3 – Distribution of response variables

Exhibit A

Project Size	Project entries	Driskcont	Dprojcost	Dprojsavings
Revenue (thousand EUR)	# Total quarters statements	# Miss.	# Miss.	# Miss.
2500	69	4	18	30
3000	65	8	22	27
4000	196	15	53	64
6000	270	27	89	87
10000	294	34	76	107
14000	217	28	60	79
20000	246	38	62	80
30000	340	60	115	134
60000	279	52	70	109
160000	269	65	79	83
> 160000	269	59	81	111
Total	**2514**	**390**	**725**	**911**

Exhibit B

		Driskcont			Dprojcost			Dprojsavings		
Superior unit	# Total quarters statements	# Miss.	Average Miss.	Std. Dev. Miss.	# Miss.	Average Miss.	Std. Dev. Miss.	# Miss.	Average Miss.	Std. Dev. Miss.
A	595	59	0.010	0.016	165	0.008	0.022	238	0.025	0.063
B	97	21	0.005	0.009	26	0.012	0.026	36	0.013	0.031
C	174	63	0.004	0.007	69	0.007	0.019	64	0.006	0.012
D	51	16	0.003	0.006	13	0.027	0.036	19	0.008	0.011
E	102	18	0.020	0.040	29	0.041	0.128	40	0.017	0.043
F	167	31	0.018	0.086	55	0.040	0.253	63	0.017	0.081
G	127	13	0.017	0.029	39	0.009	0.018	23	0.001	0.002
H	462	68	0.013	0.045	136	0.011	0.023	170	0.015	0.047
I	120	36	0.028	0.084	36	0.088	0.365	47	0.026	0.077
J	9	3	0.011	0.005	3	0.010	0.006	4	0.143	0.248
L	63	3	0.009	0.009	22	0.026	0.063	26	0.012	0.034
M	280	30	0.005	0.007	68	0.024	0.071	88	0.015	0.033
N	61	9	0.001	0.002	14	0.007	0.020	12	0.004	0.010
O	45	4	0.005	0.005	12	0.021	0.048	12	0.030	0.071
P	48	5	0.002	0.003	14	0.056	0.136	25	0.006	0.012
Q	87	9	0.008	0.012	17	0.014	0.033	35	0.031	0.054
R	19	1	0.002	-	7	0.016	0.028	4	0.009	0.010
S	7	1	0.012	-	0	-	-	5	0.004	0.005

Exhibit C

		Driskcont			Dprojcost			Dprojsavings		
Quarter	# Total quarters statements	# Miss.	Average Miss.	Std. Dev. Miss.	# Miss.	Average Miss.	Std. Dev. Miss.	# Miss.	Average Miss.	Std. Dev. Miss.
2013009	272	39	0.004	0.006	74	0.012	0.031	105	0.012	0.031
2013012	309	45	0.007	0.014	96	0.010	0.027	126	0.030	0.079
2014003	331	48	0.008	0.018	100	0.012	0.042	112	0.014	0.058
2014006	360	64	0.014	0.061	117	0.030	0.199	121	0.017	0.054
2014009	387	51	0.014	0.050	104	0.008	0.020	128	0.014	0.047
2014012	422	75	0.019	0.062	118	0.044	0.196	156	0.024	0.064
2015003	433	68	0.005	0.009	116	0.016	0.048	163	0.012	0.029

The correlation between risk contingency decrease and increase in gross profit (table 4) is 0.37 and weak. This points out that using risk contingency to smooth earnings will happen in specific misstatement cases, which will be presented further in this research. It is not possible to validate Hypothesis 1 only via the correlation.

The correlation between project cost decreases and increases in gross profit is 0.533 (table 4), which is stronger than the risk contingency decreases but still not strong.

This work pursued the misstatements identification model on risk contingency and planned cost further since this is essential to improving controls in project accounting.

Table 4: Correlation matrix with Project end gross profit quarter variation

Correlation matrix	project_end_gross_profit_q_variation
project_plan_cost_q_variation	0.53
project_rc_quarter_variation	0.38

The correlation between the project margin percentile and gross profit adjustment in a period is non-existent. However, only 15% of margin correction occurred from 0% or harmful margin projects during the database time series. Most margin corrections came from projects with margins ranging from 10% to 21% (40%). This implies that project managers refrain from correcting margins from projects with zero, under zero, or close to zero. The result refers to hypothesis 3.

Average misstatement and standard variation from response variables were abnormally higher in year-end quarters (finishing with 12) than the others, especially on Dprojsavings. Adding more quarters to the database would better confirm this, so Hypothesis 4 is partially addressed.

Research question C is addressed via a quantitative model, which is described as follows:

5.2. DISCRETIONARY ACCOUNTING MISSTATEMENTS PREDICTION MODEL

After identifying discretionary values within the three-response variable, it was possible to classify data within "misstatement" and "non-misstatement" cases, being the first project entries when discretionary values were found. Consequently, non-misstatements were all cases with zero value.

One step was taken to identify cases where values were close to zero, which will be described as follows.

5.2.1. Classification of values as "zero and close to zero" or "non-zero."

An exploratory analysis was carried out to understand the distribution of data for variables DRiskcont, DprojCost, and DprojSavings. This understanding aims to classify the values of variables into "zero and close to zero" from "non-zero" by identifying populations of different values in the data set based on the observed frequencies and measurements.

Table 4 shows the descriptive measures of the three variables. Attention is drawn to zero values that comprise 84.25% of variable Driskcont, 69.15% of variable Dprojcost, and 60.91% of Dprojsavings; these percentiles have values greater than zero. It is also observed that all skewness values were highly positive, indicating a solid positive asymmetry in the three variables. This corroborates the Shapiro-Wilk p-value, which demonstrates the absence of normality.

Table 5 - Descriptive measures of variables Driskcont, Dprojcost, and Dprojsavings

Measures	**Variables**		
	Driskcont	**Dprojcost**	**Dprojsavings**
Average	77.63	364.75	313.43
Standard deviation	1029.60	4877.65	2416.67
Percentile of first value ≠ zero	84.2%	69.1%	60.9%
50th percentile	0.00	0.00	0.00
75th percentile	0.00	0.16	0.80
Minimum	0.00	0.00	0.00
Maximum	45,773.19	204,240.12	48,818.06
Skewness	37	32	15
p Shapiro Wilk	< 0,001	< 0,001	< 0,001

To facilitate data visualization and distribution, the following data processing was applied only for graphical visualization:

- The variables were transformed into a logarithmic scale;
- Extreme values were filtered, considering only values below the 99th percentile;
- A kernel density graph was chosen as it better presents the differences in densities of the data distribution.

Figure 2 shows the density levels found in the distribution of values. The first ascending curve represents a population with a zero distribution and close to zero values until they reach the lowest limit at point -6 on the graph scale in the log. From point -6, it is possible to observe a growth in data that deviates from the distribution of the previous population of zero and close to zero values, thus being considered a different population.

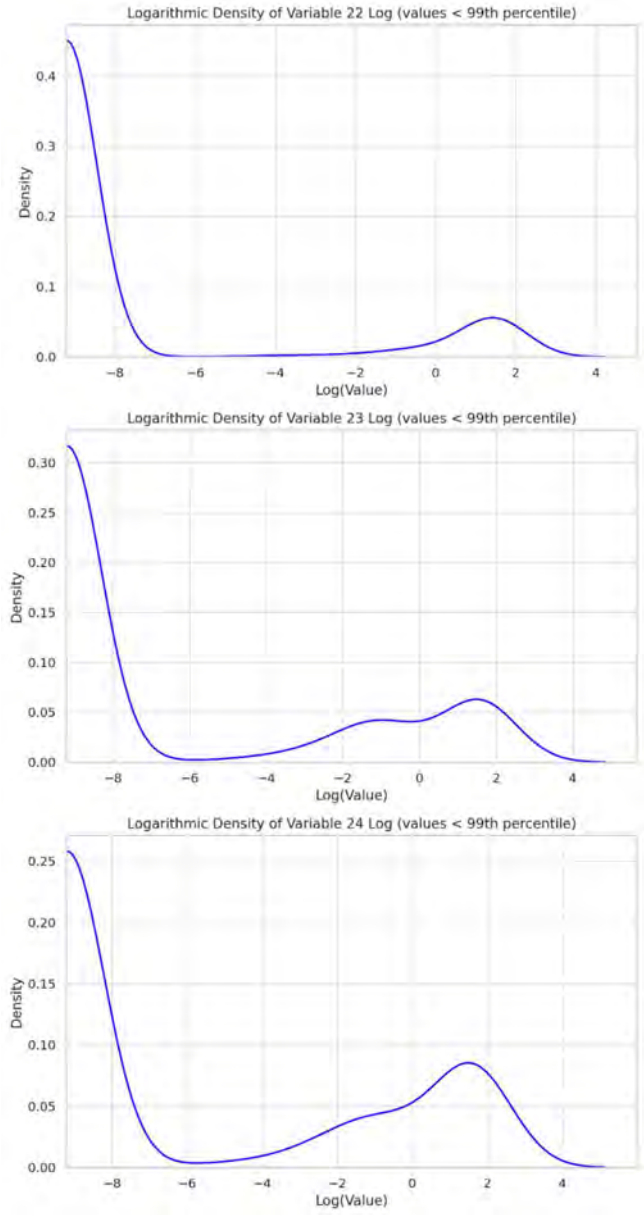

Figure 2 - Kernel density graph showing the distribution of values of variables Driskcont, Dprojcost, and Dprojsavings on a log scale (filter for values above the 99th percentile)

Understanding the population distribution of data frequencies, establishing the lower part of the density curve at point -6 of the log scale as a cutoff point, we thus obtained the values 0.00087 (percentile 84.45) of variable Driskcont, 0.00272 (71.17 percentile) of variable Dprojcost, and 0.00241 (63.74 percentile) of variable Dprojsavings (Table 2). Values equal to and below these numbers were considered "zero and close to zero," and values above were considered "non-zero."

Table 6 - Cutoff point values and their percentile position for variables 22 Driskcont, 23 Dprojcost, and 24 Dprojsavings

Variables	cutoff point	Percentile
Discr. risk contingency	0,00087	84,45
Discretionary project costs	0,00272	71,17
Discretionary project savings	0,00241	63,74

To facilitate visualization of the distribution of the "non-zero" population, starting from point -6 on the log scale, new graphs were plotted with a filter for all values equal to zero on the natural scale (Figure 3). The charts show a decrease in the frequency of values close to zero and, after point -6, an increase in the frequency of values other than zero. The end of values related to the first group, "zero and close to zero," and the beginning of values associated with the second group, "non-zero," are evident (Figure 3).

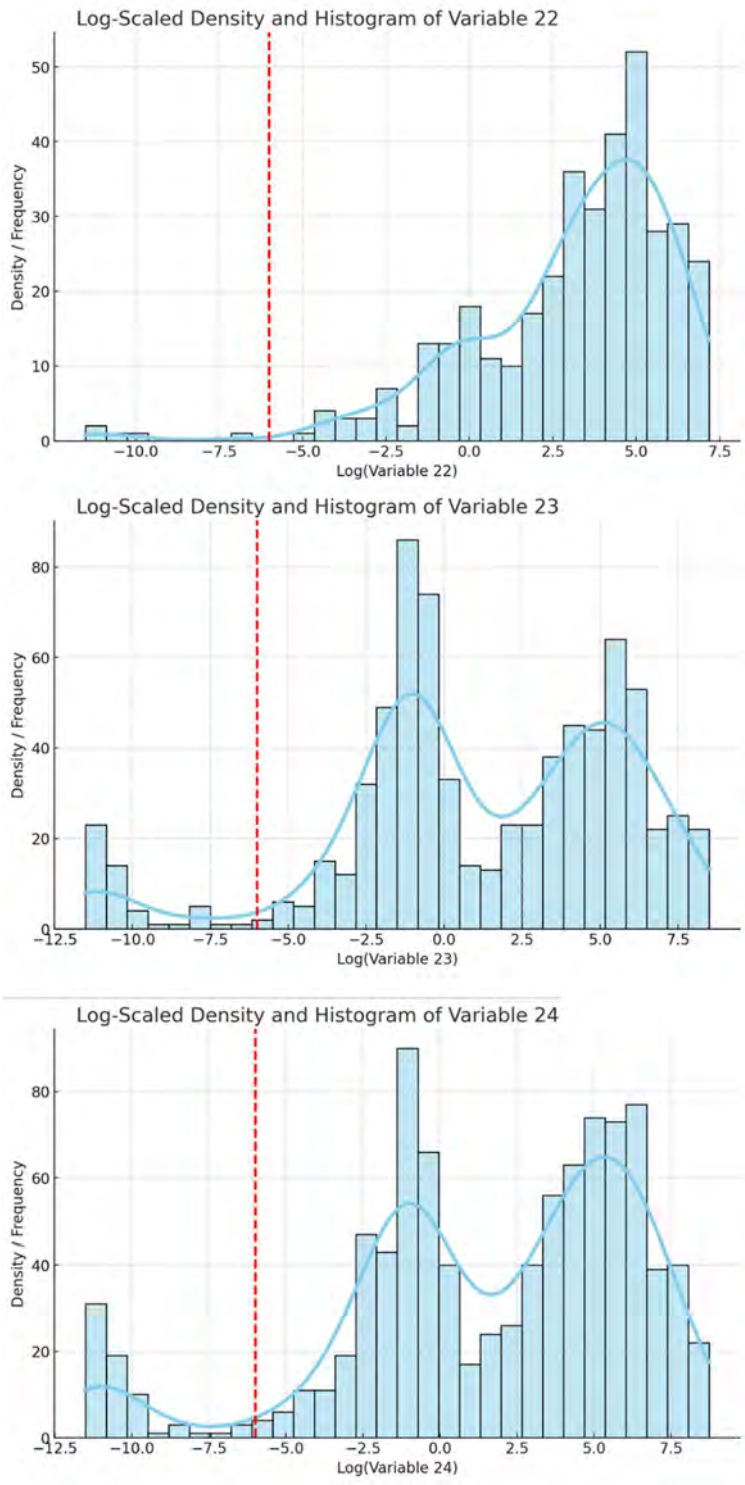

Figure 3 - A histogram with data density on a logarithmic scale for variables 22 Driskcont, 23 Dprojcost, and 24 Dprojsavings, with the absence of data equal to zero and extremes (percentile range) presented on the vertical line as a cutoff point for populations with data close to zero and non-zero.

5.2.2. Multiple regression

Table 6 shows the results of multiple linear regression models labeled (1), (2), and (3) for the independent variables DRiskcont, DprojCost, and DprojSavings, respectively. Each cell shows the estimated coefficient for an independent variable, the standard errors in parenthesis, and the code with the significance. Variables percentage of completion, Percention of completion-bop, %project margin, %project margin bop, %effective revenue, % effective margin, % Risk contingency, %Risk contingency bop, % Cost to complete bop, % plan cost variation, %plan gross profit variation (quarter), and % RC variation (quarter) were significant in all models. Also, the % RC from cost-to-complete bop was significant in Model (2), and the % Project planned cost bop was substantial in both Model (2) and (3). The constant was significant in all models. Adjusted R^2 values range from 0.663 on Model (3) to 0.702 on Model (2), indicating an excellent fit quality for all models. The F-test confirms the overall significance of the models.

Table 7: Multiple linear regression results for dependent variables DRiskcont, DprojCost, and DprojSavings

	Dependent variable:		
	` DRiskcont`	**` DprojCost`**	**` DprojSavings`**
	(1)	**(2)**	**(3)**
`Cost completion`	-0.062***	-0.306***	-0.129***
	(0.010)	(0.034)	(0.019)
`Cost completion-bop`	0.064***	0.324***	0.137***
	(0.007)	(0.024)	(0.013)
`% Project margin`	0.057***	0.316***	-0.591***
	(0.007)	(0.026)	(0.015)
`% Project margin bop.`	0.035***	0.217***	0.613***
	(0.007)	(0.025)	(0.014)
`% gross profit to superior unit`	-0.00002	-0.0002	0.0001
	(0.0001)	(0.0004)	(0.0002)
`% revenue participation superior unit`	0.00000	-0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
`% diff. superior unit`	-0.002	-0.008	0.006
	(0.003)	(0.012)	(0.007)
`% RC from cost-to-complete bop`	0.00001	0.0002*	0.00003
	(0.00003)	(0.0001)	(0.0001)
`% project end planned cost`			

`% Effective revenue`	0.083***	0.382***	0.178***
	(0.011)	(0.038)	(0.022)
`% Effective gross profit`	-0.087***	-0.403***	-0.170***
	(0.009)	(0.032)	(0.018)
`% Risk contingency`	-0.314***	-0.318***	-0.047**
	(0.011)	(0.039)	(0.022)
`% planned cost bop`	-0.002	0.106***	-0.151***
	(0.008)	(0.027)	(0.015)
`% Risk contingency bop`	0.359***	0.386***	0.094***
	(0.011)	(0.038)	(0.022)
`% Cost to complete`			
`% Cost to complete bop`	0.085***	0.414***	0.189***
	(0.008)	(0.029)	(0.017)
`% plan cost variation`	-0.00002***	-0.0002***	0.00003*
	(0.00001)	(0.00003)	(0.00001)
`% gross profit variation`	-0.00002***	-0.0002***	0.00003*
	(0.00001)	(0.00003)	(0.00001)
`% Risk contingency variation`	0.0004***	0.0004***	0.0003***
	(0.00003)	(0.0001)	(0.0001)
Constant	-0.085***	-0.511***	-0.033***
	(0.003)	(0.010)	(0.006)
Observations	2,514	2,514	2,514
R^2	0.669	0.704	0.666
Adjusted R^2	0.667	0.702	0.663
Residual Std. Error (df = 2496)	0.010	0.034	0.020
F Statistic (df = 17; 2496)	296.726***	349.808***	292.462***
Note:			*p**p***p<0.01

The earlier phases of projects increase the likelihood of earnings management since project financials still have a long run through the project lifecycle. A higher completion rate limits the flexibility to manage earnings, which is valid for the three models.

Higher-risk contingencies at the beginning of the period increase the likelihood of discretionary values. It carries discretionary values for misstatements.

Changes in planned costs in a quarter and risk contingency are both loaded in the model.

The amount of risk contingency a project has as a percentage of cost-to-complete was significant in modeling the Dprojcost, and the percentage of the Project's planned cost at the beginning of the period was important in both the Dprojcost and Dprojsavings models.

5.2.3. Logistic regression

A binary logistic regression analysis was performed to investigate and model the relationship between dependent variables DRiskcont, DprojCost, and DprojSavings and the independent variables in the data set. The dependent variable in the logistic regression analysis is dichotomous between projects that have indicated misstatement in their financials and those that have not and are equal to one for firm years involving a misstatement and zero otherwise.

The variable selection used the stepwise method, combining forward selection and backward elimination. In the former, the model starts without variables and adds new significant variables. The model starts with all available variables in the latter, and the least essential variables are gradually removed. The selection was made by minimizing the Akaike Information Criterion (AIC) (JAMES et al., 2021). The AIC is given as follows:

$$AIC = 2K + N\, ln(RSS / N)$$

RSS is the residual sum of squares, N is the sample size, and K is the number of parameters (HYNDMAN; ATHANASOPOULOS, 2018). A significance level $\alpha = 0.05$ was adopted for the statistical tests; therefore, for a p-value $\geq 5\%$, the null hypothesis should not be rejected.

The pseudo-R^2 was used as a summary measure for the logistic regression models. It compares the model's deviance to the deviance of a null model, where the deviance can be understood as a generalization of the residual sum of squares for models estimated by maximum likelihood. The pseudo-R^2 is computed as 1 – residual deviance / null deviance, where the null deviance is the deviance of the null model (without any predictor), and the residual deviance is the deviance

of the model of interest. From 0 to 1, lower pseudo-R^2 indicates lower differences between the null and the fitted model, while lower values have higher differences between the null and the fitted model (HOSMER JR et al., 2013).

The performance of the models was evaluated using metrics such as accuracy, sensitivity, specificity, positive predictive value, and negative predictive value. Accuracy is the ratio of correct predictions to the total number of cases; sensitivity is the ratio of true positives that are correctly identified; specificity is the ratio of true negatives that are correctly identified; positive predictive value is the ratio of true positives among all individuals classified as positive; and negative predictive value is the ratio of true negatives among all individuals classified as unfavorable. All metrics range from 0 to 1, with values closer to 1 indicating higher accuracy (JAMES et al., 2021).

The analysis was performed in R (R CORE TEAM, 2024). The stepwise regression was performed using the MASS package (VENABLE; RIPLEY, 2013). The logistic models were developed using the GLM (General linear model) function with a binomial family. For the F-score, the probability was assessed by predicting the type of "response" of the models, and the unconditional expectation was obtained as the average of the dichotomous independent variables.

Table 7 shows the results of logistic regression models labeled (1), (2), and (3) for the independent variables DRiskcont, DprojCost, and DprojSavings, respectively. Each cell shows the estimated coefficient for an independent variable, the standard errors in parenthesis, and the code with the significance.

Model (1) retained ten significant variables, including the Variable %project margin and %dif. Superior unit margin, % effective margin, %project end planned cost bop, % risk contingency bop, %plan cost variation (quarter), and project end gross profit variation (quarter) had a

positive relation (Coef. > 0) with the dependent variable Driskcont, and Variables %project margin bop, %Risk contingency, and % cost to complete bop showed a negative association (Coef. < 0).

Model (2) selected seven significant variables. The Variables %project margin, %project margin bop, %Risk contingency, and %project end project costs bop showed a positive association with the dependent variable Dprojcost, and the Variables %Effective revenue, %Risk contingency bop, and % cost to complete bop had a negative relation.

Model (3) retained nine significant variables, Variables %project margin bop, %dif. Margin to superior unit, %effective gross profit, % project end planned cost bop, %plan cost variation (quarter), and project end gross profit variation (quarter) showed a positive association with dependent Variable Dprojsavings, and Variables %project margin, %Effective revenue and % cost to complete bop had a negative relation.

All models' constant was statistically significant, indicating that other unrelated factors may influence the dependent variables.

Table 8 Logistic regression results for dependent variables DRiskcont, DprojCost, and DprojSavings

	Dependent variable:		
	`DRiskcont bin`	**`DProjcost bin`**	**`Dprojsavings bin`**
	(1)	**(2)**	**(3)**
`% Project margin`	37.989***	330.494***	-150.198***
	(4.063)	(22.544)	(10.906)
`% Project margin bop.`	-15.339***	39.806***	159.918***
	(4.115)	(14.690)	(11.757)
`% diff. superior unit`	4.778***		2.252***
	(1.161)		(0.860)
`% Effective gross profit`	2.413**		2.549**
	(1.047)		(1.210)
`% revenue participation superior unit`		-0.0001	
		(0.003)	

`% Effective revenue`		-1.624**	-2.255***
		(0.631)	(0.767)
`% Risk contingency`	-65.439***	260.433***	1.677
	(6.579)	(20.747)	(1.280)
`% planned cost bop`	28.554***	370.503***	14.871***
	(3.791)	(26.913)	(2.277)
`% Risk contingency bop`	67.404***	-262.573***	
	(6.387)	(20.752)	
`% Cost to complete bop`	-0.525*	-2.313***	-1.863**
	(0.309)	(0.759)	(0.727)
`% plan cost variation`	0.073*		0.007***
	(0.038)		(0.002)
`% gross profit variation`	0.068*		0.007***
	(0.038)		(0.002)
`% Risk contingency variation`		0.037	-0.040
		(0.031)	(0.053)
Constant	-29.834***	-369.252***	-12.966***
	(3.787)	(26.895)	(2.175)
Observations	2,514	2,514	2,514
Log Likelihood	-840.389	-909.471	-1,219.185
Akaike Inf. Crit.	1,702.778	1,838.942	2,462.370
Pseudo-R^2	0.225	0.398	0.259
Note:			*p**p***p<0.01

The F-Score (DECHOW et al., 2011) was used as a fraud risk assessment tool for evaluating the models. It indicates the probability of fraudulent financial reporting. The F-Score is calculated by dividing the likelihood by the unconditional expectation of misstatement, where the unconditional expectation is equal to the number of misstatement projects divided by the total number of projects, given as follows:

$$\text{Probability} = e^{\text{Predicted}} / (1 + e^{\text{Predicted}})$$

Unconditional expectation = # Misstatement projects / # Total of projects

F-Score = Probability / Unconditional expectation

If F-Score < 1, it indicates that there is no manipulation of the financial statements; if F-Score > 1, it is an indication of fraud in the project financial statements, and if F-Score = 1, then the project has the same probability of misstatement between the probabilities predicted by unconditional probability.

Figure 4 shows the cumulative distribution of F-Scores of the models (1), (2), and (3) for the cases of misstatement (left plot) and non-misstatement (right plot). For misstatement cases, the analysis indicates that for Model (1), 26.4% of misstating projects have F-Score < 1, and 73.6% have F-Score ≥ 1. In Model (2), 5.2% of misstating projects have F-Score < 1, and 94.8% have F-Score ≥ 1. Model (3) shows that 29.6% of misstating projects have an F-Score < 1, and 70.4% have an F-Score ≥ 1. For non-misstatement cases, the Model (1), 80.7% of non-misstating projects have F-Score < 1, and 19.3% have F-Score ≥ 1. In Model (2), 70.7% of non-misstating projects have an F-Score < 1, and 29.3% have an F-Score ≥ 1. For the Model (3), 82.9% of non-misstating projects have F-Score < 1, and 17.1% have F-Score ≥ 1.

Appendix B details how calculations for each of the F-Scores are made.

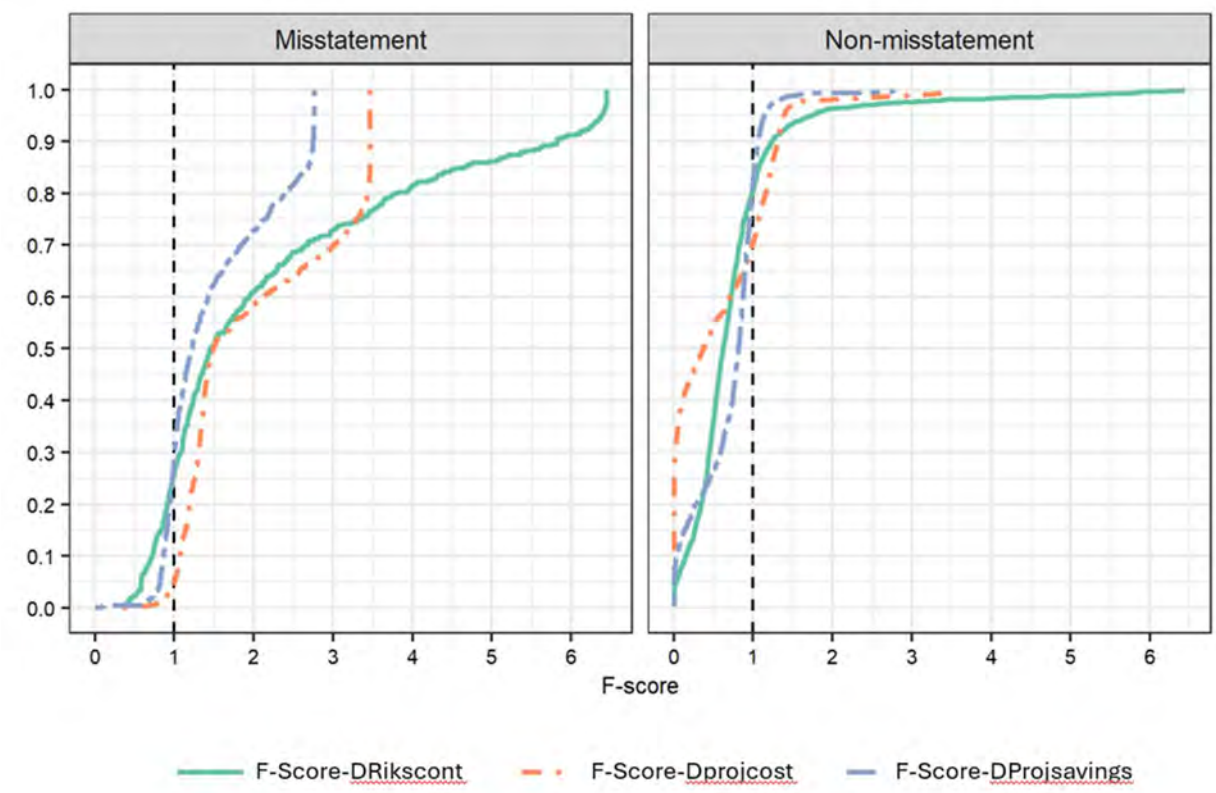

Figure 4: Cumulative Distribution of F-scores for models (1), (2), and (3) for misstatement and non-misstatement projects

Table 8 presents the performance evaluation for the three models, including accuracy, sensitivity, specificity, and predictive values metrics. Overall, Model (3) exhibits the best results in all metrics. Model (3) achieved an accuracy of 78.0% (95% CI: 76.3%-79.6%), suggesting a more reliable overall performance compared to Models (1) and (2), which have accuracies of 60.9% (95% CI: 59.0%–62.8%) and 54.2% (95% CI: 52.2%–56.1%), respectively. Model (3) also showed the highest sensitivity (98.4%) and positive predictive value (74.9%), indicating it is more effective at identifying true positives, i.e., the misstatement projects. On the other hand, Model (3) has a relatively moderate specificity (41.9%), which reflects a lower rate of correct pessimistic predictions, i.e., the non-misstatement projects, still higher than Model (1) and Model (2), which have lower specificity (4.1% and 7.0%, respectively).

Table 9: Performance metrics across different models

Measure (%)	DRiskcont	Dprojcost	Dprojsavings
Accuracy	60.9	54.2	78.0
95% CI	(59.0, 62.8)	(52.2, 56.1)	(76.3, 79.6)
Sensitivity	93.2	81.0	98.4
Specificity	4.1	7.0	41.9
Pos Pred Value	63.1	60.5	74.9
Neg Pred Value	25.3	17.3	93.9

The linear regression, logistic regression, and F-Score results answer research question C: "Can replicable data models be developed to test earnings management using construction contracts time series?"

The prediction model is successful and replicable by directly applying the formulas, coefficients, and constants to real project entries, classifying them through the F-Score, or adapting the logistic model to a company's construct contract portfolio.

Benefits are clear for Audit stakeholders:

1. Provide a theoretical framework for earnings management in construct contract accounting.
2. The projects responsible will explore statistical models in construction contract portfolios.
3. Digitize and accelerate the prediction of misstatements process.

This work closed research questions A, B, and C and covered all proposed hypotheses.

6. FINAL CONSIDERATIONS

Chapter 5 of this thesis delivers unparalleled results and innovates the current theory on internal earnings management, long-term construction contract business, and discretionary accounting prediction.

This study investigated the occurrence of earnings management in construction accounting projects from an internal perspective. It tested confirmed hypotheses, showing that internal earnings management is present in specific project management events.

The contributions of this thesis are threefold:

First, this is an innovative study because there are no previous studies that investigated earnings management in construction contract projects.

Second, the study proposes three additional models to detect earnings management, considering it to be “internal” earnings management affecting companies' reported financials at a later stage. Discretionary risk contingency, discretionary planned cost, and discretionary planned cost savings affect projects under construction contracts accounting methodology and can be used by project managers to steer project financial figures.

Earnings management is present in projects, and this work applied the F-Score model (Dechow et al., 2012) approach to identify misstatements adapted for project financials.

Third, this study represents an essential tool for internal and external audits, as it can quickly fix information asymmetry, focus on abnormal project financials, and increase scrutiny.

This study followed the objective of a Professional Doctorate, which is to provide solutions to applied relevant problems that are happening in the organizations and contributing to the professional field (Maxwell, 2019)

Future research should apply described models with statistical relevance to a project portfolio database. Because of this, additional information about patterns of earnings management and earnings quality, as well as the frequency of earnings management, will most likely rise. Models can also be adapted to be used in other areas of accounting inside the company, where

information asymmetry and agent conflict can be a problem (e.g., minority shareholding and hedge accounting).

Companies' reported financials will most likely be misrepresented if mechanisms are not in place to inhibit such accounting earnings management.

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8. APPENDIX A – AUTHENTICITY DECLARATION

I declare that I designed and wrote this doctoral thesis from 2020 until 2024 during the Programa de Pós-Graduação em Controladoria, Finanças e Tecnologias de Gestão (PPG-CFE).

The thesis is my own original work and has not been submitted previously, in whole or in part, for any degree or diploma at any other institution.

All information and content obtained from other sources have been appropriately referenced and acknowledged following academic standards.

I further affirm that I have abided by all the regulations and guidelines governing the preparation and submission of this thesis as required by Universidade Presbiteriana Mackenzie (UPM).

I understand that any form of academic dishonesty, including plagiarism, may result in penalties, including the revocation of the degree awarded.

20th September 2024

Signature: _____

Vinicius Pedro Toporcov

Doctorate Candidate

Universidade Presbiteriana Mackenzie

9. APPENDIX B – APPLIED PREDICTION MODEL

Model for discretionary risk contingency:

DRiskcont bin	Predicted value	Constant	% Project margin	% Project margin bop	% diff. superior unit	% Effective gross profit	% Risk contingency	% planned cost bop	% Risk contingency bop	% Cost to complete bop	% plan cost variation	% gross profit variation
Coeficient		-29.834	37.989	-15.339	4.778	2.413	-65.439	28.554	67.404	-0.525	0.073	0.068
Project entries			35.67%	35%	26%	32%	5%	65%	6%	89%	-16%	15.76%
(a) Predicted value	-1.187	-29.834	13.551	-5.415	1.219	0.782	-3.375	18.474	3.876	-0.465	-0.012	0.011

e	2.718
probability $(e^{(a)}/(1+e^{(a)})$	0.234
unconditional probability	0.150
Fscore (if< 1 ok; if >1 = misstatement)	**1.559**

Model for discretionary project costs:

Dprojcost	Predicted value	Constant	% Project margin	% Project margin bop	% Effective revenue	% Risk contingency	% planned cost bop	% Risk contingency bop	% Cost to complete bop	% Risk contingency variation
Coeficient		-369.252	330.494	39.806	-1.624	260.433	370.503	-262.573	-2.313	0.037
Project entries			15.6%	15.0%	85.5%	2.2%	85.0%	0.9%	11.2%	99.7%
(a) Predicted value	4.881	-369.252	51.686	5.982	-1.389	5.680	314.824	-2.429	-0.259	0.037

e	2.718
probability $(e^{(a)}/(1+e^{(a)})$	0.992
unconditional probability	0.290
Fscore (if< 1 ok; if >1 = misstatement)	**3.422**

Model for discretionary project savings:

Dprojsavings	Predicted value	Constant	% Project margin	% Project margin bop	% diff. superior unit	% Effective gross profit	% Effective revenue	% planned cost bop	% Cost to complete bop	% plan cost variation	% gross profit variation
Coeficient		-12.966	-150.198	159.918	2.252	2.549	-2.255	14.871	-1.863	0.007	0.007
Project entries			-4.8%	-1.7%	-7.5%	-4.8%	6.3%	101.7%	94.0%	1393.7%	-1393.7%
(a) Predicted value	4.503	-12.966	7.279	-2.750	-0.170	-0.124	-0.141	15.127	-1.751	0.098	-0.098

e	2.718
probability $(e^{(a)}/(1+e^{(a)})$	0.989
unconditional probability	0.360
Fscore (if< 1 ok; if >1 = misstatement)	**2.747**

Model users must fill in project entries marked in yellow, and the model will automatically define an F-score.

Audit teams or interested parties should deep-dive in cases with F-scores higher than one because the project most likely had a potential occurrence in discretionary accounting.

F-Scores below one most likely have no relevant misstatement.

10.APPENDIX C – PTT: IMPLEMENTATION MANUAL

Implementation manual

CCSA – Centro de Ciências Sociais e Aplicadas

Programa de Pós-Graduação em Controladoria e

Vinicius Pedro Toporcov

Como referenciar:
Toporcov, Vinicius Pedro (2024). Misstatment prediction model in construction contracts. Implementation manual. PPG da Universidade Presbiteriana Mackenzie. Volume e Edição.DOI

Linha de Pesquisa: Finanças, Contabilidade e Governança

Projeto de pesquisa: Earnings management detection

Produto Técnico-Tecnológico: Manual / Protocolo

Demanda Espontânea: higher transparency in project accounting

Organização:UPM

Descrição do PTT: Misstatement prediction model in construction contracts accounting

Divulgação da Produção: Congress, workshops and audit groups

Aderência Alta: Applicable in any company using construction contract accounting

Impacto Potencial Alto: Methodology can change the way auditors start their engagement towards project accounting auditing.

Impacto Realizado Alto: Model identify possible earnings management directly on real cases

Inovação Alta: no existing theory around construction contract accounting or earnings management in project management

Complexidade Alta: Development of own formulas and deep dive on linear and logistic regression

Aplicabilidade Alta: Tested through a database in an international company

Abrangência Potencial Alta: Applicable in most of multinationals company

Abrangência realizada Alta: Track-record of the models and the prediction in an existing and real databases.

Replicabilidade Escalável: Methodology can be transferred to other accounting fields of studies considering the prediction model

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Toporcov, Vinicius Pedro (2024). Misstatement prediction model in construction contracts. Implementation manual. PPG da Universidade Presbiteriana Mackenzie. Volume e Edição.DOI

Modelo de previsão de manipulação na contabilidade de contratos de construção

RESUMO

O modelo prevê a ocorrência de gerenciamento de resultados, mas na perspectiva interna da empresa, observando principalmente os contratos de construção gerenciados pelos gerentes de projetos.

O tema contratos de construção é uma prática contábil amplamente utilizada por empresas que prestam serviços de construção por meio de contratos complexos e de longo prazo a seus clientes. No método contábil em questão, as receitas e os custos são reconhecidos com base nos custos incorridos que possuem certo grau de discricionariedade, permitindo uma fonte de assimetria de informações que pode beneficiar o desempenho dos projetos e consequentemente os gestores dos projetos.

Consistente com as teorias relevantes de gerenciamento de resultados, os gerentes de projetos podem usar essa assimetria de informações a seu favor, como melhores incentivos, reconhecimento profissional e menor atenção aos seus projetos.

Este manual apresenta fórmulas sobre como calcular a contabilidade discricionária em contratos de construção e fornece um modelo matemático para prever manipulação nas finanças do projeto.

Palavras-chave:

Earnings management, discretionary accruals, construction contracts

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Misstatement prediction model in construction contract accounting

ABSTRACT

The model predicts earnings management, but from the company's internal perspective, particularly by observing construction contracts managed by project managers.

Construction contracts are an accounting practice widely used by companies providing construction services through complex and long-term contracts to their clients. In this method, revenues and costs are recognized based on the costs incurred, which have a degree of discretion. This allows a source of information asymmetry that can benefit project performance and, consequently, project managers.

Consistent with the relevant theories of earnings management, project managers can use this information asymmetry to their advantage, such as better incentives, professional recognition, and reduced attention to their projects.

This manual presents formulas for calculating discretionary accounting in construction contracts and provides a mathematical model for predicting misstatements in project financials.

Keywords: Earnings management, discretionary accruals, construction contracts

Contents

Introduction

This misstatement prediction model can be applied to any project financials database and provides an accurate result for projects under construction contract methodology, with a high indication of current or future manipulation.

Its purpose is to be used by external or internal auditors and auditing committees to predict accounting misstatements in advance and challenge project managers.

The model development was accompanied by discretionary theory in construction contracts accounting: discretionary risk contingency, discretionary project costs, and discretionary project savings.

The model and the theory are unique trendsetters in earnings management from an internal perspective. They are also a venue for further studies in other accounting fields.

Contextualization

Companies acting in markets such as constructing plants, ships, equipment, factories, hydroelectric plants, power plants, and infrastructure projects use the construction contract method. It requires a complex offering of services that include the cost of goods and materials, the cost of employees, project management, etc., in a long-term relationship with customers and conjoint responsibility; such a situation requires a lot of special effort to transform the operational view into accounting.

It has a relevant number of management judgments and carries the previously mentioned information asymmetry (Beneish, 1997; Adeleye et al., 2013).

The earnings management phenomenon inside the company, happening among middle managers and those in charge of the statutory responsibility, should have equal importance in the earnings management field of study because it can distort financial statements.

Identifying internal earnings management would aid internal controls and audit professionals in developing mechanisms to mitigate information asymmetry and curb financial statement fraud. To avoid the dysfunctional use of management judgment, companies develop internal auditing mechanisms, which external auditors and the supervisory board then double-check. However, what is seen in the end are quarterly announcements covered by misinterpretation of possible future gains, poorly managed projects leading to earnings adjustment, and all sorts of poorly managed risks (Gleason et al., 2008; Desai et al., 2006).

Strengthening controls and improving the quality of financial analysis is an effective mechanism to curb misstatement and manipulation (Klein, 2002; Wongsunwai, 2013). The model also addresses this fact.

Objectives

- Identify project financial misstatements along the development of construction contract accounting.
- how the misstatement manipulation process occurs.
- The prediction of misstatements (earnings management) is made by considering the project's quarterly financial data.

Relevance

Internal and external auditors, as well as audit committees, have a powerful data tool to challenge construction contract accounting. The suggested prediction model delivers an accuracy of 55%- 78%, depending on the misstatement.

This may increase auditors' engagement and reduce the time needed to identify misstatements.

Shareholders with relevant stakes in companies using partial construction contract methodology will entrust more to the company's financials. This risk perception reduction will increase share valuation.

Theoretical Framework

Earnings management: Accounting earnings management refers to management decisions to change the accounting impact of events for their own benefit, such as bonuses, job safety, or pure vanity. Many countries and regulators are working on accounting regulation amendments to reduce accounting earnings management in favor of more transparent and value-driven accounting (Ecker et al., 2006).

Common types of earnings management according to literature:

- Big baths: New or transition managers use restructuring opportunities to be very conservative on cost recognition and accrual. (Dechow 2004)
- "Cookie jar effect," over accruals aiming to make their life easier in the future (Dechow, 2004)
- Zero or minimal profit instead of loss: Managers avoid explaining losses (Beneish, 1997).

- Special events: Managers act opportunistically during special events, such as an IPO, secondary equity offer, or fiscal year-end, to boost share price or corporate bonus. (Burgstahler 1997; Skinner & Myers 2007; Soon Suk & Hyo Jin 2009).

- Beat the analysts: Managers avoid frustrating analyst's quarterly earnings forecasts to maintain or increase the enterprise value expectation and earn-out bonuses consequently (Chu et al. 2019

- Lack of control favors earnings management, especially when practices are accepted by superiors (Sayal & Singh, 2020)

Added theory

Construction contracts accounting should suffer from similar issues found in earnings management literature, considering the information asymmetry among project managers and the rest of the organization, including external stakeholders such as auditors and the audit committee.

The model adds the discretionary theory in project accounting, which is applied to three decisive KPIs in construction contracts accounting:

Discretionary risk contingency—A portion of the risk contingency that is not necessarily operational, which project managers use to steer project results. Risks are inflated, and reducing contingency leads to a direct improvement in the margin.

Discretionary project cost—A portion of project cost (excl. risk contingency) that is not necessarily operational and is also used to steer project results. The cost is inflated, and reducing project costs leads to a direct improvement in the margin.

Discretionary project savings are expected savings in projects that won't be realized. They are used to keep project margins stable. Reducing project savings leads to a direct worsening of the project margin.

State of the Art

The model is supported by advances in earnings management theory, which examines not only the build-up of accruals but also their release.

Dechow et al. (2012) unveiled a new approach for identifying earnings management based on the modified Jones model but with special consideration. In their opinion, it significantly increases the

model's power to predict. The “build/reverse discretionary accrual model” is the first to use not only the variation of discretionary accruals as a test for earnings management but also the nature of its reversal. The model is based on the same empirical test from the modified Jones model that working capital accruals negatively correlate with cash flow from operations positions.

The model supports the development of theories regarding project controlling and construction contract accounting.

The approach developed could also be expanded by other areas of the earnings management internal perspective, such as cash-generating unit analysis.

Technical Product Description

Components

- Three new formulas of discretionary accounting were provided: discretionary risk contingency, discretionary project costs, and discretionary cost savings.
- Relevant construction contract financials were identified through linear and logistic regression analysis

The components described above are the baseline for the misstatement prediction, which interested parties can use.

Architecture

The project database should contain at least three consecutive project financials quarter information.

Discretionary variables need to be calculated based on suggested formulas, with the goal of defining changes in project margin influenced by discretionary effects.

Project financials run in a logistic regression parameter. The aim is to efficiently predict misstatements in the three types of discretionary accounting.

Functionalities

- Prediction of misstatements in construction contract accounting using a project financial database with a short time series (3 quarters).
- Derivation of discretionary accounting under construction contracts.

Development Methodology

1. For each dataset, discretionary risk contingency, project costs, and project savings were calculated per the previously described models.

4. all quantitative variables were normalized by dividing them by the variable project revenue.

5. A Multiple regression was performed to identify variables explaining the three discretionary types of costs.

Benefits

Benefits are clear for Audit stakeholders:

1. Provide a theoretical framework for earnings management in construction contract accounting.

2. Digitize and accelerate the prediction of misstatements process.

Implementation Plan

Step one: Calculating discretionary accounting variables

Positive impacts on project margin quarterly should be divided into:

Changes due to increased price->ordinary business

Changes due to project costs - > discretionary project costs

Change due to risk contingency -> discretionary risk contingency

- The statistical model shows that 15% of discretionary risk contingency cases were from all data entries, while discretionary project cost was 29% of cases.

Negative impacts on project margin quarterly should be divided into:

Changes due to price decrease->ordinary business

Changes due to project costs -> discretionary project savings

- Regarding discretionary project savings, 36% of the data entries were affected.

Projects with positive discretionary values deserve a deep dive to identify possible misstatements.

This is a direct method of identifying discretionary accounting in construction contracts.

Conclusion

Any professional could apply three new formulas for discretionary accounting in construction contracts in an audit engagement and when at least three-quarters of project financials are available.

Considering the model's accuracy, project management will have less room to manage earnings within the projects.

Future Perspectives

Apply the discretionary accounting theory to other special accounting treatments, such as CGU accounting (cash-generating unit) or others where there is a perception of relevant management judgment as well as asymmetry of information.

Contributions

Discretionary accounting in construction contracts is a new milestone in earnings management theory. It adds the internal perspective and how control can be improved, as well as pitfalls from current accounting standards.

Business and academic accounting stakeholders are responsible for seeking improvements in current practices, and the theory presented here is an additional effort in this direction.

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