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Three Essays in Corporate Governance and Corporate Finance: International Evidence

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by

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Abstract

This thesis presents three original research frameworks, two in corporate governance and one in corporate finance, distributed in three empirical chapters, respectively. Specifically, in Chapter 1, a novel multi-criteria decision analysis (MCDA) approach is developed not only to quantify an aggregate quality of corporate governance at firm level, but also to overcome the limitations of the existing measures (i.e., corporate governance indices) mainly with respect to full compensatory structures and industry-wide heterogeneity. Furthermore, the empirical approach, using PROMETHEE methods and econometric analysis of panel data, provides a strong inverse relationship between firm performance and corporate governance quality. The results rely on outranking relationships (over five million pair comparisons) among companies (1,203 US listed firms during 2002 to 2014) across various corporate governance criteria, comparing the aggregate quality against a well-known corporate governance index (ASSET4 ESG in Datastream).

In Chapter 2, the theory of system reliability is used to model the behaviour of companies in terms of their corporate governance practices and mechanisms. Particularly, machine-learning techniques are proposed to assess a corporate governance system. The mapping of its inputs or specific indicators (e.g., corporate social responsibility, average number of board meetings, compensation policy, auditing independency and independent board) as components (either in operating or failed state), along with firm-specific conditions (i.e., age, size, risk, growth), into a reliability system aims to determine an approximate structure function that models the behaviour of the system. The proposed approach is applied to another data sample set of 1,109 US listed companies during 2002 to 2014, the financial and non-financial indicators are modelled as components of the corporate governance system, and returns on assets is defined as the system output. The results show that growth opportunities matter for the proper functioning of the system, and suggest that if companies are more transparent (i.e., components show a low probability of failure) both the trustworthiness of the companies and the system reliability improves.

In Chapter 3, a research framework to analyse failure in mergers and acquisitions (M&A) reveals that not only deal characteristics (i.e., deal attitude, means of payments, deal size, ownership), but also acquirers' and targets' firm size, acquirers' economic freedom, and targets' accounting returns significantly explain the likelihood of deal failure. To this aim, a large dataset of 137,116 worldwide M&A deals (during 1977–2014 on more than 140 countries) and novel specifications of logit regression models are analysed. This chapter contributes and expands the literature in M&A deals and business research by evaluating how incumbents' specific information can constrain the firms' assets movement (efficiency perspective).

Regarding the implications, the findings in Chapter 1 are of particular interest to both scholars and decision makers (e.g., managers, shareholders, investor, policy makers) including rating agencies, who want to assess advantages and disadvantages of corporate governance indices. Chapter 2's findings are useful mainly for board of directors for detecting what corporate governance components are more line up with the most successful companies, or for quantifying firm reliability. The results in Chapter 3 suggest to bidders to be aware of not only deal characteristics, but also firm size discernments, economic freedom outlooks, and accounting figures when considering the exit option of a deal withdrawal.

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Chapter 1. Introduction

Corporate decisions impact on how companies use their resources to become more profitable and sustainable, and also on the relationships among their members (managers, shareholders, and stakeholders). Corporate decisions are defined as a set of arrangements to align companies' strategies and harmonise conflicting objectives among their members, where the decision support lies with a person (or a group of individuals), using plain but not necessarily formalized models for answering certain queries associated with the companies' prospects (i.e., rank a set of investment alternatives, cluster them, select the best ones, or simply describe a problem) (Bouyssou et al., 2006; Brans & De Smet, 2016).

In order to assess how companies align their strategies and decisions to become more profitable and sustainable, this thesis consists of three empirical chapters, the first two on corporate governance and the last one on corporate finance (See Figure 1.1). In summary, the first empirical chapter assesses the relationship between performance and corporate governance quality (index), which is clearly a puzzle (can be positive, non-existing or even negative). This assessment combines a novel approach based on multi-criteria decision analysis (MCDA) and the econometrics of panel data. Alternatively, rather than an aggregate measurement, the second empirical chapter employs different components of corporate governance, under the usage of the system reliability theory and machine-learning techniques, to visualise what factors could enhance the performance of a company and its reliability. Finally, the third empirical chapter introduces an empirical approach to analyse why deals get withdrawn using specific

targets' and acquirers' characteristics and business conditions not reported in the literature.

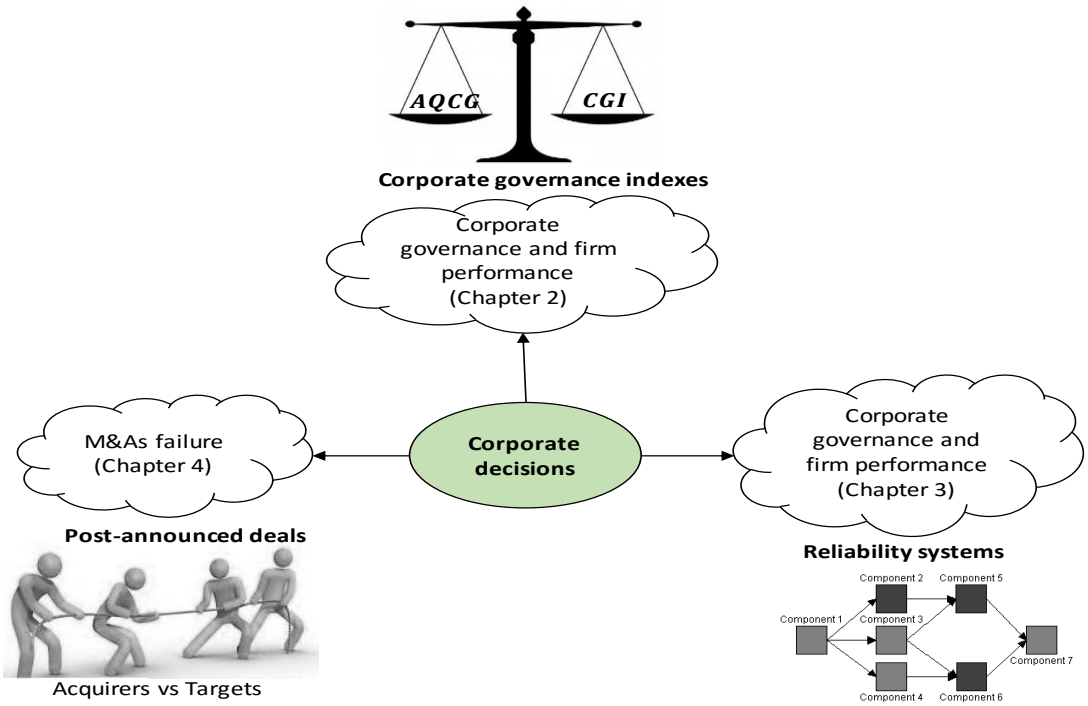


Figure 1.1. Ilustration of the empirical chapters

In more detail, Chapter 2 reviews current limitations of the existing aggregate corporate governance measures (indices) with respect to full compensatory arrangements, lack of intertemporal variation and industry-wide heterogeneity, among others (Bhagat et al., 2008; Schnyder, 2012). In addition, the empirical literature finds that the relationship between performance and corporate governance is limited. For example, it can be negative, positive, or non-existing. This chapter develops a novel research approach using MCDA to construct an alternative aggregate corporate governance index (i.e., a quality index) that synthesizes companies' practices and mechanisms. The approach, centred on the use of the PROMETHEE methods, performs exhaustive pair comparisons among companies (based on outranking relationships analysis (Brans &

Mareschal, 1986; 2005; Bouyssou et al., 2006), allows solving this puzzle and provides a more robust link for this nexus. The analysis is performed on a dataset of 1,203 US listed firms during 2002 to 2014. Our approach compares the proposed aggregate quality (based on over five million pair comparisons across various criteria) with a well-known corporate governance index, ASSET4 ESG in Datastream. As a result, we consistently obtain a negative and strong relationship between firm performance and corporate governance quality. The findings are of particular interest to both scholars and decision makers including providers of corporate governance indices and rating agencies.

Many scholars consider corporate governance as a complex system (Lipton & Rosenblum, 1991; Lipton & Lorsch, 1992b; García-Castro et al., 2013) with input/output variables and with a (maybe unknown) functional model. As a result of that viewpoint, Chapter 3 assesses corporate governance according to system reliability theory (Lisnianski & Levitin, 2003; Rausand & Høyland, 2004; Rausand, 2014) in order to visualize what corporate governance components could enhance the performance of a company. This novel approach implements machine-learning techniques using a company transparency framework (reporting and disclosure) to find an approximate structure function that enables modelling the functioning of the system by mapping its inputs as components (either in operating or failed state) along with firm-specific conditions (age, size, risk, growth, e.g.). The advantage of the proposed mapping approach is illustrated using another sample of 1,109 US listed companies during the period 2002–2014, reporting financial and non-financial information as components of the corporate governance system and the returns on assets (ROA) as the system output. Therefore, the proposed methodology is also of particular interest to both scholars and

decision makers interested in analysing the reliability of a corporate governance system (practices and mechanisms) focused on aligning managers and shareholders in terms of firm performance.

Finally, Chapter 4 introduces an empirical approach to analyse why deals get withdrawn using a large dataset of 137,118 worldwide deals during the period 1976–2014 from more than 140 countries, and different specifications of logit regression models and then computing their marginal effects for economic significance. This original study supports that the acquirers' and targets' firm size, acquirers' economic freedom and targets' accounting returns explain significantly the likelihood of deals being withdrawn, which can be seen as an exit mode (abandonment option) where either an acquirer or a target decides to go ahead or not with a deal announced (Zaheer et al., 2013; Jacobsen, 2014). As a result, this exit mode compromises the assets movement and also the firms' value creation (Tirole, 2006).

Chapter 4 not only includes explicit deal characteristics (i.e., deal attitude, means of payment, deal size, ownership, among other aspects), which matter in post-announcement deals failure or completion (Faccio & Masulis, 2005; Pablo, 2009; Erel et al., 2012; Gorbenko & Malenko, 2014; Moschieri & Campa, 2014), but also contributes to the literature of merger and acquisitions and business research because it scrutinises how targets' and acquirers' specific information can constrain the assets movement (efficiency perspective), and likewise suggests that decision makers, especially from the bidders' side, should be aware of firm size discernments, economic freedom outlooks and accounting returns figures with regard to the exit mode of withdrawing a deal announced.

Thus, the findings on corporate governance, using either MCDA or a reliability system approach, are of particular interest to both scholars and decision makers (managers, shareholders, investors, policy makers, rating agencies, among others) to analyse managers and shareholder alignment and firm performance, and the results on corporate finance analysing failure M&A deals are also relevant for decision makers, especially buyers, to assess "walking-in" or "going-away" takeovers strategies considering the incumbents' firm size, buyers' economic freedom and targets' accounting information.

Chapter 2. Is the relative strength of firms in following corporate governance practices related to company performance? Empirical evidence using a multi-criteria decision analysis approach

Abstract: *The multidimensional aspects of corporate governance always attract substantial interest from the academic, policy-making and managerial communities. Academics and data vendors have developed different aggregate corporate governance measurements to quantify corporate governance quality at firm level. Despite the limitations of the existing measures with respect to full compensatory structures, lack of intertemporal variation and industry-wide heterogeneity, among other inadequacies, they are still being commonly used. The empirical literature finds that the relationship between performance and corporate governance quality can be positive, non-existing or even negative, which is clearly a puzzling nexus.*

In an attempt to resolve this puzzle and provide a more robust link for this nexus, we introduce and develop a multi-criteria decision analysis (MCDA) approach to construct an alternative aggregate corporate governance quality that synthesizes companies' practices and mechanisms through an exhaustive pair comparison procedures based on outranking relationships analysis. With over five million pair comparisons across various criteria, our approach compares the aggregate quality with a well-known corporate governance index, ASSET4 ESG in Datastream using data for 1,203 US listed firms during 2002 to 2014. Using this MCDA approach based on PROMETHEE methods and econometric analysis of panel data, we consistently obtain a negative and strong link between firm performance and corporate governance quality. The findings are of particular interest to both scholars and decision makers including providers of corporate governance indices and rating agencies.

Keywords: *Multi-criteria analysis, Decision analysis, Corporate governance, Financial performance, Outranking relationships*

2.1. Introduction

First, corporate governance is the decision-making system used to control and guide companies (public or private) (Cadbury, 1992). Although Brown et al. (2011) mention that there is no a unifying theory to characterize corporate governance due to its multiple perspectives (financial, social, economic, etc.), some scholars observe that corporate governance puts in place internal mechanisms (e.g., board structure, board function, auditing committee, remuneration committee and so forth) to deal with agency problems (agency theory, conflict of interests among the members of an organization) (Hart, 1995; Clarke, 2004), and that corporate governance is also enhanced by external instruments (investor protection or regulation, for instance) either to protect stakeholders and minority shareholders (Jensen, 1986; La Porta et al., 2000), or to produce benefits and wealth for the society (stakeholder theory, long-run perspectives through a trade-off between firm value and stakeholder benefits) (Jensen, 2001; Mallin, 2013).

In addition to these aspects, corporate governance assures that companies allocate their resources according to their objectives and inter-corporate relationships. This framework is supported by the resource dependence theory, which states that rather than functioning autonomously, companies functions as a network constrained by other organizations' actions and decisions (Hillman et al., 2009; Tricker, 2012). In further analysis, Hillman et al. (2009); Brown et al. (2011); Tricker (2012); Mallin (2013) highlight other corporate governance issues to determine whether companies are managed in the best interest of their members.

According to Bhagat et al. (2008) and Tricker (2012), corporate governance affects major corporate decisions (takeovers, investments, IPOs, raising capital with debt or equity, growth opportunities, dividend policy and so forth). According to Lassoued and Elmir (2012) investors are aware not only of risk and returns, but also of particular firm characteristics such as size, debt, and corporate governance practices, among others, when making their investment decisions (i.e., selecting stocks). As a result, shareholders and stakeholders, especially investors, need to have confidence that companies are stable and well directed.

Nevertheless, corporate governance has been also the centre of major world scandals involving unethical behaviour (Clarke, 2004), shared-value destruction (Tricker, 2012), and accounting fraud (Bhagat et al., 2008), to name some. Particularly, during the recent financial crisis (2007–2008) many corporate governance problems notably associated with executive remuneration, regulation, transparency, risk management, auditing, and market behaviour were uncovered (Vander Bauwhede & Willekens, 2008; Kieff & Paredes, 2010; Mehran et al., 2011; Tricker, 2012). Despite the difficulties, corporate governance continues to evolve, and companies make sure that their reports help market participants understand their underlying corporate decisions.

Because of these scandals and the relevance for stakeholders, especially investors, the level of scrutiny of corporate governance's practices has been increasing (Matoussi & Jardak, 2012; Chahine & Zeidan, 2014). As a result, academics such as Bebchuk et al. (2002); Gompers et al. (2003); Bebchuk et al. (2006); Brown and Caylor (2006), and data providers and consulting firms like Risk Metrics and Institutional Shareholder Services (ISS) mentioned by (Bhagat & Bolton, 2008; Bhagat et al., 2008; Ertugrul & Hegde, 2009) and Thomson Reuters (ASSET4 ESG in *Datastream*) as shown by

Ribando and Bonne (2010), are providing different measurements (indices) to report how companies are dealing with governance and their control mechanisms.

To date, there has been little agreement in research on the consistency, setting and construction of corporate governance indices, and whether they explain companies' performance. For instance, Bhagat et al. (2008) and Tricker (2012) argue that corporate governance has multiples perspectives (economic, countries, law, e.g.) and depends on companies' specific situations; Mehran et al. (2011) state that it differs among sectors and companies (i.e., financial and non-financial); Lehmann and Weigand (2000) support the view that governance practices differs between large block-holders and minority shareholders. Furthermore, the stickiness of corporate governance (i.e., some corporate governance practices and mechanisms remain unchanged for a long time) and endogeneity (i.e., unobserved heterogeneity and bidirectional relationship between corporate governance and companies' results), for example, make it difficult to evaluate whether corporate governance affects companies' performance (Bebchuk et al., 2006; Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012; Acharya et al., 2013).

In other words, up to now, the results from aggregate corporate governance indices due to their limited ability to evaluate companies' dynamics and interrelationships are not fully satisfactory either in overcoming the weighted averaging forms (full compensatory structures) of criteria aggregation or in explaining company performance. In fact, how to organize and synthesize these multidimensional perspectives are important questions posed by scholars (Chen et al., 2007; Adjaoud & Ben-Amar, 2010; Renders et al., 2010; Brown et al., 2011; Larcker & Tayan, 2011; Tricker, 2012; Acharya et al., 2013). To address these circumstances, we employ a multi-criteria decision analysis (MCDA) approach to scrutinise the multidimensional world of

internal corporate governance information. This approach depends on the relative strength of firms in corporate governance practices (outranking relationships among companies) whereas the traditional approaches look at absolute strength (total scores or indexes based on linear and additive aggregations). Finally, the results are contrasted using econometric analysis through different models specifications obtained from the literature to determine whether this approach provides a better perspective of the puzzle of corporate governance and firm performance.

2.2. Research questions in corporate governance indices

Most studies in corporate governance have only been carried out using either global indices or particular characteristics (i.e., CEO duality, board structure and voting rights); however, the process of scrutinizing companies' dynamics and interrelationships and computing their aggregate differences has received little attention. In addition, the research to date has also created a puzzle in terms of the impact of corporate indices on company performance, which we believe is the result of not taking into consideration the dominance of relationships among companies.

We raise several research questions: if corporate governance is a fully heterogeneous environment of mechanisms and practices across countries and industries, is it possible to determine this difference to figure out the best implementing companies? If the answer is affirmative, are they the best performing companies or does their relatively high compliance with corporate governance undermine their financial performance? Are the results robust to endogeneity concerns and various sub-samples? Otherwise, for instance, is it possible to determine and contrast whether a traditional corporate index

(Z-score and weighted aggregations) provides more explanatory power and statistical significance than an aggregate measurement based on multi-criteria analysis does?

With respect to these questions, the challenge that this paper has taken is to synthesise different corporate governance disclosures (practices and mechanisms), compute differences among companies within their respective industry group, and consequently determine an aggregate quality of corporate governance. Based on these outputs, it is possible to determine whether the better-controlled and directed companies can be associated with the better performing companies. Although previous studies rely on weighted average, statistical models or Z-score approaches to construct corporate governance indices (Bhagat et al., 2008; Daines et al., 2010), which indices lack incorporating companies' relative differences among their peers and providing significant explanation of company performance, we employ an MCDA approach based on the use of well-known PROMETHEE methods (Brans et al., 1986; De Keyser & Peeters, 1996; Brans & Mareschal, 2005) to construct an aggregate quality of internal corporate governance that takes into consideration inter- and intra-industry heterogeneities through an exhaustive outranking analysis (relative strength) in an effort to complement traditional corporate governance indices (absolute strength) among companies. The proposed approach is implemented on a large panel dataset that includes the US firms covered by ASSET4 ESG (Datastream) during 2002–2014, totalling 10,171 firm-years and 5,271,380 pair comparisons.

The results obtained from the MCDA approach lead to a number of interesting and unvarying findings, and to some practical implications that are also generalizable. First, the approach provides fresh evidence that superiority or dominance relationships synthesised in an aggregate quality of corporate governance explains adequately

company performance, which is statistically significant and shows good explanatory power in contrast to a proprietary index reported by Datastream. Second, the proposed approach reduces the heterogeneities among companies and their peers, because by construction, the aggregate function reduces the corporate governance differences to net outranking flows computed by distance measures among pairs of companies. Our MCDA approach reveals that the effect of aggregate quality that we measured is negatively associated with firm performance, which implies that having a higher level of compliance, reporting and standards with corporate governance are costly for companies' operating returns.

The rest of this chapter is organized as follows. Section 1.3 presents the MCDA approach to be followed by this research. Section 1.4 provides the methodology associated with the data selection, corporate governance index and aggregate quality of corporate governance, recommended explanatory variables, and regression modelling. Section 1.5 presents and discusses the results. Section 1.6 provides some final considerations for robustness analysis and sensitivity of the results, and Section 1.7 concludes the chapter and outlines some future research directions.

2.3. Multi-criteria analysis approach

2.3.1. Modelling setting

Corporate governance has been the focal point for evaluating companies in terms of agency problems, risk management, firm performance, accounting and auditing practices, shareholder protection and value creation. Martynova and Renneboog (2011) acknowledge that corporate governance practices help managers and shareholders to

work in harmony. However, corporate governance has also been at the centre of the major world scandals. For instance, Bhagat et al. (2008) mention Enron's accounting manipulations, and Enriques and Volpin (2007) analyse the diverting of funds by Parmalat.

Market participants tend to look for companies with good governance practices, and scholars and private companies play a pivotal role in developing corporate governance measurements, composite and aggregate metrics in order to increase the dissemination of information and transparency to the financial market. Therefore, Weir et al. (2002) state that corporate governance has two main perspectives. The first is external corporate governance associated with the market for corporate control (Jensen, 1986; La Porta et al., 2000), for example, law and investor protection. The second is internal corporate governance related to aspects such as board structure, board function, executive ownership and compensation (Walsh & Seward, 1990; Bhagat et al., 2008).

In contrast to the external corporate governance, the internal perspective changes rapidly among industries and their constituents firms. As a result, companies tend to follow the best practices and codes (Cadbury, 1992; Demise, 2006), and, consequently, report their stages of compliance. This information is blended in indices by academics and private data providers, who assess and construct multiple corporate governance perspectives. For the group of academics, we have the G-Index (Gompers et al., 2003) and E-index (Bebchuk et al., 2002; Bebchuk et al., 2006) using external statistical scales and additive weighted aggregations, or Larcker et al. (2007) using principal component analysis (PCA). For the group of private data providers, we have the Institutional Shareholder Services (ISS) (Bhagat et al., 2008; Larcker & Tayan, 2011), Deminor

rating (Renders et al., 2010) and ASSET4 ESG data from Datastream (Ribando & Bonne, 2010) using Z-scores and predefined ranges.

Some scholars highlight the limitations associated with corporate governance indices. Markedly, Larcker and Tayan (2011) affirm that they are based on total scores and the sum of weighting points that are highly sensitive to the predetermined scales. Brown et al. (2011) and Schnyder (2012) remark the stickiness problems (i.e., some corporate governance outputs do not change for a long time). Consequently, these limitations lead to a lack of statistical significance in corporate governance studies. Bhagat et al. (2008); Mehran et al. (2011) and Schnyder (2012) point out that corporate governance metrics are developed by firm-specific factors mostly correlated with the outcome of interest (i.e., performance, risk, growth opportunities), and a simpler aggregate index is unable to account for complex corporate governance dynamics (i.e., interactions and differences in terms of corporate governance practices) across industries and countries.

Although these indices suffer from some limitations, scholars continue to use them for their theory building in search of a solution to the corporate governance and performance nexus. Notably, Bhagat and Bolton (2008); Bhagat et al. (2008) examine this issue by regressing return on assets (ROA) on different corporate governance indices (academics or proprietary), but without providing conclusive evidence. Also, Ertugrul and Hegde (2009) do not identify strong relationships among companies' ratings and corporate governance practices. Nonetheless, Chahine and Zeidan (2014) conclude that companies with good governance slightly outperform the others. Although the findings in the literature may be true, conclusive or not, the key problem with corporate governance indices with such limitations is that scholars and investors

are using them to find out whether good governance implies good performance and vice versa, without evaluating other frameworks, methods, or functional forms.

Acknowledging the limitations of the existing corporate governance indices, this research reviews alternative approaches to consider the indices' specific characteristics, company-specific schemes, differences across industries and countries and metrics' stickiness, which are the current problems highlighted in the literature. For instance, this study considers decision-making models that rely on MCDA techniques (Zeleny, 1982; Roy, 1996; Brans & Mareschal, 2005; Bouyssou et al., 2006; Saaty, 2013; Yager & Alajlan, 2014) in order to introduce relevant means to obtain an alternative aggregate quality based on multiple perspectives (indicators or criteria).

Various MCDA methods have been reported in the literature:

- Outranking methods (i.e., preference ranking organization method for enrichment evaluations (PROMETHEE) (De Keyser & Peeters, 1996; Brans & Mareschal, 2005), and ELECTREE methods (Brans & Mareschal, 2005; Gaganis et al., 2010; Andriosopoulos et al., 2012)
- MAUT, multi-attribute utility methods (Keeney & Raiffa, 1976; Schmitt et al., 2003)
- AHP, analytical hierarchy process (Saaty, 2003; Saaty & Shang, 2011)
- OWA operators, ordered weighted average (Yager, 2009; Yager & Alajlan, 2014)
- Multi-attribute benchmarking method (Galariotis et al., 2016)

Although these methods have not been implemented in computing an aggregate quality of internal corporate governance, the guidelines provided by the multi-attribute benchmarking method used by Galariotis et al. (2016) to evaluate financial performance of local governments helps us to visualize the possible implications of multi-criteria

analysis considering panel datasets and regression analysis. However, we contend that this method cannot be used directly because it assumes trade-off among the attributes and uses additive evaluations (highly compensatory) without evaluating the intensity of preference among alternatives, aspects criticized by researchers in corporate governance studies.

Furthermore, the outranking methods, especially PROMETHEE methods, seem to be feasible because, according to Brans et al. (1986), De Keyser and Peeters (1996), Brans and Mareschal (2005), Behzadian et al. (2010), Brans and De Smet (2016), and Rocco et al. (2016), among others, they allow exhaustive analysis of the outranking relationships, intensity of preferences, and dominance and non-dominance interactions among alternatives using pairwise comparisons. In other words, outranking methods help to compute the dominance relationships among alternatives using a non-compensatory approach based on distance measurements, which allows computing the relative strength among peer companies. However, in order to apply PROMETHEE methods a previous benchmark evaluation is required, which is common in finance and economic studies, to compare the companies and normalize the data (i.e., industry references, peer comparisons, targets firms) (Core et al., 2006; Galariotis et al., 2016; Platikanova, 2016). Consequently, the proposed MCDA approach relies on both benchmarks and outranking methods (non-compensatory) to compute the aggregate quality of corporate governance. This new score intends not only to overcome the limitations and heterogeneities of traditional corporate governance indices, but also to test whether this new approach reveals significant information in terms of company performance using regression analyses. To our best knowledge and revising Behzadian et al. (2010) and Mareschal (2015), this novel approach has not been presented

elsewhere. Therefore, the ASSET4 ESG index is going to be utilised in this research, because not only has been used widely in the literature, but also because it suffers from the same limitations of other traditional measurements (i.e., "black box" construction, weighting adjustments, unsupported trade-offs, among other aspects).

Similar to the guidelines of Galariotis et al. (2016) associated with the procedure to link an MCDA approach to empirical analyses (theoretical support and statistical significance), Figure 2.1 outlines our methodological approach for corporate governance analysis for listed companies, which consists of two stages: The first phase involves collecting, classifying and transforming the corporate governance information (companies, years, indicators and perspectives). Therefore, this dataset is used to implement the outranking methods to estimate the new aggregate quality of corporate governance that is going to be compared against a traditional corporate governance index provided by a data vendor.

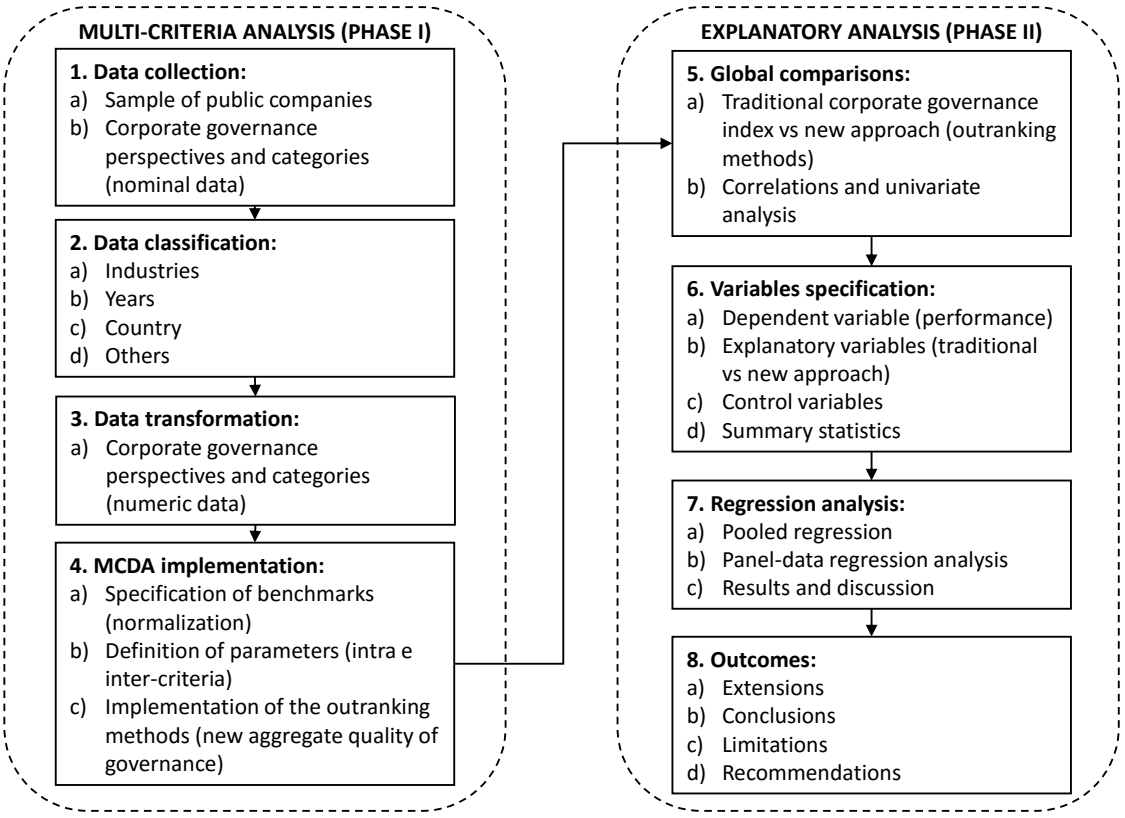


Figure 2.2. Outline of the methodological approach
Source: Author's elaboration following (Galariotis et al., 2016)

The next step involves the explanatory analysis by which both corporate governance approaches (traditional and current) are evaluated through univariate and multivariate analyses; similar perspective is reported by Bhagat et al. (2008) comparing either traditional indices or corporate governance ratings. The regression models are specified according to the information available, theoretical background and variables (dependent, explanatory and control) reported in the literature (e.g., Brown and Caylor (2006); Bhagat and Bolton (2008); Renders et al. (2010); Brown et al. (2011); Wintoki et al. (2012); Alimehmeti and Paletta (2014)). Regression models allow evaluating and contrasting the explanatory power of the models, and statistical significance of the

aggregate quality of governance and the traditional governance index to explain company performance, being in line with the earlier literature on this matter.

Finally, through the regression models, we can not only observe if the dominance relationships among companies, using this new MCDA indicator, explain firm performance but also establish conclusions and recommendations for regulators, decision makers and investors in terms of monitoring and evaluating corporate governance mechanisms and practices.

2.3.2. Multi-criteria model

Considering that companies' information is observed across time (panel data), the multi-criteria approach is also set into a panel data structure. In other words, we assume that corporate governance information can be modelled using an outranking relationship[1] framework (Brans & Mareschal, 2005; Bouyssou et al., 2006; Corrente et al., 2014; Brans & De Smet, 2016), using PROMETHEE methods and benchmarking the ideal values from the best companies among criteria, sector and year at once, to configure an aggregation function for a set of listed companies $a_i \in A$ as $g(a_i) = Z[g_1(a_i), g_2(a_i), \dots, g_n(a_i)]$ on multiple corporate governance criteria (g_j). For instance, comparing a company *a* with its peers *x* ($a, x \in A$) from a sector *s* in a year *t* can be synthesised through the following model:

$$AQCG_s^t(a) = \frac{1}{(n-1)} \sum_{j=1}^{n} \sum_{\substack{x \in A \\ x \neq a}} \left[GC_j(P_j(a,x)) - GC_j(P_j(x,a)) \right]_s^t RI_j \qquad (Eq\ 1.1)$$

where:

[1] The outranking relationship, denoted as *S*, does not determine if the relationship between two alternatives *a* and *b* is a strong preference (*aPb*), weak preference (*aQb*), or indifference (*aIb*), but instead it establishes if "the alternative *a* is at least as good as the alternative *b*" (Brans and Mareschal, 2005).

- $\mathrm{AQCG}_s^t(.)$ indicates the aggregate quality of corporate governance based on dominance relationships among companies. This new approach allows analysing corporate governance mechanisms and practices to determine whether a company is better than another and to explain company performance. Operationally, equation 1.1 can be seem as the net flow for each company: "credits" from a company outranking others and "debits" from the other outranking a given company.

- $P_j(a,x)$ is the result of performing all pairwise comparisons between a company and its peers (and vice versa $P_j(x,a)$) in their respective sector and by year. It is based on the performance difference $d_j(a,x)$ for a particular criterion, which represents the preference intensity of the calculated deviation. This means that, for each criterion g_j, decision makers have a preference function for two alternative as:

$$P_j(a,b) = d_j(a,b)\ \forall a,b \in A \text{ (for } j = 1,2,\ldots,n) \qquad (Eq\ 1.2)$$

$$0 \leq P_j(a,b) \leq 1 \qquad (Eq\ 1.3)$$

$$\text{where } d_j(a,b) = g_j(a) - g_j(b) \qquad (Eq\ 1.4)$$

For minimizations, preference function 1.2 can be obtained by symmetry (Brans & Mareschal, 2005; Brans & De Smet, 2016) as $P_j(a,b) = [-d_j(a,b)]$

- GC_j is a set of "generalised criterion (GC)"; it models whether the difference between two companies can generate enough reasons to establish an order. For this reason, a GC should be selected over the pair [g_j,$P_j(a,b)$] associated with the g_j criterion. Brans and Mareschal (2005) have proposed six types of GC. However, because there is a general concern in corporate governance studies associated with stickiness and lack of variability in the indicators reported by companies (Brown

et al., 2011), we select GC Type I (strict or usual criterion), which contends that a strict criterion can identify any difference between two alternatives[2], no matter how small it might be (Rocco et al. (2016).

- RI_j is a set of importance values or decision makers' preferences over the selected corporate governance criteria where $\sum_{j=1}^{n} RI_n = 1, RI_n \geq 0$ are the relative weights of importance among the corporate governance perspectives. For this research, we do not consider differentiated values for no skewing or outweighing some corporate governance particularities.

In summary, the left side of equation 1.1 represents the average of the aggregated preference indices favoring *a*, and it states a "credit" measure in relation to the rest companies (Figure 2.2 illustrates this statement; note that the direction of the arcs goes from the alternative to the remaining companies evaluated). The right side of equation 1.1 represents the average of the aggregate preference indices that do not support the dominance relationship of *a*. This negative flow expresses a measure of "debit," which is attributed to *a* by the effect of the remaining companies (Figure 2.2 illustrates this statement; in this case, the direction of the arcs goes from the rest of the companies to the company evaluated).

[2] Other GC types might be used (See Appendix 2A, Table 2A.1, for further details); however, they require additional information either from decision makers or from the data such as information about the parameters to model the threshold of indifference among objects or strict preference. We thus consider GC Type I since no additional information is required. Besides, our choice allows considering small differences for the corporate governance evaluations among the incumbent companies. Further research regarding other types of GC needs to be developed considering that variability among the companies is going to be relaxed, and the statistical significance and explanatory power of the regression models might be affected.

Note that the evaluation made by the aggregate quality $\mathrm{AQCG}_s^t(.)$ is used to determine if a firm is better than another and it represents the approach to discriminate the companies as better or the worse.

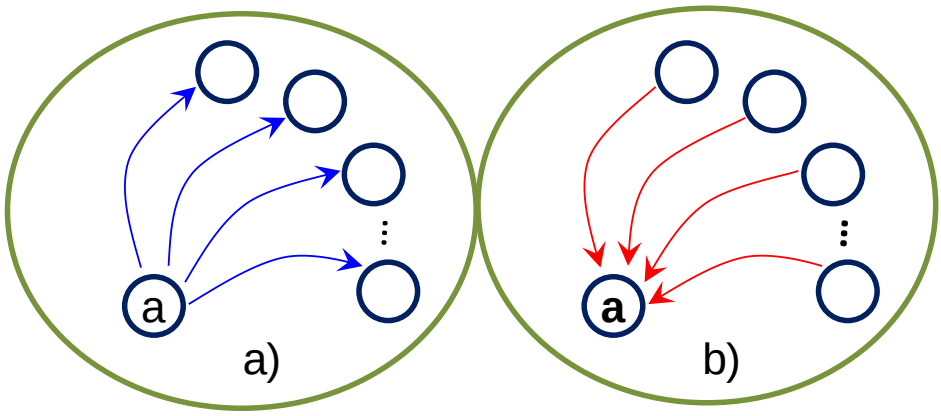


Figure 2.3. Outranking relationships: (a) positive outranking flows and (b) negative outranking flows
Source: Author's elaboration following (Brans & Mareschal, 1986; 2005)

In addition, it is important to emphasise that the corporate governance impacts a_i (i = *1,2,…,m)* evaluated on criterion g_j (j = *1,2,…,n*) are compared against a benchmark (target) a^* (i.e., maximum, ideal or goal value) on the j-criterion selected $g_j(a^*)$. The relevance of this comparison is justified by Galariotis et al. (2016), and it is also useful for decision making by corporate managers and investors. Furthermore, this approach follows a normalization procedure, across the data range under analysis, which is explored by Zeleny (1973; 1982), who underlines that the closer the alternatives to the target goals, the more preferred they are. This is a rational expression of the human behaviour.

Finally, to the best of our knowledge, the proposed $\mathrm{AQCG}_s^t(.)$ not only provides useful insights as it helps to evaluate whether corporate governance mechanisms and

outranking relationships among companies affect company performance, can be compared to the traditional governance indices, especially the governance scores (ASSET4 Environmental, Social & Governance (ESG) data reported by Thomson Reuters Datastream) that follow a "black box" construction and a simple weighted average adjusted by a Z-score function, but also overcomes the significant limitations (e.g., overweighing criteria, compensations, stickiness) of other data providers for corporate governance indices (Bhagat et al., 2008; Daines et al., 2010; Larcker & Tayan, 2011; Schnyder, 2012).

2.4. Methodology

2.4.1. Data section

Our dataset consists of 1,203 listed US companies that have corporate governance information in Datastream and are used for the corporate governance score (ASSET4 ESG module). Following the data vendor companies, we adopt 10 economic sectors according to the International Standard Industrial Classification (ISIC). The companies are selected from 2002 onwards since ASSET4 ESG data started to be available in that year, and our data collection ends in 2014. The original sample contained 15,639 company-year observations, and after correcting it for the usual filtering such as missing, duplicated and unavailable information, the final data includes 10,171 firm-years as shown in Table 2.1.

Table 2.1. Sample size and classification

Years-Sectors	Basic Materials	Consumer Cyclicals	Consumer Non-Cyclicals	Energy	Financials	Healthcare	Industrials	Technology	Telecommunications Services	Utilities	Total	Sample size (%)
2002	27	64	72	26	73	41	51	61	10	26	**451**	**4.43**
2003	27	64	72	26	74	41	51	61	10	26	**452**	**4.44**
2004	36	88	83	48	116	60	70	82	13	36	**632**	**6.21**
2005	43	105	95	50	129	61	78	91	14	38	**704**	**6.92**
2006	41	110	95	51	127	59	79	90	15	38	**705**	**6.93**
2007	42	108	100	58	126	58	84	87	12	40	**715**	**7.03**
2008	49	134	118	73	172	70	121	100	16	52	**905**	**8.90**
2009	62	149	121	79	189	83	143	121	17	59	**1,023**	**10.06**
2010	65	163	118	80	196	83	149	130	17	57	**1,058**	**10.40**
2011	63	164	115	78	193	79	148	130	16	51	**1,037**	**10.20**
2012	62	162	113	77	191	75	144	127	15	50	**1,016**	**9.99**
2013	53	139	93	65	170	60	122	103	9	36	**850**	**8.36**
2014	33	109	64	56	122	40	92	86	6	15	**623**	**6.13**
Total	**603**	**1,559**	**1,259**	**767**	**1,878**	**810**	**1,332**	**1,269**	**170**	**524**	**10,171**	**100.0**
Sample size (%)	**5.93**	**15.33**	**12.38**	**7.54**	**18.46**	**7.96**	**13.10**	**12.48**	**1.67**	**5.15**	**100.0**	

2.4.2. Index and aggregate quality of corporate governance

Datastream computes and presents a corporate governance index in the segment ASSET4 ESG[3] for listed companies in the USA. This index takes into consideration 33 governances' practices and mechanisms reported by companies, which at the same time belong to five perspectives (board structure, board function, compensation policy, shareholder rights and vision and strategy), and these perspective are the attributes under scrutiny for the MCDA approach.

[3] The ASSET4 ESG database comprises information since 2002, especially for global publicly listed companies. The scores reported are normalized using z-scoring, equally weighted and benchmarked against the complete universe of companies (Thomson-Reuters, 2016a).

According to the data provider, a weighted average and Z-score procedure is used to estimate the composite score; however, adjustments, weights and transformation from nominal to numeric information, among other aspects, are difficult to replicate methodologically. The construction is a "black box" like other proprietary indices shown by Bhagat et al. (2008) and Daines et al. (2010), for example. In addition, scholars use either corporate governance indices or the practices and mechanisms reported, single or grouped, to create new variables or weighted indices, especially, to see whether corporate governance affects companies' performance (Bebchuk et al., 2006; Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012; Acharya et al., 2013). However, the results are not fully satisfactory either to explain performance or to overcome the weighted (fully compensatory) forms of aggregation criteria to evaluate companies' dynamics and their interrelationships.

In order to evaluate the corporate governance dynamics and the dominance relationships among companies using a new aggregate quality of corporate governance (MCDA approach), an exhaustive pair comparisons process is implemented based on the full information provided on this matter by Datastream. This procedure can be perceived as a "white box" using the following three stages:

For the first stage, the 33 categories and the 5 perspectives of corporate governance are revised and transformed from nominal to numeric. Table 2.2 shows these perspectives, in particular, their definitions and categories, their descriptions from the companies' perspectives, outcomes in Datastream for users, methodology for nominal-to-numeric transformations, additional adjustments considered and relevant references supporting non-straightforward considerations according to best-practices in corporate governance form Cadbury (1992) and Demise (2006). To our best knowledge, this "white box"

procedure produces a leading-edge in relation to other corporate governance studies and opens new implementation perspectives for other MCDA methodologies presented in the current literature.

Table 2.2. Corporate governance's perspectives, definitions, categories and data adjustments

A.	**Board Structure**: It represents how well-balanced is the board of directors to have an independent decision-making process (experienced, diverse and autonomous)	
Categories	**1. Board structure/ policy:** Does the company have a policy for maintaining a well-balanced membership of the board?	Outcome: nominal (Y/ N) Transformation: Y = 1; N = 0.
	2. Experience: Average number of years each board member has been on the board.	Outcome: numeric(years)/ NA Transformation: values ≥ than the average industry =1; 0 otherwise.
	3. Percentage non-executive board members in the board	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
	4. Percentage of independent board members (as reported by the company).	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
	5. CEO-Chairman separation: Does the CEO simultaneously chair the board? AND has the chairman of the board been the CEO of the company? The transformation reflects some concerns form Krause et al. (2014) that duality deteriorates corporate governance practices	Outcomes: nominal (Double Y/ N) Transformation: NN=1, NY or YN =0.5, YY=0.
	6. Background and skills: Does a company describe the professional experience or skills of every board member? OR Does the company provide information about the age of individual board members?	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.
	7. Size of board: The total number of board members at the end of the fiscal year. The transformation reflects some concerns from Boone et al. (2007) who indicate that as companies grow, boards grow so there is no optimal size, and Coles et al. (2008) who argue that one size does not fit all. So we introduce a fuzzy adjustment around the average industry.	Outcome: numeric (integer) Transformation: values around the average of the industry +/ -10% =1, 0 otherwise.
	8. Board diversity: Percentage of women on the board of directors.	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
B.	**Board function:** It measures the board activities and functions related to management alignment, commitment and effectiveness according to the corporate governance principles, and the role of board committees based upon the given responsibilities.	
Categori	**9. % Audit committee independence:** Percentage of independent board members on the audit committee as stipulated by the company[4].	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.

[4] If companies do not disclose, figures are calculated using the equation (#Independent Board Members)/(#Audit Committee Members + #Independent Board Members) (Thomson-Reuters, 2016a).

	10. % Audit committee management independence: Percentage of non-executive board members on the audit committee as stipulated by the company.	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
	11. Audit committee expertise: Does the company have an audit committee with at least three members and at least one "financial expert" within the meaning of Sarbanes-Oxley?	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.
	12. % Compensation committee independence: Percentage of independent board members on the compensation committee as stipulated by the company[5].	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
	13. % Compensation committee management independence: Percentage of non-executive board members on the compensation committee as stipulated by the company[6].	Outcome: numeric (percent)/ NA Transformation: values ≥ than the average industry =1; 0 otherwise.
	14. % Nomination committee independence: Percentage of non-executive board members on the nomination committee[7].	Outcome: numeric (percent) Transformation: values ≥ than the average industry =1; 0 otherwise.
	15. % Nomination committee management independence: Percentage of non-executive board members on the nomination committee as stipulated by the company[8].	Outcome: numeric (percent)/ NA Transformation: values ≥ than the average industry =1; 0 otherwise.
	16. Number of board meetings (during the year[9]). The rationale for this adjustment is the more attendance, the more company monitoring.	Outcome: numeric(integer)/ NA Transformation: values ≥ than the average industry =1; 0 otherwise.
	17. % Board meeting attendance average: The average overall attendance percentage of board meetings as reported by the company[10]. Same adjustment (16)	Outcome: numeric (percent)/ NA Transformation: values ≥ than the average industry =1; 0 otherwise.
C.	**Compensation policy:** It measures the corporate governance practices regarding competitive and balanced management compensation not only to attract and retain executives and board members, but also to link their compensation to individual or company targets (financial or non-financial).	
Categorie	**18. Compensation policy:** Does the company have a policy for performance-oriented compensation that attracts and retains the senior executives and board members?	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.

[5] If companies do not disclose, figures are calculated by (#compensation committee members who are independent/#compensation committee members) (Thomson-Reuters, 2016a).
[6] This data point is shown when companies publish an overall statement on the non-executives of the audit committee (Thomson-Reuters, 2016a).
[7] If this information is disclosed, then this figure will be shown. Otherwise it will be calculated by (#nomination committee members who are independent/#nomination committee members) (Thomson-Reuters, 2016a).
[8] This data point is answered when the company publishes an overall statement on the non-executives of the audit committee (Thomson-Reuters, 2016a).
[9] Number of actual board meetings during the year, including all special meetings (Thomson-Reuters, 2016a).
[10] The average provided by the company is accepted to answer the data point (Thomson-Reuters, 2016a).

	19. Highest remuneration package: The highest value within the company in USD. For data transformation, reporting is a good practice for this criteria (Demise, 2006).	Outcome: numeric (real)/ NA. Transformation: If a company reports 1, 0 otherwise.
	20. Total board member compensation of the non-executive board members in USD. For data transformation, reporting is a good practice for this criteria (Demise, 2006).	Outcome: numeric (real)/ NA. Transformation: If the company reports 1, 0 otherwise.
	21. Stock option program: Does the company's statutes or by-laws require that stock-options are only granted with a vote at a shareholder meeting?	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.
	22. Senior executive long-term compensation incentives: The maximum time horizon of targets to reach full senior executives' compensation.	Outcome: numeric (real) / NA. Transformation: If the company reports 1, 0 otherwise.
	23. Vesting of Stock Options/ Restricted Stock: The number of years that the company's most recently granted stock options or restricted stocks take to fully vest (since the date of the grant).	Outcome: numeric (real) / NA. Transformation: If the company reports 1, 0 otherwise.
D.	**Shareholder Rights:** It considers the best practices in corporate governance for equal treatment of shareholders (large and minority) and limiting the use of anti-takeover devices.	
Categories	**24. Shareholder rights/ policy**: Do companies have a policy to equally treat minority shareholders, facilitate shareholder engagement or limit the usage of anti-takeover devices?	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.
	25. Voting rights: Are all shares of the company providing equal voting rights?[11]	Outcome: nominal (Y/ N) Transformation: Y = 1, N = 0.
	26. Ownership: Is a company owned by a reference shareholder with majority of the voting rights, veto power or golden share?	Outcome: nominal (Y/ N) Transformation: Y = 0, N = 1.
	27. Classified board structure: Does the company have a classified[12] board structure? The rational for the values transformation comes from Bhagat and Bolton (2008) who mention that devices such as poison pills, golden parachutes and classified boards undermine boards' and companies' flexibility.	Outcome: nominal (Y/ N/ NA) Transformation: Y = 0, N = 1.
	28. Staggered board structure: Does the company have a staggered board structure? Regarding the data transformation, staggered boards can allow managers to extract rents from shareholders (i.e., Bebchuk and Cohen [2005] cited by Larcker et al. (2011)]), this means is considered a good corporate governance practice.	Outcome: nominal (Y/ N/ NA) Transformation: Y = 0, N = 1.
E.	**Vision and strategy:** It measures management commitment and effectiveness to integrate financial and extra-financial aspects (i.e., social and environmental) into the daily operations.	
Categories	**29. Integrated vision and strategy challenges and opportunities:** Is the company openly reporting information about the challenges or opportunities of integrating financial and extra-financial issues, and the dilemmas and trade-offs it faces?	Outcome: nominal (Y/ N/ NA) Transformation: Y = 1, N = 0.

[11] Companies who do not have dual class stock, non-voting shares, multiple or double voting rights shares, priority shares or transfer limitations, voting cap or minimum number of shares to vote will be awarded a "Yes" for this indicator (Thomson-Reuters, 2016a)

[12] All classified boards are staggered but all staggered boards are not, in fact, classified boards (Thomson-Reuters, 2016a).

	30. CSR sustainability committee: Does the company have a CSR committee or team?	Outcome: nominal (Y/ N/ NA) Transformation: Y = 1, N = 0.
	31. GRI report guidelines: Is the company's CSR report published in accordance with the GRI guidelines?[13]	Outcome: nominal (Y/ N/ NA). Transformation: Y = 1, N = 0.
	32. CSR sustainability report global activities: Does the company's extra-financial report consider the global activities of the company?[14]	Outcome: nominal (Y/ N/ NA). Transformation: Y = 1, N = 0.
	33. CSR sustainability external audit: Does the company have an external auditor of its CSR/ Health & Safety/ Sustainability report?[15]	Outcome: nominal (Y/ N/ NA). Transformation: Y = 1, N = 0.

In the second stage, the numeric values associated with the corporate governance criteria are aggregated on their respective perspectives using the sum of numeric evaluations divided by the number of categories contained. Similar approaches are proposed Saaty (1980; 2003; 2013) aggregating multiple attributes interrelated using hierarchical structures. Note that, because we are interested in contrasting the traditional corporate governance index (Datastream) against the aggregate quality of corporate governance, some additional data revisions and adjustments were considered regarding non-available, null, or missing information. For instance: 1) if a company reports the corporate governance index, and it does not report information in a specific category, a zero (0) value is shown; 2) if for two companies (also for more than two) in the same sector and country, one reports "NA" and the other shows a data point in the same category, then a company with "NA" receives "0" in order to be aligned to the best practices (transparency and reporting). Otherwise, "NA" is considered as a missing value.

[13] A "Yes" means that a company publishes a GRI report according to GRI guidelines (Thomson-Reuters, 2016a).
[14] General Rule: Answer is "No" when there is no extra-financial report (Thomson-Reuters, 2016a).
[15] General rule: There is a statement from an external auditor on the CSR / H&S / Sustainability report, with or without indication that the data in the report has been checked (Thomson-Reuters (2016a).

In addition to this, Appendix 2B (Table 2B.1) presents the statistics summary associated with this 33 corporate governance indicators from 2002-2014. Note that the perspective with better performance, average values closer to the maximum values, is board function where 7/9 indicators (i.e., *bf_iaudit_d, bf_imaudit_d, bf_audexp_d, bf_icomcom_d, bf_imcomcom_d, bf_inomcom_d,* and *bf_imnoncom_d*) are higher than 0.89. The perspective with more dispersion by each indicator is board structure, 6/8 indicators (i.e., *bs_expe_d, bs_noexe_d, bs_indep_d, bs_duality_d, bs_size_d,* and *bs_divers_d*) have a standard deviation higher than 40%. The indicators with the highest likelihood of values closer to the maximum performance are *bs_poly_d, bf_iaudit_d, cpoly_com_d,* and *shrt_poly_d,* which have the highest negative skewness. Finally, the lowest kurtosis (fat tails) are associated with *bs_expe_d, bs_indep_d, bs_divers_d, cpoly_stok_d,* and *shrt_stabs_d.*

For the final stage, the pair comparisons approach, supported on the obtained numeric values for each corporate governance perspective, is implemented to analyse the dominance and dynamic relationships among peer companies relative to their sectors. This process helps to compute exhaustively the intensity of preferences among companies using distance measurements and generalised criteria, which is at the same time a non-compensatory approach (Roy, 1996; Brans & Mareschal, 2005; Bouyssou et al., 2006). Therefore, relative importance or relative weights associated with the corporate governance perspectives (final macro-criteria) are not taken into consideration in this current research. They can produce bias or undesired weighs (some criteria arbitrarily outweighs others) in the final outcomes, which affect some academic indices (Bhagat et al., 2008; Larcker & Tayan, 2011).

Table 2.3 shows the number of pair comparisons considered by criteria (or corporate governance perspective) that are implemented by sectors and years separately. The total pair comparisons are at most *[m*(m-1)*n]*t*, where *m* is the number of companies, *n* the number of criteria and *t* the number of years under analysis. As a result, from 10,171 company-year observations (see Table 2.1), the MCDA approach scrutinizes companies' dominance relationships using 1,054,276 pair comparisons by criteria, which in total represents 5,271,380 pair comparisons for the full corporate governance perspectives. To the best of our knowledge, this approach is the largest MCDA implementation using PROMETHEE methods in panel data structures.[16]

Table 2.3. Number of pair comparisons implemented by criterion across industry

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	**Total**
2002	702	4,032	5,112	650	5,256	1,640	2,550	3,660	90	650	**24,342**
2003	702	4,032	5,112	650	5,402	1,640	2,550	3,660	90	650	**24,488**
2004	1,260	7,656	6,806	2,256	13,340	3,540	4,830	6,642	156	1,260	**47,746**
2005	1,806	10,920	8,930	2,450	16,512	3,660	6,006	8,190	182	1,406	**60,062**
2006	1,640	11,990	8,930	2,550	16,002	3,422	6,162	8,010	210	1,406	**60,322**
2007	1,722	11,556	9,900	3,306	15,750	3,306	6,972	7,482	132	1,560	**61,686**
2008	2,352	17,822	13,806	5,256	29,412	4,830	14,520	9,900	240	2,652	**100,790**
2009	3,782	22,052	14,520	6,162	35,532	6,806	20,306	14,520	272	3,422	**127,374**
2010	4,160	26,406	13,806	6,320	38,220	6,806	22,052	16,770	272	3,192	**138,004**
2011	3,906	26,732	13,110	6,006	37,056	6,162	21,756	16,770	240	2,550	**134,288**
2012	3,782	26,082	12,656	5,852	36,290	5,550	20,592	16,002	210	2,450	**129,466**
2013	2,756	19,182	8,556	4,160	28,730	3,540	14,762	10,506	72	1,260	**93,524**
2014	1,056	11,772	4,032	3,080	14,762	1,560	8,372	7,310	30	210	**52,184**
Total	**29,626**	**200,234**	**125,276**	**48,698**	**292,264**	**52,462**	**151,430**	**129,422**	**2,196**	**22,668**	**1,054,276**

Notes: (1): Basic materials, (2): Consumer cyclicals, (3): Consumer non-cyclicals, (4): Energy, (5): Financials, (6): Healthcare, (7): Industrials, (8): Technology, (9): Telecommunications services, (10): Utilities.

[16] In the PROMETHEE Bibliographical Database (Mareschal, 2015) and the literature review on MCDA applications (Behzadian et al., 2010), there is no reference regarding large-scale implementations using panel data information for corporate governance studies.

Furthermore, Table 2.4 shows correlation among corporate governance criteria, and Table 2.5 presents the statistics summary for the given criteria: the traditional corporate governance index in decimal values (*ncgvi*) and the five constituents' perspectives of corporate governance following the transformation and adjustments described in Table 2.2, namely board structure (*bs_d*), board function (*bf_d*), compensation policy (*cpoly_d*), shareholder rights (*shrt_d*) and vision and strategy (*vstr_d*). Therefore, the linear weighted average of these perspectives is shown by *cgvi_d*. Furthermore, our MCDA approach combines these five aspects by using outranking relationships in order to generate an aggregate quality of corporate governance (*aqcg_d*).

Table 2.4. Correlation among corporate governance criteria

	ncgvi	cgvi_d	(1) bs_d	(2) bf_d	(3) cpoly_d	(4) shrt_d	(5) vstr_d	aqcg_d
ncgvi	1							
cgvi_d	0.5438*	1						
(1) bs_d	0.3004*	0.5030*	1					
(2) bf_d	0.4109*	0.4932*	0.1857*	1				
(3) cpoly_d	0.1021*	0.5738*	0.0767*	0.1841*	1			
(4) shrt_d	0.2587*	0.4246*	0.0841*	0.1123*	0	1		
(5) vstr_d	0.4533*	0.6977*	0.2001*	0.1549*	0.1639*	0.0971*	1	
aqcg_d	0.5454*	0.7657*	0.5445*	0.4588*	0.2834*	0.4563*	0.4465*	1

Notes: * indicates pairwise correlation is significant with Bonferroni-adjusted significance levels of 0.05 or less.

Significantly the data in Table 2.4, for the total sample, reveal that *ngvi* is significantly and positively associated with *cgvi_d* (54.4%), and *aqcg_d* (54.5%). The correlation between *aqcg_d* and *cgvi_d* is even higher (76.6%). Although these figures may suggest similarities among the corporate governance quality measures, our objectives in the second stage based on the panel data analysis are to examine a) whether the effect of the proposed index on firm performance leads to different findings and b) if the new index provides a better explanatory power and statistical significance regarding its relationship with firm performance.

It is important to notice that Table 2.5 and Table 2.6 reveal, respectively, that during 2002–2008 and 2009–2014, on average, the US firms' corporate governance index (*ngcvi*) is above 70%. However, the proposed aggregate quality of corporate governance (*aqcg_d*), which reports smaller average values and more variability than the traditional approach, uncovers that companies were not performing well according to the corporate governance practices during the crisis period 2007–2008, even a year before and after this period. Additionally, Table 2.5 and Table 2.6 show that compensation policy (*cpoly_d*) and shareholders' rights (*shrt_d)* unveil a higher dispersion in contrast to the other corporate governance perspectives.

Table 2.5. Statistics summary of corporate governance perspectives (2002–2008)

Criteria	Statistics	2002	2003	2004	2005	2006	2007	2008
ncgvi	mean	0.659	0.683	0.733	0.741	0.747	0.736	0.741
	median	0.730	0.736	0.773	0.775	0.780	0.769	0.774
	sd	0.228	0.214	0.167	0.159	0.156	0.146	0.161
	min	0.042	0.069	0.030	0.025	0.016	0.082	0.064
	max	0.979	0.980	0.976	0.975	0.974	0.971	0.968
	n	451	452	632	704	705	715	905
cgvi_d	mean	2.296	2.514	2.593	2.714	2.876	3.051	3.131
	median	2.313	2.513	2.599	2.713	2.883	3.022	3.106
	sd	0.406	0.392	0.367	0.390	0.382	0.385	0.434
	min	1.100	1.393	0.650	1.175	0.850	1.939	1.733
	max	3.454	3.658	3.797	4.118	3.997	4.528	4.750
	n	451	452	632	704	705	715	905
bs_d	mean	0.506	0.550	0.561	0.594	0.596	0.597	0.600
	median	0.500	0.500	0.563	0.625	0.625	0.625	0.625
	sd	0.164	0.162	0.155	0.156	0.159	0.158	0.156
	min	0.063	0.125	0.250	0.125	0.125	0.250	0.250
	max	0.938	1.000	1.000	1.000	1.000	1.000	1.000
	n	451	452	632	704	705	715	905
bf_d	mean	0.589	0.730	0.776	0.785	0.802	0.828	0.825
	median	0.667	0.778	0.778	0.778	0.778	0.778	0.778
	sd	0.205	0.172	0.149	0.125	0.128	0.092	0.093
	min	0.000	0.111	0.000	0.000	0.000	0.222	0.333
	max	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	n	451	452	632	704	705	715	905
cpoly_d	mean	0.385	0.400	0.416	0.474	0.573	0.654	0.700
	median	0.333	0.333	0.333	0.500	0.500	0.667	0.667
	sd	0.135	0.141	0.158	0.161	0.166	0.160	0.169
	min	0.000	0.000	0.000	0.000	0.000	0.167	0.167
	max	0.833	0.833	0.833	1.000	1.000	1.000	1.000
	n	451	452	632	704	705	715	905

Criteria	Statistics	2002	2003	2004	2005	2006	2007	2008
shrt_d	mean	0.776	0.786	0.799	0.810	0.843	0.851	0.855
	median	0.800	0.800	0.800	0.800	0.800	0.800	0.800
	sd	0.195	0.191	0.180	0.177	0.153	0.141	0.144
	min	0.000	0.200	0.000	0.200	0.200	0.400	0.200
	max	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	n	451	452	632	704	705	715	905
vstr_d	mean	0.040	0.048	0.041	0.051	0.062	0.120	0.151
	median	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	sd	0.112	0.126	0.113	0.137	0.145	0.214	0.252
	min	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	max	0.800	0.800	0.800	1.000	0.800	1.000	1.000
	n	451	452	632	704	705	715	905
aqcg_d	mean	-0.406	-0.670	0.042	0.090	-0.142	-0.026	-0.075
	median	0.600	-0.610	0.032	0.080	0.006	-0.004	0.002
	sd	0.256	0.256	0.241	0.262	0.253	0.259	0.272
	min	-0.712	-0.580	-0.793	-0.737	-0.800	-0.733	-0.803
	max	0.640	0.764	0.852	0.804	0.803	0.673	0.806
	n	451	452	632	704	705	715	905

Table 2.6. Statistics summary of corporate governance perspectives and criteria

Criteria	Statistics	2009	2010	2011	2012	2013	2014
ncgvi	mean	0.710	0.731	0.722	0.724	0.775	0.700
	median	0.739	0.754	0.748	0.750	0.806	0.725
	sd	0.178	0.163	0.166	0.164	0.145	0.172
	min	0.014	0.024	0.051	0.048	0.098	0.035
	max	0.970	0.963	0.966	0.966	0.962	0.964
	n	1,023	1,058	1,037	1,016	850	623
cgvi_d	mean	3.207	3.277	3.349	3.360	3.113	3.218
	median	3.181	3.236	3.314	3.323	3.092	3.192
	sd	0.479	0.491	0.502	0.504	0.470	0.516
	min	1.258	1.397	1.753	1.808	1.867	1.619
	max	4.689	4.764	4.639	4.675	4.514	4.653
	n	1,023	1,058	1,037	1,016	850	623
bs_d	mean	0.606	0.606	0.611	0.615	0.613	0.572
	median	0.625	0.625	0.625	0.625	0.625	0.625
	sd	0.162	0.164	0.163	0.162	0.160	0.147
	min	0.125	0.125	0.250	0.125	0.250	0.250
	max	1.000	1.000	1.000	1.000	1.000	0.875
	n	1,023	1,058	1,037	1,016	850	623
bf_d	mean	0.823	0.822	0.826	0.828	0.831	0.715
	median	0.778	0.778	0.778	0.778	0.889	0.778
	sd	0.105	0.105	0.099	0.097	0.092	0.166
	min	0.000	0.222	0.333	0.333	0.333	0.222
	max	1.000	1.000	1.000	1.000	1.000	1.000
	n	1,023	1,058	1,037	1,016	850	623
cpoly_d	mean	0.732	0.766	0.795	0.821	0.818	0.813
	median	0.667	0.833	0.833	0.833	0.833	0.833
	sd	0.185	0.189	0.185	0.184	0.185	0.189
	min	0.000	0.000	0.000	0.000	0.000	0.000
	max	1.000	1.000	1.000	1.000	1.000	1.000
	n	1,023	1,058	1,037	1,016	850	623

Criteria	Statistics	2009	2010	2011	2012	2013	2014
shrt_d	mean	0.854	0.858	0.864	0.815	0.577	0.873
	median	0.800	0.800	0.800	0.800	0.600	0.800
	sd	0.145	0.145	0.143	0.177	0.138	0.151
	min	0.200	0.200	0.200	0.200	0.200	0.200
	max	1.000	1.000	1.000	1.000	1.000	1.000
	n	1,023	1,058	1,037	1,016	850	623
vstr_d	mean	0.192	0.225	0.253	0.281	0.275	0.246
	median	0.000	0.000	0.200	0.200	0.200	0.000
	sd	0.278	0.294	0.308	0.321	0.323	0.318
	min	0.000	0.000	0.000	0.000	0.000	0.000
	max	1.000	1.000	1.000	1.000	1.000	1.000
	n	1,023	1,058	1,037	1,016	850	623
aqcg_d	mean	-0.217	0.330	0.142	0.217	0.104	-0.104
	median	0.009	0.012	0.010	0.090	0.016	0.015
	sd	0.284	0.280	0.288	0.278	0.255	0.278
	min	-0.790	-0.739	-0.859	-0.858	-0.841	-0.728
	max	0.697	0.690	0.666	0.725	0.597	0.737
	n	1,023	1,058	1,037	1,016	850	623

In addition, the proposed MCDA approach entails the following comments:

1) By construction, PROMETHEE methods standardise the differences among companies based on the flows of those companies who dominate or outrank others (positive flows), netted by those companies that do not support this dominance relationship (negative flows). We only employ the information from the MCDA index by company in the econometric analysis. These net flows are able to detect small changes in the corporate governance information across years and industries, and determine the relative strength of firms instead of the absolute strength, as the weighted averages (traditional index) shows in relation their peers.

   Figure 2.3 shows the behaviour of the traditional and MCDA indices by year and by industries. While the proposed index reveals that, on average, companies were having difficulties before, during and after the crisis period (i.e., years with negative MCDA index), the traditional index fails to pinpoint this situation.

The MCDA index also reveals which industries (i.e., 1, 2, 4, 7 and 9) contain companies that, relative to their respective industry peers, were not well managed according to the corporate governance perspectives considered. The traditional index, based upon absolute and no relative values, fails again to identify this observation.

2) The outranking analysis allows comparing the traditional corporate governance index with the MCDA approach using a panel data structure across firms and controlling by years and industries. For instance, by arbitrarily selecting six companies (with the following data identifiers: ID-50, ID-116, ID-162, ID-233, ID-285 and ID-690 from the energy industry, Figure 2.4 shows that most of them have, on average, a traditional governance index above 60%; however, the MCDA index shows that there are some companies with negative values (e.g., ID-162 and ID-285) in relation to their industry peers in some years. As Andriosopoulos et al. (2012) and Gaganis et al. (2010) indicate (describing the assumptions on the outranking methods), these companies are not at least as good as the other companies in terms of corporate governance practices and mechanisms. Hence, this variability in the corporate governance outcomes is not easily observed using the traditional index, mainly, because it is not based on relative comparison among companies or outranking flows.

Figure 2.4. Average corporate governance index by industries and years during 2002–2014 using two approaches

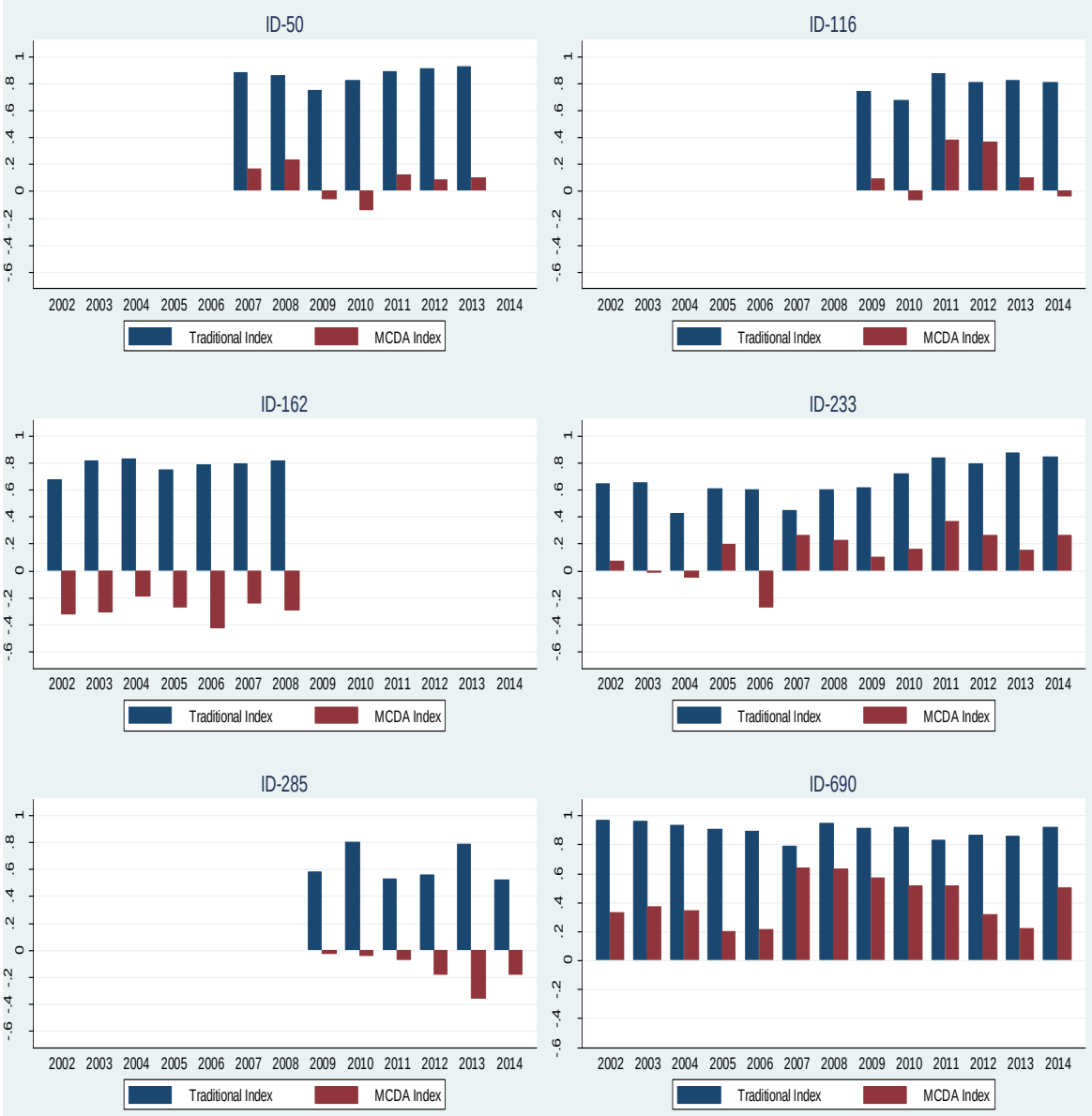


Figure 2.5. Corporate governance (traditional index vs. MCDA index) for selected companies in the energy industry

3) The MCDA approach also allows drilling down on the related corporate governance perspectives in order to visualise one of the main concerns about the traditional corporate governance scores (absolute strength of firms). For example, from Figure 2.5, considering the companies ID-50, ID-285 and ID-690 from the energy sector (y-axis is corporate governance score; no data reported for ID-50 in 2014), it is

possible to observe that company ID-285 has a lower performance on the perspective vision and strategy (*vstr_d*) during 2012–2014, and the traditional approach grades this company with at least 50%, on average, in the governance score. Particularly in 2013, ID-285 is closer to 80% in the traditional governance score. However, our MCDA index finds that this company cannot be as good as the other industry peers since it reports negative figures. In addition, note that both ID-50 and ID-690 outrank ID-285 in different governance perspectives; however, ID-50 is not at least as good as ID-690, which dominates them in most of the corporate governance aspects and provided a relative better strength to the other firms under analysis.

Figure 2.6. Corporate governance perspectives, traditional index and MCDA index for three companies in the energy industry

In terms of pair comparisons, it is important to realize that the proposed aggregate quality of corporate governance also considers information about whether the other peers provide enough arguments to confirm or refute the outranking relationship of a given company. In fact, we argue that the proposed index is more consistent for comparing companies across different corporate governance perspectives, strengthening a non-compensatory aggregation. Finally, these preliminary visual aids through the outranking analysis show that the MCDA-based approach penalises those firm with problems to report or comply with the corporate governance aspects; an approach relying on the dominance relationships among companies relative to their industry.

2.4.3. Firm performance and corporate governance

In the broad area of corporate governance research, on the one hand, some authors are using either aggregate measures of corporate governance (i.e., indices or ratings) (Gompers et al., 2003; Bebchuk et al., 2006; Brown & Caylor, 2006; Bhagat et al., 2008; Vander Bauwhede & Willekens, 2008; Ertugrul & Hegde, 2009; Alimehmeti & Paletta, 2014). On the other hand, some scholars are relying on a specific corporate governance criterion, practice or mechanism (i.e., board structure, ownership, board function, duality, among other aspects) (Brown & Caylor, 2006; Bhagat & Bolton, 2008; Brown et al., 2011; Wang et al., 2012; Wintoki et al., 2012; Krause et al., 2014) to analyse company performance (i.e., operational, sales, efficiency, returns, valuations, risk and so on).

Across these studies, one natural and common variable associated with corporate governance studies is return on assets (ROA), which in particular evaluates the strength

of operating performance in a company and determines how efficient managers are at utilizing the company's resources to generate income (Bhagat & Bolton, 2008; Bhagat et al., 2008). Indeed, Table 2.7 presents some research where ROA has been used as a dependent variable on corporate governance studies, either as a single criterion or an aggregate measurement. As well, note the puzzle associated with the relationship between corporate governance and firm performance. From Datastream, it is possible to obtain return on assets by dividing earnings before interest, taxes, depreciation and amortization (EBITDA) and total assets. In addition, Table 2C.1 in the Appendix 2C provides more information about the Datastream codes and definitions, among other aspects.

Table 2.7. Company performance (ROA) and corporate governance

Paper	Sample/Period	Corporate governance information	Methodology	Relationship
Wintoki et al. (2012)	6,000 (20,000 firm-years); 7 two-year intervals (1991–2003)[17]	Board size, independence, duality	Pooled OLS, Fixed Effects, GMM	Negative and none in some specifications
Daines et al. (2010)	USA listed firms: 5,059 for CGQ, 1,565 for GMI, 1,906 TCL, and 6,714 for AGR[18]; period 2005–2007	Corporate governance ratings: ISS (CGQ) , GIM, TLC, AGR	Pooled OLS	Limited evidence of relationship
Renders et al. (2010)	Two samples of EU countries (1,199 firm-years for FTSEurofirst 300); period 1999–2003	Deminor rating on corporate governance	Pooled OLS, 2SLS	Negative and positive
Ertugrul and Hegde (2009)	1,618 for ISS ratings, 1,487 for GMI[19] ratings; 4.820 for TCL; period 2004–2006	Proprietary indices: ISS (CGQ)[20]; TCL and GMI ratings	Pooled OLS	Negative and positive
Bhagat and Bolton (2008); Bhagat et al. (2008)	1500 USA companies; period 1999–2002	Academic and propietry indices: GIM G-Index[21]; BCF E-Index[22]; Glass Lewis; TCL[23] Benchmark score; Brown and Caylor Gov-score; Brown and Caylor Gov-7	2SLS-3SLS	Negative and none in some specifications

[17] Firms are collected from CRSP and Compustat, no market was given.
[18] Audit Integrity's Accounting Governance and Risk.
[19] Governance Metrics International.
[20] ISS Corporate Governance Quotient.
[21] Gompers, Ishii and Metrick's G-Index.
[22] Bebchuck, Cohen and Ferrell's index.
[23] The Corporate Library's index.

Paper	Sample/Period	Corporate governance information	Methodology	Relationship
Larcker et al. (2007)	2,106 USA Inc. companies included in the major indices (e.g., Fortune 500, S&P Super 1500, etc.), period 2002–2003	Principal component analysis, obtaining 14 factors that retain 61.7% of the total variance of 37 corporate governance criteria	Pooled OLS, Recursive partitioning	Negative and none in some specifications
Klapper and Love (2004)	374 companies emerging markets, year 2000	CLSA[24] Governance index	Pooled OLS	Positive
Yermack (1996)	452 USA industrial corporations, period 1984–1991	Board size and board independence	Pooled OLS, Fixed Effects	Negative and positive

Finally, from Table 2.7 it can be observed that none of the literature has assessed the corporate governance score provided by Datastream that, in contrast other metrics, notably adds information about companies' vision and strategy, nor have scholars used information about corporate governance from recent years, particularly after the crisis period (2007–2008). As a result, this research also provides both a fresh perspective using a new proprietary index[25] and its influence on company performance, and updated company information in a large panel, especially during and after the crisis period.

2.4.4. Company-specific characteristics

The firm-specific variables used in this paper are similar to those employed in related studies of corporate governance and firm performance. Thus, as suggested we use size, age, number of business segments, growth opportunities, debt and stock price volatility. Although Table 2C.1 in the Appendix 2C shows further details (i.e., Datastream's and

[24] Corporate Governance and Sustainability in Asia.

[25] Although the proposed MCDA approach uses ASSET4 ESG (corporate governance score from Datastream), additional indices can be included and evaluated (i.e., GMI, ISS-CGQ, G-Index, Bebchuck, among other shown in Table 2.7). However, some are not subscribed in the University of Hull database; others only contain small data sets (years or companies), or cover other countries or firms, or do not show data especially during and after the crisis period. Future research might also consider contrasting and comparing other indices (academic or proprietary) reported by the literature using MCDA.

Thomson One Banker's codes and clarifications), here they are described and justified as follows:

- Size: Daines et al. (2010); Renders et al. (2010) and Wintoki et al. (2012) recommend market value of equity (*mv*) in logarithm form as a firm's size (*lmv*).
- Age (*age2fndinc)*: Brown and Caylor (2006); Renders et al. (2010) and Wintoki et al. (2012) use the natural log of the company's age to control the estimations (*lage2fndinc*). Particularly, in contrast to the Wintoki et al. (2012), who use the first date when a company shows up in CRSP, we use the information from Thomson One Banker associated with both the founding date and incorporation date (when both exist, the older was considered), and for those companies delisted, age was adjusted appropriately.
- Number of business segments (*busegm*): This variable is considered, as in Wintoki et al. (2012), as the logarithm of the number of business segments (*lbusegm*). By year, the total number of business segments reported by each company are revised following the codification provided by Thomson One Banker.
- Growth opportunities: For this variable the market-to-book ratio (*mtb2*) is taken into account. Other studies also examine this variable as a firm performance, which is associated with Tobin's Q despite its limitations (Gugler et al., 2004); however, Linck et al. (2008); Lehn et al. (2009) and Wintoki et al. (2012) provide empirical evidence of the notion that growth options are a cause, rather than an effect, in corporate governance structures.
- Debt (*ltdebtasset*): This is the ratio of the company's long-term debt to total assets, which is recommended by Brown et al. (2011); Alimehmeti and Paletta (2014) and Wintoki et al. (2012) as a control variable.

- Stock price volatility (*nvolreturn*): This is the standard deviation, over the past 12 months, of the monthly company's return index (RI in Datastream). It controls the estimation by the company's risk (Bhagat & Bolton, 2008; Bhagat et al., 2008; Wintoki et al., 2012).

Table 2.8 and Table 2.9 show the summary statistics for the performance variable and firm-specific characteristics for the periods 2002–2008 and 2009–2014, respectively.

Table 2.8. Company performance (ROA) and firm characteristics (2002–2008)

	Statistics	2002	2003	2004	2005	2006	2007	2008
roa	mean	0.104	0.115	0.130	0.135	0.146	0.139	0.109
	median	0.109	0.113	0.121	0.128	0.130	0.130	0.117
	sd	0.182	0.112	0.107	0.124	0.123	0.123	0.173
	min	-1.845	-0.715	-0.690	-1.025	-0.560	-0.604	-1.446
	max	2.649	0.757	0.603	1.373	1.215	0.927	1.496
	n	995	1,017	1,060	1,088	1,092	1,097	1,085
mv ($millions)	mean	7,898	10,279	11,423	12,182	13,447	15,278	10,874
	median	2,122	3,140	3,639	4,187	4,562	5,362	3,506
	sd	21,699	27,062	28,398	27,872	30,440	34,097	25,844
	min	17	17	26	69	45	64	4
	max	238,925	314,470	359,981	366,810	392,643	499,157	396,453
	n	1,000	1,013	1,040	1,069	1,097	1,133	1,153
mtb2	mean	1.664	1.943	1.998	2.130	2.051	2.235	1.713
	median	1.280	1.462	1.549	1.621	1.663	1.742	1.359
	sd	1.223	1.310	1.342	2.681	1.305	1.665	1.099
	min	0.348	0.431	0.571	0.374	0.372	0.302	0.371
	max	16.342	9.991	12.102	74.927	12.658	21.219	10.061
	n	891	916	956	981	984	1,031	1,035
busegm	mean	4.09	4.08	4.07	4.05	4.04	4.02	4.01
	median	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	sd	2.08	2.07	2.07	2.06	2.05	2.06	2.05
	min	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	max	8.00	8.00	8.00	8.00	8.00	8.00	8.00
	n	978	991	1,002	1,034	1,064	1,096	1,125
age2fndinc	mean	35.47	36.16	36.54	36.97	37.25	37.90	38.60
	median	24.00	25.00	25.10	26.00	26.70	27.00	28.00
	sd	30.09	30.15	30.28	30.41	30.41	30.58	30.69
	min	0.10	0.20	0.10	0.20	0.10	0.10	0.10
	max	103.00	104.00	105.00	106.00	107.00	108.00	109.00
	n	1,016	1,025	1,042	1,057	1,072	1,074	1,056
ltdebtasset	mean	0.224	0.215	0.207	0.199	0.212	0.225	0.240
	median	0.206	0.195	0.177	0.159	0.168	0.180	0.211
	sd	0.212	0.184	0.186	0.182	0.271	0.260	0.219
	min	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	max	3.478	1.384	1.404	1.046	6.991	5.846	2.671
	n	1,062	1,086	1,111	1,133	1,133	1,131	1,116

	Statistics	2002	2003	2004	2005	2006	2007	2008
nvolreturn	mean	0.120	0.095	0.077	0.074	0.072	0.073	0.136
	median	0.097	0.079	0.067	0.067	0.065	0.067	0.128
	sd	0.080	0.064	0.049	0.036	0.036	0.036	0.072
	min	0.023	0.020	0.017	0.019	0.000	0.000	0.000
	max	0.687	0.775	1.024	0.313	0.310	0.560	0.844
	n	990	1,006	1,021	1,048	1,079	1,111	1,141

Table 2.9. Company performance (ROA) and firm characteristics (2009–2014)

	Statistics	2009	2010	2011	2012	2013	2014
roa	mean	0.106	0.128	0.130	0.120	0.122	0.120
	median	0.102	0.118	0.122	0.116	0.113	0.114
	sd	0.152	0.113	0.118	0.137	0.105	0.144
	min	-1.385	-0.699	-0.564	-1.679	-0.750	-2.964
	max	2.307	0.985	1.337	1.297	0.827	0.650
	n	1,089	1,068	1,042	1,007	983	956
mv ($millions)	mean	10,684	11,902	11,653	14,242	16,212	18,084
	median	3,699	4,307	4,294	5,249	6,199	6,775
	sd	23,754	25,386	26,021	34,361	33,598	38,629
	min	3	1	0	0	0	0
	max	324,775	318,992	354,458	611,742	438,831	584,387
	n	1,159	1,182	1,197	1,203	1,203	1,203
mtb2	mean	1.683	1.785	1.683	1.796	1.988	2.029
	median	1.364	1.423	1.309	1.424	1.594	1.644
	sd	1.033	1.194	1.091	1.168	1.337	1.325
	min	0.278	0.289	0.243	0.266	0.295	0.345
	max	11.335	16.594	10.060	10.987	17.534	12.321
	n	1,028	1,014	1,005	972	861	833
busegm	mean	4.00	3.99	3.99	3.98	3.98	3.98
	median	4.00	4.00	4.00	4.00	4.00	4.00
	sd	2.04	2.04	2.03	2.03	2.03	2.03
	min	1.00	1.00	1.00	1.00	1.00	1.00
	max	8.00	8.00	8.00	8.00	8.00	8.00
	n	1,139	1,150	1,170	1,185	1,188	1,188
age2fndinc	mean	39.19	39.74	40.69	41.75	42.72	43.85
	median	28.60	29.00	30.00	31.00	32.00	33.35
	sd	30.76	30.88	31.03	31.13	31.14	31.18
	min	0.20	0.10	0.70	1.70	2.70	3.70
	max	110.00	111.00	112.00	113.00	114.00	115.00
	n	1,044	1,046	1,030	992	971	946
ltdebtasset	mean	0.227	0.218	0.229	0.242	0.247	0.256
	median	0.199	0.190	0.200	0.211	0.221	0.230
	sd	0.198	0.193	0.200	0.219	0.217	0.202
	min	0.000	0.000	0.000	0.000	0.000	0.000
	max	1.479	1.817	1.988	2.077	2.161	1.732
	n	1,112	1,096	1,060	1,033	1,013	991
nvolreturn	mean	0.144	0.089	0.085	0.079	0.064	0.058
	median	0.113	0.087	0.080	0.063	0.055	0.053
	sd	0.128	0.050	0.052	0.288	0.069	0.046
	min	0.000	0.000	0.000	0.000	0.000	0.000
	max	1.212	0.632	0.380	9.882	1.262	0.552
	n	1,153	1,168	1,187	1,201	1,203	1,203

Note that to avoid sample selection bias, as was explained by Wintoki et al. (2012), an unbalanced panel is used; thus, the number of firms differs the number of years, and estimations use all the available information associated with the USA firms in the ASSET4 ESG in Datastream. Note that the higher average volatility can be observed during the period 2008–2009. ROA takes values between 10% and 15% during 2002–2014, and the statistics for the other variables are comparable to the empirical literature. Finally, Table 2.10 presents the relationship (correlations) among company performance, corporate governance and company-specific variables.

Table 2.10 Correlations among the selected variables (performance, corporate governance and firm-specific)

	roa	ncgvi	aqcg d	lmv	mtb2	nvolreturn	lbusegm	lage2fndinc	ltdebtasset
1roa	1								
ncgvi	0.0354*	1							
aqcg d	-0.0247	0.5454*	1						
lmv	0.1531*	0.2391*	0.3144*	1					
mtb2	0.3928*	-0.0432*	-0.0285	0.1529*	1				
nvolreturn	-0.1977*	-0.0844*	-0.0443*	-0.2393*	-0.0435*	1			
lbusegm	0.0110	0.1000*	0.1067*	0.2032*	-0.1030*	-0.0493*	1		
lage2fndinc	0.0674*	0.1693*	0.1680*	0.1805*	-0.0303	-0.1224*	0.1855*	1	
ltdebtasset	-0.0195	-0.0389*	-0.0227	-0.0996*	-0.1057*	0.0835*	-0.1203*	-0.0484*	1

Note: * indicates pairwise correlation is significant with Bonferroni-adjusted significance levels of 0.05 or less.

2.4.5. Modes for the explanatory analysis

The main rational followed by the proposed MCDA approach is to evaluate whether the dominance relationships among peer companies, in terms of corporate governance practices and mechanisms, increase the statistical significance and explanatory power in contrast to a traditional corporate governance index. This approach tends to overcome the following concerns: 1) heterogeneity among companies, sector and

corporate governance mechanisms (Mehran et al., 2011), and 2) stickiness due to the most corporate governance criteria remaining unchanged for long periods of time (Brown et al., 2011; Schnyder, 2012). Thus, our MCDA perspective detects even small changes among companies and homogenises the industry and firm differences in terms of net flows (credits and debits among companies). As a result, the approach yields stronger and more reliable estimations for the regression models adopted by the literature for corporate governance studies (see e.g., Yermack (1996); Daines et al. (2010); Brown et al. (2011); Wintoki et al. (2012); Cremers and Ferrell (2014); among others revised in Table 2.7).

The modelling setup considers the following equations to estimate and contrast the explanatory power and statistical significant of (*ncgvi*), the traditional corporate governance metric provided by Datastream (ASSET4 ESG), and the new metric (*aqcg_d*), the aggregate quality of corporate governance using the proposed MCDA approach obtained through a deep process of pair comparisons. Relevant tests are implemented to evaluate whether a specific specification is necessary (Baltagi, 2008; Duanmu & Guney, 2009; Brown et al., 2011; Galariotis et al., 2016), such as the Breusch-Pagan LM test and Hausman test. The model can be seen as follows:

1. For pooled OLS modelling, equations 1.5 and 1.6 are set:

$$roa_i = \beta_0 + \beta_1 ncgvi_i + \beta_2 controlvar_i + \varepsilon_i \qquad (Eq\ 1.5)$$

$$roa_i = \beta'_0 + \beta'_1 agcg\_d_i + \beta'_2 controlvar_i + \varepsilon'_i \qquad (Eq\ 1.6)$$

where *i* identifies the listed companies

2. The models for panel data analysis can be shown as follows (*i* refers to firms and *t* to time):

$$roa_{it} = \beta_0 + \beta_1 ncgvi_{it} + \sum_{k=1} \gamma_k \, controlvar_{it} + \varpi_i + \varpi_t + \eta_{it} \qquad (Eq\ 1.7)$$

$$roa_{it} = \beta'_0 + \beta'_1 accg\_d_{it} + \sum_{k=1} \gamma'_k \, controlvar_{it} + \varpi_i' + \varpi_t' + \eta_{it} \ (Eq\ 1.8)$$

where *roa* is the ratio of EBITDA (earnings before interest, taxes, depreciation and amortization) to total assets; β_0 is the constant term; β_1 is our coefficient of interest; γs are estimable slope terms; ϖ_i represents unobserved and time-invariant firms' fixed effects including the industry group they operate in; ϖ_t is for time-specific effects that potentially influence all firms; η_{it} is the time-varying error term that is serially uncorrelated with mean zero and variance and *controlvar* are as explained in Section 1.4.6. The model uses year dummies as further controls.

Although we claim that stickiness is the major limitation on corporate governance studies, and the traditional aggregate measurements are deficient in providing enough evidence about corporate governance dynamics among companies, we test also other adjustments on the models specification based on Core et al. (2006) and Ertugrul and Hegde (2009). For example, they use future operating performance[26] regressed on current corporate governance information and control variables to avoid two issues. Firstly, to evaluate whether endogeneity (corporate governance might affect performance or vice versa) can be a limitation; and secondly, to avoid look-forward bias (incorrect assumption that companies' performance is immediately affected by the instantaneous release of corporate governance information at the end of the fiscal year). This non-contemporaneous approach is also use in Bhagat et al. (2008) mainly to evaluate whether corporate governance indices predict future performance.

[26] For ROA, we use the average measure for years *t*+2 and *t*+1, or for lagging analysis similar to Bhagat and Bolton (2008).

Finally, this modelling setup not only allows testing, in a contemporaneous perspective, of the MCDA approach (outranking relationships among companies) on corporate governance quality and firm performance, but also extends its analysis on those specifications that help to overcome other types of endogeneity, beyond the unobserved heterogeneity mentioned by Brown et al. (2011) that may affect the stability results.

2.5. Results

In this study the second part of the analysis, which is phase two of the proposed approach illustrated in Figure 2.1, is developed by estimating the regression model (multivariate analysis); however, before this some univariate analyses are implemented, mainly to asses a general concern raised by Mehran et al. (2011), who emphasise that corporate governance is fully heterogeneous and mainly differs between financial and non-financial sectors; furthermore, according to Brown et al. (2011) that heterogeneity, mostly problematic to be observed, could be also a source of endogeneity.

2.5.1. Univariate Analysis

Using pair comparisons among companies and an aggregate quality of governance based on net flows that synthesise companies' differences and outranking perspectives, it is possible to evaluate whether by this approach these heterogeneities could be mitigated. Thus, our dataset is divided into two panels (non-financial and financial sector) as suggested by Mehran et al. (2011), and the univariate analyses are implemented (t-test and Wilcoxon test of difference in means and medians, respectively) in order to test the differences for firm performance, corporate governance measurements and control variables.

Table 2.11 shows that the mean and median differences between the performance of firms in non-financial and financial sectors are statistically significant at the 1% level (Panel A) as well as for the traditional corporate governance index (Panel B), growth opportunities, volatility, firm age and capital structure (Panel C). For the business segments, the mean difference is significant only at the 10% level, and for firm size neither the mean nor the median is statistically different between two groups.

Table 2.11. Univariate analysis: t-test and Wilcoxon test for difference in means and medians

Panel A. Performance variables

	Non-financial			Financial			Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
roa	11267	0.136	0.0480	2312	0.0635	0.133	0.0725***	44.5699***

Panel B. Corporate governance variables

	Non-financial			Financial			Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
ncgvi	8293	0.739	0.695	1878	0.672	0.777	0.067***	18.5636***
aqcg d	8293	-0.216	0.00417	1878	0.000	0.00494	0.3301	0.4153

Panel C. Firm-specific characteristics

	Non-financial			Financial			Non-financial vs. Financial	
	N	Mean	Median	N	Mean	Median	t-test	Wilcoxon
lmv	11934	8.511	8.369	2718	8.510	8.384	0.001	-0.7939
mtb2	10578	1.994	1.100	1929	1.372	1.582	0.622***	30.1842***
nvolreturn	11820	0.0920	0.0587	2691	0.0784	0.0783	0.0136***	18.7087***
lbusegm	11647	1.250	1.386	2663	1.220	1.386	0.03*	3.4509***
lage2fndinc	10906	3.320	3.246	2465	3.081	3.367	0.239***	11.4142***
ltdebtasset	11460	0.231	0.109	2617	0.203	0.208	0.028***	8.4966***

Notes: See Table 2C.1 for the definitions of the variables. *** p<0.01, ** p<0.05, * p<0.1.

In particular, the differences associated with the measures of central tendency for aggregate quality of corporate governance (*agcg_q*) using the MCDA approach, as expected, are small and without statistical significance between two industries. This

fact also corroborates an important characteristic of the PROMETHEE methods since the net flows (i.e., the difference between "credits" and "debits" flows) homogenises the global average comparisons among industries and years. However, the use of both flows allows uncovering differences in terms of outranking relationships among companies.

2.5.2. Regression analysis (multivariate analysis)

In order to assess the explanatory power and the statistical significance of the variables under analysis, and to compare the traditional corporate governance index (*ncgvi*) against the MCDA approach (*aqcg_d*), Table 2.12, Table 2.13 and Table 2.14 present the results of twelve regression models on different specifications, which are tuned by with and without years and sectors dummies. In addition, Table 2D.1 (Appendix 2D) provides information about the VIF coefficients for multicollinearity. For further explanations, any value of a predictor in models with VIF aggregated or equal to 10 indicates a high level of multicollinearity.

Table 2.12 shows the model's specifications associated with pooled OLS (corrected by robust standard errors). Thus, models stated in columns 1 to 4 show that the MCDA variable is statistically significant at a 1% level, in contrast to *ncgvi* where there is no evidence of statistical significance. Note that the standard errors are robust to heteroscedasticity, are clustered by firm level, and are reported in parentheses below the coefficients.

Table 2.12. Multivariate analysis: corporate governance and company performance (ROA_t) on different OLS settings

	(1)	(2)	(3)	(4)
Variables	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**
ncgvi	0.00404		-0.00719	
	(0.00719)		(0.00726)	
aqcg_d		-0.0196***		-0.0203***
		(0.00431)		(0.00420)
lmv	0.00418***	0.00577***	0.00615***	0.00750***
	(0.00128)	(0.00131)	(0.00132)	(0.00136)
mtb2	0.0464***	0.0460***	0.0462***	0.0459***
	(0.00210)	(0.00210)	(0.00217)	(0.00217)
nvolreturn	-0.285***	-0.279***	-0.343***	-0.337***
	(0.0286)	(0.0284)	(0.0363)	(0.0361)
lbusegm	0.00644***	0.00659***	-0.000483	-0.000407
	(0.00223)	(0.00223)	(0.00221)	(0.00221)
lage2fndinc	0.00789***	0.00857***	0.00516***	0.00572***
	(0.00125)	(0.00125)	(0.00127)	(0.00127)
ltdebtasset	-0.00705	-0.00715	-0.0201*	-0.0196*
	(0.0116)	(0.0116)	(0.0120)	(0.0119)
Constant	-0.00455	-0.0178	0.0285**	0.0100
	(0.0120)	(0.0125)	(0.0137)	(0.0138)
Observations	8,412	8,412	8,412	8,412
R-squared	0.274	0.276	0.323	0.324
Year	No	No	Yes	Yes
Sector	No	No	Yes	Yes
Adjusted R2	0.274	0.276	0.320	0.322
F/Wald statistic	162.224	163.746	113.044	112.617
P-value F/Wald	0.000	0.000	0.000	0.000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In addition to the traditional OLS settings, we assume that pooled OLS might suffer from some endogeneity because of individual-firm effects and hidden heterogeneity among companies. Table 2.13 displays the results of testing the relevance of panel data (random effects) against pooled OLS to correct some unobserved heterogeneity among the information. Therefore, the Breusch-Pagan LM test contrasts the pooled OLS and random effects estimations (models in columns 5 to 8); the significant p-value rejects

the null hypothesis that there are no panel effects, hence favouring the random effects results.

Table 2.13. Multivariate analysis: corporate governance and company performance (ROA_t) on different panel data (random effects) specifications

	(5)	(6)	(7)	(8)
Variables	**Random Effects**	**Random Effects**	**Random Effects**	**Random Effects**
ncgvi	0.000357		-0.00630	
	(0.00731)		(0.00748)	
aqcg_d		-0.00870*		-0.0105**
		(0.00476)		(0.00473)
lmv	0.0106***	0.0111***	0.0126***	0.0130***
	(0.00165)	(0.00165)	(0.00165)	(0.00166)
mtb2	0.0355***	0.0354***	0.0360***	0.0359***
	(0.00126)	(0.00126)	(0.00129)	(0.00129)
nvolreturn	-0.168***	-0.166***	-0.173***	-0.172***
	(0.0171)	(0.0171)	(0.0192)	(0.0192)
lbusegm	0.000373	0.000516	-0.00660	-0.00646
	(0.00436)	(0.00435)	(0.00420)	(0.00419)
lage2fndinc	0.00777***	0.00821***	0.00599**	0.00628***
	(0.00238)	(0.00237)	(0.00236)	(0.00236)
ltdebtasset	-0.0727***	-0.0721***	-0.0700***	-0.0694***
	(0.00853)	(0.00853)	(0.00857)	(0.00857)
Constant	-0.0267	-0.0320**	-0.00713	-0.0166
	(0.0162)	(0.0162)	(0.0184)	(0.0184)
Observations	8,412	8,412	8,412	8,412
R-squared				
Year	No	No	Yes	Yes
Sector	No	No	Yes	Yes
Adjusted R2	0.254	0.256	0.304	0.306
F/Wald statistic	1491.813	1497.18	1792.432	1799.645
P-value F/Wald	0.000	0.000	0.000	0.000
Number of id	1,075	1,075	1,075	1,075
Hausman				
P-value H				
Breush_Pagan	3485.318	3458.802	2720.729	2696.323
P-value B-P	0.000	0.000	0.000	0.000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.14 shows the result for panel data (fixed effects). The Hausman test[27] is also implemented comparing fixed effects (models 9 to 12) and random effects estimations (Table 2.13); the significant p-value rejects the null hypothesis that the unobserved entity's heterogeneity is uncorrelated with the regressors, hence favouring fixed effect results.

Table 2.14. Multivariate analysis: corporate governance and company performance (ROA_t) on different panel data (fixed effects) specifications

	(9)	(10)	(11)	(12)
Variables	**Fixed Effects**	**Fixed Effects**	**Fixed Effects**	**Fixed Effects**
ncgvi	0.00172		0.000983	
	(0.00782)		(0.00808)	
aqcg_d		-0.00262		-0.00272
		(0.00516)		(0.00518)
lmv	0.0173***	0.0174***	0.0201***	0.0201***
	(0.00229)	(0.00229)	(0.00243)	(0.00243)
mtb2	0.0291***	0.0291***	0.0291***	0.0291***
	(0.00152)	(0.00153)	(0.00157)	(0.00157)
nvolreturn	-0.124***	-0.124***	-0.101***	-0.101***
	(0.0180)	(0.0180)	(0.0202)	(0.0202)
lbusegm				
lage2fndinc	0.00137	0.00181	0.00991	0.0100
	(0.00507)	(0.00507)	(0.00645)	(0.00645)
ltdebtasset	-0.117***	-0.117***	-0.104***	-0.104***
	(0.0107)	(0.0107)	(0.0109)	(0.0109)
Constant	-0.0461**	-0.0471**	-0.101***	-0.101***
	(0.0230)	(0.0231)	(0.0287)	(0.0283)
Observations	8,412	8,412	8,412	8,412
R-squared	0.122	0.122	0.131	0.131
Year	No	No	Yes	Yes
Sector	No	No	Yes	Yes
Adjusted R2	0.212	0.213	0.214	0.215
F/Wald statistic	169.086	169.126	61.158	61.175
P-value F/Wald	0.000	0.000	0.000	0.000
Number of id	1,075	1,075	1,075	1,075
Hausman	188.135	189.637	245.191	247.127
P-value H	0.000	0.000	0.000	0.000
Breush_Pagan				
P-value B-P				

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

[27] This procedure is simply to contrast fixed and random effects. Note that the Hausman test cannot be used with vce(robust), vce(cluster cvar), or p-weighted data (StataCorp_LP, 2015). Once selected the specification models should be adjusted by robust standard errors as reported in order to correct likely heteroscedasticity, if any.

It is important to emphasise that the favouring models need to be adjusted by robust standard errors to correct some heteroscedasticity that might affect the results. Table 2.15 presents the results for the fixed effects' specification (models 1 and 2) accounting for standard error robust to heteroscedasticity and clustered by sectors. Therefore, to complement fixed effects specifications we also use panel-corrected standard error (PCSE) estimates (Greene, 2012). PCSE assumes that the errors are heteroscedastic and contemporaneously correlated across panels (models 3 and 4). The results show a clear dominance of *agcg_d*, which is statistically significant at a 5% level at the least, in contrast to *ncgvi* that does not reveal any evidence of its statistical significance.

In spite of the expected sign of *agcg_d* being aligned with some other corporate governance studies (Bhagat et al., 2008; Ertugrul & Hegde, 2009; Daines et al., 2010), these results for the MCDA approach are consistent for all the model's specifications associated with pooled OLS and panel data. Indeed, the higher the company's *agcg_d*, which represents a stronger dominance and outranking relationships among its peers on corporate governance practices and mechanisms, the higher the penalisation or punishment of the company's performance.

Additionally, this MCDA approach shows a remarkable stability on sign and statistical significance in contrast to a traditional corporate governance metric. The explanatory power of the specification with *agcg_d* is also higher than the traditional corporate governance index, and where the MCDA approach is involved, the evidence supports statistically (sign and significance) that company-specific information (i.e., size, growth opportunities, volatility, age and debt) also impacts on performance.

Table 2.15. Multivariate analysis: the link between contemporaneous corporate governance and company performance (final models)

	(1)	(2)	(3)	(4)
Variables	**Fixed Effects Robust**	**Fixed Effects Robust**	**GLS PCSE**	**GLS PCSE**
ncgvi	-0.00719		-0.0113	
	(0.00736)		(0.00805)	
aqcg_d		-0.0203**		-0.0157***
		(0.00699)		(0.00485)
lmv	0.00615	0.00750*	0.00995***	0.0106***
	(0.00336)	(0.00352)	(0.00176)	(0.00178)
mtb2	0.0462***	0.0459***	0.0367***	0.0367***
	(0.00958)	(0.00970)	(0.00241)	(0.00240)
nvolreturn	-0.343***	-0.337***	-0.149***	-0.150***
	(0.0516)	(0.0514)	(0.0433)	(0.0432)
lbusegm	-0.000483	-0.000407	-0.00327	-0.00315
	(0.00362)	(0.00360)	(0.00354)	(0.00352)
lage2fndinc	0.00516***	0.00572***	0.00606***	0.00640***
	(0.00156)	(0.00164)	(0.00188)	(0.00188)
ltdebtasset	-0.0201	-0.0196	-0.0616***	-0.0602***
	(0.0317)	(0.0317)	(0.0127)	(0.0126)
Constant	0.00807	-0.0104	-0.000477	-0.0158
	(0.0255)	(0.0278)	(0.0186)	(0.0190)
Observations	8,412	8,412	8,412	8,412
R-squared	0.274	0.276	0.191	0.193
Number of sect	10	10		
Year	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Adjusted R-squared	0.279	0.281		
Number of id	1,075	1,075	1,075	1,075
F/Wald statistic	48.09	81.59	1485.341	1508.31
P-value F/Wald	0.000	0.000	0.000	0.000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Standard errors are clustered by industry for models (1) and (2).

Finally, the negative sign of *agcg_d* is aligned with some other corporate governance studies using traditional corporate governance indices (Bhagat et al., 2008; Ertugrul & Hegde, 2009; Daines et al., 2010). Note that the possible reason for the negative association between corporate governance and firm performance may stem from the

fact that companies allocate significant amounts of time and resources in order to comply with good corporate governance practices.

2.6. Final Considerations

Although the results in Table 2.15 are highly consistent, we investigate whether our findings are sensitive to other considerations. Firstly, following Larcker et al. (2007) and Renders et al. (2010), we introduce some sub-sampling analyses (i.e., financial vs. non-financial firms and the latest financial crisis period [2007–2008]). Secondly, we follow Wintoki et al. (2012); Bellemare et al. (2015), among others, who suggest the use of lagging all explanatory variables for partial control of the endogeneity concerns. In addition, as we argue that stickiness is the major limitation on corporate governance studies, and that the traditional aggregate measurements fail to provide enough evidence about dominance relationships in terms of corporate governance practices and mechanisms among companies. Consequently, we also consider other adjustments as discussed in Core et al. (2006) and Ertugrul and Hegde (2009). These papers use also future operating performance regressed on current corporate governance information and control variables to avoid two issues. One, to evaluate whether endogeneity (corporate governance might affect performance or vice versa) can be a limitation; and two, to avoid look-forward bias (incorrect assumption that performance is immediately affected by the instantaneous release of governance information at the end of the fiscal year). This non-contemporaneous approach is also used by Bhagat et al. (2008) mainly to evaluate whether corporate governance indices predict future performance.

Table 2.16 shows that our corporate governance metric is still negative and significant at the 1% level for both sectors and during the latest global financial crisis period,

whereas the traditional measure is either insignificantly or weakly related to firm performance across these sub-samples

Table 2.16. Corporate governance and firm performance based on sub-sampling (non-financial & financial sector and crisis period 2007–2008): additional robustness analyses

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Fixed Effects Non-financial**	**Fixed Effects Financial**	**Fixed Effects Non-financial**	**Fixed Effects Financial**	**Fixed Effects Crisis**	**Fixed Effects Crisis**
ncgvi	-0.0204*	-0.0103			-0.0140	
	(0.0117)	(0.00788)			(0.0221)	
aqcg_d			-0.0204***	-0.0216***		-0.0435***
			(0.00689)	(0.00481)		(0.0126)
lmv	0.00196	0.00672***	0.00305*	0.00806***	0.00753**	0.0107***
	(0.00180)	(0.00116)	(0.00185)	(0.00119)	(0.00317)	(0.00326)
mtb2	0.0702***	0.0440***	0.0699***	0.0437***	0.0534***	0.0528***
	(0.00227)	(0.00110)	(0.00226)	(0.00109)	(0.00304)	(0.00302)
nvolreturn	-0.195***	-0.373***	-0.184***	-0.370***	-0.500***	-0.478***
	(0.0281)	(0.0238)	(0.0284)	(0.0238)	(0.0623)	(0.0624)
lbusegm	-0.0111***	0.00246	-0.0118***	0.00251	-0.000705	-0.000257
	(0.00362)	(0.00231)	(0.00358)	(0.00230)	(0.00600)	(0.00597)
lage2fndinc	-0.000114	0.00554***	0.000492	0.00608***	0.00611*	0.00747**
	(0.00219)	(0.00141)	(0.00219)	(0.00141)	(0.00368)	(0.00367)
ltdebtasset	0.0300***	-0.0359***	0.0287***	-0.0350***	-0.00253	-0.00332
	(0.00923)	(0.00715)	(0.00920)	(0.00713)	(0.0176)	(0.0175)
Constant	0.00727	0.0164	-0.0174	-0.00384	-0.0162	-0.0611*
	(0.0213)	(0.0133)	(0.0216)	(0.0135)	(0.0336)	(0.0340)
Observations	1,147	7,265	1,147	7,265	1,381	1,381
R-squared	0.514	0.267	0.516	0.269	0.273	0.279
No of firms	173	902	173	902	806	806
F/Wald statistic	62.74***	139***	63.36***	140.3***	63.88***	65.87***

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Industry and time dummies are included in all models. Standard errors are clustered by industry.

Table 2.17 reports the results when we regress the current firm performance (ROA_t) on all explanatory variables lagged by one period assuming that they are valid instruments for endogeneity issues.

Table 2.17. Current firm performance and lagged corporate governance

	(1)	(2)	(3)	(4)
Variables	**Fixed Effects**	**Fixed Effects**	**PCSE**	**PCSE**
Lag ncgvi1	-0.00178		0.00343	
	(0.00544)		(0.00875)	
Lag aqcg_d1		-0.0175*		-0.00937*
		(0.00835)		(0.00521)
Lag lmv1	0.00565*	0.00694*	0.00613***	0.00687***
	(0.00302)	(0.00336)	(0.00180)	(0.00180)
Lag mtb21	0.0474***	0.0472***	0.0414***	0.0413***
	(0.00892)	(0.00906)	(0.00246)	(0.00244)
Lag nvolreturn1	-0.298***	-0.292***	-0.153***	-0.153***
	(0.0747)	(0.0741)	(0.0407)	(0.0406)
Lag lbusegm1	0.00107	0.00117	0.00154	0.00165
	(0.00375)	(0.00383)	(0.00344)	(0.00342)
Lag lage2fndinc1	0.00553***	0.00611***	0.00681***	0.00719***
	(0.00107)	(0.00120)	(0.00193)	(0.00192)
Lag ltdebtasset1	0.0164	0.0167	0.0360***	0.0359***
	(0.0157)	(0.0157)	(0.0134)	(0.0133)
Constant	0.000355	-0.0141	-0.00981	-0.0147
	(0.0243)	(0.0262)	(0.0188)	(0.0189)
Observations	7,875	7,875	7,875	7,875
R-squared	0.251	0.252	0.189	0.191
Number of firms	1,070	1,070	1,070	1,070
F/Wald statistic	405.63***	266.33***	1515.885***	1530.448***

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Industry and time dummies are included in all models. Standard errors are clustered by industry for models (1) and (2). The dependent variable is ROA measured at time *t* in all models.

In addition, Table 2.18 and Table 2.19, respectively, consider future performance ROA_{t+1} and ROA_{t+2}, and Table 2.20 takes into consideration future performance as the average of ROA_{t+1} and ROA_{t+2}, regressed on contemporaneous corporate governance measurements and other firm-specific factors. All the results in these tables reveal that our main findings hold true. Once more, for all the specifications, our measure *agcg_d* affects future company performance significantly with a negative link, whereas the traditional measure *ncgvi* has no significant association with future ROA. These findings may shed some light on the conflicting evidence in the literature as summarised in Table 2.7.

Table 2.18. Current corporate governance and future company performance (ROA_{t+1})

Variables	(1) Fixed Effects ROA_{t+1}	(2) Fixed Effects ROA_{t+1}	(3) PCSE ROA_{t+1}	(4) PCSE ROA_{t+1}
ncgvi	-0.00178		0.00343	
	(0.00544)		(0.00875)	
aqcg_d		-0.0175*		-0.00937*
		(0.00835)		(0.00521)
lmv	0.00565*	0.00694*	0.00613***	0.00687***
	(0.00302)	(0.00336)	(0.00180)	(0.00180)
mtb2	0.0474***	0.0472***	0.0414***	0.0413***
	(0.00892)	(0.00906)	(0.00246)	(0.00244)
nvolreturn	-0.298***	-0.292***	-0.153***	-0.153***
	(0.0747)	(0.0741)	(0.0407)	(0.0406)
lbusegm	0.00107	0.00117	0.00154	0.00165
	(0.00375)	(0.00383)	(0.00344)	(0.00342)
lage2fndinc	0.00553***	0.00611***	0.00681***	0.00719***
	(0.00107)	(0.00120)	(0.00193)	(0.00192)
ltdebtasset	0.0164	0.0167	0.0360***	0.0359***
	(0.0157)	(0.0157)	(0.0134)	(0.0133)
Constant	0.000355	-0.0141	-0.00981	-0.0147
	(0.0243)	(0.0262)	(0.0188)	(0.0189)
Observations	7,875	7,875	7,875	7,875
R-squared	0.251	0.252	0.189	0.191
Number of firms	1,070	1,070	1,070	1,070
F/Wald statistic	405.63***	266.33***	1515.88***	1530.44***

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Industry and time dummies are included in all models. Standard errors are clustered by industry for models (1) and (2). The dependent variable in models 1-4 is ROA_{t+1}.

Table 2.19. Current corporate governance and future company performance (ROA_{t+2})

Variables	(5) Fixed Effects ROA_{t+2}	(6) Fixed Effects ROA_{t+2}	(7) PCSE ROA_{t+2}	(8) PCSE ROA_{t+2}
ncgvi	-0.00616		-0.00544	
	(0.00610)		(0.00948)	
aqcg_d		-0.0189**		-0.0120**
		(0.00816)		(0.00573)
lmv	0.00535	0.00666*	0.00475**	0.00544***
	(0.00311)	(0.00341)	(0.00192)	(0.00193)
mtb2	0.0433***	0.0431***	0.0336***	0.0335***
	(0.00824)	(0.00839)	(0.00251)	(0.00250)
nvolreturn	-0.229***	-0.224***	-0.103***	-0.103***
	(0.0676)	(0.0675)	(0.0395)	(0.0393)
lbusegm	0.00191	0.00199	0.000431	0.000503
	(0.00352)	(0.00362)	(0.00395)	(0.00393)
lage2fndinc	0.00501***	0.00557***	0.00517**	0.00551***
	(0.00126)	(0.00127)	(0.00206)	(0.00206)
ltdebtasset	0.0158	0.0164	0.00298	0.00361
	(0.0158)	(0.0159)	(0.0153)	(0.0152)
Constant	0.0192	0.00161	0.0430**	0.0321
	(0.0202)	(0.0216)	(0.0204)	(0.0206)
Observations	7,072	7,072	7,072	7,072
R-squared	0.202	0.204	0.155	0.156
Number of firms	1,049	1,049	1,049	1,049
F/Wald statistic	83.80***	317.33***	1184.80***	1196.01***

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Industry and time dummies are included in all models. Standard errors are clustered by industry for models (5) and (6). The dependent variable in models 5–8 is ROA_{t+2}.

Table 2.20. Current corporate governance and average future company performance

	(1)	(2)	(3)	(4)
Variables	**Fixed Effects ROA$_{t+1}$ to ROA$_{t+2}$**	**Fixed Effects ROA$_{t+1}$ to ROA$_{t+2}$**	**PCSE ROA$_{t+1}$ to ROA$_{t+2}$**	**PCSE ROA$_{t+1}$ to ROA$_{t+2}$**
ncgvi	-0.00567		-7.96e-05	
	(0.00553)		(0.00630)	
aqcg_d		-0.0200*		-0.00789**
		(0.00886)		(0.00388)
lmv	0.00524	0.00666*	0.00293*	0.00347**
	(0.00298)	(0.00332)	(0.00167)	(0.00167)
mtb2	0.0457***	0.0454***	0.0328***	0.0328***
	(0.00827)	(0.00842)	(0.00222)	(0.00222)
nvolreturn	-0.246***	-0.240***	-0.0745***	-0.0747***
	(0.0685)	(0.0680)	(0.0284)	(0.0284)
lbusegm	0.00205	0.00214	0.00258	0.00266
	(0.00349)	(0.00359)	(0.00313)	(0.00312)
lage2fndinc	0.00482***	0.00542***	0.00545***	0.00572***
	(0.00102)	(0.00107)	(0.00181)	(0.00180)
ltdebtasset	0.0144	0.0150	0.0266**	0.0267**
	(0.0159)	(0.0160)	(0.0118)	(0.0117)
Constant	0.0124	-0.00583	0.0355**	0.0299*
	(0.0208)	(0.0227)	(0.0172)	(0.0173)
Observations	7,015	7,015	7,015	7,015
R-squared	0.292	0.294	0.256	0.257
Number of firms	1,046	1,046	1,046	1,046
F/Wald statistic	59.56***	1465.37***	1405.53***	1420.08***

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PCSE stands for panel-corrected standard errors. Industry and time dummies are included in all models. Standard errors are clustered by industry for models (1) and (2). The dependent variable in all models is the average of ROA$_{t+1}$ and ROA$_{t+2}$.

To summarize the research framework, Figure 2E.1 in the Appendix 2E links the resulting sections of this research with the proposed MCDA approach from Figure 2.1. This figure displays for future research, the general perspectives and guidelines to analyse internal corporate governance approaches, and also extends the information provided by Galariotis et al. (2016) in their study of financial performance and local government issues, in order to get a better understanding of some theoretical and practical financial problems using MCDA methodologies and techniques.

In addition, this chapter also discloses the different routines programmed and executed to implement the PROMETHEE methods in VBA-Excel (see Appendix 2F) in order to

estimate the aggregate quality of corporate governance. Therefore, Appendix 2G displays the Stata® 14 code with all the regression models implemented and the different Outreg2 commands to export the results for their analysis. These are key aspects to extend the research and the practical implications of the aggregate quality of corporate governance and firm performance.

2.7. Conclusions

This study introduces a novel perspective, using multi-criteria decision analysis (MCDA) based on outranking analysis, to evaluate corporate governance heterogeneities and internal practices and mechanisms to see how they are addressed and controlled. Furthermore, computing a new aggregate quality of corporate governance based on the same information used for the traditional corporate governance index construction but employing an exhaustive set of pair comparisons and outranking analysis, uncovering the relative strength of firms in term of their corporate governance practices rather than absolute strength abtained from traditional approaches, provides robustness in the empirical results.

We used traditional pooled OLS (unreported results) panel data fixed and random effects estimation methods with robust standard errors. We also conducted regressions for different sampling frameworks and addressed at least partially the endogeneity concerns, noting that our novel corporate governance measure is less susceptible to endogeneity relative to its existing alternatives. In all cases, we found that our measure for corporate governance quality is significantly and negatively associated with firm performance, but this link is very weak or non-existent when the traditional measure is opted for. One may attribute the costs related to following various ‘good’ corporate

governance practices to the negative link between corporate governance quality and financial performance. Namely, there are various direct costs of maintaining good corporate governance (i.e., board function, board structure, compensation policy, shareholders' rights and vision and strategy), but the underlying benefits may not be as tangible as company managers would expect.

The proposed MCDA approach, based on the PROMETHEE methods, reveals a new and fundamental path to analyse the link between corporate governance and firm performance. Moreover, it overcomes the limitations of traditional governance indices that are associated with various problems such as weighting and stickiness. Traditional measurements thus fail to detect and scrutinize small differences among companies regarding their governance quality. Therefore, our approach can be used by policymakers, investors, managers, shareholders and stakeholders to evaluate the stability and explanatory power of other existing indices to understand how corporate governance mechanisms affect firm performance. This paper does not intend to compromise the current practices of selecting companies for investments. Rather, our main goal is to contribute to the current literature of corporate financial decision making and to extend the MCDA based on the multi-dimensional perspectives of corporate governance information.

Surely, our analysis itself is subject to some limitations: i) the corporate governance adjustments and transformations implemented (nominal to numeric, see Table 2.2) may be examined by external parties (i.e., investors, regulators and other stakeholders). Therefore, other academics and proprietary indices need to be scrutinised and assessed by paying careful attention to the corporate governance indicators, perspectives, benchmark for normalization and information overlapping, among other aspects; and ii)

the comparisons among companies to get the aggregate quality of corporate governance is developed across industries; however, other circumstances (i.e., law and regulation), relative weights of preferences (compensatory schemes) over the criteria selected and sensitivity analysis, among other robustness and simulations analyses are out of the scope of the current research. Future research is warranted on mitigating such limitations.

Chapter 3. Mapping the corporate governance assessment into a reliability model using machine-learning techniques

Abstract: *Corporate governance has become an important aspect in assessing how well controlled and managed companies are to create value for shareholders. In fact, shareholders and investors support their decisions (investment or financing) on companies' information and reports (financial and non-financial). For this reason, transparency (reporting and disclosure) is capital for a company's stability (managers' and shareholders' alignment and company performance).*

Although many scholars consider corporate governance as a complex system, with input/output variables and with a (maybe unknown) functional model, to date there has been little agreement on how reliable this system is and what factors could enhance the performance of a company.

This original research introduces the system reliability theory to model the behaviour of companies. Particularly, we propose the assessment of the corporate governance framework by mapping its inputs as components (either in operating or failed state) along with firm-specific conditions (i.e., age, size, risk, growth) to determine an approximate Structure Function that enables modelling the functioning of the system. The advantage of the proposed mapping approach is illustrated using a sample of 1,109 US listed companies during the period 2002–2014, reporting financial and non-financial information as components of the corporate governance system and the returns on assets (ROA) as the system output.

Keywords: *Corporate governance, Financial risk, Firm performance, Machine learning, System reliability, Structure function*

3.1. Introduction

Corporate governance examination is largely focused on internal mechanisms (i.e., board function and structure, ownership, remunerations incentives, and so forth) and external mechanisms (i.e., investor protection, law enforcement, property rights, and so on). In general, scholars emphasise that corporate governance is a system to assess companies' control, direction and alignment between managers and shareholders (Cadbury, 1992; Haxhi & Aguilera, 2015). This alignment depends on internal corporate governance, which pertains to firm-level mechanisms for dealing mainly with agency problems (conflict of interests among the members of an organization), and on external corporate governance to protect stakeholders and minority shareholders from corporate actions (Jensen, 1986; La Porta et al., 2000).

Nevertheless, corporate governance also can be affected by unscrupulous actions of manager and shareholders (Clarke, 2004), leading to shared-value destruction (Tricker, 2012), accounting fraud (Bhagat et al., 2008), and so forth. Notably, Vander Bauwhede and Willekens (2008); Kieff and Paredes (2010); Tricker (2012) mention some problems that had arisen during the recent financial (2007–2008); for example, uncontrolled managerial remuneration, lack of company transparency and passive regulation, among other aspects. Although corporate governance presents inefficiencies, there is no doubt that it is evolving. Market participants continue requiring more information related to corporate governance mechanism and practices, and companies and decision makers are more aware of transparency (Tricker, 2012).

In terms of the corporate governance framework, Mason and Simmons (2014); Aguilera and Crespi-Cladera (2016) and Lipton and Rosenblum (1991), among other authors,

have perceived it as a system, composed of practices and mechanisms, that ensures managers are aligned to shareholders' interests through the board of directors in order to create a stable environment to generate profits. As an example, many studies suggest that firm performance indices (e.g., information disclosure) could be linked to return on assets (ROA) (Bhagat & Bolton, 2008; Bhagat et al., 2008).

In this case, performance indices are considered as the input variables and ROA as the system output. Lack of proper "functioning" in the input variables could affect system output, for example, companies' benefits and also economy stability. Regarding these impacts, Cormier et al. (2010) and Mahr et al. (2015) emphasise that information disclosure, particularly about the status of the corporate governance components, represents an imperative aspect to show whether boards are effective at controlling managers and aligning them with the shareholders' interests. In other words, transparency is a significant quality in making companies and financial markets more reliable, mainly because it reduces those monitoring costs incurred by investors when they want to gather financial and non-financial information (i.e., corporate governance).

Traditional approaches to evaluate how corporate governance and its components impact on company performance have been carried out, either using aggregated indices (i.e., ISS Corporate Governance Quotient, Gompers, Ishii and Metrick's G-Index, the Corporate Library's index., among others) (Bhagat & Bolton, 2008; Bhagat et al., 2008; Renders et al., 2010) or specific components (board size, duality, ownership) (Larcker et al., 2007; Brown et al., 2011; Wintoki et al., 2012; Aslan & Kumar, 2014), but these approaches offer contradictory findings about company performance. For example, some findings show that a strong corporate governance undermines performance (Bhagat & Bolton, 2008; Bhagat et al., 2008), while others suggest either an

enhancement (Ertugrul & Hegde, 2009; Renders et al., 2010) or mixed impacts (Larcker et al., 2007; Wintoki et al., 2012).

However, far too little attention has been paid to the fact that corporate governance can be modelled as a reliability system (operating and failed states associated with components and outputs). So, despite its low reliability or high trustworthiness, how can decision makers analyse which components of corporate governance have the most impact? What components (practices and mechanisms) are enriching well-functioning companies? What firm-specific characteristics are more related to system reliability?

This paper seeks to address these questions using the systems reliability theory, which according to Rausand and Høyland (2004) helps to evaluate the ability of an item or group of them (i.e., components or systems considered as an entity) to perform a required function under certain given conditions (external or internal) and during a stated period of time. To the best of our knowledge, this is the first research approach to assess how reliable a corporate governance system could be, assuming that its components or elements (items) can be characterized by two states: 1) operating, when companies disclose information, and 2) failed, when companies are not reporting or following the best (required) practices of corporate governance, and these components' failures are independent events. In addition, certain external and internal conditions can be involved in the system, which are associated with specific-firm characteristics (i.e. age, size, growth opportunities, risk, and so forth).

In summary, we propose the study of the corporate governance framework from the system reliability theory point of view, mapping input variables to system components and analysing under what conditions the corporate governance system is operating or

has failed, by deriving its approximate structure function (*SF*) to thus be able to model the functioning of the system for given states of its components. From here, decision makers can analyse which components affect the system the most, what type of corporate governance components are enriching well-functioning companies, what is the probability that the system is operating, as well as other aspects. To the best of our knowledge, this type of assessment has not been reported in the literature.

Therefore, the approach using the systems reliability theory provides a fresh standpoint for investigating what corporate governance components and specific conditions cause companies to perform their required function (value creation for shareholders). In other words, a corporate governance system is reliable when certain components are operating and condition are given, and consequently, the system output is functioning as it should be. Hence, managers and shareholder alignment increases and companies perform properly.

The proposed reliability system approach is implemented on a case study containing 1,109 listed companies in the US market. These companies have reported financial and non-financial information in the segment ASSET4 ESG (Datastream™) for the period 2002–2014. As a result, the data is summarised into a panel of 8,412 company-year observations.

The rest of the chapter is organized as follows. Section 2.2 introduces corporate governance as a system, and describes the role of companies' disclosure (reporting) to understand how transparency can impact on the system stability. Section 2.3 presents a general overview about reliability systems and the main aspects to map corporate governance components and specific conditions in this field. Section 2.4 describes the

case study (data selected, corporate governance components, system output, and firm-specific conditions) and Section 2.5 shows the main results and discussions. Finally, Section 2.6 concludes the chapter and outlines some future research directions.

3.2. Corporate governance system and disclosure

Corporate governance is a set of practices and mechanisms (hereafter "components") that assures not only that companies can allocate their resources according to their objectives (i.e., value creation), but also that they are managed in the best interest of shareholders (Hillman et al., 2009; Brown et al., 2011; Tricker, 2012; Mallin, 2013). Lipton and Rosenblum (1991) were one of the first authors to introduce corporate governance as a system. They claim that this system works in two ways: 1) it ensures alignment between managers and shareholders and 2) it creates a stable environment to generate sustainable profits. Alterations on the system (as whole or in its components) could harm companies' benefits and an economy as a whole.

Corporate governance by itself can be divided in internal and external systems. The internal is related to firm-level mechanisms to deal with conflict of interests among those who own capital (shareholders) and those who control the business (executives) (Hart, 1995; Clarke, 2004), and the external takes into consideration investor protection, law enforcement, property rights, and so forth to protect stakeholders and minority shareholders from corporate fraud or theft (Jensen, 1986; La Porta et al., 2000). However, according to Lipton and Lorsch (1992a), most of a company's problems between control and ownership are not highly associated with the structure of laws and regulations.

Scholar acknowledge that Unbalances between control and ownership mostly appear because of the failure of internal devices regarding the boards of directors' roles, obligations, and duties, which affect the corporate governance system, especially guarantying fiduciary duty from managers to shareholders and value creation (García-Castro et al., 2013; Bellavite Pellegrini et al., 2016). Consequently, this study begins by scrutinising how some authors see corporate governance as a system. With this systems viewpoint in mind, Table 3.1 (sorted by years) presents some scholarly perspectives about corporate governance and guidelines for evaluating it through the lenses of reliability systems.

Table 3.1. Corporate governance as a system approach

Authors	Observations and perspectives
Lipton and Lorsch (1992a)	The cornerstone of the corporate governance system is the board of directors, which legitimises both actions taken and decisions made by managers in the name of the shareholders. Thus, the system should be capable of producing meaningful information about the board of directors, company performance and its managerial leadership.
Holmstrom and Kaplan (2003)	One of the major risks for the corporate governance systems, especially in the US, is overregulation, which can be costly and counterproductive for companies. However, because of many corporate governance scandals, the Sarbanes-Oxley Act of 2002 has helped to renovate confidence in the US corporate governance system, and these authors consider that a less effective system leads to poor company productivity and performance. However, it is important to assess executive compensation, shareholders' interests and the board of directors' decisions.
Strine Jr (2007)	A rational corporate governance system should rely more on accountability, abandoning some unnecessary staggered or classified boards, implementing clearer corporate elections, and controlling managerial compensation, without forgetting that companies should generate benefits for both shareholders and stakeholders (employees, communities, for example).
Mason and Simmons (2014)	A corporate governance system has faith in the board of directors, that defines and exercises corporate strategies according to the key beneficiaries' interests. For instance, one element of the system is corporate social responsibility. It helps business as a linkage between companies' outcomes and stakeholders' viewpoints.
García-Castro et al. (2013)	Corporate governance is perceived as an insider system (shareholders-oriented), mainly because the governance practices and mechanisms are noticeably interrelated with different firm perspectives (e.g., firm performance, value creation)

Authors	Observations and perspectives
Bellavite Pellegrini et al. (2016)	Corporate governance systems are observed from a separation perspective. Indeed, they consider the implications of the separation between managerial and supervisory bodies. For instance, in a one-tier system the board of directors and the supervisory board work together, and in a two-tier system both boards work separately.
Aguilera and Crespi-Cladera (2016)	These authors state that governance can be represented as a leadership system, with practices of managerial control, and norms and mechanisms that shape how companies are directed and governed in the best interest of the shareholders.

According to these authors, corporate governance can be seen as a system with many components (practices, mechanisms, accountabilities, and so forth) where managers, shareholders and the board of directors are aligned to make companies perform their required function (i.e., profit generation and value creation, among other aspects). Furthermore, shareholders and stakeholders, especially investors, evaluate the level and types of information disclosure about corporate governance's practices, which are reported by companies to reveal how well controlled and directed they are (Matoussi & Jardak, 2012; Chahine & Zeidan, 2014). In other words, decision makers rely, primarily, on transparency (disclosure and reporting) for corporate governance matters in order to assess whether it is functioning properly.

Omran and Abdelrazik (2013) point out that disclosure is a channel wherein shareholders and stakeholders can obtain valuable information regarding a corporate governance system (e.g., level of managerial control and alignment, decision-making difficulties, power distribution, and so forth), and can evaluate its likely impact on firm performance. Consequently, Table 3.2 presents some literature related to the fact that disclosure and reporting, representing the level of companies' transparency, provide the means to analyse and evaluate a corporate governance system.

Table 3.2. Transparency (reporting and disclosure) into a corporate governance system

Authors	Comments and perspectives
Adiloglu and Vuran (2012)	Corporate governance is a way to enhance transparency of the relationships between the shareholders, board of directors and managers in terms of roles and obligations to create sustainable value to all the stakeholders. When companies are more transparent and information accountable, the investors' confidence improves. This is one of the basic aspects of a corporate governance system.
Chen et al. (2007)	They argue that poor reporting and disclosure create asymmetries of information for investors and produce large economic costs. Transparency helps shareholders to understand more thoroughly a firm's management and reputation and their impacts on performance (i.e., liquidity).
Cormier et al. (2010)	Reporting and disclosure are central aspects of a firm's governance configuration, showing that boards are effectively enforcing the corporate governance mechanisms and reducing the monitoring costs incurred by investors. Reporting corporate governance information (practices and mechanisms) is less costly than making market participants to gather it.
Hermalin and Weisbach (2012)	They claim that disclosing corporate governance information is seen as a good practice that reduces managerial fraud or theft, which is mostly stimulated by regulators and public scrutiny due to many corporate scandals (i.e., bankruptcies, market manipulations) that have affected shareholders.
Luo and Salterio (2014)	Divulging corporate governance practices allows market participants not only to evaluate whether companies are managed effectively but also to make informed decisions (i.e., buy companies' shares). Whether disclosure is mandatory or simply recommended, corporate governance depends on the companies' firm-specific characteristics.
Mahr et al. (2015)	Under efficient information, these authors remark the agency costs for those firms with bad governance are higher than for those with good governance. Hence, shareholders are able to pay a higher price for the better governed companies because of the reduction in monitoring and auditing costs.
Samaha et al. (2012)	Disclosing corporate governance practices uncovers companies' strengths and weaknesses in performance, uncertainties, ownership dispersion, human resources capabilities, and so forth. Consequently, corporate governance disclosure can be associated with many attributes (i.e., board function and composition, board size, CEO duality, ownership, audit committee) that investors monitor in order to see how companies are directed.

It can be noted that disclosure or lack of reporting allows characterising whether companies have their corporate governance components in an operating or failed state. Thus, they can be evaluated using reliability systems to see which ones are more aligned with the system that is functioning well in terms of company performance. In other

words, the corporate governance components in the operating state, through the lenses of transparency, enhance the systems reliability (linking good governance to firm performance) given certain firm-specific conditions.

From this review, several points can be summarized:

- There is a set of N input variables $\boldsymbol{x} = (x_1, x_2, \ldots, x_N)$ (binary or continuous). Each company could be evaluated using this set of variables.
- There is a set of output variables (binary or continuous) that mimics the performance of the company.
- The set of input variables, even if defined from theoretical or practical aspects, is not complete.
- The possible relationship between $\boldsymbol{x}$ and one selected output y is given by $y = SF(\boldsymbol{x})$, where Structure Function (SF) is an unknown function that must be determined or at least approximated.

These conditions allow us to map the corporate governance assessment (CGA) to a well-known mathematical model used in the reliability field, the structure function, to be able to model the functioning of the system for given states of its components, as explained in the next section.

3.3. Reliability Systems

In general, according to Rausand and Høyland (2004), the systems reliability theory considers reliability as the probability that an entity (i.e., item, component, subsystem or system) will carry out a desired function under certain conditions in a stated period of time. However, this concept was extended, even adopted by the ISO 8402, to account

for the extent to which an entity performs the required function (single or multiple) given external and operational conditions.

Therefore, Rausand (2014) states that reliability evaluations are always based on system models, and need to transform observable figures (i.e., operating or failure states) into reliability measures or importance indicators (Birnbaum Index, Fussell-Vesely's Measure, for example). However, the model shows balance simplicity (to manage available mathematical and statistical methods) and realism (to deduct practical results to support the decision-making process). Consequently, this section introduces some common definitions relating to reliability systems and proposes a general approach to map a corporate governance system.

3.3.1. Definitions

For this study, it is assumed that system components or elements have two states (operating and failed), component failures are independent events and the system is coherent (Colbourn & Colbourn, 1987). To clarify, the system can be represented with a Structure Function that takes into consideration the relationships between the states of components and the final system state (Gámiz & Martínez Miranda, 2010).

The state x_i of the *i*th component is defined as (Billinton & Allan, 1992):

$$x_i = \begin{cases} 1\ (operating\ state) \\ 0\ (failed\ state) \end{cases} \qquad (Eq\ 2.1)$$

Let P_i and $Q_i = 1 - P_i$ be the probabilities that component *i* is operating or failed, respectively. Note that $E[x_i] = P_i$.

Let $\boldsymbol{x} = (x_1, x_2, \ldots, x_N)$ be a vector representing the state of a system containing *N* components.

The performance of the whole system is described by the Structure Function (*SF*) (Colbourn & Colbourn, 1987):

$$y = SF(x) = \begin{cases} 1 \; if \; the \; system \; is \; operating \; in \; this \; state \\ 0 \; if \; the \; system \; is \; failed \; in \; this \; state \end{cases} \qquad (Eq\ 2.2)$$

The *SF* is a Boolean function expressed as a sum-of-product of terms related to the states of the components (x_i or their complements $\overline{x}_i$). In many cases, a transformation can be applied to derive an equivalent expression involving only the sum of disjoint products (SDP). From this SDP expression, the symbolic reliability expression (RE) of the system is obtained by changing logical sums and products with standard sums and products between real numbers and by substituting every component x_i with the corresponding probability P_i and every complement $\overline{x}_i$ with the probability Q_i (Rocco S & Muselli, 2004).

The numerical evaluation of the RE is used to determine the reliability of the system as well to solve several related problems, such as reliability allocation and optimisation (Aggarwal et al., 1982) or determining the importance of the components (e.g., by using the Birnbaum index[28] (Vasseur & Llory, 1999; Rausand, 2014), a sensitivity-based index evaluated as the difference between the reliability of the system when a selected component is perfectly functioning and the reliability of the system when the selected component is failed). Of course, other important measures (Vasseur & Llory, 1999) could be also evaluated.

[28] Note that according to Birnbaum (1968) this index measures the difference between the system reliability, namely, when the component (x_i) is totally faulty and when it is working perfectly. It can be observed that the Birnbaum index increases when the probability of operating of the other components in a system increases.

To illustrate, consider a system modelled by the network in Figure 3.1 (Rocco S & Muselli, 2004). The *SF* of this network is readily obtained by direct inspection, considering that the system is in the operating state if both components *1* and 3 are operating or both components *2* and *4* are operating, that is: $SF(x) = x_1x_3 + x_2x_4$, This *SF* is equivalent to the SDP expression $SF(x) = x_1x_3 + \bar{x}_1x_2x_4 + x_1x_2\bar{x}_3x_4$. Consequently, the RE for this system is given by $SF(x) = P_1P_3 + Q_1P_2P_4 + P_1P_2Q_3P_4$.

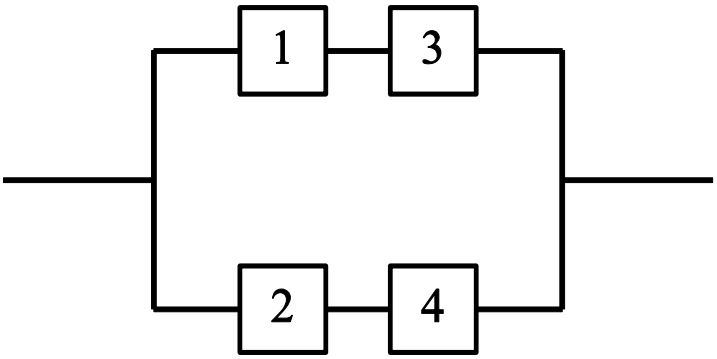


Figure 3.1. A four-component network representation

Source: Based on (Rocco S & Muselli, 2004)

When the *SF* is unknown, standard classification techniques, such as neural networks (Witten & Frank, 2011), support vector machines (Rocco & Moreno, 2002), decision trees (DT) (Bevilacqua et al., 2003; Rocco S, 2003) and Logic Learning Machine (LLM) (Cangelosi et al., 2013), among others, have been employed to retrieve or approximate the *SF* of a network. In this case, a set of different states of the network along with the components' states (the training set) is examined by the selected technique in order to assess if a proposed operation can be used to adequately mimic the behaviour of the network.

In some approaches (e.g., neural networks or support vector machines) the analytical expression of the operation (i.e., the binary function) derived is difficult to understand since it generally involves non-linear operators, whose meaning is not directly comprehensible. A possible solution to this problem consists of adopting rule generation methods (Muselli & Liberati, 2002) (e.g., decision trees, LLM), a particular kind of classification techniques that are able to generate a set of intelligible rules describing the binary function to be reconstructed. Usually, the rules assume the following **if-then-else** form: If X is true (operating) and Y is false (failed), then conclude the system is failed (i.e., $y = 0$).

For decision trees a set of conjunctive decision rules is built up. In this format, there are only **AND**'s within each rule, but each rule exists within an **if-then-else** structure.

For example, consider the system shown in Figure 3.1. Using all of the possible states in the network (i.e., $2^4 = 16$) and determining the system output by inspection (shown in Table 3.3, i.e., the training set), the DT presented in Figure 3.2 is derived (Rocco S & Muselli, 2004).

Table 3.3. Component and system states for the network shown in Figure 3.1

ID	x_1	x_2	x_3	x_4	$y = EF(\mathbf{x})$
1	0	0	0	0	0
2	0	0	0	1	0
3	0	0	1	0	0
4	0	0	1	1	0
5	0	1	0	0	0
6	0	1	0	1	1
7	0	1	1	0	0
8	0	1	1	1	1
9	1	0	0	0	0
10	1	0	0	1	0
11	1	0	1	0	1
12	1	0	1	1	1

ID	x_1	x_2	x_3	x_4	$y = EF(\boldsymbol{x})$
13	1	1	0	0	0
14	1	1	0	1	1
15	1	1	1	0	1
16	1	1	1	1	1

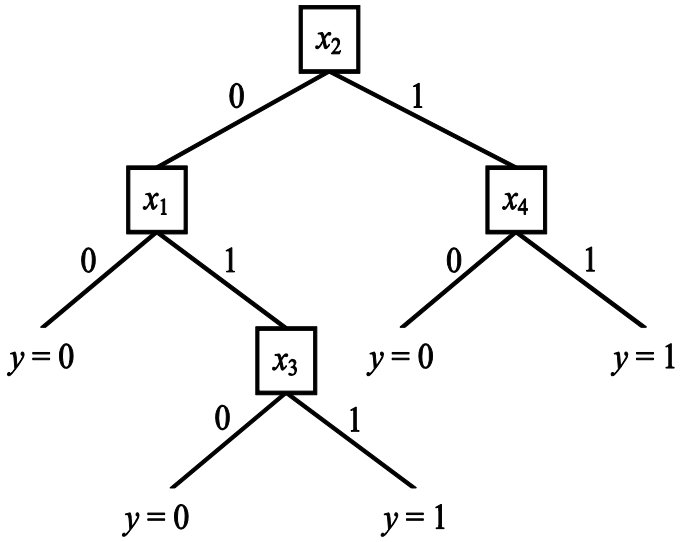


Figure 3.2. Example of a decision tree

Source: Based on (Rocco S & Muselli, 2004)

To determine if a selected network configuration is operating, its components' states are considered. First, the DT checks if the component x_2 is operating or failed. If x_2 is failed, the left branch is chosen and a new test on component x_1 is performed. If x_1 is failed, the left branch is chosen and $y = 0$ is concluded.

A DT is defined as a direct acyclic graph: nodes are either a decision node with two or more successors or a leaf node. Every leaf node is labelled with a class corresponding to the state of the system, whereas every decision node is associated with a test on a component's state and gives rise to one branch for each possible output of the test (Portela da Gama, 1999).

Given a DT, it is possible to extract a collection of rules by following the different paths that connect the root to the leaves. "Every node encountered produces a condition to be added to the **if** part of the rule; the final leaf contains the output value to be selected when all the conditions in the **if** part are satisfied. Since the tree is a direct acyclic graph we have as many rules as leaves" (Portela da Gama, 1999). As an example, for the tree shown in Figure 3.2, three rules give the output $y = 0$, while two rules give the output $y = 1$.

The set of decision rules derived from a DT are conjunctive decision rules: the conditions in the **if** part are connected through **AND** operations, whereas different rules are grouped in an **if-then-else** structure. For example, the following set of rules solves the problem in Figure 3.2:

if $x_1 = 0$ **AND** $x_2 = 0$ **then** $y = 0$

else if $x_1 = 0$ **AND** $x_4 = 0$ **then** $y = 0$

else if $x_2 = 0$ **AND** $x_3 = 0$ **then** $y = 0$

else if $x_3 = 0$ **AND** $x_4 = 0$ **then** $y = 0$

else $y = 1$

Other approaches (e.g., LLM) produce a set of compact rules for each class. For the previous example, the LLM approach produces the following rules:

If ($x_1 = 1$ **AND** $x_3 = 1$) then $y = 1$;

If ($x_2 = 1$ **AND** $x_4 = 1$) then $y = 1$

which is equivalent to the *SF* for this network, $SF(\mathbf{x}) = x_1x_3 + x_2x_4$.

In general, LLM produces better results than DT (Rocco & Muselli, 2007). However, DT rules are in disjoint form, so the RE can be easily determined. In contrast, rules generated by LLM are not disjointed, so an additional procedure has to be used to perform this task, such as the algorithm KDH88 (Heidtmann, 1989).

In many cases, the set of rules (Rocco & Muselli, 2007) derived is associated with special operators with a physical interpretation. For example, the set of rules for the class operating could correspond to the set of minpaths (a minpath is a set of elements that must simultaneously operate in order for the system to operate).

In real cases, the training set could not be completely derived by inspection since there are many system states to be analysed, the conditions for operation are not evident or, as in the corporate governance problem, the information is limited. In these cases, classification techniques are only able to extract an approximation of the *SF* of a network and, consequently only an approximated RE (ARE). In general, the approximation of the *SF* is better than the real one as long as the samples in the training set increase.

3.3.2. The proposed mapping

Table 3.4 shows a hypothetical set of 23 companies in a given year and country (i.e., the system to map corporate governance into reliability systems), and three particular input variables or components associated with board structure, coded as binary variables (the complete set of input variables to be used will be described in Section 2.4). For example: 1) *bs_poly_r* = 1, means that a company has a policy for maintaining a well-balanced membership of the board; 2) *bs_expe_r* = 0 means that companies do not disclose the average number of years each board member has been on the board;

and 3) *bs_noexe_r* = 1 indicates that companies report the percentage of non-executive board members in the board.

The average ROA (*roa_mean1*) is selected as the system output ***y***. An *roa_mean1* = 1 means that the system is in the operating state when a company is outperforming a reference value, and *roa_mean1* = 0 shows that the system is in the failed state (a company is underperforming a reference value). Please note that this output transformation, either operating or failed state, not only facilitates the reliability modelling to extract more precise rules from the machine learning techniques (Portela da Gama, 1999), but also mitigates the problem of combinatorial explosion (Witten & Frank, 2011). This issue appears when the number of combinations to examine a variable, continuous or with more categories, grows exponentially limiting the convergence of the machine learning algorithms.

Table 3.4. Components and system states for a given corporate governance system

Companies	x_1= bs_poly_r	x_2= bs_expe_r	x_3= bs_noexe_r	y = roa_mean1
Comp01	1	1	1	1
Comp02	1	1	1	0
Comp03	0	0	1	0
Comp04	1	1	1	1
Comp05	1	1	1	1
Comp06	1	1	1	0
Comp07	1	1	1	1
Comp08	0	1	1	0
Comp09	1	0	1	0
Comp10	1	1	1	1
Comp11	1	1	0	1
Comp12	1	0	1	0
Comp13	1	1	1	1
Comp14	1	1	1	0
Comp15	1	0	1	0
Comp16	1	1	1	1
Comp17	1	0	1	0
Comp18	1	1	1	0
Comp19	1	1	1	1
Comp20	0	1	0	0
Comp21	1	0	1	0
Comp22	0	1	1	1
Comp23	1	1	0	1

The main idea of the proposed approach is to extract an *SF* able to approximate the behaviour of the corporate governance assessment. This mapping into a reliability system gives a practical advantage for decision makers (i.e., investor and shareholders) because of: 1) it characterises the corporate governance components (operating or failure), thus enhancing a company's transparency (disclosure and reporting) as a central aspect for the system reliability; 2) it evaluates under what corporate governance conditions and firm-specific circumstances the system is functioning (managers and shareholders alignment and value creation, for example); and 3) the ARE derived could be used to numerically estimate the probability of the system functioning as well as component importance indices.

3.4. Case study

3.4.1. Data section

The case study for mapping the corporate governance assessment to reliability systems uses a dataset of 1,203 US–listed companies (period 2002–2014). The financial information is obtained from Datastream™ and Thomson One™, and the non-financial information from the segment ASSET4 ESG in Datastream. Therefore, companies are classified according to the data providers in ten economic sectors according to the ISIC (International Standard Industrial Classification). Finally, after correcting the dataset for some data anomalies (i.e., null, blanks, non-available (NA), and so forth), the original panel of 15,639 company-year observations has been reduced to 8,412 observations on 1,109 companies (Table 3.5).

Table 3.5. Sample size and classification

Sectors-Years	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Basic Materials	25	24	31	38	37	39	46	59	58	59	58	52	31	**557**
Consumer Cyclicals	51	51	68	84	88	89	119	130	142	149	141	118	93	**1323**
Consumer Non-Cyclicals	64	63	75	87	88	93	111	115	114	113	110	82	54	**1169**
Energy	24	24	45	46	46	51	67	70	67	66	66	56	47	**675**
Financials	29	32	65	82	80	82	118	130	130	140	133	78	48	**1147**
Healthcare	32	34	50	53	48	49	59	68	68	67	65	49	33	**675**
Industrials	47	49	66	72	70	74	111	129	130	129	124	106	78	**1185**
Technology	46	49	62	73	69	76	87	110	113	114	107	79	65	**1050**
Telecom. Services	8	8	10	8	9	9	14	15	15	14	13	7	5	**135**
Utilities	25	25	33	35	37	39	48	57	55	48	48	33	13	**496**
Total	**351**	**359**	**505**	**578**	**572**	**601**	**780**	**883**	**892**	**899**	**865**	**660**	**467**	**8412**

3.4.2. Corporate governance components

The segment ASSET4 ESG in Datastream identifies 33 corporate governance components that companies need to disclose, and these components belong to five corporate governance perspectives (board structure, board function, compensation policy, shareholder rights, and vision and strategy). Therefore, they are labelled according to the reliability systems approach; for instance, Table 3.6 shows their states meanings in form of operating "1" and failure "0". These binary outputs come from the evaluation of the data provided by Datastream and also follow the best corporate governance practices in terms of disclosure and transparency (Cadbury, 1992; Demise, 2006).

Finally, some data adjustments are also considered regarding data anomalies in order to characterise the component states, especially for the failed state. For instance, in

addition to the best practices of transparency, it is considered a failed stated either if Datastream reports the corporate governance index (Z-score) and a company does not report information in a specific component, or if one of two or more companies in a specific sector and year reports "NA" and the others show a data point in the same component. Thus, the company with a component in "NA" is considered in a failed state.

Note that in Chapter 1, the main aim is combining MCDA and corporate governance information not only to obtain an aggregate quality of corporate governance characterising the relative strength of firms, but also to assess its statistical impact on firm performance using the econometrics of data panel. Conversely, this chapter, relying on the theory of reliability systems, makes use of the different corporate governance practices and mechanisms as system components, in operating or failed state, to determine which one enhances or diminishes the system output (performance). This influence relies on machine learning techniques to define a structure function and consequently an approximated reliability expression. This reliability expression allows obtaining those governance aspects that affects the most firms' reliability or trustworthiness, and the well-functioning of the system regarding the system output.

Table 3.6. Corporate governance components to map to reliability systems

Perspectives	**Components**	**Definition (Operating "1", Failure "0")**
A. Board Structure: Shows how well-balanced the board of directors is in the corporate governance system.	1. bs_poly_r	Does the company have a policy for maintaining a well-balanced membership of the board? Y = 1, N = 0
	2. bs_expe_r	Does the company report the average number of years each board member has been on the board? Y = 1, N = 0
	3. bs_noexe_r	Does the company disclose the percentage of non-executive board members in the board? Y = 1, N = 0
	4. bs_indep_r	Does the company report the percentage of independent board members? Y = 1, N = 0

Perspectives	Components	Definition (Operating "1", Failure "0")
	5. bs_duality_r	Does the company report info about CEO-Chairman separation? Y = 1, N = 0
	6. bs_skills_r	Does the company report either the skills of every board member or the age of individual board members? Y = 1, N = 0
	7. bs_size_r	Does the company report the total number (#) of board members at the end of the fiscal year? Y = 1, N = 0
	8. bs_divers_r	Does the company report the percentage (%) of women in the board? Y = 1, N=0
B. Board function Measures the boards' and committees' role for managerial alignment and company control.	9. bf_iaudit_r	Does the company disclose the percentage (%) of independent board members on the audit committee as stipulated by the company? Y = 1, N = 0
	10. bf_imaudit_r	Does the company report the percentage (%) of non-executive board members on the audit committee as stipulated by the company? Y = 1, N = 0
	11. bf_audexp_r	Does the company have an audit committee with at least three members and at least one "financial expert" within the meaning of SOX? Y = 1, N = 0
	12. bf_icomcom_r	Does the company disclose the percentage (%) of independent board members on the compensation committee as stipulated by the company? Y = 1, N = 0
	13. bf_imcomcom_r	Does the company disclose the percentage (%) of non-executive board members on the compensation committee as stipulated by the company? Y = 1, N = 0
	14. bf_inomcom_r	Does the company report the percentage (%) of non-executive board members on the nomination committee? Y = 1, N = 0
	15. bf_imnoncom_r	Does the company disclose the percentage (%) of non-executive board members on the nomination committee as stipulated by the company? Y = 1, N = 0
	16. bf_bmeet_r	Does the company report the # of board meetings Y = 1, N = 0
	17. bf_bmeetave_r	Does the company disclose the average overall attendance percentage of board meetings as reported by the company? Y = 1, N = 0
C. Compensation policy Measures competitive compensation for executives and board members according to specific	18. cpoly_com_r	Does the company have a policy for performance-oriented compensation that attracts and retains senior executives and board members? Y = 1, N = 0
	19. cpoly_rem_r	Does the company disclose the highest remuneration package? Y = 1, N = 0
	20. cpoly_brem_r	Does the company disclose the total board member compensation of the non-executive board? Y = 1, N = 0
	21. cpoly_stok_r	Does the company's statutes or by-laws require that stock-options are only granted with a vote at a shareholder meeting? Y = 1, N = 0

Perspectives	Components	Definition (Operating "1", Failure "0")
financial or non-financial targets.	22. cpoly_ltcom_r	Does the company report the maximum time horizon of targets to reach full senior executives' compensation? Y = 1, N = 0
	23. cpoly_vest_r	Does the company report the # of years that most recently grant stock options or restrict stocks (since the granted date)? Y = 1, N = 0
D. Shareholder Rights Considers both equal treatment of shareholders and preventing the usage of anti-takeover devices.	24. shrt_poly_r	Do the companies have a policy to equally treat shareholders (large and minority) or limit the usage of anti-takeover devices? Y = 1, N = 0
	25. shrt_votrt_r	Are all shares of the company providing equal voting rights? Y = 1, N = 0
	26. shrt_own_r	Is a company owned by a reference shareholder with majority of the voting rights, veto power or golden share? Y = 0, N = 1
	27. shrt_clabs_r	Does the company have a classified board structure? Y = 0, N = 1.
	28. shrt_stabs_r	Does the company have a staggered board structure? Y = 0, N = 1.
E. Vision and strategy Evaluates management commitment to integrate financial and non-financial aspects into the daily operations.	29. vstr_chall_r	Is the company openly reporting information about the challenges or opportunities of integrating financial and extra-financial issues? Y = 1, N = 0
	30. vstr_csr_r	Does the company have a CSR committee or team? Y = 1, N = 0
	31. vstr_grcguid_r	Is the CSR report published according the GRI guidelines? Y = 1, N = 0
	32. vstr_csrrep_r	Does the company's extra-financial report consider also its global activities? Y = 1, N = 0
	33. vstr_csrxaud_r	Does the company have an external auditor of its CSR/Health & Safety/Sustainability report? Y = 1, N = 0

3.4.3. System output *y* (firm performance)

Several empirical studies investigating corporate governance and firm performance have tended to focus on specific governance components (practices or mechanisms) such as board structure, ownership, board function and duality, among other aspects (Brown & Caylor, 2006; Bhagat & Bolton, 2008; Brown et al., 2011; Wang et al., 2012; Wintoki et al., 2012; Krause et al., 2014). Although the system reliability approach

provides a competitive edge because it allows examining all components simultaneously, those studies suggest that return on assets (ROA), hereafter "system output," are a central aspect to link corporate governance components to firm performance.

ROA measures how efficiently managers are using the company's resources to generate profits (Bhagat & Bolton, 2008; Bhagat et al., 2008). It is computed in Datastream by dividing a company's earnings before interest, taxes, depreciation and amortization by its total assets. Thereupon, to map this information into the reliability system approach, the system output (*roa_mean1*) contains "1" if a company's ROA is outperforming the industry (the system is operating in this state), or "0" if it is underperforming the industry (the system is failed in this state).

3.4.4. Company-specific characteristics (other system conditions)

Although some studies in the field of data mining to evaluate corporate governance and firm performance failed to explore in depth company-specific conditions (Yue et al., 2008; Apparao et al., 2009; Moldovan & Mutu, 2015), other empirical studies (i.e., econometric approaches) on corporate governance have stated that firm-specific conditions also affect companies' performance, and their usage is central to understanding value creation. Those conditions include, for example, companies' age (Brown & Caylor, 2006; Renders et al., 2010; Wintoki et al., 2012), number of number of business segments (Wintoki et al., 2012), debt structure (Brown et al., 2011; Wintoki et al., 2012; Alimehmeti & Paletta, 2014), size (Daines et al., 2010; Renders et al., 2010), growth opportunities (Linck et al., 2008; Lehn et al., 2009) and risk (Bhagat et al., 2008; Wintoki et al., 2012), among others.

Therefore, the reliability systems approach presented in this paper takes into consideration firm-specific conditions in order to illustrate their potential impact on the system output. These specific conditions are explained as follows:

- Age (*comp_age)*: Takes into consideration both a company's founding date and incorporation date (when both exist, the older value is considered), and for those companies delisted, age was adjusted appropriately. This information is found in Thomson One Banker.
- Number of business segments (*numbusegm*): Measures the number of business segments reported by each company (at the end of the fiscal year). This information is also obtained from Thomson One Banker.
- Debt (*ltdebtasset_mean1*): The ratio of the company's long-term debt to total assets adjusted by the industry information from Datastream. For example, a company's ratio above the industry takes a value of 1, 0 otherwise.
- Size (*mv_mean1*): Takes into account market value of equity of a company adjusted by the industry information from Datastream. Thus, companies with values above the industry take a value of 1, 0 otherwise.
- Growth opportunities (*mtb_mean1*): The market-to-book ratio of a company, which supports the notion that growth opportunities are related to governance components. This ratio is also adjusted by the industry information from Datastream (i.e., companies' values above the industry takes a value of 1, 0 otherwise).
- Risk or stock price volatility (*nvolreturn_mean1*): Computed from the company's monthly return index (RI in Datastream) using the standard deviation of the past 12 months. It controls the reliability system by companies' risk.

In order to apply a classification method to generate an ARE, the set of all pairs (***x***, *y*) is organized into two subsets to be used in the training phase and in the subsequent performance evaluation of the resulting set of rules. To this aim, $N_T + N_E$ pairs (***x***, *y*) have been randomly assigned to each subset. The first N_T pairs are then used to form the training set, whereas the remaining N_E pairs are employed to evaluate the performance, according to the standard measure of *sensitivity, specificity* and *accuracy* (Veropoulos et al., 1999):

$$sensitivity = \frac{\mathrm{TP}}{\mathrm{TP+FN}}\,;\; specificity = \frac{\mathrm{TN}}{\mathrm{TN+FP}};\; accuracy = \frac{\mathrm{TP+TN}}{\mathrm{TP+TN+FN+FP}} \quad (Eq\ 2.3)$$

where

- TP (resp. TN) is the number of examples belonging to the class $y = 1$ (resp. $y = 0$) for which the classifier gives the correct output,
- FP (resp. FN) is the number of examples belonging to the class $y = 1$ (resp. $y = 0$) for which the classifier gives the wrong output.

For reliability evaluation, *sensitivity* gives the percentage of correctly classified operational states and the *specificity,* the percentage of correctly classified failed states.

The training set is selected using 70 % of the total pairs (Torgo, 1999) and the rest of the pairs are assigned to the testing dataset. However, to avoid unbalance in the sample set (i.e., the fact that there are more samples in the dataset belonging to class $y = 0$ than $y = 1$ or vice versa and therefore may derive naïve classifiers) a set of 8,412 balanced samples is selected (with approximately 50% of each class) from the total pairs.

As previously mentioned, DT algorithms produce rules that are easily converted to RE. For this reason, we will use a DT implemented in Weka (machine-learning software)

(Frank et al., 2004; Hall et al., 2009): the J48 algorithm (Cunningham & Holmes, 1999; Witten & Frank, 2011; Bhargava et al., 2013)

3.5. Results

3.5.1. Association rules and the Birnbaum index

The procedure J48 from Weka[29] extracts a set of 246 rules with some performance indices (i.e., accuracy):

Training phase	**Testing phase**
Accuracy = 71.55 %. TP = 64.3 %; FP = 35.7 % TN = 78.8 %; FN = 21.2 %	Accuracy = 83.32 %. TP = 88.1 %; FP = 11.9 % TN = 79.4 %; FN = 20.6 %

A qualitative analysis of the rules reveals that 16 out of the 33 variables appear at least once in the set of rules. The number of conditions in a rule varies between 2 and 23. Appendix 3A (Table 3A.1) shows the full structure of the decision tree for analysing the corporate governance systems and firm performance (system output). Therefore, Appendix 3B (Table 3B.1) displays the probabilities associated with each operating and failure state linked to the system output using the generated rules. Thus, the approach allows the determination of an approximate Structure Function that enables modelling of the functioning of the system or of a given company.

[29] For further information about this tool and other data mining procedures, see (Frank et al., 2004; Hall et al., 2009; Witten & Frank, 2011).

Examples of some generated rules are as follows (highlighted terms correspond to components):

1) IF mtb_mean1 = 0 AND *nvolreturn_mean1* = 0 AND **bs_expe_r** = 0 THEN *y* = 0

2) IF *mtb_mean1* = 0 AND *nvolreturn_mean1* = 0 AND ***bs_expe_r*** = 1 AND ***bf_inomcom_r*** = 0 AND ***bf_bmeet_r*** = 0 THEN y = 0

3) IF *mtb_mean1* = 0 AND *nvolreturn_mean1* = 0 AND ***bs_expe_r*** = 1 AND ***bf_inomcom_r*** = 0 AND ***bf_bmeet_r*** = 1 AND ***vstr_csrxaud_r*** = 0 AND *numbusegm* = 1 THEN y = 1

4) IF *mtb_mean1* = 0 AND *nvolreturn_mean1* = 0 AND ***bs_expe_r*** = 1 AND ***bf_inomcom_r*** = 0 AND ***bf_bmeet_r*** = 1 AND ***vstr_csrxaud_r*** = 0 AND *numbusegm* > 1 THEN y = 1

Note that for a company with *mtb_mean1* = 0 and *nvolreturn_mean1* = 0 (rule 1), this condition corresponds to a first-order cut set.

As previously mentioned, all of the rules with the condition *y* = 1 could be used to derive the ARE. For example, one of the terms associated with ARE and valid for companies with *mtb_mean1* = 0 AND *nvolreturn_mean1* = 0 AND *numbusegm* = 1 is:

$$P(bs\_expe\_r = 1)*P(bf\_inomcom\_r = 0)*P(f\_bmeet\_r = 1)*P(vstr\_csrxaud\_r = 0)$$

where, for example, P(*bf_inomcom_r* = 0) is the probability that *bf_inomcom_r* = 0 (i.e., component *bf_inomcom_r* is "failed": the company does not report the percentage of the non-executive board members on the nomination committee).

The ARE could then be used to estimate the reliability of any selected company, that is, the probability that a selected company's ROA is outperforming its industry.

To illustrate, let's consider a company with the following characteristics: *numbusegm* = 2 and *comp_age* = 4; and assume that for this company, the probability of failure of all of the components is 0.10 (i.e., P(*bf_inomcom_r* = 0) = 0.10; probability values could be estimated from yearly records of the company). Then, the numerical evaluation of the ARE results in a reliability of almost 0.90 (0.8934).

For this company, the importance of the components (evaluated using the Birnbaum measure) is shown in Figure 3.3 (a large index means that a small change in the reliability of a component will result in a comparatively large change in the system reliability (Vasseur & Llory, 1999).

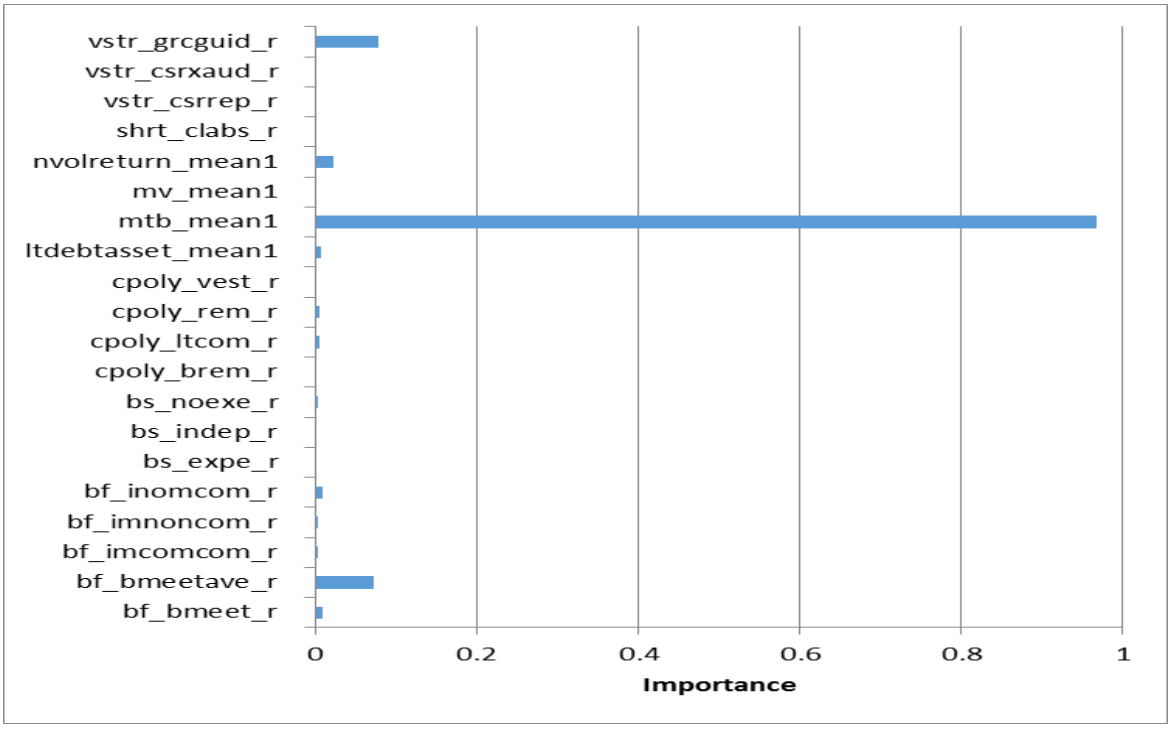


Figure 3.3. Birnbaum index for the importance of components for a company with *numbusegm* = 2 and *comp_age* = 4

The analysis of the Birnbaum importance indices surprisingly reveals that the reliability-mapping approach proposed is able to correctly mimic the behaviour of the

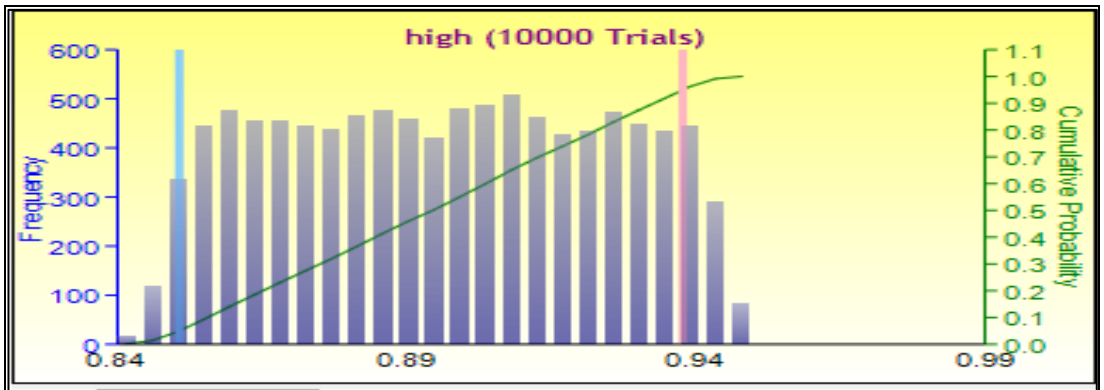
system analysed. For example, Figure 3.3 shows that the variable *mtb_mean1* (growth opportunities above the industry) is crucial for the reliability of the system. This aspect is aligned with the literature (Linck et al., 2008; Lehn et al., 2009) because a higher market-to-book ratio indicates how well managers are using the firm's resources (including the best current and future prospect of the company) to drive earnings, for instance, using the cash holding on value-increasing projects (Platikanova, 2016) and enhancing R&D investment and speeding innovations (Garner et al., 2002), among other aspects.

Some authors argue that engaging in socially responsible activities enhances firm performance; however, whether that is true depends on specific companies' supply and demand conditions (Mackey et al., 2007). Therefore, Wang and Hsu (2011) and Mishra and Suar (2010), respectively, using a global index from companies on the Taiwan Stock Exchange and a weighted average score from Indian manufacturing companies, show that fulfilling corporate social responsibility would impact positively on firm performance. Consequently, the Birnbaum index also reveals that reporting corporate social responsibility (*vstr_grcguid_r*) according to the Global Reporting Initiatives (GRI), which embeds part of the companies' vision and strategies, influences the well-functioning of the system relative to the other corporate governance mechanisms.

In addition, the Birnbaum index also shows that reporting information on the average number of board meetings (*bf_bmeetave_r),* in relation to the other corporate governance aspects, impacts on the trustworthiness of the company (this aspect has been studied under the lenses of board activity (Vafeas, 1999; Brick & Chidambaran, 2010) using the number of board meetings, but with an inconclusive nexus with firm performance).

3.5.2. Model assessment

To illustrate the reliability of the system, let's consider that all of the probabilities of failure of the components could vary in the range [0.05, 0.15], and the selected company-specific characteristics are, as in the previous example, *numbusegm* = 2 and *comp_age* = 4. Using Monte Carlo simulation (Mun, 2010), the uncertainties are modelled by uniform independent distributions and by using 10,000 samples for estimating the distribution associated with the reliability of the company, as shown in Figure 3.4. From here, it is clear that the reliability of the system could vary in the range [0.8365, 0.9472]. Also see the statistics summary obtained from Risk Simulator software provided by Mun (2010) for further statistical analysis.



Statistics	Result
Number of Trials	10000
Mean	0.8935
Median	0.8939
Standard Deviation	0.0280
Variance	0.0008
Coefficient of Variation	0.0313
Maximum	0.9472
Minimum	0.8365
Range	0.1108
Skewness	-0.0003
Kurtosis	-1.1571
25% Percentile	0.8692
75% Percentile	0.9175
Percentage Error Precision at 95% Confidence	0.0614%

Figure 3.4. Distribution function and statistics of the reliability of the company *numbusegm* = 2 and *comp_age* = 4

In like manner, for a given company (*comp_age* = 4) and for a different the number of business segments (4, 6 and 8), differentiated distribution of reliability can be obtained. Figure 3.5 shows the minimum, average and maximum values for the reliability of the system. Note that the values are almost equal, suggesting that the number of business segments, under the scenarios simulated, have no influence and work as control variables, as considered by (Wintoki et al., 2012) who analyse corporate governance using econometric analysis.

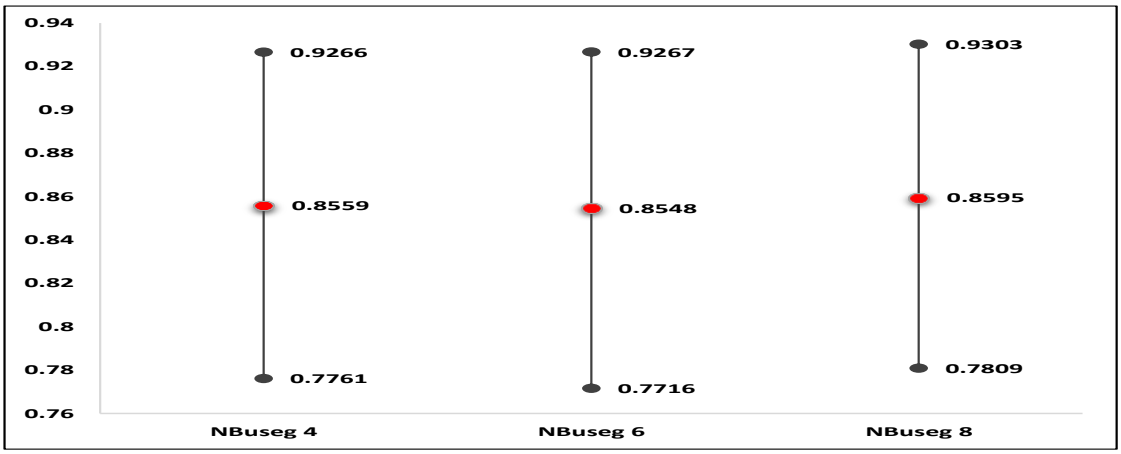


Figure 3.5. Distribution of the reliability across different companies' number of business segments and *comp_age* = 4

Figure 3.6 shows the importance of the components on the reliability of the system for the different companies' number of business segments, evaluated using the rank correlation index (RCI). According to Mun (2010) the RCI is able to capture possible non-linear effects among components and the system output.

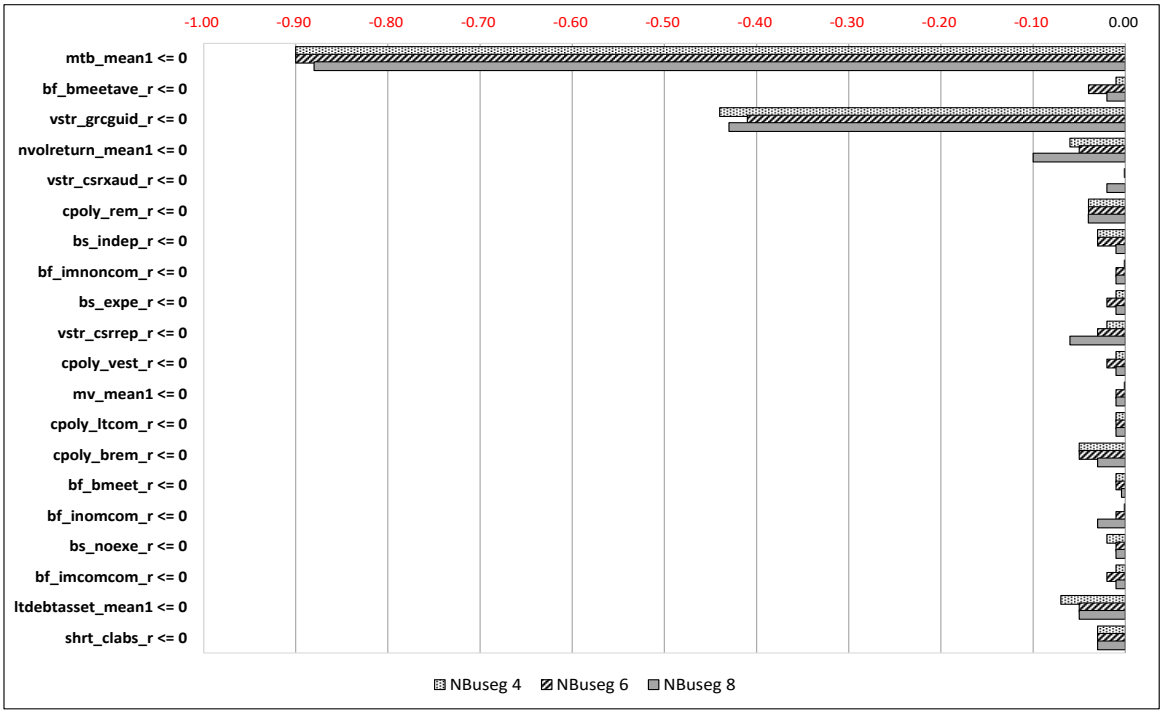


Figure 3.6. Rank correlation index for different companies' business segments and for *comp_age* = 4

As in the previous evaluation using the Birnbaum index, the action to improve the companies' growth opportunities (*mtb_mean1*) is the most important factor for affecting the reliability of the system. Again, the rest of the components have less influence on the trustworthiness of the company; as can be observed with *bf_bmeetave_r* that considers the frequency of board activity (Vafeas, 1999; Brick & Chidambaran, 2010). However, note that in this case, the component *vstr_grcguid_r*, for different companies' business segments, is still the second most important component but with a possible greater influence than what is shown in Figure 3.3. This aspect is aligned with the analysis of Wang and Hsu (2011) and Mishra and Suar (2010) regarding the role of socially responsible activities and firm performance.

The results from mapping corporate governance components to a reliability model show that disclosure on compensation policy, remuneration and vesting options, and due

reporting on board function (auditing independency) and board structure (independent board) are central aspects for the operating state of the system (companies' return on assets outperforming the industry). The results can be also considered as complementary evidence of the role of transparency in corporate governance practices and mechanisms (Cormier et al., 2010; Adiloglu & Vuran, 2012; Mahr et al., 2015) in understanding how the system functions for managers' and shareholders' align in terms of firm performance.

Additionally, Appendix 3C (Figure 3C.1 and Figure 3C.2) illustrates also the reliability distribution for different companies' age and with a number of business segments equalling two. Note that for this approach, the previous conclusion about compensation policy also holds, and the average number of board meetings starts to play an important role in the reliability in these types of companies.

Finally, note that the model derived could be easily used for 1) estimating the reliability of different types of companies (e.g., by varying the company age, the number business segments); 2) performing an uncertainty propagation study (i.e., the effects on the reliability of the system when considering the uncertainty that may exist regarding the probabilities of failure of the components of the system); and 3) carrying out more detailed sensitivity studies (e.g., based on global sensitivity analysis (Saltelli et al., 2008).

3.6. Conclusions

In this chapter, a reliability system approach is implemented to successfully mimic a corporate governance framework under a transparency perspective and following the best practices of reporting information. Indeed, rather that determining the statistical

impact of an aggregate corporate governance measurement or index on firm performance (Chapter 1), the basic idea in this chapter is to consider corporate governance as a system, composed of inputs related to corporate governance practices and mechanisms (i.e., components) related to transparency (e.g., diclosure, reporting, and compliance) and outputs (i.e., system performance).

On a set of US companies, the system is modelled through a reliability model where operating/failed states of components and company-specific conditions define an approximated structure function related to company performance. The structure function or unknown function is estimated using machine-learning techniques and converted to an approximated reliability expression that could be used to quantify the reliability of any selected company, that is, the probability that a company is outperforming the industry.

From the approximated reliability expression, the results not only show that growth opportunities matter for the proper functioning of the system, but also suggest that if companies are more transparent, their reliability into the systems improve. Therefore, note that if the probability of failure of particular corporate governance components reduces, such as, corporate social responsibility, average number of board meetings, compensation policy, remuneration and vesting options, auditing independency and independent board), both the trustworthiness of the companies and the system reliability are enhanced.

In other words, companies following the best practices of transparency and reporting (operating states) in corporate governance, enhances the reliability of the system and helps to evaluate how well companies are controlled and managed (i.e., to assess

managers and shareholders' alignment). Consequently, this mapping can be seen as a quicker way to classify companies operating according to the shareholders' interests and information disclosure, and to help them in the decision-making process.

The main implication of our study is that the board of directors can learn what corporate governance components are more aligned with the most successful companies. Investors and managers can also use this approach either to assess the firm's reliability in terms of its transparency, or to inform policy makers about which factors are driving or undermining the reliability of a defined system's outcome (i.e., company performance).

This approach, based on the use of system reliability theory and machine-learning techniques, enhances institutional participation for alternative usages of corporate governance information, rather than aggregate corporate governance indices or particular mechanisms (e.g., duality, board size, independence, and so forth), aspects analysed in Chaper 1.

However further investigations are required to consider other aspects of regulation impacting on the US corporate governance system and other company-specific information that might affect the operating state of the system. Other information could include, for example, how to compare different corporate governance systems across countries (Anand et al., 2005), assess compliance or explain practices (Luo & Salterio, 2014), evaluate the impacts of large shareholder and investors (Shleifer & Vishny, 1997) and analyse other systems outputs (valuations, bankruptcy, for instance).

Finally, the research questions could also require investigation of additional reliability models (e.g., multistate models (Lisnianski & Levitin, 2003)]), data mining approaches

(Witten & Frank, 2011), robustness analysis (Rocco & Hernandez, 2015) and multi-criteria methods (Roy, 1996; Bouyssou et al., 2006) as well as results comparisons with traditional empirical regression models (Bhagat & Bolton, 2008; Bhagat et al., 2008; Ertugrul & Hegde, 2009; Wintoki et al., 2012).

Chapter 4. Why do some M&A deals fail? A global perspective

Abstract*: A deal completion (i.e., acquisitions, mergers and subsidiary purchases, among other takeover strategies) allows companies to move assets from lower to higher productivity; consequently, shareholders and managers can maximize their company value. However, a deal withdrawn can be seen as an exit mode (abandonment option) where either an acquirer or a target decides whether going ahead with an announced deal compromises the assets movement and also the value creation. In this case, this chapter analyses why deals are withdrawn from a new perspective that considers simultaneously the role of acquirers' and targets' firm size, inner economic freedom information and role of accounting returns.*

Using a large dataset of 137,116 worldwide deals during the period 1977–2014, on more than 140 countries and with different specifications of logit regression models, we find that the likelihood of a deal's withdrawal increases if i) the target firm's size is larger or its profitability is lower, ii) the acquiring firm's size is smaller and iii) the economic freedom index of the acquiring firm's country is higher. Furthermore, our analyses reveal that deal characteristics (i.e., deal attitude, means of payment, deal size, ownership sought) also matter in affecting the outcome of announced merger and acquisitions (M&A) deals.

Finally, this novel study contributes to the M&A literature and to the business literature on how incumbent-specific and country-specific information can constrain the movement of assets in line with the efficiency theory. Likewise, it suggests that decision makers, especially bidders, need to be aware of firm size discernments, economic freedom outlooks and accounting returns figures to exercise the exit option of a deal withdrawal.

Keywords*: Company returns; Deals failure; Economic freedom; Firm size; M&A*

4.1. Introduction

To either complete or withdraw a deal during the negotiation process, the incumbent decision makers (acquirers and targets) in deal transactions, especially in mergers and acquisitions (M&A), require comprehensive and extensive information pertaining to, for instance, financial recommendations, valuation results, country characteristics, due diligence outcomes, negotiation criteria and expected synergies, among other aspects. This information allows them to balance potential risks and assess the costs and benefits of takeover strategies. The M&A activity involves a great deal of scrutiny; completion is an indicator that both parties, bidder and target, are satisfied with the inputs, process, and outputs of the M&A transactions. However, the question is why do some decision makers withdraw an announced deal (exercising an exit option)?

Note the synopsis of deals in Table 4.1 obtained from Thomson One Banker (module of M&A deals), and observe that some deals completed and others were withdrawn, but the underlying reasons are unclear. In fact, some transactions rely on either cash usage or cash-stock combinations as a means of payment, and involve either domestic or cross-border negotiations under different economic and regulatory perspectives. Other transactions disclose the deals in terms of monetary values (billions of dollars) or only the percentage of shares sought by the bidders. Moreover, there are deals with a friendly or a hostile attitude, or that consist of either large acquirers or large targets. Therefore, the aim of this this study is to provide evidence of some of the determinants behind this exit option of rejecting an announced deal.

According to Tirole (2006), M&A deals are likely to be withdrawn when companies perceive that they cannot move assets from low to high productivity (efficiency theory).

The more the degrees of freedom in terms of asset efficiency and the better the competitive advantages, the more value an M&A deal can create for shareholders. Nevertheless, there are other perspectives that might cause deals to be withdrawn; for instance, when an acquirer reveals managerial entrenchment (agency theory) (Jensen, 1988; Ambrose & Megginson, 1992) or misevaluation problems (hubris theory) (Roll, 1986), or a target becomes better positioned during a negotiation (Weston et al., 2004).

Table 4.1. M&A activity deal synopses

[2000: US] – "Deutsche Telekom AG (DT) acquired (completed) VoiceStream Wireless Corp (VS), a provider of commercial and personal cellular and communication services, in a stock and cash combination. DT offered $15.7262 bil in cash and 3.6693 ordinary shares per VS share. VS's board classified this cross-border deal under a friendly attitude".
[2001: US] – "Hewlett-Packard Co (HP) acquired (completed) all the outstanding common stock of Compaq Computer Corp (CC), a manufacturer of personal computers, in a stock swap transaction (cash and stock Combination) valued at $25.263 bil. HP offered .6325 common shares per CC share. Upon completion, HP shareholders held 64% of the combined company, while CC shareholders held the remaining 36% stake. Concurrently, both CC and HP, located in US, adopted shareholder rights plans to protect the merger agreement from third-party interference".
[2007: UK] – "Delta (Two) Ltd of Qatar withdrew its plans to acquire 75% of interest, or 1.306 bil ordinary shares, which it did not already own, in J Sainsbury PLC, a London-based retailer of food, home and garden products, for 6 British pounds ($12.296 US) in cash per ordinary share, or a total value of 7.836 bil pounds ($16.060 bil)".
[2007: HUNGARY] – "OMV AG of Germany withdrew its plans to launch a hostile offer to acquire the remaining 79.8% interest, or 87.245 mil ordinary shares, which OMV AG did not already own, in MOL Magyar Olaj, a Budapest-based oil and gas exploration and production company, for 32,000 Hungarian forints (127.758 euros/$180.704 US) in cash. The transaction was subject to regulatory approvals according to the target country's specifications".

Source: Author's own assessment based on Thomson One Banker.

The literature mainly approaches the deal completions issue from different angles; see, for example, Kau et al. (2008); Intralinks-Dealspace (2014) using companies' market returns; Dauber (2012); (Barros & Dominguez, 2013) assessing post-merger synergies;

Rossi and Volpin (2004); Pablo (2009); Teerikangas (2012); Wang and Wang (2012) analysing cross-border determinants; Faccio and Masulis (2005); Ismail (2011); Gorbenko and Malenko (2014) studying the means of payments (cash, stock, or both). In reality, there is no doubt that when companies' prospects are not clear, information is incomplete, expectations do not match, and high negotiation power around targets influence the acquisition premium, an announced deal could be withdrawn. Indeed, Puranam et al. (2006) stress that a deal withdrawal uncovers problems found during the due diligence. Bearing the efficiency theory in mind, this study investigates how target- and acquirer-specific circumstances, uncovered during the due diligence or negotiation process, might exert influence on decision makers to withdraw an announced deal. This issue will enable us to develop a set of hypotheses about firm size and profitability, and the economic freedom of the related countries.

We address a number of research questions. First, *would it be too difficult to reject a deal if it is attached to a very large acquirer or if the target firm is too large to take over?* Berger and Humphrey (1997) raise similar concerns for the banking sector. Second, *can the cross-border M&A deals get withdrawn if the quality of the economic freedom between the respective countries is significant*? Capron and Guillén (2009) relate the economic freedom to country perceptions (e.g., regulation, property rights and investor protection), which matters for assets restructuring, deals transactions and growth strategies.[30] Despite the multiple approaches to analyse a given country, aggregate indices help to identity the quality of a country in terms of its economic freedom (Spamann, 2009; Feito-Ruiz & Menéndez-Requejo, 2011; Gwartney et al.,

[30] For instance, China is preparing to tighten the cross-border M&A rules regarding the deal approval process following the renminbi's recent depreciation and fall in their forex reserves (Wildau et al., 2016).

2015). Consequently, we also investigate whether post-announcements deals withdraw either when the country-level quality of acquirers is higher, or when the country-level quality of targets is higher.

Third, *does the profitability of the target and acquiring firms play a role in affecting the outcome of the intended M&A deal*s? It is important to emphasise that decision makers and M&A analysts throughout the due diligence process systematically gather and revise operational, financial and accounting information, among other aspects. They are highly concerned about firms' resources, revenues, costs and expenses (Epstein, 2005). For example, firms with very low profitability ratios reveal their vulnerability to the market as this suggests high operating expenses and/or inefficient use of assets, which can make them ideal targets. Similarly, firms with very high profitability might accumulate cash to acquire other companies.

To date, there has been little discussion about firm size and profitability, and economic freedom in the M&A literature as a central aspect for calling off the announced deals (Steger & Kummer, 2007; Kau et al., 2008; Jacobsen, 2014; Cumming et al., 2016). Furthermore, the recent literature has approached bid failures by analysing only market price information, particularly using USA companies. Namely, Kau et al. (2008) investigate whether decision makers learn from stock prices to call off investments, and Jacobsen (2014) assesses deals where the purchase price of a target becomes too high and scrutinizes different types of deal withdrawal (i.e., "restrains withdrawal" due to market influence, or "other withdrawal" due to regulatory, judicial, material changes, and so forth) to evaluate CEOs' quality. In addition to this, Damodaran (2005), Dutordoir et al. (2014) and Zaheer et al. (2013) also evaluate deal failures focusing on the expected synergies realization on deals completed. To the best of our knowledge,

no research has extensively studied the determinants of deal withdrawals by analysing both the targets' and acquirers' perspectives simultaneously.

The proposed research relies on a dataset based on over 140 countries during the period 1977 to 2014, and takes into account a large number of deal characteristics (over 137 thousand) and firm-specific information such as deal attitude, means of payments, country- and industry-specific differences and the method of integration. With respect to extant knowledge, this research offers three main contributions in M&As failure and, consequently, in asset movement perspectives: First, we find that the size of the acquirers is negatively associated with the probability of withdrawing an M&A deal whereas this occurrence has a positive relationship with the size of the target firms. This new evidence shows that firm size has a significant impact on deal failures. Second, although we obtain an insignificant link between the acquiring firms' profitability and the likelihood of M&A deals, the effect is significantly negative for the target firm's profitability, which is vital for M&A deals as a mean to create value for shareholders. Third, it seems the target firm's country's economic freedom index does not affect the outcome of the M&A deals but if the index, but for the acquiring firm's country it increases the chance of cancelling the deal. As well as in Pablo (2009) and Di Guardo et al. (2016), this finding suggests that the acquirers are more aware of M&A risks, information asymmetries and economic conditions when evaluating takeover strategies, especially whether and how to exercise or abandon.

Therefore, our analyses further show that if the attitudes of deals are classified as friendly, hostile or neutral, then the odds of a failed M&A deal would be reduced. However, according to the marginal effects or economic significance, the lowest magnitude is associated with a hostile attitude. This might be aligned with Sudarsanam

and Mahate (2006) who found that friendly bidders, using high share-market ratings, destroy more value than unfriendly bidders. Finally, we report that the propensity to withdraw the M&A deals increases if the deal is large in size, is offered to be financed through stocks or if the ownership sought by the acquirer is high.

The remainder of this chapter is organised as follows: Section 3.2 provides a theoretical framework on deal withdrawal; Section 3.3 formulates the hypothesis; Section 3.4 describes the methodology; Section 3.5 presents the empirical results and their support of the hypothesis formulated, and Section 3.6 introduces some other M&A determinants to assess the stability and consistency of the results (robustness check). Finally, Section 3.7 shows the main conclusions and implications of the empirical findings for both theory and practice.

4.2. Theoretical framework on deal withdrawal

A deal withdrawal is an exit option where either an acquirer's or a target's decision makers refuse to go ahead with a bid announced. Some researchers have tried to explain why M&A deals fail either directly (i.e., prices and valuations), or indirectly (i.e., preferences, expectations and other aspects).

Directly, deals could fail because of unsatisfactory price offers from a bidder to a target, which can be also associated with a CEO's lack of experience in takeover strategies (Jacobsen, 2014), under-confidence about a target's valuations (Roll, 1986) and negative reactions to stock prices movements of the incumbent companies (Kau et al., 2008). Indirectly, deals could be withdrawn because of dissimilar means of payments preferences among decision makers (Walter & Barney, 1990; Faccio & Masulis, 2005; Gorbenko & Malenko, 2014), mismatch on the ownership structure sought between

buyers' and large targets' shareholders (Bajo et al., 2013), and large deviations between expected and realized synergies (Garzella & Fiorentino, 2014).

Although these direct or indirect aspects depend on the research framework followed by scholars, we state that if any information weakness is exposed among the incumbents (bidders and sellers) regarding prices, valuations, synergies, financials estimations or accounting figures, or even related to the inner country economic conditions (domestic or cross-border), a deal could also fail.

Therefore, we claim that under the theory of efficiency (Tirole, 2006), by which takeover strategies help companies to add new technologies, improve their corporate governance mechanisms, and become more efficient and effective managing their resources, decision makers can abandon a deal if they perceive that the assets movement (from low to high productivity) is not possible. Consequently, the M&A costs surpass the benefits, especially when acquirers pay higher premia to convince the shareholders of target companies.

Figure. 4.1 shows the worldwide trends of M&A activity. It illustrates the movements of the average deal value (completed and withdrawn) in US dollars and constant prices (1982 = 100 base year), and the percentage of deals withdrawn by years. This information, obtained from Thomson One Bankers between 1977 and 2014 (137,116 deals), reveals that although the proportion of withdrawals over total deals announced has decreased, their average value has been higher than the value of completed deals and the gap is widening. Briefly, this might indicate that there are relevant transactions (in numbers and volume) where the assets movement has been highly constrained.

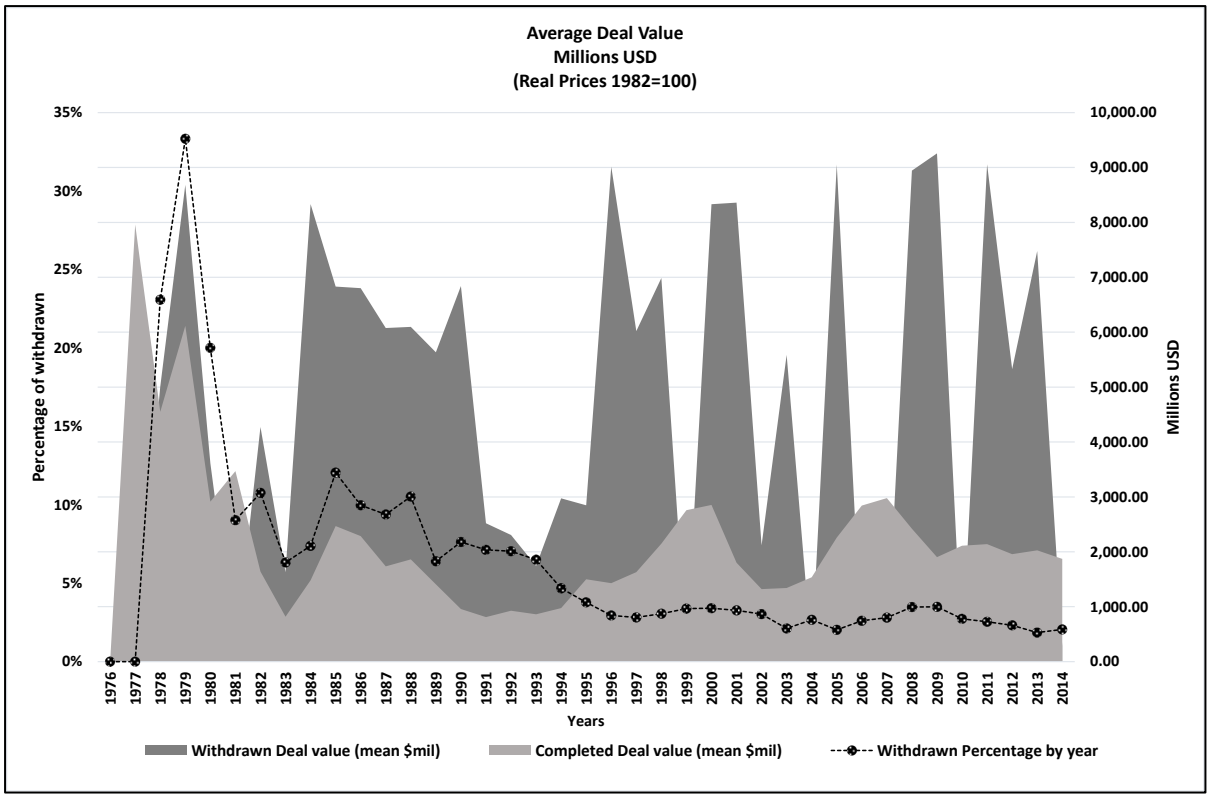


Figure 4.1. Average deal values by deals completed and withdrawn, in real US prices (1982 = 100), and percentage of withdrawals by years

In contrast to previous studies related to M&A deals (Pablo, 2009; Bajo et al., 2013; Garzella & Fiorentino, 2014; Jacobsen, 2014), both Figure 4.1 and our approach take into consideration the full perspective and classifications of the M&A activity provided by Thomson One Banker (Thomson-Reuters, 2016b), including (1) *Mergers*, transactions in which 100% of the stock of a private or public firm is acquired. (2) *Acquisitions*, transactions in which 100% of a company is split off and classified as an acquisition by shareholders. (3) *Acquisition of majority interest*, transactions in which an acquirer seeks to purchase 50% or more, but less than 100% of the target. (4) *Acquisitions of partial interest*, transactions in which the acquirer holds over 50% and seeks less than 100% of the target. (5) *Acquisition of remaining interest*, transactions in which the acquirer holds over 50% and seeks to acquire 100% of the

target. (6) *Acquisition of assets*, transactions in which the assets of a firm, or part of it (i.e., subsidiary, division, and so forth), are bought. (7) *Acquisition of certain assets*, transactions in which only certain assets of a firm, or part of it (i.e., subsidiary, division, and so forth), are bought. (8) *Recapitalization*, transactions in which a firm undertakes a shareholders' leveraged recapitalization to keep equity interest in the firm. (9) *Buyback*, transactions in which a company buys back its equity securities through either a private negotiation or a tender offer. (10) *Exchange offers*, transactions in which a firm offers (exchange) new financial instruments for its current securities.

Faccio and Masulis (2005) acknowledge the influence of financial choices (i.e., means of payments) and firm size, mentioning that large acquirers have more degree of diversification and less insolvency problems; consequently they can complete their bids straightforwardly (i.e., lower tendency for withdrawals). However, does this outcome hold for larger targets? In fact, Gorbenko and Malenko (2014) argue that large targets require mostly cash deals to avoid acquirers' shares misvaluation, and the acquirers do not have sufficient cash to finance large cash payments. Then, acquisition of large targets is more problematic and M&A deals are more likely to be withdrawn.

Behr and Heid (2011) found for the banking sector that small targets are more likely to be acquired because of the easy realization of scale economies. Nevertheless, Baker and Wurgler (2006) and McNichols and Stubben (2015) mention that small targets are difficult to value because of their irregular cash flows, sales volatility and high weight on intangibles assets, among other aspects. It thus emerges that the nexus on target firms' size and deal withdrawal propensity remains a puzzle.

In addition to firm size, other studies underline that deals can also be cancelled because of external factors (e.g., level of regulation, property rights, and government intervention) (Pablo, 2009; Moschieri & Campa, 2014) or weak financial figures observed during the due diligence in terms of revenues enhancements and accounting returns, among other aspects (Mukherjee et al., 2004; Adolph et al., 2006). Furthermore, Di Guardo et al. (2016) relate the country-level corruption to the mode of cross-border M&As.

4.3. Hypothesis development

In the M&A literature, many aspects are already considered to provide structural explanations of deals outcomes, especially deals completion, for example, deal attitude (Moschieri & Campa, 2014), means of payments (Gorbenko & Malenko, 2014; Moschieri & Campa, 2014), countries' heterogeneities (i.e., macroeconomic conditions, regulation issues, capital convertibility) (Hijzen et al., 2008; Pablo, 2009), and so forth. Therefore, this study analyses not only the effects of both targets' and acquirers' size and accounting returns, but also their aggregate county-level economic freedom on deals withdrawal and has developed and formulated the following hypotheses for those perspectives.

4.3.1. Size and deal withdrawal

When analysing previous studies on company deals (Table 4.2), note that company size (for targets or acquirers) has been used either as an explanatory or as a control variable in different aspects (i.e., cross-border completions, financing strategies, means of payments, and so on). This table summarizes some of these studies categorized by

authors, sample selection, modelling perspectives, methods and function of the firm size variables. Note that some studies report different proxies of firm size such as market value, number of employees, total assets, and total sales. The table also presents the statistical significance and sign of the coefficients for the company size variables, which differ notably among them.

Table 4.2. Company size and deals analysis

Paper	Sample selection	Modelling perspectives	Methods	Company size function and relationship
Amihud et al. (1990)	US, 209 deals, 1981–1983; COMPUSTAT	Probability of stock financing	Probit regression	As control variables: log of sales (-T*), not statistically significant for the acquirer
Hagedoorn and Sadowski (1999)	Worldwide, 1970–1993, 6,425 technology deals; MERIT-CATI, Securities Data Corporation (SDC)	Strategic alliances and probability of transformation into M&As	Poisson regression	As explanatory variables: log of employment for both acquirers and targets (-)
Faccio and Masulis (2005)	13 EU countries, 9,935 deals, 1997–2000; SDC	Choice of means of payments	Tobit regression	As explanatory variables: log of assets (+A*), relative size target to acquirer (-T*)
Buehler et al. (2006)	Switzerland, 524 mergers, 1995–2000; SBC 95 and DBED	Likelihood of mergers and bankruptcies	Parametric models (hazard function)	As explanatory variables: log number of employees (-T*)
Capron and Guillén (2009)	North America and Europe, 2,020 deals (manufacture), 1988–1992; SDC, Dealers' Digest, etc.	Predicting post-acquisition reorganization	OLS and SEM	As control variables: relative annual sales of target to acquirer (+), (statistically insignificant)
Pablo (2009)	Latin America, 835 M&As, 1998–2004; Dow Jones Factiva	Likelihood of cross-border M&As	Logistic regression	As control variables: log of sales (+) and log of assets (+) only for the acquirers (statistically insignificant)
Behr and Heid (2011)	Germany,3,265 banks, 1994–2003; Deutsche Bundesbank Database	Merger propensity (portability)	Propensity score matching	As explanatory variables: log of total assets (+A*; -T*)
Erel et al. (2012)	Worldwide (48 countries), 187,841 deals, 1990–2007; SDC	Likelihood of cross-border vs domestic M&As	Logistic regression	As control variables: log of total assets (+A*), (-T)
Martin and Shalev (2009)	US, 5,572 deals, 1980–2012; SDC	Post-announced withdrawals	Logistic regression	As control variables: log of market values (-A*; +T)

Paper	Sample selection	Modelling perspectives	Methods	Company size function and relationship
McNichols and Stubben (2015)	US, 2427 acquisitions, 1990–2010; SDC	Effect of target accounting quality on acquirer returns	OLS	As explanatory variables: log of market values (-A*); ratio market value target to acquirer (-), both with limited significance

Notes: For companies: T (target), A (acquirer); empirical sign: negative ("-"), positive ("+"); and statistical significance ("*")

Despite this puzzling nexus in term of firm size variables, there are some guidelines suggesting that large acquirers might be less likely to withdraw because of their inherent level of diversification (Faccio & Masulis, 2005), economies of scale (Behr & Heid, 2011), and partnering experience (Duysters & Hagedoorn, 1995). Consistently with these authors, we posit that:

Hypothesis 1a: The larger the acquirer's size, the less likely is the deal's withdrawal.

For targets analysis, divergent views of previous studies draw our attention to the following considerations. Gorbenko and Malenko (2014) argue that large target firms require mostly cash deals, which may be problematic because of the acquirers' potential cash constraints. Rossi and Volpin (2004) also identify that target firms with larger size have a negative and significant impact on M&A activity because their size diminishes the takeover premium. Bajo et al. (2013) state that managers and shareholders of such firms are mostly concerned about losing ownership and control, which would make deals more likely to fail. Dietrich and Sorensen (1984) and Beitel et al. (2004) state that small targets can reduce acquisition costs and are less complex to capture the potential synergies, which implies that such aspects facilitate takeovers. Nevertheless, smaller targets can be exposed to valuation problems (Baker & Wurgler, 2006; McNichols & Stubben, 2015) because there is less information access and more adverse selection on

company valuations (Feito-Ruiz & Menéndez-Requejo, 2011). Overall, the literature emphasises the difficulties of working with large targets mainly because of the high takeover premium required and the concerns about ownership and control. Hence, we frame the following hypothesis:

Hypothesis 1b: The larger the target's size, the more likely is the deal's withdrawal.

4.3.2. Economic freedom and deal withdrawals

The location of the target and acquiring firms matters for assets restructuring, deals transactions and growth strategies (Capron & Guillén, 2009), which are related to factors associated with economic freedom and country-level considerations (e.g., regulations, property rights, rule of law, government intervention and investor protection). This suggests that some locations are more attractive than others for takeover strategies and growth opportunities (Moschieri & Campa, 2014), and for the efficient movement of corporate resources (Rossi & Volpin, 2004).

There are some indicators that help decision makers to assess the quality of countries: anti-director rights index (Spamann, 2009), corruption index (Mauro, 1998), Dow Jones economic freedom (Pablo, 2009) and economic freedom index of the world (EWF) (Gwartney et al., 2015), among others. EWF relies on four pillars: freedom regarding personal choices, exchange coordination across markets, free entrance and competition, and people's protection and property rights. According to Gwartney et al. (2015), countries enhancing the mentioned pillars are more open to engaging in voluntary transactions (e.g., M&A deals). In fact, when analysing takeover strategies, some studies have evaluated the effect of some country-level factors on incumbents' decisions. For instance, Moschieri and Campa (2014) and Rossi and Volpin (2004)

claim that regulatory boundaries negatively affect M&A activities; and particularly, Pablo (2009), evaluating cross-border deals in Latin-American countries, finds that 1) targets' government intervention, regulation, property rights, and foreign investment and 2) acquirers' property rights reduce the likelihood of cross-border transactions.

The evidence shows that the acquiring country's property rights negatively impact cross-border completions (Pablo, 2009), especially when their shareholder rights are robust because then the post-acquisition reorganizations weaken (Capron & Guillén, 2009). Consequently, economic freedom level of the acquirers' country can be considered as a risk if it is deemed as too low. Thus, we put forward the following hypothesis:

Hypothesis 2a: The greater the acquirers' country economic freedom, the more likely is the deal's withdrawal.

Regarding the targets' country factors and M&A deals, Pablo (2009), assessing 835 cross-border deals in Latin America (1998–2004), finds mainly that government intervention and regulation negatively affect the likelihood of cross-border deals in Latin America. Hijzen et al. (2008), analysing 23 OECD countries and 21,234 cross-border deals (1990–2001), reveal that multilateral trade costs functioning as markets barriers between an acquirer and a target negatively affect the number of cross-border mergers. In addition, Feito-Ruiz and Menéndez-Requejo (2011), including 469 M&As of European listed firms (2002–2006), emphasise that less economic freedom and law enforcement in the targets' country increase acquirers' business risks and reduce their potential gains, providing early warnings to withdraw the announced transactions. Hence, we formulate the next hypothesis:

Hypothesis 2b: The greater the target's economic freedom, the less likely is the deal's withdrawal.

4.3.3. Firm profitability and deal withdrawals

During due diligence, decision makers (buyer and seller) in a systematic manner gather operational, financial and market information about the incumbent firms (Financier-Worlwide, 2004). While they review the companies' resources, revenues, costs and expenses, scrutinising the financial and accounting records is the first step in aligning decision makers' expectations and visualising the likely synergies (Epstein, 2005). According to Garzella and Fiorentino (2014), synergies expectations and realizations play an important role in M&A studies. Consequently, the higher the synergies, the higher the potential for shareholders value due to assets productivity (Tirole, 2006).

At the heart of the commercial due diligence, examining the trends of targets' revenues and accounting figures is relevant for successfully closing a deal and visualising the likely post-deal integrations (Financier-Worlwide, 2004). Therefore, Martin and Shalev (2009) indicate that the announced returns (operating performance) of both an acquirer and a target can serve as indicators of acquisition efficiency based on the assumption that they could capture the expected surplus of deals. Consequently, we propose that accounting returns (proxy of company profitability) should also provide information as to whether exercising the exit option of a deal is optimal.

Regarding the empirical evidence, Pablo (2009) only analyses the impact of acquirers' profitability, EBITDA returns (earnings before taxes, interest, depreciation and amortization over total assets), due to limited data for targets. However, Pablo (2009) finds that the respective regression coefficients are statistically insignificant. In addition,

Martin and Shalev (2009), evaluating post-announcement withdrawals, show that acquirers' and targets' EBITDA returns have negative and positive effects, respectively; but again these results also lack statistical significance.

Taking into account these puzzling connexions among incumbents' accounting returns, and being consistent with Dietrich and Sorensen (1984), who mention that positive company prospects enhance future cash flows through synergies; mainly because acquirers might be more willing to look for combined synergies through M&As in order to improve their financial prospects, we state the following hypothesis:

Hypothesis 3a: The higher the acquirers' profitability, the less likely is the deal's withdrawal.

For the target perspective, the rationale comes from Rossi & Volpin (2004), who consider that target size has a negative and significant impact on M&A activity because of the lower takeover premia. Likewise, we assume that when targets show higher profitability, this might not only increase their negotiation power but also reduce expected synergies through the takeover premia. We then hypothesize that:

Hypothesis 3b: The higher the targets' profitability, the more likely is the deal's withdrawal.

4.4. Methodology

Figure 4.2 presents this chapter's research approach, which also globally represents the due diligence and decision-making process. It can be observed that after a deal announcement, both targets and acquirers follow a due diligence process to gather information about deal conditions (i.e., means of payments), companies characteristics

(i.e., operations, financials, market approach, etc.) and economic perspectives, among other aspects, to see whether a deal goes ahead ("walking-in" strategy) or withdraws ("going-away" strategy). We explore this decision-making process under the perspective of deals withdrawal by analysing both target' and acquirers' information about size, economic freedom and accounting returns, simultaneously. The main research aspects for this empirical chapter are represented by the dotted lines in Figure 4.2[31].

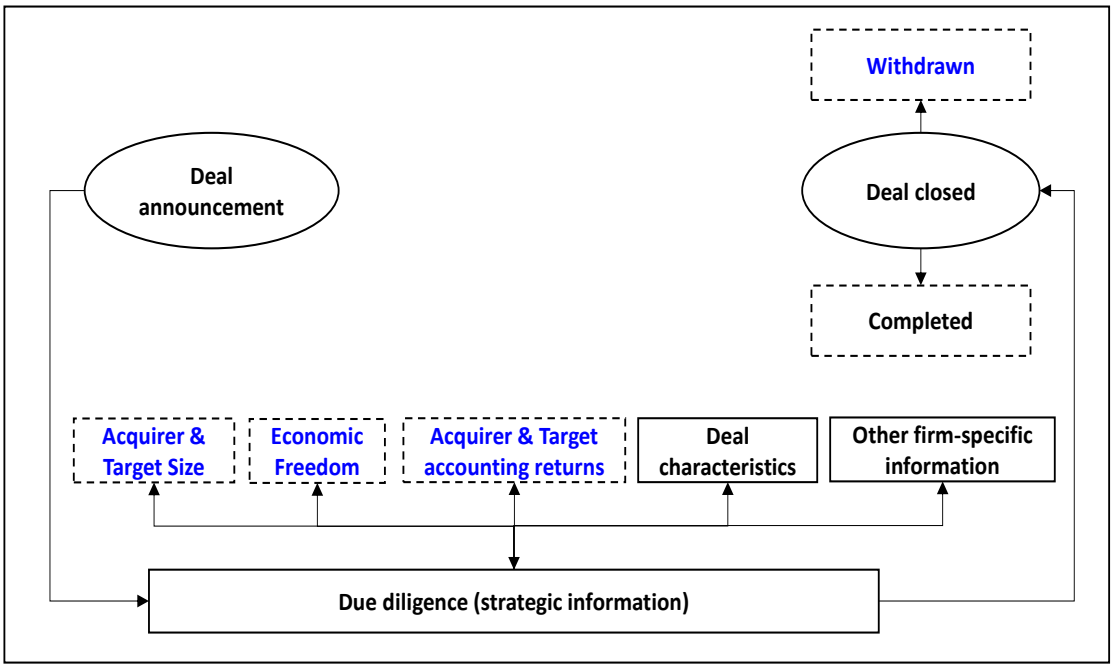


Figure 4.2. Overview of the decision-making process for deals withdrawn or completed
Source: Author's elaboration based on Thomson Reuters

[31] According to Thomson-Reuters (2016b), a deal enters in the data throughout the announcement date, which is the date when one or more parties makes the first public disclosure (collective or unilateral) of intention to pursue a transaction (no formal agreement is required). This initiative can be supported by the disclosure of conversations between parties, a unilateral approach made by a potential bidder, a signed memorandum of understanding (MOU), or other disclosure strategies. Therefore, if the deal does not complete, it is particularly classified as withdrawn when it expires or becomes otherwise unsuccessful (public statement, confirmed news, for example). Also, an agreement is also noted as withdrawn if an incumbent in the transaction informs that the negotiation has unsuccessfully terminated, the letter of intent or plans for the M&A has been closed, or rumours have stopped.

4.4.1. Data section

The original sample contains 186,640 deals disclosed from 147 countries[32] and across 137 criteria (i.e., status, year of announcement, legal aspects, means of payments, deals attitude, deal values, regions, financial attributes, and so forth). The time frame includes bids from 1 January 1977 to 31 December 2014 from Thomson One Banker (M&A deal module). After correcting the sample for data anomalies (i.e., missing, null, blanks, duplicates and non-available information), the final dataset includes 137,116 deals, considering bidders from both public and private targeting listed companies, and transactions with status completed and withdrawn.

Unlike the previous studies related to M&A deals (Pablo, 2009; Bajo et al., 2013; Garzella & Fiorentino, 2014; Jacobsen, 2014), we take into consideration the full perspective and classification of the M&As activities provided by Reuters Thomson One Banker and described in Section 3.2; for instance: mergers, acquisitions, acquisition of majority interest, acquisitions of partial interest, acquisition of remaining interest, acquisition of assets, acquisition of certain assets, recapitalization, buyback

[32] The countries reported in Thomson One Banker and considered for this study are: "Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Cape Verde, Chad, Chile, China, Colombia, Dem Rep of the Congo, Costa Rica, Ivory Coast, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Republic of Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, South Korea, Kuwait, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar(Burma), Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Surinam, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States of America, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe".

and exchange offers. In addition, and differing from Moschieri and Campa (2014), there is no data adjustment associated with the percentage of shares sought to be purchased by the acquirers. This consideration avoids eliminating relevant transactions on those deals where an acquirer already has some controlling stake of a target company. Finally, all the monetary variables are gathered and disclosed in US dollars and in constant prices (1982 = 100), using the consumer price index (CPI) data gathered from the US Department of Labour Bureau of Labour Statistics.

Table 4.3 presents the sample distribution of total deals announced and their status (completed and withdrawn), and shows the classification of M&A deals according to the data provider during the period 1977–2014. Note that more than 82% of the transactions are associated with acquisitions of partial interest, acquisition of assets and mergers, and the number of deals withdrawn is lower than the deals completed. Although the withdrawals are fewer than the completions, Table 4.4 displays summary statistics of deal values in constant US prices and shows that the mean and median of deal value for the withdrawals outweighs the completions for the majority of the years under analysis. Alternatively, Figure 4.1 illustrates the average values of deal status and their trends for both deals withdrawn and deals completed.

Additionally, Table 4A.1 (in the Appendix 4A) discloses the distribution of deals status across targets' and acquirers' industry (following the ISIC International Standard Industrial Classification) and also across regions; Table 4A.2 (in the Appendix 4A) displays the deals status between domestic and cross-borders transactions, means of payments and deals attitude.

Table 4.3 Number of deals completed, withdrawn and announced, and deals classification across years

Year of announcement	Total number of deals completed	Total number of deals withdrawn	Total number of deals announced	Sample size (%)	(1) Merger	(2) Acquisition	(3) Acq. Maj. Int.	(4) Acq. Part. Int.	(5) Acq. Rem. Int.	(6) Acq. of Assets	(7) Acq. Cert. Asts.	(8) Recapitalization	(9) Buyback	(10) Exchange offer
1977	1	0	1	0.0	1	0	0	0	0	0	0	0	0	0
1978	10	3	13	0.0	11	0	1	0	0	1	0	0	0	0
1979	4	2	6	0.0	5	0	0	0	0	1	0	0	0	0
1980	12	3	15	0.0	13	0	0	0	0	2	0	0	0	0
1981	121	12	133	0.1	108	0	1	4	0	20	0	0	0	0
1982	166	20	186	0.1	137	0	0	10	0	36	1	0	2	0
1983	311	21	332	0.2	149	3	4	47	1	108	0	0	20	0
1984	427	34	461	0.3	174	1	11	82	2	128	0	0	62	1
1985	387	53	440	0.3	78	4	21	62	7	244	7	0	17	0
1986	659	73	732	0.5	119	3	65	100	8	403	13	1	16	4
1987	831	86	917	0.7	127	1	52	148	27	520	5	1	35	1
1988	1114	131	1245	0.9	144	4	96	219	35	682	16	2	43	4
1989	1710	117	1827	1.3	203	6	144	417	60	923	26	3	45	0
1990	1864	154	2018	1.5	177	5	169	508	44	1031	39	0	42	3
1991	2201	169	2370	1.7	226	7	260	585	89	1143	17	1	39	3
1992	2088	158	2246	1.6	243	12	249	511	91	1074	18	0	45	3
1993	2333	162	2495	1.8	321	11	278	591	66	1150	20	0	58	0
1994	2875	141	3016	2.2	351	13	351	686	101	1428	14	1	69	2
1995	3388	133	3521	2.6	448	12	475	781	113	1590	21	0	81	0
1996	3760	114	3874	2.8	507	16	498	773	136	1823	28	0	89	4
1997	4342	126	4468	3.3	633	21	499	805	167	2260	21	0	62	0
1998	5203	164	5367	3.9	704	17	541	827	196	2992	23	0	65	2
1999	6111	214	6325	4.6	937	19	694	1319	241	3016	38	0	61	0
2000	6898	243	7141	5.2	997	38	719	1659	300	3314	25	0	88	1
2001	5883	199	6082	4.4	799	13	711	1255	283	2938	32	0	51	0
2002	5096	159	5255	3.8	610	15	579	949	271	2699	69	0	63	0
2003	5499	119	5618	4.1	857	20	525	1040	288	2757	54	0	75	2
2004	5885	161	6046	4.4	910	18	622	977	328	3066	38	0	87	0
2005	6591	136	6727	4.9	1048	31	705	1062	318	3444	44	0	74	1
2006	7269	194	7463	5.4	1247	25	742	1195	292	3826	60	0	75	1
2007	7980	230	8210	6.0	1338	26	869	1581	330	3897	53	0	110	6
2008	7444	268	7712	5.6	1321	32	844	1592	279	3484	48	0	107	5
2009	5959	216	6175	4.5	1044	12	706	1371	356	2510	84	1	60	31
2010	6283	176	6459	4.7	1177	23	755	1193	335	2808	71	0	83	14
2011	6206	162	6368	4.6	1152	28	659	1173	280	2875	36	1	152	12
2012	5953	141	6094	4.4	1072	14	619	1093	255	2849	66	1	104	21
2013	5092	96	5188	3.8	828	24	581	875	206	2546	24	1	94	9
2014	4476	94	4570	3.3	728	10	468	790	147	2332	30	3	56	6
Total	132432	4684	137116	100.0	20944	484	14513	26280	5652	65920	1041	16	2130	136
Sample size (%)	96.6	3.4	100.0	100.0	15.3	0.4	10.6	19.2	4.1	48.1	0.8	0.0	1.6	0.1

Notes: According to the information contained in Thomson One Banker, the deals classification contains, as per column headings above: (1) Mergers; (2) Acquisitions; (3) Acquisition of majority interest (Acq. Maj. Int.); (4) Acquisitions of partial interest (Acq. Part. Int.); (5) Acquisition of remaining interest (Acq. Rem. Int); (6) Acquisition of assets (Acq. of Assets); (7) Acquisition of certain assets (Acq. Cert. Asts); (8) Recapitalization; (9) Buyback; (10) Exchange offers.

Mergers are transactions in which 100% of the stocks of a public or private company are acquired. *Acquisitions* are transactions in which 100% of a company is split off and classified as an acquisition by shareholders. *Acquisitions of majority interest* are transactions in which an acquirer seeks to purchase over 50% but less than 100% of the target. *Acquisitions of partial interest* are transactions in which the acquirer holds over 50% and seeks less than 100% of the target. *Acquisitions of remaining interest* are transactions in which the acquirer holds over 50% and seeks to acquire 100% of the target. *Acquisitions of assets* are transactions in which the assets of a company, subsidiary, division or branch are acquired. *Acquisitions of certain assets* are transactions in which only certain assets of a company, subsidiary, or division are acquired. *Recapitalization* is a transaction in which a company undergoes shareholders' leveraged recapitalization to retain an equity interest in the company. *Buyback* is a transaction in which a company buys back its equity securities through either a private negotiation or a tender offer. *Exchange offers* are transactions in which a company offers to exchange new securities for its equity securities.

Table 4.4. Distribution of deals' status and summary statistics of deal values across years

	Total deals (million USD)				Completed deals (million USD)				Withdrawn deals (million USD)			
Year	N	Deal value (mean)	Deal value (median)	Deal value (Sd)	N	Deal value (mean)	Deal value (median)	Deal value (Sd)	N	Deal value (mean)	Deal value (median)	Deal value (Sd)
1977	1	7.960	7.960	-	1	7.960	7.960	-	0	-	-	-
1978	13	4.655	2.890	5.069	10	4.549	2.205	5.760	3	5.006	4.945	2.148
1979	4	7.400	6.700	6.119	2	6.116	6.116	6.213	2	8.683	8.683	8.194
1980	15	3.053	2.357	3.172	12	2.914	2.056	3.425	3	3.613	2.754	2.306
1981	88	4.682	0.715	17.300	79	3.470	0.679	12.850	9	15.320	1.639	38.780
1982	105	1.966	0.363	5.215	92	1.640	0.299	5.042	13	4.274	0.995	6.025
1983	200	0.879	0.258	1.701	185	0.818	0.246	1.687	15	1.628	0.811	1.758
1984	289	2.074	0.378	6.763	264	1.481	0.332	3.818	25	8.333	1.559	18.560
1985	220	3.084	0.898	7.848	189	2.469	0.903	5.621	31	6.831	0.797	15.320
1986	349	2.713	0.730	6.852	316	2.286	0.612	5.982	33	6.802	1.825	11.800
1987	462	2.139	0.572	4.908	419	1.735	0.465	3.896	43	6.076	2.834	9.790
1988	662	2.348	0.464	5.578	586	1.862	0.414	4.718	76	6.097	2.053	9.192
1989	907	1.641	0.327	4.353	857	1.408	0.299	3.768	50	5.634	1.856	9.228
1990	982	1.366	0.279	3.473	914	0.958	0.231	2.528	68	6.840	4.365	7.536
1991	1032	0.904	0.169	2.964	976	0.811	0.154	2.839	56	2.520	0.808	4.352
1992	1055	1.013	0.169	4.329	989	0.927	0.154	4.168	66	2.306	0.637	6.173
1993	1188	0.895	0.172	2.780	1143	0.862	0.165	2.782	45	1.743	0.662	2.625
1994	1450	1.066	0.194	3.511	1384	0.975	0.181	3.408	66	2.974	0.523	4.877
1995	1571	1.551	0.196	7.219	1512	1.500	0.182	7.278	59	2.847	0.722	5.385
1996	1823	1.691	0.279	5.907	1760	1.429	0.261	4.540	63	9.014	2.044	19.600
1997	2353	1.770	0.281	6.409	2278	1.630	0.264	6.084	75	6.020	1.364	12.160
1998	2761	2.307	0.295	13.390	2670	2.148	0.283	13.210	91	6.987	1.227	17.310
1999	3242	3.533	0.300	20.720	3110	2.758	0.274	15.970	132	21.780	1.998	64.950
2000	3569	3.067	0.281	20.940	3430	2.854	0.259	20.590	139	8.331	1.582	27.810
2001	2983	2.045	0.189	10.890	2872	1.801	0.179	10.190	111	8.360	1.355	21.610
2002	2734	1.349	0.214	7.609	2639	1.321	0.205	7.709	95	2.118	0.645	3.871
2003	2880	1.416	0.206	6.985	2829	1.341	0.201	6.801	51	5.587	1.937	13.240
2004	3126	1.879	0.253	10.940	3034	1.536	0.242	7.986	92	13.200	2.175	43.030
2005	3311	2.406	0.321	10.710	3239	2.259	0.312	10.290	72	9.052	1.276	21.780
2006	3586	3.417	0.397	14.990	3460	2.842	0.378	13.300	126	19.200	4.488	35.900
2007	3938	3.652	0.412	20.230	3794	2.978	0.392	14.920	144	21.420	3.998	70.950
2008	3455	2.717	0.302	12.100	3298	2.420	0.279	11.050	157	8.943	1.532	24.830
2009	2894	2.221	0.239	11.980	2769	1.903	0.223	10.400	125	9.257	1.081	29.720
2010	3171	2.379	0.353	9.761	3066	2.111	0.335	8.593	105	10.220	1.146	25.770
2011	3096	2.383	0.366	9.244	2987	2.140	0.356	8.527	109	9.057	1.778	19.800
2012	2961	2.068	0.393	7.082	2864	1.957	0.374	6.982	97	5.327	2.098	9.040
2013	2400	2.175	0.429	12.530	2335	2.027	0.418	12.500	65	7.478	2.164	12.450
2014	2062	2.690	0.432	15.450	1998	1.871	0.422	6.688	64	28.240	5.376	75.530
Total	66938	2.294	0.296	12.370	64362	1.997	0.277	10.710	2576	9.711	1.557	32.520

Notes: All monetary values are in constant prices (1982 = 100), using the consumer price index (CPI) data gathered from the US Department of Labour Bureau of Labour Statistics. Compared to Table 4.3, this table reports only transactions disclosing deal values in monetary terms.

4.4.2. Company size–related variables

In M&A studies, firm size is measured by market value (Martin & Shalev, 2009), number of employees (Buehler et al., 2006), total assets (Faccio & Masulis, 2005; Behr

& Heid, 2011; Barros & Dominguez, 2013) or total sales (Amihud et al., 1990; Pablo, 2009), among other proxies.

In our study, we adopt the definitions based on total sales and total assets adjusted for inflation.[33] However, given that Thomson One Banker (M&As module) also provides information related to the number of employees, which is only available for targets, we also computed the pairwise correlations between number of employees and total assets, and number of employees and total net sales (in logarithm form of the real prices). Both correlations are statistically significant (0.8575* and 0.7517*, respectively) with Bonferroni-adjusted significance levels of 0.05 or less, and the results of the regression models are qualitatively the same across the three definitions of targets' firm size. Hence, this research considers only total assets and total net sales for targets' firm size, excluding the number of employees to avoid multicollinearity problems in the empirical estimations.

Finally, both acquirers' total assets (*acqtotassets_rl*) and total net sales (*acqnetsaleslmt_rl*), and targets' total assets (*tgttotassets_rl*) and total net sales (*tgtnetsaleslmt_rl*) are considered as factors determining a company's size to test the hypotheses "1a" and "1b". These proxies of firm size present information about the year previous to the deal announcement. Thus, in terms of the notation, the last two letters

[33] Some studies in M&A transactions lack dealing with real prices adjustments (for monetary variables); for instance, Martin and Shalev (2009); Behr and Heid (2011); Moschieri and Campa (2014) do not state whether inflation affects the monetary variables used. We follow the recommendations of Duanmu and Guney (2009), who emphasise that monetary values should be corrected for inflation (i.e., prices growth). For this reason and due to the large numbers of years under analysis, the firm size proxies (in monetary terms) for both acquirers and targets are deflated by the US consumer price index (CPI, 1982 = 100). The US Department of Labour Bureau of Labour Statistic provides this index.

indicate the following: "*r"* means real terms or constant prices and "*l",* the natural logarithm transformation.

4.4.3. Incumbents' economic freedom index

There are various approaches relating economic freedom perspectives to the likelihood of making strategic investments, but they differ in terms of the criteria used (e.g., protection, law enforcement, investor rights) and locations assessed (e.g., US, Latin America, Europe, and so on). For instance, La Porta et al. (1998; 2000) evaluate legal systems (i.e., common and civil law) for studying dividends and depth of capital markets; Rossi and Volpin (2004) analyse the role of shareholder protections in M&A deal for the US and UK; and Pablo (2009) considers government intervention, regulation and property rights, among others aspects, for cross-border deals in Latin America.

Certainly, the country aspects mentioned by Rossi and Volpin (2004) and Pablo (2009) are single components of the full perspective of economic freedom. However, Spamann (2009) mentions the advantage of working with composite indices that synthesise multiple variables, which allow certain compensation among criteria. Using composite indicators, which combine different criteria, has been another way to analyse to the likelihood of M&A deals, especially because they enhance a full perspective of the economic stability of a given country (Gwartney et al., 2015).

The literature mentions some indicators such as the economic freedom index from the Heritage Foundation (Feito-Ruiz & Menéndez-Requejo, 2011) and the Anti-Director Right Index (Spamann, 2009), to name some, which consider both larger locations and years coverage. However, our research uses the Economic Freedom of the World (EWF

index) from the Fraser Institute that, according to Gwartney et al. (2015), mitigates the probable dispersion of interrelated criteria and enhances a full perspective of the economic freedom of a given country. Furthermore, the EWF index considers a global approach to see when decision makers (investors, shareholders and stakeholders) feel more protected by institutions to be able to exercise voluntary transactions without harming others (incumbents or property), and consistently ranks 157 countries and territories, and for over 100 locations tracking back to 1980, and to 1970 for others.

Another key point is that the EWF index synthetises five major country-level perspectives (i.e., size of government, legal system and security of property rights, sound money, freedom to trade internationally and regulation) across 24 economic freedom criteria (i.e., law enforcement, regulation, inflation, capital convertibility, business regulation, and so forth) (Gwartney et al., 2015). The information for the EWF index is set and contrasted against other sources, such as the International Country Risk Guide, the Global Competitiveness Report, the World Bank's Doing Business Project, European Values Study, the Policy Research Institute of Market Economy, Institute of Economic Affairs, and other international organizations.

This composite index allows testing the hypotheses "2a" and "2b", for both acquirers and targets respectively, in order to visualise country-level economic freedom and the propensity of deal withdrawal. With this in mind, the notation for economic freedom associated with the targets is "*tgtefridx2ln*" and for the acquirers it is "*acqefridx2ln*". The last two letters, "*ln"*, mean the natural logarithm transformation.

4.4.4. Company returns (profitability) variables

Some scholars consider different proxies of profitability accounting returns, either as a control or as an explanatory variable, to determine their influence on deals activities. For example, Dietrich and Sorensen (1984) analyse post-announcement withdrawals, Pablo (2009) assesses the determinants of cross-border deals, and Martin and Shalev (2009) explore the likelihood of mergers, and in so doing they consider corporate-level profitability.

Company returns are part of the financial information revised and uncovered during the due diligence process by decision makers (i.e., buyer, seller and financial and legal advisors) (Financier-Worlwide, 2004). Therefore, scholars particularly consider EBITDA (earnings before interest, taxes, depreciation and amortization) over the total assets as a measure of company returns (Pablo, 2009; Feito-Ruiz & Menéndez-Requejo, 2011; Thomson-Reuters, 2016b). This information is frequently available in the M&A synopsis, namely, from the fiscal year preceding the deal announcement.

The aim of analysing the incumbent company's returns (profitability) is to simultaneously test the hypothesis "3a", by which acquirers are less likely to withdraw when they have lower company returns (*acqebitdaassets*), and the hypothesis "3b", by which targets are more likely to withdraw when they have higher company returns (*tgtebitdaassets*). Our study not only uses this definition, but also considers the alternative definition of net income over total assets for robustness check (see Section 3.6).

4.4.5. Deal characteristics and control variables

The deal's characteristics, target's idiosyncrasies, and control variables used in this research follow previous studies on M&A and match them with the information reported by Thomson One Banker, for example, deal attitude, means of payments, location perspectives, type of integration, deal size, ownership sought and liquidity. Although Table 4B.1 (Appendix 4B) shows further details of deal characteristics and other attributes, this section defines them as follows:

- Deal attitude: This variable takes into account how the target perceives the acquirer's approach during the announcement or through the initial negotiation. Moschieri and Campa (2014) state that gentle approaches produce more deal completions. Hence, the study considers all these attitude dummy variables: friendly (*attitude2f1*), hostile (*attitude2h1*), and neutral (*attitude2n1*).
- Means of payments: Gorbenko and Malenko (2014) and Moschieri and Campa (2014) mention that stock payments are mostly exposed to probable misvaluations and unavoidable shared risks between a target and an acquirer, particularly when stock payments are used during the negotiation. Thus, the research considers dummy variables of means of payments for different deal structures such as cash only (*structure2c1*), stock only (*structure2s1*) and a combination of cash and stocks or explicit hybrid payments structure (*structure2cas1*).
- Location perspectives: Allows differentiating domestic (nationals) from transnational (cross-borders) counterparts. This separation puts under perspective the fact that cross-borders' deals reveal more countries' heterogeneities (i.e., macroeconomic conditions, regulation issues, capital convertibility) (Hijzen et al.,

2008; Pablo, 2009). Hence, this study controls these characteristics using a cross-border dummy (*crosborder1).*

- Type of integration: Considers whether the M&A deals relate in a different (vertical) or similar sector (horizontal). An integration binary variable (*vertical1*) is used, which takes one for vertical integration, and zero otherwise.
- Deal size: The total monetary value paid (or willing to be paid) by the acquirer excluding fees and expenses, which is shown in real terms (adjusted by inflation). For modelling purposes, the notation for this variable is "*dealval_rl"*, where "*r"* means real terms and "*l" is* the natural logarithm transformation. Deal size allows controlling the estimation by deal complexity (the larger the deal values, the more complex the transactions) (Grinstein & Hribar, 2004).
- Ownership sought: This variable, codified as "*pshrseekpurch*", takes into account the percentage of shares sought by a buyer in terms of common, equivalent or outstanding shares.
- Liquidity: This aspect is associated with the ratio of targets' cash and cash equivalents to total assets (*tgtcashstassets*), which control[34] the estimations by the signalling effect of excess of liquidity and likely inefficiency of asset allocations (Dietrich & Sorensen, 1984). For acquirers, there is no data available in Thomson One Banker. Our study likewise considers the ratio targets' target total debt to total assets, proxy of leverage, for robustness check (see Section 3.6).
- Also, we control for country-, industry- and time-fixed effects (Faccio & Masulis, 2005; Pablo, 2009; Erel et al., 2012; Moschieri & Campa, 2014).

[34] In our study we also control the estimations by using firm leverage (ratio of total debt to total assets) instead of liquidity ratio for robustness check (see Section 3.8). This variable is only available for targets.

Finally, Table 4.5 presents a summary of the notation and description of all variables considered in this study, and Table 4.6 shows the summary statistics (number of observations, mean, median, standard deviation, and so on) for the dependent variable (status) and the independent variables. The last group includes company size, economic freedom, company returns, deal characteristics and targets' liquidity and leverage.

Table 4.5. Brief description of the variables for the study

Variables	Description
Deal outcome	
(1) Status2	Binary variable (1= withdrawn; 0 = completed)
Panel A: Company size	
(2) acqtotassets_rl	Acquirer total assets (deflated in million USD)
(3) tgttotassets_rl	Target total assets (deflated in million USD)
(4) acqnetsaleslmt_rl	Acquirer net sales (deflated in million USD)
(5) tgtnetsaleslmt_rl	Target net sales (deflated in million USD)
Panel B: Economic freedom index	
(6) acqefridx2ln	Acquirer economic freedom index
(7) tgtefridx2ln	Target economic freedom index
Panel C: Company returns	
(8) acqebitdaassets	Acquirer returns (EBITDA)
(9) tgtebitdaassets	Target returns (EBITDA)
(10) acqnetincomlassets	Acquirer returns (ROA)
(11) tgtnetincomlassets	Target returns (ROA)
Panel D: Deal characteristics	
(12) attitude2f1	Friendly attitude (dummy)
(14) attitude2h1	Hostile attitude (dummy)
(15) attitude2n1	Neutral attitude (dummy)
(16) structure2c1	Cash payment (dummy)
(17) structure2s1	Stock payment (dummy)
(17) structure2cas1	Combination of cash and stock payment (dummy)
(18) crosborder1	Cross-border (dummy)
(19) vertical1	Vertical integration (dummy)
(20) dealval_rl	Deal value (deflated in million USD)
(21) pshrseekpurch	Percentage sought to purchase
(22) tgtcashstassets	Ratio cash to total assets (target's liquidity proxy)
(23) tgtleverage2	Ratio debt to total assets (target's leverage proxy)

Notes: For the company size (Panel A) after *"-", "r"* means figures in real terms, and *"l"* means natural logarithm transformation. For the economic freedom (Panel B) after "2", *"ln"* means natural logarithm transformation. For the dealval_rl (Panel D) after *"-", "r"* means figures in real terms, and *"l"* means natural logarithm transformation.

In Table 4.6, Panel A shows that acquirers are much larger than targets, and this size dispersion is relatively high for the former. Panel B presents the economic freedom index where the mean values of economic freedom index of the targets' and acquirers' home countries are very similar (7.7 vs. 7.8). Panel C displays information about profitability (EBITDA returns and ROA) for targets and acquirers. On average, when

the profitability is based on EBITDA, acquirers are more profitable (8% vs. 7%); when it is based on net income, they are still more profitable but the acquirers' (targets') profitability ratios are down to 0.4% (-117%).[35] Finally, Panel D offers information about the deal characteristics. It shows that the largest proportion of deal perception reported and means of payments considered are within the categories of friendly attitude (91%) and cash usage (22.2%), respectively.

Table 4.6. Descriptive statistics of deals variables

Variables	N	Mean	Median	SD	Skewness	Kurtosis	Min	Max
status2	137116	0.0342	0	0.182	5.129	27.31	0	1
Panel A: Company size								
acqtotassets_r ($mil)	67631	218.2	21.15	1072	37.06	3877	4.96e-06	135,583
tgttotassets_r ($mil)	28082	56.12	2.202	438.8	20.00	521.3	4.22e-06	17,505
acqnetsaleslmt_r ($mil)	68012	59.30	13.86	248.3	84.94	10695	4.29e-06	37,816
tgtnetsaleslmt_r ($mil)	37436	10.86	0.802	52.70	23.09	1094	4.22e-06	3,779
Panel B: Economic freedom index								
acqefridx2	134974	7.804	7.900	0.653	-1.265	5.912	2.900	9.200
tgtefridx2	136090	7.682	7.800	0.767	-1.321	5.672	2.500	9.200
Panel C: Company returns								
acqebitdaassets	66691	0.0822	0.110	4.738	-196.6	42105	-1074	106.4
tgtebitdaassets	21445	0.0709	0.0884	1.487	18.55	5242	-118.8	121.3
acqnetincomlassets	67494	0.00357	0.0432	5.406	-167.6	30362	-1079	101
tgtnetincomlassets	26663	-1.172	0.0253	191.2	-163.1	26620	-31210	819.8
Panel D: Deal characteristics								
attitude2f1	137116	0.905	1	0.293	-2.759	8.610	0	1
attitude2h1	137116	0.00284	0	0.0532	18.69	350.5	0	1
attitude2n1	137116	0.0628	0	0.243	3.605	14.00	0	1
structure2c1	137116	0.222	0	0.415	1.339	2.793	0	1
structure2s1	137116	0.0329	0	0.178	5.241	28.46	0	1
structure2cas1	137116	0.0204	0	0.141	6.780	46.97	0	1
crosborder1	137116	0.437	0	0.496	0.255	1.065	0	1
vertical1	137116	0.390	0	0.488	0.453	1.205	0	1
dealval_r ($mil)	66938	2,294	0,296	12,37	26,57	1186	4.29e-06	956.7
pshrseekpurch	128383	0,780	1.00	0.3418	-1.134	2.608	0.00100	1,00
tgtcashstassets	22857	0.166	0.0828	1.541	144.4	21469	8.68e-07	229.5
leveragetgt2	21595	0.344	0.245	4.025	106.6	12158	8.88E-07	497.2

Notes: All monetary values are in constant US prices (1982 = 100). The US Department of Labour Bureau of Labour Statistic provides the consumer price index (CPI).

[35] According to the deals synopsis and decision makers' rationale disclosed by the data provider, companies with negative values in profitability might uncover inefficient usage of assets, which can make those companies easy targets or influence asset movements and deals' completion or withdrawal. Consequently, we do not consider winsorizing outliers (i.e., substituting extreme values of a dataset with a certain percentile) or trimming (i.e., removing those extreme values) so as not to lose important information embedded in such values. However, the extreme values were revised, especially, total assets and total net sales for both acquirers and targets. We review the greatest outliers manually through the M&A news, deal synopsis, and information available. These values were consistent with the statistics summary. In addition to this, the negative values associated with the company returns were contrasted and computed separately regarding the financial information presented. Finally, for a robustness check, the extreme values, above (95%) and below (5%) for both company size and returns, were trimmed (selection bias assumption), and unreported results reveal that the quality of our most important findings, qualitatively does not change.

In addition to this, Table 4.7 presents the relationship (pairwise correlations analysis) among the selected dependent and the independent variables. This table indicates when the pairwise correlation is significant, with Bonferroni-adjusted significance levels of 0.05 or less, using an asterisk "*".

Table 4.7. Correlation matrix among selected variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	1.0000									
(2)	0.0093	1.0000								
(3)	0.1259*	0.4553*	1.0000							
(4)	0.0002	0.8706*	0.3383*	1.0000						
(5)	0.1352*	0.3656*	0.8653*	0.3542*	1.0000					
(6)	-0.0004	-0.0907*	-0.0716*	-0.0567*	-0.0547*	1.0000				
(7)	0.0002	-0.1216*	-0.0647*	-0.1089*	-0.0295*	0.6125*	1.0000			
(8)	-0.0009	0.0415*	-0.0011	0.0352*	-0.0038	-0.0034	0.0008	1.0000		
(9)	0.004	0.0111	0.0399*	0.0185	0.0561*	-0.0056	-0.0119	-0.0001	1.0000	
(10)	-0.0017	0.049*	0.0012	0.0324*	-0.0016	-0.0061	-0.0002	0.9484*	-0.0003	1.0000
(11)	0.0018	0.0256	0.025*	0.026	0.0798*	0.0033	0.0022	0.011	0.788*	0.0068
(12)	-0.0929*	-0.074*	-0.2652*	-0.0338*	-0.3005*	0.0509*	0.0517*	0.0057	-0.015	0.0061
(13)	0.1674*	0.0048	0.0495*	0.0096	0.0645*	0.0135*	0.0193*	0.0007	0.0044	0.0006
(14)	-0.0088	0.0678*	0.0939*	0.0271*	0.1223*	-0.0733*	-0.0913*	-0.0066	0.0029	-0.0071
(15)	0.016*	-0.0135	0.0601*	-0.0089	0.1446*	0.0461*	0.0655*	0.0032	0.009	0.0042
(16)	0.0392*	-0.0557*	0.0187	-0.0746*	0.0337*	0.0327*	0.0454*	-0.0034	-0.0071	-0.0023
(17)	0.0353*	-0.0957*	0.0373*	-0.1056*	0.0552*	0.0485*	0.054*	-0.0004	0.002	-0.0017
(18)	-0.0039	0.119*	-0.0655*	0.1592*	-0.0809*	-0.0499*	-0.2158*	0.0016	-0.0029	0.0008
(19)	-0.0257*	0.0146*	-0.0986*	0.0426*	-0.0326*	-0.0186*	0.0069	-0.0024	0.0065	-0.0038
(20)	0.1505*	0.3389*	0.6003*	0.2981*	0.5716*	0.031*	0.07*	0.01	0.0491*	0.0059
(21)	0.0203*	-0.21*	-0.2482*	-0.1435*	-0.2914*	0.1711*	0.2239*	0.0024	0.0048	0.0011
(22)	-0.0058	-0.0355*	-0.0434*	-0.0356*	-0.0371*	0.0113	0.0135	0.004	0.0281*	0.0044
(23)	-0.0038	-0.0075	-0.0381*	-0.0083	-0.0148	0.0033	0.0025	-0.0003	-0.0974*	-0.0001

Continue

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(11)	1.0000									
(12)	-0.0039	1.0000								
(13)	0.0007	-0.1644*	1.0000							
(14)	0.0027	-0.7979*	-0.0138*	1.0000						
(15)	-0.0072	-0.1519*	0.0306*	0.076*	1.0000					
(16)	0.0017	-0.0004	0.0094	-0.0233*	-0.0984*	1.0000				
(17)	0.0013	-0.0038	0.0437*	-0.0117*	-0.0771*	-0.0266*	1.0000			
(18)	0.005	0.0566*	-0.0083	0.0089	-0.0391*	-0.0951*	-0.05*	1.0000		
(19)	-0.007	-0.0198*	-0.0111*	0.0569*	0.0124*	-0.0358*	-0.036*	-0.0509*	1.0000	
(20)	0.0125	-0.0733*	0.0988*	-0.0482*	0.0296*	0.0819*	0.0951*	0.016*	-0.0795*	1.0000
(21)	-0.0027	0.4106*	0.0169*	-0.4004*	-0.115*	0.0187*	0.0554*	-0.0335*	-0.077*	0.1455*
(22)	0.0209	0.0125	-0.0045	-0.0078	0.0107	-0.0007	-0.0039	-0.0045	0.0035	-0.0137
(23)	0.1506*	0.0107	-0.0027	-0.0055	0.0061	-0.002	-0.003	0.0037	-0.0041	-0.0057

Continue

	(21)	(22)	(23)
(21)	1.0000		
(22)	0.0125	1.0000	
(23)	0.0065	0.5223*	1.0000

Notes: The variables are described as per Table 4.5: (1) status2, (2) acqtotassets_r, (3) tgttotassets_r, (4) acqnetsaleslmt_r, (5) tgtnetsaleslmt_r, (6) acqefridx2, (7) tgtefridx2, (8) acqebitdaassets, (9) tgtebitdaassets, (10) acqnetincomlassets, (11) tgtnetincomlassets, (12) attitude2f1, (13) attitude2h1, (14) attitude2n1, (15) structure2c1, (16) structure2s1, (17) structure2cas1, (18) crosborder1, (19) vertical1, (20) dealval_r, (21) pshrseekpurch, (22) tgtcashstassets, (23) leveragetgt2.

4.4.6. Estimation methods

Previous M&A studies used logit/probit analyses for their binary dummy dependent variable: likelihood of cross-border deals (Pablo, 2009; Moschieri & Campa, 2014), causes of domestic vs international deals (Erel et al., 2012), predictions of merger targets (Dietrich & Sorensen, 1984) and determinants of acquisition attempts (Zhang et al., 2011). Aligned with these studies, we employ logit[36] models to explore the determinants of the propensity to withdraw deals. The modelling approach starts from a general linear model (equation 3.1) and is represented as follows:

$$Z_{(i)} = \beta X_{(i)} + u_{(i)} \qquad (Eq\ 3.1)$$

$$P_{(i)} = Pr\left(Z_{(i)} = 1 \middle| X_{(i)}\right) = \left[1 + e^{-\beta X_{(i)}}\right]^{-1} \qquad (Eq\ 3.2)$$

where $P_{(i)}$ is the probability of a deal *i* being withdrawn; *e* is the exponential function; $X_{(i)}$ is the vector of independent variables (explanatory variables and control variables); and β is the regression coefficient for the independent variables. In addition, industry, country, and year dummies are included in the logit regression models. The regressions make use of robust standard errors to control for heteroscedasticity and serial correlation, at the same time. Finally, the explanatory power of the logit models is determined using the likelihood ratio test (convergence criteria) and the Wald test (global significance).

The equations consider targets' (T) and acquirers' (A) company size, economic freedom and company returns (profitability) to explain the likelihood of deal withdrawal (Z_i).

[36] We also use the probit analysis; the quality of the regression results does not change.

The modelling approach also relies on an additive and interactive set of independent equations to analyse the coefficients and models strength and stability as follows:

$$Z_i = \alpha + \beta Size_i^{T,A} + \gamma DCharact_i + \delta Control_i + u_i \quad (Eq\ 3.3)$$

$$Z_i = \alpha + \beta Size_i^{T,A} + \beta' EFree_i^{T,A} + \gamma DCharact_i + \delta Control_i + u_i \quad (Eq\ 3.4)$$

$$Z_i = \alpha + \beta Size_i^{T,A} + \beta' EFree_i^{T,A} + \beta'' Returns_i^{T,A} + \gamma DCharact_i + \delta Control_i + u_i \quad (Eq\ 3.5)$$

The first model considers only the effect of company size ($Size$), deal characteristics ($DCharact$) and some company-specific variables ($Control$). The second model, in addition to the first model specification, adds variables associated with the economic freedom index for the incumbents' companies ($EFree$). The last model, representing the full model, extends the second model by considering accounting returns ($Returns$). Finally, for each model the marginal effects ($\partial Z/\partial X$) of independent variables *X* on Z are also obtained. These effects complement the results and their interpretation in terms of economic significance rather than reading them from the log of odds.

4.5. Results

4.5.1. Univariate analysis

In order to implement the univariate analysis, the data sample is divided into two groups (Table 4.8) according to the deal status (completed and withdraw) by using some measures of central tendency (means and medians). Therefore, relying on the t-test and Wilcoxon test (Table 4.9), we assess the difference in means and medians between groups, respectively. Through these tests the status differences are assessed for the

targets' and acquirers' firm size (Panel A), economic freedom index (Panel B) and accounting returns (Panel C), as well as the deals' characteristics and targets' specific information (Panel D).

Table 4.8. Univariate analysis: differences between completed and withdrawn deals

	Completed			Withdrawn		
Description	**N obs**	**Mean**	**Median**	**N obs**	**Mean**	**Median**
Panel A: Company size						
acqtotassets_r	65100	218.1	21	2531	221.1	25.81
tgttotassets_r	25994	53.65	1.990	2088	86.97	7.743
acqnetsaleslmt_r	65491	58.96	13.82	2521	68.17	14.66
tgtnetsaleslmt_r	35144	10.36	0.723	2292	18.44	3.896
Panel B: Economic freedom						
acqefridx2	130375	7.804	7.900	4599	7.809	8
tgtefridx2	131459	7.681	7.800	4631	7.691	7.900
Panel C: Company returns						
acqebitdaassets	64221	0.0830	0.111	2470	0.0615	0.102
tgtebitdaassets	19686	0.0691	0.0880	1759	0.0910	0.0922
acqnetincomlassets	64969	0.00542	0.0433	2525	-0.0441	0.0377
tgtnetincomlassets	24619	-1.270	0.0251	2044	0.0135	0.0277
Panel D: Deal characteristics						
attitude2f1	132434	0.910	1	4684	0.760	1
attitude2h1	132434	0.00116	0	4684	0.0502	0
attitude2n1	132434	0.0632	0	4684	0.0515	0
structure2c1	132434	0.221	0	4684	0.257	0
structure2s1	132434	0.0315	0	4684	0.0700	0
structure2cas1	132434	0.0195	0	4684	0.0470	0
crosborder1	132434	0.437	0	4684	0.427	0
vertical1	132434	0.392	0	4684	0.323	0
dealval_r	64362	1.997	0.277	2576	9.711	1.557
pshrseekpurch	124407	0.778	1,00	3976	0,818	1,00
tgtcashstassets	21079	0.169	0.0833	1778	0.136	0.0756
leveragetgt2	19760	0.349	0.2444	1835	0.294	0.2492

Notes: All monetary values are in constant US prices (1982 = 100). The consumer price index (CPI) data was gathered from the US Department of Labour Bureau of Labour Statistics.

According to Table 4.9, it is evident that the median differences for most of the variables are statistically significant. As for the mean values, the economic freedom indices, the size of acquirers and profitability ratios show no statistical significance across the two sub-samples. However, the size of the target firms is significantly smaller for the completed deals compared to the case of withdrawn deals.

In particular, it can be observed that the differences between deals completed and withdrawn (deal status) are statistically significant at a 1% level for the targets' size (net sales) and deal characteristics (friendly and neutral attitude, all means of payments dummies, integration, deal size and % of shares sought to purchase) for both tests.

The status differences for targets' size (assets) and neutral attitude are statistically significant at the 5% level (t-test) and at 1% (Wilcoxon test). However, the differences for acquirers' size (assets), targets' liquidity and both incumbents' economic freedom index and EBITDA returns are only statistically significant at 5% for the Wilcoxon test. Finally, for the acquirers' size (sales), cross-border dummy, and targets' profitability (ROA) and leverage, the data does not support the differences between the groups.

Table 4.9. Univariate analysis: t-test and Wilcoxon test of difference between groups

	Completed versus Withdrawn	
Description	**t-Test**	**Wilcoxon**
Panel A: Company size		
acqtotassets_r	-0.141	-3.7259***
tgttotassets_r	-3.34**	-22.4334***
acqnetsaleslmt_r	-1.827	-1.1464
tgtnetsaleslmt_r	-7.113***	-28.4963***
Panel B: Economic freedom		
acqefridx2	-0.513	-3.7597***
tgtefridx2	-0.827	-4.1127***
Panel C: Company returns		
acqebitdaassets	0.221	4.5003***
tgtebitdaassets	-0.592	-2.1785**
acqnetincomlassets	0.452	5.1593***
tgtnetincomlassets	-0.292	-1.1094
Panel D: Deal characteristics		
attitude2f1	34.55***	34.4024***
attitude2h1	-62.86***	-61.9748***
attitude2n1	3.252**	3.2517***
structure2c1	-5.941***	-5.9407***
structure2s1	-14.53***	-14.517***
structure2cas1	-13.07***	-13.0659***
crosborder1	1.442	1.4419
vertical1	9.514***	9.5105***
dealval_r	-31.26***	-37.0984***
pshrseekpurch	-7.262***	-4.0254***
tgtcashstassets	0.873	3.0331***
leveragetgt2	0.556	-1.306

Notes: The t-statistic (Z-statistic; Wilcoxon signed negative ranks test) is for the mean (median) differences of each variable between two groups. *** p<0.01, ** p<0.05, * p<0.1. See Table 4B.1 for the definitions of the variables.

4.5.2. Likelihood of withdrawal of deals

Using robust standard errors to control heteroscedasticity and autocorrelation, Table 4.10 and Table 4.11 present the results of the logit regression models (both the coefficients and marginal effects). Particularly, they illustrate different company size specifications: net sales and total assets. In addition to these tables, Table 4C.1 (Appendix 4C) provides information about the variance inflation factor (VIF). The coefficients presented allow analysing multicollinearity issues (i.e., any value of a predictor in a model with VIF aggregated or equal to 10 indicates a high level of multicollinearity). Hence, Table 4C.1 confirms that multicollinearity is not an issue since the VIF values are all below the critical value of 10 for all the models specified.

Firstly, regarding the logit regression models and marginal effects respectively, columns one and two in Table 4.10 and Table 4.11 show the base-case specifications to analyse the impact of company size on the likelihood of deal withdrawals. Consistent with theoretical expectations, the evidence supports our hypotheses "1a" and "1b" for both proxies of company size considered at the 1% level. Certainly, the higher the acquirers' size, the lower the likelihood of withdrawal at the 1% level. This is aligned with Faccio and Masulis (2005), who stated that larger acquirers are more diversified, and with Behr and Heid (2011), who mention that larger acquirers can better exploit their economies of scales perspectives.

In contrast to this, the larger the acquirer's size, the higher the likelihood of deal withdrawal at a 1% level of statistical significance. This is consistent with Dietrich and Sorensen (1984) and Beitel et al. (2004), who state, respectively, that larger targets increase the acquisition costs and the complexity to capture the potential synergies.

Secondly, the next columns (three and four) in Table 4.10 and Table 4.11 take into account the role of the economic freedom index associated with acquirers' and targets' countries. The evidence only supports our hypothesis "2a" at the 1% level, suggesting that a higher economic freedom index pertaining to an acquiring firm's country increases the tendency to cancel the M&A deals. The respective marginal effects as a measure for the economic significance is very high (31%). Indeed, the supporting evidence is consistent with the argument of Pablo (2009), who finds a negative influence between acquirers' property rights on cross-border completions, and with the explanation of Feito-Ruiz and Menéndez-Requejo (2011), who mention that strong protection and information transparency makes decision makers more aware of business risks and acquisition costs. Consequently, deals are more sensitive to public scrutiny and therefore strengthen the exit option in post-announcement deals. In contrast, our analysis fails to confirm hypothesis "2b" as the respective coefficient estimates (i.e., targets' economic freedom) are all insignificant.

Thirdly, columns five and six (the full model) in Table 4.10 and Table 4.11 consider the role of accounting returns (i.e., ratio EBITDA to total assets) for both targets and acquirers and also the previous explanatory variables. Our results do not lend any support to hypothesis "3a" as the accounting performance of the acquirers exerts no significant influence on the propensity to reject M&A deals. Similarly, our findings related to the profitability of target firms oppose our hypothesis "3b" because the coefficient estimates are negative and significant albeit at the 1% level. An explanation for this is that targets get more attractive when their accounting returns are higher. Indeed, Garzella and Fiorentino (2014) note that synergies expectations and realizations are essential for M&A deals in order to create value for the shareholder. This approach

increases the chance of the deal's completion as decision makers become more aware of the synergies enhancement and more willing to complete the deal announced.

Regarding the control variables (statistical significance, expected sign and stability through the different models' specifications), most of the deals' characteristics considered are consistent with previous studies. For instance, as is suggested by Gorbenko and Malenko (2014), the usage of shares (i.e., *structure2s1*) as a means of payment augments the likelihood of deal withdrawal at a 10% level at the least. The respective marginal effects as a measure of the economic significance is around 1.8% for the full model specification. Observe also that the odds of deals being withdrawn reduce under a friendly (i.e., *attitude2f1*, high marginal effects around 17%) and neutral attitude (i.e., *attitude2n1*, high marginal effects around 20%). This is aligned with Moschieri and Campa (2014), who emphasise that gentle approaches enhance better M&A negotiations. These characteristics are again statistically significant at the 1% level.

Furthermore, the higher the deal size (i.e., *dealval_rl*) and the percentage of shares sought for purchase by the acquirers (i.e., *pshrseekpurch*), the larger the likelihood of deal withdrawal at the 1% level. These findings are supported, respectively, by Grinstein and Hribar (2004), who highlight high complexity and more managerial skills and effort in large deals, and Bajo et al. (2013), who remarks that changes in ownership and control create distress and uncertainty on the decision makers. Finally, the other controls turn out not to have significant effects on the M&A deals' withdrawal.

The overall results are statistically consistent and stable in terms of the coefficients obtained. Therefore, the Wald statistics are significant at the 1% level, suggesting that

all the coefficients associated with the explanatory variables (independent and control variables) are simultaneously different from zero.

Table 4.10. Multivariate analysis: deal withdrawal on different settings using net sales as the main variant of company size

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Coeff.**	**Marginal effects**	**Coeff.**	**Marginal effects**	**Coeff.**	**Marginal effects**
acqnetsaleslmt_rl	-0.161***	-0.00894***	-0.163***	-0.00901***	-0.186***	-0.0106***
	(0.0277)	(0.00154)	(0.0278)	(0.00154)	(0.0305)	(0.00174)
tgtnetsaleslmt_rl	0.124***	0.00686***	0.127***	0.00700***	0.151***	0.00862***
	(0.0373)	(0.00207)	(0.0377)	(0.00208)	(0.0427)	(0.00244)
acqefridx2ln			5.638***	0.311***	6.401***	0.366***
			(1.820)	(0.101)	(1.977)	(0.113)
tgtefridx2ln			-1.161	-0.0640	-1.843	-0.105
			(1.326)	(0.0731)	(1.384)	(0.0790)
acqebitdaassets					0.00461	0.000263
					(0.00824)	(0.000471)
tgtebitdaassets					-0.0189*	-0.00108*
					(0.00976)	(0.000558)
attitude2f1	-3.041***	-0.169***	-3.028***	-0.167***	-3.128***	-0.179***
	(0.168)	(0.00888)	(0.170)	(0.00889)	(0.188)	(0.0103)
attitude2h1	-0.523**	-0.0290**	-0.496**	-0.0274**	-0.617**	-0.0352**
	(0.221)	(0.0123)	(0.223)	(0.0123)	(0.249)	(0.0142)
attitude2n1	-3.615***	-0.201***	-3.638***	-0.201***	-3.732***	-0.213***
	(0.265)	(0.0146)	(0.270)	(0.0147)	(0.291)	(0.0164)
structure2c1	-0.0909	-0.00505	-0.0896	-0.00494	-0.0333	-0.00190
	(0.116)	(0.00644)	(0.116)	(0.00642)	(0.125)	(0.00716)
structure2s1	0.276**	0.0153**	0.257*	0.0142*	0.305**	0.0175**
	(0.141)	(0.00782)	(0.141)	(0.00779)	(0.150)	(0.00856)
structure2cas1	-0.0962	-0.00534	-0.124	-0.00682	-0.129	-0.00739
	(0.167)	(0.00924)	(0.169)	(0.00931)	(0.181)	(0.0103)
crosborder1	0.0328	0.00182	0.0249	0.00137	0.000281	1.61e-05
	(0.119)	(0.00659)	(0.121)	(0.00667)	(0.132)	(0.00757)
vertical1	0.180	0.00997	0.179	0.00989	0.0873	0.00499
	(0.110)	(0.00609)	(0.110)	(0.00607)	(0.121)	(0.00691)
dealval_rl	0.205***	0.0113***	0.207***	0.0114***	0.204***	0.0116***
	(0.0433)	(0.00240)	(0.0436)	(0.00240)	(0.0479)	(0.00274)
pshrseekpurch	0.0109***	0.000607***	0.0108***	0.000597***	0.0103***	0.000588***
	(0.00209)	(0.000115)	(0.00209)	(0.000114)	(0.00227)	(0.000130)
tgtcashstassets	0.0110	0.000612	0.00687	0.000379	0.0983	0.00562
	(0.107)	(0.00594)	(0.114)	(0.00628)	(0.182)	(0.0104)
Constant	-0.532		-9.640***		-9.741***	
	(0.456)		(3.443)		(3.679)	
Observations	9,339	9,339	9,297	9,297	7,894	7,894
Years	Yes	Yes	Yes	Yes	Yes	Yes
Industry_Acq & Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Country_Acq & Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.279		0.28		0.279	
F/ Wald statistic	1064.411		1040.997		920	
P-value F/ Wald	2.6000e-136		4.6000e-134		2.6000e-111	

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4.11. Multivariate analysis: deal withdrawal on different settings using total assets as the main variant of company size

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Coeff.**	**Marginal effects**	**Coeff.**	**Marginal effects**	**Coeff.**	**Marginal effects**
acqtotassets_rl	-0.201***	-0.0109***	-0.205***	-0.0110***	-0.228***	-0.0129***
	(0.0304)	(0.00164)	(0.0304)	(0.00164)	(0.0342)	(0.00192)
tgttotassets_rl	0.196***	0.0106***	0.201***	0.0108***	0.206***	0.0116***
	(0.0436)	(0.00237)	(0.0438)	(0.00237)	(0.0508)	(0.00288)
acqefridx2ln			5.497***	0.296***	6.194***	0.349***
			(1.834)	(0.0991)	(1.963)	(0.111)
tgtefridx2ln			-1.170	-0.0630	-1.763	-0.0995
			(1.315)	(0.0707)	(1.362)	(0.0767)
acqebitdaassets					0.00864	0.000487
					(0.0112)	(0.000633)
tgtebitdaassets					-0.0174*	-0.000982*
					(0.0100)	(0.000567)
attitude2f1	-3.029***	-0.164***	-3.011***	-0.162***	-3.103***	-0.175***
	(0.166)	(0.00858)	(0.168)	(0.00860)	(0.187)	(0.0100)
attitude2h1	-0.515**	-0.0279**	-0.487**	-0.0262**	-0.585**	-0.0330**
	(0.219)	(0.0119)	(0.222)	(0.0119)	(0.247)	(0.0139)
attitude2n1	-3.579***	-0.194***	-3.598***	-0.194***	-3.709***	-0.209***
	(0.263)	(0.0141)	(0.266)	(0.0142)	(0.289)	(0.0160)
structure2c1	-0.0549	-0.00297	-0.0504	-0.00271	-0.00187	-0.000105
	(0.115)	(0.00620)	(0.115)	(0.00618)	(0.124)	(0.00702)
structure2s1	0.228*	0.0123*	0.211	0.0114	0.270*	0.0152*
	(0.138)	(0.00747)	(0.138)	(0.00745)	(0.147)	(0.00833)
structure2cas1	-0.143	-0.00772	-0.164	-0.00882	-0.172	-0.00972
	(0.165)	(0.00893)	(0.167)	(0.00899)	(0.180)	(0.0102)
crosborder1	0.0286	0.00155	0.0185	0.000993	0.00719	0.000406
	(0.117)	(0.00632)	(0.119)	(0.00639)	(0.130)	(0.00734)
vertical1	0.161	0.00871	0.161	0.00865	0.0962	0.00543
	(0.109)	(0.00591)	(0.110)	(0.00590)	(0.121)	(0.00682)
dealval_rl	0.169***	0.00914***	0.170***	0.00913***	0.182***	0.0102***
	(0.0490)	(0.00265)	(0.0493)	(0.00265)	(0.0553)	(0.00311)
pshrseekpurch	0.0116***	0.000630***	0.0115***	0.000621***	0.0109***	0.000612***
	(0.00216)	(0.000116)	(0.00216)	(0.000116)	(0.00239)	(0.000135)
tgtcashstassets	0.0360	0.00195	0.0286	0.00154	0.0762	0.00430
	(0.111)	(0.00601)	(0.121)	(0.00649)	(0.218)	(0.0123)
Constant	-0.517		-9.246***		-9.315**	
	(0.461)		(3.457)		(3.663)	
Observations	9,812	9,812	9,765	9,765	8,133	8,133
Years	Yes	Yes	Yes	Yes	Yes	Yes
Industry_Acq & Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Country_Acq & Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.28		0.281		0.282	
F/ Wald statistic	1099.004		1081.202		944	
P-value F/ Wald	8.9000e-143		1.4000e-141		9.3000e-116	

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.6. Final Considerations

This section assesses the stability of the empirical results using the full model under two additional approaches: 1) effect of bottom-line accounting returns (i.e., net income over total assets) and 2) impact of capital structure (i.e., leverage) on the likelihood of deal withdrawal. Consequently, the findings show that the regression coefficients obtained in Table 4.10 and Table 4.11 keep their statistical significance and signs. Therefore, the implications of the hypothesis testing in the previous sub-section still hold, which makes our deductions more solid.

In detail, the first approach tests the ratio of net income to total assets (traditional return on assets or ROA) instead of using EBITDA over total assets as returns, for both acquirers and targets. We follow a managerial rationale highlighted during the due diligence process (Lebedow, 1999; Financier-Worlwide, 2004; McGrady, 2005), where decision makers also revise the bottom line of accounting figures to see how profitable the companies are after debt obligations (interests) and government duties (taxes) (see e.g., Martin and Shalev (2009)).

Thus, Table 4D.1 (Appendix 4D), using ROA in combination with both variants of company size (total net sales and total assets) reveals that the global results obtained are similar (in terms of statistical significance and expected sign) to those using EBITDA returns for both variants of company size. The results also hold for the economic freedom index, deal characteristics, and other control variables. Particularly, note again that the higher the targets' returns, either the EBITDA returns or ROA, the lower the likelihood of deals withdrawn.

In the second approach, we also control the estimations by using firm leverage (ratio of total debt to total assets) instead of liquidity ratio in the full model, and regarding both variants of firm size (net sales and assets) and company returns (EBITDA returns and ROA). For this approach, Thomson One Banker only provides information for the targets.

Table 4D.2 (Appendix 4D) presents that targets' leverage is not statistically significant for the model specifications under evaluation. These results are aligned with Martin and Shalev (2009), who find non-statistical significance of the influence of high acquirers' or targets' leverage on post-announcement deals failure. Note that the only change observed is on EBITDA returns. Although this is not statistically significant, the coefficient sign remains similar to the full regression model controlled by the liquidity ratio. Therefore, using ROA, Table 4D.3 (Appendix 4D) shows that the likelihood of deal withdrawal is consistent and stable (in statistical significance and sign) for all the variations of company size and accounting returns, and also for economic freedom index, deal characteristics and targets' specific information (e.g., liquidity and leverage).

Finally, also using ROA as a proxy of company returns, Appendix 4E presents some other results of the logit regression models (both the coefficients and marginal effects) for distinct deal classifications obtained from Table 4.3. Namely, mergers, acquisitions, acquisition of majority interest, acquisitions of partial interest, acquisition of remaining interest, acquisition of assets, acquisition of certain assets, recapitalization, buyback, and exchange offers.

After adjusting and considering sampling and modelling problems related to insufficient observations, non-convexity, solutions non-achieved, lack of convergence,

and so forth, five particular regression models were considered. For instance, acquisitions of partial interest, mergers, all other acquisitions (general acquisition, acquisition of majority interest, acquisition of remaining interest, acquisition of assets, and acquisition of certain assets), all acquisitions, and remaining deals (mergers, buyback, exchange offer, and recapitalization). The models rely on robust standard errors to control heteroscedasticity and autocorrelation.

Using both net sales (Table 4E.1 and Table 4E.2) and total assets (Table 4E.3 and Table 4E.4) as proxies of company size, the findings show (in statistical significance and sign) that company size of acquirer and neutral deals attitude impact on the likelihood of deals withdrawal across all deals classification. Therefore, deal size, friendly deals attitude and ownership affect mostly the likelihood of deals withdrawal for acquisitions of partial interest, mergers, and remaining deals.

Finally, the current chapter discloses in Appendix 4F the Stata® 14 code with all the regression models implemented and the different Outreg2 commands to export the results for their analysis. These are key aspects to extending the research and have practical implications in terms of firm size discernments, economic freedom outlooks and accounting returns figures and their impact on M&A deals failure.

4.7. Conclusions

In an effort to introduce other perspectives to the M&A studies, this chapter showed a different research framework for investigating the factors causing the withdrawal of deals during 1977 to 2014 based on an initial dataset consisting of 186,640 deals in 147 countries. Overall, we find that economic freedom index, corporate size and profitability do affect the propensity not to go ahead with the announced M&A deals. Specifically, the likelihood of the failure of an M&A deal decreases as the size of the acquiring firm gets larger, but it increases as the size of the target firm gets larger. This new evidence shows that firm size significantly impacts deal failures, which might be related to assets movement from low to high productivity level as the efficiency theory professes (Tirole, 2006; Garzella & Fiorentino, 2014).

Furthermore, M&A deals are less prone to fail if the target firm's profitability (EBITDA returns or ROA) is higher. However, our analyses showed that an acquiring firm's profitability exerts no significant influence on this propensity. This aspect is associated with the highly expected synergies to be realised, which are essential for M&A deals as a vehicle to create value for shareholders through assets movements (Garzella & Fiorentino, 2014).We also find that although the economic freedom index of the target firm's country bears no significant effect, this index for the acquirer's country is positively associated with the probability of the M&A withdrawal. This finding is in line with Pablo (2009) who determines a negative link between the acquirer's property rights and cross-border completions, implying that the higher the acquirer's economic freedom index, the higher the likelihood of a deal's withdrawal. This finding suggests that the acquirers are more aware of M&A risks and costs,

information asymmetries, and also market and economic environments where companies are located.

Regarding the deal characteristics, and aligned with some claims from previous studies, the results show that using stocks as a means of payments (Gorbenko & Malenko, 2014), approaching unfriendly deal transactions (Moschieri & Campa, 2014) and seeking high percentages of targets' shares to purchase (Bajo et al., 2013) or high deal size (Grinstein & Hribar, 2004) increase the probability of having a failed M&A deal. It seems that offering stocks instead of financing the deals via cash or debt does not favour the deal as this probably satisfies neither the bidding nor target firms' shareholders for various reasons including uncertainty, loss of control and dilution in ownership if the deal is completed. The evidence statistically supports these findings at the univariates (t-test and Wilcoxon test) and multivariate analysis (logit regression models).

In term of managerial implications, the study shows that an appropriate level of due diligence and awareness in terms of firm size and accounting returns information, and the economic and legal environment, help decision makers (especially buyers) to have an appropriated "walking-in" or "going-away" strategy for an M&A deal. This information also aids financial and legal advisors, among other M&A advisory professionals, in their fiduciary duty to both targets and acquirers, to embrace likely variations of the negotiation process and their outcomes in terms of deal withdrawal.

Because of lack of information, the current study was unable to analyse whether the role of the deal voting process (Burch et al., 2004), persistency of acquirer's role (natural bidders) across time (Coleman et al., 2010) and influence of internal corporate governance mechanisms (Wang & Xie, 2009), in combination with the incumbents'

firm size and accounting returns, and related country economic freedom, might affect deal failure. Finally, aspects such as quality of accounting reports and role of legal and financial advisors would merit further research.

Chapter 5. Final conclusions

The first empirical chapter (Chapter 2) contributes to the corporate governance literature using multi-criteria decision analysis (MCDA). The proposed MCDA approach computes a corporate governance quality, based on the PROMETHEE methods (relying on outranking analysis), and reveals a new and fundamental path to analyse the relationship between corporate governance and firm performance. Therefore, it overcomes the limitations of traditional governance indices that are associated with various problems such as weighting and stickiness and highly compensatory aggregations.

The outranking analysis on dominance relationships among companies provides robustness in the empirical results, even in addressing at least partially the endogeneity concerns. In all cases, we found that our measure for corporate governance quality is significantly and negatively related to company performance. This result may be due to the costs associated with following or maintaining several 'good' corporate governance practices (i.e., board function, board structure, compensation policy, shareholders' rights and vision and strategy).

Chaper 3 utilizes the reliability systems theory to successfully mimic a corporate governance system and its components (internal and external). The system is assessed through a reliability model and machine-learning techniques. The operating/failed states of components and company-specific conditions allow defining an approximated structure function related to company performance. This structure function models the functioning of the system for given states of its components.

The results of this chapter show that growth opportunities matter for the proper functioning of the system. They also suggest that both the trustworthiness of companies and the system reliability could improve if companies are more transparent (i.e., specific components, such as corporate social responsibility, average number of board meetings, compensation policy, remuneration and vesting options, auditing independency and independent board, show low probabilities of failure).

Chaper 4 introduces a novel research framework to analyse corporate finance decisions, particularly on post-announcement M&A deals failure. This approach relies on different modelling specifications using logit regression models, and shows that individual targets' and acquirers' company size (total net sales and total assets), acquirers' economic freedom index, and targets' company returns (EBITDA returns or ROA) impact on deal withdrawal (considering expected signs and statistical significance). This original study, controlled by a large number of deals characteristics (i.e., means of payments, deal attitude, ownership, deals size, and so forth) extend the literature on deal failure and on determinants of takeover efficiency in terms of assets movement (from low to high productivity).

Limitations and future research

Future research seeking solutions for the limitations of this thesis, which are presented in detail at the end of each empirical chapter, or extending the research questions to other aspects of corporate governance and corporate finance could be performed. For instance, in Chaper 2 the proposed aggregate quality of corporate governance (MCDA approach) may need to be examined by external parties (i.e., investors, regulators and other stakeholders), and contrasted against other corporate governance indices provided

by the literature or rating agencies. The proposed approach can be extended using other law and regulation environments, and strengthened implementing advanced analytics for sensitivity and simulation analysis that are out of the scope of the current research.

Future research is warranted to mitigate the limitations of Chapter 3 associated with mapping corporate governance into reliability systems; for example, the limitations with regards to considering law and regulation, comparing different corporate governance systems across countries and assessing the impacts of large shareholder and investors, among other aspects. Therefore, the research can also be extended through investigating additional reliability models and data mining approaches, as well as results comparisons with traditional empirical regression models.

Finally, regarding the corporate finance decisions associated with M&A deals activity and developed in Chapter 4, note that company size, economic freedom index and firm accounting returns impact on the exit/abandonment option of an announced takeover strategy (statistically significant at the univariates and multivariate analysis). However, aspects such as the role of the deal voting process, persistency of natural bidders, influence of internal corporate governance, quality of accounting and financial reports and role of legal and financial advisors (M&A advisory professionals) would merit further research and also allow extending the current research framework in M&A deals failure.

Chapter 6. Practical implications: Managers, policy makers, and investors

The findings of this thesis have a number of important implications for future practice. For example, Chapter 2 shows how a traditional corporate governance measurement (ASSET4 ESG) fails to detect and scrutinize small differences among companies regarding their governance quality and firm performance. Therefore, our new MCDA approach not only provides robustness in the empirical results, but also can be used by policymakers, investors, managers, shareholders and stakeholders to evaluate the stability and explanatory power of other existing indices to understand how corporate governance mechanisms affect firm performance. Our methodological and empirical framework do not intend to compromise the current practices of selecting companies for investments. However, the study provides novel perspectives to enhance a better usage of corporate governance information and high transparency in the rating agencies for their aggregate corporate governance indices.

Therefore, the findings in Chapter 3 enhance an additional participation of decision makers for alternative usages of corporate governance information using system reliability and machine-learning techniques. The approach is needed for a board of directors either to see what corporate governance components are more aligned with the most successful companies, investors and managers, or to assess a firm's reliability in terms of its reported corporate governance practices and mechanisms. In addition, systems reliability should be made available to inform policy makers about which factors are increasing or diminishing the reliability of a defined system's outcome (i.e., firm performance).

Finally, another important practical implication is obtained from Chapter 4 for managers and investors, especially for M&A bidders. The chapter shows that they need to have an appropriate level of due diligence and awareness of individual targets' and acquirers' company size (net sales and total assets), acquirers' economic freedom index, and targets' company returns (EBITDA returns or ROA) to develop a consistent "walking-in" or "going-away" strategy for an M&A transactions. In addition, M&A advisory's professionals (legal, financial, e.g.) can also visualise possible variations of deals negotiation and likely outcomes on post-announcement deals failure.

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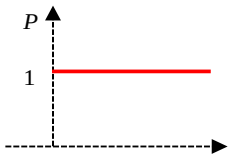
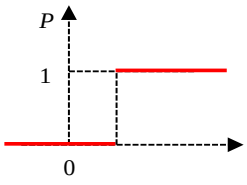
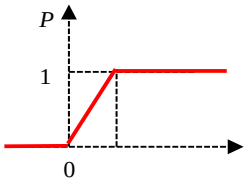
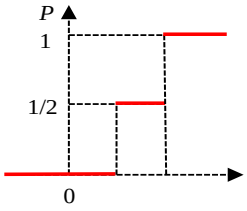
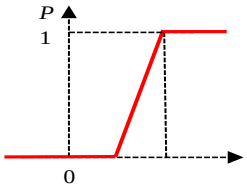
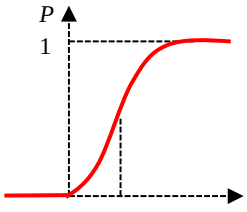
Appendix Chapter 2

2A. Generalised criteria (GC) associated with the PROMETHEE methods

Scholars have suggested six types of generalised criteria for modelling other ranges of pair-wise comparison conditions around the differences between alternatives (companies) (Brans et al., 1986; Brans & Mareschal, 2005; Brans & De Smet, 2016). In addition to the aforementioned Type I used for this research framework, they propose U-shape, V-Shape, Level, V-Shape with indifference, and Gaussian (See Table 2A.1 for further details). The GCs can also be utilized to model dominance relationships among alternatives. However, they require information, either from decision makers or from the problem itself, particularly the parameters q (threshold of indifference), p (threshold of strict preference) and s (intermediate value between q and p). For the current research, Type I is recommended because it requires both less information and high precision in the corporate governance criteria.

Table 2A.1. Summary table of generalised criteria of the PROMETHÉE methods

Type and Common Name	Illustration	Definition and Comments	Parameters to be set	Category
I: *Usual or Normal*		$P(d)=\begin{cases}0 & d\le 0\\ 1 & d>0\end{cases}$ Applied to highly precise criteria	None	Strict criterion
II: *U-Shape*		$P(d)=\begin{cases}0 & d\le 0\\ 1 & d>0\end{cases}$ For qualitative criteria, fuzzy or with imprecise information	q	Quasi-criterion
III: *V-Shape*		$P(d)=\begin{cases}0 & d\le 0\\ d/p & 0<d\le p\\ 1 & d>p\end{cases}$ For quantitative criteria with some precision and linear consequences	p	Pre-criterion
IV: *Level*		$P(d)=\begin{cases}0 & d\le q\\ 1/2 & q<d\le p\\ 1 & d>p\end{cases}$ For qualitative criteria, fuzzy or with some degree imprecise information	q, p	Pseudo-criterion
V: *Linear o V-Shape with Indifference*		$P(d)=\begin{cases}0 & d\le q\\ \dfrac{(d-q)}{(p-d)} & q<d\le p\\ 1 & d>p\end{cases}$ For quantitative criteria provided with some precision and linear consequences	q, p	Pseudo-criterion
VI: *Gaussian*		$P(d)=\begin{cases}0 & d\le 0\\ 1-e^{-\frac{d^2}{2s^2}} & d>0\end{cases}$ Applied to quantitative criteria provided with some precision and nonlinear consequences	σ	Pre-criterion

Source: Author's elaboration based on (De Keyser & Peeters, 1996; Brans & Mareschal, 2005).

2B. Individual corporate governance indicators (statistics summary)

Table 2B.1. Statistics summary for the corporate governance criteria (2002-2014)

CG-Criteria	Mean	Median	Sd	Skew	Kurtosis	Min	Max	N obs
bs_poly_d	0.981	1	0.135	-7.110	51.55	0	1	10171
bs_expe_d	0.453	0	0.498	0.188	1.035	0	1	10171
bs_noexe_d	0.603	1	0.489	-0.423	1.179	0	1	10171
bs_indep_d	0.571	1	0.495	-0.286	1.082	0	1	10171
bs_duality_d	0.339	0	0.436	0.672	1.650	0	1	10171
bs_skills_d	0.968	1	0.176	-5.304	29.14	0	1	10171
bs_size_d	0.362	0	0.480	0.576	1.332	0	1	10171
bs_divers_d	0.471	0	0.499	0.116	1.013	0	1	10171
bf_iaudit_d	0.991	1	0.0937	-10.49	111.0	0	1	10171
bf_imaudit_d	0.979	1	0.144	-6.658	45.33	0	1	10171
bf_audexp_d	0.896	1	0.305	-2.598	7.747	0	1	10171
bf_icomcom_d	0.956	1	0.204	-4.473	21.00	0	1	10171
bf_imcomcom_d	0.953	1	0.212	-4.271	19.24	0	1	10171
bf_inomcom_d	0.927	1	0.260	-3.281	11.77	0	1	10171
bf_imnoncom_d	0.903	1	0.296	-2.726	8.433	0	1	10171
bf_bmeet_d	0.384	0	0.486	0.476	1.227	0	1	10171
bf_bmeetave_d	0.181	0	0.385	1.660	3.754	0	1	10171
cpoly_com_d	0.986	1	0.116	-8.409	71.72	0	1	10171
cpoly_rem_d	0.937	1	0.242	-3.614	14.06	0	1	10171
cpoly_brem_d	0.784	1	0.412	-1.377	2.895	0	1	10171
cpoly_stok_d	0.543	1	0.498	-0.172	1.030	0	1	10171
cpoly_ltcom_d	0.345	0	0.476	0.650	1.423	0	1	10171
cpoly_vest_d	0.460	0	0.498	0.161	1.026	0	1	10171
shrt_poly_d	0.978	1	0.146	-6.561	44.04	0	1	10171
shrt_votrt_d	0.819	1	0.385	-1.658	3.749	0	1	10171
shrt_own_d	0.946	1	0.226	-3.939	16.52	0	1	10171
shrt_clabs_d	0.847	1	0.360	-1.929	4.721	0	1	10171
shrt_stabs_d	0.488	0	0.500	0.0470	1.002	0	1	10171
vstr_chall_d	0.084	0	0.277	3.009	10.06	0	1	10171
vstr_csr_d	0.311	0	0.463	0.819	1.670	0	1	10171
vstr_grcguid_d	0.157	0	0.364	1.881	4.540	0	1	10171
vstr_csrrep_d	0.245	0	0.430	1.185	2.405	0	1	10171
vstr_csrxaud_d	0.057	0	0.232	3.813	15.54	0	1	10171

2C. Definition of the variables

Table 2C.1. Definition of the variables for corporate governance and firm performance

Variable	Definitions and Datastream codes
Dependent variable	***Company performance (operating performance)***
roa	Return on assets obtained using the ratio earnings before interest, taxes, depreciation and amortization–EBITDA (WC18198 in Datastream) to book value of total assets (WC02999 in Datastream).
Explanatory variables	***Corporate governance***
ncgvi	CGI. Corporate governance index provided by Datastream (ASSET4 ESG). This is a proprietary index that measure the companies' exposure and reports on the corporate governance practices and mechanisms. This indicator is shown in decimal values, and it was computed using a weighted z-scores adjusted by some "black box" benchmarks.
aqcg_d	Aggregate quality of corporate governance using the MCDA approach. It is an indicator of dominance relationships and quality of governance among companies, which is obtained through an extensive process of pair comparisons.
Control variables	***Company-specific information***
lmv	It is the logarithm of the market value of the company (MV in Datastream). MV is the share price multiplied by the number of ordinary shares in issue displayed in millions of units of local currency. According to Datastream, the amount in issue is updated whenever new tranches of stock are issued or after a capital change, and for companies with more than one class of equity capital, the market value is expressed according to the individual issue.
mtb2	Ratio market-to-book value: mv2 = mv*1000; mtb2= (mv2 + Total assets - Common equity - Deferred taxes) / Total assets where: • Market value (mv) = the market value of a company (MV in Datastream). To make the market value (displayed in millions of units of local currency) comparable with the other variables (displayed in thousands of units of local currency), the data points were multiplied by 1,000. • Total Assets (WC02999 in Datastream) • Common equity (WC03501 in Datastream) • Deferred taxes (WC03263 in Datastream)
ltdebtasset	Ratio of a company's long-term debt (WC03251 in Datastream) to Total assets (WC02999 in Datastream)
lbusegm	Logarithm of a company's business segment. For this variable the database Thomson One Banker® is considered in order to count business segments reported by each company at the end of the fiscal year. The data vendor reports eight big business segments (i.e., SIC_Code1, SIC_Code2,

Variable	Definitions and Datastream codes
	SIC_Code3, SIC_Code4, SIC_Code5, SIC_Code6, SIC_Code7, and SIC_Code8).
lage2fndinc	This variable represents the logarithm age of the company. It is constructed also using Thomson One Banker®, namely, when the company was founded (TF.FN.CompanyFoundedDate) and/or when it was incorporated (TF.FN.CompanyIncorporatedDate) until 31/12/2014. If a company shows both pieces of information, the age used is the company's founding, otherwise, only the information of incorporation. Data adjustments were considered when companies are delisted, in other words, the age is computed and shown until the delisted time.
nvolreturn	Corresponds to the past twelve months of volatility of the returns. It is computed using the standard deviation of the return index (RI in Datastream). RI is available for individual equities and unit trusts and assumes that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. It allows control of the models by the volatility of the company. To avoid losing a year from the sample, the data collected for this variable considers 2001.

2D. Variance inflation factor

Table 2D.1. Variable inflation of the selected variable's corporate governance regressed on firm performance

Datastream Index			**MCA approach**		
Variable	VIF	1/VIF	Variable	VIF	1/VIF
ncgvi	1.16	0.858626	aqcg_d	1.15	0.873191
lmv	1.41	0.709101	lmv	1.49	0.672891
mtb2	1.26	0.79642	mtb2	1.25	0.796856
nvolreturn	1.47	0.680242	nvolreturn	1.48	0.677716
lbusegm	1.18	0.847116	lbusegm	1.18	0.847354
lage2fndinc	1.12	0.894852	lage2fndinc	1.12	0.891439
ltdebtasset	1.12	0.888971	ltdebtasset	1.12	0.889534
year			year		
2003	1.95	0.51265	2003	1.95	0.512546
2004	2.35	0.425939	2004	2.34	0.427791
2005	2.54	0.394301	2005	2.52	0.39615
2006	2.53	0.395726	2006	2.51	0.39802
2007	2.59	0.385687	2007	2.58	0.387012
2008	2.97	0.336785	2008	2.94	0.339738
2009	3.19	0.313085	2009	3.18	0.314398
2010	3.22	0.310507	2010	3.19	0.313028
2011	3.24	0.309041	2011	3.22	0.310969
2012	3.19	0.313382	2012	3.17	0.315074
2013	2.77	0.361161	2013	2.73	0.366674
2014	2.26	0.442089	2014	2.26	0.442577
sect			sect		
2	2.92	0.342154	2	2.89	0.346082
3	2.77	0.36147	3	2.76	0.362121
4	2.1	0.476517	4	2.09	0.477944
5	2.81	0.355379	5	2.76	0.362591
6	2.18	0.459356	6	2.17	0.461256
7	2.74	0.365008	7	2.73	0.365982
8	2.69	0.371672	8	2.69	0.371817
9	1.25	0.798833	9	1.25	0.802085
10	1.87	0.534752	10	1.87	0.534907
Mean VIF	**2.24**		**Mean VIF**	**2.24**	

Note: The variance inflation factors (VIF) are far below 10 with the mean value of 2.24, suggesting the absence of the multicollinearity problem.

2E. Linking the MCDA approach into the Chapter 1 analysis

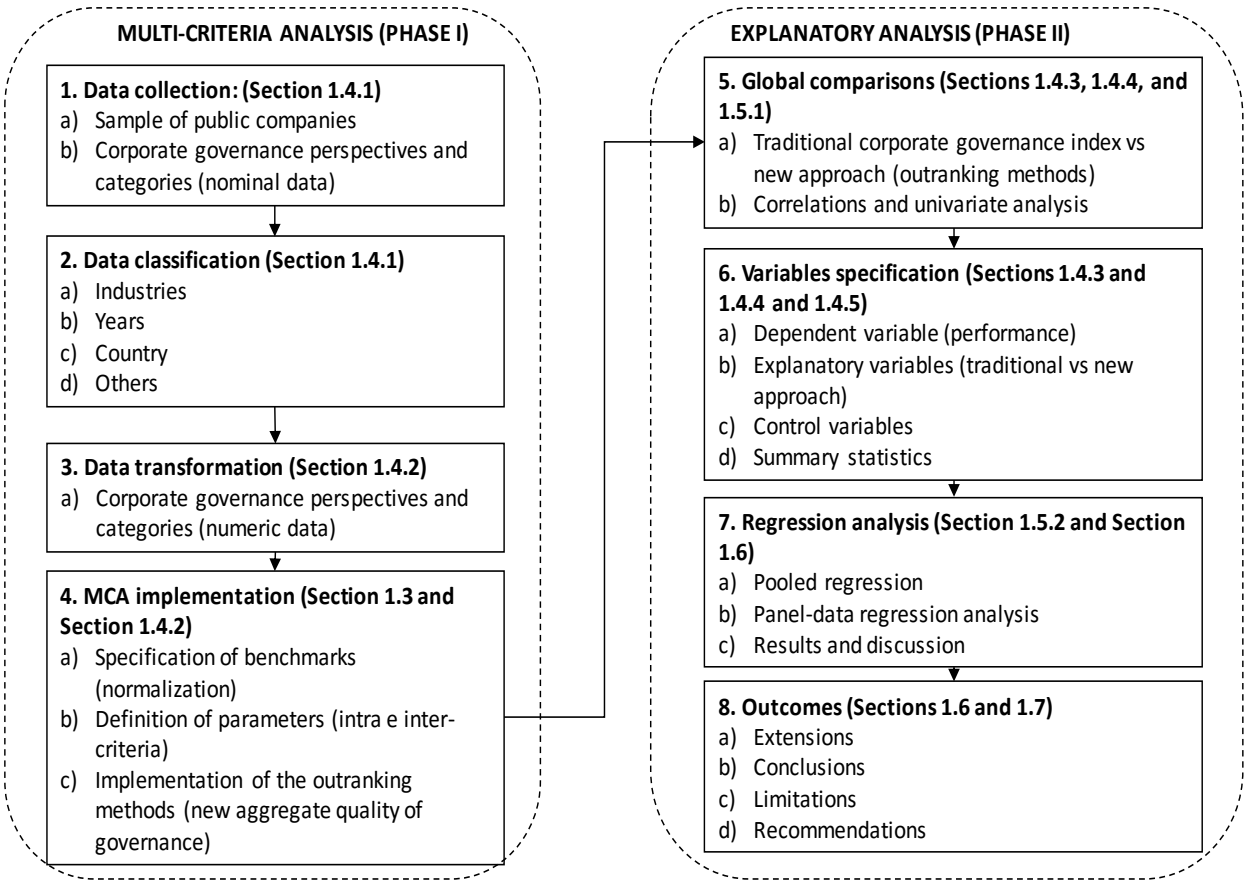


Figure 2E.1. Linking the methodological approach to the research sections of Chapter 1

2F. Algorithm: PROMETHEE methods application in VBA-Excel

```
'------------------------------------------------------------------------------
'------------------------------------------------------------------------------
'--PROMETHEE Methods implementation for the Aggregate Quality of Corporate Governance--
'---------------------------------------------- Elvis Hernandez ----------------------------------------------
'------------------------------------------------------------------------------

'To make the routines public in VBA excel
Option Explicit
'------------------------------------------------------------------------------
'Routine for Pair comparisons
Sub ConstructMatrixPC()

' Step 1: Construction of the pair comparison matrix
' This step run the other VBA macros
Dim nRows, nCols, nRow, nRow2, n, m, x As Integer
Dim NewRange As Variant

'Initial data
Worksheets("MCA_Algorithm").Select
Range("W2:ABC200000").Select
Selection.ClearContents
Range("K10:N200000").Select
Selection.ClearContents
Range("W2").Select
nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

m = 0
n = 1
x = 1
For nRow2 = 1 To nRows
For nRow = 1 To nRows

n = n
m = m
x = x
Worksheets("MCA_Algorithm").Select
   Set NewRange = Range(Cells(1 + x, 23), Cells(x + 1, nCols + 22))
   NewRange.Select

Selection.FormulaArray = "=+R[" & 9 - n & "]C[-17]:R[" & 9 - n & "]C[-13]-R[" & 8 - m & "]C[-
17]:R[" & 8 - m & "]C[-13]"
n = n + 1
x = x + 1
Next nRow
n = n - 1
m = m + nRows
Next nRow2
Worksheets("MCA_Algorithm").Select
```

```
' Step 2: Introduction of generalise criteria (intra-criteria information)
Call CriteriaGen

' Step 3: Introduction of decision makers weights (preferences)
Call CriteriaGenWeighted

' Step 4: Matrix Identity for Matrix adjustments
Call MatrixIdentity

' Step 5: Positive Flows Credits Computations
Call PrometheeIIPosit

' Step 6: Negative Flows Debits Computations
Call PrometheeIINegat

' Step 7: Aggregate Quality and Global Rank
Call PrometheeIINet

End Sub

'-----------------------------------------------------------------------------
Sub CriteriaGen()
' This is Step 2: Introduction of generalise criteria (intra-criteria information)

Dim nRows, nCols, nRow, nRow2, n, Total As Integer

Dim NewRange As Variant

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

Total = nRows * nRows

For n = 1 To Total

Worksheets("MCA_Algorithm").Select
   Set NewRange = Range(Cells(1 + Total + n, 23), Cells(Total + n + 1, nCols + 22))
   NewRange.Select

   Selection.FormulaR1C1 = "=+IF(R[" & -Total & "]C:R[" & -Total & "]C[4]>0,1,0)"

   Application.CutCopyMode = False

Next n

End Sub

'-----------------------------------------------------------------------------
Sub CriteriaGenWeighted()
' This is Step 3: Introduction of decision makers weights (preferences)
```

```
Dim nRows, nCols, nRow, nRow2, n, Total As Integer

Dim NewRange As Variant

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value
Total = nRows * nRows
For n = 1 To Total

Worksheets("MCA_Algorithm").Select
   Set NewRange = Range(Cells(1 + (Total + Total) + n, 23), Cells(1 + (Total + Total) + n, 23))
   NewRange.Select

   Selection.FormulaArray = "=+MMULT(R[" & -Total & "]C:R[" & -Total &
"]C[4],TRANSPOSE(R7C6:R7C10))"

    Application.CutCopyMode = False

Next n

End Sub

'- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Sub MatrixIdentity()
' This is Step 4: Matrix Identity for Matrix adjustments


Dim nRows, nCols, nRow, nRow2, x, y, Total As Single
' declare ALL your variables
Dim n As Long, m As Long
' specify type for all variables, otherwise they will be Variant
Dim Sigmai As Single, Sigmaj As Single, Rho As Single

' Specify required lower bound. Default base is 0
Dim matrixelement1(1 To 1000, 1 To 1000) As Single
Dim matrixelement2(1 To 1000, 1 To 1000) As Single

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

Total = nRows * nRows

Sigmai = 1
Sigmaj = 0

'Identity for debits
For n = 1 To nRows
      For m = 1 To nRows
      If m = n Then
         matrixelement1(n, m) = Sigmai
```

```
        Else
            matrixelement1(n, m) = Sigmaj
        End If
        Next m
Next n

For x = 1 To nRows
    Worksheets("MCA_Algorithm").Range(Cells((Total + Total) + (nRows * x - n + 3), 24),
Cells((Total + Total) + (x * nRows + 1), 23 + nRows)).Select
    Worksheets("MCA_Algorithm").Range(Cells((Total + Total) + (nRows * x - n + 3), 24),
Cells((Total + Total) + (x * nRows + 1), 23 + nRows)) = matrixelement1
Next x

'Identity for credit
For x = 1 To nRows
    For n = 1 To nRows
        For m = 1 To nRows
            If x = m Then
                matrixelement2(n, m) = Sigmai
            Else
                matrixelement2(n, m) = Sigmaj
            End If
        Next m
    Next n

Worksheets("MCA_Algorithm").Range(Cells((Total + Total) + (nRows * x - n + 3), 24 + nRows),
Cells((Total + Total) + (x * nRows + 1), 23 + 2 * nRows)).Select
Worksheets("MCA_Algorithm").Range(Cells((Total + Total) + (nRows * x - n + 3), 24 + nRows),
Cells((Total + Total) + (x * nRows + 1), 23 + 2 * nRows)) = matrixelement2

Next x

End Sub

'-----------------------------------------------------------------------------------------------
Sub PrometheeIIPosit()
' This is Step 5: Positive flows- Credits Computations

Dim nRows, nCols, nRow, nRow2, n, Total As Integer

Dim NewRange As Variant

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

Total = nRows * nRows

For n = 1 To nRows

Worksheets("MCA_Algorithm").Select
```

```
    Set NewRange = Range(Cells(9 + n, 6 + nCols), Cells(9 + n, 6 + nCols))
    NewRange.Select

Selection.FormulaArray = _
        "=+MMULT(TRANSPOSE(R[" & Total * 2 - n - 7 & "]C[" & 12 + n & "]:R[" & Total * 3 - n - 8
& "]C[" & 12 + n & "]),R[" & Total * 2 - n - 7 & "]C[12]:R[" & Total * 3 - n - 8 & "]C[12])/(nRows-
1)"

      Application.CutCopyMode = False

Next n

End Sub

'-----------------------------------------------------------------------------
Sub PrometheeIINegat()
' Step 6: Negative flows Debits Computations

Dim nRows, nCols, nRow, nRow2, n, Total As Integer

Dim NewRange As Variant

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

Total = nRows * nRows


For n = 1 To nRows

Worksheets("MCA_Algorithm").Select
    Set NewRange = Range(Cells(9 + n, 7 + nCols), Cells(9 + n, 7 + nCols))
    NewRange.Select

Selection.FormulaArray = _
        "=+MMULT(TRANSPOSE(R[" & Total * 2 - n - 7 & "]C[" & 11 + n + nRows & "]:R[" & Total
* 3 - n - 8 & "]C[" & 11 + n + nRows & "]),R[" & Total * 2 - n - 7 & "]C[11]:R[" & Total * 3 - n - 8 &
"]C[11])/(nRows-1)"


      Application.CutCopyMode = False

Next n

End Sub

'-----------------------------------------------------------------------------
Sub PrometheeIINet()
' Step 7: Aggregate Quality and Global Rank
```

```
Dim nRows, nCols, nRow, nRow2, n, Total As Integer

Dim NewRange As Variant

nRows = Worksheets("MCA_Algorithm").Range("D4").Value
nCols = Worksheets("MCA_Algorithm").Range("D3").Value

Total = nRows * nRows

For n = 1 To nRows

'net flows computations (aggregate quality)
Worksheets("MCA_Algorithm").Select
   Set NewRange = Range(Cells(9 + n, 8 + nCols), Cells(9 + n, 8 + nCols))
   NewRange.Select

ActiveCell.FormulaR1C1 = "=RC[-2]-RC[-1]"

'rank computations (aggregate rank)
Worksheets("MCA_Algorithm").Select
   Set NewRange = Range(Cells(9 + n, 9 + nCols), Cells(9 + nRows, 9 + nCols))
    NewRange.Select

ActiveCell.FormulaR1C1 = "=+RANK(RC[-1],R[" & 1 - n & "]C[" & -1 & "]:R[" & nRows - n &
"]C[" & -1 & "],0)"
Next n
'ActiveWorkbook.Save
End Sub
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

2G. STATA Code: Regression models including Outreg2 commands

```
*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*= = = = = = = = = = = == == === == ==== === ==== ====== ================
* SUMMARY OF FINAL MODELS REPORTED IN THIS RESEARCH FRAMEWORK, CHAPTER 1***
*ROA contemporaneous
*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*-----------------------
*1) Pooled OLS (robust)
*-----------------------
*---------------
ereturn list //r-command

set more off
*no dummies
reg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    , robust
estimates store roa_olsncgvi1
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, No, Sector, No) ///
          addstat(Adjusted R-squared, e(r2_a), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          adec(3) replace ctitle(Pooled OLS)

reg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          , robust
estimates store roa_olsaqcg_d1
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, No, Sector, No) ///
          addstat(Adjusted R-squared, e(r2_a), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          adec(3) append ctitle(Pooled OLS)

*dumies
reg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect, robust
estimates store roa_olsncgvi2
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_a), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          adec(3) append ctitle(Pooled OLS)

reg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
```

```
        i.year i.sect, robust
estimates store roa_olsaqcg_d2
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_a), ///
        F/Wald statistic, e(F), P-value F/Wald, `p') ///
        adec(3) append ctitle(Pooled OLS)

*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*-----------------------
**2) Random Effects**
*-----------------------
xtset id year

*no dummies year-sector
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                , re
estimates store ndum_ncgvire1
xttest0
*return list
local pBP = 1-gammap((`r(df)')/2),(`r(lm)'/2))
local BP = `r(lm)'*1
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
*display "chi2= "`BP'
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, No, Sector, No) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(chi2), P-value F/Wald, `p1', ///
        Breush_Pagan, `BP', P-value B-P, `pBP') ///
        afmt(g) append ctitle(Random Effects)


xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        , re
estimates store ndum_aqcgre1
xttest0
*return list
local pBP = 1-gammap((`r(df)')/2),(`r(lm)'/2))
local BP = `r(lm)'*1
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
*display "chi2= "`BP'
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, No, Sector, No) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(chi2), P-value F/Wald, `p1', ///
        Breush_Pagan, `BP', P-value B-P, `pBP') ///
```

```
        afmt(g) append ctitle(Random Effects)

* dummies year-sector
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                i.year i.sect, re
estimates store dum_ncgvire1
xttest0
*return list
local pBP = 1-gammap((`r(df)')/2),(`r(lm)'/2))
local BP = `r(lm)'*1
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
*display "chi2= "`BP'
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(chi2), P-value F/Wald, `p1', ///
        Breush_Pagan, `BP', P-value B-P, `pBP') ///
        afmt(g) append ctitle(Random Effects)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        i.year i.sect, re
estimates store dum_aqcgre1
xttest0
*return list
local pBP = 1-gammap((`r(df)')/2),(`r(lm)'/2))
local BP = `r(lm)'*1
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
*display "chi2= "`BP'
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(chi2), P-value F/Wald, `p1', ///
        Breush_Pagan, `BP', P-value B-P, `pBP') ///
        afmt(g) append ctitle(Random Effects)

*= = = = = = = = = = = == == === == ==== === ==== ====== ================ =
*-----------------------
*3) Fixed Effects
*-----------------------
*xtset id year

*no dummies year-sector
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                ,fe
estimates store ndum_ncgvife1
hausman ndum_ncgvife1 ndum_ncgvire1 //test can not be used with VCE
*return list
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
```

```
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, No, Sector, No) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p', ///
        Hausman, r(chi2), P-value H, r(p)) ///
        adec(3) append ctitle(Fixed Effects)


xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        ,fe
estimates store ndum_aqcgfe1
hausman ndum_aqcgfe1 ndum_aqcgre1 //test can not be used with VCE
return list
*return list
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, No, Sector, No) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p', ///
        Hausman, r(chi2), P-value H, r(p)) ///
        adec(3) append ctitle(Fixed Effects)

* dummies year-sector
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                i.year i.sect, fe               // re vce(robust)
estimates store dum_ncgvife1
hausman dum_ncgvife1 dum_ncgvire1 //test can not be used with VCE
*return list
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p', ///
        Hausman, r(chi2), P-value H, r(p)) ///
        adec(3) append ctitle(Fixed Effects)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        i.year i.sect, fe
estimates store dum_aqcgfe1
hausman dum_aqcgfe1 dum_aqcgre1 //test can not be used with VCE
*return list
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p', ///
```

```
        Hausman, r(chi2), P-value H, r(p)) ///
        adec(3) append ctitle(Fixed Effects)

*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*-------------
**1)Robust Models ROAt (Contemporaneous)**
*-------------
*VCE
xtset id year
set more off
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                i.year i.sect, fe i(sect) robust
ereturn list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel2.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o)) ///
        replace ctitle(Fixed Effects Robust)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        i.year i.sect, fe i(sect) robust
*return list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel2.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o)) ///
        append ctitle(Fixed Effects Robust)

xtset id year
xtpcse roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                i.year i.sect, het c(ar1)
ereturn list
local p1 = 1-gammap((`e(df)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel2.xls, ///
        keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
        afmt(g) append ctitle(GLS PCSE)

xtset id year
xtpcse roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        i.year i.sect, het c(ar1)
*return list
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel2.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
        afmt(g) append ctitle(GLS PCSE)
```

```
*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*----------------------
**2) Robust Models ROAt+1 and ROAt+2 (future)**
*-------------
*VCE
xtset id year
set more off
xtreg af1roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect, fe i(sect) robust
ereturn list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o)) ///
          replace ctitle(Fixed Effects Robust ROAt+1)

xtreg af1roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect, fe i(sect) robust
*return list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o)) ///
          append ctitle(Fixed Effects Robust ROAt+1)

xtset id year
xtpcse af1roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect, het c(ar1)
ereturn list
local p1 = 1-gammap((`e(df)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
          afmt(g) append ctitle(GLS PCSE ROAt+1)

xtset id year
xtpcse af1roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect, het c(ar1)
*return list
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
          afmt(g) append ctitle(GLS PCSE ROAt+1)


xtset id year
set more off
```

```
xtreg af2roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect, fe i(sect) robust
ereturn list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o)) ///
          append ctitle(Fixed Effects Robust ROAt+2)

xtreg af2roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect, fe i(sect) robust
*return list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o)) ///
          append ctitle(Fixed Effects Robust ROAt+2)

xtset id year
xtpcse af2roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect, het c(ar1)
ereturn list
local p1 = 1-gammap((`e(df)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
          afmt(g) append ctitle(GLS PCSE ROAt+2)

xtset id year
xtpcse af2roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect, het c(ar1)
*return list
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel3.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
          afmt(g) append ctitle(GLS PCSE ROAt+2)
*-------------------------------------------------------------

*= = = = = = = = = = == == === == ==== === ==== ====== ================
*-------------
**3) Stability or Final Considerations**
*-------------
*VCE
xtset id year
** 1. Industry Analysis (Non-Financial and Financial)**
sort nonfin1
set more off
```

```
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect if nonfin1==1, fe vce()
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          replace ctitle(Fixed Effects Robust NoFin)

xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect if nonfin1==0, fe vce()
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          append ctitle(Fixed Effects Robust Fin)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect if nonfin1==1, fe vce()
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          append ctitle(Fixed Effects Robust NonFin)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
          i.year i.sect if nonfin1==0, fe vce()
*return list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
          keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
          addstat(Adjusted R-squared, e(r2_o), ///
          F/Wald statistic, e(F), P-value F/Wald, `p') ///
          append ctitle(Fixed Effects Robust Fin)

*= = = = = = = = = = = = = = == === == ==== === ==== ====== ================= *
```

2) Crisis Analysis

```
sort crisis1
set more off
xtreg roa ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
                    i.year i.sect if crisis1==1, fe vce()
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
          keep(ncgvi lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
          addtext(Year, Yes, Sector, Yes) ///
```

```
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p') ///
        append ctitle(Fixed Effects Robust Crisis)

xtreg roa aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset ///
        i.year i.sect if crisis1==1, fe vce()
local p =  Ftail(`e(df_m)',`e(df_r)',`e(F)')
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel4.xls, ///
        keep(aqcg_d lmv mtb2 nvolreturn lbusegm lage2fndinc ltdebtasset) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o), ///
        F/Wald statistic, e(F), P-value F/Wald, `p') ///
        append ctitle(Fixed Effects Robust Crisis)
*-----------------------------------------------------------------

*= = = = = = = = = = = == == === == ==== === ==== ====== ================
*------------
**3) Endogeneity Final considerations (models specifications according to the literature)**
**\* Lag analysis**
*-------------
*VCE
xtset id year
set more off
xtreg alagroa1 lagncgvi1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1 ///
                i.year i.sect, fe i(sect) robust
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel5.xls, ///
        keep(lagncgvi1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o)) ///
        replace ctitle(Fixed Effects Robust)

xtreg alagroa1 lagaqcg_d1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1 ///
        i.year i.sect, fe i(sect) robust
*ereturn list
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel5.xls, ///
        keep(lagaqcg_d1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(Adjusted R-squared, e(r2_o)) ///
        append ctitle(Fixed Effects Robust)

xtset id year
xtpcse alagroa1 lagncgvi1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1 ///
                i.year i.sect, het c(ar1)
local p1 = 1-gammap((`e(df)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel5.xls, ///
```

```
        keep(lagncgvi1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
        afmt(g) append ctitle(GLS PCSE)

xtset id year
xtpcse alagroa1 lagaqcg_d1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1 ///
        i.year i.sect, het c(ar1)
*return list
local p1 = 1-gammap((`e(df_m)'/2),(`e(chi2)'/2))
outreg2 using F:\CorporateGov\C001_Results\ModelTotal_OLS_Panel5.xls, ///
        keep(lagaqcg_d1 laglmv1 lagmtb21 lagnvolreturn1 laglbusegm1 laglage2fndinc1
lagltdebtasset1) ///
        addtext(Year, Yes, Sector, Yes) ///
        addstat(F/Wald statistic, e(chi2), P-value F/Wald, `p1') ///
        afmt(g) append ctitle(GLS PCSE)
*= = = = = = = = = = = = == == === == ==== === ==== ====== ================
```

Appendix Chapter 3

3A. Decision tree (J48) and machine-learning rules (Weka output)

Table 3A.1. Association rules for corporate governance and firm performance

J48 pruned tree *(highlighted for the operating state of the system)*

- -

```
mtb_mean1 < = 0
|   nvolreturn_mean1 < = 0
|   |   bs_expe_r < = 0: low (50.0/ 8.0)
|   |   bs_expe_r > 0
|   |   |   bf_inomcom_r < = 0
|   |   |   |   bf_bmeet_r < = 0: low (18.0/ 1.0)
|   |   |   |   bf_bmeet_r > 0
|   |   |   |   |   vstr_csrxaud_r < = 0
|   |   |   |   |   |   numbusegm < = 1: high (2.0)
|   |   |   |   |   |   numbusegm > 1: low (33.0/ 5.0)
|   |   |   |   |   vstr_csrxaud_r > 0
|   |   |   |   |   |   mv_mean1 < = 0
|   |   |   |   |   |   |   vstr_grcguid_r < = 0: low (34.0/ 11.0)
|   |   |   |   |   |   |   vstr_grcguid_r > 0: high (5.0/ 1.0)
|   |   |   |   |   |   mv_mean1 > 0
|   |   |   |   |   |   |   vstr_grcguid_r < = 0: high (7.0/ 2.0)
|   |   |   |   |   |   |   vstr_grcguid_r > 0
|   |   |   |   |   |   |   |   ltdebtasset_mean1 < = 0
|   |   |   |   |   |   |   |   |   comp_age < = 82.5: high (4.0/ 1.0)
|   |   |   |   |   |   |   |   |   comp_age > 82.5: low (2.0)
|   |   |   |   |   |   |   |   ltdebtasset_mean1 > 0: low (2.0)
|   |   |   bf_inomcom_r > 0
|   |   |   |   bf_bmeet_r < = 0
|   |   |   |   |   vstr_csrxaud_r < = 0: high (10.0)
|   |   |   |   |   vstr_csrxaud_r > 0
|   |   |   |   |   |   cpoly_brem_r < = 0
|   |   |   |   |   |   |   comp_age < = 17: high (6.0/ 1.0)
|   |   |   |   |   |   |   comp_age > 17: low (7.0)
|   |   |   |   |   |   cpoly_brem_r > 0: low (8.0/ 1.0)
|   |   |   |   bf_bmeet_r > 0
|   |   |   |   |   bf_imcomcom_r < = 0
|   |   |   |   |   |   bs_indep_r < = 0: low (8.0/ 1.0)
|   |   |   |   |   |   bs_indep_r > 0
```

J48 pruned tree ***(highlighted for the operating state of the system)***

```
------------------------------------------------------------------
| | | | | | | bf_imnoncom_r < = 0
| | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | comp_age < = 57.4: high (8.0/ 1.0)
| | | | | | | | | comp_age > 57.4: low (4.0/ 1.0)
| | | | | | | | cpoly_vest_r > 0
| | | | | | | | | bf_bmeetave_r < = 0
| | | | | | | | | | numbusegm < = 5
| | | | | | | | | | | comp_age < = 49.3: high (8.0)
| | | | | | | | | | | comp_age > 49.3: low (3.0)
| | | | | | | | | | numbusegm > 5: low (3.0)
| | | | | | | | | bf_bmeetave_r > 0: low (15.0/ 4.0)
| | | | | | | bf_imnoncom_r > 0: high (11.0/ 2.0)
| | | | | bf_imcomcom_r > 0
| | | | | | numbusegm < = 5
| | | | | | | bf_imnoncom_r < = 0
| | | | | | | | mv_mean1 < = 0
| | | | | | | | | comp_age < = 90
| | | | | | | | | | cpoly_ltcom_r < = 0
| | | | | | | | | | | cpoly_rem_r < = 0: high (2.0)
| | | | | | | | | | | cpoly_rem_r > 0: low (9.0/ 3.0)
| | | | | | | | | | cpoly_ltcom_r > 0: low (5.0)
| | | | | | | | | comp_age > 90: high (4.0)
| | | | | | | | mv_mean1 > 0: high (6.0/ 1.0)
| | | | | | | bf_imnoncom_r > 0
| | | | | | | | cpoly_rem_r < = 0
| | | | | | | | | numbusegm < = 4
| | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | numbusegm < = 2: high (2.0)
| | | | | | | | | | | | numbusegm > 2
| | | | | | | | | | | | | comp_age < = 4.1: high (2.0)
| | | | | | | | | | | | | comp_age > 4.1: low (8.0/ 2.0)
| | | | | | | | | | | ltdebtasset_mean1 > 0: high (2.0)
| | | | | | | | | | cpoly_vest_r > 0: low (62.0/ 22.0)
| | | | | | | | | numbusegm > 4: low (22.0/ 3.0)
| | | | | | | | cpoly_rem_r > 0
| | | | | | | | | bs_noexe_r < = 0
| | | | | | | | | | bs_indep_r < = 0
| | | | | | | | | | | numbusegm < = 4: low (6.0)
```

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | numbusegm > 4: high (2.0)
| | | | | | | | | | bs_indep_r > 0
| | | | | | | | | | | ltdebtasset_mean1 < = 0: low (17.0/ 7.0)
| | | | | | | | | | | ltdebtasset_mean1 > 0: high (20.0/ 7.0)
| | | | | | | | | bs_noexe_r > 0
| | | | | | | | | | comp_age < = 84.8
| | | | | | | | | | | cpoly_ltcom_r < = 0
| | | | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | | | vstr_csrrep_r < = 0
| | | | | | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | | | | | numbusegm < = 3: low (3.0)
| | | | | | | | | | | | | | | numbusegm > 3: high (2.0)
| | | | | | | | | | | | | | cpoly_vest_r > 0: high (41.0/ 18.0)
| | | | | | | | | | | | | vstr_csrrep_r > 0
| | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | | | | | | cpoly_brem_r < = 0: high (9.0/ 2.0)
| | | | | | | | | | | | | | | | cpoly_brem_r > 0
| | | | | | | | | | | | | | | | | comp_age < = 19: high (3.0)
| | | | | | | | | | | | | | | | | comp_age > 19: low (3.0)
| | | | | | | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | | | | | | | | | numbusegm < = 3: low (29.0/ 6.0)
| | | | | | | | | | | | | | | | | numbusegm > 3
| | | | | | | | | | | | | | | | | comp_age < = 17: high (4.0)
| | | | | | | | | | | | | | | | | comp_age > 17: low (22.0/ 7.0)
| | | | | | | | | | | | | | | | cpoly_brem_r > 0
| | | | | | | | | | | | | | | | | comp_age < = 22.9: low (18.0/ 3.0)
| | | | | | | | | | | | | | | | | comp_age > 22.9
| | | | | | | | | | | | | | | | | bf_bmeetave_r < = 0: high (4.0/ 1.0)
| | | | | | | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | | | | | | numbusegm < = 4
| | | | | | | | | | | | | | | | | | comp_age < = 28.5: high (5.0)
| | | | | | | | | | | | | | | | | | comp_age > 28.5
| | | | | | | | | | | | | | | | | | | comp_age < = 35.1: low (2.0)
| | | | | | | | | | | | | | | | | | | comp_age > 35.1
| | | | | | | | | | | | | | | | | | | | comp_age < = 40: high (2.0)
| | | | | | | | | | | | | | | | | | | | comp_age > 40: low (3.0/ 1.0)
| | | | | | | | | | | | | | | | | | numbusegm > 4: low (2.0)

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | | | | | | | | cpoly_vest_r < = 0: low (22.0/ 8.0)
| | | | | | | | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | | | | | | | numbusegm < = 4
| | | | | | | | | | | | | | | | | | bf_bmeetave_r < = 0
| | | | | | | | | | | | | | | | | | | numbusegm < = 2
| | | | | | | | | | | | | | | | | | | | comp_age < = 12.4: low (3.0)
| | | | | | | | | | | | | | | | | | | | comp_age > 12.4: high (10.0/ 1.0)
| | | | | | | | | | | | | | | | | | | numbusegm > 2: low (13.0/ 4.0)
| | | | | | | | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | | | | | | | numbusegm < = 1: low (2.0)
| | | | | | | | | | | | | | | | | | | numbusegm > 1: high (12.0/ 5.0)
| | | | | | | | | | | | | | | | | numbusegm > 4: high (11.0/ 2.0)
| | | | | | | | | | | | | | | cpoly_brem_r > 0
| | | | | | | | | | | | | | | bf_bmeetave_r < = 0: low (19.0/ 3.0)
| | | | | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | | | | | | | numbusegm < = 3: high (5.0/ 1.0)
| | | | | | | | | | | | | | | | | numbusegm > 3: low (2.0)
| | | | | | | | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | | | | | | | comp_age < = 47.8: high (27.0/ 12.0)
| | | | | | | | | | | | | | | | | comp_age > 47.8: low (6.0)
| | | | | | | | | | | | mv_mean1 > 0
| | | | | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | | | | | | | numbusegm < = 3: low (8.0/ 1.0)
| | | | | | | | | | | | | | | numbusegm > 3: high (3.0/ 1.0)
| | | | | | | | | | | | | | cpoly_brem_r > 0
| | | | | | | | | | | | | | | bf_bmeetave_r < = 0
| | | | | | | | | | | | | | | | numbusegm < = 2: low (2.0)
| | | | | | | | | | | | | | | | numbusegm > 2: high (2.0)
| | | | | | | | | | | | | | | bf_bmeetave_r > 0: high (5.0/ 1.0)
| | | | | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | | | | | | | comp_age < = 19: high (5.0/ 1.0)
| | | | | | | | | | | | | | | comp_age > 19: low (13.0/ 3.0)
| | | | | | | | | | | | | | cpoly_brem_r > 0: low (44.0/ 12.0)
| | | | | | | | | | | cpoly_ltcom_r > 0

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | vstr_grcguid_r < = 0
| | | | | | | | | | | | | numbusegm < = 3
| | | | | | | | | | | | | | vstr_csrrep_r < = 0
| | | | | | | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | | | | | | comp_age < = 74.3
| | | | | | | | | | | | | | | | | numbusegm < = 2
| | | | | | | | | | | | | | | | | | numbusegm < = 1: low (37.0/ 13.0)
| | | | | | | | | | | | | | | | | | numbusegm > 1
| | | | | | | | | | | | | | | | | | | comp_age < = 13.5
| | | | | | | | | | | | | | | | | | | comp_age < = 4.3: high (3.0)
| | | | | | | | | | | | | | | | | | | comp_age > 4.3
| | | | | | | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0: low (8.0)
| | | | | | | | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | | | | | | | comp_age < = 9.3: low (10.0/ 1.0)
| | | | | | | | | | | | | | | | | | | | | comp_age > 9.3: high (3.0)
| | | | | | | | | | | | | | | | | | | comp_age > 13.5: high (106.0/ 39.0)
| | | | | | | | | | | | | | | | | numbusegm > 2
| | | | | | | | | | | | | | | | | shrt_clabs_r < = 0
| | | | | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0: low (14.0/ 3.0)
| | | | | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | | | | | comp_age < = 25.6: low (6.0)
| | | | | | | | | | | | | | | | | | | comp_age > 25.6
| | | | | | | | | | | | | | | | | | | | comp_age < = 46.1: high (6.0)
| | | | | | | | | | | | | | | | | | | | comp_age > 46.1: low (3.0)
| | | | | | | | | | | | | | | | | shrt_clabs_r > 0: low (107.0/ 44.0)
| | | | | | | | | | | | | | | | comp_age > 74.3: low (17.0)
| | | | | | | | | | | | | | | mv_mean1 > 0
| | | | | | | | | | | | | | | | comp_age < = 48.5: low (37.0/ 6.0)
| | | | | | | | | | | | | | | | comp_age > 48.5
| | | | | | | | | | | | | | | | | comp_age < = 62.1: high (3.0)
| | | | | | | | | | | | | | | | | comp_age > 62.1
| | | | | | | | | | | | | | | | | | comp_age < = 70.5: low (2.0)
| | | | | | | | | | | | | | | | | | comp_age > 70.5: high (2.0)
| | | | | | | | | | | | | | | vstr_csrrep_r > 0
| | | | | | | | | | | | | | | | mv_mean1 < = 0: low (159.0/ 47.0)
| | | | | | | | | | | | | | | | mv_mean1 > 0
| | | | | | | | | | | | | | | | bf_bmeetave_r < = 0: high (9.0/ 1.0)
| | | | | | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | | | | | shrt_clabs_r < = 0: high (3.0/ 1.0)

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | | | | | | shrt_clabs_r > 0
| | | | | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | | | | | numbusegm < = 2: low (19.0/ 6.0)
| | | | | | | | | | | | | | | | | | | numbusegm > 2
| | | | | | | | | | | | | | | | | | | vstr_csrxaud_r < = 0: high (7.0/ 1.0)
| | | | | | | | | | | | | | | | | | | vstr_csrxaud_r > 0
| | | | | | | | | | | | | | | | | | | | comp_age < = 13: high (3.0)
| | | | | | | | | | | | | | | | | | | | comp_age > 13: low (8.0/ 1.0)
| | | | | | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | | | | | cpoly_vest_r < = 0: high (2.0)
| | | | | | | | | | | | | | | | | | | cpoly_vest_r > 0: low (16.0/ 3.0)
| | | | | | | | | | | | | numbusegm > 3
| | | | | | | | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | | | | | | | numbusegm < = 4: low (16.0/ 5.0)
| | | | | | | | | | | | | | | numbusegm > 4
| | | | | | | | | | | | | | | | comp_age < = 30.1
| | | | | | | | | | | | | | | | | comp_age < = 20.1
| | | | | | | | | | | | | | | | | | cpoly_vest_r < = 0: low (2.0)
| | | | | | | | | | | | | | | | | | cpoly_vest_r > 0: high (9.0/ 3.0)
| | | | | | | | | | | | | | | | | comp_age > 20.1: high (5.0)
| | | | | | | | | | | | | | | | comp_age > 30.1: low (6.0)
| | | | | | | | | | | | | | | cpoly_brem_r > 0: low (295.0/ 87.0)
| | | | | | | | | | | | | vstr_grcguid_r > 0
| | | | | | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | | | | | bf_bmeetave_r < = 0
| | | | | | | | | | | | | | | | numbusegm < = 4
| | | | | | | | | | | | | | | | | cpoly_brem_r < = 0: high (3.0/ 1.0)
| | | | | | | | | | | | | | | | | cpoly_brem_r > 0: low (2.0)
| | | | | | | | | | | | | | | | numbusegm > 4: high (2.0)
| | | | | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | | | comp_age < = 73.5: low (67.0/ 19.0)
| | | | | | | | | | | | | | | | | comp_age > 73.5: high (5.0)
| | | | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | | | numbusegm < = 1
| | | | | | | | | | | | | | | | | | comp_age < = 65: low (7.0/ 2.0)
| | | | | | | | | | | | | | | | | | comp_age > 65: high (6.0/ 1.0)
| | | | | | | | | | | | | | | | | numbusegm > 1: low (74.0/ 24.0)
| | | | | | | | | | | | | | | mv_mean1 > 0

J48 pruned tree *(highlighted for the operating state of the system)*

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- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
| | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | cpoly_brem_r < = 0: low (7.0/ 2.0)
| | | | | | | | | | | | | | | cpoly_brem_r > 0
| | | | | | | | | | | | | | | | vstr_csrxaud_r < = 0
| | | | | | | | | | | | | | | | | numbusegm < = 2: high (7.0/ 1.0)
| | | | | | | | | | | | | | | | | numbusegm > 2
| | | | | | | | | | | | | | | | | | comp_age < = 27.1: high (2.0)
| | | | | | | | | | | | | | | | | | comp_age > 27.1: low (10.0/ 1.0)
| | | | | | | | | | | | | | | | vstr_csrxaud_r > 0
| | | | | | | | | | | | | | | | | shrt_clabs_r < = 0
| | | | | | | | | | | | | | | | | | comp_age < = 28.1: low (3.0)
| | | | | | | | | | | | | | | | | | comp_age > 28.1: high (7.0/ 2.0)
| | | | | | | | | | | | | | | | | shrt_clabs_r > 0
| | | | | | | | | | | | | | | | | | numbusegm < = 2: low (4.0/ 1.0)
| | | | | | | | | | | | | | | | | | numbusegm > 2
| | | | | | | | | | | | | | | | | | | bf_bmeetave_r < = 0: low (2.0)
| | | | | | | | | | | | | | | | | | | bf_bmeetave_r > 0: high (48.0/ 15.0)
| | | | | | | | | | | | | | | ltdebtasset_mean1 > 0: low (46.0/ 15.0)
| | | | | | | | | comp_age > 84.8
| | | | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | | | cpoly_ltcom_r < = 0: low (6.0)
| | | | | | | | | | | cpoly_ltcom_r > 0
| | | | | | | | | | | | bf_bmeetave_r < = 0: high (3.0)
| | | | | | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | | | | | comp_age < = 93.5: low (4.0)
| | | | | | | | | | | | | comp_age > 93.5: high (2.0)
| | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | numbusegm < = 3
| | | | | | | | | | | | shrt_clabs_r < = 0: high (10.0/ 2.0)
| | | | | | | | | | | | shrt_clabs_r > 0
| | | | | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | | | | vstr_grcguid_r < = 0
| | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | | cpoly_ltcom_r < = 0: low (3.0)
| | | | | | | | | | | | | | | | cpoly_ltcom_r > 0: high (20.0/ 5.0)
| | | | | | | | | | | | | | | ltdebtasset_mean1 > 0
| | | | | | | | | | | | | | | | cpoly_ltcom_r < = 0: high (7.0/ 2.0)
| | | | | | | | | | | | | | | | cpoly_ltcom_r > 0
| | | | | | | | | | | | | | | | | vstr_csrrep_r < = 0: low (14.0/ 5.0)
```

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | | | | | | vstr_csrrep_r > 0

| | | | | | | | | | | | | | | | | | vstr_csrxaud_r < = 0: high (2.0)

| | | | | | | | | | | | | | | | | | vstr_csrxaud_r > 0: low (3.0/ 1.0)

| | | | | | | | | | | | | | | | vstr_grcguid_r > 0: low (5.0/ 1.0)

| | | | | | | | | | | | | | | mv_mean1 > 0: high (22.0/ 6.0)

| | | | | | | | | | | | numbusegm > 3

| | | | | | | | | | | | | vstr_csrxaud_r < = 0

| | | | | | | | | | | | | mv_mean1 < = 0

| | | | | | | | | | | | | numbusegm < = 4: low (27.0/ 12.0)

| | | | | | | | | | | | | numbusegm > 4: high (32.0/ 7.0)

| | | | | | | | | | | | | mv_mean1 > 0: low (11.0/ 2.0)

| | | | | | | | | | | | vstr_csrxaud_r > 0

| | | | | | | | | | | | cpoly_brem_r < = 0

| | | | | | | | | | | | ltdebtasset_mean1 < = 0: high (9.0/ 2.0)

| | | | | | | | | | | | ltdebtasset_mean1 > 0

| | | | | | | | | | | | | bf_bmeetave_r < = 0

| | | | | | | | | | | | | comp_age < = 101.5: high (4.0)

| | | | | | | | | | | | | comp_age > 101.5: low (3.0/ 1.0)

| | | | | | | | | | | | | bf_bmeetave_r > 0: low (5.0/ 1.0)

| | | | | | | | | | | | cpoly_brem_r > 0

| | | | | | | | | | | | vstr_grcguid_r < = 0

| | | | | | | | | | | | | bf_bmeetave_r < = 0

| | | | | | | | | | | | | comp_age < = 91.4: high (2.0)

| | | | | | | | | | | | | comp_age > 91.4: low (14.0/ 1.0)

| | | | | | | | | | | | bf_bmeetave_r > 0

| | | | | | | | | | | | cpoly_ltcom_r < = 0: high (2.0)

| | | | | | | | | | | | cpoly_ltcom_r > 0: low (31.0/ 8.0)

| | | | | | | | | | | vstr_grcguid_r > 0

| | | | | | | | | | | comp_age < = 110

| | | | | | | | | | | comp_age < = 101.7

| | | | | | | | | | | | ltdebtasset_mean1 < = 0

| | | | | | | | | | | | comp_age < = 95.2

| | | | | | | | | | | | numbusegm < = 4: high (10.0/ 3.0)

| | | | | | | | | | | | numbusegm > 4

| | | | | | | | | | | | comp_age < = 88.5: high (2.0)

| | | | | | | | | | | | comp_age > 88.5: low (3.0)

| | | | | | | | | | | comp_age > 95.2: low (11.0/ 1.0)

| | | | | | | | | | | ltdebtasset_mean1 > 0

| | | | | | | | | | | mv_mean1 < = 0: high (4.0/ 1.0)

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | | | | | | | mv_mean1 > 0: low (2.0)
| | | | | | | | | | | | | | | | | | comp_age > 101.7: high (15.0/ 2.0)
| | | | | | | | | | | | | | | | | | comp_age > 110: low (7.0)
| | | | | | numbusegm > 5
| | | | | | | cpoly_rem_r < = 0
| | | | | | | | cpoly_vest_r < = 0: low (5.0)
| | | | | | | | cpoly_vest_r > 0
| | | | | | | | | bf_imnoncom_r < = 0: low (8.0/ 1.0)
| | | | | | | | | bf_imnoncom_r > 0
| | | | | | | | | | cpoly_ltcom_r < = 0
| | | | | | | | | | | mv_mean1 < = 0: low (5.0)
| | | | | | | | | | | mv_mean1 > 0: high (11.0/ 3.0)
| | | | | | | | | | | cpoly_ltcom_r > 0: high (14.0/ 2.0)
| | | | | | | cpoly_rem_r > 0
| | | | | | | | cpoly_ltcom_r < = 0
| | | | | | | | | vstr_grcguid_r < = 0
| | | | | | | | | | numbusegm < = 7
| | | | | | | | | | | comp_age < = 17: high (13.0/ 3.0)
| | | | | | | | | | | comp_age > 17: low (72.0/ 13.0)
| | | | | | | | | | numbusegm > 7: low (75.0/ 14.0)
| | | | | | | | | vstr_grcguid_r > 0
| | | | | | | | | | cpoly_vest_r < = 0: high (2.0)
| | | | | | | | | | cpoly_vest_r > 0
| | | | | | | | | | | comp_age < = 40.8
| | | | | | | | | | | | numbusegm < = 7
| | | | | | | | | | | | | comp_age < = 28.1: low (2.0)
| | | | | | | | | | | | | comp_age > 28.1: high (3.0/ 1.0)
| | | | | | | | | | | | numbusegm > 7: high (2.0)
| | | | | | | | | | | comp_age > 40.8: low (6.0)
| | | | | | | | cpoly_ltcom_r > 0
| | | | | | | | | mv_mean1 < = 0: low (328.0/ 97.0)
| | | | | | | | | mv_mean1 > 0
| | | | | | | | | | comp_age < = 100.1
| | | | | | | | | | | numbusegm < = 6
| | | | | | | | | | | | vstr_csrxaud_r < = 0
| | | | | | | | | | | | | vstr_grcguid_r < = 0
| | | | | | | | | | | | | | ltdebtasset_mean1 < = 0
| | | | | | | | | | | | | | | comp_age < = 16.5: high (8.0/ 2.0)
| | | | | | | | | | | | | | | comp_age > 16.5: low (13.0/ 1.0)

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | | | | | | | ltdebtasset_mean1 > 0

| | | | | | | | | | | | | | | comp_age < = 6.8: low (4.0/ 1.0)

| | | | | | | | | | | | | | | comp_age > 6.8: high (8.0/ 1.0)

| | | | | | | | | | | | | | vstr_grcguid_r > 0: low (2.0)

| | | | | | | | | | | | | | vstr_csrxaud_r > 0: low (47.0/ 11.0)

| | | | | | | | | | | | numbusegm > 6

| | | | | | | | | | | | | | vstr_csrxaud_r < = 0

| | | | | | | | | | | | | | vstr_grcguid_r < = 0

| | | | | | | | | | | | | | cpoly_vest_r < = 0: high (3.0)

| | | | | | | | | | | | | | cpoly_vest_r > 0

| | | | | | | | | | | | | | | ltdebtasset_mean1 < = 0

| | | | | | | | | | | | | | | comp_age < = 17: high (3.0)

| | | | | | | | | | | | | | | comp_age > 17: low (38.0/ 8.0)

| | | | | | | | | | | | | | | ltdebtasset_mean1 > 0

| | | | | | | | | | | | | | | vstr_csrrep_r < = 0: high (3.0)

| | | | | | | | | | | | | | | vstr_csrrep_r > 0

| | | | | | | | | | | | | | | | numbusegm < = 7: high (3.0/ 1.0)

| | | | | | | | | | | | | | | | numbusegm > 7: low (3.0)

| | | | | | | | | | | | | | vstr_grcguid_r > 0

| | | | | | | | | | | | | | ltdebtasset_mean1 < = 0

| | | | | | | | | | | | | | | comp_age < = 16.1: low (3.0)

| | | | | | | | | | | | | | | comp_age > 16.1: high (6.0/ 1.0)

| | | | | | | | | | | | | | ltdebtasset_mean1 > 0: low (3.0/ 1.0)

| | | | | | | | | | | | | vstr_csrxaud_r > 0

| | | | | | | | | | | | | comp_age < = 80.2

| | | | | | | | | | | | | | numbusegm < = 7

| | | | | | | | | | | | | | comp_age < = 29.6: high (13.0/ 1.0)

| | | | | | | | | | | | | | comp_age > 29.6

| | | | | | | | | | | | | | | vstr_grcguid_r < = 0: low (4.0)

| | | | | | | | | | | | | | | vstr_grcguid_r > 0

| | | | | | | | | | | | | | | | comp_age < = 51.2: low (5.0/ 2.0)

| | | | | | | | | | | | | | | | comp_age > 51.2: high (6.0)

| | | | | | | | | | | | | | numbusegm > 7

| | | | | | | | | | | | | | comp_age < = 12.1: high (17.0/ 5.0)

| | | | | | | | | | | | | | comp_age > 12.1: low (38.0/ 11.0)

| | | | | | | | | | | | | comp_age > 80.2: high (29.0/ 5.0)

| | | | | | | | | comp_age > 100.1: low (34.0/ 3.0)

| nvolreturn_mean1 > 0: low (2431.0/ 676.0)

mtb_mean1 > 0

J48 pruned tree *(highlighted for the operating state of the system)*

- -

| nvolreturn_mean1 < = 0
| | bf_bmeet_r < = 0
| | | bf_inomcom_r < = 0: low (10.0/ 1.0)
| | | bf_inomcom_r > 0: high (30.0/ 6.0)
| | bf_bmeet_r > 0: high (1842.0/ 232.0)
| nvolreturn_mean1 > 0
| | vstr_grcguid_r < = 0
| | | ltdebtasset_mean1 < = 0
| | | | bf_imnoncom_r < = 0
| | | | | bf_bmeetave_r < = 0
| | | | | | cpoly_vest_r < = 0
| | | | | | | numbusegm < = 4: low (3.0/ 1.0)
| | | | | | | numbusegm > 4: high (4.0)
| | | | | | cpoly_vest_r > 0: low (10.0)
| | | | | bf_bmeetave_r > 0: high (20.0/ 3.0)
| | | | bf_imnoncom_r > 0
| | | | | numbusegm < = 7
| | | | | | numbusegm < = 5: high (391.0/ 93.0)
| | | | | | numbusegm > 5
| | | | | | | numbusegm < = 6
| | | | | | | | comp_age < = 24.8
| | | | | | | | | vstr_csrxaud_r < = 0
| | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | comp_age < = 16.7: low (4.0)
| | | | | | | | | | | comp_age > 16.7
| | | | | | | | | | | | comp_age < = 21.5: high (3.0)
| | | | | | | | | | | | comp_age > 21.5: low (4.0/ 1.0)
| | | | | | | | | | mv_mean1 > 0: high (2.0)
| | | | | | | | | vstr_csrxaud_r > 0: high (8.0/ 3.0)
| | | | | | | | comp_age > 24.8: high (13.0)
| | | | | | | numbusegm > 6
| | | | | | | | shrt_clabs_r < = 0: low (2.0)
| | | | | | | | shrt_clabs_r > 0
| | | | | | | | | comp_age < = 55.5: high (10.0)
| | | | | | | | | comp_age > 55.5: low (7.0/ 1.0)
| | | | | numbusegm > 7: high (30.0/ 2.0)
| | | ltdebtasset_mean1 > 0
| | | | cpoly_rem_r < = 0
| | | | | bf_bmeetave_r < = 0: low (2.0)

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | bf_bmeetave_r > 0
| | | | | | mv_mean1 < = 0
| | | | | | | comp_age < = 30.8
| | | | | | | | comp_age < = 12.9: high (5.0/ 1.0)
| | | | | | | | comp_age > 12.9: low (6.0)
| | | | | | | comp_age > 30.8: high (5.0)
| | | | | | mv_mean1 > 0
| | | | | | | cpoly_ltcom_r < = 0: low (2.0)
| | | | | | | cpoly_ltcom_r > 0
| | | | | | | | comp_age < = 38.4: high (2.0)
| | | | | | | | comp_age > 38.4: low (2.0)
| | | | cpoly_rem_r > 0
| | | | | numbusegm < = 2
| | | | | | numbusegm < = 1
| | | | | | | bf_bmeet_r < = 0: high (5.0)
| | | | | | | bf_bmeet_r > 0
| | | | | | | | bf_bmeetave_r < = 0: low (2.0)
| | | | | | | | bf_bmeetave_r > 0
| | | | | | | | | shrt_clabs_r < = 0
| | | | | | | | | | comp_age < = 17.4: high (3.0/ 1.0)
| | | | | | | | | | comp_age > 17.4: low (2.0)
| | | | | | | | | shrt_clabs_r > 0
| | | | | | | | | | mv_mean1 < = 0
| | | | | | | | | | | cpoly_ltcom_r < = 0: high (7.0/ 1.0)
| | | | | | | | | | | cpoly_ltcom_r > 0
| | | | | | | | | | | | comp_age < = 16.1: low (6.0/ 1.0)
| | | | | | | | | | | | comp_age > 16.1: high (10.0/ 2.0)
| | | | | | | | | | mv_mean1 > 0: low (6.0/ 2.0)
| | | | | | numbusegm > 1
| | | | | | | bf_bmeetave_r < = 0
| | | | | | | | cpoly_brem_r < = 0
| | | | | | | | | comp_age < = 17.6: low (2.0)
| | | | | | | | | comp_age > 17.6: high (6.0/ 1.0)
| | | | | | | | cpoly_brem_r > 0: low (3.0)
| | | | | | | bf_bmeetave_r > 0: high (102.0/ 20.0)
| | | | | numbusegm > 2
| | | | | | bf_bmeetave_r < = 0
| | | | | | | cpoly_vest_r < = 0: high (5.0)
| | | | | | | cpoly_vest_r > 0

J48 pruned tree *(highlighted for the operating state of the system)*

| | | | | | | | cpoly_ltcom_r < = 0
| | | | | | | | | comp_age < = 29.5: low (3.0)
| | | | | | | | | comp_age > 29.5: high (2.0)
| | | | | | | | cpoly_ltcom_r > 0: high (3.0)
| | | | | | bf_bmeetave_r > 0
| | | | | | | cpoly_brem_r < = 0
| | | | | | | | cpoly_vest_r < = 0
| | | | | | | | | comp_age < = 10.8: low (2.0)
| | | | | | | | | comp_age > 10.8: high (5.0/ 1.0)
| | | | | | | | cpoly_vest_r > 0: high (5.0/ 1.0)
| | | | | | | cpoly_brem_r > 0
| | | | | | | | shrt_clabs_r < = 0
| | | | | | | | | vstr_csrrep_r < = 0: low (10.0/ 4.0)
| | | | | | | | | vstr_csrrep_r > 0: high (5.0)
| | | | | | | | shrt_clabs_r > 0
| | | | | | | | | vstr_csrrep_r < = 0
| | | | | | | | | | numbusegm < = 3
| | | | | | | | | | | comp_age < = 16: high (7.0/ 2.0)
| | | | | | | | | | | comp_age > 16: low (11.0/ 1.0)
| | | | | | | | | | numbusegm > 3: high (37.0/ 12.0)
| | | | | | | | | vstr_csrrep_r > 0
| | | | | | | | | | vstr_csrxaud_r < = 0
| | | | | | | | | | | comp_age < = 19.3: low (7.0)
| | | | | | | | | | | comp_age > 19.3: high (8.0/ 2.0)
| | | | | | | | | | vstr_csrxaud_r > 0
| | | | | | | | | | | numbusegm < = 3: high (6.0/ 2.0)
| | | | | | | | | | | numbusegm > 3: low (10.0/ 3.0)
| | vstr_grcguid_r > 0: high (142.0/ 21.0)

Number of Leaves : 246

Size of the tree : 491

3B. Terminal nodes and system outputs from the decision tree

Table 3B.1. Probabilities obtained from the corporate governance inputs and campanies' specific information to estimate the system's reliability

Terminal node	Total Probabilities	Result	Outcome
bs_expe_r < = 0	0.0053152	low (50.0/ 8.0)	low
bf_bmeet_r < = 0	0.0002514	low (18.0/ 1.0)	low
numbusegm < = 1	0.0004519	high (2.0)	high
numbusegm > 1	0.0065883	low (33.0/ 5.0)	low
vstr_grcguid_r < = 0	0.0040810	low (34.0/ 11.0)	low
vstr_grcguid_r > 0	0.0010489	high (5.0/ 1.0)	high
vstr_grcguid_r < = 0	0.0015625	high (7.0/ 2.0)	high
comp_age < = 82.5	0.0001922	high (4.0/ 1.0)	high
comp_age > 82.5	0.0000378	low (2.0)	low
ltdebtasset_mean1 > 0	0.0001716	low (2.0)	low
vstr_csrxaud_r < = 0	0.0032726	high (10.0)	high
comp_age < = 17	0.0001625	high (6.0/ 1.0)	high
comp_age > 17	0.0005113	low (7.0)	low
cpoly_brem_r > 0	0.0026237	low (8.0/ 1.0)	low
bs_indep_r < = 0	0.0002911	low (8.0/ 1.0)	low
comp_age < = 57.4	0.0000339	high (8.0/ 1.0)	high
comp_age > 57.4	0.0000132	low (4.0/ 1.0)	low
comp_age < = 49.3	0.0000420	high (8.0)	high
comp_age > 49.3	0.0000202	low (3.0)	low
numbusegm > 5	0.0000213	low (3.0)	low
bf_bmeetave_r > 0	0.0004557	low (15.0/ 4.0)	low
bf_imnoncom_r > 0	0.0081252	high (11.0/ 2.0)	high
cpoly_rem_r < = 0	0.0001496	high (2.0)	high
cpoly_rem_r > 0	0.0026413	low (9.0/ 3.0)	low
cpoly_ltcom_r > 0	0.0087231	low (5.0)	low
comp_age > 90	0.0015481	high (4.0)	high
mv_mean1 > 0	0.0050011	high (6.0/ 1.0)	high
numbusegm < = 2	0.0000930	high (2.0)	high
comp_age < = 4.1	0.0000065	high (2.0)	high
comp_age > 4.1	0.0002676	low (8.0/ 2.0)	low
ltdebtasset_mean1 > 0	0.0002740	high (2.0)	high
cpoly_vest_r > 0	0.0073480	low (62.0/ 22.0)	low
numbusegm > 4	0.0054356	low (22.0/ 3.0)	low
numbusegm < = 4	0.0001458	low (6.0)	low
numbusegm > 4	0.0000992	high (2.0)	high
ltdebtasset_mean1 < = 0	0.0041991	low (17.0/ 7.0)	low
ltdebtasset_mean1 > 0	0.0031338	high (20.0/ 7.0)	high
numbusegm < = 3	0.0004487	low (3.0)	low
numbusegm > 3	0.0005787	high (2.0)	high

Terminal node	Total Probabilities	Result	Outcome
cpoly_vest_r > 0	0.0117764	high (41.0/ 18.0)	high
cpoly_brem_r < = 0	0.0002003	high (9.0/ 2.0)	high
comp_age < = 19	0.0002206	high (3.0)	high
comp_age > 19	0.0005594	low (3.0)	low
numbusegm < = 3	0.0010029	low (29.0/ 6.0)	low
comp_age < = 17	0.0003119	high (4.0)	high
comp_age > 17	0.0009814	low (22.0/ 7.0)	low
comp_age < = 22.9	0.0031618	low (18.0/ 3.0)	low
bf_bmeetave_r < = 0	0.0008944	high (4.0/ 1.0)	high
comp_age < = 28.5	0.0013375	high (5.0)	high
comp_age < = 35.1	0.0008666	low (2.0)	low
comp_age < = 40	0.0004251	high (2.0)	high
comp_age > 40	0.0002773	low (3.0/ 1.0)	low
numbusegm > 4	0.0019775	low (2.0)	low
cpoly_vest_r < = 0	0.0001495	low (22.0/ 8.0)	low
comp_age < = 12.4	0.0000060	low (3.0)	low
comp_age > 12.4	0.0000340	high (10.0/ 1.0)	high
numbusegm > 2	0.0001178	low (13.0/ 4.0)	low
numbusegm < = 1	0.0000553	low (2.0)	low
numbusegm > 1	0.0008066	high (12.0/ 5.0)	high
numbusegm > 4	0.0006939	high (11.0/ 2.0)	high
bf_bmeetave_r < = 0	0.0011228	low (19.0/ 3.0)	low
numbusegm < = 3	0.0002149	high (5.0/ 1.0)	high
numbusegm > 3	0.0002771	low (2.0)	low
comp_age < = 47.8	0.0037583	high (27.0/ 12.0)	high
comp_age > 47.8	0.0018812	low (6.0)	low
numbusegm < = 3	0.0000936	low (8.0/ 1.0)	low
numbusegm > 3	0.0001207	high (3.0/ 1.0)	high
numbusegm < = 2	0.0000327	low (2.0)	low
numbusegm > 2	0.0000964	high (2.0)	high
bf_bmeetave_r > 0	0.0007053	high (5.0/ 1.0)	high
comp_age < = 19	0.0006948	high (5.0/ 1.0)	high
comp_age > 19	0.0017619	low (13.0/ 3.0)	low
cpoly_brem_r > 0	0.0095650	low (44.0/ 12.0)	low
numbusegm < = 1	0.0001797	low (37.0/ 13.0)	low
comp_age < = 4.3	0.0000116	high (3.0)	high
ltdebtasset_mean1 < = 0	0.0002491	low (8.0)	low
comp_age < = 9.3	0.0000175	low (10.0/ 1.0)	low
comp_age > 9.3	0.0001684	high (3.0)	high
comp_age > 13.5	0.0021731	high (106.0/ 39.0)	high
ltdebtasset_mean1 < = 0	0.0004446	low (14.0/ 3.0)	low
comp_age < = 25.6	0.0001346	low (6.0)	low
comp_age < = 46.1	0.0001298	high (6.0)	high
comp_age > 46.1	0.0000674	low (3.0)	low
shrt_clabs_r > 0	0.0074694	low (107.0/ 44.0)	low

Terminal node	Total Probabilities	Result	Outcome
comp_age > 74.3	0.0028596	low (17.0)	low
comp_age < = 48.5	0.0035726	low (37.0/ 6.0)	low
comp_age < = 62.1	0.0013002	high (3.0)	high
comp_age < = 70.5	0.0003516	low (2.0)	low
comp_age > 70.5	0.0000993	high (2.0)	high
mv_mean1 < = 0	0.0231687	low (159.0/ 47.0)	low
bf_bmeetave_r < = 0	0.0013730	high (9.0/ 1.0)	high
shrt_clabs_r < = 0	0.0007059	high (3.0/ 1.0)	high
numbusegm < = 2	0.0009857	low (19.0/ 6.0)	low
vstr_csrxaud_r < = 0	0.0014462	high (7.0/ 1.0)	high
comp_age < = 13	0.0002356	high (3.0)	high
comp_age > 13	0.0012217	low (8.0/ 1.0)	low
cpoly_vest_r < = 0	0.0002329	high (2.0)	high
cpoly_vest_r > 0	0.0026696	low (16.0/ 3.0)	low
numbusegm < = 4	0.0080402	low (16.0/ 5.0)	low
cpoly_vest_r < = 0	0.0000655	low (2.0)	low
cpoly_vest_r > 0	0.0007510	high (9.0/ 3.0)	high
comp_age > 20.1	0.0018530	high (5.0)	high
comp_age > 30.1	0.0028009	low (6.0)	low
cpoly_brem_r > 0	0.0526043	low (295.0/ 87.0)	low
cpoly_brem_r < = 0	0.0004107	high (3.0/ 1.0)	high
cpoly_brem_r > 0	0.0015989	low (2.0)	low
numbusegm > 4	0.0013673	high (2.0)	high
comp_age < = 73.5	0.0083539	low (67.0/ 19.0)	low
comp_age > 73.5	0.0022055	high (5.0)	high
comp_age < = 65	0.0003827	low (7.0/ 2.0)	low
comp_age > 65	0.0001232	high (6.0/ 1.0)	high
numbusegm > 1	0.0073748	low (74.0/ 24.0)	low
cpoly_brem_r < = 0	0.0009775	low (7.0/ 2.0)	low
numbusegm < = 2	0.0004805	high (7.0/ 1.0)	high
comp_age < = 27.1	0.0006196	high (2.0)	high
comp_age > 27.1	0.0007956	low (10.0/ 1.0)	low
comp_age < = 28.1	0.0000821	low (3.0)	low
comp_age > 28.1	0.0000977	high (7.0/ 2.0)	high
numbusegm < = 2	0.0004385	low (4.0/ 1.0)	low
bf_bmeetave_r < = 0	0.0001999	low (2.0)	low
bf_bmeetave_r > 0	0.0010918	high (48.0/ 15.0)	high
ltdebtasset_mean1 > 0	0.0035698	low (46.0/ 15.0)	low
cpoly_ltcom_r < = 0	0.0006736	low (6.0)	low
bf_bmeetave_r < = 0	0.0003259	high (3.0)	high
comp_age < = 93.5	0.0015989	low (4.0)	low
comp_age > 93.5	0.0001807	high (2.0)	high
shrt_clabs_r < = 0	0.0013099	high (10.0/ 2.0)	high
cpoly_ltcom_r < = 0	0.0010063	low (3.0)	low
cpoly_ltcom_r > 0	0.0031452	high (20.0/ 5.0)	high

Terminal node	Total Probabilities	Result	Outcome
cpoly_ltcom_r < = 0	0.0007510	high (7.0/ 2.0)	high
vstr_csrrep_r < = 0	0.0008804	low (14.0/ 5.0)	low
vstr_csrxaud_r < = 0	0.0007307	high (2.0)	high
vstr_csrxaud_r > 0	0.0007363	low (3.0/ 1.0)	low
vstr_grcguid_r > 0	0.0018634	low (5.0/ 1.0)	low
mv_mean1 > 0	0.0034892	high (22.0/ 6.0)	high
numbusegm < = 4	0.0038457	low (27.0/ 12.0)	low
numbusegm > 4	0.0026166	high (32.0/ 7.0)	high
mv_mean1 > 0	0.0024742	low (11.0/ 2.0)	low
ltdebtasset_mean1 < = 0	0.0010537	high (9.0/ 2.0)	high
comp_age < = 101.5	0.0001130	high (4.0)	high
comp_age > 101.5	0.0000087	low (3.0/ 1.0)	low
bf_bmeetave_r > 0	0.0006647	low (5.0/ 1.0)	low
comp_age < = 91.4	0.0007835	high (2.0)	high
comp_age > 91.4	0.0000987	low (14.0/ 1.0)	low
cpoly_ltcom_r < = 0	0.0011677	high (2.0)	high
cpoly_ltcom_r > 0	0.0036498	low (31.0/ 8.0)	low
numbusegm < = 4	0.0004126	high (10.0/ 3.0)	high
comp_age < = 88.5	0.0002447	high (2.0)	high
comp_age > 88.5	0.0000360	low (3.0)	low
comp_age > 95.2	0.0000717	low (11.0/ 1.0)	low
mv_mean1 < = 0	0.0004128	high (4.0/ 1.0)	high
mv_mean1 > 0	0.0001581	low (2.0)	low
comp_age > 101.7	0.0001020	high (15.0/ 2.0)	high
comp_age > 110	0.0000272	low (7.0)	low
cpoly_vest_r < = 0	0.0003955	low (5.0)	low
bf_imnoncom_r < = 0	0.0003051	low (8.0/ 1.0)	low
mv_mean1 < = 0	0.0007412	low (5.0)	low
mv_mean1 > 0	0.0002838	high (11.0/ 3.0)	high
cpoly_ltcom_r > 0	0.0032038	high (14.0/ 2.0)	high
comp_age < = 17	0.0036006	high (13.0/ 3.0)	high
comp_age > 17	0.0113272	low (72.0/ 13.0)	low
numbusegm > 7	0.0018510	low (75.0/ 14.0)	low
cpoly_vest_r < = 0	0.0003460	high (2.0)	high
comp_age < = 28.1	0.0009810	low (2.0)	low
comp_age > 28.1	0.0011669	high (3.0/ 1.0)	high
numbusegm > 7	0.0002663	high (2.0)	high
comp_age > 40.8	0.0015523	low (6.0)	low
mv_mean1 < = 0	0.0476706	low (328.0/ 97.0)	low
comp_age < = 16.5	0.0007394	high (8.0/ 2.0)	high
comp_age > 16.5	0.0024634	low (13.0/ 1.0)	low
comp_age < = 6.8	0.0001378	low (4.0/ 1.0)	low
comp_age > 6.8	0.0022525	high (8.0/ 1.0)	high
vstr_grcguid_r > 0	0.0014376	low (2.0)	low
vstr_csrxaud_r > 0	0.0070843	low (47.0/ 11.0)	low

Terminal node	Total Probabilities	Result	Outcome
cpoly_vest_r < = 0	0.0000880	high (3.0)	high
comp_age < = 17	0.0001393	high (3.0)	high
comp_age > 17	0.0004383	low (38.0/ 8.0)	low
vstr_csrrep_r < = 0	0.0001617	high (3.0)	high
numbusegm < = 7	0.0002397	high (3.0/ 1.0)	high
numbusegm > 7	0.0000297	low (3.0)	low
comp_age < = 16.1	0.0000361	low (3.0)	low
comp_age > 16.1	0.0001254	high (6.0/ 1.0)	high
ltdebtasset_mean1 > 0	0.0001205	low (3.0/ 1.0)	low
comp_age < = 29.6	0.0004847	high (13.0/ 1.0)	high
vstr_grcguid_r < = 0	0.0004237	low (4.0)	low
comp_age < = 51.2	0.0000748	low (5.0/ 2.0)	low
comp_age > 51.2	0.0000341	high (6.0)	high
comp_age < = 12.1	0.0000182	high (17.0/ 5.0)	high
comp_age > 12.1	0.0001079	low (38.0/ 11.0)	low
comp_age > 80.2	0.0002455	high (29.0/ 5.0)	high
comp_age > 100.1	0.0013691	low (34.0/ 3.0)	low
nvolreturn_mean1 > 0	0.2668295	low (2431.0/ 676.0)	low
bf_inomcom_r < = 0	0.0001298	low (10.0/ 1.0)	low
bf_inomcom_r > 0	0.0033926	high (30.0/ 6.0)	high
bf_bmeet_r > 0	0.1980433	high (1842.0/ 232.0)	high
numbusegm < = 4	0.0000308	low (3.0/ 1.0)	low
numbusegm > 4	0.0000210	high (4.0)	high
cpoly_vest_r > 0	0.0005931	low (10.0)	low
bf_bmeetave_r > 0	0.0035215	high (20.0/ 3.0)	high
numbusegm < = 5	0.0382753	high (391.0/ 93.0)	high
comp_age < = 16.7	0.0003604	low (4.0)	low
comp_age < = 21.5	0.0003887	high (3.0)	high
comp_age > 21.5	0.0007883	low (4.0/ 1.0)	low
mv_mean1 > 0	0.0005886	high (2.0)	high
vstr_csrxaud_r > 0	0.0021422	high (8.0/ 3.0)	high
comp_age > 24.8	0.0066915	high (13.0)	high
shrt_clabs_r < = 0	0.0002023	low (2.0)	low
comp_age < = 55.5	0.0013794	high (10.0)	high
comp_age > 55.5	0.0005672	low (7.0/ 1.0)	low
numbusegm > 7	0.0063715	high (30.0/ 2.0)	high
bf_bmeetave_r < = 0	0.0003835	low (2.0)	low
comp_age < = 12.9	0.0001184	high (5.0/ 1.0)	high
comp_age > 12.9	0.0006276	low (6.0)	low
comp_age > 30.8	0.0007683	high (5.0)	high
cpoly_ltcom_r < = 0	0.0001405	low (2.0)	low
comp_age < = 38.4	0.0002576	high (2.0)	high
comp_age > 38.4	0.0001816	low (2.0)	low
bf_bmeet_r < = 0	0.0000124	high (5.0)	high
bf_bmeetave_r < = 0	0.0001082	low (2.0)	low

Terminal node	Total Probabilities	Result	Outcome
comp_age < = 17.4	0.0000139	high (3.0/ 1.0)	high
comp_age > 17.4	0.0000418	low (2.0)	low
cpoly_ltcom_r < = 0	0.0000938	high (7.0/ 1.0)	high
comp_age < = 16.1	0.0000655	low (6.0/ 1.0)	low
comp_age > 16.1	0.0002278	high (10.0/ 2.0)	high
mv_mean1 > 0	0.0001482	low (6.0/ 2.0)	low
comp_age < = 17.6	0.0000827	low (2.0)	low
comp_age > 17.6	0.0002454	high (6.0/ 1.0)	high
cpoly_brem_r > 0	0.0012774	low (3.0)	low
bf_bmeetave_r > 0	0.0087676	high (102.0/ 20.0)	high
cpoly_vest_r < = 0	0.0004055	high (5.0)	high
comp_age < = 29.5	0.0005357	low (3.0)	low
comp_age > 29.5	0.0005909	high (2.0)	high
cpoly_ltcom_r > 0	0.0035215	high (3.0)	high
comp_age < = 10.8	0.0000542	low (2.0)	low
comp_age > 10.8	0.0003983	high (5.0/ 1.0)	high
cpoly_vest_r > 0	0.0051870	high (5.0/ 1.0)	high
vstr_csrrep_r < = 0	0.0007754	low (10.0/ 4.0)	low
vstr_csrrep_r > 0	0.0012920	high (5.0)	high
comp_age < = 16	0.0007197	high (7.0/ 2.0)	high
comp_age > 16	0.0025386	low (11.0/ 1.0)	low
numbusegm > 3	0.0042018	high (37.0/ 12.0)	high
comp_age < = 19.3	0.0017886	low (7.0)	low
comp_age > 19.3	0.0044029	high (8.0/ 2.0)	high
numbusegm < = 3	0.0027248	high (6.0/ 2.0)	high
numbusegm > 3	0.0035140	low (10.0/ 3.0)	low
vstr_grcguid_r > 0	0.0277933	high (142.0/ 21.0)	high

3C. Distribution of the reliability of the different companies' ages and with the number of business segments equalling two

Figure 3C.1 presents the reliability of different companies across the system (min, average and max), differentiated by age, given a base case for the number of business segments (*numbusegm* = 2). Figure 3C.2 presents a summary of the non-linear rank correlation for the variants of the companies' age, and displays which components are more relevant through this uncertainty and sensitivity analysis. The results confirm that actions to improve the companies' growth opportunities (*mtb_mean1*), average board meetings (*bf_bmeetave_r*), due reporting of the company CSR report (*vstr_grcguid_r*) and disclosure of the highest remuneration package (*cpoly_rem_r*) could produce a better reliability of the given companies and the system according to these variants of company age.

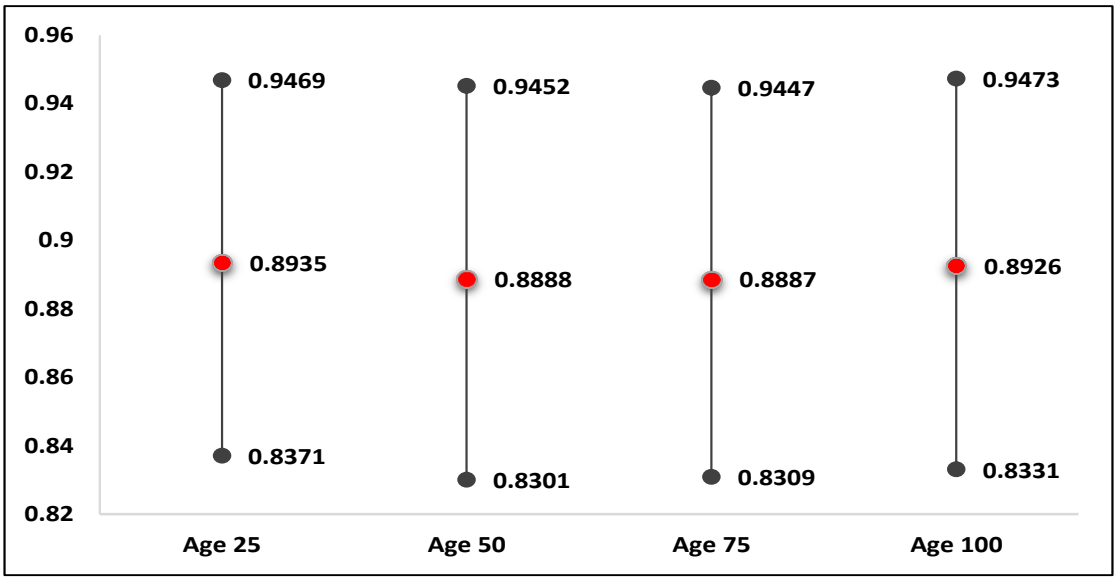

Figure 3C.1. Distribution of the reliability across different companies' age and *numbusegm* = 2

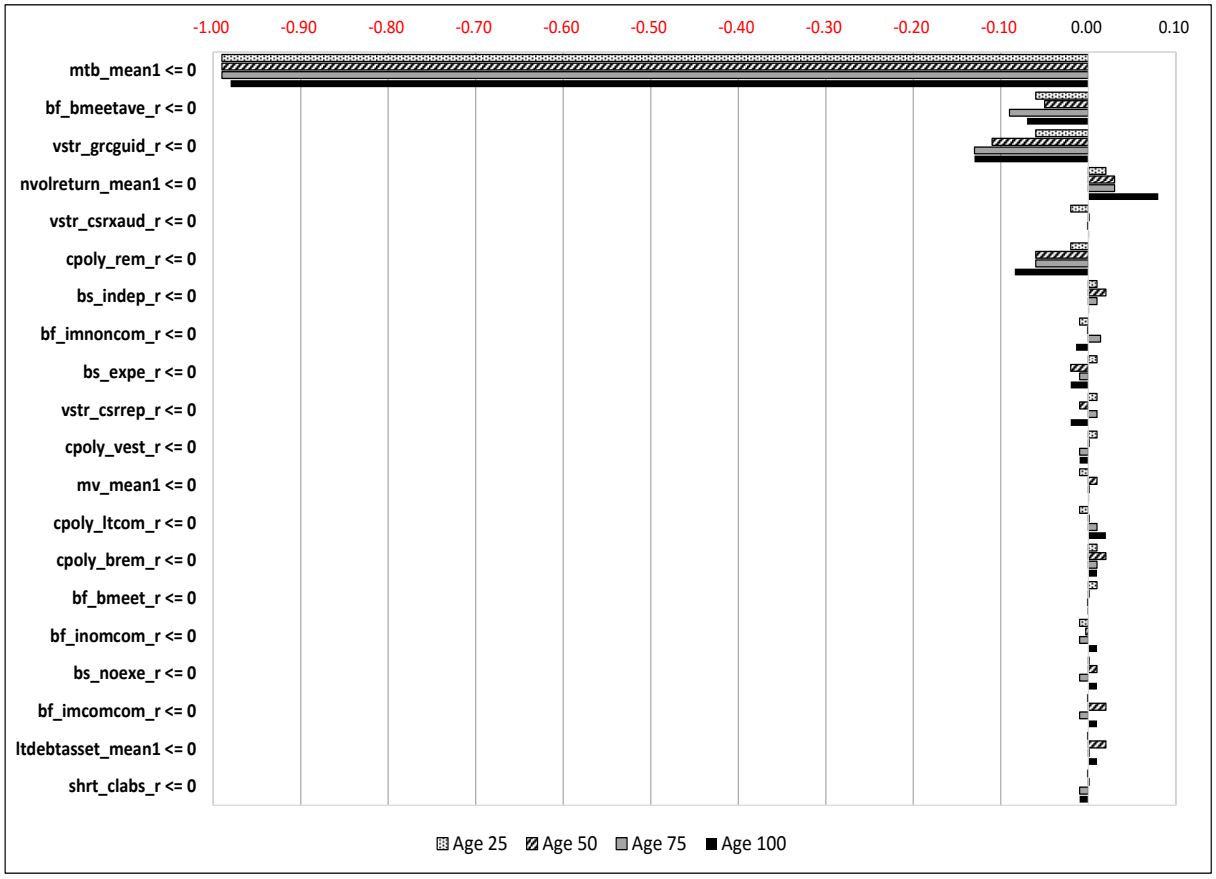

Figure 3C.2 Rank correlation index for different companies' age and *numbusegm* = 2

Appendix Chapter 4

4A. M&A classifications and data summary

Table 4A.1. Acquirers' and targets' macro industries and regions (period 1976–2014)

Deal activity (categories)	Deals completed (total)	Deals withdrawn (total)	Deals announced (total)	Deals withdrawn (per cent)
Acquirer Macro Industry				
Consumer Products and Services	7972	148	8120	1.8%
Consumer Staples	7743	260	8003	3.2%
Energy and Power	11309	407	11716	3.5%
Financials	33999	1385	35384	3.9%
Government and Agencies	291	15	306	4.9%
Healthcare	6209	165	6374	2.6%
High Technology	13138	255	13393	1.9%
Industrials	16562	617	17179	3.6%
Materials	13716	636	14352	4.4%
Media and Entertainment	7362	257	7619	3.4%
Real Estate	5449	131	5580	2.3%
Retail	4140	140	4280	3.3%
Telecommunications	4544	268	4812	5.6%
Target Macro Industry				
Consumer Products and Services	10756	173	10929	1.6%
Consumer Staples	8451	280	8731	3.2%
Energy and Power	12551	475	13026	3.6%
Financials	16974	808	17782	4.5%
Government and Agencies	81	3	84	3.6%
Healthcare	7159	192	7351	2.6%
High Technology	16992	344	17336	2.0%
Industrials	18552	703	19255	3.7%
Materials	15737	744	16481	4.5%
Media and Entertainment	8570	329	8899	3.7%
Real Estate	6724	167	6891	2.4%
Retail	5468	178	5646	3.2%
Telecommunications	4419	288	4707	6.1%
Acquirer Region				
Africa/ Middle East/ Central Asia	2371	108	2479	4.4%
Americas	54626	2024	56650	3.6%
Asia-Pacific (Ex Central Asia)	15756	884	16640	5.3%
Europe	48174	1442	49616	2.9%
Japan	10176	174	10350	1.7%
Supranational	19	1	20	5.0%
Unknown	1312	51	1363	3.7%
Target Region				
Africa/ Middle East/ Central Asia	2946	128	3074	4.2%
Americas	53504	2010	55514	3.6%
Asia-Pacific (Ex Central Asia)	19498	997	20495	4.9%
Europe	48118	1414	49532	2.9%
Japan	8363	133	8496	1.6%
Supranational	4	1	5	20.0%

Note: We followed the International Standard Industrial Classification (ISIC) for the target's and acquirer's macro industry classifications.

Table 4A.2. Deal activity: cross-border transactions, mean of payments and deals attitude (period 1976–2014)

Deal activity (categories)	Deals completed (total)	Deals withdrawn (total)	Deals announced (total)	Deals withdrawn (per cent)
Cross-Border				
N	74535	2686	77221	3.5%
Y	57899	1998	59897	3.3%
Means of payments				
Cash Only	29210	1205	30415	4.0%
Stock Only	4178	328	4506	7.3%
Cash and Stock Combination	2581	220	2801	7.9%
Choice between Cash or Stock or Combination	327	44	371	11.9%
Choice between types of shares/ stocks	19	3	22	13.6%
Choice involving Other non-cash and non-stock Consideration	142	11	153	7.2%
Other	65940	2001	67941	2.9%
Unknown	30037	872	30909	2.8%
Attitude				
Friendly	120506	3559	124065	2.9%
Hostile	154	235	389	60.4%
Neutral	8367	241	8608	2.8%
Not Appl.	3356	368	3724	9.9%
Unsolicited	51	281	332	84.6%
Total	**132432**	**4684**	**137116**	**3.4%**

Notes: Table 4A.1 and Table 4A.2 take into consideration M&A deals reported in Thomson One Banker and associated with the following countries: "Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Cape Verde, Chad, Chile, China, Colombia, Dem Rep of the Congo, Costa Rica, Ivory Coast, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Republic of Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, South Korea, Kuwait, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar(Burma), Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Surinam, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States of America, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe".

4B. Definition of the variables

Table 4B.1. Definition of the variables by company size, economic freedom, returns, and deal characteristics

Variable	Definitions
• *Status2*	Deal outcome (1 = Withdrawn; 0 = Completed): Dummy variable 1 if the deal is withdrawn (i.e., the target or acquirer has terminated their agreement, letter of intent, or plans for the acquisition or merger); 0, if the deal is completed and closed. This variable considers the most recent status of the transaction.
Panel A: Company size	
Total assets (acquirer, target)	Current assets, long-term investments and funds, net fixed assets, tangible assets, and deferred charges (in million USD). Equals total liabilities + shareholders' equity + minority interest (last 12 months).
• *acqtotassets_rl*	⇨ Natural logarithm of the acquirer's deflated total assets in million USD.
• *tgttotassets_rl*	⇨ Natural logarithm of the target's deflated total assets in million USD.
Total sales (acquirer, target)	Net sales generated by the incumbents after deductions, allowances and discounts allowed (in million USD).
• *acqnetsaleslmt_rl*	⇨ Natural logarithm of the acquirer's deflated net sales in million USD.
• *tgtnetsaleslmt_rl*	⇨ Natural logarithm of the target's deflated net sales in million USD.
Panel B: Economic freedom index	
Economic Freedom Index (acquirer, target)	The index measures the degree of economic freedom present in 5 major areas and 24 criteria associated with size of government, legal system and security of property rights, sound money, freedom to trade internationally and regulation. The index ranges from 0 to 10, and higher values indicate higher freedom (http://www.freetheworld.com/).
• *acqefridx2*	⇨ Natural logarithm of acquirers' economic freedom index.
• *tgtefridx2*	⇨ Natural logarithm of targets' economic freedom index.
Panel C: Company returns	
EBITDA (acquirer, target)	Earnings before interest, taxes, depreciation and amortization (last 12 months) ending on the date of the most current financial information prior to the announcement (in million USD).
• *acqebitdaassets*	⇨ Ratio of acquirers' EBITDA to total assets.
• *tgtebitdaassets*	⇨ Ratio of targets' EBITDA to total assets.
Net income (acquirer, target)	Net income last 12 months (in million USD) from continuing operations, after taxes and minority interest, before extraordinary items and preferred dividends
• *acqnetincomlassets*	⇨ Ratio of acquirers' net income to total assets.
• *tgtnetincomlassets*	⇨ Ratio of targets' net income to total assets.
Panel D: Deal characteristics	
Deals attitude	Code for the attitude of the target company's management or board of directors toward the transaction.
• *attitude2f1*	⇨ Friendly attitude: Dummy variable: 1 if the company's management or board of directors recommends the offer; 0, otherwise.
• *attitude2h1*	⇨ Hostile attitude: Dummy variable: 1 if the company's management or board of directors officially rejects the offer but the acquirer continues with the takeover; 0, otherwise.
• *attitude2n1*	⇨ Neutral attitude: Dummy variable: 1 if the company's management or board of directors has nothing to do with the transaction; 0, otherwise. When constructing this deal attitude measure and the two just above, the other cases such as the attitude of the board is not applicable (e.g., splits and spin offs) and unsolicited (the offer is a surprise to the target's board and has not yet been given a recommendation) are also considered.

Variable	Definitions
Means of payments	Structure of means payments offered in the transaction
• *structure2c1*	⇨ Cash payment: Dummy variable: 1 if the transaction of the deal is via cash only as a payment method (i.e., cash, earn-out or assumption of liabilities, or any combination of the three); 0, otherwise.
• *structure2s1*	⇨ Stock payment: Dummy variable: 1 if the transaction of the deal is via stocks only as a payment method; 0, otherwise.
• *structure2cas1*	⇨ Combination of cash & stock payment (hybrid): Dummy variable: 1 if the transaction of the deal is via cash and stocks as payment methods (i.e., one of either of cash, earn-out, or assumption of liabilities and the other types of stocks); 0, otherwise. When constructing this means of payment measure and the two just above, the other cases such as 'unknown' (this includes deals where the values for each type of consideration are unknown) and 'others' (any combination excluding cash only, stock only and hybrid) are also considered.
Location perspectives (cross-border)	Thomson One Banker reports a cross-border transaction flag: Yes/ No flag set to 'Y' when the target company (or assets being sold) in the deal is not located in the same country as the acquirer.
• *crosborder1*	⇨ Cross-border: Dummy variable: 1 if the deal is cross-border (i.e., the target company or assets being sold is not located in the same country as the acquirer's); 0, otherwise.
Type of integration	Deals where an acquirer's sector is different from a target's sector are codified as vertical integration.
• *vertical1*	⇨ Vertical Integration: Dummy variable: 1 if the acquirer's industry is different from the target's industry, 0 otherwise.
Deal size	Total value of consideration (in million USD) paid by the acquirer, excluding fees and expenses. It includes the amount paid for all common stock, common stock equivalents, preferred stock, debt, options, assets, warrants and stake purchases made within six months of the announcement date of the transaction.
• *dealval_rl*	⇨ Natural logarithm of deflated deal value in million USD.
Ownership sought	Percentage of common stocks and equivalent outstanding of the target sought by the acquirer in the transaction.
• *pshrseekpurch*	⇨ Percentage Sought to Purchase.
Liquidity (cash and marketable securities)	Includes cash and the temporary investment vehicles for cash, including commercial paper and short-term government securities, as of the date of the most current financial information prior to the announcement of the transaction ($mil). For banks, cash does not include loans, but does include federal funds sold.
• *tgtcashstassets*	⇨ Ratio of targets' cash and marketable securities to total assets, non-available information for acquirers.
Capital structure (leverage)	In relation to the total assets, it includes the total of all short-term debt, straight debt (long term non-convertible debt) and convertible debt of the target as of the date of the most current financial information available prior to the announcement of the transaction ($ mil).
• *tgtleverage2*	⇨ Ratio of targets' target total debt to total assets, non-available information for acquirers.

Source: Author's own elaboration based on Thomson One Banker data.

4C. Variable inflation (VIF) factor

Table 4C.1. Variable inflation (VIF) factor of the selected variables

	Size (Assets)		Size (Sales)		Returns (EBITDA)		Returns (Net Income)	
Variable	**VIF**	**1/ VIF**	**VIF**	**1/ VIF**	**VIF**	**1/ VIF**	**VIF**	**1/ VIF**
acqtotassets_rl	1.360	0.737					1.370	0.729
tgttotassets_rl	3.140	0.319					2.920	0.342
acqnetsaleslmt_rl			1.300	0.770	1.320	0.760		
tgtnetsaleslmt_rl			2.260	0.442	2.120	0.471		
acqefridx2ln	1.610	0.622	1.610	0.623	1.620	0.618	1.620	0.617
tgtefridx2ln	1.700	0.589	1.710	0.586	1.720	0.583	1.700	0.587
acqebitdaassets	1.010	0.987	1.010	0.993				
tgtebitdaassets	1.200	0.833	1.240	0.809				
acqnetincomlassets					1.010	0.994	1.010	0.989
tgtnetincomlassets					1.110	0.901	1.090	0.916
attitude2f1	6.880	0.145	6.870	0.145	6.640	0.150	6.720	0.149
attitude2h1	2.030	0.494	2.030	0.492	2	0.501	2	0.500
attitude2n1	6.350	0.158	6.350	0.158	6.100	0.164	6.170	0.162
structure2c1	1.360	0.736	1.370	0.731	1.370	0.732	1.350	0.742
structure2s1	1.410	0.709	1.410	0.711	1.410	0.711	1.410	0.711
structure2cas1	1.290	0.778	1.290	0.777	1.280	0.783	1.270	0.786
crosborder1	1.110	0.903	1.120	0.897	1.110	0.899	1.100	0.907
vertical1	1.060	0.942	1.060	0.946	1.060	0.947	1.060	0.944
dealval_rl	3.560	0.281	2.600	0.385	2.510	0.398	3.390	0.295
pshrseekpurch	2.530	0.395	2.080	0.481	2.040	0.489	2.440	0.410
tgtcashstassets	1.350	0.743	1.360	0.737	1.160	0.860	1.170	0.855
Years	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Acq&Tag	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Acq&Tag	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean VIF		2.290		2.160		2.090		2.220

Notes: The variance inflation factors (VIF) are far below 10 with the mean value of 2.15, suggesting the absence of the multicollinearity problem. Same results are obtained for proxies of ROA and leverage.

4D. Results associated bottom-line accounting returns and leverage

Table 4D.1. Full model: deal withdrawals on variants of company size using ROA as a proxy of company returns

	(1)	(2)	(3)	(4)
Variables	**Coefficients**	**Marginal Effects**	**Coefficients**	**Marginal Effects**
acqnetsaleslmt_rl	-0.167***	-0.00926***		
	(0.0282)	(0.00156)		
tgtnetsaleslmt_rl	0.130***	0.00717***		
	(0.0380)	(0.00210)		
acqtotassets_rl			-0.201***	-0.0110***
			(0.0306)	(0.00167)
tgttotassets_rl			0.200***	0.0109***
			(0.0443)	(0.00243)
acqefridx2ln	5.986***	0.331***	6.046***	0.329***
	(1.856)	(0.103)	(1.836)	(0.100)
tgtefridx2ln	-1.123	-0.0621	-1.200	-0.0654
	(1.324)	(0.0732)	(1.298)	(0.0706)
acqnetincomlassets	0.000147	8.15e-06	0.00209	0.000114
	(0.00315)	(0.000174)	(0.00305)	(0.000166)
tgtnetincomlassets	-0.0179*	-0.000992*	-0.0172*	-0.000937*
	(0.00944)	(0.000523)	(0.00965)	(0.000526)
attitude2f1	-3.039***	-0.168***	-3.011***	-0.164***
	(0.172)	(0.00902)	(0.168)	(0.00873)
attitude2h1	-0.515**	-0.0285**	-0.489**	-0.0266**
	(0.227)	(0.0125)	(0.223)	(0.0122)
attitude2n1	-3.659***	-0.202***	-3.590***	-0.196***
	(0.273)	(0.0149)	(0.267)	(0.0144)
structure2c1	-0.0766	-0.00424	-0.0505	-0.00275
	(0.117)	(0.00648)	(0.116)	(0.00629)
structure2s1	0.253*	0.0140*	0.212	0.0115
	(0.142)	(0.00785)	(0.139)	(0.00757)
structure2cas1	-0.104	-0.00577	-0.140	-0.00760
	(0.169)	(0.00937)	(0.168)	(0.00917)
crosborder1	0.0359	0.00198	0.0313	0.00171
	(0.122)	(0.00673)	(0.120)	(0.00651)
vertical1	0.171	0.00946	0.178	0.00971
	(0.111)	(0.00612)	(0.110)	(0.00597)
dealval_rl	0.206***	0.0114***	0.170***	0.00927***
	(0.0436)	(0.00241)	(0.0495)	(0.00269)
pshrseekpurch	0.0105***	0.000581***	0.0115***	0.000627***
	(0.00209)	(0.000115)	(0.00217)	(0.000118)
tgtcashstassets	0.0462	0.00255	0.0378	0.00206
	(0.133)	(0.00733)	(0.157)	(0.00856)
Constant	-10.40***		-10.32***	
	(3.490)		(3.468)	
Observations	9,199	9,199	9,575	9,575
Years	Yes	Yes	Yes	Yes
Industry_Acq & Tgt	Yes	Yes	Yes	Yes
Country_Acq & Tgt	Yes	Yes	Yes	Yes
Pseudo R-squared	0.28		0.282	
F/ Wald statistic	1037.676		1075.552	
P-value F/ Wald	1.4000e-132		1.1000e-139	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4D.2. Full model: deals withdrawal, controlled by targets' leverage, on variants of company size and EBITDA as a proxy of company returns

	(1)	(2)	(3)	(4)
Variables	**Coefficients**	**Marginal Effects**	**Coefficients**	**Marginal Effects**
acqnetsaleslmt_rl	-0.174***	-0.0105***		
	(0.0314)	(0.00189)		
tgtnetsaleslmt_rl	0.161***	0.00970***		
	(0.0471)	(0.00284)		
acqtotassets_rl			-0.201***	-0.0120***
			(0.0357)	(0.00212)
tgttotassets_rl			0.193***	0.0116***
			(0.0579)	(0.00347)
acqefridx2ln	3.338*	0.202*	3.246*	0.195*
	(1.862)	(0.113)	(1.856)	(0.111)
tgtefridx2ln	-1.836	-0.111	-1.782	-0.107
	(1.359)	(0.0820)	(1.364)	(0.0817)
acqebitdaassets	0.00496	0.000300	0.00638	0.000383
	(0.0104)	(0.000627)	(0.00572)	(0.000343)
tgtebitdaassets	-0.0160	-0.000968	-0.0136	-0.000817
	(0.0103)	(0.000622)	(0.0112)	(0.000669)
attitude2f1	-3.051***	-0.184***	-3.027***	-0.181***
	(0.185)	(0.0107)	(0.183)	(0.0105)
attitude2h1	-0.601**	-0.0363**	-0.574**	-0.0344**
	(0.244)	(0.0147)	(0.242)	(0.0145)
attitude2n1	-3.630***	-0.219***	-3.601***	-0.216***
	(0.281)	(0.0167)	(0.279)	(0.0164)
structure2c1	-0.127	-0.00768	-0.112	-0.00673
	(0.126)	(0.00762)	(0.126)	(0.00753)
structure2s1	0.254*	0.0153*	0.231	0.0138
	(0.146)	(0.00884)	(0.145)	(0.00869)
structure2cas1	-0.178	-0.0108	-0.199	-0.0119
	(0.174)	(0.0105)	(0.175)	(0.0105)
crosborder1	0.00442	0.000267	0.0169	0.00101
	(0.127)	(0.00769)	(0.126)	(0.00756)
vertical1	0.0163	0.000985	0.0254	0.00152
	(0.126)	(0.00760)	(0.126)	(0.00755)
dealval_rl	0.198***	0.0120***	0.188***	0.0113***
	(0.0511)	(0.00308)	(0.0602)	(0.00360)
pshrseekpurch	0.0119***	0.000718***	0.0121***	0.000726***
	(0.00229)	(0.000138)	(0.00242)	(0.000145)
leveragetgt2	-0.148	-0.00892	-0.198	-0.0119
	(0.203)	(0.0122)	(0.212)	(0.0127)
Constant	-3.355		-3.160	
	(3.476)		(3.466)	
Observations	7,523	7,523	7,632	7,632
Years	Yes	Yes	Yes	Yes
Industry_Acq & Tgt	Yes	Yes	Yes	Yes
Country_Acq & Tgt	Yes	Yes	Yes	Yes
Pseudo R-squared	.278		.281	
F/ Wald statistic	903		910	
P-value F/ Wald	2.8000e-106		1.5000e-107	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4D.3. Full model: deals withdrawal, controlled by targets' leverage, on variants of company size and ROA as a proxy of company returns

	(5)	(6)	(7)	(8)
Variables	**Coefficients**	**Marginal Effects**	**Coefficients**	**Marginal Effects**
acqnetsaleslmt_rl	-0.160***	-0.00932***		
	(0.0302)	(0.00176)		
tgtnetsaleslmt_rl	0.153***	0.00891***		
	(0.0446)	(0.00260)		
acqtotassets_rl			-0.175***	-0.0101***
			(0.0332)	(0.00191)
tgttotassets_rl			0.193***	0.0111***
			(0.0539)	(0.00311)
acqefridx2ln	3.645**	0.213**	3.669**	0.212**
	(1.782)	(0.104)	(1.783)	(0.103)
tgtefridx2ln	-1.489	-0.0868	-1.458	-0.0841
	(1.278)	(0.0745)	(1.281)	(0.0739)
acqnetincomlassets	0.00170	9.92e-05	0.00267	0.000154
	(0.00669)	(0.000390)	(0.00487)	(0.000281)
tgtnetincomlassets	-0.0201*	-0.00117*	-0.0187*	-0.00108*
	(0.0103)	(0.000599)	(0.0103)	(0.000594)
attitude2f1	-2.910***	-0.170***	-2.917***	-0.168***
	(0.167)	(0.00927)	(0.165)	(0.00905)
attitude2h1	-0.457**	-0.0266**	-0.465**	-0.0268**
	(0.222)	(0.0129)	(0.220)	(0.0127)
attitude2n1	-3.462***	-0.202***	-3.455***	-0.199***
	(0.259)	(0.0149)	(0.256)	(0.0146)
structure2c1	-0.119	-0.00692	-0.107	-0.00617
	(0.119)	(0.00694)	(0.119)	(0.00684)
structure2s1	0.259*	0.0151*	0.244*	0.0141*
	(0.139)	(0.00812)	(0.138)	(0.00794)
structure2cas1	-0.150	-0.00875	-0.170	-0.00981
	(0.165)	(0.00964)	(0.165)	(0.00954)
crosborder1	0.0935	0.00545	0.0955	0.00551
	(0.117)	(0.00684)	(0.116)	(0.00670)
vertical1	0.100	0.00583	0.121	0.00699
	(0.116)	(0.00676)	(0.116)	(0.00666)
dealval_rl	0.207***	0.0121***	0.185***	0.0107***
	(0.0494)	(0.00287)	(0.0576)	(0.00331)
pshrseekpurch	0.0125***	0.000730***	0.0133***	0.000765***
	(0.00213)	(0.000124)	(0.00226)	(0.000130)
leveragetgt2	-0.0984	-0.00574	-0.145	-0.00834
	(0.178)	(0.0104)	(0.186)	(0.0107)
Constant	-4.975		-5.017	
	(3.359)		(3.375)	
Observations	8,770	8,770	8,947	8,947
Years	Yes	Yes	Yes	Yes
Industry_Acq & Tgt	Yes	Yes	Yes	Yes
Country_Acq &Tgt	Yes	Yes	Yes	Yes
Pseudo R-squared	.28		.283	
F/ Wald statistic	1934.419		1885.211	
P-value F/ Wald	1.8000e-303		1.2000e-293	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4E. Results associated with different deals classifications

Table 4E.1. Full model: deal withdrawals for diferent deals classification on total net sales as company size and using ROA as a proxy of company returns

Variables	(1) Coefficients	(2) Marginal Effects	(3) Coefficients	(4) Marginal Effects	(5) Coefficients	(6) Marginal Effects
acqnetsaleslmt_rl	-0.183**	-0.00543**	-0.219***	-0.0178***	-0.179**	-0.00747**
	(0.0792)	(0.00236)	(0.0386)	(0.00315)	(0.0907)	(0.00379)
tgtnetsaleslmt_rl	-0.0295	-0.000878	0.251***	0.0204***	0.107	0.00449
	(0.0817)	(0.00243)	(0.0586)	(0.00478)	(0.101)	(0.00427)
acqefridx2ln	6.680	0.199	3.896	0.317	13.18**	0.552**
	(5.870)	(0.174)	(3.236)	(0.264)	(6.111)	(0.255)
tgtefridx2ln	2.345	0.0698	-0.581	-0.0472	-4.829	-0.202
	(3.037)	(0.0904)	(3.190)	(0.259)	(4.436)	(0.184)
acqnetincomlassets	0.884	0.0263	-0.0719	-0.00584	-0.600	-0.0251
	(0.859)	(0.0254)	(0.0706)	(0.00575)	(1.535)	(0.0642)
tgtnetincomlassets	0.0638	0.00190	-0.248*	-0.0202*	-0.00952	-0.000398
	(0.183)	(0.00544)	(0.135)	(0.0110)	(0.0144)	(0.000606)
attitude2f1	-1.338	-0.0398	-3.722***	-0.303***	-3.363***	-0.141***
	(0.873)	(0.0258)	(0.243)	(0.0179)	(0.581)	(0.0236)
attitude2h1	0.0355	0.00106	-1.081***	-0.0879***	-1.501	-0.0628*
	(1.425)	(0.0424)	(0.290)	(0.0235)	(0.917)	(0.0381)
attitude2n1	-1.941**	-0.0578**	-4.074***	-0.331***	-4.703***	-0.197***
	(0.902)	(0.0265)	(0.637)	(0.0515)	(0.838)	(0.0356)
structure2c1	0.371	0.0110	0.0293	0.00238	-0.596*	-0.0250*
	(0.264)	(0.00796)	(0.175)	(0.0142)	(0.306)	(0.0127)
structure2s1	0.354	0.0106	0.312*	0.0254*	-0.474	-0.0198
	(0.739)	(0.0221)	(0.182)	(0.0148)	(0.448)	(0.0187)
structure2cas1	-0.000655	-1.95e-05	-0.0872	-0.00708	-0.230	-0.00964
	(0.811)	(0.0242)	(0.210)	(0.0171)	(0.555)	(0.0232)
crosborder1	0.405	0.0120	-0.0901	-0.00732	-0.457	-0.0191
	(0.376)	(0.0111)	(0.163)	(0.0132)	(0.369)	(0.0154)
vertical1	-0.428	-0.0127	0.124	0.0101	0.130	0.00545
	(0.339)	(0.0101)	(0.151)	(0.0123)	(0.312)	(0.0131)
dealval_rl	0.279**	0.00830**	0.119**	0.00964**	0.397***	0.0166***
	(0.130)	(0.00383)	(0.0600)	(0.00486)	(0.106)	(0.00445)
pshrseekpurch	0.0170**	0.000507**	0.00978	0.000794	-0.00875*	-0.000366*
	(0.00678)	(0.000207)	(0.00745)	(0.000604)	(0.00523)	(0.000221)
tgtcashstassets	-0.467	-0.0139	0.256	0.0208	-0.0903	-0.00378
	(0.780)	(0.0232)	(0.193)	(0.0157)	(0.434)	(0.0181)
Constant	-22.90*		-6.594		-17.16	
	(12.79)		(6.048)		(10.45)	
Observations	2,517	2,517	3,854	3,854	1,801	1,801
Years	Yes	Yes	Yes	Yes	Yes	Yes
Industry_Acq&Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Country_Acq&Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.228		0.31		0.332	
F/Wald statistic	270		888		847	
P-value F/Wald	0		0		0	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Models (1-2) acquisitions of partial interest, (3-4) mergers, (5-6) all other acquisitions (general acquisition, acquisition of majority interest, acquisition of remaining interest, acquisition of assets, and acquisition of certain assets).

Table 4E.2. Full model: deal withdrawals for diferent deals classification on total net sales as company size and using ROA as a proxy of company returns

Variables	(7) Coefficients	(8) Marginal Effects	(9) Coefficients	(10) Marginal Effects
acqnetsaleslmt_rl	-0.125**	-0.00421**	-0.195***	-0.0160***
	(0.0507)	(0.00171)	(0.0388)	(0.00319)
tgtnetsaleslmt_rl	0.0256	0.000867	0.219***	0.0180***
	(0.0564)	(0.00191)	(0.0565)	(0.00466)
acqefridx2ln	8.403***	0.284***	3.967	0.326
	(3.076)	(0.105)	(3.214)	(0.264)
tgtefridx2ln	-0.0440	-0.00149	-0.788	-0.0647
	(1.790)	(0.0606)	(3.157)	(0.259)
acqnetincomlassets	0.00316	0.000107	-0.00479	-0.000394
	(0.00392)	(0.000133)	(0.0484)	(0.00398)
tgtnetincomlassets	-0.00797	-0.000270	-0.243*	-0.0200*
	(0.0113)	(0.000381)	(0.130)	(0.0108)
attitude2f1	-2.681***	-0.0907***	-3.466***	-0.285***
	(0.443)	(0.0152)	(0.232)	(0.0169)
attitude2h1	-0.986	-0.0334	-0.730***	-0.0599***
	(0.729)	(0.0246)	(0.273)	(0.0224)
attitude2n1	-3.383***	-0.114***	-3.824***	-0.314***
	(0.496)	(0.0171)	(0.643)	(0.0524)
structure2c1	0.0518	0.00175	-0.0328	-0.00269
	(0.181)	(0.00612)	(0.170)	(0.0140)
structure2s1	0.317	0.0107	0.277	0.0228
	(0.306)	(0.0104)	(0.181)	(0.0148)
structure2cas1	0.105	0.00356	-0.121	-0.00997
	(0.391)	(0.0132)	(0.208)	(0.0170)
crosborder1	0.147	0.00497	-0.0958	-0.00786
	(0.215)	(0.00728)	(0.162)	(0.0133)
vertical1	0.0457	0.00155	0.178	0.0146
	(0.188)	(0.00636)	(0.150)	(0.0123)
dealval_rl	0.314***	0.0106***	0.128**	0.0105**
	(0.0818)	(0.00275)	(0.0590)	(0.00483)
pshrseekpurch	0.00251	8.49e-05	0.0295***	0.00242***
	(0.00332)	(0.000113)	(0.00619)	(0.000496)
tgtcashstassets	-0.267	-0.00903	0.238	0.0195
	(0.427)	(0.0144)	(0.193)	(0.0159)
Constant	-19.18***		-8.504	
	(6.667)		(5.892)	
Observations	4,919	4,919	3,875	3,875
Years	Yes	Yes	Yes	Yes
Industry_Acq&Tgt	Yes	Yes	Yes	Yes
Country_Acq&Tgt	Yes	Yes	Yes	Yes
Pseudo R-squared	0.208		0.302	
F/Wald statistic	407		1010.707	
P-value F/Wald	0		0	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Models (7-8) all acquisitions, and (9-10) remaining deals (mergers, buyback, exchange offer, and recapitalization).

Table 4E.3. Full model: deal withdrawals for diferent deals classification on total assets as company size and using ROA as a proxy of company returns

Variables	(1) Coefficients	(2) Marginal Effects	(3) Coefficients	(4) Marginal Effects	(5) Coefficients	(6) Marginal Effects
acqtotassets_rl	-0.217**	-0.00617**	-0.267***	-0.0216***	-0.173*	-0.00713*
	(0.0889)	(0.00252)	(0.0414)	(0.00336)	(0.101)	(0.00414)
tgttotassets_rl	0.0370	0.00105	0.362***	0.0293***	0.0851	0.00351
	(0.117)	(0.00334)	(0.0674)	(0.00549)	(0.131)	(0.00544)
acqefridx2ln	6.822	0.194	3.911	0.316	14.27**	0.589**
	(5.558)	(0.158)	(3.145)	(0.255)	(6.083)	(0.249)
tgtefridx2ln	2.332	0.0664	-1.004	-0.0812	-5.861	-0.242
	(2.955)	(0.0840)	(3.131)	(0.253)	(4.355)	(0.177)
acqnetincomlassets	0.460	0.0131	-0.0489	-0.00395	-0.245	-0.0101
	(0.629)	(0.0178)	(0.0429)	(0.00347)	(0.515)	(0.0212)
tgtnetincomlassets	0.107	0.00306	-0.113*	-0.00914*	-0.00841	-0.000347
	(0.204)	(0.00581)	(0.0600)	(0.00487)	(0.0146)	(0.000604)
attitude2f1	-1.501*	-0.0427*	-3.626***	-0.293***	-3.353***	-0.138***
	(0.862)	(0.0243)	(0.229)	(0.0168)	(0.604)	(0.0242)
attitude2h1	-0.126	-0.00358	-0.995***	-0.0805***	-1.566*	-0.0646*
	(1.431)	(0.0407)	(0.278)	(0.0224)	(0.943)	(0.0386)
attitude2n1	-2.036**	-0.0580**	-3.997***	-0.323***	-4.670***	-0.193***
	(0.888)	(0.0250)	(0.616)	(0.0497)	(0.869)	(0.0363)
structure2c1	0.307	0.00874	0.0608	0.00492	-0.559*	-0.0230*
	(0.267)	(0.00765)	(0.171)	(0.0138)	(0.301)	(0.0124)
structure2s1	0.378	0.0108	0.232	0.0188	-0.510	-0.0210
	(0.707)	(0.0202)	(0.176)	(0.0142)	(0.443)	(0.0182)
structure2cas1	0.0490	0.00139	-0.152	-0.0123	-0.217	-0.00894
	(0.843)	(0.0240)	(0.206)	(0.0166)	(0.568)	(0.0234)
crosborder1	0.389	0.0111	-0.0831	-0.00672	-0.494	-0.0204
	(0.359)	(0.0102)	(0.158)	(0.0128)	(0.372)	(0.0153)
vertical1	-0.427	-0.0122	0.139	0.0112	0.139	0.00573
	(0.336)	(0.00959)	(0.149)	(0.0121)	(0.310)	(0.0128)
dealval_rl	0.229	0.00652	0.0390	0.00315	0.427***	0.0176***
	(0.145)	(0.00411)	(0.0696)	(0.00562)	(0.119)	(0.00482)
pshrseekpurch	0.0152**	0.000431**	0.00955	0.000772	-0.00972*	-0.000401*
	(0.00703)	(0.000204)	(0.00711)	(0.000574)	(0.00540)	(0.000224)
tgtcashstassets	-0.447	-0.0127	0.235	0.0190	-0.0485	-0.00200
	(0.773)	(0.0220)	(0.206)	(0.0167)	(0.396)	(0.0163)
Constant	-22.84*		-5.457		-17.34	
	(12.28)		(5.941)		(10.73)	
Observations	2,675	2,675	4,007	4,007	1,847	1,847
Years	Yes	Yes	Yes	Yes	Yes	Yes
Industry_Acq&Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Country_Acq&Tgt	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.227		0.309		0.334	
F/Wald statistic	296		935		769	
P-value F/Wald	0		0		0	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Models (1-2) acquisitions of partial interest, (3-4) mergers, (5-6) all other acquisitions (general acquisition, acquisition of majority interest, acquisition of remaining interest, acquisition of assets, and acquisition of certain assets).

Table 4E.4. Full model: deal withdrawals for diferent deals classification on total assets as company size and using ROA as a proxy of company returns

Variables	(7) Coefficients	(8) Marginal Effects	(9) Coefficients	(10) Marginal Effects
acqtotassets_rl	-0.144**	-0.00473**	-0.243***	-0.0199***
	(0.0584)	(0.00191)	(0.0415)	(0.00340)
tgttotassets_rl	0.0676	0.00222	0.311***	0.0255***
	(0.0720)	(0.00237)	(0.0665)	(0.00547)
acqefridx2ln	9.110***	0.299***	3.922	0.321
	(3.135)	(0.104)	(3.122)	(0.256)
tgtefridx2ln	-0.166	-0.00545	-1.159	-0.0948
	(1.783)	(0.0584)	(3.077)	(0.252)
acqnetincomlassets	0.00458	0.000150	-0.00159	-0.000130
	(0.00362)	(0.000119)	(0.0468)	(0.00383)
tgtnetincomlassets	-0.00637	-0.000209	-0.114*	-0.00931*
	(0.0125)	(0.000411)	(0.0599)	(0.00491)
attitude2f1	-2.693***	-0.0883***	-3.378***	-0.276***
	(0.449)	(0.0149)	(0.219)	(0.0159)
attitude2h1	-1.039	-0.0341	-0.643**	-0.0526**
	(0.738)	(0.0242)	(0.262)	(0.0214)
attitude2n1	-3.340***	-0.110***	-3.772***	-0.308***
	(0.497)	(0.0166)	(0.629)	(0.0511)
structure2c1	0.0418	0.00137	0.00317	0.000259
	(0.179)	(0.00588)	(0.167)	(0.0136)
structure2s1	0.293	0.00960	0.203	0.0166
	(0.307)	(0.0101)	(0.174)	(0.0143)
structure2cas1	0.111	0.00363	-0.184	-0.0151
	(0.397)	(0.0130)	(0.204)	(0.0166)
crosborder1	0.154	0.00504	-0.0842	-0.00688
	(0.214)	(0.00702)	(0.157)	(0.0129)
vertical1	0.0283	0.000929	0.190	0.0155
	(0.188)	(0.00617)	(0.148)	(0.0121)
dealval_rl	0.304***	0.00998***	0.0655	0.00536
	(0.0910)	(0.00296)	(0.0686)	(0.00560)
pshrseekpurch	0.00279	9.13e-05	0.0291***	0.00238***
	(0.00360)	(0.000118)	(0.00586)	(0.000468)
tgtcashstassets	-0.310	-0.0102	0.199	0.0163
	(0.466)	(0.0153)	(0.211)	(0.0173)
Constant	-20.38***		-7.351	
	(6.754)		(5.768)	
Observations	5,131	5,131	4,028	4,028
Years	Yes	Yes	Yes	Yes
Industry_Acq&Tgt	Yes	Yes	Yes	Yes
Country_Acq&Tgt	Yes	Yes	Yes	Yes
Pseudo R-squared	.211		.301	
F/Wald statistic	421		1007.165	
P-value F/Wald	2.26000e-31		5.1000e-132	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Models (7-8) all acquisitions, and (9-10) remaining deals (mergers, buyback, exchange offer, and recapitalization).

4F. STATA Code: Regression models including Outreg2 commands

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* = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
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/*------------------------------------------------------
--------FINAL MODELS LOGOUT (Cash Control) ------------
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*A.1) MODEL1=Size (Sales)
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) replace ctitle(Size1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_dydx)

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*A.2) MODEL1=Size (Assets)
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
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        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_dydx)

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***B.1) MODEL2=Size(Sales)+EFW**

```
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size1_EWF_logit)
*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_EWF_dydx)

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*B.2) MODEL2=Size(Assets)+EFW
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_EWF_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_EWF_dydx)

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*C.1) MODEL3=Size(Sales)+EFW + EBITDA
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
```

```
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size1_EWF_ROA1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_EWF_ROA1_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

***C.2) MODEL3=Size(Assets)+EFW +EBITDA**

```
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_EWF_ROA1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
```

```
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_EWF_ROA1_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
*D.1) MODEL4=Size(Sales)+EFW + ROA
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size1_EWF_ROA2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_EWF_ROA2_dydx)



*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
*D.2) MODEL4=Size(Assets)+EFW +ROA
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
```

```
        tgtcashstassets i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_EWF_ROA2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_EWF_ROA2_dydx)

************************

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*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
/*----------------------------------------------------
            EXTENSION
--------FINAL MODELS LOGOUT (DEBT Controls) ----------
----------------------------------------------------*/
*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
*A.1) MODEL1=Size (Sales)
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2 ///debt
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
```

```
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) replace ctitle(Size1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

***A.2) MODEL1=Size (Assets)**

```
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2 ///debt
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

```
*B.1) MODEL2=Size(Sales)+EFW
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2 ///debt
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size1_EWF_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_EWF_dydx)


*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
*B.2) MODEL2=Size(Assets)+EFW
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2 ///debt
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
```

```
          leveragetgt2) ///debt
          addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
          addstat(Pseudo R-squared, e(r2_p), ///
          F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
          afmt(g) append ctitle(Size2_EWF_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
          keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
          acqefridx2ln tgtefridx2ln ///efwindex
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          leveragetgt2) ///debt
          addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
          afmt(g) append ctitle(Size2_EWF_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

***C.1) MODEL3=Size(Sales)+EFW + EBITDA**

```
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
          acqefridx2ln tgtefridx2ln /// efwindex
          acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          leveragetgt2 ///debt
          i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
          i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
          keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
          acqefridx2ln tgtefridx2ln /// efwindex
          acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          leveragetgt2) ///debt
          addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
          addstat(Pseudo R-squared, e(r2_p), ///
          F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
          afmt(g) append ctitle(Size1_EWF_ROA1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
          keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
          acqefridx2ln tgtefridx2ln /// efwindex
          acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
```

```
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size1_EWF_ROA1_dydx)


*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

***C.2) MODEL3=Size(Assets)+EFW +EBITDA**

```
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2 ///debt
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(Size2_EWF_ROA1_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqebitdaassets tgtebitdaassets /// ebitda-ret (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        leveragetgt2) ///debt
        addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
        afmt(g) append ctitle(Size2_EWF_ROA1_dydx)


*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

***D.1) MODEL4=Size(Sales)+EFW + ROA**

```
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
```

```
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            leveragetgt2 ///debt
            i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
            i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
            keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            leveragetgt2) ///debt
            addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
            addstat(Pseudo R-squared, e(r2_p), ///
            F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
            afmt(g) append ctitle(Size1_EWF_ROA2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
            keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            leveragetgt2) ///debt
            addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
            afmt(g) append ctitle(Size1_EWF_ROA2_dydx)

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```

***D.2) MODEL4=Size(Assets)+EFW +ROA**

```
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            leveragetgt2 ///debt
            i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
            i.acqnation2 i.tgtnation2, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
            keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln ///efwindex
            acqnetincomlassets tgtnetincomlassets ///roa(yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            leveragetgt2) ///debt
```

```
          addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
          addstat(Pseudo R-squared, e(r2_p), ///
          F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
          afmt(g) append ctitle(Size2_EWF_ROA2_logit)

*marginal effects
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\ModelTotal_2016D.xls, ///
          keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
          acqefridx2ln tgtefridx2ln ///efwindex
          acqnetincomlassets tgtnetincomlassets ///roa (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          leveragetgt2) ///debt
          addtext(Years, Yes, Industry_Acq & Tgt, Yes, Country_Acq & Tgt, Yes) ///
          afmt(g) append ctitle(Size2_EWF_ROA2_dydx)

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```

*** REGRESSION FOR PARTICULAR DEALS CLASSIFICATIONS**

***------------SALES---------------------------------**

```
*Viva.1) MODEL4=Size(Sales)+EFW + ROA (individual)
* CASE 1 Individual ACQUISITIONS
sort deal3
set more off
* category 3AcqPartInt
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
          acqefridx2ln tgtefridx2ln /// efwindex
          acqnetincomlassets tgtnetincomlassets /// roa (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          tgtcashstassets ///cash
          i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
          i.acqnation2 i.tgtnation2 ///
          if deal3==3, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case1(3)
          keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
          acqefridx2ln tgtefridx2ln /// efwindex
          acqnetincomlassets tgtnetincomlassets /// roa (yes)
          attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
          structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
          tgtcashstassets) ///cash
          addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
          addstat(Pseudo R-squared, e(r2_p), ///
          F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
          afmt(g) append ctitle(C1_3AcqPartInt)
margins, dydx(*) post
```

```
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case1(3)
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C1_3AcqPartInt_dydx)

set more off
* Category 9 Merger
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if deal3==9, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case1(9)
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C1_9Merger)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case1(9)
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C1_9Merger_dydx)


*Viva.1) MODEL4=Size(Sales)+EFW + ROA (individual)
*otheracqcat1 (case2) PARTIAL ACQUISITION
sort otheracqcat1
```

```
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if otheracqcat1==1, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case2(1)
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C2_1OtherAcq)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case2(1)
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C2_0OtherAcq_dydx)

*Viva.1) MODEL4=Size(Sales)+EFW + ROA (individual)
*allacqcat1 (case3) ALL ACQUISITIONS
sort allacqcat1
set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if allacqcat1==1, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case3(1)
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
```

```
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C3_1AllAcq)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case3(1)
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C3_1AllAcq_dydx)

set more off
logit status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if allacqcat1==0, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case3(0)
        keep(status2 acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C3_0MergerOther)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr.xls, ///case3(0)
        keep(acqnetsaleslmt_rl tgtnetsaleslmt_rl ///size(sales)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
```

```
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            afmt(g) append ctitle(C3_0MergerOther_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
*------------ASSETS----------------------------------
*Viva.1) MODEL4=Size(ASSETS)+EFW + ROA (individual)
* CASE 1 Individual ACQUISITIONS
sort deal3
set more off
* category 3AcqPartInt
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets ///cash
            i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
            i.acqnation2 i.tgtnation2 ///
            if deal3==3, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case1(3)
            keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            addstat(Pseudo R-squared, e(r2_p), ///
            F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
            afmt(g) append ctitle(C1_3AcqPartInt)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case1(3)
            keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            afmt(g) append ctitle(C1_3AcqPartInt_dydx)

set more off
* Category 9 Merger
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
```

```
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if deal3==9, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case1(9)
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C1_9Merger)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case1(9)
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C1_9Merger_dydx)


*Viva.1) MODEL4=Size(ASSETS)+EFW + ROA (individual)
*otheracqcat1 (case2) PARTIAL ACQUISITION
sort otheracqcat1
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if otheracqcat1==1, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case2(1)
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
```

```
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C2_1OtherAcq)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case2(1)
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        afmt(g) append ctitle(C2_0OtherAcq_dydx)

*Viva.1) MODEL4=Size(ASSETS)+EFW + ROA (individual)
*allacqcat1 (case3) ALL ACQUISITIONS
sort allacqcat1
set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets ///cash
        i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
        i.acqnation2 i.tgtnation2 ///
        if allacqcat1==1, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case3(1)
        keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
        structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
        tgtcashstassets) ///cash
        addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
        addstat(Pseudo R-squared, e(r2_p), ///
        F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
        afmt(g) append ctitle(C3_1AllAcq)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case3(1)
        keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
        acqefridx2ln tgtefridx2ln /// efwindex
        acqnetincomlassets tgtnetincomlassets /// roa (yes)
        attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
```

```
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            afmt(g) append ctitle(C3_1AllAcq_dydx)

set more off
logit status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets ///cash
            i.yearannouc i.acqmacindust2 i.tgtmacindust2 ///
            i.acqnation2 i.tgtnation2 ///
            if allacqcat1==0, robust
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case3(0)
            keep(status2 acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            addstat(Pseudo R-squared, e(r2_p), ///
            F/Wald statistic, e(chi2), P-value F/Wald, e(p)) ///
            afmt(g) append ctitle(C3_0MergerOther)
margins, dydx(*) post
outreg2 using E:\RespaldoPend64HULL\BD-IndicatorsCG-CSR-Env-
Company\M&As\C001_Results\VivaCaseCorr2.xls, ///case3(0)
            keep(acqtotassets_rl tgttotassets_rl ///size(Assets)
            acqefridx2ln tgtefridx2ln /// efwindex
            acqnetincomlassets tgtnetincomlassets /// roa (yes)
            attitude2f1 attitude2h1 attitude2n1 structure2c1 structure2s1 ///
            structure2cas1 crosborder1 vertical1 dealval_rl pshrseekpurch ///
            tgtcashstassets) ///cash
            addtext(Years, Yes, Industry_Acq&Tgt, Yes, Country_Acq&Tgt, Yes) ///
            afmt(g) append ctitle(C3_0MergerOther_dydx)

*= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
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