

RESEARCH ARTICLE

It's a matter of time! CEO turnover and corporate turnarounds in Italy

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Abstract

This paper examines whether CEO turnover affects company performance and the optimal time for CEO renewal during a turnaround process. Results, derived from data collected from Italian companies, highlight the necessity of introducing the new CEO before beginning an insolvency procedure. A later appointment can reduce his/her impact, probably due to the difficulty of managing negotiations with the creditors. Moreover, we show a positive and significant relationship between CEO turnover and the likelihood of a bankrupt firm re-emerging from an insolvency procedure. The analysis was based on the traditional logit model and more modern approaches like the random forest and the AdaBoost models, combined with the SHAP technique. Overall, our findings provide valuable insight for all company stakeholders, whose interests are significantly impacted by its default.

Key words: Bankruptcy; corporate governance; machine learning; turnaround; Z''-score

Introduction

The current pandemic crisis has deeply affected companies worldwide, with devastating and long-lasting impacts for several of them and our societies (Ayoko, Caputo, & Mendy, 2022). The economic consequences of COVID-19 have led to a significant increase in the indebtedness of firms, often leading to entering a restructuring process (Demmou, Calligaris, Franco, Dlugosch, McGowan, & Sakha, 2021). Furthermore, the consequences of this process will not only impact the defaulted company, but also the local economy and community, especially in countries with an unstable political situation (Cuervo-Cazurra, Mudambi, & Pedersen, 2017).

A similar scenario, which is the consequence of a low-probability but high-impact event (that, therefore, is largely unexpected), can threaten the life of a company if it cannot quickly adapt to the new economic and strategic framework (Haibing, Jinhong, Qi, & Wilbur, 2015). Research reports that typically large companies have the necessary experience in managing a crisis and a successful turnaround (Parnell & Crandall, 2020; Serrasqueiro, Leitão, & Smallbone, 2021), while high firm mortality rates are reported among firms of smaller size (Kücher, Mayr, & Mitter, 2020). Consequently, it is not a surprise that the percentage of firms that manage to implement an effective turnaround is very low: it has been estimated that two-thirds of companies in difficulty are unable to overcome the crisis (Chowdhury, 1996). Understanding which variables can impact the result of a turnaround process, and when they do so, is fundamental, especially for responding effectively to crises such as the COVID-19 pandemic (Wenzel, Stanske, & Lieberman, 2021).

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In this field, various scholars have highlighted the role of a company's management team in promoting and introducing strategic changes and new decision-making processes for survival during a crisis (Alipour, 2013). Several studies have shown that the top executives' background and skills (Mazzotta, 2018; Paoloni, Mattei, Dello Strologo, & Celli, 2020) and the renewal of the management team, through the introduction of new human capital (Agostini & Nosella, 2017), can affect the performance of a firm (Bennedsen, Pérez-González, & Wolfenzon, 2020; Gong & Wu, 2011; Hilger, Mankel, & Richter, 2013). However, literature in this field is still inconclusive and contradictory and, thus, more evidence on these issues is needed. This is especially true for smaller companies facing turnarounds because previous studies mostly focused on periods of stability (Domínguez-CC & Barroso-Castro, 2017). Moreover, prior research had been still focused on large corporations and there tends to be less analysis of small-medium companies which, on the contrary, tend to face more crises because of internal resource shortcomings and fragility in responding to competition and economic slowdowns (Kücher, Mayr, & Mitter, 2020; Parnell & Crandall, 2020).

In the context of turnaround, prior literature focused on the relationship between the renewal of the CEO and the impact on a company's performance (e.g., Dimopoulos & Wagner, 2016). Yet, to our knowledge, a gap emerges about studying when a new CEO should join a company during a situation of crisis. Knowing the right time to hire a new CEO can play a crucial role in company survival during a turnaround. Furthermore, the relationship between the role of management in a restructuring process (Elloumi & Gueyié, 2001) and the effect of the turnaround is focused mainly on geographical contexts like the USA (Dardour, Boussada, Yekini, & Makhoul, 2018). An investigation of countries with different legislations and procedures in terms of creditor power and corporate governance practices is still lacking (Manzaneque, Priego, & Merino, 2016). By analysing a set of Italian companies, the aim of this paper is to study the timing for companies in crisis to hire a new CEO, and to analyse the impact between the renewal of the CEO and company performance, and, thus, its probability of re-emerging from a crisis, during a turnaround process.

As such, the paper brings several contributions to theory and practice. First, the Italian sample has unique features because companies are characterized by: (a) inadequate corporate governance practices; (b) the insolvency procedures managed by the debtor and (c) an economic environment where small-medium enterprises are predominant. Thus, studying the impact of a new CEO in the Italian small and medium enterprises (SMEs) context is important in comparison with the more widely researched US large-companies context. Second, we adopted a different perspective, in comparison with previous research, regarding the definition of a successful turnaround process, which is often subjective. Instead of using, as in past research (Scafarto, Ricci, Della Corte, & De Luca, 2017), the Return on Assets ("ROA"), which is only a profitability ratio, we adopted a more objective and global ratio by examining the increase of the Altman Z-score (Altman, 1993), as an indicator of the likelihood of bankruptcy. Furthermore, from a methodological point of view, this paper applied an innovative approach to interpreting the impact of corporate governance variables through the use of novel machine-learning techniques (Althey, 2018). Until now, the literature has focused, to the best of our knowledge, only on the ability of machine-learning models to predict bankruptcy situations or the exit from the turnaround process, without analysing and interpreting how these models are impacted by corporate governance variables. Specifically, we applied the SHAP techniques (Lundberg & Lee, 2017), which allowed to interpret the relationship between CEO replacement and the likelihood of a company emerging from a crisis, not only in the case of the traditional logit model but also in the case of the random forest and AdaBoost models. Finally, the main contribution of this paper is represented by the identification of the correct timing for changing the CEO during a turnaround. The findings indicate that the renewal of the CEOs is significant only if the new CEO is appointed before the true declaration of the state of crisis. This confirms that a successful turnaround requires a strategy (Parnell & Crandall, 2020) and the implementation of new

business plans (Cirka & Corrigall, 2010) for managing the crisis before the default event. The results confirm that companies that replace the CEO during, and especially before, a turnaround process are associated with a greater probability of firm survival and performance improvement. From a practical point of view, this paper highlights the fact that a new CEO is a prerequisite for surviving during a crisis since it allows to introduce new human and relational capital. Moreover, the entrance of a new CEO allows also to obtain more bargaining power with creditors, and thus the possibility of obtaining new financing, which is a necessity for overcoming a crisis.

The remainder of this paper is structured as follows. The next section presents a review of the literature to build the theoretical framework in support of the hypotheses for the study. The third section describes the methodology employed. The fourth section reports the findings, followed by the fifth section subsequently discussing these results. The paper concludes with a summary of the conclusions and the implications for future research.

Theoretical background and hypothesis development

Corporate crisis and turnaround

The concepts, causes and effects of a crisis have been studied by various scholars with different and heterogenous backgrounds: strategic (Wenzel, Stanske, & Lieberman, 2021), for example, to identify the most adequate strategic responses to a crisis; public relations (Eriksson, 2018), for example, to find the appropriate tools for managing a social media crisis communication; marketing (Clark, 1988), for example, to understand the causes of a marketing crisis and its relationship with a financial crisis; disaster management (Shaluf, Ahmadun, & Mat Said, 2003), for example, for understanding the management procedures to put in place during a disaster or a crisis and financial (Li & Faff, 2019), for example, to predict bankruptcies, and, thus, the destruction of value.

From a financial point of view, research still debates the definition of corporate crisis: it can be considered as the asset value of the company under its debt (Riccetti, Russo, & Gallegati, 2015), or as a synonym of insolvency and, therefore, as the unsustainability of future debt repayment (Dallocchio, Pirrone, & Lucchini, 2021) or as a series of continuous negative economic results (Whitaker, 1999). Despite this fact, predicting corporate survival through bankruptcy is an important area of investigation in corporate finance which has been analysed by several studies over the last few decades (e.g., Lian, 2017; Lin, Liu, Tan, & Zhou, 2020).

The increasing research interest in this field is due to the importance and the consequences of corporate defaults on the economic system. A company bankruptcy can impact severely all the stakeholders of a company (Trahms, Ndofo, & Sirmon, 2013): creditors, since the loss of credit can affect their profitability and their financial sustainability (Hansen & Ziebarth, 2017); suppliers and customers, since the customer–supplier relationship is typically based on long-term contracts (Lian, 2017), the cost of finding a new supplier/customer can be significant with negative impacts for the supplier/customer on profitability (Kim, Song, & Zhang, 2015), leverage (Oliveira, Kadapakkam, & Beyhaghi, 2017) and cost of capital (Dhaliwal, Judd, Serfling, & Shaikh, 2016) and employees, since bankruptcy can cause loss of human capital, with relevant consequences on the salaries of employees and on the local labour market (Bae, Kang, & Wang, 2011; Graham, Kim, Li, & Qiu, 2015). Therefore, in order to prevent defaults and, thus, minimize the economic and social impacts of insolvency, a large body of literature seeks to predict corporate bankruptcy, using various methodological approaches based on logit/probit models (among others, Foreman, 2003; Ohlson, 1980), discriminant analysis models (e.g., Altman, 1968; Altman, Danovi, & Falini, 2013) and, recently, on machine-learning models (among others, Barboza, Kimura, & Altman, 2017; Jones, Johnstone, & Wilson, 2017).

Findings indicate that small-medium firms are more vulnerable to the effects of a crisis since they tend to face more financing restrictions than large companies (Denis & Rodgers, 2007;

Serrasqueiro, Leitão, & Smallbone, 2021). Moreover, the difficulty in accessing credit and the strong dependence of small-medium firms on bank loans can reduce their possibility for future investments, with consequent negative impacts on their growth (Serrasqueiro, Leitão, & Smallbone, 2021). Therefore, a minor growth combined with the unfeasibility of receiving external finance can affect the long-term probability of survival of small-medium firms, especially during a financial crisis (Collignon & Esposito, 2013).

The study of turnaround processes and their effects should take into consideration the legal framework within which they take place. Country-specific corporate governance practices can affect the relationship between CEO turnover and firm performance. Scholars, until now, analysed this relationship mainly in the USA (Manzaneque, Priego, & Merino, 2016), where creditors have a considerable influence over the governance of bankrupt firms (Lin *et al.*, 2020). However, the USA and the UK economic systems share several distinctions from the European one: (i) shareholder rights are stronger in the USA and in the UK, thanks to the common law, than under the civil law in Europe; (ii) the majority of firms in Europe are familiar with a unique dominant shareholder while in the USA and the UK the public company is more common and (iii) in Europe, the dominant shareholder can severely damage corporate governance control systems (Owen, Kirchmaier, & Grant, 2006).

Across Europe, it is possible to identify two types of corporate governance and ownership systems: (i) Rhenish type, characterized by the fact that companies tend to be controlled by workers and banks; and (ii) Latin-type, in which the majority shareholder controls the management through the board of directors (Luo, 2007). The Latin corporate governance characteristics are shared by several countries, such as Italy, France, Belgium, Spain, Portugal and Greece (Luo, 2007), which would benefit from more research, as most studies currently focus only on the USA and UK (Dardour *et al.*, 2018). While the governance of the companies in these countries has been profoundly renewed during the last few decades, there still are significant differences with the Anglo-Saxon systems (Dardour *et al.*, 2018; Luo, 2007). Therefore, as mentioned before, these relevant differences, in terms of control and corporate governance systems, may impact the relationship between CEO turnover and firm performance. Further research on these countries is needed for a better understanding of the impact of CEO turnover on firm performances and if there are differences with the Anglo-Saxon results (Dardour *et al.*, 2018). This research gap is also shown by the fact that literature in this field is still contradictory and scholars found that the relationship between CEO renewal and firm performance is both influenced (Burns, Minnick, & Starks, 2018) and not influenced (Dimopoulos & Wagner, 2016) by country-specific factors.

These differences are even more evident in the Italian context (Cortesi, Tettamanzi, & Corno, 2009), which is characterized by a lack of separation between ownership and management combined with an inadequate governance system (Tron, 2021). In several Italian companies, the controlling shareholder is also the CEO of the company – and often also the unique sole director. In some cases, to replace the CEO a transfer of ownership may need to happen, which can cause a delay in the implementation of the turnaround strategy. Furthermore, according to the Italian bankruptcy law, creditors have only limited power over defaulted firms, and the insolvency procedures are managed by the debtor (Tron, 2021). Therefore, the replacement of the CEO in Italy or similar countries, where literature is still limited (Manzaneque, Priego, & Merino, 2016), can have a different impact, from the US case, on the probability of a company emerging from bankruptcy. The study at hand contributes to such a picture by investigating the Italian context.

CEO renewal in corporate turnarounds

Previous studies have also examined if managers can be considered a key factor for a company to emerge from bankruptcy (Goyal & Wang, 2017; Lin *et al.*, 2020). Since a crisis typically stimulates innovation (Wenzel, Stanske, & Lieberman, 2021). According to Hothckiss (1995), the sustained

involvement of pre-bankruptcy management in the restructuring process is strongly connected with poor performances after the bankruptcy. Therefore, management replacement represents a significant point of discontinuity for the company in relation to its past, a discontinuity that may be necessary when the company is in an irreversible state of crisis. This is also shown by the fact that most business failures are attributable to managers (Ahn, Cho, & Kim, 2000) and their poor managerial choices, such as: failure to respond to corporate decline (Balgobin & Pandit, 2001), incompetence (Altman, 1983), failure to recognize early warning signs or changes in the target market (Dunbar & Goldberg, 1978) and poor performance measurement systems (Schendel, Patton, & Riggs, 1976). Therefore, during a crisis, which typically requires making decisions in an unpredictable contest (Parnell & Crandall, 2020), the most dangerous strategy is passivity, and thus, the renewal of the management is a necessity (Domínguez-CC & Barroso-Castro, 2017).

A key role, especially in SMEs, is played by the CEO, who has a more direct imprint and impact on the firm's strategic directions and actions. Being characterized by smaller sizes, SMEs usually employ a limited number of hierarchical level that reduces the distance between the top decision-maker and the implementation of the decision itself. Thus, the studies on the relationship between CEO turnover and firm performance are important to our investigation. According to the agency theory, this relationship is explained by the fact that owners and managers tend to have conflicting interests since CEOs tend to pursue their own interests and not the corporate ones unless proper corporate governance policies are applied by the company to protect the interests of shareholders (Donaldson & Davis, 1991). Specifically, agency theory suggests that the interests of firms' owners and CEO could diverge, especially in the long term when the different structure of their compensation becomes more evident (Nyberg, Fulmer, Gehart, & Carpenter, 2010), thus a CEO renewal can become a necessity for the re-alignment of the interests between firms' owners and managers. Therefore, current literature has further analysed the consequences of CEO renewal as it is an extraordinary event that affects all company processes, from strategy to performance (Schepker, Kim, Patel, Thatcher, & Campion, 2017). The CEO can be considered the key internal figure in determining the strategy of a company and, thus, can facilitate the application of innovative processes and products (Hilger, Mankel, & Richter, 2013).

However, the choice to change the CEO of a company is far from obvious and is the result of a cost-benefit analysis. CEO turnover can also negatively affect firm performance. Prior literature has suggested that the recruitment of a new CEO can lead to unexpected events. These incidents can decrease financial performance since strategic plans applied by new CEOs can be incoherent with company structure and relationship systems (Schepker et al., 2017). The effects on a company's managerial performance depend largely on the decisions of the new CEO and on his/her integration within the organization (Finkelstein, Hambrick, & Cannella, 2009). During a crisis, the failure to replace the CEO can be caused by the fact that a crisis requires prompt intervention, which can only be guaranteed by an internal figure who comprehensively understands the company (O'Kane & Cunningham, 2012). This view seems to be confirmed by PWC (2019) data which show that, in the years following the great financial crisis of 2008, the forced turnover rate of CEOs reached an all-time low, signalling the necessity of stability in an uncertain environment. In such a context, replacement of the CEO could create further uncertainty and aggravate the crisis. Moreover, when the economic situation and the general framework are stable, the recruitment of a new CEO can have a negative impact on the profitability of the company (Domínguez-CC & Barroso-Castro, 2017).

Scholars have found both positive (Bennedsen, Pérez-González, & Wolfenzon, 2020; Gong & Wu, 2011) and negative relationships (Dardour et al., 2018; Hilger, Mankel, & Richter, 2013) between CEO renewal and a firm's performance (Bennedsen, Pérez-González, & Wolfenzon, 2020; Gong & Wu, 2011), also during a crisis (Chen & Hambrick, 2011; Hothckiss, 1995). Consequently, literature in this field is still inconclusive and contradictory and further studies are needed, especially for small-medium companies (Parnell & Crandall, 2020) facing a financial

crisis (Domínguez-CC & Barroso-Castro, 2017). Moreover, in the literature, the in-depth relationship between CEO replacement and the likelihood for a company to emerge from a crisis has not yet been analysed (Lin *et al.*, 2020).

Such contradictory results in literature can be explained by the fact that CEOs have various profiles, backgrounds and behaviours which can affect the probability of success for a CEO turnover. Prior literature has suggested various reasons for this incoherence in results. New CEOs have been related to increasing the likelihood of strategic changes (Hutzschenreuter, Kleindienst, & Greger, 2012) as they would bring new ideas and culture based on their previous experience. For example, the previous experience has been linked to many aspects of behaviour, like attention creativity, allocation, alertness and perception (Hutzschenreuter, Kleindienst, & Greger, 2012). Similarly, the type of turnover can have an impact, since forced turnovers tend to be fewer and to affect company performance less than unforced turnovers (Jenter & Lewellen, 2021). Also, the frequency of turnovers is a fundamental factor because firms with more frequent CEO turnovers have a lower firm performance as they are not able to build long-term relationships (Kim, Jeong, Yiu, & Moon, 2021). Moreover, a CEO's education is an important factor for the selection of a new CEO, however, it does not seem to impact the long-term performance of a company (Bhagat, Bolton, & Subramanian, 2010). Finally, the network and the long-term relationships of the CEO are crucial factors since CEOs with a more robust network, especially with political connections, tend to be replaced less and to affect company performances less often (Cao, Pan, Qian, & Tian, 2017).

Therefore, we expect that the CEO turnover should positively impact the financial performance of a company in crisis because, especially in Latin corporate governance systems, the renewal of the CEO allows the introduction of new human capital and relational capital, it brings discontinuity from previous strategic actions, and provide a cleaner negotiation position with the creditors (e.g., Tron, Valenza, & Caputo, 2018). A new CEO should positively enhance the company's organizational and financial performances (Fee, Hadlock, Huang, & Pierce, 2018; Kim *et al.*, 2021). Thus, we propose the following hypothesis:

Hypothesis 1: The renewal of the CEO positively affects the financial performance of a company in crisis.

Having argued for the benefits of changing the CEO in crisis situations, a further practically led question to which scholars are yet to find an answer is about when the change is best to happen during a crisis situation. While the literature has studied in-depth the relationship between CEO tenure and firm performance (e.g., Im & Cao, 2015), the investigation of the timing for CEO replacement has not yet been fully investigated (Schweizer & Nienhaus, 2017). The analysis of the timing is a fundamental aspect since it allows us to properly study when the strategic change should occur in the context of turbulent periods, enhancing our knowledge regarding the relationship between CEO turnover and firm performance (Hutzschenreuter, Kleindienst, & Greger, 2012). Theoretical studies argue that the effects of a turnaround process depend on proper timing within the organizational life cycle (Agarwal & Gort, 2002; Amburgey, Kelly, & Barnett, 1993). Yet empirical proof of the procedural aspects of turnarounds are still lacking (Schweizer & Nienhaus, 2017).

In the context of SMEs, understanding when a new CEO should be hired during a crisis has a central role because it can affect deeply the final outcome (Ciampa, 2020). During a crisis, typically the new CEO is not recruited until the true declaration of the state of crisis. However, if the turnover is anticipated, this allows the new CEO to gain a better knowledge of the company and, thus, to apply a more efficient strategic change (Ciampa, 2020). Recognizing the best timing for CEO turnover and anticipating the state of crisis allows a company to reduce the loss of intellectual capital, since top employees tend to leave a company in crisis. It also allows a business to better prepare for CEO succession, which, if not properly managed, tends to destroy value

(Rivolta, 2018). However, research has not yet studied this topic in-depth and, thus, more research on the correct timing of the CEO turnover is needed (Hutzschenreuter, Kleindienst, & Greger, 2012).

We expect that the CEO turnover should occur before the true declaration of the state of crisis. Recognizing the appropriate timing for CEO turnover can also impact the effects of their renewal on the company's performance. Since a crisis requires prompt solutions, a CEO should have the necessary time for understanding a company, like its market, structure and network, in order to be able to apply an efficient strategic change (Schweizer & Nienhaus, 2017; Tron, Valenza, & Caputo, 2018). Acting promptly may allow reducing the loss of intellectual capital by keeping key employees and may allow to raise new financing before it is too late (Tron, 2021). Thus, we propose the following hypothesis:

Hypothesis 2: The timing of a CEO turnover is important for the resolution of the crisis.

Methods

Research design

As for the methodology, a logistic regression, a random forest model and an AdaBoost model were carried out.

The logit model allows one to predict the probability of a certain class or event by using a set of independent variables (Hilbe, 2015). The logit model is useful for economic-finance studies because it does not require the independent variables to be normally distributed or to have equal variance in each group (Hilbe, 2015). Moreover, a logit model is particularly suitable for determining the probability of binary events such as pass/fail, win/lose, alive/dead (Omondi-Ochieng, 2020).

Regarding the two machine-learning techniques, we selected the random forest and the AdaBoost techniques since several authors (i.e., Barboza, Kimura, & Altman, 2017) have shown they perform better than the logit model in predictions, especially for defaulted companies (Jones, Johnstone, & Wilson, 2017).

The random forest, created by Breiman (2001), is an algorithm which can randomly select a series of characteristics from each node of the tree, following a bagging technique. The AdaBoost model derives from the boosting techniques, which allows one to identify the best model according to a sample (Friedman, 2001), thanks to its ability to create various training sets and to identify the one with the lowest error rate (Hastie, Tibshirani, & Friedman, 2009). Different from the AdaBoost, which is based on the concept of charting decision rules, the random forest method uses a tree structure. Both the random forest and the AdaBoost, differently from the logit model, are robust to overfitting and outliers and can manage data of mixed type (Jones, Johnstone, & Wilson, 2017). To reinforce our results and as a robustness check, we employed 10 times a 10th *K*-fold cross-validation approach (Hastie, Tibshirani, & Friedman, 2009) to accurately select and test the parameters of both models, such as the number of trees and the number of variables randomly selected in the case of the random forest.

However, one of the main problems of machine-learning techniques is their lack of transparency and interpretability (Lantz, 2019), which prevents one from capturing the importance of each variable used in the model. To solve this issue, we used the SHAP technique as an innovative approach (Lundberg & Lee, 2017). The SHAP method, through the Shapley values (a technique borrowed from the game theory), is used to calculate the influence of each variable on the model. Thanks to the use of the SHAP technique, we were able to easily interpret the results in the case of the random forest and AdaBoost models. To our knowledge, scholars have not yet examined, using new machine-learning models, the impact of corporate governance variables on the probability of emerging from a crisis.

Until recently (Barboza, Kimura, & Altman, 2017), prior literature has focused on analysing only the impact that financial variables have on these models. However, the literature has not yet studied how corporate governance variables may affect the outcomes of these models. As a consequence, these models, given their characteristics and advantages, allow us to test the relationship between different variables with greater precision than other models. This allows us to confirm or disprove the effect of CEO turnover on performance improvement. In the second place, given that these models are increasingly used (Althey, 2018), it is necessary to verify whether the variables have the same effect, or rather, the effect we expect, even using these new-age models. Indeed, unexpected relationships may emerge from these analyses. Finally, machine-learning techniques can be an innovative tool in studying the relationship between CEO turnover and firm performance, especially for companies in crisis and for which, many times, data are unavailable or anomalous. In fact, these models are immune to these problems (Jones, Johnstone, & Wilson, 2017) and, therefore, allow the use of a larger and more varied sample that can certainly contribute to the development of research in this field.

Sample and data collection procedure

The sample contains 90 Italian companies that were identified using the following criteria:

- adopted an Italian insolvency procedure during the period 2007–2016;
- the insolvency procedure did not have the objective of liquidating the company.

Out of the initial sample of the 90 companies, 45 changed their CEO during the 2 years before the beginning of the insolvency procedure, while the remaining 45 decided to maintain the CEO for the entire duration of the insolvency procedure. In order to compare two homogeneous groups, the companies were selected to be comparable in terms of sector, size, ownership, time and the crisis resolution tool used.

Therefore, an overview of the selected companies can be found in [Tables 1](#) and [2](#).

To classify the companies within one of the two groups ('Change of the management' and 'NOT Change of the management'), it was necessary to define a time horizon of analysis. The chosen time included 6 years, starting from the 2 years before the entrance in the insolvency

Table 1. Overview of the characteristics of the sample

Revenues (€M)	Change of the management	NOT Change of the management
10–100	25	23
100–500	16	18
500–1,000	3	1
Over 1,000	1	3
Total	45	45
Sector	Change of the management	NOT Change of the management
Consumer	18	18
Industrial	16	15
Services	3	5
Retail	5	3
Other	3	4
Total	45	45

Table 2. Overview of the characteristics of the sample

Default year	Change of the management	NOT Change of the management
2007–2010	12	14
2011–2012	9	12
2013–2016	24	19
Total	45	45
Insolvency procedure	Change of the management	NOT Change of the management
Art. 67	23	21
Art. 182bis	21	20
Art. 160	1	4
Total	45	45

procedure ($T - 2$) and ending 3 years after the entrance in the insolvency procedure ($T + 3$). T_0 represents the year in which the insolvency procedure started from a legal point of view (e.g., judge authorization). The choice of our analysis covering 6 years was because companies tend to show the first signs of a crisis 2 years before the default (Altman, Danovi, & Falini, 2013), and the recovery plan in order to be efficient should be completed 3 years after the beginning of the crisis (Tron, 2021).

After establishing the time horizon, we adopted the following criteria in order to classify the companies within one of the two groups, the managerial discontinuity ('Change of the management') or managerial continuity group ('NOT Change of the management'):

- (1) Companies that never changed their CEO in the analysis period (from $T - 2$ to $T + 3$) are considered in the managerial continuity group.
- (2) Companies that changed the CEO after T_0 have been categorized in the managerial continuity group. We decided to apply this criterion since the CEO was present in $T - 2$ and, therefore, they prepared the turnaround and execution plan, which was approved by creditors in $T - 0$. Therefore, in judging the likelihood of insolvency and granting new finance, creditors assessed the capabilities of the 'historical' CEO without considering discontinuity factors at the CEO level. Consequently, the historical CEO significantly influenced the financial results in $T + 3$.
- (3) Companies that changed CEO before T_0 were classified in the managerial discontinuity group.
- (4) Companies that changed the CEO in T_0 were classified in the managerial discontinuity group. In this case, the negotiations with the creditors were mainly conducted by the previous CEO, however, the new CEO had the role to execute the turnaround and execution plan.

Data analysis

Since in the literature the moment of exit from a crisis is still not clearly defined, and since insolvency procedures can last for several years and defaulted companies tend to re-enter a crisis after the first period of recovery (Tron, 2021), we preferred to adopt a more objective approach, using the Altman Z-score as an indicator of the improvement of a company's economic-financial performance. This ratio, created by Altman (1993), proved to be reliable in the Italian context (Altman, Danovi, & Falini, 2013; Dallochio, Ferri, Tron, & Vizzaccaro, 2020) and more precise than the Z-score (Altman, Danovi, & Falini, 2013). Moreover, it does not consider only the

profitability of a company, like the ROA typically used in past research (Scafarto *et al.*, 2017), but also other several factors, like the leverage of a company, a key indicator during a turnaround.

Therefore, to objectively measure the impact of the change of CEO on the performance of a company, and on its probability of emerging from a crisis, we used as the dependent variable the increase in the Z-score between $T - 2$ and $T + 3$ (case 1) and between T_0 and $T + 3$ (case 2). Every model was run using firstly, as the dependent variable, the dummy variable Z-score increase between $T - 2$ and $T + 3$, and secondly, using as the dependent variable the dummy variable Z-score increase between T_0 and $T + 3$.

The reliability of the Z-score was also confirmed in the case of our sample (Table 3). Table 3 also shows that, between the period $T - 2$ and $T + 3$, the Change of the management group is characterized by a greater number of companies transiting outside the distressed area.

An overview of the variables that we used in this paper and their source can be found in Table 4. Their values were obtained relying on ORBIS, one of the largest financial databases, as in Succurro (2017).

In Table 5, descriptive statistics of the variables are reported.

We proceeded to the analysis of the correlation among the variables, which showed a positive relationship between the increase in the Z-score and the change of management, both at time $T - 2$ and at time T_0 . The results are shown in Table 6.

For the logit model, to test for multicollinearity, we performed the Variance Inflation Test ("VIF") test. In any case, the variance inflation factor was not higher than two, therefore, we did not have any signs of serious multicollinearity requiring correction. We also conducted the Shapiro and the Breusch Pagan test without any sign of non-normality or heteroskedasticity.

Results

Firstly, we ran a T -test on the average increase of the Z-score between T_0 and $T + 3$ for the two groups (Change of the management and NOT Change of the management). The results are shown in Table 7.

The results of the T -test suggest companies that change CEOs during a turnaround procedure can reach higher performances and, therefore, tend to have more probability of exiting from a crisis.

Secondly, we ran the logit model using the Z-score increase between $T - 2$ and $T + 3$ (model 1) and the Z-score increase between T_0 and $T + 3$ (model 2). The results are shown in Table 8.

Table 3. Z'-score analysis

Number of companies classified	Change of the management	NOT Change of the management	Total
$T - 2$: Distressed zone	40	36	76
$T - 2$: Grey zone	4	8	12
$T - 2$: Safe zone	1	3	4
T_0 : Distressed zone	37	30	67
T_0 : Grey zone	4	15	19
T_0 : Safe zone	4	0	4
$T + 3$: Distressed zone	24	30	54
$T + 3$: Grey zone	17	9	26
$T + 3$: Safe zone	4	6	10

Note: Companies with a Z'-score under 1.1 were classified in the distressed zone, companies with a Z'-score between 1.1 and 2.6 were classified in the grey zone, companies with a Z'-score over 2.6 were classified in the safe zone.

Table 4. Variable description

Variable	Description
Z''-score $T+3 > T-2$	Dummy variable equal to 1 if there was an increase in the Z''-score of the company between $T-2$ and $T+3$
Z''-score $T+3 > T0$	Dummy variable equal to 1 if there was an increase in the Z''-score of the company between $T0$ and $T+3$
Change of Management	Dummy variable equal to 1 if there was a change of the management of the company between $T-2$ and $T+3$
Type of crisis	Dummy variable equal to 1 if the crisis was exogenous and equal to 0 for endogenous crisis. The type of crisis was identified by analysing the documents (e.g., financial statements, newspapers) related to each company
EBITDA $T-2$	Dummy variable equal to 1 if there was an increase in the EBITDA of the company between $T-2$ and $T+3$
EBITDA $T-0$	Dummy variable equal to 1 if there was an increase in the EBITDA of the company between $T0$ and $T+3$
ROI $T-2$	Dummy variable equal to 1 if there was an increase in the ROI of the company between $T-2$ and $T+3$
ROI $T0$	Dummy variable equal to 1 if there was an increase in the ROI of the company between $T0$ and $T+3$
Sector	Factor variable for controlling the sector effect
Procedure year	Factor variable for controlling the year effect

Table 5. Descriptive statistics by company status

All sample	N	P1	Mean	P50	P99
Z''-score $T+3 > T-2$	90	0	.71	1	1
Z''-score $T+3 > T0$	90	0	.61	1	1
EBITDA $T-2$	90	0	.53	1	1
EBITDA $T-0$	90	0	.57	1	1
ROI $T-2$	90	0	.24	1	1
ROI $T0$	90	0	.66	1	1
Change of management	N	P1	Mean	P50	P99
Z''-score $T+3 > T-2$	45	0	.80	1	1
Z''-score $T+3 > T0$	45	0	.67	1	1
EBITDA $T-2$	45	0	.51	1	1
EBITDA $T-0$	45	0	.60	1	1
ROI $T-2$	45	0	.62	1	1
ROI $T0$	45	0	.64	1	1
NOT Change of management	N	P1	Mean	P50	P99
Z''-score $T+3 > T-2$	45	0	.62	1	1
Z''-score $T+3 > T0$	45	0	.56	1	1
EBITDA $T-2$	45	0	.56	1	1
EBITDA $T-0$	45	0	.53	1	1
ROI $T-2$	45	0	.62	1	1
ROI $T0$	45	0	.66	1	1

Table 6. Correlation analysis

	Change of management	Z''-score $T + 3 > T - 2$	Z''-score $T + 3 > T0$	Type of crisis	EBITDA $T - 2$	EBITDA $T - 0$	ROI $T - 2$	ROI $T0$
Change of management	1.00							
Z''-score $T + 3 > T - 2$	.1784*	1.00						
Z''-score $T + 3 > T0$	.2100**	.4937***	1.00					
Type of crisis	.1334	-.2004*	-.2783***	1.00				
EBITDA $T - 2$	-.0445	.0781	.2619**	-.1574	1.00			
EBITDA $T - 0$	.0673	.2963**	.1967	-.0478	.3955***	1.00		
ROI $T - 2$	.0000	.1060	.2339**	-.2578**	.5114	.2436**	1.00	
ROI $T0$	-.0234	.2916**	.1939	-.0541	.3062***	.5930*	.3998***	1.00

Table 7. *T*-test results

	Change of the management	NOT Change of the management
Average Z'' -score increase	.86	.09
Variance	4.22	4.93
Observations	45	45
Grade of freedom	87	
<i>T</i> -stat	1.70	
<i>P</i> -value	.046**	

The *T*-test was estimated using the sample variance.

Table 8. Logit results

Dependent variable	Z'' -score $T + 3 > T - 2$	Z'' -score $T + 3 > T0$
Models	(1)	(2)
Independent variables		
Change of management	1.31**	.92
	.65	.62
Type of crisis	2.18*	.20
	1.11	.90
EBITDA $T - 2$	.49	
	.77	
EBITDA $T - 0$		2.01***
		.74
ROI $T - 2$	2.16**	
	.86	
ROI $T0$		1.75**
		.69
Sector	1.29	1.51
	.72	.75
Procedure year	.59**	.34
	.24	.21
Constant	−1,191.09**	−680.17
	482.20	424.94
Observations	45	45

***, ** and * indicate statistically significant levels at 1, 5 and 10%, respectively.

In model 1, the variable change of management is statically significant, with a positive impact on the increase of the *Z*-score between $T - 2$ and $T + 3$, thus confirming the previous results of the *T*-test. However, in model 2, the increase of the *Z*-score between $T0$ and $T + 3$ is not statistically significant.

Thirdly, we ran the random forest model using the *Z*-score increase between $T - 2$ and $T + 3$ (model 3) and the *Z*-score increase between $T0$ and $T + 3$ (model 4). The SHAP values are shown in Figure 1 (model 3) and Figure 2 (model 4).

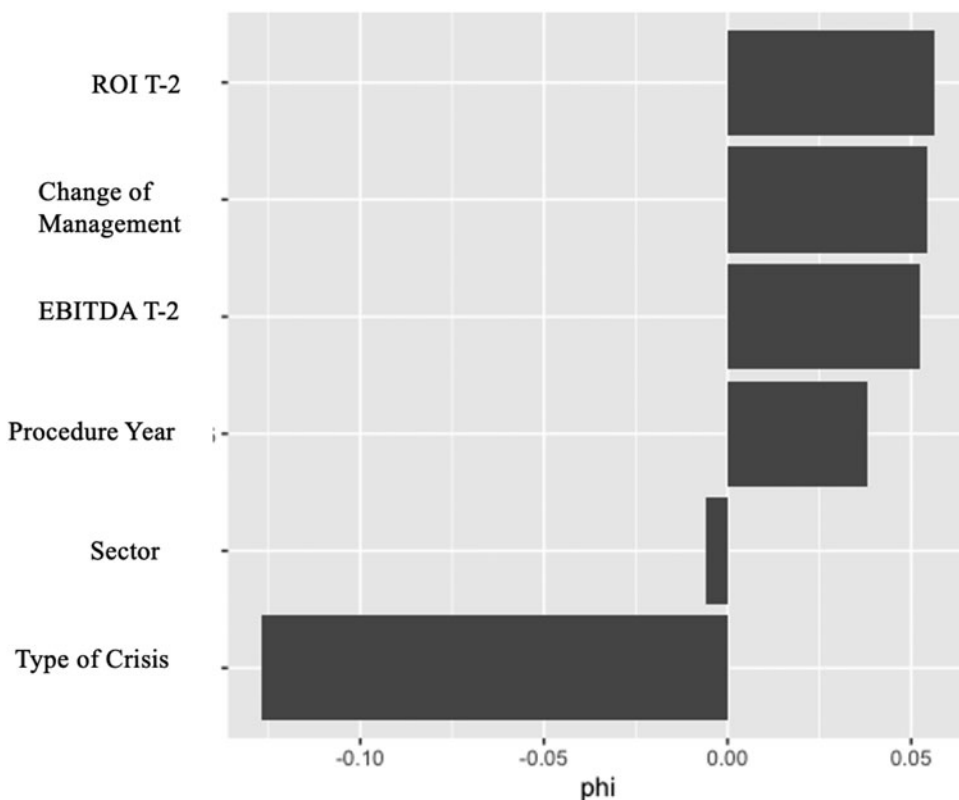


Fig. 1. SHAP values – random forest model 3.

Results of the random forest model confirm the previous results of the logit model. In model 3, the Change of Management is the second most important variable and, mainly, it has a significant positive impact on the increase of the Z-score between $T - 2$ and $T + 3$. These results confirmed our hypothesis 1. On the contrary, the Change of Management does not have a considerable impact on the increase of the Z-score between T_0 and $T + 3$, thus confirming our hypothesis 2.

Finally, we ran the AdaBoost model using the Z-score increase between $T - 2$ and $T + 3$ (model 5) and the Z-score increase between T_0 and $T + 3$ (model 6). The SHAP values are shown in Figure 3 (model 5) and Figure 4 (model 6).

Also, in the case of the AdaBoost model, previous results and our hypothesis are confirmed. The Change of Management has a positive impact on the increased performance of the company between $T - 2$ and $T + 3$ (model 5), while it seems to have less influence on the Z-score between T_0 and $T + 3$ (model 6).

Overall, all our analysis demonstrates: (i) a positive and significant relationship between CEO turnover and the likelihood for a bankrupt firm to re-emerge from an insolvency procedure; and (ii) the CEO turnover should occur before the true declaration of the state of the crisis.

Discussion

In this study, using a set of defaulted Italian companies combined with an innovative approach, we extend the literature on predicting a bankrupt firm's likelihood of emerging from insolvency procedures by documenting a significant and positive relationship between CEO turnover and

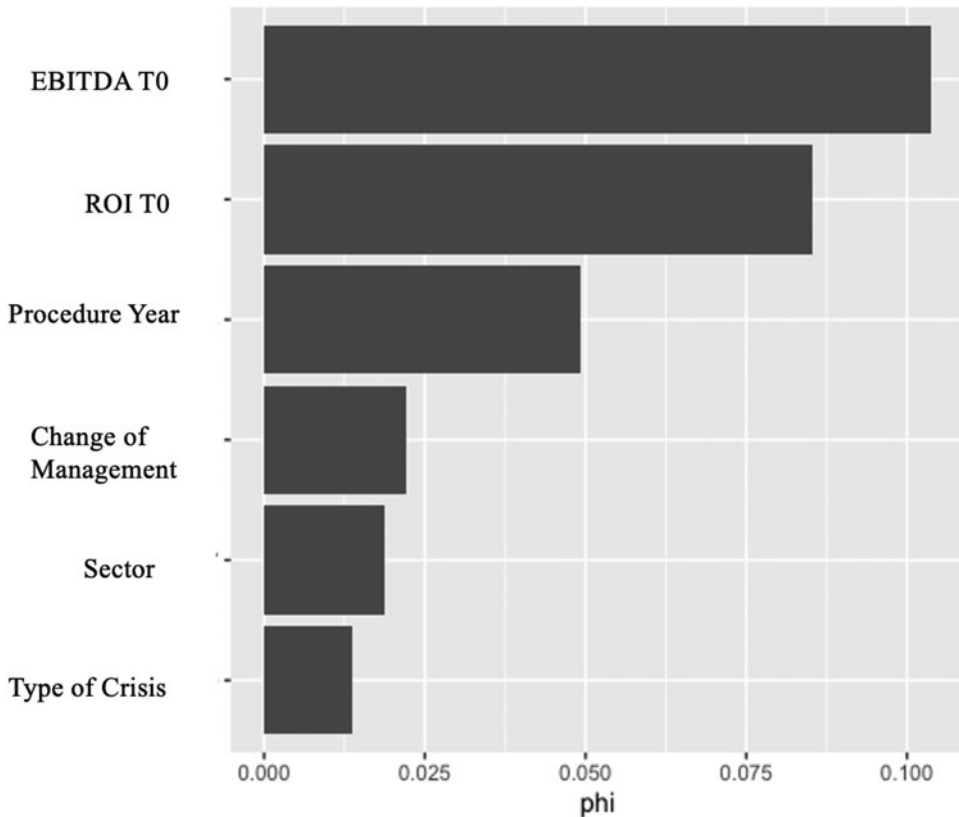


Fig. 2. SHAP values – random forest model 4.

firm Z-score increase. Indeed, results indicate that the entrance of a new CEO in a company during a turnaround process can raise its performance, and thus, its probability of survival, in line with past research (Berezinets, Garanina, & Ilina, 2016; Gong & Wu, 2011; Lin et al., 2020), confirming our first hypothesis. In addition, the results confirm that positive linkage between CEO renewal and firm performance also exists in the Italian context, despite its lack of corporate governance control system. The results are robust and confirmed by all the models applied in this paper (*T*-test, logit, random forest and AdaBoost). These findings seem to support the connection between CEO turnover and the renewal of strategy and therefore, the possible introduction of products/processes in line with previous scholars (Domínguez-CC & Barroso-Castro, 2017; Parnell & Crandall, 2020), confirming the necessity of the renewal of firm strategy for a successful turnaround.

Moreover, in all the models, as expected, the Change of Management does not have a considerable impact on the increase of the Z-score between *T*₀ and *T* + 3. Therefore, the analysis indicates that the impact of the new CEO is significant only if the new CEO is appointed before the true declaration of the state of crisis (*T*₀), which confirms our second hypothesis. This could be a consequence of the fact that the appointment of a new CEO before the default announcement serves as a signal about the firm's viability and quality and prospects to a potential capital-provider. Therefore, the later appointment of a new CEO can suggest the true unwillingness of shareholders in supporting the company during the turnaround. Furthermore, during the period *T* – 2 and *T*₀, a CEO can participate in the negotiations with the creditors and can further extend their knowledge of the company, and thus, they can have a greater impact during the turnaround

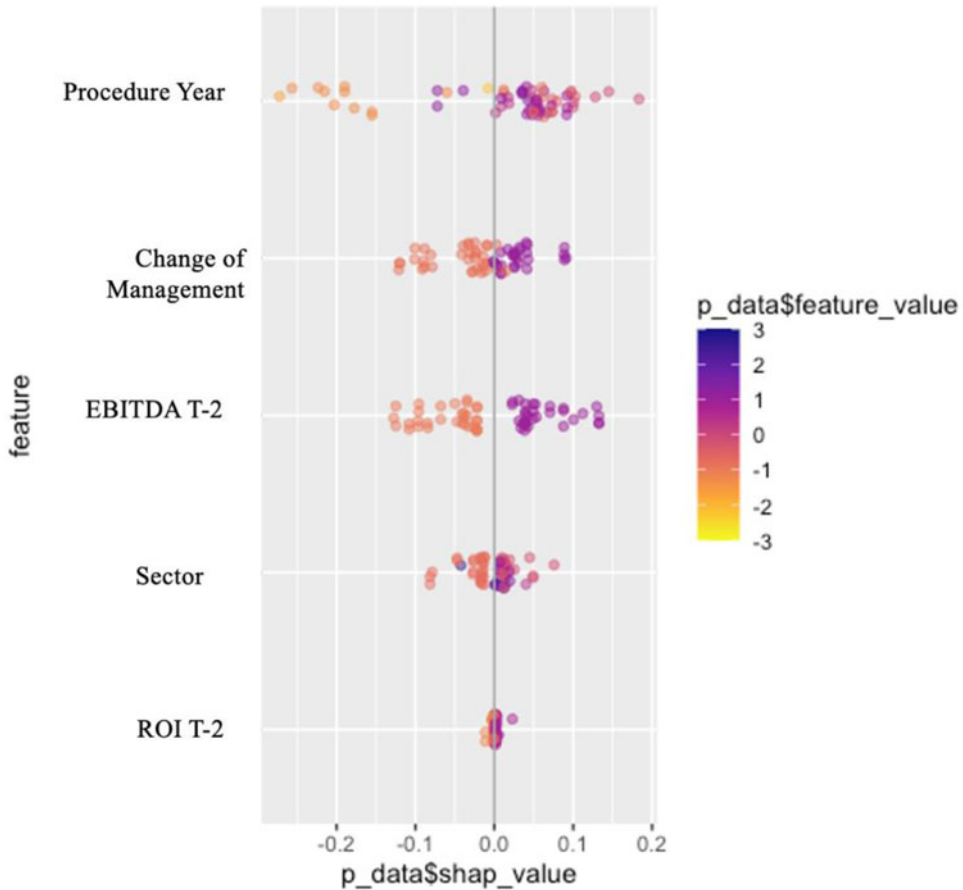


Fig. 3. SHAP values – AdaBoost model 5.

procedure. As a consequence, the lack of significance of the Change of Management on the increase of the Z-score between T_0 and $T + 3$ confirms the fact that a crisis requires prompt intervention, as suggested by various scholars (e.g., Domínguez-CC & Barroso-Castro, 2017; Parnell & Crandall, 2020; Tron, 2021).

Furthermore, this research highlights the fact that time is a crucial variable during a period of crisis: the ability to anticipate the beginning of a crisis raises the possibility of survival for a company.

As a consequence, a manager should use all the financial instruments and tools available, like a cash budget with a horizon of 12 months, for predicting a crisis in order to be able to have the proper time for finding the most suitable solution. If detecting a crisis soon enough to make changes in the top management is vital for the solution of the crisis, also governance bodies and shareholders should deploy resources to effectively prepare for a crisis by monitoring the environment and detecting early signals. Moreover, this paper suggests that banks and creditors should play an active role in the governance of firms during turnaround processes by requiring the hiring of a new management team inside the company.

A further insight of this paper is the measurement of the use of Z-score as an indicator of a company's economic-financial performance improvement, and thus, of its probability of re-emerging from a crisis. Given the typical, unpredictable length of insolvency procedure, this measurement allowed us to use a reliable and objective ratio to measure both the increase of a

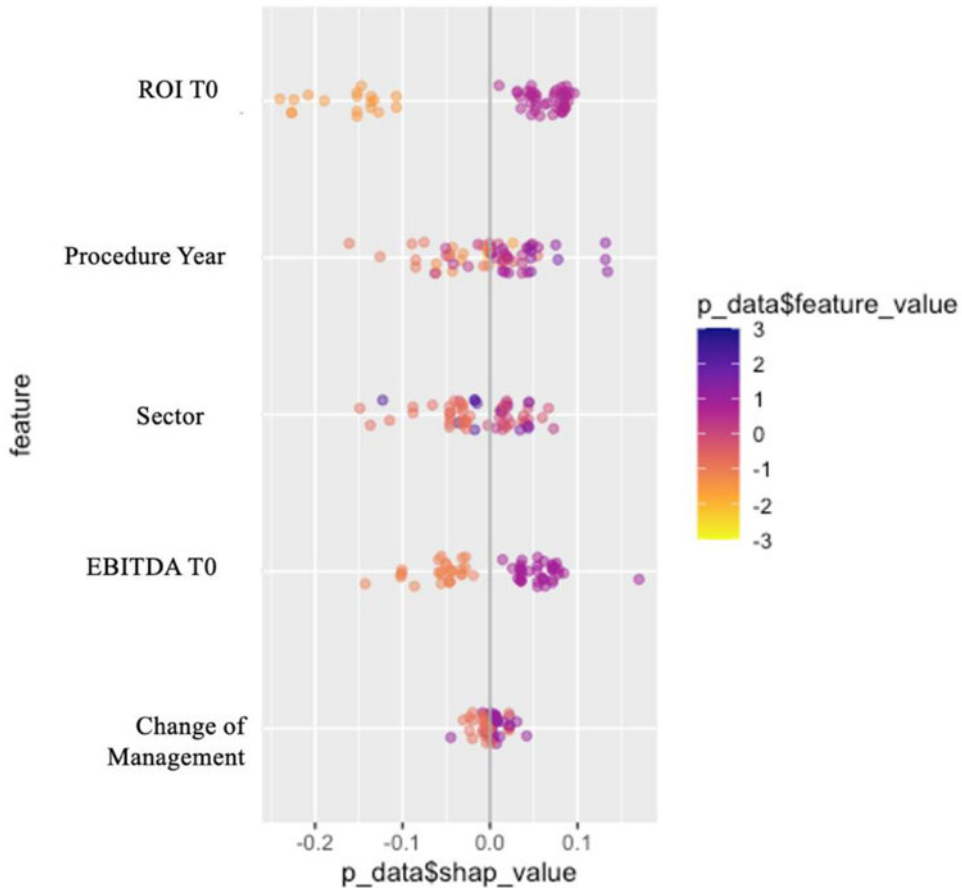


Fig. 4. SHAP values – AdaBoost model 6.

company's performance and its likelihood of defaulting. Finally, to the best of our knowledge, this is the first study that has applied the SHAP values for measuring the impact of corporate governance variables on the likelihood of re-emerging from bankruptcy. Despite the lack of transparency and interpretability of machine-learning techniques, we showed, thanks to the use of the SHAP value, that these models can be utilized for other purposes, rather than just as prediction tools, as suggested by Lantz (2019). Given the increasing application of machine-learning techniques by banks and investors (Althey, 2018), our results indicate that these techniques have wider applications and additional usefulness for future research.

Conclusion

The research aimed to demonstrate the effects of changing a CEO on company performance and, especially, the correct timing of this renewal during a turnaround process. Results produced evidence regarding the existence of a significant link between CEO turnover and a successful corporate turnaround. However, the main impact of our paper is its contribution to the literature related to the relationship between CEO tenure and firm performance. Our results identified the optimal timing of CEO turnover, which should anticipate 2 years (at least) the declaration of the state of crisis. Delayed CEO renewal does not significantly affect company performance, probably because the turnover takes place when the situation is already compromised.

The complexity of the decision situation framework during a turnaround process – which includes time pressure and short-term targets – leads to an increase in the risk of irrational biases in decision-making, as compared to regular business situations. Therefore, during a crisis, the recruitment of a new CEO can be considered one of the most effective actions for a company to implement, since it introduces new human capital (knowledge, skills and experience) and relational capital (social ties and networks). At the same time, it is important to remark that the entrance of a new CEO can have positive effects also during the negotiations with the creditors of the company. Allowing the company to be managed, during the turnaround process, by the same people who caused the situation and who probably did not recognize the symptoms of the crisis, is one of the main reasons creditors do not agree to grant new financing (Tron, 2021). Therefore, a new CEO, besides introducing new competencies, can increase the likelihood of obtaining new financing, which is a necessity and a prerequisite for the recovery of a defaulted firm (Dominguez-CC & Barroso-Castro, 2017; Parnell & Crandall, 2020).

However, our work could be limited by the choice of the sample, which only includes Italian companies. Nevertheless, we consider this feature an additional contribution of our research since Italy has unique conditions compared to the US context (analysed in-depth in previous literature), in terms of credit power during an insolvency procedure and corporate governance characteristics. However, in that sense, our results seem to corroborate the theory of Dimopoulos and Wagner (2016) which showed in the UK and Germany that CEO turnover is followed by significant performance improvements despite their significant differences in terms of corporate governance. Therefore, our findings seem to confirm that, also in the Latin-type corporate governance and ownership systems, the CEO renewal has a positive effect on a company's performance, like in the US and UK case (Dimopoulos & Wagner, 2016).

This study could be expanded upon by further widening the interpretation of and the use of modern approaches, such as machine-learning techniques. Furthermore, future research could continue to analyse the impact of corporate governance, or, in general, the impact of environmental, social and corporate governance indicators, on the probability of a successful turnaround process.

Conflict of interest. The authors declare none.

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