ISO 9001 certification and failure risk: any relationship?

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The goal of this paper is to investigate the existence of a possible connection between Quality Management System certifications according to the ISO 9001 standard and the failure risk of a company. A sample of Italian manufacturing companies is studied in the period 2008/2010, characterised by the beginning of a severe economic crisis. The risk of failure of the companies is estimated by synthetising a set of economic/financial indexes extracted from their balance sheet. The obtained index is assumed as the response variable subject to the effects of multiple factors: company size, regional development and certification. Preliminary results show the significance of the analysed factors.

Keywords: ISO 9001; ISO 9000 family standards; quality certification; corporate performance; risk of failure

1. Introduction

The ISO 9000 family consists of a set of standards defining the basic requirements for the implementation of a quality management system within a company. Promoted by the International Organization for Standardization, these standards may be applied to any kind of small, medium or large organisations either in the manufacturing or service (private or public) field (ISO 9000, 2005; ISO 9001, 2008; ISO 9004, 2009; ISO 19011, 2011). Among the possible certifications, the one according to ISO 9001 is certainly among the most popular (ISO, 2013; Marimon, Casadesús, & Heras, 2010; Sampaio, Saraiva, & Guimarães Rodrigues, 2009). Data published on 'The ISO Survey of Management System Standard Certifications – 2012' show that, up to the end of December 2012, 1,101,272 certificates had been issued in 184 different countries (ISO, 2013) with an increase of 2% (+21,625) over 2011.

1.1. Literature review

Since the introduction of these standards, researchers and practitioners have studied this phenomenon, particularly focusing on few topics:

- the current diffusion of quality certification and its future trend (Franceschini, Galetto, Maisano, & Mastrogiacomo, 2010, 2011a, 2011b; Marimon, Heras, & Casadesús, 2009);
- the reasons that drive an organisation towards the acquisition of a certificate (Bell & Omachonu, 2011; Sampaio et al., 2009);
- the benefits and the obstacles/drawbacks (Karapetrovic, Casadesús, & Heras, 2010; Rusjan & Alič, 2010; Srivastav, 2010);

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- the impact of certifications on the economic/financial performance and on the organisational process.

In particular, a number of researches recently focused on this latter topic with the ultimate aim of providing evidence of the usefulness and effectiveness of certifications. The topic is interesting for both academics and practitioners that are constantly looking for experimental indications to support certifications. The complexity of the problem lies in the fact that the usefulness of certifications can be accessed in different ways, for example in terms of competitiveness, performance, turnover, profit, etc. For this reason, the literature regarding this topic is particularly rich and interesting. Here follows a summary of just some of the contributions in this regard.

The common approach of most of the studies on the topic is to benchmark the results obtained by certified and not-certified companies, with the aim of demonstrating that the formers succeed (or fail) in achieving different goals, such as reducing guarantee costs, defectiveness and reworking, improving customer satisfaction, profitability and productivity. Specifically, Yahya and Goh (2001) reported that certified companies have higher profits also deriving from a major consciousness about quality and improvement of measuring systems. Studying a sample of certified and not-certified companies, Koc (2007) noticed noteworthy dissimilarities in the results obtained in some of the phases of the production process (product design, production planning, control, use of machinery and instrumentation, working and waiting times, lot sizing, raw materials inventory). In their comparative analysis of a sample of certified and not-certified Portuguese companies, Texeira Quirós and do Rosário Fernandes Justino (2013) showed the major significant differences in variables such as human resource management, customers relations, strategic quality planning and even quality costs. Jones, Arndt, and Kustin utilise a sample of 272 Australian ISO 9002 quality-certified companies to examine two issues: first, the relationship between a company's initial motivation for seeking certification (QCert) and its perception of the benefits it has received and, second, the impact of time on perceptions of benefits received. Companies which sought QCert because of an externally imposed perception of the necessity to 'obtain a certificate' were found to experience fewer beneficial outcomes of QCert, in comparison with companies which sought QCert because of an internally driven desire to improve organisational performance. Additionally, no evidence was found that longer-certified companies experience more benefits than recently certified companies, regardless of the initial motivation for seeking QCert (Jones et al., 1997). Aba, Badar, and Hayden investigated the impact of ISO 9001 certification on US firms' financial operating performance for a period of five years including one year prior to certification, year of certification and three fiscal years after certification. He concludes that there was significant improvement performance from prior year to year of certification: the certified firms performed better than the non-certified firms. The certified firms also performed better than the matched-control firms (Aba et al., 2016).

Contradictory conclusions have been suggested by few researchers: Terziovski, Power, and Sohal (2003) reported that ISO 9001 certification is not positively correlated with customer satisfaction, while Rahman (2001) has not noticed any difference between results obtained by certified and not-certified companies, in terms of organisational and financial variables. Dick (2000) explores the literature and finds that there is no proven link between quality certification (ISO, 9001) and improved business performance, even if it is clear that better quality has a consistent, positive relationship with business performance.

While most of the researches show a positive relationship between the implementation of quality management practices and organisational performance improvement, the conclusions achieved about the effect of quality certification over business performance are still conflicting (Sampaio et al., 2009): Heras, Dick, and Casadesús (2002) showed how certified companies achieve better results in comparison to not-certified ones. On the contrary, Lima, Resende, and Hasenclever (2000) did not notice any significant difference according to most of the analysed financial/economic indicators. An interesting conclusion is proposed by Dick, Heras, and Casadesús (2008), according to which, although there is some evidence indicating that Quality Management System certification has some causal influence on business performance, there is also evidence for the existence of a substantial mechanism whereby better performing firms self-select to adopt certification. This has implications in the interpretation of business performance achievements associated with quality certification since the encountered benefits may be inflated by the presence of the self-select mechanism. Feng, Terziovski, and Samson (2008) demonstrated a significant relationship between certification practices and operational performance in Australia and New Zealand-based manufacturing and service companies. However they did not find any significant connection between these practices and business performance. Relying on the study of a database of Portuguese companies' financial information, Sampaio, Saraiva, and Guimarães Rodrigues (2011) noticed that companies with higher financial performance have a greater propensity to implement a Quality Management System. However, for some financial indicators, not-certified companies show higher performance than those that are certified. Analysing a sample of Spanish companies, similar results about business performance have been achieved by Martínez-Costa, Choi, Martínez, and Martínez-Lorente (2009). Marín and Ruiz-Olalla (2011), by studying a sample of Spanish companies from the furniture sector, demonstrated the existence of a positive relationship between ISO 9001 quality certification and both quality results and operative results.

The above presented analysis of the literature shows how up to now the research relating ISO 9001 certification and economic/financial performance has not led to definitive results. A univocal conclusion cannot be drawn also because of the different methods used for modelling and measuring the involved aspects of analysis. The contradiction may also be due to the presence of other factors affecting companies' performance, such as productivity, image, customer satisfaction, etc. that in turn are affected by many other variables and may influence the direct relationship between quality and financial results (Hardie, 1998; Sampaio et al., 2009).

1.2. *Goal of the research*

The present work tries to face the problem of verifying the existence of a relation between quality certification and corporate performance from a new perspective: the risk of failure. Analysing a period marked by a severe economic crisis, this paper intends to analyse the difference between the risk of failure of certified and not-certified companies.

The novelty of this paper is in the viewpoint of the analysis: rather than verifying if the certification is related to company excellence in terms of economic indicators, this paper tries to figure out if the certification can be in any relation to the survival of a company in a period of crisis.

The analysis is conducted on a sample of Italian companies belonging to the manufacturing sector in the period 2008–2010. Their risk of failure – quantified by using the Altman score (1993) – is tested throughout an ANOVA with three factors: certification, company size and regional development (Everitt & Dunn, 2010). The analysis deliberately

refers to a period of economic crisis since the goal is to test the behaviour of failure risk – typically increasing in such periods – against the aforementioned factors.

All data used for the presented analysis were drawn from two databases: (i) Aida® by Bureau van Dijk (www.bvdinfo.com) and (ii) the database available on the website of the Italian accreditation body ACCREDIA (www.accredia.it). Because of containing different information, the two databases are complementarily used: for each analysed company, the company's balance sheet information was obtained from Aida®, while the certification state was extracted from the ACCREDIA database.

The remaining of the paper is organised into three sections: Section 2 describes the proposed methodology, with particular attention to the econometric model and to the statistical methodologies used for the analysis; Section 3 is dedicated to the presentation and discussion of the obtained results. Conclusion and future work are reported in Section 4.

2.　Methodology

The Altman indicator Z-Score (Altman & Hotchkiss, 2005) has been used to give an aggregate expression of the economic/financial profile of a company. This index summarises, through a single numerical value, five macro-aspects of a company: liquidity, profitability, leverage, solvency and activity. High values of Z-Score indicate that the company is in a situation of stability and economic security; conversely, low values of Z-Score signal that the company is at risk of failure.

The Z-score has been assumed as the response variable of a statistical model for studying the risk of failure, as a function of a specific set of factors (certification, company size and regional development).

2.1.　*The response variable: Z-Score*

Z-Score index is generally used for representing the economic/financial 'health' of a company on the basis of a set of specific independent variables (financial ratios). This index represents a simple but powerful instrument for predicting the probability of success or failure of a company in the following two years after its computation (Altman & Hotchkiss, 2005).

A first version of the previsional model Z-Score was developed in 1968 by E.I. Altman using an approach based on Multiple Discriminant Analysis (Lebart, Morineau, & Warwick, 1984). According to this method, a linear discriminant function, which transforms the individual variables into a single discriminant score (specifically, the Z-Score), can be defined and used to classify companies.

Altman set and analysed the economic/financial characteristics of two groups, respectively, bankrupt and active companies. He individuated five independent variables that were significant for the model and classified them into five standard categories: liquidity, profitability, leverage, solvency and activity.

The discriminant function obtained by Altman in the first edition of his model was (Altman, 1968; Altman & Hotchkiss, 2005):

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5, \tag{1}$$

where: X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = earnings before interest and taxes/total assets; X_4 = market value equity/book value of total liabilities; X_5 = sales/total assets; Z = overall index (Z-score);

Variables X_1 through X_4 are expressed as absolute percentage values, while variable X_5 is expressed in a relative manner (Altman, 1968; Altman & Hotchkiss, 2005).

Since the original model was only applicable to publicly traded entities, in 1993 Altman revised his model and substituted in X_4 the 'market value of equity' with the 'book value of equity' (Altman, 1993; Altman & Hotchkiss, 2005). As a consequence of this correction, all the coefficients resulted to be changed. The obtained discriminant function was

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X'_4 + 0.998X_5, \qquad (2)$$

where X'_4 is the book value equity/book value of total liabilities.

Further revisions of Z-Score have been introduced during the years by Altman, but they are not considered in the present study since they do not fit the characteristics of the analysed corporate sector (Altman, Hadelman, & Narayanan, 1977; Altman & Hotchkiss, 2005).

In general, according to the Z-Score model, it is possible to classify a company on three different zones of risk: *bankrupt zone*, *zone of ignorance* (*grey zone*) and *non-bankrupt zone*. Furthermore, in the *grey zone*, a cutoff score between the two groups of companies (bankrupt and active companies) may be identified. Table 1 reports the different zones obtained with Z-Score and Z'-Score.

It is important to highlight that, even if the first introduction of the Z-Score dates back to 1968, many successive studies have demonstrated the robustness and effectiveness of the model so that it is still widely applied in many contexts for the analysis of a company risk of bankruptcy (Altman & Hotchkiss, 2005). Recent studies have demonstrated good predictive effectiveness of Z'-Score when applied to the Italian market, though Italian peculiarities could require the development of ad hoc parameters (Altman, Danovi, & Falini, 2013). In the statistical approach implemented in the present work, the analysis is specifically focused on the Italian manufacturing sector. Owing to that, for this exploratory study, the Z'-Score is used, which is most representative for this commodity sector and represents an appropriate variable for the statistical analysis.

Notice that, in order to be applied to other counties' economy, the Z-score needs to be adapted, meaning that the coefficients of the Z-score need to be suitably modified.

2.2. *Factors analyzed*

The goal of the analysis presented in this paper is to verify if the ISO 9001 *certification* may be considered one of the possible factors that systematically influence the *risk of failure* of a company. As well as *certification*, *company size* and *regional development* have been investigated as two other possible factors that may affect company

Table 1. Representation of the classification zones according to Z-Score and Z'-Score, and corresponding values of cutoff (Altman et al., 2013).

	Bankrupt zone	Grey zone	Non-bankrupt zone
Z-Score (for publicly traded entities)	$Z \leq 1.81$	$1.81 < Z \leq 2.99$ (cutoff = 2.67)	$Z > 2.99$
Z'-Score (for firms in the private sector)	$Z' \leq 1.23$	$1.23 < Z' \leq 2.9$ (cutoff = 2.67)	$Z' > 2.90$

economic/financial performance. Hereafter there is a description of these three factors and the definition of the corresponding modalities.

Certification. With *certification* it is intended that a company is in possession of a valid (i.e. not expired) ISO 9001 certificate. This classification aims at distinguishing between *certified* and *not certified* companies in the considered triennium, making a further distinction for long-run (i.e. for more than three years) and short-run certified companies. Three modalities are defined for this factor:

- *not certified*: companies that have never obtained a quality certification or that had it in the past, but it expired and has not been renewed in the triennium 2008/2010;
- *certified for less than three years*: companies that obtained the certification for the first time in 2008, 2009 or 2010;
- *certified for more than three years*: companies that obtained certification before 2008 and that in the triennium 2008/2010 had a still valid certificate.

Company size. With the factor *company size* it is intended the dimension of the company in terms of headcount and annual turnover (or annual balance sheet total). Four modalities are defined for this factor:

- micro,
- small,
- medium-sized,
- large.

The classification for the first three modalities (see Table 2) has been defined in accordance with the European Commission recommendation number 1422 of 6 May 2003 (2003/361/EC). The two classification criteria are cumulative, which means that both of them must be satisfied. It is assumed that a *large* company is a company which does not fulfil any of the reported criteria.

Regional development. Company classification according to *regional development* is obtained on the bases of QUARS (Qualità Regionale dello Sviluppo) indicator, which is a composite indicator specifically constructed for measuring the level of development of Italian regions (Gnesi, Segre, & Villa, 2010).

The variables concurring to the definition of QUARS are 41 and are grouped in 7 dimensions: environment, economy and work, health, education and culture, rights and citizenship, equality of opportunity, and involvement. According to these dimensions, 7 macro-indicators are defined, obtained by synthesising the 41 original variables. QUARS is a single indicator obtained through a further synthesis of the 7 macro-indicators and is used for regional comparison. It is periodically calculated and compared with other indicators (such as Human Development Index, Gender Equity Index, Basic Capabilities

Table 2. Criteria for small-medium enterprises (SMEs) definition (European Commission, 2003).

Company size	Headcount: annual work unit (AWU)		Annual turnover (€ million)		Annual balance sheet total (€ million)
micro	<10	and	<2	or	<2
Small	<50	and	<10	or	<10
medium-sized	<250	and	<50	or	<43

Index, Footprint Index, etc.) produced by UN (United Nations), ISTAT (Istituto Nazionale di Statistica), World Bank and Banca d'Italia (Gnesi et al., 2010).

Referring to the scores reported in QUARS report 2010, and considering that positive values represent a score higher than the regional mean, while the negative ones corresponds to a lower score, in the present analysis the *regional development* factor has been defined as (Gnesi et al., 2010):

- *positive*: values higher than the mean,
- *negative*: values lower than the mean.

We are studying the possibility to extend this concept to other countries in the near future.

2.3. *Data collection*

Data collection for the statistical analysis presented in this work has been conducted in two different phases: first a sample of Italian companies has been extracted considering general corporate information (register, economic, financial); then for each company the presence of an ISO 9001:2008 certification has been verified.

Data have been acquired from two sources: the database Aida® by Bureau van Dijk (www.bvdinfo.com) for general corporate information and the database of the Italian accreditation body Accredia (www.accredia.it) for certification information.

In the first phase of data collection, in order to select an appropriate and representative set of companies, the two following filters have been fixed (www.infocamere.it):

- type of company: *corporation* (Srl, Srl unipersonale, Spa),
- commodity sector: *manufacturing* (according to ATECO 2007 codification).

The option of focusing this first exploratory work on a single commodity sector (i.e. *manufacturing*) has been motivated by the fact that this sector has the widest presence of factories in Italy. Hence it represents a significant area to be investigated. Future research will be extended also to other sectors.

Data extracted from Aida® are:

- legal status (active, not active),
- sub-sector (according to ATECO 2007 codification, 23 sub-sectors have been defined),
- register data (name of the company and legal address),
- complete balance sheet according to the scheme defined by the Fourth European Directive (European Council, 1978) and related financial indexes,
- headcount.

Aida® database includes all the companies with a minimum turnover of € 250,000; hence, according to this constraint, companies with an annual turnover lower than this threshold have not been considered in the present analysis.

According to these constraints (*turnover* > € *250,000*, *balance sheet registered in 2010*, *corporations* and *manufacturing sector*), the considered sample was formed by 63,401 Italian companies. Even if the sample only contains companies with a turnover greater than 250,000€, we believe that the results of the analysis may still be interesting.

By eliminating companies with a relatively small turnover, we are neglecting 'nano' and analysing 'micro', 'small', 'medium' and 'large'-sized companies as defined by the European Commission recommendation number 1422 of 6 May 2003 (2003/361/EC).

In the second phase, the goal was to individuate, among all the companies in the sample, those having a valid quality certification according to the ISO 9001:2008 standard. In order to obtain this information, data have been extracted from Accredia database fixing the following filters:

- standard: *ISO9001:2008*,
- date of issue of the certificate: *till the end of year 2010*,
- commodity sector: *manufacturing*,
- registered office: *Italy*.

The obtained sub-sample was composed by 12,082 certified companies. Data have then been matched with the information included in the sample extracted from Aida® database, obtaining the complete set of input data for the statistical analysis.

We recognise that the sample analysed is the result of the introduced working hypotheses (country: Italy, type of company: corporation (Srl, Srl one shareholder, Spa), commodity sector: manufacturing (according to NACE 2007 codification), turnover $> €$ 250,000, etc.). Thus, the results of the analysis only hold for the sample of companies analysed. Additional studies would be needed to generalise the conclusions or to extend them to other types of companies.

3. Results of the analysis and discussion

From a first rough descriptive analysis of the obtained data, it is possible to see that among the 63,400 analysed companies 19.06% are certified and, in particular, 5.27% attained a quality certification in the period from 2008 to 2010, while the remaining 13.79% got it before 2008.

A first analysis of Z' values highlights the relative severity of this indicator: 40.19% of the companies are classified as being at risk of failure, 55.2% are in the grey area and the remaining 4.6% are in the non-bankrupt zone (see Figure 1). Although surprising, these data are in line with those presented by Altman et al. (2013), confirming the trend of negative growth which sees an increasing number of companies entering the area of bankruptcy and the grey zone.

Although the values of risk are high in general, the following factorial analysis is aimed at observing its variations as a function of the factors analysed.

3.1. *Analysis of influence factors*

After the early exploratory analysis, a three-factor ANOVA was performed with the goal of studying the effects of one or more of the three factors (certification, company size and regional development) or their interactions on the response variable risk of failure. The large amount of available information and the unbalanced distribution of the acquired data over the modalities of the three considered factors have suggested adopting the general linear model (GLM), which is an extension of the balanced ANOVA and serves to perform univariate ANOVA with unbalanced as well as balanced designs.

Although less restrictive for such a model (Everitt & Dunn, 2010; Minitab®, 2014), the fundamental assumptions of ANOVA, namely the normality and homoscedasticity
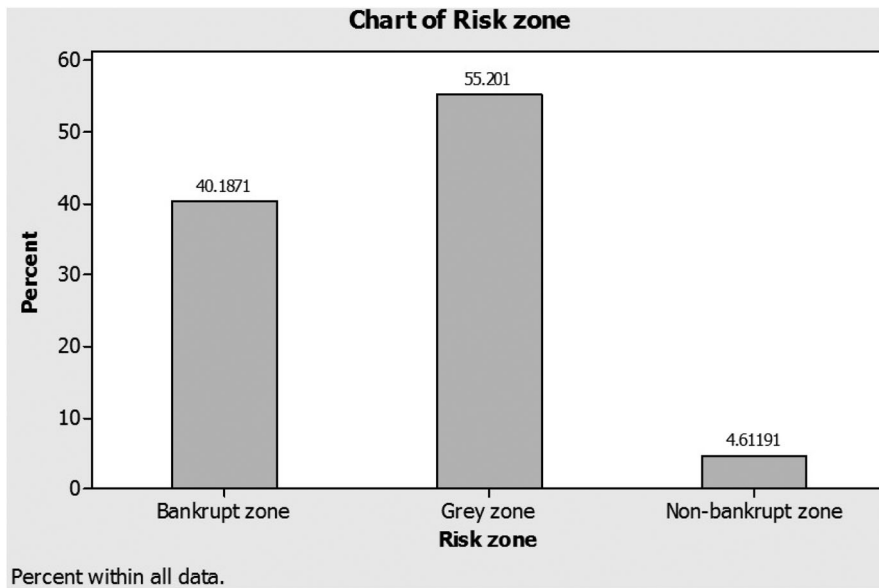
Figure 1. Company distribution among the three risk zones defined by Z'.

of the observations, were positively tested, respectively, by an Anderson-Darling and a Bartlett's test at a significance level $\alpha = 5\%$. The analysis was performed using statistical software Minitab® 17 (Minitab®, 2014). Table 3 reports a summary of the obtained results.

The ANOVA shows that two of the three analysed factors are highly significant: while *company size* and *regional development* seem to be significant, the *certification* weakly affects Z' (P-value 0.096).

Significant interactions are *company size – regional development* and *certification – company size*. In light of these results, the ANOVA was then repeated modifying the GLM to consider only (highly and weakly) significant factors and the significant interactions. A summary of the obtained results is reported in Table 4.

With the reduced GLM, also the *certification* becomes more significant in this analysis. Notice that the sum of squares of the error (SS_E) when compared to the total sum of

Table 3. ANOVA result table (A = certification, B = company size, C = regional development). The adopted GLM considers the three analysed factors and their interactions.

Source	DF	Seq SS	Adj SS	Adj MS	*F*	*P*
Certification (A)	2	39.479	2.93	1.465	2.34	0.096
Company size (B)	3	108.887	14.063	4.688	7.49	<0.0005
Regional development (C)	1	442.295	24.02	24.02	38.39	<0.0005
A × B	6	9.922	10.185	1.697	2.71	0.012
A × C	2	0.317	1.007	0.504	0.81	0.447
B × C	3	8.74	6.339	2.113	3.38	0.017
A × B × C	6	2.824	2.824	0.471	0.75	0.607
Error	63377	39653.28	39653.28	0.626		
Total	63400	40265.74				

Table 4.   ANOVA result table (A = certification, B = company size, C = regional development). At this stage, the adopted GLM only takes into account factors that emerged as? significant in the former step of analysis.

Source	DF	Seq SS	Adj SS	Adj MS	*F*	*P*
Certification (A)	2	39.479	7.829	3.914	6.26	0.002
Company size (B)	3	108.887	22.405	7.468	11.94	<0.0005
Regional development (C)	1	442.295	68.659	68.659	109.74	<0.0005
A × B	3	8.183	8.073	2.691	4.3	0.005
B × C	6	9.813	9.813	1.635	2.61	0.016
Error	63385	39657.09	39657.09	0.626		
Total	63400	40265.74				

squares (SS_T) suggests that the three factors and their interaction, although significant, are not able to completely justify the variability of the *Z'* values. It is obvious to expect that the factors considered, although important, are not the main causes determining the failure (or conversely the success) of a company.

The Main Effects Plots display their influence on the response. In detail, the Main Effects Plot in Figure 2 shows that:

- Companies with different sizes have different risks of failure. Contrary to what one might expect, *micro* and *small* companies appear to have a lower risk of failure than *large* ones. The reason for these apparent contradictions should probably be sought in the bankruptcy law and in particular their modifications in relation to the bankruptcy of small companies. When facing difficult situations, these companies are subsidised and therefore tend to present better balance sheets (and as a consequence *Z'* values) than larger companies that cannot benefit from such advantages (Camera dei Deputati, 2005).
- Companies located in regions with a positive development have a slightly lower risk of failure. This result is quite intuitive: the context in which companies operate has a significant impact on their risk of failure: companies that operate in regions with positive social-economic conditions show better balance sheets (and hence *Z'* values) than similar companies operating in worst environments. In some ways, this finding supports Porter's theory of the diamond model according to which a company's competitiveness depends on the substrate in which it operates (Porter, 2011). The main difference is the different research point of view: the present study analyses the risk of failure rather than the company's competitiveness. It seems logical to expect a decrease in the risk of failure of a company as its competitiveness increases.
- The most surprising result concerns the significance of the certification. Although less important than other factors, certification appears to have a weak effect on the *Z*-score: contrary to expectations, data show that the certified companies are on average characterised by a higher risk of failure. This surprising result is justifiable if considering that many companies facing troubles may have sought certification as a possible strategy for the reorganisation of production processes. This, coupled with the fact that the acquisition of the certificate requires an important effort, justifies the fact that companies – and in particular those recently certified – are characterised by a lower value of *Z*.
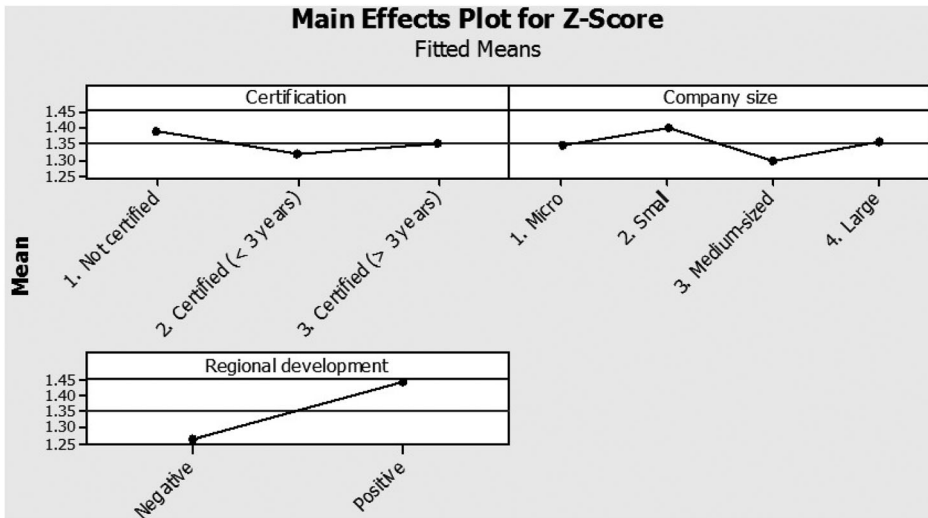
Figure 2. Main Effects Plot. Considered factors are *certification*, *company size* and *regional development*.

The Interaction Plot is shown in Figure 3. Observing the graph the following interactions between the factors can be noticed:

- *company size* and *regional development*. It seems that *large* companies are less sensitive to the regional context in which they operate, while *regional development* has a more significant impact on *micro*, *small* and *medium-sized* companies. In support of this, observing the graph, it can be noted how the distance between the mean Z-
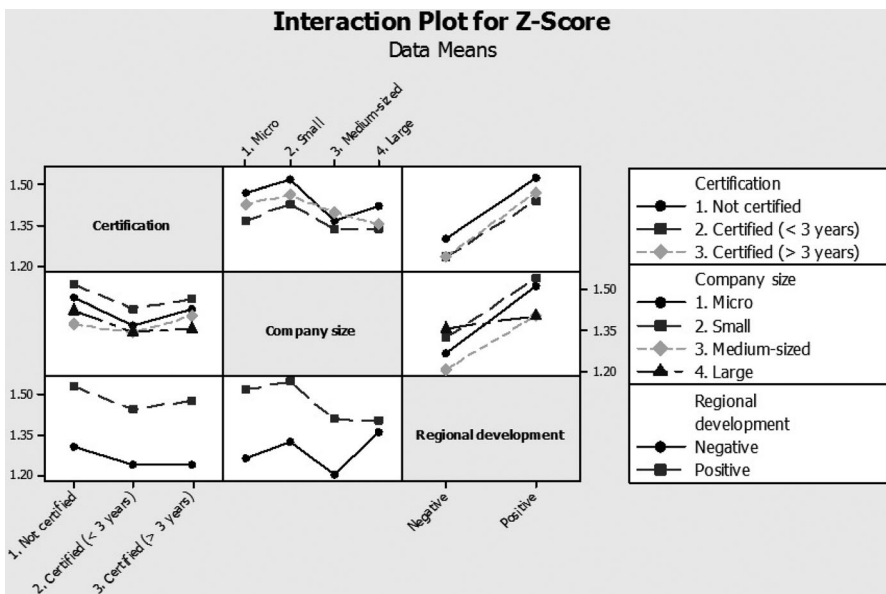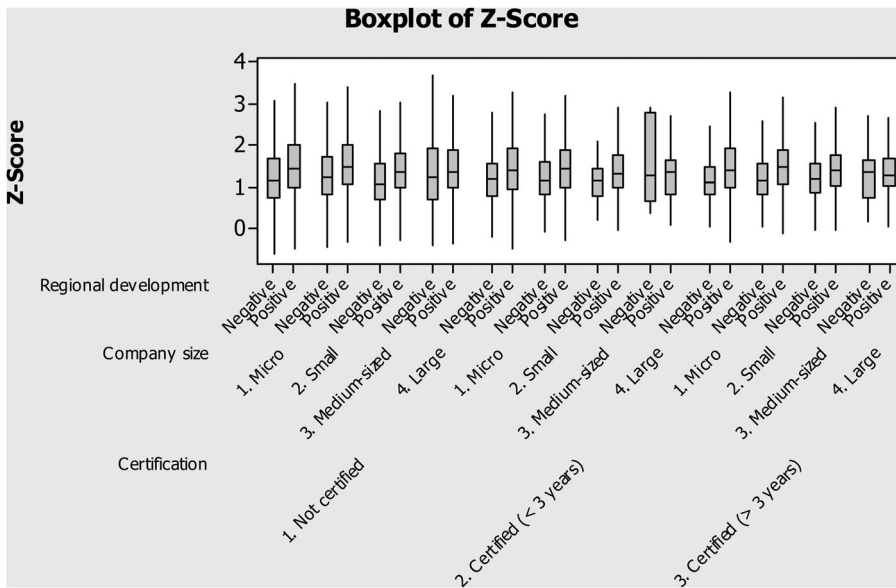

Figure 3. Interaction Plot.

Figure 4. Box Plot of Z-Score with respect to *certification*, *company size* and *regional development*.

scores related to negative and positive *regional development* are progressively decreasing while increasing the *company size*.

- *Certification* and *company size*. The graph shows how certification is differently perceived by companies with different sizes. In particular, the *micro* and *small* companies are those most affected (in terms of Z') by *certification*.

As a supplement of analysis, Figure 4 shows a box plot of Z-score with respect to the three factors. It can be qualitatively noted how both data variability and symmetry are constant between the boxes. This supports the hypothesis of normality of the data tested, respectively, by the aforementioned Anderson-Darling and Bartlett tests.

4. Conclusion

This paper presents the results of a study conducted on a sample of Italian companies in the manufacturing sector. The study aims at investigating the possible relationship between ISO 9001 quality certification and the corporate profiles of Italian companies in the period 2008/2010, characterised by the beginning of a severe economic crisis.

Compared to the existing literature, the novelty of this study is in its point of view: the risk of failure. Rather than attempting to verify if the certification is related to company excellence in terms of economic indicators, this paper tries to figure out if the certification can be in any relation to the survival of a company.

The study of the balance sheets of companies in the sample – aggregated into a failure risk indicator – has produced few major outcomes: (i) about 40% of the analysed companies run the risk of failure. Although surprising, these data are in line with those presented by Altman et al. (2013), confirming the trend of negative growth which sees an increasing number of companies entering the area of bankruptcy and the grey zone. This staggering

scenery is justified if considering the particular economic background in which the analysis is set; (ii) companies with different sizes show different risks of failure. In particular, according to the analysed sample, *micro* and *small* companies appear to have a lower risk of failure than *large* ones. This result is justified if considering the specific aid policies implemented by the Italian government during the analysed period and aimed at financially supporting small and medium-sized companies facing difficult economic conditions; (ii) the territorial background in which the company is established affects its risk of failure: companies located in regions with a positive development show a lower risk of failure; (iii) certification appears to have a weak effect on the risk of failure: contrary to expectations, data show that the certified companies are on average characterised by a higher risk of failure. Although there is evidence of connection between *certification* and *risk of failure*, these results suggest not to draw any definitive conclusion of connection between certification and the corporate profile of a company.

Although interesting, the presented results cannot be viewed as definitive for different reasons: (i) the study is only based on a sample of companies in a specific sector; (ii) the analysed factors do not adequately explain the variability in the data of the response variable and (iii) they rely on the definition of the Z'-score which – although widely adopted for quantification of the risks of failure – may still be seen as a questionable indicator.

However, the study opens a way for a number of important questions about the meaning, usefulness and effectiveness of ISO 9001 certification. In particular, it may be time to ask whether the paradigm of certification actually needs a radical rethink (Franceschini et al., 2011b).

At this stage, it must be said that the present work represents a preliminary study for a more extensive survey involving an all-round analysis of the Italian corporate sectors. Z'-Score has been used for tracing the economic/financial profile of companies, but – due to the fact that it takes its origin from the U.S. market – it may not fit exactly the Italian situation. Future works will deeply analyse other econometric indicators, specifically developed to fit this research, also expanding the database of companies to consider other countries and commodity sectors.

Disclosure statement

No potential conflict of interest was reported by the authors.

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