INSOLVENCY PREDICTION IN MANUFACTURING FIRMS. A COMPARATIVE STUDY BETWEEN ITALY AND TURKEY

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Purpose – This paper investigates the prediction of failure among Italian and Turkish manufacturing companies during the global crisis. The recent financial crisis has pushed many businesses, either large or small, into bankruptcy or near bankruptcy. Given two different economic environments (Italy in recession and Turkey in expansion) and potential future global economic downturns, there is an urgent need to deeper understand the reasons behind the Italian and Turkish corporate failure. The study aims to expand the domain of financial distress by including two countries with different economic scenario.

Design/methodology/approach – This paper opted for applying the Revised Altman model in order to investigate the impact of the crisis on financial distress among Italian and Turkish manufacturing non-listed public limited companies. Companies are observed over the crisis period 2008- 2013. We allocate companies in one out of three areas: alarm, grey and safe. We suggest spreading the hybrid companies who fall in the grey area over the extreme areas. By setting a threshold, we group the companies in two different clusters: with financial distress and with no, with the intention of discovering hybrid companies at the intermediate level that necessitate financial backing.

Findings – The results confirm our hypotheses: the great majority of Italian manufacturing companies (72.70%) have been suffering the downturn and, consequently, increasing the likelihood of financial distress. While only the 26.68% of Turkish companies have a reasonable risk of financial distress. The findings indicate that the majority of Italian manufacturing companies have been suffering the financial crisis, while Turkey shows an opposite situation.

Research limitations/implications – Because of the chosen research methodology (Z-Scores), the research findings may be less reliable because they are strongly linked to Z-Scores. Therefore, researchers are encouraged to test dynamic models further.

Practical implications – The paper includes implications for the impact of the recent economic crisis and the bankruptcy prediction in two countries which portrait opposite scenarios.

Originality/value – This paper fulfils an identified need to study how the global financial impact on countries with opposite scenario.

Index terms- Bankruptcy, Altman's model, Financial Reporting, Financial Distress, Accounting, Global Economic Crisis.

Article Type: Research paper

I. INTRODUCTION

. The last decade has witnessed a massive and traumatic phenomenon: the global economic crisis which has generated the insolvency of many enterprises all over the world.

The global financial crisis of 2008 is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s. It threatened the total collapse of large financial institutions, which was prevented by the bailout of banks by national governments, but stock markets still dropped worldwide. In many areas, the housing market also suffered, resulting in evictions, foreclosures and prolonged unemployment. The crisis plays a significant role in the failure of key businesses, declines in consumer wealth estimated in trillions of U.S. dollars, and causes a downturn in economic activity leading to the 2008–2013 global recession and contributing to the European sovereign-debt crisis. In today's global economic crisis, there is much concern associated in finding the best way to measure the likelihood of bankruptcy. Many studies provided a definition of "bankruptcy" (Dirickx Van Landeghem 1994; Ward & Foster, 1997; Van Caillie, 1999; Daubie &Meskens, 2002; Charitou *et al.*, 2004). Models were based on "financial distress" criterion (Keasey & Watson, 1991; Hill *et al.*, 1996; Kahya & Theodossiou, 1996; Doumpos & Zopoudinis, 1999; Platt &Platt, 2002) or on other financial distress events such as cash-flow insolvency (Laitinen, 1994), loan default (Ward & Foster, 1997), capital reconstructions, informal government support and loan covenant renegotiations with banks (Taffler & Agarwal, 2003).

A more recent definition is provided by Pongsatat *et al.* (2014). They argued that a failed or financially distressed company is one that either: (1) had been liquidated during the current year, (2) had received an audit that expressed concern about the going concern capabilities of the firm, (3) had been closed down by governmental authorities, (4) had been asked

to submit restructuring plans by governmental authorities, (5) had filed bankruptcy proceedings in one or more countries or some other notification indicating bankruptcy proceedings.

Despite the above wealth of extended previous research to date to the knowledge of the authors, there are no contributions at all which have the matched results of different countries. In a related manner, no comparison have been done yet between different countries which present opposite growth/recession scenarios, so that to permit to enrich existing literature with additional knowledge. As a matter of fact, we would analyse the emerging economy of Turkey which has witnessed a massive growth in spite of the global crisis and the declining economy of Italy which has suffered the global crisis, on the other hand. With these premises, this study aims at analysing the effects of the global financial crisis on a sample of Italian and Turkish companies and, more specifically, whether the global financial crisis has increased the number of firms with a high likelihood of failure and, in that way, determining the different impact of crisis itself. In order to make this comparison, we have used the Z-Scores to the entire population of non-listed public limited companies belonging to the manufacturing industries[1] which operate in Italy and Turkey.

In the light of the above, we found that there is a significant number of Italian manufacturing firms under financial distress. This is mainly due to Italian scenario which has been suffering from political instability, economic stagnation and lack of structural reforms. The global crisis have deteriorated the Italian economy showing the strongest GDP (1,573 billion of € in 2009) drop ever. The economy recorded contractions of -2.3 % in 2012 and -1.9% in 2013. The unemployment rate has increased constantly over the crisis period: in 2013, it reached highest level of 12.2%. Public finances have dramatically increased: in 2013, Italy reached a public debt of € 132,6 billion, the second biggest debtor in the Eurozone.

On the other hand, Turkey has shown positive findings because of the growing domestic demand as well as the GDP. Despite the global crisis, the unemployment rate has decreased and the Public debt has been cut of 8.7 billion of USD over the past five years. Furthermore, the consumption has increased as well as the foreign investment: more than two-thirds of the stocks in the Istanbul stock exchange are actually owned by foreign investors.

At this point, we would assess whether Altman's Z-Scores confirm the real economic situation of both countries. We expect that Z-Scores in Italy show lower values (mostly concentrated around 1.23) and that Z-Scores in Turkey display higher values (mostly concentrated around 2.90). This confirm the opposite results of the Z-Scores in Italy and Turkey and so their opposite economic status.

Our study contributes to the literature in the following way. The recent financial crisis has pushed many businesses, either large or small, into bankruptcy or near bankruptcy.

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[1] In this study, Listed companies were excluded because the Revised Altman Model (1993) can not be applied to listed firms (Altman et al., 2013).

Given the current economic environments (Italy in recession and Turkey in expansion) and potential future global economic downturns, there is an urgent need for us to deeper understand the reasons behind the Italian and Turkish corporate failure. Our analysis presents an approach to the study of the likelihood of corporate bankruptcy in Italy, state in an economic recession, and in Turkey, country with an ongoing expansion.

In the light of the above, the hypothesis addressed in this study is:

H_0. Overall, there is a significant number of manufacturing firms under financial distress and with a reasonable risk of failure. The majority of the above mentioned is mainly due to the Italian scenario which has been deeply suffering the global crisis. On the other hand, Turkey shows different results because of its growing economic. According the macro-economic data, we expect that Italy and Turkey show different results. The former has a greater number of firms with high likelihood of failure than the latter.

In the second section, we discuss the prior literature by going into details of Altman's model and Revised Altman's model. The third section analyses economic background of Italy and Turkey. In the fourth and fifth sections, we describe the data analysis, the sampling process and, afterwards, we present the empirical results. The sixth section provides conclusions and comments to the paper. Several suggestions for further research are also presented in the seventh section.

II. PRIOR LITERATURE

A substantial volume of the corporate failure diagnosis and financial distress signalling literature has mainly employed. The pioneers of business failure prediction using financial ratios were Beaver (1966) and Altman (1968)[2]. Beaver's (1966) analysis used a univariate approach and Altman's (1968) employed a MDA linear model (Multiple Discriminant Analysis) for corporate failure diagnosis. Beaver (1966), through the univariate analysis, showed that 5 years prior to bankruptcy, insolvent companies presented a decrease in sales volume, a decrease in cash flow and income levels and growing debt compared to healthy companies.

Altman (1968), using multivariate discriminant analysis, found that the financial ratios of healthy companies were different from those of insolvent ones and that this diversity became progressively stronger as the date of bankruptcy approached. Since the initial work of Altman, the number and complexity of studies on business failure prediction have seen an exponential increase. From the work of Beaver until 2007, there were more than 165 related models published in English alone (Bellovary *et al.*, 2007). Kosmidis and Stavropoulos (2014) pointed out that, the following decades after Altman's contribution, academics were focused on finding out

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[2] The first attempts to use the behaviour of financial ratios for predictive purposes are based on statistical univariate approaches, characterised by the separate observations of various financial ratios in the years immediately prior to the bankruptcies of companies compared with those of sound firms (Hickman, 1957).

appropriate financial ratios that would maximise the accuracy and predictive power of their models (Altman *et al.*, 1977; Altman, 1984; Johnsen & Melicher, 1994) and testing these models in different sectors, industries (Espahbodi and Espahbodi, 1984) and markets (Peel & Peel, 1988; Keasey *et al.*, 1990; Tamari, 1984; Ugurlu & Aksoy, 2006). Charitou et al. (2014) resumed the subsequent extensions including: (a) the assignment of prior probability membership classes (Deakin, 1972); (b) the use of a more appropriate quadratic classifier (Altman *et al.*, 1977); (c) the use of cash flow-based models (Casey and Bartczak, 1984); (d) the use of quarterly information (Baldwin & Glezen, 1992); and (e) the use of current cost information (Aly *et al.*, 1992).

Ohlson (1980) employed logistic regression to predict business bankruptcy, a technique that avoids some of the problems of the MDA approach. Extensions to Ohlson's technique include the development of industry-specific models (Platt *et al.*, 1994) as well as the adoption of a multinomial logit approach to reduce misclassification error by adding, to the outcome space used to predict bankruptcy, a 'weak' state of financial distress (Johnsen and Melicher, 1994). Peel and Peel (1988) and, consequently, Keasey *et al.* (1990) investigated whether it is possible to discriminate simultaneously between healthy and failing firms for a number of reporting periods prior to failure, by applying multi-logit models. Lennox (1999) validated that the industry sector, company size and the economic cycle have substantial effects on the likelihood of business bankruptcy. Those kind of companies are expected to increase when the company in question is unprofitable, is largely leveraged and without liquidity problems.

Since Beaver, Altman and Ohlson, the financial ratios has become a vital element of failure prediction methods. According to Wu (2010), financial ratios can be categorized according to several aspects in order to measure the business performance or competence of a firm. For example, financial ratios can be used to measure a firm's profitability, liquidity, capital structure, and efficiency. Huang *et al.* (2008) point out that financial ratios are relevant tools in prediction bankruptcy and they are also commonly used to develop the models or classifiers.

There is significant doubt about a firm's ability to continue as a going concern. Many scholars have debated the role of independent auditors' in assessing the potential corporate financial distress. Indeed, professional standards require independent auditors to disclose the uncertainty in their report. Phyllis et al. (2015) investigated the relationship between audit reporting and bankruptcy risk. By issuing a going concern option to a sample of Chinese financially-distressed companies, revealed that the Big 4 auditors had a great propensity in maintaining their reputations when the clients' bankruptcy risk was low. By adopting a sample of 2,000 firms, Bhimani et al. (2009) provided an Empirical estimation of a logit model controlling for accounting cash- flow-related and non-accounting variables shows that the likelihood of default for firms that received going concern opinion is 2.792 times that of firms that received a clean opinion.

Altman *et al.* (2013) apply the Z-Score through an application to Italian companies subject to extraordinary administration between 2000 and 2010. The results confirm a good predictive effectiveness, though Italian peculiarities could require the development of ad hoc parameters.

- *Altman's model (Z-Score)*

The most widely-used bankruptcy prediction model is the Altman's Z-score (Altman, 1968), developed using a statistical method called multiple discriminant analysis (MDA). This model was one of many multivariate analysis studies that built upon Beaver's initial findings (Beaver, 1966). MDA derives a linear combination of financial ratios that best discriminate between two groups of enterprises. In this line of research, the groups consist of the qualitative classification of bankrupt or non-bankrupt and the features are selected financial ratios. The coefficients of ratios are the appropriate weights that will separate the financial ratio values between the two groups as much as possible, while minimizing the statistical distance of each ratio from its own group mean. The discriminant coefficients can then be applied directly to the financial ratios within the discriminant function to produce an overall Z-score that can be used to classify the firm into one of the above mentioned groups.

The sample of firms used for analysis consisted of a paired set of bankrupt and non-bankrupt firms. Given 1946-1965 the time period analysis, the pairs of bankrupt and non-bankrupt were chosen to be reasonably similar in size and industry classification. The final discriminant function consisted of five performance indicators, weighted by coefficients, and is described as follows:

$$Z = 0.012\frac{WC}{TA} + 0.014\frac{RE}{TA} + 0.033\frac{EBIT}{TA} + 0.006\frac{MVE}{TL} + 0.999\frac{SR}{TA}$$

where:
WC is Working Capital.

TA is Total Assets.

RE is Retained Earnings.

EBIT is Earnings Before Interest and Taxes (Operating Profit).

MVE is Market Value of Equity.

SR is Sales Revenue.

The five ratios are following explained. The WC/TA ratio was considered the most valuable of liquidity ratios. The decline in current assets and, thus, working capital will be more likely to experience an adverse liquidity event. The RE/TA ratio indicates the cumulative profitability by only taking into account the reinvested earnings over a firm's entire life[3]. The EBIT/TA ratio, similar to ROA ratio (Beaver, 1966), shows the productivity of the firm's assets in assessing the level of surviving from short and long-term investments. The relevance of this ratio in the context of failure is straightforward. The MVE/TL is computed as the combined market value of all common and preferred shares of stock, and the combined ratio is a gauge of how much the firm's asset value can fall before

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[3] This measure penalizes start-up firms, but since as discussed earlier it is more likely that a younger firm will go bankrupt, the bias is justified.

the firm becomes insolvent. Finally, the S/TA ratio indicates overall sales-generating ability of the firm's assets.

According to Xu and Zhang (2009), overall, these five accounting ratios capture the company's characteristics such as liquidity, profitability, productivity, solvency and sales-generating ability. As expected, non-bankrupt firms showed higher values; by using a cut-off score of 2.675[4], the model was between 82 and 94 percent accurate in predicting bankruptcy within one year of failure. The authors' analysis (Altman, 1968; Altman & Hotchkiss, 2005; Altman, 1983) shows that the average Z-scores range from 6.2 to 0.33 for AAA-rated and CCC-rated firms respectively.

- *Revised Altman's model (1993)*

The original Altman's model (1968) has been revised along the way in order to make it more reliable and applicable to most of cases. This study considers two groups of companies of the same size and, based on a linear relationship, identifies five variables for each subject in the sample. These, weighted by coefficients, give rise to a score that should be noted the proximity to a group, rather than the other. The variables are five financial ratios covering the areas of profitability, liquidity and solvency. The model has been revised several times by Altman who has constantly updated the parameters and adapted indices in different populations. In 1993, Altman proposed a revise of his original model which consists of an adjustment in order to make it suitable for the manufacturing non-listed companies. In the original model, the cut-off is equal to 2.67 but, after the revision, the area of uncertainty is between 1.23 and 2.90. A score lower than 1.23 indicated a high likelihood of failure, a higher score than 2.90 shows a lower likelihood of failure and the area in between indicates uncertainty.

In the later model revision (1993), the retained earnings were replaced by the proxy "Net Profit" (*Retained Earnings + Dividends*). In addition, MVE was replaced by Book Value of Equity concentrating on only financial statements. This was made by Altman (1993) and resumed by Altman *et al.* (2011) in analysing Italian companies subject to extraordinary administration. Table A shows the original and revised models.

In this study, we would use the revised Altman's model within all the Italian and Turkish manufacturing non-listed companies during the global financial crisis period. This with the purpose of identifying the trend of scores in order to predict business failure.

A. Italy and Turkey. Historical Data and Global Economic Crisis.

- *ITALY*

DATA _ Italy is the world's ninth biggest economy[5]. The economic structure relies mainly on services (three quarters of the total GDP and employs around 65% of the Italian total employees) and manufacturing industries

(specialized in high-quality goods and run by SMEs, most of them are family owned business). One of the most important pillars of the economy is the production of high-quality products (machinery, textiles, industrial designs, alimentary and furniture) which contribute substantially to the country's exports. The country can be divided in two different geographic parts: a developed and highly-industrialized northern part, where approximately 75% of the nation's wealth is generated; and a less-developed, more agriculture-oriented southern part. As a result, unemployment in the north is lower and *per capita* income in higher compared to the south. Italy is also a country poor in national resources, its energy and manufacturing sectors are highly dependent on imports. This makes Italy's external position vulnerable to changes in import prices such as fuel.

*Financial Crisis_* Italy has been suffering from political instability, economic stagnation and lack of structural reforms. Prior to the 2008 financial crisis, the country was already idling in low gear. In fact, Italy grew an average of 1.2% between 2001 and 2007. The global crisis had a deteriorating effect on the already fragile Italian economy. In 2009, the economy suffered a hefty 5.5% contraction—the strongest GDP (1,573 billion of € in 2009) drop in decades. Since then, Italy has shown no clear trend of recovery. In fact, in 2012 and 2013 the economy recorded contractions of -2.3 % and -1.9% respectively. Going forward, the Italian economy faces a number of important challenges, one of which is unemployment. The weaknesses of the italian labour market is demonstrated by the unemployment rate has increased constantly in the last years: in 2013, it reached 12.2%, which is the highest level on record. Another challenge is presented by the difficult status of the country's public finances. In 2013, Italy was the second biggest debtor in the Eurozone by recording a public debt of € 132,6 billion. Since the crisis started in 2007, the main point of the Italian economic policies has been to deal with the effects of the financial crisis: two main austerity packages have been introduced, aimed at reducing the country's soaring public debt and government deficit. In a bid to face the recession, the government has passed two major austerity packages. The first one focused on the reduction of government spending in order to reduce the nation's budget deficit and public debt, was implemented on May 2010, under the administration of Silvio Berlusconi, and consisted of €24 billion. In December 2011, the government led by Mario Monti introduced a €30 billion austerity package, mainly consisted of a series of tax increases. The actual government of Matteo Renzi is focusing on facing the effects of the financial crisis by introducing economic and structural reforms: the senate reform, labour reform and electoral law. Ensuring that these reforms are vital to supporting growth and strengthening Italy's position in the global market.

- *TURKEY*

DATA _ The Turkish economy, on the other hand, is dynamic and growing. In recent years, the Turkish economy is considered one of the most emerging by growing more than tripled (rising from USD 231 billion in 2002 to USD 821.3 billion in 2013) with an average rate of annual growth of 5.2%

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[4] a lower overall discriminant score (i.e. "Z-Score") indicates increased potential for financial distress.
[5] Source: Focus Economics – Economic Forecasts from the World's leading economists. 2015.

as reported by the Turkish government[6]. The economic structure relies mainly on traditional agriculture, modern industry and commerce[7]. The last decade has seen a rapidly growing of the automotive and electronic industries which have overcome the textile. Turkey also has an awakening science and innovation sector, though it lags behind most OECD countries in this area. With rapid growth rates and a young and increasing population of 76,5 million (in 2013), Turkey has the potential to be the largest economy in Europe after Germany and the most populous if it will be accepted into the EU. According to rating agency of Moody, Turkey is placed on the 5th position among the 20 fastest growing emerging economies in 2013 with great prospects for the next years[8]. Turkey is also opening to foreign investments reaching 123 billion of USD over the past 10 years (especially trading with the European Union, the Middle East and North Africa), as well as domestic investments on infrastructure and tourism that allowed the country to raise in 2012, the 17th world economy.[9] Analysts' forecasts suggest that Turkey will grow faster than any other country besides India or China, during the next decade.

*Financial Crisis_* Although capital inflows contracted, and private investment and the consuming of durable goods declined, there was no fundamental damage to Turkey's economy. This due to the reforms in the Turkish financial sector and tighter regulation, Turkey's economy recovered swiftly, and growth in 2010 was estimated at 9.2% (from -4.8% in 2009), mostly attributed to growing domestic demand (+13.5% in 2010). GDP has significantly grown by 208,3 billion of USD from 2009 to 2013, the unemployment rate has decreased from 13% to 9.1% over the past five years and the Public debt has been cut of -8.7 billion of USD (from 2009 to 2013). Inflation was just below the 2010 target, and capital inflows intensified driven by wide interest rate gaps and increased political certainty. Although the global crisis, the consumption has increased from -2.3% of 2009 to 5.1% of 2013 as well as the investment (moving from -19% in 2009 to 4.2% in 2013), and so on. In the Istanbul stock exchange more than two-thirds of the stocks on are now owned by foreign investors. Table A shows the economic data in the global crisis period in Italy and Turkey.

B. Data analysis, sampling and hypothesis developed

Financial Accounting data was gathered from *Amadeus* Bureau Van Dijk database. For each selected firm, all the appropriate ratios required by Revised Altman's model were computed. We did not need to adjust financial data in order to make them more uniform and comparable because database already provided proper and standardized data (see Appendix A).

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[6] Source: Focus Economics – Economic Forecasts from the World's leading economists (2015)
[7] One-third of those employed in industry work in textiles (FocusEconomics.com)
[8] Source: Moody's agency rating (2013)
[9] Source: International Monetary fund (2012)

A coding sheet was used for data collection. The coding sheet was developed on an Excel spreadsheet including the name of the company, the country (Italy or Turkey), the financial data required for computing the Z-Score: *Working Capital, Total Assets, Net Profit, Operating Profit (EBIT), Book Value of Equity (BVE), Total Liabilities* and *Sales Revenues*. The Final Z-Score of a generic firm is the result of the average among all of its scores obtained from 2008 to 2013.

$$Revised\ Z\ Score = 0.717\frac{WC}{TA} + 0.847\frac{NP}{TA} + 3.107\frac{EBIT}{TA} + 0.420\frac{BVE}{TL} + 0.998\frac{SR}{TA}$$

WC: Working Capital.

TA: Total Assets.

NP: Net Profit (proxy for Retained Earnings).

EBIT: Earnings Before Interest and Taxes (Operating Profit).

BE: Book Value of Equity.

SR: Sales Revenue.

These companies are observed over a period of six years from 2008 to 2013. Since the Altman's model can not be applied to listed companies because of its biased results, the sample is composed by 10,973 manufacturing non-listed public limited companies (9,911 from Italian manufacturing industry and 1,062 from Turkey). We excluded companies with no financial data available (289 in total). The Table C and D show the sampling process selection.

In this last regard, we apply the Revised Altman model (1993) in order to investigate the likelihood of failure among non-listed public limited companies which operate in Italian and Turkish manufacturing industries. In Table E, we allocate companies in one out of three areas (Altman, 1993).

According to the above table, the zones are explained as follows:
- *"Alarm Area"*. This zone is "at-risk" and includes all the firms that reached a Z-Score below 1.23. These are the companies with a high likelihood of bankruptcy.
- *"Grey Area"* includes the entire group of companies that reached a Z-Score in between 1.23 and 2.90. These firms are considered hybrid companies because of their condition of uncertainty. They may fall in the areas at extreme.
- *"Safe Area"*. This zone is the "lower-risk area" and contains all the companies that presented a Z-Score above 2.90. These are the firms with a low likelihood of bankruptcy

Subsequently, we examine in details the "grey zone" in order to better understand where the hybrid companies would tend to migrate towards. In which zone do the companies might fall? In which zone are they oscillating? Are they about to fall in the Safe or in the Alarm? or, conversely, are they about to remain in an intermediate zone with the condition of uncertainty?

In the light of the above purpose, we spread the hybrid companies of the "grey area" over the extreme areas. We made a different clustering analysis by identifying a threshold of 2.065 situated in the middle of range so as to cluster companies in two different groups: financial distress and non-financial distress. Companies with scores below the threshold are the ones with no financial distress and, on the other hand, companies with scores above the threshold are the ones with a reasonable risk of financial distress. By doing so, we aim at discovering hybrid companies at the intermediate level that necessitate financial backing.

In the new data collection method, we have two groups of companies. The first category includes companies belonging to "alarm area" and the side of the grey area that might exceed the threshold above which they come into bankruptcy (alarm area). On the other hand, within the second category, we have companies of the near side of grey area to the companies with low likelihood of failure (safe area) and the safe area itself.

In addition, we examine the trend of companies' Z-Scores year by year that will be discussed in details in the following sections.

III. RESULTS AND COMMENTS

- *General Results*

The general findings[10] of the Revised Altman's model, conducted on Italian and Turkish manufacturing companies, were compared and reported as follow[11]:

a. Table G. It shows the computation of average Z-scores (2008-2013) within three areas zones (alarm, grey and safe).

b. Table H. It shows the composition of the grey area by dividing the zone in two parts, one side near the alarm zone, the other close to the safe one.

The Tables G and H show the following findings:

- In total, the 21.06% have a great likelihood of failure over the past six years (crisis period) since 2,250 companies out of 10,684 show a Z' score less than 1.23. The remaining 8,434 companies have been divided in two areas (802 belong to the "Safe Area" and 7,636 have a low risk of bankruptcy).

- The Italian scenario during the crisis period shows a dangerous situation within manufacturing industries: the 22.89% have had a great likelihood of failure showing 2,235 companies out of 9,762 with a Z' score less than 1.23, while a low number of companies (the 5.96%) show a low risk of failure. The remaining 71.14% companies belong to the "Grey Area".

- The Turkish scenario during the crisis period illustrates a very different situation compared with Italy. Only the 1.63% of manufacturing companies (15 out of 922) has a great probability of failure, while the 74.51% belong to the "Grey Area" and the 23.86% are considered "safe".

According to the table H, we also made a further analysis on manufacturing firms belonging to the "Grey Area" in order to investigate companies closer to "Alarm Area" and the ones near the "Safe Area". We found that 2,603 (34.11%) are much closer to "Safe Area", while 5,029 are closer to the "Alarm Area"(65.89%). More in depth, the sample of Italian companies shows that only the 30.63% belongs to the "closer safe area" while Turkish scenario records the opposite results: the 30.71% are closer to the "Alarm area", while even the 69.29% are closer to the "Safe area". This confirms that Italian companies are suffering the global financial crisis and they could deal with financial distress in the short period, while Turkey is reacting better to the crisis.

After splitting the intermediate level (Grey area) in two parts, we come up with a further analysis by grouping the companies in two categories: with risk or no risk of financial distress[12]. We used the central value of 2.065 to discriminate the two groups of Italian and Turkish manufacturing companies.

After analysing the three zones as well as the composition of the intermediate zone, we end up with the results in Table I.

According to the Table I, results show the 68.73% of manufacturing non-listed companies has a risk of financial distress and 31.27% that can be considered healthy. In Italy, almost 3 out of 4 companies have a reasonable risk of failure and only 27.30% are healthy. Turkey shows an opposite situation recording almost 3 out of 4 firms with no risk of failure and the remaining 26.68% with a risk.

The Table L shows the groups of companies with Risk and No Risk of Financial Distress in Italy and Turkey[13].

The findings confirm our hypothesis that global crisis period causes a relevant deterioration of economy among Italian manufacturing firms that, as a consequence, increase the likelihood of bankruptcy. On the other hand, Turkey shows a different scenario, even the opposite in terms of percentages, because of its growing economic.

- *Financial distress analysis year by year during crisis period*

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[10] In order to assure that Revised Altman's test is valid and results are reliable, the same test was applied to a control sample. A generic manufacture industry was selected to test the model. This consisted of all European public limited companies (belonging to the *"Manufacture of Food"* industry) bankrupted within the period 2008-2013. The results show that the 80% of bankrupted companies has a value below 1.23, according to the Revised Altman's model. See *appendix A*.

[11] The companies included in the analysis all the companies with at maximum "three missing values" over the past six years. Companies with more than three missing values were excluded.

[12] Companies with no risk of financial distress are companies belonging to the "Safe area" plus companies close to the same area". On the other hand, companies with risk of financial distress are the ones included in "Alarm area" plus companies close to the same area.

[13] The colours have the following meaning: the more it is close to the red the worse the financial situation is. On the other side, the more it is close to the blue the better the financial situation is.

Finally, we made a trend of Z-scores within 2008-2013 period. We set process of comparing the scores over time to identify any consistent results or trends in Italy and Turkey. This helped us to better understand how the companies have performed year by year along the crisis period. The Table M shows the percentages for both countries and for each year indicating companies with risk and no risk of financial distress.

The Table M shows that for each year, Italy has 70% on average of firms with risk of financial distress. It reaches the higher value of 76.05% (+9.19% compared to the previous year) and starts to decrease slightly up to 67.75% in 2013. On the other side, Turkey has 30% on average of firms with risk of financial distress (while the same % in Italy represents the firms with no risk of distress!). It reaches the higher value of 35.57% in 2010 (+5.64% and +7.59% respectively compared to 2009 and 2008) and starts to decrease slightly up to 24.30%.

IV. CONCLUSION

Overcoming literature gap.

Our contribution is to shed further light on how relevant is the impact of the recent economic crisis, in Italy and Turkey, which have caused a downward trend of the Z-Scores from 2008 to 2013. Based on Altman's model upon two European countries that present a very different economic status, this research has overcome the literature gap in the way that no one had investigated before.

According to the previous contributions on Bankruptcy Prediction, no authors have investigated two matched results of different countries. This because no comparison have been carried out yet between two countries which portrait opposite scenarios, so that to enrich existing literature with additional knowledge. As a matter of fact, in this study we have analysed the emerging economy of Turkey which has witnessed a massive growth even within the global crisis period and the declining economy of Italy which has suffered the global crisis. This research seeks to provide an investigation about the impact of the global financial crisis on a sample of Italian and Turkish companies and, more specifically, whether the global financial crisis has increased the number of firms with a high likelihood of failure and, in that way, determining the impact of crisis itself. For the above purpose, we have applied the Z-Scores to the entire population of non-listed public limited companies belonging to the manufacturing industries[14] which operate in Italy and Turkey.

Results Comments. Our results seek to evaluate the impact of global financial crisis on Italian and Turkish non-listed manufacturing public limited companies. As we demonstrate with the Revised Altman's model, the Italian situation is definitely worse than Turkish: the 72.70% of Italian manufacturing companies has a reasonable risk of financial distress while only the 26.68% is the percentage of Turkish companies with risk. The results indicate that the majority of Italian manufacturing companies have been suffering the financial crisis, while Turkey shows an opposite situation.

We generally find that, for both Italian and Turkish manufacturing companies, the model is useful and reliable in predicting bankruptcy because it confirms the economic situation of both countries: the model identify the 22.89% of Italian companies with a high risk of failure ("Alarm area")[15] which demonstrate the effects of global crisis in terms of political instability, economic stagnation and lack of structural reforms. Furthermore, the model identify the 1.63% of Turkish manufacturing companies belonging to the "Alarm area"[16], which are seeing a better situation rather than Italy.

Limitations. Although the study is reliable, several important limitations still exist. Two important limitations should be taken into consideration when it comes to applying the research findings. At first, the prediction of bankruptcy model of Altman depends on Z-Score values lower than 1.23, in between 1.23 and 2.90 and, higher than 2.90. Since the findings depend on Z-Score values, this could make the research findings less reliable because they are strongly linked to Z-Scores and, so, the model offers little flexibility. Secondly, the period of the global financial crisis is debatable since it could vary from country to country. The period is based on the trend in GDP worldwide: as the GDP trend shows there is a huge drop in 2008, we assume it overlaps with the beginning of the crisis.

To conclude, our inferences are based on comparisons of financial metrics for a broad sample of manufacturing non listed firms which operate in Italy and Turkey. Instead of picking a winner between them, more meaningful questions in future research are addressed in the next section.

A. Suggestion for future researches

There is considerable scope for further empirical research along the lines of the Altman model discussed and analysed above.

In the light of our findings, it would be interesting examining the Z-scores trend in the after-crisis years so as to assess whether Turkey, today considered an emerging economy, will still shows the same situation and the relative high Z-score values. At the same time, it would be useful to check whether the new findings will be as much further from Italians as they are in the above analysis. Consequently, it would be possible to determine the trend of the gap between the two European countries and demonstrate the reasonable hypothesis of a potential assessment of the Z-score which, once the global crisis comes to an end, are expected to move towards similar values.

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[14] In this study, Listed companies were excluded because the Revised Altman Model (1993) can not be applied to listed firms (Altman et al., 2013).

[15] In total 72.70% of Italian companies have a reasonable risk of bankruptcy. In this % we consider the companies with scores below 1.23 and, in addition, the companies of the "Grey area" that are near to the value of 1.23. Thus, all the Italian companies with scores lower than 2.065.

[16] In total 26.68% of Turkish companies have a reasonable risk of bankruptcy. In this % we consider the companies with scores below 1.23 and, in addition, the companies of the "Grey area" that are near to the value of 1.23. Thus, all the Turkish companies with scores lower than 2.065.

A promising avenue of research would be applying the Revised Altman's model to other EU countries that are characterized with different economic situation (in recession and in expansion), like Italy and Turkey. It would be interesting to assess the likelihood of bankruptcy occurring in manufacturing sub-industries and in other sectors such as banking and insurance sectors. It would be even useful to focus on a multiple country-setting (EU countries and non-EU countries) in order to analyse the impact of the crisis on the likelihood of bankruptcy in different contexts and compare the findings afterwards.

Furthermore, it would be also useful to explore each indicator of Altman (WC/TA, NP/TA, EBIT/TA, BVE/TL, SR/TA) in order to provide an insight into specific issues that companies are dealing with. In this last regard, we think it would be helpful if we could somehow find a way to consider additional performance indicators which show a probability of failure.

In addition to continued empirical research based on accounting data we also need better integration between different types of research. In addition to accounting data, we need to encourage high quality surveys, more wide ranging interview studies, and a more thorough development of the theoretical foundations of accounting choices.

By summing up, we need research to be more directly linked to policy-making as well as to the change firms behaviours. A greater focus on identifying, disseminating, and encouraging all firms to adopt best practice so as to react to systematic events may be one way to go. In order to apply the suggested research techniques, it would be better to have a going concern perspective and so bankruptcy should be prevented. Where bankruptcy cannot be avoided for either internal or external factors, we may need to pay more attention to the tails of bankruptcy prediction distribution. What causes the worst form of Bankruptcy and what can we do to prevent it? What causes the best firms to show low probability of bankruptcy, and how can we encourage other firms to emulate them? With regard to future research, these questions are the next challenge which should be taken up.

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Tables and Charts

- *Table A – Original and Revised Z-Score*

Original Z-Score (Altman, 1968)		Revised Z-Score (Altman, 1993)	
Coefficient	Ratio	Coefficient	Ratio
1.2	Working Capital / Total Assets	0.717	Working Capital / Total Assets
1.4	Retained Profit / Total Assets	0.847	Net Profit / Total Assets
3.3	Operating Profit (EBIT) / Total Assets	3.107	Operating Profit (EBIT) / Total Assets
0.60	MVE / Total Liabilities	0.420	BVE / Total Liabilities
0.99	Sales Revenues / Total Assets	0.998	Sales Revenues / Total Assets
Original-Z = 1.2X₁ + 1.4X₂ + 3.3X₃ + 0.60X₄ + 0.99X₅		*Revised-Z = 0.717X₁ + 0.847X₂ + 3.107X₃ + 0.420X₄ + 0.998X₅*	

- *Table B – Economic Indicators in Italy and Turkey over the last five years*

	ITALY*					TURKEY**				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Population (million)	59	59.2	59.4	59.4	59.7	72.1	73	74	74.9	76.5
GDP per capita (EUR Italy, USD Turkey)	26,653	27,099	27,616	27,407	27,121	8,509	9,983	10,437	10,509	10,738
GDP (billion)	1,573	1,604	1,639	1,628	1,619	613	728.8	771.8	787	821.3
Economic Growth (GDP, annual variation in %)	-5.5	1.7	0.7	-2.3	-1.9	-4.8	9.2	8.8	2.1	4
Domestic Demand (annual variation in %)	-2.9	0.7	-0.7	-4.2	-2.8	-7.4	13.5	9.5	-1.8	6.7
Consumption (annual variation in %)	-1.5	1.3	0	-4.1	-2.7	-2.3	6.7	7.7	-0.5	5.1
Investment (annual variation in %)	-10	-0.6	-1.7	-7.5	-5.4	-19	30.5	18	-2.7	4.2
Industrial Production (annual variation in %)	-18.7	6.7	1.2	-6.4	-3.1	-10.4	12.4	9.6	2.5	3.4
Unemployment Rate	7.8	8.4	8.4	10.7	12.2	13	11.2	9.2	8.4	9.1
Fiscal Balance (% of GDP)	-5.5	-4.5	-3.7	-3	-3	-5.5	-3.6	-1.4	-2.4	-1.2
Public Debt (% of GDP)	116.4	119.3	120.7	127	132.6	46	42.3	39.1	36.2	36.3
Current Account (% of GDP)	-1.9	-3.5	-3.1	-0.5	1	-2	-6.2	-9.7	-6.2	-7.9
Current Account Balance (billion)	-30.4	-55.7	-50.4	-8.2	16.6	-12	-45.3	-75.1	-48.5	-65
Trade Balance (billion)	-5.9	-30	-25.5	9.9	29.2	-24.8	-56.3	-89.1	-65.3	-79.9
Exports (billion)	405.9	447.9	521.9	500.1	517.9	109.7	121	142.4	162	161.8
Imports (billion)	413.9	488	557.4	487.6	479.2	134.5	177.3	232.7	228.7	243.6

*Data in € **Data in USD*

- *Table C – Sampling process*

Countries	Italy and Turkey	
Standardized Legal Form	Public Limited Companies (Listed Companies were not included)	
Industry Sector	NACE Rev.2 main section: C. Manufacturing Companies	

- *Table D – Sample selection process*

	TOTAL	ITALY	TURKEY
Companies in total	10,973	9,911	1,062
Out of sample	289	149	140
Companies with data available	10,684	9,762	922
Coverage	97.37%	98.50%	86.82%

- *Table E – Clustering made by Altman (1993)*

- *Table F - Re-clustering analysis using the central value of the range.*

- *Table G – General Results of Italian and Turkish Manufacturing companies*

	TOTAL		ITALY		TURKEY	
Companies belong to "Safe area"	802	7.51%	582	5.96%	220	23.86%
Companies belong to "Grey area"	7,632	71.43%	6,945	71.14%	687	74.51%
Companies belong to "Alarm area"	2,250	21.06%	2,235	22.90%	15	1.63%
Total	10,684	100.00%	9,762	100.00%	922	100.00%

- *Table H – Spreading of Grey Area*

	TOTAL		ITALY		TURKEY	
Companies close to "Safe area"	2,603	34.11%	2,127	21.79%	476	51.63%
Companies close to "Alarm area"	5,029	65.89%	4,818	49.35%	211	22.89%
Companies belong to "Grey area"	7,632	100.00%	6,945	71.14%	687	74.52%

- *Table I – General Results of Italian and Turkish Manufacturing companies*

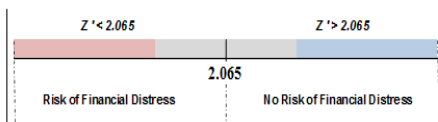|	TOTAL		ITALY		TURKEY	
Non-listed manufacturing companies with data available	10,684	100.00%	9,762	100.00%	922	100.00%
Companies with no risk of financial distress (Z' > 2.065)	3,341	31.27%	2,665	27.30%	676	73.32%
Companies with a reasonable risk of financial distress (Z' < 2.065)	7,343	68.73%	7,097	72.70%	246	26.68%

- *Table L - Groups of Risk and No Risk of FD in Italy and Turkey*

- *Table M – Results on trend analysis*

	2013	2012	2011	2010	2009	2008
ITALY_risk	67.75%	71.73%	71.23%	73.87%	76.05%	66.86%
ITALY_no risk	32.25%	28.27%	28.77%	26.13%	23.95%	33.14%
TURKEY_risk	24.30%	29.83%	34.38%	35.57%	29.93%	22.34%
TURKEY_no risk	75.70%	70.17%	65.62%	64.43%	70.07%	77.66%

Appendix A - *Global Standards format from Amadeus database: Income Statement, Assets and Liabilities*

Income **Statement**

Operating revenue (Turnover)

Sales

Costs of goods sold

Gross profit

Other operating expenses

P/L [=EBIT]

revenue

before tax

Taxation

after tax

and other revenue

and other expenses

and other P/L

for period [=Net income]

Assets

Fixed assets

Intangible fixed assets

Tangible fixed assets

Other fixed assets

Current assets

Stock

Debtors

Other current assets

Cash & cash equivalent

Total assets

Liabilities & Equity

Shareholders funds

Capital

Other shareholders funds

current liabilities

Long term debt

Other non-current liabilities

Provisions

Operating   Current liabilities

Financial   Loans

Financial   expenses   Creditors

Financial   P/L   Other current liabilities

P/L   Total shareh. funds & liab.

Non-

P/L

Extr.

Extr.

Extr.

P/L

Appendix B - *Control Sample. Testing Revised Altman's model on public limited companies of "Manufacture of food" bankrupted in the period 2008-2013*

Food Industry – Data

PLC Bankrupted	242
Missing Values	51
Companies with Avail. Scores	191
Coverage	**78.93%**

Food Industry - Results

Companies with Low Risk of Failure	12	6.28%
Companies in Grey Area	27	14.14%
Companies with High Risk of Failure	**152**	79.58%
Total	**191**	100.00%

Appendix C - *Average Scores of Revised Altman's model*

	2013	2012	2011	2010	2009	2008
ITALY	1.863	1.769	1.989	1.844	1.712	1.956
TURKEY	2.583	2.725	2.672	2.320	2.639	2.709

Appendix D - *Trend of companies with risk and no risk of financial distress in Italy and Turkey*

Appendix D - *Trend of companies with risk and no risk of financial distress in Italy and Turkey*