Determinants and Impacts of Internal Credit Rating

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Abstract

This study enrich the research in the area of credit rating by adding supportive power to the explanation of using factors which have an influence on the CR. Such a power can increase the awareness of the current situation of CR as a subject in one of the developing countries that has unique political and economic characteristics. The results in summary confirm that firm characteristic variables have a significant impact on CR. Profitability is positively associated with CR for all models, while leverage and loss propensity are associated negatively with CR for all (or nearly all regarding loss propensity) models. However, capital intensity is not important. Only size and growth potential (Tobin's q) are very strongly positively associated with CR. By contrast, type of sector and audit are not related to CR.

Keywords: Numerical score rating, Internal credit rating

1. Introduction

The credit rating of a firm plays an important role not only in evaluating accounting and financial information in order to provide a rating, but also through the rating itself in adding to the information set available to bondholders and other stakeholders of the firm. It is purported that investors need this credit rating to increase their ability to make useful decisions.

Many studies have discussed credit rating in many countries, for example US (Blume et al., 1998), UK (Abams, M and Hardwick, P, 2003) and Australia (Gray et al., 2006), but regarding Jordanian firms this research did not find any such study, Jordan is an interesting choice as a result of the changes in the Jordanian economic environment, the newly established Jordanian capital market, and the developments of technological communication investments, which provide a suitable environment for the current empirical investigation of this study.

The credit risk assessment of a firm plays an important role not only in evaluating accounting and financial information in order to provide a rating, but also through the rating itself in adding to the information set available to bondholders and other stakeholders of the firm. It is purported that investors need this credit rating to increase their ability to make useful decisions.

Fast changes in global businesses affect most countries and Jordan is no exception. These developments impact upon the needs of Jordanian users of CRs' information given to different stakeholders including, for example, bondholders, investors and shareholders. Due to the nature of the provision of that information they may look forward to receiving high quality information about the financial and accounting position which may help them in their decisions. Consequently, CR assessments have expanded in Jordanian corporations as an effective tool for supporting required new information in assisting investors.

The objective of this study is to evaluate the impact of the firm characteristic factors upon the CR of Jordanian firms, after allowing for firm specific factors and examine the extent to which the varied dimensions.

2. A Brief Review of CR Literature Background

Currently, CR represents one of the most important financial issues due to the recent economic crises. Evaluating the financial trustworthiness for companies is a major concern for CRAs which represent one of the key communication vehicles in providing an independent evaluation of the probability of default on bond issues, as such providing information to debt-market participants additional to publicly available sources (e. g., Reiter and Zlebart, 1991).

A number of studies have provided definitions of credit ratings of various CRAs, such as Standard and Poor's, Moody's and Fitch, as well as definitions by the agencies themselves (For example, Belkaoui, 1980; Cantor, 1994; Steeman, 2002; Fight, 2001; Gonzalez, 2004). These will be discussed shortly. It is important to appreciate that CRAs provide views to help investors identify risks, particularly on the most serious default, indicate the quality of long-term debt through the agency's unpublished forecast, and estimates through the characteristics of future cash flows relevant to the type of funding (Belkaoui, 1980).

The first CRA in the world was established in the 1909 in US by John Moody for the American railway companies bond rating (Partnoy, 1999; Sylla 2001). John Moody issued the first CR to cover the creditworthiness of bonds Railway Company to help bondholders in their investment decision (Fight, 2000). CRs used to cover only estimate ratings in the United States because it had the largest bond market than anywhere else in the world, and there were rising levels of income in the US which by 1909 broadened the investor base through the US corporate bond market, essentially US railroad bond market (Sylla 2001). This remained so for 50 years, and during this time the ratings industry was smaller than today, being confined to the railway sector (Sylla, 2001). Moody's did not rate US state and government bonds until 1919 but earlier in 1910 they extended their coverage to utility and industrial bonds. In the 1920s, Moody's alone rated more than 3,000 issuers in the US (Moody's, 1997). At that time the number of competitors was very small. Moody's and Poor's were publishing standard statistics, and in 1924 Fitch Publishing Company joined the market (Sylla, 2001).

The importance of CR has increased in the recent years for many reasons. This is attributed to the increasing pressures on companies and managers of firms to reach higher levels of accountability resulting from an increase in the level of competition between companies, and an increased desire of various stakeholders to obtain a justifiably high credit rating from one or more agencies approved by Nationally Recognized Statistical Rating Organization (NRSRO). Therefore, companies compete with each other to get higher scores. The first goal of a firm's financing strategy is to achieve the desired rating from one of NRSROs, indicating financial soundness, efficiency of internal control systems and more general managerial competence, providing a good signal to the external environment (e. g. investors) through the level of CR (Cantor, 1994; Gonzalez, 2004). A number of researchers have illustrated the importance of CR in finance (for example, Sherwood, 1976; Kaplan and Urwitz, 1979; Belkaoui, 1983; Ederington et al., 1987; Pottier, 1998; Pottier and Sommer, 1999; Gabbi and Sironi, 2002; Gonzalez, 2004).

Many changes in the business environment have caused pressures on changing CRs. Examples of these changes are: the increase rate of complexity in operating businesses, the growth and globalization of capital markets and the rapid growth of knowledge-based industries. Accuracy in CRs is very important for it is reflected on financial markets through CRAs that act as a gateway to the financial markets in a similar way to securities' analysts, although not auditors.

Therefore, the reputation of the agency is established through accurate CRs. An objective evaluation of CRs can assist financial markets so there is a need to provide adequate and useful information on CRs to investors, because the investors do not have the fundamental knowledge of CRAs to penetrate the information complexity of firms (Coffee, 2006).

Evaluations assist all stakeholders and users. Financial statements and other statements are no longer enough to meet the needs of all users, and so a CRA will supply a report providing valid and pertinent additional information on the organization (Sherwood, 1976; Belkaoui, 1983; Ederington et al., 1987; Pottier, 1998; Pottier and Sommer, 1999). Therefore, it can be said that credit rating will help in improving the efficiency of financial statements in specific and accounting in general terms.

Kliger and Sarig (2000) focus on the effect of capital market reactions of stock and bond prices through changes in CRs, including interactions between the external value of outstanding debt and any inverse impact on the value of outstanding equity. They call for greater of use of CRs capital market, more frequent credit ratings and less aggregated announcements of rating change.

A credit rating effect on stock return, from a change in the level of CR, on the day of the announcement of a change in bond rating can be either positive or negatively; indeed, downgrades of CR are bad news for all stakeholders, including bondholders and shareholders (Holthausen and Leftwich, 1992; Matolcsy and Lianto, 1995; Barron et al., 1997). On the other hand, some authors have argued that bond downgrades have a negative effect on excess stock returns, but not for all bond downgrades; consequently, these effects depend on the degree of downgrade (see Goh and Edderington, 1993). These impacts are useful in raising awareness of the potential impact of these CRs on capital markets. For example, Estrella (2000) and Van Duyn (2002) expect useful expansion in firm coverage by CRAs in the near future as useful information to all stakeholders, not just investors. He also shows that the formation of CRs has spread widely in

the financial markets and will increase in the future. But consequent upon the rapid widespread use of the CRs as a medium of information for financial markets, stakeholders are beginning to question high CRs and thus the suitability and quality of CRs score.

The issues of relevance and usefulness of CR assessments have become very vital in today's corporate environment as well for the regulatory bodies, especially due to crises and failure of some major corporations. Therefore, Securities and Exchange Commission (SEC) believes that their bilateral monopoly of the financial markets by Standard and Poor and Moody's is a real threat through their negligence in determining the degree of real financial stability, as in the case of Enron and WorldCom, for their evaluations could have previously been more accurate (SEC, 2003b).

CRs have been described as "information equalizers" in their very important roles that are crucial to understanding companies' risks and potentials, especially concerning future cash flows; and are important for new bond issues, because all investors should be looking to the CRs as a criterion for investment decisions and reviews on pricing, thus demonstrating the key role of CRs in presenting such information to investors (see Nayar and Rozeff, 1994; Gonzalez, 2004; Boot et al., 2006).

Furthermore, there is a relationship between CRs and yield spreads, as realized yields on new debt issues reflect the quality of credit ratings via the cost of debt and price adjustments on the financial markets. So CRs are important determinants of the differences in yield spreads, for credit spreads rise as ratings deteriorate, and capital markets seem to validate the agencies' decisions by pricing lower rated bonds at higher average yields, and for new debt issues higher rated bonds at lower bond yields (see Altman, 1989; Cantor, 1994; Cantor and Packer, 1995; Sengupta, 1998; Bhojraj and Sengupta, 2003).

Credit ratings play a strong pivotal role in the financial capital market since they are important to all stakeholders, including investors who are looking to the CRs as guides to the credit risk of an issuer. As such they also demonstrate their key role in presenting this information to institutional investors, banks, and firms. Consequently, credit risk management of an organization is founded upon CRs, and the issuance of bonds in any market is now heavily dependent on the outcome of this evaluation.

The credit quality of an issuer is perceived from the CR; more specifically, CRs play a verification function in the fixed income markets by providing a clear assessment of credit through an alphabetical rating of debt, which indicates the degree of investment or speculative grade within a narrow sub-category (Steeman, 2002). The regulation of CR will be discussed in the next section.

The CRs should reflect future cash flows to the firm, and gives the likely result of exposed corporate bankruptcies, although CR agencies argue that ratings do not infer corporate bankruptcy risk. A higher CR is a result of perceived strong future cash flows to the firm, and favourable financial accounting assessments. At the same time, a lower rating is more closely related to default, through poorer anticipated future cash flows than a higher rating (Gray*et al*., 2006).

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Prediction of bankruptcy should clearly have a crucial impact on a firm's CR. So, bankruptcy models play an important role in measuring and monitoring credit risk (Stein, 2002). Many previous studies contain a number of different measures and different models, which use financial accounting ratios and different information dependent on the available information on companies to predict a firm's credit rating and possible bankruptcy. Altman (1968) who is the pioneer for this branch of research explained corporate bankruptcy status in the US based on a set of accounting and financial variables and thereby improved the accuracy of traditional ratio analysis.

Given small differences in categorization classes, prediction of CRs is more complex than the prediction of bankruptcy, and tries to quantify the relationship between financial and industry data and CRs. Studies of bond rating prediction models for at least 40 years have been published, attempting to model agency credit ratings using financial ratios, non financial data, and qualitative information. A wide range of different methodologies has been used, which have evolved and become more sophisticated over time. Like the bankruptcy prediction models presented in the last review, CRs predictor models are vital for assessing and monitoring risk, A number of early studies have developed a statistical model based on historic and publicly available information, which helps in predicting the credit rating and chose either a regression-based approach (Pogue and Soldofsky 1969; West 1970) or multivariate analysis (Horrigan, 1966). These studies assess credit rating applying available financial accounting information to both qualitative and quantitative methods, for example, through the use of a number of financial ratios such as net working capital, long-term debt/assets,

and net income/total assets to replicate CRs. The relationship between CR and financial and industry data is widely reported in literature studies, and analysed through categorical dependent variables through appropriate econometric techniques.

Accordingly, Horrigan's (1966) two-step analytical approach was the first and main early study in this area to estimate and determine the characteristics of the bond issuing firms in order to predict their bond rating based on their financial ratios and characteristics of the bond rating. He used ordinary least-squares (OLS) regression on 9 grades of bond ratings with various combinations of variables, from selected accounting data, to predict the ratings of newly issued bonds as well as any changes in bond rating from 1961-1964. He could explain 65% of variation in the dependent variable and found that total assets had the most significant impact on bond ratings. The result of these predictions was correct for 58% of the Moody's rating and for 52% of Standards and Poor's rating. However, since Horrigan's study there arescores of studies that have extended his initial research using more sophisticated statistical techniques, such as logistic regression and probity models as discussed later, and a wider range of accounting and non-accounting variables.

Ederington (1985) used an unordered multinomial logic model in his comparison of bond rating models comparing this to each of the statistical methods discussed so far. An unordered model allows the relative importance of different independent variables to vary across rating classifications but does not make use of the a priori knowledge that bond ratings are ordered. Ederington found that the ordered probity and unordered logic outperformed the models estimated using ordinary least square (OLS) and multiple discriminate analysis (MDA). The logic model performed best in the estimation sample where 70% of ratings were correctly classified, and on average probity and logic analysis correctly classified and about 14% more of the ratings than OLS or MDA. Gentry, Newbold and Whitford (1988) also compared these three methods in the analysis of bankrupt firms using cash flow data and confirmed the superiority of probity.

3. Research Hypotheses and Methodology

The main hypothesis is there is a significant relationship between CRs and firm characteristic variables of the Jordanian listed companies.

The source of research data from the Amman Stock Exchange (ASE) database, and internal numerical credit rating data from the World'Vest Base (WVB) rating. Fortunately, for each firm a separate numerical score was also supplied by the rating agency and so instead of using only an ordered logistic regression model for four categories, I will also able to apply ordinary least squares, which was able to capture finer distinctions in the assessments. This is a substantial advantage over many of the previous studies that have been reviewed earlier, for instead of just a couple or several categories, I utilized hundreds of distinctly separate (numerical) ratings.

The availability of continuous numerical credit risk assessment scores obtained directly from WVB enables more rigorous statistical testing to be undertaken. The ordinary least square (OLS) technique has been applied to develop the firm rating model, which suffers as explained before from some problems in its assumptions. The structure of CRs, however, presents several econometric issues.

The current study draws upon the long-term CRs according to WVB credit risk ratings for using four groups from classes represented by letters arrayed downwards from BB1 (the best rating) to D (payment is in default-bankruptcy), details of which are given at below:

(Near-term vulnerability to default than other speculative issues): when DS > 5.25 and DS <= 5.65 then BB1; when DS > 4.95 and DS <= 5.25 then BB2; when DS > 4.75 and DS <= 4.95 then BB3.

(Speculative): when DS > 4.5 and DS <= 4.75 then B1; when DS > 4.15 and DS <= 4.5 then B2; when DS > 3.75 and DS <= 4.15 then B3.

(Highly speculative); when DS > 3.2 and DS <= 3.75 then C1; when DS > 2.5 and DS <= 3.2 then C2; when DS > 1.75 and DS <=2.5 then C3.

(Bankruptcy): when DS <= 1.75.

The proxy firm-specific explanatory variables are included in the rating models based on a survey of prior research on the determinants of corporate credit ratings for firm characteristics variables (e.g., Horrigan, 1966; Kaplan and Urwitz, 1979; Lamy and Thompson, 1988; Ziebart and Reiter, 1992; Blume et al., 1998; Adams et al., 2003; Pettit et al., 2004; Altman and Rijken, 2004; Demirovic and Thomas, 2007). Table summarises the operationalistion of the independent variables that determine CR.

<Insert Table 1 Here>

Many techniques will be used in the current study. Bivariate analysis is used for each independent variable's association with CR, by using parametric and non parametric tests.

The ordinary least squares (OLS) model of the current study can be illustrated as follow:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_8 X_{8i} + \varepsilon_i$$

Where Y is credit rating (numerical score), i is number of company, α is the intercept, $\beta_1, \ldots, \beta_8$ are the coefficients of the independent variables, $X_1, \ldots, X_8$ are the explanatory variables and ε is the error term.

Each model containing five continuous variables (X_1 = Leverage, X_2 = Profitability, X_3 = Capital intensity, X_5 = Company size, X_6 = Tobin's q) and 4 categorical variables (X_4= Loss propensity, X_7 = Type of sector, and X_8 = Audit type).

4. Univariate and Multivariate Regression Analysis

4.1 Descriptive Analysis

According to the population of this study, the percentage of Jordanian firms which have a WVB_CR 85% for 2005, 82%for 2006 and 79% for 2007. The CRs of this agency are spread from a minimum of category D to a maximum of category BB. The percentage of Jordanian firms with CRs scores from BB3 to BB is 9.45%, whilst for firms with CRs from B3 to B it is 10.4%, on the other hand 56.45% have CRs from C3 to C but 23.75% have a D credit rating. The mean for all Jordanian firm CRs is C2. It can be observed that a significant minority has a very low rating. (Table 2 presents the sector credit ratings).

<Insert Table 2 Here>

The classifications of the sectors are as per the ASE. The table shows that CR firms are spread across the sectors but a large proportion of the sample comes from the following sectors: Financial (38%), Industry (37%). This is mainly because of the ASE where some of these sectors have experienced a rapid growth. It can see that as to the CR in the BB3-BB category there are more in the finance sector, namely, 11.87%, compared with service of 6.81%, but as a proportion of all sectors in the same category it is 4.76% for financials, 1.73% for service, and 8.49% for industry.

It is quite interesting to note that on the D credit rating that a significant minority has a very low rating, namely 23.75% for all sectors, comprising financial 7.45%, service 5.55% and industry 10.75%, but as a proportion of its own respective compare with each sector the figures are: financial 19.63%, service 21.2% and industry 29.25%. We find that the financial sector has the majority from category C3-C for all sectors namely, CR 21.14%, compared with service 15.9% and industry 19.41%, while within each sectors they are 55.71% for financial, 63% for service and 52.83 for industry. Finally, the B3-B category accounts for 10.40% of all categories, broken down into: financial 4.85%, service 2.08% and industry 3.47%, and within each sector financials have 12.79%, service 8.22% and industry 9.43%.

Table 3 shows summary statistics of the independent continuous variables in the study. The first variable is the size (total assets), that averages (median) total assets 42,802,317 JD (16,399,646 JD). Total assets for the sample range from 473,221 to 42,802317 JD with a high standard deviation of 8.361. Large firms gain from economies of scale and are stronger in facing default risk, enjoy high CRs, have lower risk, are likely to have a good reputation, have more stable future cash flows and face fewer hazards of being liquidated, while the average (median) capital intensity 0.08 (0.04), which means that 92% of a firm's assets are fixed assets with a low standard deviation 0.249 and coefficients of variation 0.77. Unexpectedly, it has been noticed that industrial firms have lower fixed assets than non-industrial firms. The average (median) leverage is 31.71% (29.00). Profitable firms are stronger in facing financial distress and continuing in the future than unprofitable firms. The mean for the net profit margin is 0.47,and its median is 19.10, with a standard deviation of 0.744; net profit margin for the sample ranges from 0.001 to 7.155, and finally the average (median) Tobin's *q* is 1.60 (1.41). Tobin's *q* for the sample ranges from 0.039 to 1.61 with a high standard deviation of 0.751. Growth opportunities are considered to be an indicator for the firm's success and the level of its profitability; this encourages investors to lend to these firms which might present high growth rates or valuable growth opportunities in the firm's future.

<Insert Table 3 Here>

<Insert Table 4 Here>

<Insert Table 5 Here>

According to the Pearson product moment and spearman rank correlation coefficients, firm size (total assets) and growth opportunity (Tobin's q) are each significantly related to the CR score at 1% level of significance. So, larger firms with better growth opportunities, which may be considered to be an indicator for the firm's creditworthiness,

reflect better CRs, which should encourage investors to lend to these firms with confidence in their stability and future growth opportunities. Under the one criterion, namely, the Spearman rank order correlation coefficient, profitability is also significant at the 1% of significance, which is consistent with rational economic thinking.

4.2 Multivariate Analysis: Ordinary Least Squares (OLS) Regression

The residuals of the dependent variable are approximately normally distributed.

According to the current study there is no multicollinearity problem between the continuous independent variables, this means that the explanatory variables are sufficiently independent of one another.

<Insert Table 6 Here>

<Insert Table 7 Here>

Residual plots indicated some non-linearity, which are later corrected by transforming variables. A number of log transformations are undertake in line with the recommendation by Field (2007).

4.3 Results of the OLS Analysis

The first model was run with un-transformed data. As explained earlier, non-linearity between independent and dependent variables can cause too much positive or negative clustering of residuals. By transforming some variables, typically through log transforms, this potential problem can be much reduced. This model incorporates transformed data for variables-measurement. The results of these models are explained in the following tables:

<Insert Table 8 Here>

As indicated from Table above, the adjusted R-squares were around 50% for untransformed data, which improved to around 60% for the transformed data, comparable with previous studies. That (Horrigan 1966; Thomas et al., 1967; and Skaife et al., 2006) had R-squares of 48%, 56%, 60% adjusted R-square of the model of the current study is acceptable.

According to the accounting and financial variables of the first category in first model, just leverage and profitability have a significant relationship at a level of 1% and 5% significance, respectively, with CR, while three out of four variables in the second model were found to be significant and represented leverage, and profitability and loss significant at the 1%, 5% and 10% level of significance, respectively. Thus, leverage, profitability, and loss propensity are important determinants of WVB credit risk assessment in descending order.

Concerning the market and regulatory category, two out of four variables in both models were found to be significant, the findings providing evidence for the influence of these variables on CR, and represent firm size and growth opportunities, which are associated and positively significant at the level 1% of in both models, except at 5% level of significance for growth opportunities in the first model with CR. This implies that firm size and growth opportunities have a role to play in the determination of WVB credit risk assessments.

5. Discussion of the OLS Results and Conclusion

As in the previous section, the untransformed and transformed models are used for this analysis. The focus here is on the significance of the variables that influence the CR, discussed according to the different groups of explanatory variables.

The profitability and loss variables demonstrate different results between bivariate and multivariate analyses. The reason for finding a potentially significant association between any independent and dependent variables in the multivariate analysis which not appear in the bivariate analysis is due to the possible impact of the combination of other variables in the multivariate analysis (OLS) on the significance of this variable. On the other hand, when a significant association appears in the bivariate analysis which is not in the multivariate analysis, this may be due to the multicollinearity (even if minor) between the independent variables which explain the lack of significance of this variable (Hosain et al., 1994).

Where there are differences between the findings of bivariate and multivariate analyses regarding some variables, the emphasis will be given to the multivariate analysis for the determinants of CR in the Jordanian context by examining groups of variables simultaneously.

Multivariate analyses have supported the influence of leverage on the Jordanian listed companies' CR being significantly negatively related to CR at the 99 per cent level of confidence and as expected, there is a clear inverse relationship between financial risk, as evidenced by the relative debt level, and the firm's CR. Bivariate and multivariate analysis indicate that loss propensity has a negatively significant effect on CR at the 99% and 90% level of confidence, respectively. A negative effect supports the disciplining of management hypothesis in that managers

would be constrained in their financial decisions, on behalf of the company, because of a lower CR caused by the losses incurred and would be disciplined to help enable the firm to perform better.

No empirical evidence, whether based on bivariate or multivariate analysis in the current study, have been found to support the relationship between the Jordanian listed company's capital intensity and CR. One observation is that in the Jordanian data-set the level of fixed assets appeared to be relatively small.

It can be seen that all the market and regulatory variables have a significant impact on CR at the presented levels and mainly at the 99% level of confidence in both bivariate and multivariate analyses-except type of sector and type of audit variables which have a significant influence in only the bivariate analysis.

The results of the bivariate and multivariate analyses reveal a positive relationship between the firm's size and CR. All these results are statistically significant at the 99% level of confidence. The results show that larger the size of the total assets of Jordanian listed companies is an important criterion in determining a higher CR. This supports the signalling theory, which assumes that large firms are stronger when facing bankruptcy and financial distress through the creation of future cash flows to the firm. Thus, there is an incentive for larger companies to attain higher CRs since this should reduce the cost of capital on account of the lower perceived credit risk there. In addition, for most of these large companies the benefits of high CRs should be reflected in the provision of provide future cash flows to all stakeholders, including bondholders.

Tobin's q (TSQ) is a proxy used to measure the growth opportunities. The results of bivariate and multivariate analyses are highly significant, namely, at the 99% level of confidence. Concerning this growth potential variable, both bivariate and multivariate analyses indicate that Jordanian listed companies with higher growth potential generally have higher CRs as reflected in the positive relationship between the firm's CR and growth opportunities. This positive and significant effect gives support to the argument of signalling theory, which is undervalued on plainly unrecorded. Companies with high growth may signal that to their investors to illustrate their high expected performance which should result in their higher future profits, consequently attracting a higher CR. Also, firms with greater growth opportunities might have lower leverage ratios enabling firms to reduce expensive default risk and reduce the risk of expropriation of wealth to shareholders from bondholders. Indeed, the correlation between growth opportunities and leverage is negative (-.074) although the multicollinearity is not an issue for this data-set.

Type of sector and audit showed incongruous results between bivariate and multivariate analyses. Only bivariate analysis indicates a significant association between type of sector and audit and CR of Jordanian listed companies. Type of sector bears a significant level (at the 99%, 95% confidence level) relationship with CR for non-parametric and parametric tests, respectively; and audit type is significant (at the 99% confidence level) with CR for both parametric and non-parametric tests. The multivariate analysis implies that type sector and type audit has an insignificant impact on CRs in the Jordanian context. This result suggest that it is the quality of the companies rather the quality of the auditing firm, that is important to the CR, although the bivariate (parametric) test reveals same auditing in attracting a big 4 audit company.

The results of the multivariate (but not bivariate) models confidence a strong negative relationship at the 99 per cent level of confidence for Jordanian listed companies. Thus, is not only supported by this analysis, but the results of this study shows consistency with some of the previous studies (Blume et al. 1998; Doumpos and Patsiouras 2005; Skaife*et al*., 2006).

The results of the bivariate (non-parametric) models, supports this hypothesis, as there is a highly significantly positive result at the 99% level of confidence, and the multivariate analysis supports this hypothesis at the 95 per cent level of confidence for all models. These findings which support are consistent with many previous studies (Galil 2003; Pettit *et al*., 2004; Skaife*et al* 2006).

Instead, the results of the bivariate analysis reveal a negative association between capital intensity and CR for three pairs of CR categories at the 95% level of confidence. No empirical evidence based on the multivariate models (U-OLS, T_OLS) in the current study supports the relationship between the Jordanian listed company's capital intensity and CR. The result reveals that the capital intensity of Jordanian listed companies in the ASE has not an impact on CR.

The results of the bivariate and multivariate analyses clearly demonstrate that firm size (log assets) is highly significantly positively related to the CR score. The positive relationship between firm size and CR for the multivariate models in the current study is consistent with many prior studies, (for example: Horrigan, 1966; Kaplan and Urwitz, 1979; Altman and Rijken, 2004; Skaife*et al*., 2006; Demirovic and Thomas, 2007). Consequently, proposing a positive association between the size of Jordanian listed companies and CR can be supported in the current study.

The results of all models namely, bivariate and multivariate analysis support this hypothesis and these results are highly significant positively. Jordanian listed companies with high growth potential have a higher credit rating than those with lower level of growth. This finding is supported by others (Potter and Sommer, 1999; Adams *et al*., 2003). Consequently, the significant association between growth potential of the Jordanian listed companies and CR supports in the current study.

Type of sector and big audit firm propensity show mixed results for the parametric and non-parametric bivariate models. Only bivariate parametric analysis indicates a significant positive association between both type sector and / big audit and the CR of Jordanian listed companies, for which the parametric and non-parametric bivariate analyses indicate a significance at the 99%, and 95% level of confidence, respectively but with different signs. It can be shown that under the multivariate analyses sector type and audit type have insignificant impacts on CR in the Jordanian context. Consequently, the current study fails to find evidence for the theories that explain the relationship between both the type of audit and type of sector of the Jordanian listed companies and CR.

This result suggests that it is the quality of the companies, rather the quality of the auditing firm that is important to the CR, although the bivariate (parametric) test reveals that there is some CR benefit in attracting a big 4 audit company. The binary classification for sector type was one for the financials and zero for the non-financials, the latter covering the service and industrial subsectors. An earlier table revealed that for each sector (financials, service and industrials) the typical classification was C3-C. Although the proportion of firms in higher credit categories was greater for financials than non-financials, the difference was not strong enough to be statistically significant.

According to the above discussion there are (firm size and growth opportunities) variables a strong positive significant association with CR in the Jordanian context in all models. This confirms a role for size and growth opportunities impinging on credit ratings.

As conclusion the results of this research have been confirmed by different techniques using CR internal data models for U_OLS, T_OLS analysis.

The results in summary confirm that some variables have a significant impact on CR. Profitability is positively associated with CR for all models, while leverage and loss propensity are associated negatively with CR for all (or nearly all regarding loss propensity) models, in the Jordanian context. However, capital intensity is not important.

The CRs are applied to numerical data with results for all tow methods (U_OLS, and T_OLS models). Only size and growth potential (Tobin's q) are very strongly positively associated with CR. By contrast, type of sector and audit are not related to CR.

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Table 1. Measurement of independent variables

Variables and Abbreviation		Description
Leverage	LEV	Total debt divided by total assets.
Profitability	PM	Net income before extraordinary items divided by net sales.
Capital intensity	CAP_INTE	Gross fixed assets divided by total assets.
Loss Propensity	LOSS	1 if the net income before extraordinary items is negative in the current and prior fiscal year, 0 otherwise.
Firm size	SIZE	Natural logarithm of total assets.
Growth opportunities	TSQ	Tobin's q.
Industry type	TYP_SECT	1 if firm is a financial sector, 0 otherwise
Audit quality	AUD_BIG	1 if the company is audited by a big four company, 0 otherwise.

Table 2. The rating of different sectors in Amman Stock Exchange CRs Firms

Sector company	D	C3 - C	B3 – B	BB3 - BB	Total
Finance sector	19.63	55.71	12.79	11.87	100%
Finance sector compared with all sectors	7.45	21.14	4.85	4.51	37.95%
Service sector	21.20	63.01	8.22	6.81	100%
Service sector compared with all sectors	5.55	15.90	2.08	1.73	25.26
Industry sector	29.25	52.83	9.43	8.49	100%
Industry sector compared with all sectors	10.75	19.41	3.47	3.12	36.75%
Total observation	23.75	56.45	10.40	9.45	100%

Table 3. Summary statistics of independent continuous variables

Variables	Mean	S.D.	Max.	Min.	Median.
LEV	0.320	0.230	1.170	0.002	29.000
PM	0.470	0.750	7.160	0.001	19.100
SIZE	42802317	8.360	664791204	473221	16399646
CAP_INTEN	0.080	0.081	0.350	0.001	0.040
TSQ	1.610	0.750	5.830	0.039	1.410

Table 4. Bivariate analysis between CR and continuous variables

Variables	Pearson	Spearman
LEV	0.031	0.049
PM	0.049	0.152***
CAP_INTEN	0.028	-0.020
SIZE	0.438***	0.702***
TSQ	0.119***	0.137***

Table 5. T-test and Mann Whitney tests for nominal variables

Variables	T-Test		Mann Whitney test	
	Mean	T. value	Mean Rank	Z value
TYP_SECT		2.064***		-2.058**
Financial	3.073		307.27	
Non-Financial	2.778		277.83	
AUD_BIG		6.959***		-6.689***
Big 4	3.316		331.64	
NB4	2.385		238.45	
LOSS		-3.419		-3.385***
Yes	2.505		249.98	
No	3.035		302.81	

Note: (1) *** significant at 1%, ** significant at 5%, * significant at 10% level of significance.

(2) TYP_SECT= type of sector, AUT_BIG = 4big audit, LOSS = loss propensity.

Table 6. Correlation matrix for independent variables

	profitability	size	capital intensity	Tobin's q
Leverage	-0.137**	0.215**	0.088*	-0.074*
Profitability		-0.060	-0.197**	0.069*
Size			0.085*	0.121**
capital intensity				0.003

The biggest variance inflection factor (VIF) value is 0.90 and the lowest tolerance (1/VIF) is 1.104; consequently no serious multicollinearity, between the independent variables.

Table 7. Multicollinearity test for determinants of credit ratings

Variables	Variance Inflation Factor	Tolerance
LEV	0.788	1.269
PM	0.812	1.232
SIZE	0.518	1.931
CAP_INTEN	0.820	1.220
TSQ	0.900	1.111
TYP_SECT	0.787	1.271
LOSS	0.771	1.296
AUD_BIG	0.820	1.219

Table 8. Full regression models of credit rating score

Variables	Untransformed(U-OLS)		Transformed(T-OLS)	
	Coefficient	t-statistic	Coefficient	t-statistic
LEV	-1.304	-5.310***	-1.766	-6.187***
PM	0.151	2.064**	0.224	2.489**
CAP_INTEN	0.518	0.736	-0.016	-0.381
LOSS	0.171	-1.354	0.267	-1.657*
SIZE	2.133	17.194***	2.991	20.963***
TSQ	0.207	3.00**	0.307	3.788***
TYP_SECT	0.176	1.542	0.0175	1.079
AUD_BIG	0.018	0.167	0.000	-0.002
F-Ratio	28.5		42	
Adjusted R-square	50		60	