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Modelling market implied ratings using LASSO variable selection techniques☆

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ABSTRACT

Making accurate predictions of corporate credit ratings is a crucial issue to both investors and rating agencies. In this paper, we investigate the determinants of market implied credit ratings in relation to financial factors, market-driven indicators and macroeconomic predictors. Applying a variable selection technique, the least absolute shrinkage and selection operator (LASSO), we document substantial predictive ability. In addition, when we compare our LASSO-selected models with the benchmark ordered probit model, we find that the former models have superior predictive power and outperform the latter model in all out-of-sample predictions.

1. Introduction

Recent turmoil in the financial markets has focused attention on the rating agencies and the process by which they assign ratings to firms and their financial obligations. A careful management of credit risk is high the agenda for both market participants and regulators. It is well known that the credit ratings of the top three nationally recognized statistical rating organizations (NRSROs), Standard and Poor's, Moody's and Fitch play a key role in the pricing of credit risk and in the delineation of investment strategies since they measure the firm's long-term ability and willingness to meet debt servicing obligations. As such, the ratings indicate the probability that a given borrower will default. However, the accuracy and the timing of the ratings have been heavily criticized, especially during the most recent financial crisis. It has been argued that the standard agency ratings do not adjust quickly to price changes and therefore may be out of date. In response to these concerns, Fitch has recently developed a new model to derive Market Implied Ratings (MIRs) from bond and equity prices. The obvious advantage of these ratings compared to the conventional agency ratings is that they adjust instantaneously to price changes.

This study offers methodological extensions applying a variable selection approach, the least absolute shrinkage and selection operator (LASSO), and its most promising derivation, the Elastic net, into ordered probit and continuation ratio models, to the task of predicting Fitch's CDS and Equity implied ratings (CDSIRs and EQIRs respectively hereafter). The research aims to exploit the LASSO properties and unveil the underlying structure of CDSIRs and EQIRs.[1] There are several studies that use accounting

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[1] With respect to the latter aim of this study, we do not report estimated coefficients of the prediction models to preserve space. These results are available upon request.

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ratios and other publicly available information in reduced-form models in order to predict credit ratings. These studies use various techniques (OLS, multinomial and ordered logit/probit models) to identify the most important characteristics for predicting bond ratings (see for instance the early studies by Pogue and Soldofsky, 1969; Pinches and Mingo, 1973; Kaplan and Urwitz, 1979; Kao and Wu, 1990). The upshot is that financial healthiness is associated with ratings determination and prediction of default. Another line of research advocates the importance of estimating the models in a dynamic setting and documents a noticeable improvement in the predictive ability of the models once state dependence is controlled for (see Mizen and Tsoukas, 2012). One drawback of the reduced-form models, discussed above, is that they tend to employ many rating predictors as inputs despite the fact that only a sub-set is relevant. This has two critical implications. First, this approach can omit potentially important determinants leading to a decrease in prediction accuracy. Second, given the large number of predictors included, it does not provide a sparse representation, implying that these models cannot be readily used by market participants and rating agencies.

Our approach is mostly related to the literature that examines the determinants of credit ratings, but we add to it in two important ways. First, we make a methodological contribution by deriving a simple and more intuitive, yet innovative model, which is based on the variable selection technique, pioneered the by Tibshirani (1996)—the least absolute shrinkage and selection operator (LASSO). It is well accepted that this selection approach not only helps in identifying the most relevant predictors from an extensive set of candidate variables, but also improves the predictive power (see Fan and Li, 2001; Tian et al., 2015). In addition, LASSO does not require strict assumptions such as a pre-selection of the variables considered and it is consistent statistically as the number of observations approach infinity (van de Geer, 2008). Importantly, LASSO can potentially sidestep the problem of multicollinearity, which is fairly common in probit/logit models, and it is computationally efficient even when considering a large set of potential predictors. Our study is the first, as far as we know, to provide a systematic empirical analysis of LASSO in MIRs forecasts. In doing so, we explore the relative importance of several time-varying covariates from an extensive set of firm-, market-specific and macro-economic explicators used to predict market implied ratings. This is important as we provide a parsimonious set of predictors that can be readily implemented by investors, managers and credit risk agencies.

Second, we use a data-set made up by MIRs instead of the standard long-term ratings. The former type of ratings represents an innovation to the ratings industry to address the issue of staleness in their long-term counterparts. The market implied ratings rely on proprietary and data-intensive rating models that incorporate market information into a model-based credit assessment (see for instance Rösch, 2005; Tsoukas and Spaliara, 2014). The most appealing characteristic of these ratings is that they can adjust instantly to market changes. Hence, we build on the foundations of the literature on implied (or point-in-time ratings) by investigating the forecasting power of models that capture volatile market changes.

To preview our findings, we show that several financial factors along with market-driven and macroeconomic variables contain information about market implied ratings. Importantly, when applying the LASSO techniques, we are able to significantly improve the predictive power of our models in out-of-sample predictions compared to the ordered probit model, which is commonly adopted in the literature. Moreover, we note that the LASSO models with BIC-type tuning parameter selector outperform their LASSO counterparts with AIC-type selector for the dataset and periods under study. Thus, LASSO-selected models display improved forecasting power.

The rest of the paper is laid out as follows. In Section 2 we discuss the relevant literature. Section 3 presents the data and summary statistics. In Section 4 we describe our methodology. In Section 5 we report the empirical results and robustness tests. Section 6 concludes the paper.

2. Related literature

The issue of how rating agencies use public information in setting quality ratings has attracted considerable attention in the literature. In fact, the literature goes as far back as Horrigan (1966). This study presents the first attempt to predict ratings based on the characteristics of the bonds and the issuing firms. The author concentrates on accounting data and financial ratios in order to find the most appropriate predictors. The set of preferred variables contains total assets, net worth to total debt, net operating profit to sales and working capital. Pogue and Soldofsky (1969) also assign ordinal numbers to ratings and investigate different accounting variables as potential determinants. They conclude that the most significant independent variables are long-term debt to total assets, the coefficient of variation of earnings, and total assets.[2] West (1970) challenge Horrigan's study by using another set of explanatory variables namely earnings volatility, capital structure, reliability and marketability. Based on values of the obtained R-squared, the author claims that the proposed model has a better explanatory power.

Pinches and Mingo (1973) adopt a two-stage approach to assign ratings to bond issues. This study attempts to test the predicting ability of a small number of explanatory variables using multiple regression and discriminant analysis. The proportion of correct predictions lie in the region of 70 percent. Moreover, Kaplan and Urwitz (1979) confirm the above studies by using an ordered probit analysis. They show that ratings may be reasonably well predicted using balance sheet information. Other studies that use a small number of explanatory variables (e.g leverage, profitability, interest coverage, firm's size and subordination status) to predict credit ratings include Ederington (1985) and Gentry et al. (1988). The former study uses long-term debt, subordination, total assets and interest coverage as explanatory variables, while the later focuses on subordination, size of issue, debt ratio, cumulative years that dividends were paid and net income to interest.

Blume et al. (1998) depart from the traditional examination of credit ratings determinants by considering whether there is any tendency for a company that maintains the same values of accounting ratios over time to receive a lower rating due to worsening of rating standards. Using an ordered probit analysis they find that rating agencies have changed the way in which they evaluate credit

[2] The study shows that both profitability and coverage ratio are insignificant and quantitatively unimportant.