



Economic benefit of powerful credit scoring

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Abstract

We study the economic benefits from using credit scoring models. We contribute to the literature by relating the discriminatory power of a credit scoring model to the optimal credit decision. Given the receiver operating characteristic (ROC) curve, we derive (a) the profit-maximizing cutoff and (b) the pricing curve. Using these two concepts and a mixture thereof, we study a stylized loan market model with banks differing in the quality of their credit scoring model. Even for small quality differences, the variation in profitability among lenders is large and economically significant. We end our analysis by quantifying the impact on profits when information leaks from a competitor's scoring model into the market.

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1. Introduction

In this paper, we investigate the economic benefit of credit scoring models. Ordinal performance measures such as, e.g., the receiver operating characteristic (ROC) curve, are widely used to assess the discriminatory power of credit scoring and rating models. However, the performance statistics and common lending practice seem to be two separate

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worlds. We show how to reconcile ordinal power measures with metrics like profit and loss. In addition, we present a simple loan market model where banks with different credit scoring models compete for loans. By calibrating the model, we find that higher discriminatory power translates into significant profit improvement.

For banking institutions, loans are often the primary source of credit risk. Traditional lending practice has been to grant loans that have a positive net present value (NPV) and to deny those that do not. Recently, the use of statistical models has increased significantly. To assess the risk of these loans, banks use credit scoring models and credit ratings to estimate default risk on a single obligor basis.

Loans to small and medium sized companies, mostly unrated firms, are an important portion of most banking institutions' portfolios. Since the individual amount of exposure to such firms is often relatively small, it is uneconomical to devote extensive resources to the credit analysis. The credit scoring model should optimize both the likelihood of a bad obligor being accepted and the likelihood of a good obligor being rejected. Similarly, in the case of a pricing-based lending, a credit scoring model with low discriminatory power can lead to underpricing of bad and overpricing of good loans. For a recent survey on the use of credit scoring models, we refer to [Thomas \(2000\)](#) and [Thomas et al. \(2002\)](#).

In evaluating the performance of credit scoring models, it is a common practice to use ordinal measures such as, e.g., the receiver operating characteristic (ROC) curve and its associated discriminatory power statistics. However, it is not a priori clear how discriminatory power is linked to credit decision making and credit risk pricing. Establishing such a link is essential for the profitability of the bank's credit business. If in a market with several suppliers of loans in which, by means of a higher default prediction accuracy, one bank has better knowledge of the quality of loans than its competitors, the information advantage may translate into better profitability figures.

We show how lenders can incorporate the scoring model and its ROC-based performance measure into traditional lending practices, based on NPV considerations. By relating the discriminatory power of a credit scoring model to the optimal credit decision, we derive (a) the profit-maximizing cutoff and (b) the pricing curve. In addition, to analyze the economic impact of discriminatory power, we study a stylized loan market with banks that differ in the quality of their credit scoring model. Already for small differences in the discriminatory power of the credit scoring models, we find that profitability varies substantially among lenders. More powerful credit scoring models lead to economically significant differences in credit portfolio performance. Finally, we study the market impact of a model improvement by one bank. Such an improvement will have a negative impact on the profit of the other competitors. We also study the situation in which information leaks and the competitors obtain perfect knowledge of the improved model. We show that the information leak offsets a large part of the profit increase.

To some extent, our work is motivated by the contribution of [Stein and Jordão \(2003\)](#). In their paper, they provide empirical evidence of the economic impact of differences in discriminatory power between various default models. Their simulation is based on historical data of middle-market financial statement and loan performance data. [Stein and Jordão \(2003\)](#) claim that, due in part to the non-parametric nature of power curves, an analytical exploration of their economic benefits is inherently difficult. By deriving the profit-maximizing cutoff and the pricing curve, we are able to resolve this difficulty. In a similar way and independently of our study, the recent contribution of [Stein \(2005\)](#) also derives a link between the power curve and the pricing of loans. However, our derivation

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