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The estimation of transition matrices for sovereign credit ratings

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Abstract

Rating transition matrices for sovereigns are an important input to risk management of portfolios of emerging market credit exposures. They are widely used both in credit portfolio management and to calculate future loss distributions for pricing purposes. However, few sovereigns and almost no low credit quality sovereigns have ratings histories longer than a decade, so estimating such matrices is difficult. This paper shows how one may combine information from sovereign defaults observed over a longer period and a broader set of countries to derive estimates of sovereign transition matrices.

JEL classification: G15; C25; C11; F34
Keywords: Sovereign default; Credit rating; Credit risk; Ordered probit

1. Introduction

Transition probabilities between different credit ratings play a crucial role in any rating-based credit portfolio model. The difficulty faced by analysts wishing to estimate such probabilities for particular types of obligor, however, is the lack of data. If one is prepared to assume that the same transition probabilities hold for any type of obligor, then one may employ the substantial data sets of ratings histories published

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by the two primary rating agencies, Moody's and Standard and Poor's. The Moody's dataset, for example, includes approximately 60,000 yearly ratings observations if one pools the data for all the individual obligors covered by Moody's since 1970.

However, the Moody's data, like that of Standard and Poor's, is heavily weighted, in the pre-1990 period, towards US industrials. Post-1990, the agencies have rated large numbers of obligors from other countries, but the majority of these have been banks or financials. If one's primary interest is in a specific group of obligors (examples might be European industrials or emerging market sovereigns), the number of annual observations of rating transitions available is quite small. The problem is particularly great if one wishes to estimate transition probabilities for low credit quality issuers in such specific categories since, outside the US, rating agencies primarily rate high credit quality issuers.

This paper shows how one may estimate transition probabilities for an important class of obligors, namely sovereign issuers. Sovereign transition matrices are widely used in credit portfolio modelling and in calculating future loss distributions for pricing purposes. The techniques we develop allow one to combine the relatively small amount of transition data available for sovereigns with information on sovereign defaults for a broader set of countries and over a longer period of time.

More precisely, our approach consists of modelling sovereign defaults and Standard and Poor's sovereign ratings within a common Maximum Likelihood, ordered probit framework. The credit standing of any given obligor in a given year is assumed to be governed by a latent variable consisting of a random error plus an index, $X\beta$, of current and lagged macroeconomic variables including measures of indebtedness.

When no rating is available, the likelihood for a given sovereign is based on whether that sovereign is in default or not. When a rating is available, the likelihood consists of the probability that the sovereign is in the rating category observed. Use of this common framework enables us to pool information from rated and non-rated sovereigns in different years.

Having estimated our model, we employ it to predict which rating category each obligor would have occupied for each year of our sample. Using the "fitted" rating histories generated in this way, we estimate rating transition matrices. The number of observations of forecast rating transitions is considerably greater than the number of observations of actual rating transitions, and it is in this sense that our approach adds information to what one could achieve using naive estimators of sovereign transition probabilities.

The last topic we examine is how one may apply Bayesian techniques to combine the sovereign transition matrix estimates with the additional information supplied by transition matrices estimated from larger samples such as industrial obligors. The approach we describe is based on methods proposed in a different context, namely the Bayesian estimation of contingency tables. Effectively, our approach consists of taking weighted averages of transition matrix estimates obtained in different ways, where the weights are selected in a data-driven way based on a goodness of fit statistic.

One may compare the techniques developed in this article with other recent work on estimation of rating transition matrices with few observations. Lando and Skodeberg (2002) apply continuous-time methods to estimate transition matrices. They