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The Jarrow/Turnbull default risk model—Evidence from the German market

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Abstract

This article estimates default intensities within the continuous-time Jarrow and Turnbull model for German bank and corporate bond prices. It is shown that a joint implicit estimation of the default intensity and the recovery rate is numerically unstable. In addition to cross-sectional estimations, separate estimations (for each bond individually) are performed. Results strongly support separate estimation over the building of any cross-sections. In contrast to preceeding literature, the optimum volume of data required to provide reasonable estimates of the default intensity is also investigated. It is shown that calibration based on daily data as a rule does not minimize the ex ante mean squared pricing errors. Finally, it is shown that the constant default intensity assumption is not sound with the underlying data and the determinants of the default intensity are investigated. Regressions show that the

lagged default intensity estimate, the level of the default-free term structure and liquidity proxies affect the estimated default intensity via joint parameters.

Keywords:

Credit risk intensity-based models Jarrow/Turnbull model term structure of interest rates

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Notes

1. We are aware that the 'default intensity' λ, received by implicit estimation of the Jarrow and Turnbull (1995) model, is not a pure default intensity but it captures also all other factors that drive a wedge between default-risky bond prices and government bond prices. These factors include any tax differences, liquidity differences and differences in systematic risk between default-risky bonds and government bonds (Duffie and Singleton, 1997; Delete; Huang and Huang, 2000; Liu et al., 2004; Prigent et al., 2001; Grinblatt, 2001; Elton et al., 2001). It is to be analyzed in the future whether there are differences in tax treatment or systematic risk between bank/corporate bonds traded in the German market and German government bonds. Furthermore, we consider liquidity differences as plausible. To get more insight into the role of liquidity, we investigate the influence of liquidity proxies on the risk-adjusted 'default intensity' estimate in Section 5.2. An in-depth analysis of the factors behind the

‘default intensity’ is not the purpose of this paper. For the rest of this paper, we stick to the term ‘default intensity’ keeping in mind that non-default factors might be subsumed among this term.

2. Some clarifying statements have to be made with respect to this database:

First, one argument sometimes raised against the analysis of default risk of banks is that banks usually are bailed out and therefore cannot go bankrupt. However, bailing out is no default in the sense of Jarrow and Turnbull (1995) and other credit risk models, as no claims are reduced. One recent and popular example of a bank default, corresponding to the usual definition, is the Barings case in 1995. In addition, analysts forecast that intensifying competitive pressures in the banking sector will provoque an increase in the number of bank defaults. Furthermore, if banks could not default it would have to be argued why banking laws contain insolvency provisions for banks, why secured senior bonds or subordinated bonds are issued by banks and why there are price differences between government bonds and identical bank bonds and within identical bank bonds of different seniority. It is hard to believe that the total of these price differences is attributable to liquidity differences. Also, Kiesel et al. (2003) cannot support the argument, that bank bonds are less risky than non-bank bonds with the same rating.

Second, as the liquidity of bank and corporate bonds usually is smaller than that of government bonds, sometimes researchers use credit derivatives instead of or in addition to default-risky bonds to estimate or evaluate credit risk models (Cossin and Hricko, 2001; Houweling and Vorst, 2005). However, as the credit derivatives market in Germany is only in its infancy and therefore liquidity of credit derivatives is not satisfactory, we decided to use bonds. The same is done by Düllmann et al. (2000) and Houweling et al. (2001), who use German bond data of different rating classes for credit risk analysis.

Third, as regards the rating scale, when available we used the long-term issuer rating from Standard and Poor’s. In a few cases where an S&P rating was not available we used Moody’s senior unsecured rating or the Fitch issuer rating. For bonds issued by a financing subsidiary and guaranteed by the mother, we used the rating of the guaranteeing mother. Most of the issuers remained in one rating class throughout the whole observation period. In a few cases where a rating change has occured during the observation period, we allocated the issuer to the rating class, where the issuer spent most of the time of the observation period, and eliminated from our analysis all days with different rating.

3. We are aware that using this recovery rate might cause distortions, since the $\delta = 0.5$ estimate is derived from the US market and there are differences between bankruptcy legislations in different countries. Unfortunately, the limited number of default observations in the German market prohibits estimation of the recovery rates based on historical default data for bonds traded in the German market. This forces us to rely on the assumption that regarding recovery rate the US experience is a good estimate for the German market. This is also consistent with the Basle 2 provisions of a loss-given-default for bank loans of 50% independent of the country. Furthermore, Moody's (2001) state that there is no reason to assume that the 50% rate does not hold for Germany, thus, when implementing their default risk model for Germany, they also use a 50% recovery rate. Equally, Houweling and Vorst (2005) use a 50% recovery rate for bonds (and credit default swaps) outside the US market.