The data for estimating the German term structure of interest rates

Sebastian T Schich[1]

The choice of securities used in constructing the yield curve from the prices of government debt instruments is important since it affects the estimates. A decision has to be taken on the trade-off between "homogeneity" and the availability of sufficient observations in each range of the maturity spectrum. There is no objective criterion available for determining the optimal choice of data. The following paragraphs describe an attempt to find a compromise solution to these problems.[2]

The available set of data comprises end-month observations of the officially quoted prices ("amtlich festgestellte Kassakurse"), remaining maturities and coupons of a total of 523 listed public debt securities from September 1972 to February 1996. They include bonds issued by the Federal Republic of Germany (Anleihen der Bundesrepublik Deutschland), bonds issued by the Federal Republic of Germany - "German Unity" Fund (Anleihen der Bundesrepublik Deutschland - Fonds "Deutsche Einheit"), bonds issued by the Federal Republic of Germany - ERP Special Fund (Anleihen der Bundesrepublik Deutschland - ERP-Sondervermögen), bonds issued by the Treuhand agency (Anleihen der Treuhandanstalt), bonds issued by the German Federal Railways (Anleihen der Deutschen Bundesbahn), bonds issued by the German Federal Post Office (Anleihen der Deutschen Bundespost), five-year special federal bonds (Bundesobligationen), five-year special Treuhand agency bonds (Treuhandobligationen), special bonds issued by the German Federal Post Office (Postobligationen), Treasury notes issued by the German Federal Railways (Schatzanweisungen der Deutschen Bundesbahn), Treasury notes issued by the German Federal Post Office (Schatzanweisungen der Deutschen Bundespost), and Federal Treasury notes (Schatzanweisungen des Bundes).[3]

The vast bulk of available securities have a fixed maturity and an annual coupon. There are a few bonds with semiannual coupons and special terms, such as debtor right of notice and sinking funds. The differing coupon payment frequencies (annual, semiannual) are taken into account in the calculation of yields. Bonds with semiannual coupon payments were issued until the end of December 1970; they matured not later than December 1980. The debtor right of notice gives the issuer the right to redeem (or call) loans prematurely after expiry of a fixed (minimum) maturity; therefore these bonds are referred to as callable bonds. Such bonds were issued until September 1973 and were traded until November 1988. Bonds with a sinking fund may be redeemed prematurely and in part after a fixed (minimum) maturity. They were issued until December 1972 and traded until December 1984.

In order to obtain a more homogeneous set of data, bonds with special terms and those issued by the German Federal Railways and the German Federal Post Office were eliminated from the original set.[4] The yields of these debt securities are characterised by additional premia compared to debt securities on standard terms issued by the Federal Republic of Germany. For example, the price of a bond with a debtor right of notice can be interpreted as the price of a standard bond minus the price of a call option on that bond. Since this call option has a positive value as long as the volatility of interest rates is positive, the price of the bond with the debtor right of notice is lower and its yield higher than that of a standard bond. As for bonds issued by the German Federal Railways and the German Federal Post

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[1] Deutsche Bundesbank, currently on sabbatical in the Money and Finance Division of the OECD's Economics Department.

[2] No data are available for May 1982. The May 1982 term structure estimates are proxied by the arithmetic average of the estimates for April and June 1982.

[3] For information on individual securities issued after 1984, see Deutsche Bundesbank (1995), pp 81-8.

[4] Another possible source of variation among the yields is the fact that, since the introduction of the Deutsche Terminbörse (DTB), it has been possible to deliver some bonds and Special Federal Notes under bund futures contracts. In particular, bonds with a remaining time to maturity of between eight and a half and 10 years and Special Federal Notes with a remaining time to maturity of between three and a half and five years are candidates for delivery under futures contracts. However, a close inspection of the data did not reveal significant differences due to these characteristics.

Office, they have a rating disadvantage compared to bonds issued by the Federal Republic of Germany because the perceived default risk is marginally higher.[5] In practice, the bonds of the former carry a spread with respect to the bonds of the latter, and this spread varies over time.

The final data set comprises (standard) bonds issued by the Federal Republic of Germany (170 issues), five-year special federal bonds (116 issues), and Federal Treasury notes (17 issues), making altogether 303 issues for the period September 1972-February 1996. A list of the individual securities, as of end-December 1996, is contained in the appendix to Schich (1997).[6] The debt securities available for each month vary considerably over time, especially until the mid-1980s. For example, only a few observations are available at the beginning of the 1970s, the smallest set being September 1972 with just 15 observations. The number of debt securities available grows sharply during the 1970s, increasing (almost) monotonically to more than 80 observations in 1983. During the rest of our sample period, the number of observations available varies between 80 and almost 100.

The observations are in general spaced equally over the maturity range from zero to 10 years. Nevertheless, there are a few gaps in the maturity spectrum at the beginning of the 1970s. Although there are no bonds with a short original time to maturity, the short end of the yield curve is generally well represented by medium- and long-term issues with small residual maturities.

This leads on to the question of the maturity spectrum used. We adopt the Bank of England approach and consider all bonds with a remaining time to maturity above three months. The yields of bonds with residual maturities below three months are excluded because they appear to be significantly influenced by their low liquidity and may therefore not be very reliable indicators of market expectations. Bonds with maturities between three months and one year appear to be more liquid. Including these bonds is at variance with the Bundesbank's former practice of excluding bonds with a residual time to maturity below one year. Although this exclusion would improve the overall fit in terms of the deviations between observed and estimated yields, we do not adopt that strategy here because it implies very imprecise estimates for the one-year yields. Since observations of exactly one year and slightly higher than one year are regularly missing, the estimate of the one-year rate essentially becomes an out-of-sample forecast. This forecast turned out to be often not very reliable. For example, the parametric approach adopted here could produce a "spoon effect", whereby the curve flips up at the short end when observations are sparse, thus resulting in unrealistically high estimates for the one-year rate. As the one-year rate is of special concern to policymakers and is also one of the frequently cited interest rates in reports on the capital market, these properties are particularly undesirable. Thus, bonds with a remaining time to maturity of between three months and one year are included.

Another issue is whether or not the three bonds at the very long end of the maturity spectrum should be included. There is a case for leaving them out because not all of them appear to be very actively traded. However, when the curve is very steep, the observations at the long end help to tie down the 10-year estimates. We follow the practice employed in the past at the Bundesbank and include the long-term bonds as well.

Reducing the sample to the 303 issues improved the fit of the estimates, measured as the deviation between observed and estimated yields. The extent of improvement varied over time and amounted to just 1 basis point on average. It should be noted that the reduction of the sample also rendered convergence of the estimates more difficult. Nevertheless, convergence was achieved in all periods. Thus, the sample of 303 issues seems to offer a good compromise between homogeneity and efficiency in estimation.

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[5] This is supported by simple statistical tests. Regressing separately for various dates the yields of the final set of securities, on the one hand, and of the omitted securities, on the other, on the coupons and maturities, the null hypothesis of equality of the estimated coefficients (Wald test) can be rejected, with the coefficients obtained from the omitted securities being generally higher.

[6] Clearly, in estimating its (spot) yield curve, the Deutsche Bundesbank continuously updates the list of securities.

References

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