Claus Brand

Money Stock Control and Inflation Targeting in Germany

A State Space Modelling Approach to the Bundesbank's Operating Procedures and Intermediate Strategy

With 24 Figures and 26 Tables

Physica-Verlag
A Springer-Verlag Company

Contents

1. Introduction **1**
1.1 Intermediate strategies for monetary policy 1
1.2 The role of the Bundesbank 3
1.3 The methodological framework 4

2. Measuring monetary policy: Operating procedures and intermediate strategies 7
2.1 The conduct of monetary policy in Germany 7
2.1.1 The practice of monetary targeting 7
2.1.2 The development of instruments for monetary control. 19
2.2 Operating procedures and money supply 30
2.3 A note on the identifiability of mone]' demand 32
2.3.1 The identification problem 32
2.3.2 Money demand and monetary policy rules 33
2.3.3 Tracing the supply side using bank reserves? 34
2.4 A note on the identifiability of autonomous monetary policy actions 35
2.4.1 Common identification problems in *VARs* 35
2.4.2 Identifying monetary policy regimes 37
2.4.3 Narrative approaches 39
2.4.4 Unresolved issues 39
2.5 Evidence from recent empirical analyses of German monetary policy 40
2.5.1 Was there no role for monetary aggregates in Germany? 40
2.5.2 Did the Bundesbank pursue a Lombard rate regime? .. 41

3, **Theoretical framework** 45
3.1 Basic considerations 45
3.2 Interest rate operating procedure (from 1985 on) 47
3.3 An alternative approach: reserves targeting 49
3.4 Discount window borrowing procedure (1975-1984) 51
3.5 Concluding remarks 52

4. Analysis of time series using linear state space models 53
4.1 Basic concepts . . . 53
4.1.1 Common approaches to multivariate time series analysis 53
4.1.2 The system theoretic approach . . . 54
4.1.3 Filtering and smoothing . . . 55
4.2 The linear state space model . . . 55
4.3 Specific properties of the linear model . . . 58
4.3.1 Innovation state space representation . . . 58
4.3.2 Linear state space models and time series models . . . 59
4.3.3 Minimality . . . 64
4.4 Signal extraction using the Kalman filter . . . 67
4.4.1 Filtered forecasts . . . 67
4.4.2 Smoothed forecasts . . . 70
4.4.3 The use of the Kalman filter in econometrics . . . 70
4.5 Structural analysis . . . 71
4.5.1 Impulse-responses to orthogonal innovations . . . 71
4.5.2 Impulse-responses to non-orthogonal innovations using a Wold-ordering scheme . . . 72
4.5.3 Impulse-responses to non-orthogonal innovations: Beyond the Wold-ordering scheme . . . 74
4.5.4 The forecast error variance decomposition . . . 76
4.5.5 Distribution of impulse-response functions . . . 77
4.6 Model selection and estimation . . . 79
4.6.1 The model building algorithm . . . 79
4.6.2 Salient features of the algorithm as compared with *VARs* 83
4.6.3 Model specification tests . . . 85
4.7 Modelling nonstationary time series and common stochastic trends . . . 88
4.7.1 Detrending and common trend representation in econometrics . . . 88
4.7.2 Modelling trend and cycle . . . 90
4.7.3 A useful generalisation for cointegrated time series 95
4.7.4 Properties of the decomposition into permanent and transitory components . . . 96

5. Empirical implementation and results . . . 101
5.1 Is a multiplier approach adequate to model German money supply? . . . 101
5.1.1 Data . . . 101
5.1.2 Results . . . 102
5.2 Monetary targeting and the business cycle . . . 117
5.2.1 Data . . . 117
5.2.2 Results . . . 118
5.3 A quantity theory based approach to inflation targeting . . . 126
5.3.1 Money stock control and inflation targeting . . . 126

5.3.2 The *P** approach . . . 128
5.3.3 Data and results . . . 129

6. Conclusions . . . 141
6.1 Methodological remarks . . . 141
6.2 Money stock control and the day-to-day conduct of monetary policy . . . 142
6.3 Money stock control and inflation targeting in Germany . . . 143
6.4 Prospects for the ECB's monetary policy strategy . . . 144

List **of figures** . . . 147

List of tables . . . 149

Bibliography . . . 151

A. **GAUSS-programs** . . . 157
A.I Estimation of balanced state space model . . . 157
A.2 Obtaining in-sample forecasts using the Kalman filter . . . 166
A.3 Calculation of impulse—responses . . . 168
A.4 Calculation of forecast—error variance decompositions . . . 169
A.5 Decomposition of Error Vaxiance-Covariance-Matrix *A* . . . 170
A.6 Aoki C-Test for model specification . . . 171