DEPARTMENT OF ECONOMICS

RESEARCH MEMORANDUM

A MONTHLY MODEL FOR THE MONETARY POLICY IN THE NETHERLANDS

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1. Introduction

In this paper a monthly model for the monetary policy in the Netherlands is presented. The behavioral equations of the model were theoretically specified and empirically estimated for the period January 1977 (April 1979) till December 1983[1)].

The model consists of three blocks of equations: the monetary base block (or money and exchange market block), the money multiplier block and the monetary policy block. The monetary base block includes behavioral equations of the domestic money market interest rate, the net foreign asset of the banks, the relative position of the guilder within the EMS fluctuation band and the spot exchange rate of the dollar in guilders.

The money multiplier block is composed of behavioral equations of the broadly defined demand for money, the unborrowed cash reserves ratio, the demand deposits ratio and the secundary liquid assets ratio. Both these blocks constituted together the basic model and were further extended with a monetary policy block to the complete model.

The monetary policy block comprises reaction functions of the exchange market interventions, the special loans facilities, the swaps and the interest rate on advances by the central bank. As a consequence of this the external monetary policy of the Dutch central bank (De Nederlandsche Bank) was made endogenous and thus the binding constraints for the Netherlands resulting from the simultaneous maintenance of the external value of the guilder were taken into account. We chose the relative EMS-position of the guilder and the spot exchange rate of the Deutsche mark in guilders as the 'official' respectively 'semi-official' target variable of the central bank.

The model is estimated with monthly data for the period January 1977 (April 1979 in case of the relative EMS-position of the guilder) till December 1983. As estimation technique was used the method of Ordinary Least Squares (OLS) and in the event of autocorrelation Generalized Least Squares (GLS). Therefore, the model can be characterized as a model for the very short term and a partial approach of the monetary sector in the Netherlands. So this model may and will have a more limited size than models based on annual or quarterly data for the medium term. Firstly, the substitution effects between the money market, exchange market and credit market on the one side

small in the very short run and thus may be abstracted from the capital and goods market. Secondly, the available monthly data do not allow the estimation of a general monthly model for the Netherlands.

Furthermore, the model is constructed around the redefined monetary base as a central endogenous variable which determines the money supply given the stable money multiplier for the very short term[2]. The money multiplier is made up of ratios which have empirical content by behavioral equations for the banks and the public. These equations reflect the demand for the various liquid assets by the banking and private sector. The model is completed by a set of reaction functions which describe the external monetary policy of the Dutch central bank to maintain the relative position of the guilder within the EMS band and to stabilize the spot exchange rate of the Deutsche mark in guilders.

Finally, the variables of the model are expressed in levels (x_t), absolute changes (Δx_t) or percentage changes ($\dot{x}_t$). The interest rates are monthly averages and the other variables are defined as (changes between) the end of months. The exogenous variables have a stripe above the variable ($\bar{x}_t$). All amounts are expressed in milliard of guilders (10^9).

2. The equations and variables of the model

This chapter comprises the behavioral equations, definitional equations, balance sheet identities and equilibrium conditions of the complete model. As mentioned before, the model can be devided in three blocks of equations:

(i) the monetary base block: equations (1) - (10);
(ii) the money multiplier block: equations (11) - (23);
(iii) the monetary policy block: equations (24) - (28).

The behavioral equations are estimated with not seasonally adjusted monthly data for the period 1977:1 - 1983:12 and, in case of the relative EMS-position of the guilder, for the period 1979:4-1983:12.

Some of the equations contain special dummy variables reflecting the realignments within the EMS (D_r) or extraordinary uncertainty in the money market (D_G) and the exchange market (D_v). Other equations include seasonal dummy variables (S_i) if a seasonal fluctuation in the endogenous variable can be observed and explained. In general, the coëfficients of the explanatory variables are significant at a 5% - confidence level and the OLS - and GLS-regressions have a satisfactory or even a good fit, i.e. a relatively high determination coëfficient (R^2) and few or no first-order autocorrelation (Durbin-Watson statistic relatively close to 2).

The complete model consists of the following equations:

(1) $B_r = L^s + NFA^b + \bar{C}$

(2) $\Delta L^s = \Delta NFA^{cb} + \Delta NDA$

(3) $\Delta NDA = \Delta SD + \Delta SWAP + \overline{\Delta NDA^{AUT}} + \overline{\Delta NDA^{RIJK}}$

(4) $r = 0,2767 + 0,3430.r_{-1} - 0,8006.\frac{L^s_{-1}}{1-L^s_{-1}} + 0,6322.r^{cb} +$
$+ 0,7006.\overline{r^c} + 1,2157.D_G^{79/80} + \sum_{i=1}^{11} s_i.S_i$

(5) $NFA^b = 0,9820.NFA^b_{-1} - 0,1150.(r - 0,5.\overline{r^{VS}} - 0,5.\overline{r^{EMS}})$
$- 0,5250.\Delta SWAP + 0,3882.\overline{NMF} + 2,1617.D_R^{82} - 2,5562.D_R^{83}$

(6) $\Delta NFA^{cb} = \overline{\Delta NFA^{\$}} + \overline{\Delta NFA^{EMS}}$

(7) $\Delta NFA^{cb} = \overline{MF_{VS}} + \overline{MF_{EMS}} + \overline{MF_{ov}} + \overline{NMF} + RBB$

(8) $\dot{S}DM = \dot{S}DOL - \overline{\dot{S}DMDOL}$

(9) $SEMS = 0,2316 + 0,7637.SEMS_{-1} + 0,1486.(\Delta r - \overline{\Delta r^{EMS}})_{-2} +$
$+ 0,1081.\overline{MF_{EMS}} - 0,7331.D_R^{79a} - 0,2108.D_R^{79b} + 0,0590.D_R^{81a}$
$- 1,4691.D_R^{81b} - 0,4921.D_R^{82a} - 2,1059.D_R^{82b} - 2,2934.D_R^{83}$

onder: $-1,125 \leq SEMS \leq +1,125$

(10) $\dot{S}DOL = -0,1510.(\Delta r - \overline{\Delta r^{VS}})_{-\frac{1}{2}} - 0,2766.\overline{MF_{VS}} + 0,9463.\overline{\dot{S}DMDOL}$

(11) $M2^s = m_r.B_r$

(12) $m_r = [(k+a)(d+t) + 1 - d - t]^{-1}$

(13) $M2 = \bar{C} + D + T$

(14) $\frac{M2^d}{p} = -0,0113 + 0,9553.\frac{M2^d_{-1}}{p} + 0,0574.\frac{\overline{CONS}}{p} +$
$+ 0,0004.(0,5.\overline{r^T} + 0,5.\overline{r^D} - r)_{-1} + \sum_{i=1}^{11} s_i.S_i$

(15) $M2^s = M2^d$

(16) $a = \frac{NFA^b}{D+T}$

(17) $$k = \frac{L^d}{D+T}$$

(18) $$\frac{L^d}{D+T} = -0,0059 + 0,7574.\frac{L^d_{-1}}{D+T} - 0,0011.(\overline{r^{EMS}} - r)_{-\frac{1}{2}} + \\ + 0,0026.(r^{cb} - r)_{-\frac{1}{2}} + 0,0126.D_G^{79/80} + \sum_{i=1}^{11} s_i.S_i$$

(19) $$L^s = L^d$$

(20) $$d = \frac{D}{M2^d}$$

(21) $$\frac{D}{M2^d} = 0,0053 + 0,8424.\frac{D_{-1}}{M2^d} + 0,0018.(\overline{r^D} - r) + 0,0675.\frac{\overline{CONS}}{M2^d} + \\ + 0,2073.\frac{\Delta M2^d}{M2^d} + \sum_{i=1}^{11} s_i.S_i$$

(22) $$t = \frac{T}{M2^d}$$

(23) $$\frac{T}{M2^d} = 0,1890 + 0,7935.\frac{T_{-1}}{M2^d} - 0,0024.(\overline{r^D} - r) + 0,1259.\frac{\overline{CONS}}{M2^d} + \\ + 0,5306.\frac{\Delta M2^d}{M2^d} + \sum_{i=1}^{11} s_i.S_i$$

(24) $$\Delta NFA^{cb} = 0,0848.\frac{SEMS}{(1,2)^2 - SEMS^2} + 0,4032.\Delta SEMS_{-\frac{1}{2}} - 0,2313.\dot{S}DM_{-1} \\ - 0,0509.\dot{S}DOL_{-1} + 1,9868.D_v^{81} + 2,0025.D_v^{82a} + \\ + 1,5903.D_v^{82b} - 1,4213.D_v^{83}$$

(25) $$\Delta NDA^{cb} = \Delta SD + \Delta SWAP$$

(26) $$\Delta SD = -0,1509.\Delta SD_{-1} + 0,4364.\Delta SEMS - 0,4984.\Delta NFA^{cb} \\ - 0,6190.\overline{\Delta NDA^{AUT}} - 0,6930.\overline{\Delta NDA^{RIJK}}$$

(27) $$\Delta SWAP = -0,1379 - 0,4026.\Delta SWAP_{-1} + 0,1915.\Delta SEMS_{-\frac{1}{2}} \\ - 0,2327.\Delta NFA^{cb} - 0,1234.\overline{\Delta NDA^{AUT}} - 0,1911.\overline{\Delta NDA^{RIJK}} \\ - 0,0994.\Delta SD + 2,198.D_G^{80a} + 1,717.D_G^{80b} + 2,187.D_G^{81} + \\ + 1,013.D_G^{82} + 0,8867.D_G^{83}$$

(28) $$r^{cb} = 0,7909.r^{cb}_{-1} + 0,1953.\overline{r^{EMS}} - 0,1877.SEMS_{-1} - 0,3922.\overline{NMF}$$

The variables of the model can be divided in endogenous and exogenous variables which are determined within respectively outside the model. In case of the endogenous variables a further distinction can be made between instruments, indicators and targets of monetary policy and the other endogenous variables. Consequently, the variables are listed in three groups with a brief definition of each variable:

(I) Instruments, indicators and targets (endogenous variables)

B_r= redefined monetary base

L^s= domestic monetary market volume (degree of ease or tightness)

$M2^s$= broadly defined supply of money

r = domestic money market interest rate (three-month interbank deposits).

SDM= spot exchange rate of the Deutsche mark in guilders

SDOL= spot exchange rate of the U.S. dollar in guilders

SEMS= relative position of the guilder within the EMS band

ΔNDA^{cb}= money market policy of the central bank

ΔNFA^{cb}= exchange market policy (interventions) of the central bank

r^{cb} = official interest rate on advances by the central bank

ΔSD= special loans facilities of the central bank

ΔSWAP= swaps in U.S. dollars by the central bank

(II) Other endogenous variables

NDA= net domestic assets of the central bank

NFA^b= net foreign assets of the banks

m_r= redefined money multiplier

$M2^d$= broadly defined demand for money

a= net foreign assets ratio

k= unborrowed cash reserves ratio

L^d= unborrowed cash reserves of the banks

d= demand deposits ratio

D= demand deposits

t= secundary liquid assets ratio

T= secundary liquid assets (time and savings deposits)

(III) Exogenous variables

ΔNFA^{EMS}= exchange market interventions in other EMS-currencies

$\Delta NFA^{\$}$= exchange market interventions in U.S. dollars

r^{c}= fixed penalty interest rate of the central bank

C= currency (coins and bank notes)

CONS= domestic consumption of households

MF_{VS}= net short-term capital inflows from the U.S.

MF_{EMS}= net short-term capital inflows from the EMS-countries

MF_{ov}= net short-term capital inflows from the other countries

NMF= surplus or deficit on the basic balance (current account and long-term capital account)

ΔNDA^{AUT}= autonomous factors of the money market volume

ΔNDA^{RYK}= money market operations of the government

SDMDOL= spot exchange rate of the U.S. dollar in Deutsche marks

p= domestic consumption price index of households

r^{VS}= three-month eurodollar rate

r^{EMS}= three-month euro-DM-rate

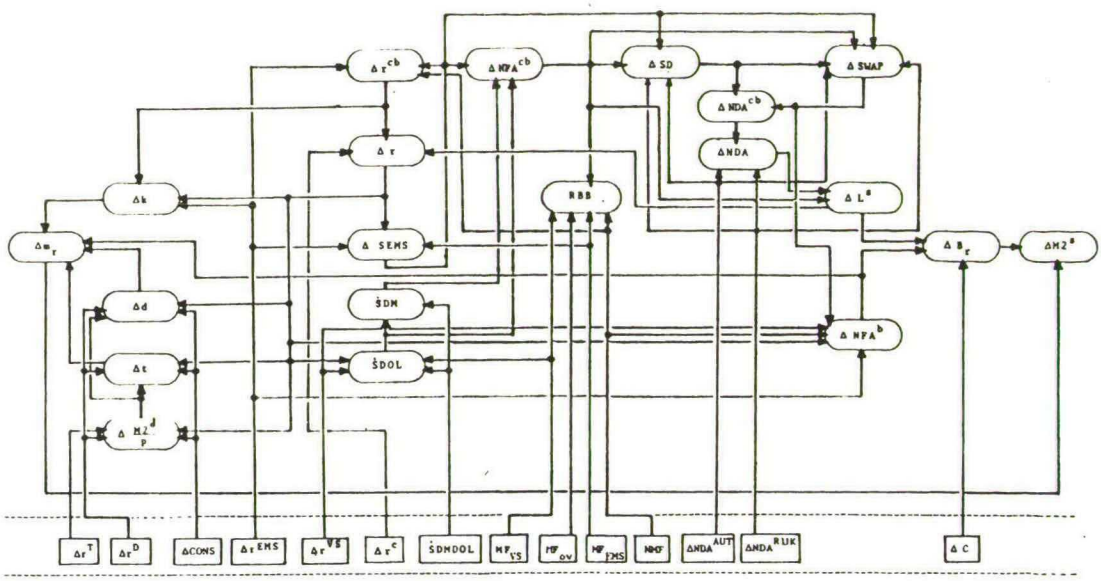
r^{D}= interest rate on demand deposits

r^{T}= interest rate on three-month time deposits

3. The dynamic performance of the model

The complete model can be summarized and illustrated with a flow chart in which the relations between the instruments, indicators, targets and other endogenous variables (in round compartments) among themselves and the relations with the exogenous variables (in rectangular compartments) are reflected by means of arrows. The flow chart of the model is shown in figure 1.

Figure 1. A flow chart of the complete model



Considering the flow chart above and the lags in the relations between the endogenous variables, the model appears to be recursive[3]. The recursivity of the model is caused by the small time intervals (months) of the data and the resulting lag structure between the endogenous variables.

The dynamic performance of the model is tested by a graphic comparison of the simulated values (forecasts) and the actual values (realisations) of the endogenous variables for the most recent two-and-a-half years of the

estimation period (1981:7 - 1983:12). Dynamic simulation is more apted to judge the performance of a model than static (period-to-period) simulation because the simulated values of the lagged endogenous variables are substituted. As simulation period has been chosen the most recent two-and-a-half years which equals a period of thirty months. This period is sufficiently long to test the adjustment of a model for the very short term. Furthermore, the simulation period is free from radical changes in Dutch monetary policy such as the abolition of the instrument of direct credit control after June 1981. The graphic comparisons of the simulated and actual values of 17 important endogenous variables are shown in figures 2-18. The simulated time path is reflected by an interrupted line and the actual or historical time path by a continuous line. The deviations between these time paths express the residuals (forecast errors) for an endogenous variable.

Figure 2. Domestic money market interest rate

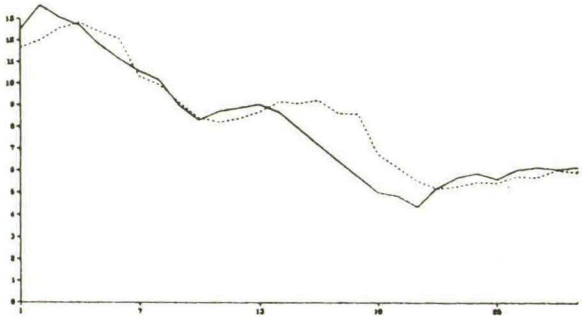


Figure 3. Net foreign assets of the bank

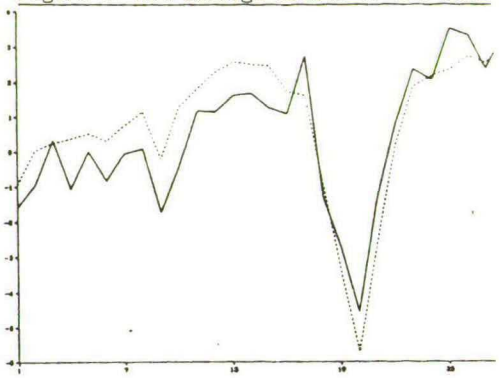


Figure 4. Spot exchange rate of U.S. dollar in guilders

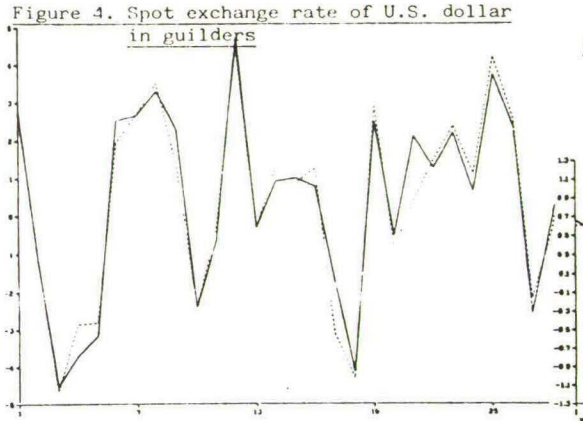


Figure 5. Relative EMS-position of the guilder

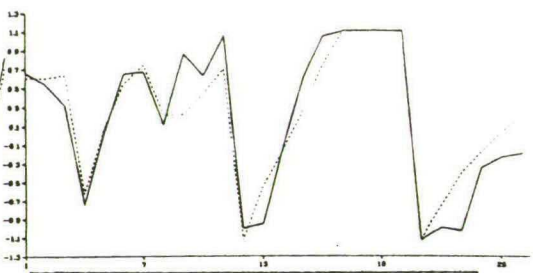
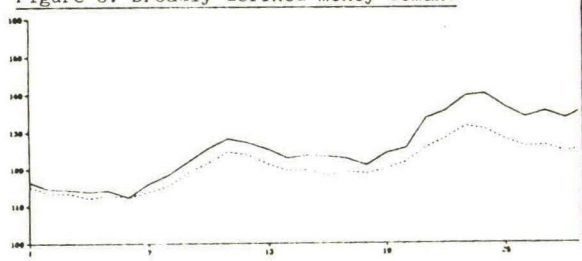


Figure 6. Broadly defined money demand



Legenda :

- - - - - = Simulated time path (forecasts)

——— = Actual time path (realisations)

Simulation period : 1981:7 - 1983:12

Figure 7. Broadly defined money supply

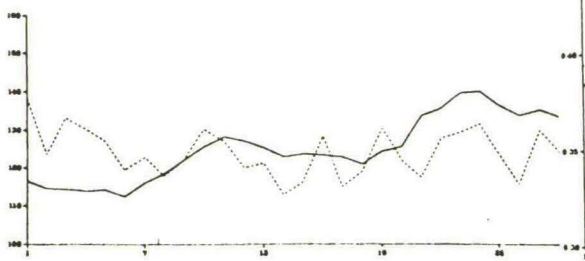


Figure 8. Demand deposits ratio

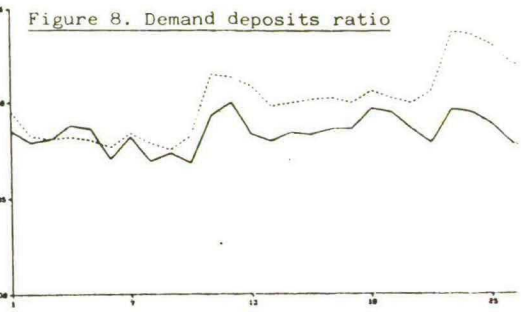


Figure 9. Secundary liquid assets ratio

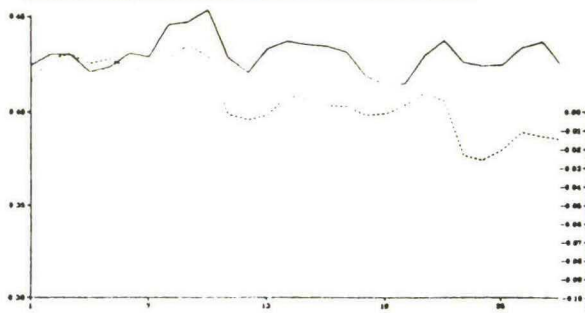


Figure 10. Unborrowed cash reserves ratio

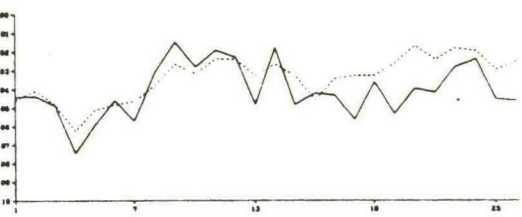


Figure 11. Redefined monetary base

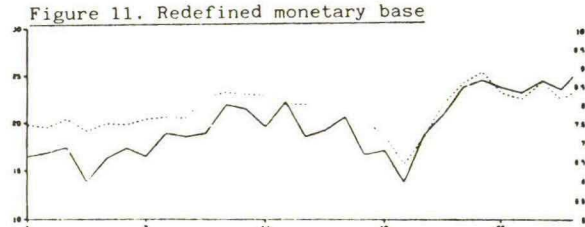


Figure 12. Redefined money multiplier

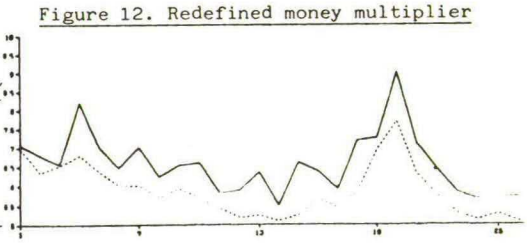


Figure 13. Official interest rate of the central bank

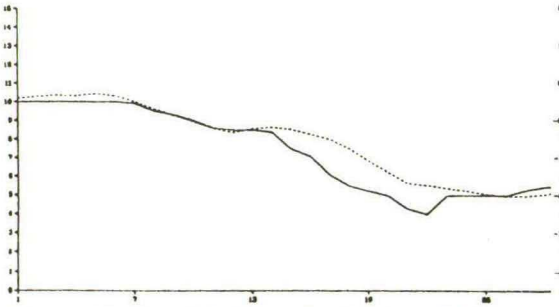


Figure 14. Exchange market interventions of the central bank

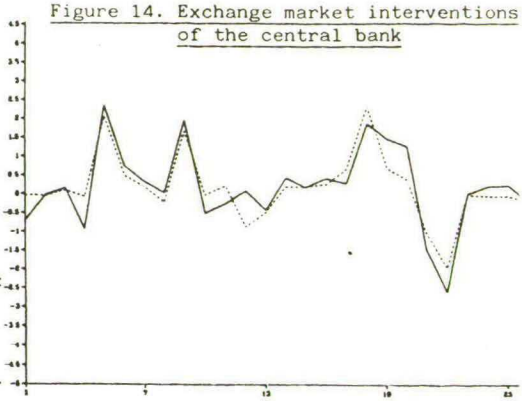


Figure 15. Special loans facilities of the central bank

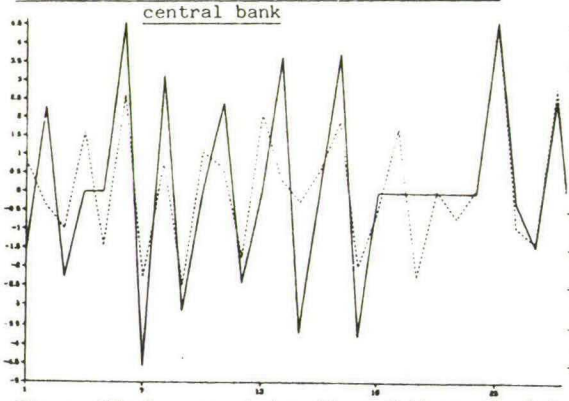


Figure 16. Dollarswaps of the central bank

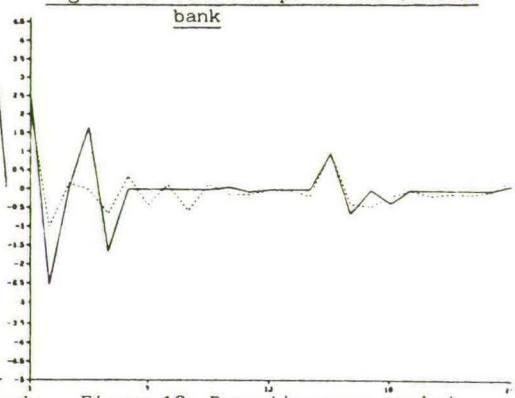


Figure 17. Money market policy of the central bank

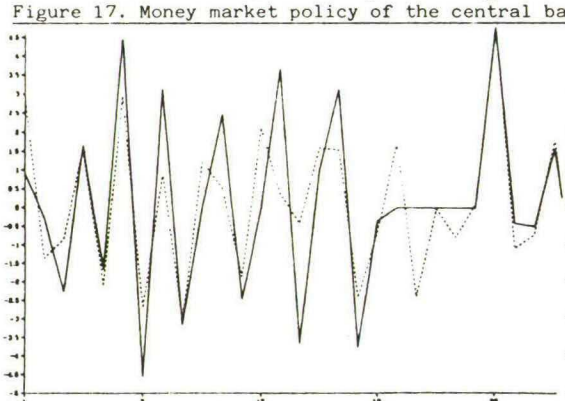
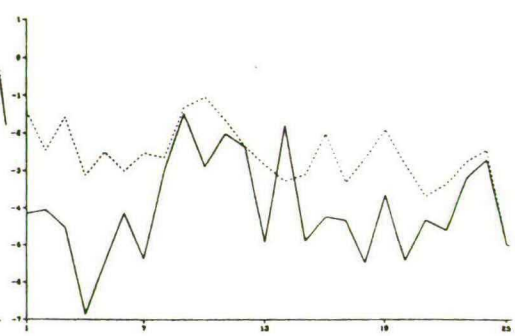


Figure 18. Domestic money market volume



In general, graphic comparison in the figures above do not show striking outliers, but for some endogenous variables notable residuals. In case of the broadly defined money demand and secundary liquid assets ratio there is a small underestimation and for the demand deposits ratio a slight overestimation[4]. The residuals of both ratios compensate each other mostly within the money multiplier. The simulated and actual values of the net foreign assets of the banks, the exchange market interventions, the special loans facilities, the dollarswaps and consequently also the money market policy of the central bank have a volatile nature and show in some cases remarkable deviations.

Those deviations explain partly the residuals for the money market volume (degree of ease or tightness). Besides the sharp fluctuations of the special loans facilities and swaps, both variables equal zero for some respectively many months, if the central bank does not wish to intervene in the money market, and have almost a discrete character.

The lagged adjustment of the official interest rate during a few months causes some overestimation of the money market interest rate. However, in most cases the turning points of the endogenous variables are accurately predicted, which can be marked as an important test for the dynamic simulation of the model. Therefore, on account of the graphic comparison of forecasts and realisations the dynamic preformance of the model was deemed satisfactory for the concerning period, in particular regarding the volatility of some endogenous variables in the very short run.

4. Conclusion

In conclusion of this paper some final remarks will be made on the innovative features of the presented monetary model for the Netherlands. The model can be distinguished from other monetary (sub-)models for the Dutch economy, that have been published before[5], in at least three respects. Firstly, it can be considered to be the first consistent monthly model for the monetary sector in the Netherlands. The model describes the adjustment process of the Dutch money market, exchange market and credit market from month to month. Because of the very short run nature the model has an exogenous capital market and goods market.

Secondly, it can be regarded as the first model, in which the external monetary policy of the Dutch central bank has been endogenised and thus explained within the model. Monetary instruments such as the exchange market interventions, special loans facilities, dollarswaps and official interest rate of the central bank are endogenous variables in the model as a consequence of the more or less compulsory character of the external monetary policy to maintain a stable spot exchange rate of the Deutsche mark. Finally, the model comprises an endogenous relative position of the guilder within the EMS-band of fluctuation[6] which influences the exchange market interventions in a non-linear way and is essential to the whole model.

5. Notes

1) A detailed description of the model is given in: S.C.W. Eijffinger, Over de beheersbaarheid van de geldhoeveelheid (On the controllability of the money supply), Free University Press, Amsterdam, 1986.

2) See: A. Knoester & J. van Sinderen, Money, the Balance of Payments and Economic Policy, Applied Economics, 1985, pp. 215-240.

3) In a recursive model the various reactions between the endogenous variables are not of a simultaneous, but of a sequential nature. See e.g.: R.J. Wonnacott & T.H. Wonnacott, Econometrics, New York, 1979, pp. 296-299.

4) Notice that the vertical scale is rather detailed in these cases.

5) Examples of these monetary (sub-)models are: A. Knoester, Over geld en economische politiek, Leiden/Antwerpen, 1980; P.D. van Loo, A sectoral analysis of the Dutch financial system, Leiden/Antwerpen, 1983; De Nederlandsche Bank, MORKMON-Een kwartaalmodel voor macro-economische beleidsanalyse, Deventer, 1984.

6) See also: S.C.W. Eijffinger, The relative positions of the currencies within the EMS-band of fluctuation, in: D.E. Fair (ed.), International Monetary and Financial Integration - The European Dimension, Martinus Nijhoff Publishers, Dordrecht, 1987.

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