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EXAMINING THE EFFECTS OF ANTICIPATED POLICY ACTIONS:

RESULTS WITH THE FINNISH MICRO-QMED MODEL***

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ABSTRACT

This paper reports some policy simulations which have been carried out with the Finnish MICRO-QMED model. This rational expectations model built at the Economics Department of Bank of Finland is used to evaluate the short-run effects some anticipated policy actions. The paper also contains a short description of the MICRO-QMED model as well as a short user's guide for the model and for the MIKRO-TEKO programme used in simulating the model.

1 INTRODUCTION

This paper reports some basic results which have been obtained with the Finnish MICRO-QMED model, developed in the Economics Department of Bank of Finland, where it is mainly used in short-term forecasting. In addition, some advice is provided for the practical use of the model; as the name of the model already suggests, this version of the model is used in a microcomputer (PC) environment. This application has become possible thanks to the new MIKRO-TEKO programme developed in Bank of Finland.[1]

The MICRO-QMED is to a large extent similar to earlier versions of the QMED models (which however, have been used with a mainframe computer only, see Lahti and Virén (1989) and Lahti (1989) for details). The main difference is that the MICRO-QMED model is somewhat smaller: altogether there are 18 stochastic equations, 14 identities and 59 variables (excluding the residuals) in the model. The second difference with respect to the earlier versions of the model is that the estimation period is now 1976.1 - 1988.4. The exclusion of the early 1970s is motivated by the fact that the current institutional framework (particularly in terms of the capital market) is very much different from that period (not to speak about the 1950s and 1960s). Thirdly, but no less importantly, the structure of the model has been changed. Now, rational expectations also affect business investment (and thus not only consumption demand and wage formation). In addition, the (endogenous) capacity variable has been changed so that it now corresponds to the actual capacity utilization rate of the Bank of Finland investment inquiry.

Here, we do not intend to go through the details of the model. A short summary of the main behavioural equations of the model is, however, presented in Table 1. In addition, Appendix 1 contains some diagnostic statistics for these equations. Finally, Appendix 2 contains a very brief user's guide of the model and the MIKRO-TEKO programme. In this paper we concentrate on examining the simulation properties of the model. This is done in two different ways. Firstly, we scrutinize the dynamic and static simulation paths for the estimation period (see Section 2.1) and, secondly, compute a set of policy multipliers in terms of key exogenous variables of the model (see, e.g. Fair (1989) for a recent defence of this kind of exercises in analyzing policy alternatives; see also Section 2.2). The novelty of the latter results lies in the fact that the changes in these exogenous variables are assumed to be known already in advance.

2 SIMULATION RESULTS

2.1 Static and Dynamic Ex-Post Simulations

We start by reporting some summary statistics from the ex-post simulations which were performed with the model for the estimation period 1976.1 - 1988.4. Both Mean Absolute Percent Errors (MAPE) and Mean Percent Errors (difference between the simulated and actual values, abbreviated as MPE) are shown in Table 2. In addition, a graph for GDP and the price deflator for private consumption is presented (Figure 1).[2]

Generally speaking, the tracking performance of the model is good. It may be noted that the time series of the selected endogenous variables are rather volatile, as can seen from the standard erros which are computed for the deviations between the actual (log) values and the linear time trend (denoted by SD(Y)[3]). Alternatively, one can compare the MAPE values with those obtained from a larger quarterly model for the Finnish economy (BOF3 (1985)). It is only imports which create some problems in a dynamic simulation over the 52-quarter sample period. More precisely, a rather clear overprediction can be discerned. If static simulation is carried out, a somewhat different result emerges. Now, it is rather (private) investment which shows some underprediction. The static simulation errors are, however, generally very small, which is obviously also due to the importance of exogenous variables in the model.[4]

2.2 Measuring the Effect of Anticipated Policy Changes

Now, let us turn to the effects of some policy actions. The corresponding simulation results are reported in Table 3. All results correspond to permanent, once-for-all ceteris paribus changes in the exogenous variables mentioned in this table. In all cases, it is also assumed that the changes are known for 8 months in advance. This, in turn, makes it possible to examine the dynamic adjustment path of the endogenous variables of the model both before and after the policy action. Altough we speak about "policy actions", some changes in exogenous variables are literally speaking not "policy actions" but just changes in the overall policy environment.

Because price and wage adjustment is of crucial importance in the case of a small open economy (such as Finland), we also present results with a model version which includes a wage equation for contract wages. Most of the forecasting is carried out treating contract wages as exogenous, which can be motivated with the highly unionized and centralized wage settlement system in Finland. However, with policy simulations, this assumption is obviously much too restrictive, particularly in the case of large changes in exogenous variables.[5]

The policy multipliers clearly indicate that the advance effects are simply not zero. In fact, the effects are more important and diverse than what can be concluded on the basis of Table 3. For instance, in the case of an increase in contract wages there is a positive and anticipated income effect in terms of private consumption and a negative and anticipated income effect on private investment, in addition to a negative simultaneous or lagged competitiveness effect on exports and imports. The net effect in terms of GDP can, however, be almost negligible. This clearly shows up if we scrutinize the following data for the period 1977.4 - 1979.4 in the case of the contract wage simulation:

	1977.4	1978.1	1979.4
effect on GDP	-0.14	-0.28	-0.35
	(-0.14)	(-0.62)	(-0.66)
effect on private consumption	0.50	0.64	1.51
	(0.50)	(0.64)	(1.51)
effect on investment	-1.57	-0.93	0.22
	(-1.57)	(-1.16)	(-0.08)
effect on exports	0.00	0.00	-2.35
	(0.00)	(-1.76)	(-3.60)
effect on imports	0.01	1.36	1.72
	(0.01)	(0.64)	(1.09)

where the numbers in parentheses correspond to a simulation in which a 10 per cent increase in contract wages is accompanied by a (somewhat arbitarily assumed) 5 per cent decrease in bilateral exports and exports of services. As was pointed out above, the advance effects can be of considerable importance with respect to certain components of aggregate demand. Quite obviously, the results are also sensitive to the assumptions concerning the exogenous demand components, particularly as regards the exogenous exports component.[6] In the same way as GDP, private consumption is also affected by two future effects with opposite signs, which almost offset each other: a positive real interest rate effect and a negative direct inflation effect (for further details, see Table 1).

These examples surely indicate that already minor changes in model specification may crucially affect the short-run dynamics. In particular, the assumption that some effect is a result of forward-looking behaviour instead of backward-looking behaviour definitely has a nontrivial effect on short-term results. One should therefore treat the corresponding results from "old-fashioned" macro models with some caution at least.

FOOTNOTES

1 Unfortunately, currently there is no proper document of the programme available. Those interested in the programme may, however, contact Jukka Syrjänen at the Bank of Finland.

2 The use of static simulation (and conventional single-equation diagnostic testing (cf. Appendix 1)) is motivated by the arguments presented in Pagan (1989) and Fisher and Wallis (1988). Pagan, as well as Fisher and Wallis, takes a rather critical attitude towards using dynamic simulation in the statistical evaluation of econometric models. For instance, Pagan argues that "it is therefore very hard to utilize tracking performance for the purpose of model evaluation: a good record may be comforting, but nothing substantial can really be concluded from it about any misspecification".

3 In the case of the capacity utilization rate, the current account/GDP ratio and the interest rate, the sample standard deviations are computed.

4 We also carried out a dynamic "ex ante" simulation for a pre-estimation period 1972.1 - 1975.4 (which also includes the first "oil crisis"). The results were surprisingly good. Thus, the following values were obtained for GDP and consumption prices: MAPE(y) = 1.50, MPE(y) = 0.19, MAPE(pc) = 1.84 and MPE(pc) = -1.15.

5 The contract wage equation applied here is of the following form:

$$\Delta wc = \underset{(3.65)}{.64061} \cdot \Delta pc(-1) - \underset{(1.98)}{.03761} \cdot (wc(-4)/pc(-4)) + \underset{(2.51)}{.04777} \cdot cap(+1)$$

$R2 = .2299$ D-W = 2.0769 SE = .0087,

where the symbols are the same as in Table 1.

6 Recall also that the discount rate is exogenous in all simulations performed here.

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TABLE 1

OLS Estimates of the Main Behavioural Equations of the QMED Model

(1)

$$x^* = \underset{(1.85)}{0.4484}\cdot f^* + \underset{(13.99)}{0.78207}\cdot \log(x^*(-1))$$

$$- \underset{(0.85)}{0.2303}\cdot f^*(-1) - \underset{(2.50)}{0.36315}\cdot (pxf)(-3)$$

$$- \underset{(1.78)}{0.05252}\cdot d1 + \underset{(1.89)}{0.06022}\cdot d2 + \underset{(4.3)}{1.10330}$$

R2 = 0.9805   D-W = 2.121   SE = 0.02845

(2)

$$\Delta m = \underset{(4.41)}{1.184753}\cdot \Delta z + \underset{(1.90)}{0.57459}\cdot \Delta pzm - \underset{(3.62)}{0.45654}\cdot (m-z)(-1)$$

$$+ \underset{(3.68)}{0.45956}\cdot (m-z)(-2) + \underset{(1.59)}{1.29193}\cdot cap(-1)$$

R2 = 0.6125   D-W = 2.3669   SE = 0.00504

(3)

$$c = \underset{(2.54)}{0.15624}\cdot yhr(+1) - \underset{(2.41)}{0.00346}\cdot (r-(400\cdot \Delta pc(+1)))$$

$$- \underset{(2.54)}{1.52173}\cdot \Delta pc(+1) + \underset{(15.40)}{0.84187}\cdot c(-1) + \underset{(3.06)}{0.76308}$$

R2 = 0.994   D-W = 2.209   SE = 0.00938

(4)

$$ih = \underset{(3.20)}{0.36721}\cdot ih(-1) + \underset{(3.41)}{0.23450}\cdot bp(-1) + \underset{(1.09)}{0.08408}\cdot bp(-3)$$

$$- \underset{(2.53)}{0.00167}\cdot (r(-4)-(400\cdot \Delta pih(-3))) + \underset{(1.46)}{0.15315}\cdot (yh-pih)(-4)$$

$$- \underset{(3.36)}{0.13830}\cdot d3 + \underset{(4.12)}{3.97789}$$

R2 = 0.7116   D-W = 1.975   SE = 0.03819

(5)

$$\Delta if = - \underset{(6.21)}{0.69326}\cdot (if-y)(-1) + \underset{(4.73)}{0.55338}\cdot (if-y)(-2) + \underset{(2.15)}{1.09583}\cdot \Delta y$$

$$+ \underset{(2.88)}{0.52217}\cdot cap - \underset{(1.23)}{0.00093}\cdot \Delta(r(-4)-400\cdot \Delta pi(-3))$$

$$- \underset{(1.88)}{0.85099}\cdot \Delta(w-pq)(+2) + \underset{(2.45)}{0.07709}\cdot d4 - \underset{(4.39)}{0.70972}$$

R2 = 0.6294   D-W = 2.2035   SE = 0.0390

$$(6)\quad lw-n = \underset{(3.95)}{0.47315}\cdot(lw-n)(-1) + \underset{(2.29)}{0.13369}\cdot cap - \underset{(4.53)}{0.89921}$$

R2 = 0.3648 D-W = 1.8228 SE = 0.0147

$$(7)\quad \Delta w = \underset{(29.40)}{1.02118}\cdot\Delta wc + \underset{(1.80)}{0.01933}\cdot\Delta 4pc^{*}(+1) + \underset{(3.86)}{0.00437}\cdot cap$$

R2 = 0.9523 D-W = 2.0045 SE = 0.0023

$$(8)\quad \Delta pc = \underset{(4.0)}{0.21242}\cdot\Delta wn + \underset{(3.59)}{0.18461}\cdot\Delta wn(-1) + \underset{(4.49)}{0.23128}\cdot\Delta wn(-2)$$

$$+ \underset{(3.16)}{0.09410}\cdot\Delta pm + \underset{(3.85)}{0.11840}\cdot\Delta pm(-1) + \underset{(1.06)}{0.03201}\cdot pm(-2)$$

R2 = 0.6522 D-W = 1.2896 SE = 0.0050

$$(9)\quad \Delta pi = \underset{(3.92)}{0.44943}\cdot\Delta 2wn + \underset{(2.13)}{0.23487}\cdot\Delta 2wn(-1) + \underset{(2.12)}{0.12767}\cdot\Delta 2pm$$

$$+ \underset{(0.84)}{0.05189}\cdot\Delta 2pm(-1)$$

R2 = 0.4494 D-W = 1.4913 SE = 0.0126

$$(10)\quad \Delta pg = \underset{(16.41)}{0.75454}\cdot\Delta wn + \underset{(3.72)}{0.15234}\cdot\Delta pm$$

R2 = 0.5827 D-W = 1.9893 SE = 0.0075

$$(11)\quad \Delta pfx = -\underset{(2.69)}{0.22355}\cdot pxf(-1) + \underset{(1.62)}{0.40741}\cdot\Delta w + \underset{(2.11)}{0.01144}\cdot d5 - \underset{(2.56)}{0.01825}$$

R2 = 0.2044 D-W = 1.8195 SE = 0.0176

$$(12)\quad r = \underset{(3.91)}{15.08003}\cdot\Delta 4pc(+1) + \underset{(7.16)}{0.87602}\cdot rd + \underset{(2.31)}{5.02296}\cdot\Delta(nd-pc)(-1) + \underset{(1.26)}{1.2392}$$

R2 = 0.7790 D-W = 0.5814 SE = 0.5948

$$(13)\quad cap = \underset{(21.45)}{1.66337}\cdot cap(-1) - \underset{(9.16)}{0.72619}\cdot cap(-2) + \underset{(3.70)}{0.20454}\cdot\Delta y - \underset{(1.56)}{1.41475}\cdot\Delta n(-1)$$

$$- \underset{(0.93)}{0.00575}\cdot if(-1) - \underset{(1.15)}{0.00843}\cdot\Delta(pmo-pq)(-4) + \underset{(2.04)}{0.10631}$$

R2 = 0.9847 D-W = 1.4663 SE = 0.0048

All variables, except r, are expressed in logs, and all expenditures are defined in real terms. Variables marked with an asterisk are two period averages so that x* = (x+x(-1))/2. The number of lags is shown in parentheses after each lagged variable. Numbers in parentheses below parameter estimates are unadjusted t-ratios. E.g. (-1) refers to period t-1. Δ denotes the first backwards differencing operator and Δ4 denotes the fourth and Δ2 the second backwards differencing operator. R2 = coefficient of determination, D-W = Durbin - Watson statistic and SE = standard error of estimate.

TABLE 1 continued

LIST OF VARIABLES (exogenous variables are underlined)

b	building permits for residental construction
c	private consumption
ca	current account
cap	capacity utilization rate in manufacturing
d1-d5	dummy variables
f	foreign import demand
g	public consumption
ig	public investment
if	manufacturing investment
ih	housing investment
lw	wage-earners' employment
m	imports (excluding oil)
n	working-age population
nd	central government's long-term domestic debt
pc	private consumption prices
pf	foreign producer prices
pg	public consumption prices
pi	investment prices
pih	dwelling prices
pm	import prices
pme	import prices (excluding oil)
pmo	import prices of oil
pmz	pme - pz
pq	GDP deflator
px	export prices of goods (excluding bilateral exports)
pxf	px -pf
pz	private demand prices
r	interest rate (government bond yield)
rd	discount rate
s	employers' social security contributions rate
t	linear time trend
w	wage rate
wc	contract wage rate (cf. fn. 5)
wn	w·(1+s)
wr	w·(1+s) - pq
x	exports of goods (excluding bilateral exports)
xe	bilateral exports
y	gross domestic product at constant 1985 purchasers' prices
yh	households' disposable income
yhr	yh - pc
z	private demand

Data source: Bank of Finland's data bank (TAKO). The data are seasonally adjusted. The definitions of the variables and printouts of the data (also a printout of the complete model file) are avaiable upon request from Anneli Majava at the Economics Department of Bank of Finland.

TABLE 2

MAPE- and MPE- values for the estimation period 1976.1 - 1988.4

	Dynamic simulation		Static simulation		
	MAPE	MPE	MAPE	MPE	SD(Y)
Gross Domestic Product	1.31	-1.13	1.20	-0.27	1.64
Imports	7.68	7.33	2.72	-0.67	6.77
Exports	2.88	0.18	2.71	0.03	7.28
Private consumption	2.63	2.07	0.74	0.04	2.10
Investment	3.89	-0.91	2.85	-2.01	5.16
Employment	1.40	-0.03	1.16	0.01	1.75
Capacity utilization rate	1.54	-0.41	0.42	-0.06	3.67
Consumption prices	2.52	-2.41	0.38	0.04	4.80
Export prices	2.04	0.01	1.44	0.01	7.00
Wage rate	0.56	-0.02	0.16	-0.00	2.80
Current account / GDP	2.30	-2.19	1.12	0.20	1.84
Interest rate	0.52	-0.03	0.50	-0.02	1.29

All aggregate demand components are volumes, prices are implicit price deflators. Employment is expressed in working hours and the capacity utilization rate, current accout in relation to GDP and the interest rate in percentage terms. In these cases, the MPE values are computed simply as MPE(Y) = Mean(Y(simulated)-Y(actual)).

TABLE 3

Policy simulation results

	77.4	78.1	79.4	82.4
<u>Effects on GDP</u>				
contract wage rate	-0.14	-0.28	-0.35	0.29
	(-)	(-)	(-)	(-)
public consumption	0.00	2.29	2.22	2.28
	(0.00)	(2.28)	(2.19)	(2.31)
foreign demand	-0.00	0.56	1.21	1.29
	(0.00)	(0.56)	(1.21)	(1.32)
working-age population	0.05	0.08	0.32	0.02
	(0.06)	(0.10)	(0.38)	(-0.06)
bilateral exports	-0.00	0.35	0.32	0.47
	(-0.00)	(0.35)	(0.31)	(0.48)
government debt	0.00	0.00	-0.03	-0.00
	(0.00)	(0.00)	-0.03	-0.00
oil prices	-0.02	-0.10	-0.16	-0.23
	(-0.03)	(-0.11)	(-0.19)	(-0.77)
discount rate	0.00	-0.12	-0.58	-0.77
	(0.00)	(-0.12)	(-0.57)	(-0.78)
income tax rate	-0.09	-0.18	-0.47	-0.59
	(-0.09)	(-0.18)	(-0.46)	(-0.59)
foreign prices (pf,pme,pmo)	-0.12	1.44	0.65	0.76
	(-0.17)	(1.35)	(0.48)	(0.85)
<u>Effects on consumption prices</u>				
contract wage rate	-0.02	2.11	6.65	6.75
	(-)	(-)	(-)	(-)
public consumption	0.00	0.01	0.03	0.01
	(0.00)	(0.02)	(0.30)	(0.18)
foreign demand	0.00	0.01	0.04	-0.01
	(0.00)	(0.02)	(0.18)	(0.11)
working-age population	0.00	0.00	-0.07	-0.06
	(0.00)	(-0.01)	(-0.81)	(-1.04)
bilateral exports	-0.00	0.01	0.01	-0.00
	(0.00)	(0.01)	(0.06)	(0.04)
government debt	0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(-0.01)	(0.00)
oil prices	-0.00	0.15	0.52	0.53
	(-0.00)	(0.15)	(0.76)	(1.04)
discount rate	0.00	-0.00	-0.02	-0.00
	(-0.00)	(-0.00)	(-0.07)	(-0.07)
income tax rate	-0.00	-0.01	-0.02	-0.07
	(-0.00)	(-0.01)	(-0.07)	(-0.05)
foreign prices (pf,pme,pmo)	-0.00	0.97	2.65	2.68
	(0.00)	(0.97)	(4.51)	(5.48)

to be continued

TABLE 3 continued

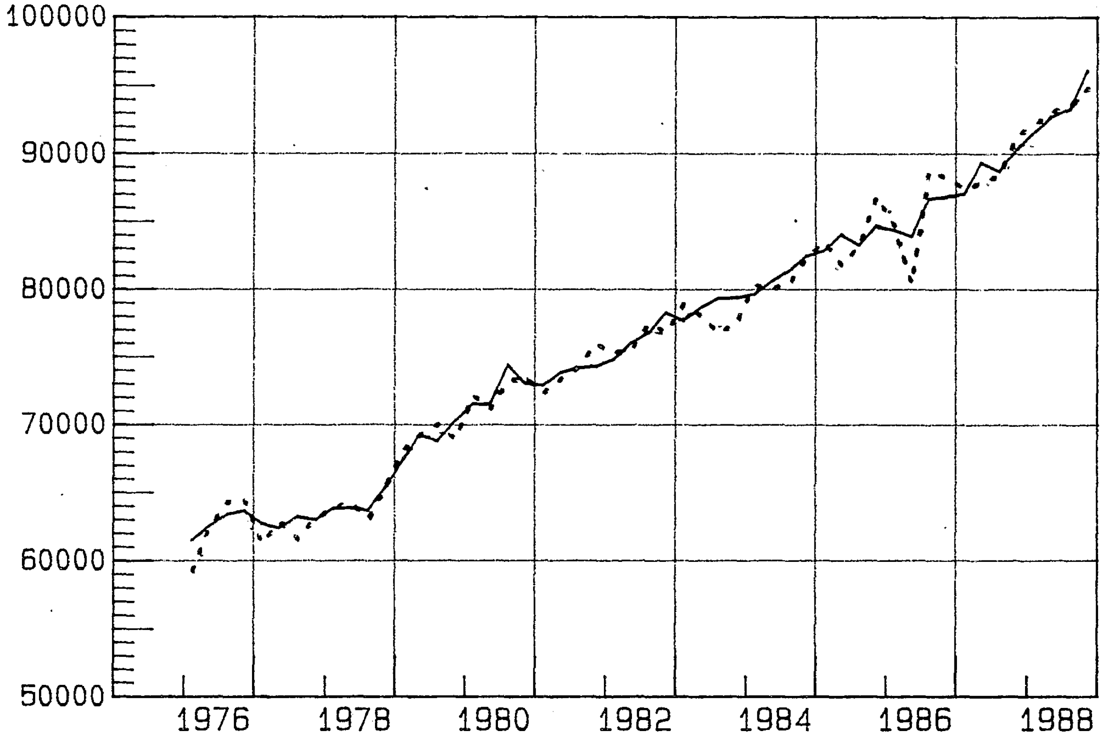
	77.4	78.1	79.4	82.4
Effects on current account/gdp				
contract wage rate	-0.00	0.76	-1.36	-1.40
	(-)	(-)	(-)	(-)
public consumption	-0.00	-0.17	-0.38	-0.03
	(0.00)	(-0.16)	(-0.41)	(-0.09)
foreign demand	0.00	0.48	1.04	1.19
	(0.00)	(0.49)	(1.05)	(1.19)
working-age population	-0.03	-0.05	0.79	-0.20
	(-0.04)	(-0.07)	0.84	0.04
bilateral exports	0.00	0.29	0.26	0.42
	(0.00)	(0.30)	(0.26)	(0.42)
government debt	0.00	-0.00	0.02	-0.00
	(0.00)	(0.00)	(0.02)	(-0.00)
oil prices	0.01	-0.47	-0.73	-0.74
	(0.02)	(-0.47)	(-0.76)	(-0.87)
discount rate	-0.00	0.08	0.46	0.42
	(0.00)	(0.08)	(0.46)	(0.42)
income tax rate	0.07	0.11	0.35	0.48
	(0.07)	(0.11)	(0.35)	(0.35)
foreign prices (pf,pme,pmo)	0.09	1.49	1.07	1.55
	(0.12)	(1.57)	(0.91)	(1.10)

Effects are given as cumulative percentage differences between the base (control solution) and the variant. Numbers in parentheses are results obtained by a model version with endogenous contract wages. All changes in exogenous variables are permanent and they take place in the beginning of the first quarter of 1978. The variables are then increased by 10 per cent. In the case of the working-age population the increase is, however, 1 per cent and in the case of the discount rate and the income tax rate 1 percentage point. The simulation period is 1976.1 - 1988.4. Hence, these changes are known already 8 quarters in advance. Accordingly, the first quarter represents the one-quarter-ahead anticipated effect of the respective policy actions.

Figure 1

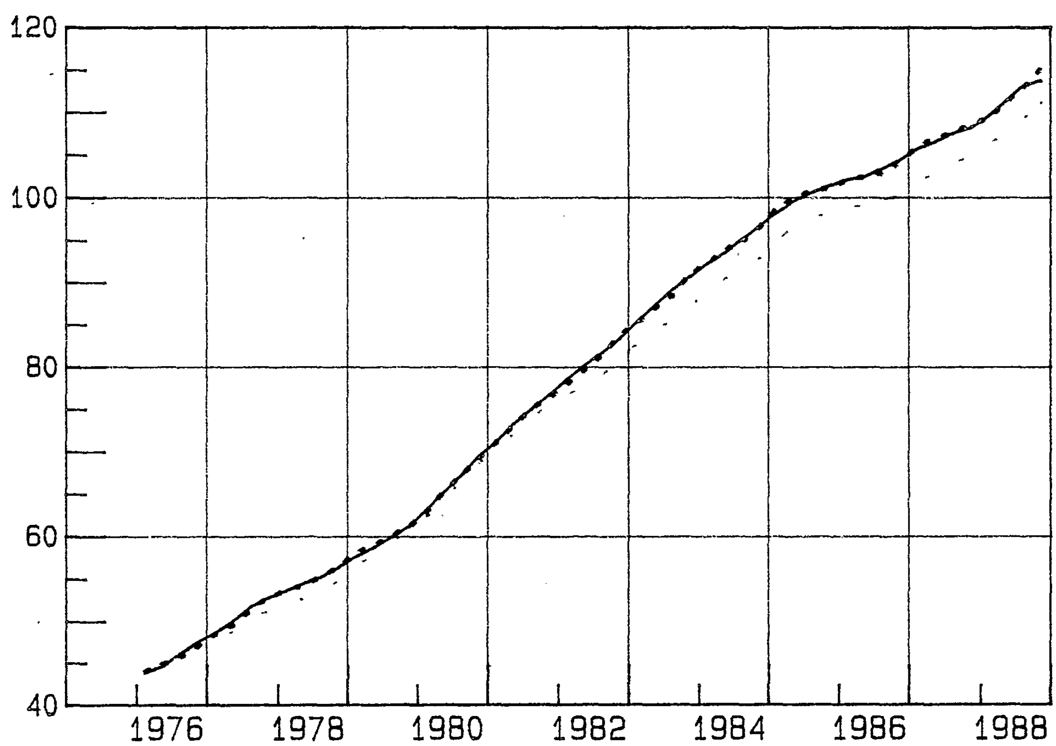
COMPARISON OF ACTUAL & FORECAST VALUES OF GDPQ

GDPQ.U1	ACTUAL VALUE	76Q1	88Q4
GDPQ.UN	DYNAMIC SIMULATION	76Q1	88Q4
GDPQ.UZ	STATIC SIMULATION	76Q1	88Q4



COMPARISON OF ACTUAL & FORECAST VALUES OF CONSUMPTION PRICES

PC.U1	ACTUAL VALUE	76Q1	88Q4
PC.UN	DYNAMIC SIMULATION	76Q1	88Q4
PC.UZ	STATIC SIMULATION	76Q1	88Q4



1975 - 1988

11-Oct-89

APPENDIX 1

DIAGNOSTIC TEST STATISTICS

Equation	r_1	r_2	r_3	r_4	CHOW	J-B	ARCH(4)
x*	-0.601	-1.051	2.166	-1.274	-	1.835	4.416
Δm	-1.490	-1.409	-0.220	1.208	1.696	6.977	3.360
c	-1.225	-0.518	-0.013	-0.218	4.808	1.472	14.064
ih	-0.039	0.537	-0.539	0.026	-	1.341	2.544
Δif	-0.997	-0.757	0.495	-0.065	-	2.439	1.010
lw	0.212	-1.965	-0.076	0.136	0.411	4.244	2.688
Δw	-0.121	-0.666	0.317	1.599	5.753	3.670	4.800
Δpc	2.014	0.282	-0.730	0.692	2.973	0.043	1.536
Δpi	1.529	-2.768	-0.662	0.885	1.906	0.590	10.560
Δpg	-0.356	-1.392	-0.910	3.657	3.413	6.232	10.128
Δpfx	0.586	0.631	-0.071	-2.081	-	1.085	3.648
r	4.852	3.009	2.247	1.803	10.686	1.120	16.992
cap	1.867	-2.320	-2.698	-0.058	2.065	1.368	4.032
Critical 5 % values	1.645	1.645	1.645	1.645	2.370	5.991	9.488

OLS estimates of these equations are reported in Table 1. The r_i's refer to Godfrey's autocorrelation test statistics for lags of 1, 2, 3 and 4 periods, CHOW to the Chow stability test statistic for the period 1981.2 (owing to dummy variables, this statistic could not be computed for all equations), J-B to the Jarque-Bera test statistic for normality, and ARCH(4) to Engle's autoregressive conditional heteroscedasticity test statistic for four lags. For other details, see Krämer and Sonnberger (1986).

APPENDIX 2

HOW TO USE THE MIKRO-TEKO PROGRAM

1. Data transfer from Burroughs A17 to PC

Creating the required files on the mainframe computer

ˆPCH, D VSAR	(create a data file)
ˆPCH, E EXO	(create an equation file)
ˆPCH, M QMED	(create a model file)

These files are then transferred by the Handshake programme to a floppy disk which is here held in drive B.

2. Running the MIKRO-TEKO programme with a PC

```
C:A
TEKO
ˆREAD, DW
B:VSAR
ˆSET, KY #B:EXO
ˆREAD, MW
B:QMED
ˆTIME               (time command; see below)
ˆMOD,V              (version command; see below)
ˆMOD,FQ             (solution command; see below)
```

Solution with an Olivetti PC M280 with a math processor for 10 periods takes about 5 minutes (using one floppy disk for the programme and another for the model and equations and data)

3. Short description of the MOD command in the MIKRO-TEKO programme

ˆT,K 89Q1 91Q2	(time command; the model will be solved for the period 1989Q1 - 1991Q2)

```
¨MOD,V V1,V2,V3,V4,V1,     (version command; data versions are defined
V1,VZ                       for exogeneous and endogenous variables)
TAX
¨
¨MOD,FQARNW QMED           (solve the model QMED with dynamic simulation)
```

EXPLANATION OF VERSIONS AND OPTIONS

- V1 Historical data (e.g. GDPQ.V1, TAX.V1)
- V2 Data for exogenous variables (to be used in the solution period)
- V3 Data for endogenous variables (to be used as starting values in the solution period with the S option)
- V4 Version for stored results
- VZ Version for individual shocked variables (max. 50) which are different from normal values, here the TAX variable
- F Fair-Taylor algorithm for rational expectations
- Q Lagged values are used as initial values in solving the model
- R Values of the residuals are set to zero
- A Maximum number of iterations, accuracy and values of the path extension parameter for the required three stages of iterations will be defined by separate commands
- N Short printout
- W Results are stored in the working space

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