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USING A MACROMODEL TO EXAMINE POLICY ALTERNATIVES: SOME FINNISH RESULTS

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ABSTRACT

This paper focusses on the question of how to design policies which would help a small open economy to improve its growth potential. To this end, the effects of several policy instruments are evaluated using the QMED model of the Bank of Finland as an analytical framework. Special emphasis is placed on supply-side effects, which include both relative price effects and (endogenous) capacity effects. The policy simulations suggest that well-designed economic policies would indeed pay off in the form of improvements in competitiveness and productive capacity.

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1. INTRODUCTION

This paper reports some policy experiments carried out with the Quarterly Model of the Economics Department of the Bank of Finland (QMED). Given this model, we show how the performance of a (small open) economy can be improved considerably by a combination of monetary, fiscal and incomes policy measures. First, we examine the five-year period 1981-1985 in Finland using the dynamic simulation solution of QMED as a point of reference. Then we present an alternative scenario for some key exogenous variables, which includes a smaller increase in contract wages, a lower interest rate and a lower growth rate of public consumption.[1] When public consumption is decreased in this scenario (denoted by AP) the unused resources are shifted one for one to manufacturing investment.[2] When the results of the model simulations are examined it turns out that if, in fact, the alternative policy scenario is followed, at the end of the experiment period there is about the same level of total output and private consumption as in the control solution but much more productive capacity and a far better situation as regards competitiveness. Obviously, the relevance of these results depends on the relevance and importance of the Lucas crituque. In this context we are not, however, able to assess this question, which should be kept in mind when evaluating the subsequent results.

In the following we first present a short summary of our model in section 2. Section 3 contains a description of the policy experiment and reports the main results. Finally, there is a brief concluding section.

2. A SHORT DESCRIPTION OF THE QMED-MODEL

QMED is a small, aggregative quarterly model of the Finnish economy. The current version consists of 79 endogenous and exogenous variables, the number of stochastic equations being 20. However, 6 of these equations are some sort of auxiliary equations for income

Table 1

Main behavioral equations of the QMED-model

(1) $\Delta x = -.311*\Delta x(-4) - .703*\Delta pxf(-2) - .378*(x-f)(-1)$
$+ .370*(x-f)(-2) + .778*\Delta f + .604*\Delta f(-2) + .355*cap(-2)$

R2 = .537 D-W = 2.182 SE = .053

(2) $\Delta m = 1.009*\Delta z + .846*\Delta pzm - .509*(m-z)(-1)$
$+ .331*(m-z)(-2) + .164*(m-z)(-3) - .231*cap(-1)$

R2 = .596 D-W = 2.183 SE = .051

(3) $c = .578*c(-1) + .426*yhr(+1) - .002*(r-(400*\Delta pc(+1)))$
$- .810*\Delta pc(+1) + .024*d1 + 1.892$

R2 = .993 D-W = 2.495 SE = .011

(4) $ih = .588*ih(-1) + .170*yhr(+1) - 1.990*hk(-1) + 14.095*n$
$- .002*(r-(400*\Delta pc(+1))) - 0.454*\ pch(-4) - 87.772$

R2 = .741 D-W = 2.248 SE = .044

(5) $\Delta k = .822*\Delta k(-1) + 1.099*\Delta ye - .016*\Delta wr(-4)$
$- .00003*(r-(400*\Delta pi))(-2) - .005*cap(-1) + .001$

R2 = .792 D-W = 2.571 SE = .001

(6) $\Delta l = .196*\Delta l(-4) + 1.073*\Delta yi - .064*\Delta wr(-4)$
$- .198*(l-n)(-1) - .042*cap(-1)$
$- .005*d2 + .024*d3 + .007*d4 - .292$

R2 = .652 D-W = 1.512 SE = .004

(7) $\Delta w = .108*\Delta 4(pc(+1)) + .909*\Delta wc - .014*cap(-1)$

R2 = .849 D-W = 2.149 SE = .006

(8) $\Delta pc = .279*\Delta wn + .188*\Delta wn(-1) + .177*\Delta wn(-2) + .079*\Delta pm$
$+ .068*\Delta pm(-1) + .060*pm(-2)$

R2 = .736 D-W = 1.763 SE = .006

(9) $\Delta pi = .487*\Delta wn + .020*\Delta pmo + .175*\Delta pm(-2) + .196*\Delta pi(-1)$
$- .051*d5 + .028*d6$

R2 = .504 D-W = 2.156 SE = .014

(10) $\Delta pg = .626*\Delta wn + .173*\Delta wn(-3) + .125*\Delta pm + .013*d7$
$- .042*d8 + .035*d9$

R2 = .817 D-W = 1.945 SE = .008

(11) $\Delta px = -.172*\Delta px(-4) + .370*\Delta wn + .512*\Delta pf - .087*\Delta 3pxf(-1) + .014*\Delta pmo(-1) + .285*\Delta er(-4) + .054*d10 + .059*d11$

R2 = .723 D-W = 2.096 SE = .018

(12) $r = .749*r(-1) + 15.517\Delta pc + .208*rd + 3.441*\Delta dr$

R2 = .890 D-W = 1.831 SE = .548

(13) $q = .466*q(-1) + .513*z + .086*ig - .110*d12 - 1.395$

R2 = .988 D-W = 1.393 SE = .020

(14) $cap = .006*t - 2.066 + .7*k(-1) + .3*n - q + mr$

(15) $\Delta wc = .611\Delta pc(-3) + .404\Delta(w-wc)(-3) + 1.000g(-3) + .052d12 - .006$

R^2 = .242 D-W = 2.285 SE = .019

All variables, except r, are expressed in logs, and all expenditures are defined in real terms. The number of lags in quarters is shown in parentheses after each lagged variable (i.e. (-1) refers to the t-1 period and (+1) to the t+1 period). Δ denotes the first backwards differencing operator and $\Delta 4$ denotes the fourth backwards differencing operator. In addition R2 = (unadjusted) coefficient of multiple correlation, D-W = Durbin - Watson statistic and SE = standard error of estimate. In most cases the model is used without the contract wage equation (15), i.e. wc is assumed to be exogenous.

List of variables
(Exogenous variables are underlined.)

c	private consumption
cap	unused capacity in manufacturing
dr	real outstanding government domestic debt
d1-d12	dummy varibles
er	exchange rate
f	foreign import demand
g	lagged 20-quarter moving average of change of labor productivity
hk	stock of residential capital
ig	public consumption and investment
ih	housing investment
k	stock of capital in manufacturing
l	wage earners' employment
m	imports (excluding oil)
mr	scale parameter for capacity utilization
n	working-age population
pc	private consumption prices
pch	pc - pih
pf	foreign producer prices
pg	public consumption prices
pi	investment prices
ph	housing investment prices
pm	import prices
pmo	import prices of oil
pq	GDP deflator
pr	raw material prices
prz	pr - pz
px	export prices of goods (excluding bilateral export prices)
pxf	px - pf
pz	domestic demand prices
pzm	pz - pm
q	manufacturing production
r	interest rate (government bond yield)
rd	commercial banks' average lending rate
s	employers' social security contributions
t	linear trend
w	wage rate
wc	contract wage rate
wn	w*(1+s)
wr	w*(1+s) - pq
x	exports of goods (excluding bilateral exports)
xe	bilateral exports
ye	instrumental variable for output (determined by Δf and Δ(px-pq))
yh	households' disposable income
yhr	yh - pc
yi	instrumental variable for output (determined by Δxe, Δf, Δ(px-pq) and Δig)
z	domestic demand

accounting, the structure of private consumption expenditure, and employment and the labor fource. The remaining 14 main equations are reported in Table 1. In order to save space only the coefficient estimates and the basic equation statistics are reported. In addition to these equations, there are, of course, a number of identities, which are not reported here.

As can be seen, QMED is basically a Keynesian macromodel in which effective demand plays a crucial role. There are, however, some features which abstract from the standard Keynesian framework (or at least from the orthodox version of that model). First, prices, wages and interest rates are not completely rigid, second, the capacity variable is endogenous allowing for supply side effects, third, the the main domestic demand components are not determined by actual output or income, and, finally, inflationary and income expectations are modelled according to the Rational Expectations Hypothesis.

To be more precise this means that wages are determined by an expectations augmented Phillips-curve which is specified in terms of the endogenous capacity utilization rate. Prices, in turn, follow a mark-up pricing rule with respect to both wages and (exogenous) import prices. The interest rate, in turn, is determined by the rate of inflation, the exogenous lending rate and the government debt. The capacity utilization rate reflects, on the one hand, the level of working-age population and the stock of capital, and on the other hand, the level of industrial production. The latter variable, in turn, is mainly determined by aggregate demand. The capacity utilization rate then affects the economy via two channels: first, via exports and imports, and second, via wage formation.

As far as the main domestic demand components, private consumption, residental investment and private manufacturing investment, as well as employment, are concerned the important thing is that these variables are not determined by current income or output. Instead, some exogenous demand shift variables or expected real income is used as scale variable. Thus, the model is not particularly simultaneous and there seems to be no obvious diagnostic problems.[3] Finally, one important feature of the model is the treatment of

expectations. Thus, it is assumed that inflation and (households' disposable) income expectations are formed rationally given the current period information. Inflation expectations affect wages and (expected) real interest rates which, in turn, affect private consumption and investment in residental construction. In addition, inflation expectations affect private consumption directly. Households' income expectations together with inflation expectations determine expected real income, which also affects both private consumption and investment in residental construction. Obviously, this kind of specification creates problems both in terms of estimation and simulation. As far as the estimation problems are concerned, we try to solve them by making use of the Iterative Instrumental Variable technique proposed by Hatanaka (1978). Thus, we first estimate the whole model using OLS for the period 1971.1 - 1986.4. Then we form the Gauss-Seidel solution for the whole model and use the solution as the instrument for both the expected inflation rate and the current period endogenous variables. The solution of the model is carried out using the Extended Path Method by Fair and Taylor (1983). (See Lahti and Virén (1987) for details of the estimation and model-solution properties of the QMED-model.)

Some idea of the performance of the model may be obtained by examining the following Mean Absolute Per Cent Errors (MAPE) for this same period:

Table 2 MAPE-values for the estimation period 1971.1 - 1986.4, %

	wc exogenous	wc endogenous
Gross Domestic Product (v)	1.75	1.73
Private Consumption (v)	2.37	2.84
Private Investment (v)	3.91	4.97
Exports (v)	3.79	5.38
Imports (v)	3.29	6.02
Implicit GDP Deflator (p)	2.06	4.45
Consumption Prices (p)	2.19	4.51
Export Prices (p)	4.03	6.35
Wage Rate (p)	2.12	5.81
Employment (h)	1.00	1.02

v refers to volumes, p to implicit price deflators and
h to working hours

3. POLICY ALTERNATIVES FOR THE FINNISH ECONOMY

The performance of the Finnish economy during the five-year period 1981-1985 was relatively satisfactory. The growth rate of GDP was on average 2.7 per cent, the level unemployment 5.9 per cent and the rate of inflation 8.8 per cent. Compared with other OECD countries these figures are not much inferior; rather the opposite. The rate of inflation was, however, somewhat higher than in countries which compete with Finland in terms of exports. Even though the Finnish Markka was devalued in November 1982 (by about 8 per cent), Finland's competitive position deteriorated over the whole period 1981-1985. This deterioration, in turn, caused some speculation against the Finnish markka, which forced the Bank of Finland to adopt a policy of very high interest rates and this presumably had some sort of depressing effect on private investment and consumption.[4]

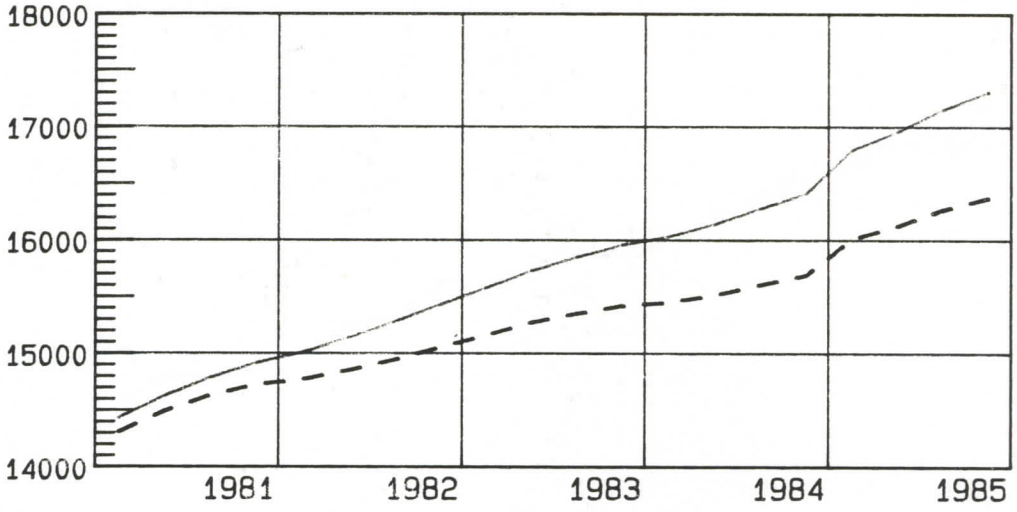
Finland also succeeded in avoiding large budget deficits, which were typical e.g. in other Scandinavian countries. Even so, the growth rate of public consumption was clearly higher than the growth rate of total output: thus the sample average of Δcg was 3.7 while the corresponding figure for Δy was 2.7.

Although the economic performance of the Finnish economy cannot therefore be said to have been poor, it is nevertheless worth examining whether a better result could have been obtained by reducing wage increases and by shifting the structure of demand away from (public) consumption to productive investments. Given the fact that smaller wage increases would have implied a better level of competitiveness and thus less pressures against the Markka, it may be assumed that this would have allowed for considerably lower interest rates. This paper reports the results of an experiment in which these three exogenous variables (cg, wc, and rd) are changed as shown in Figure 1. Thus, the growth rate of public consumption is decreased by 1.00 percentage points per annum, the rate of change in contract wages is set at the same level as the weighted average of the Federal Republic of Germany, the UK, and Sweden, and finally the interest rate is lowered to a level which roughly corresponds to the yield on long-term German government bonds.[5]

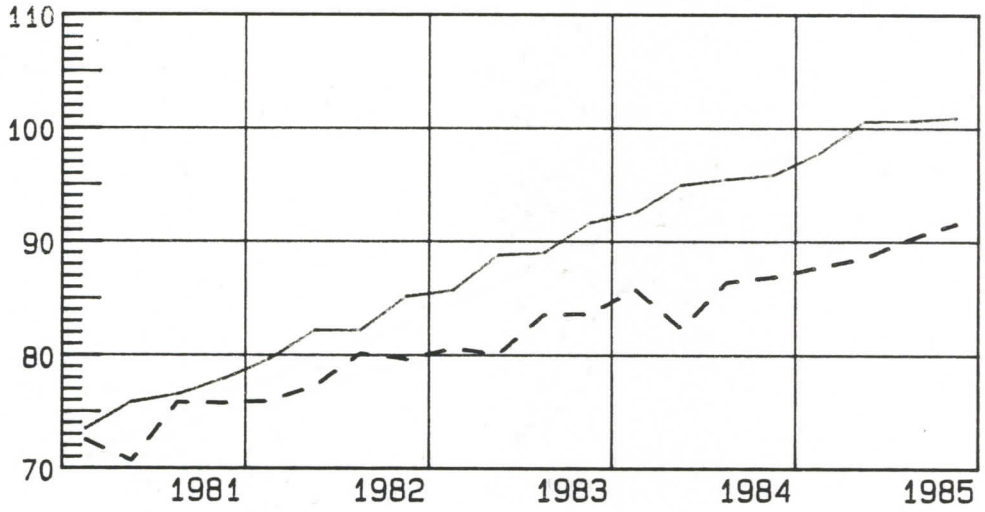
Figure 1

POLICY VARIABLES

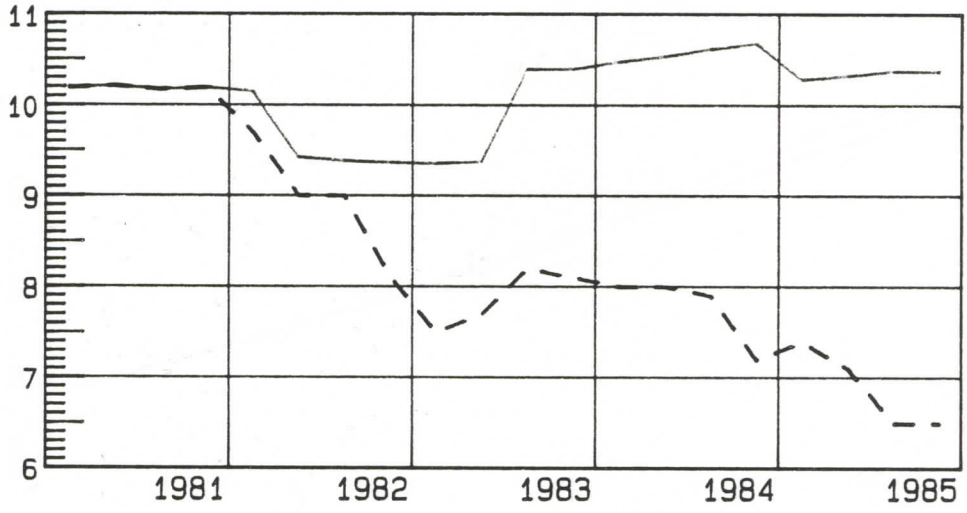
Public consumption, millions of 1985 FIM



Contract wages, 1985=100



Interest rate, % p.a.

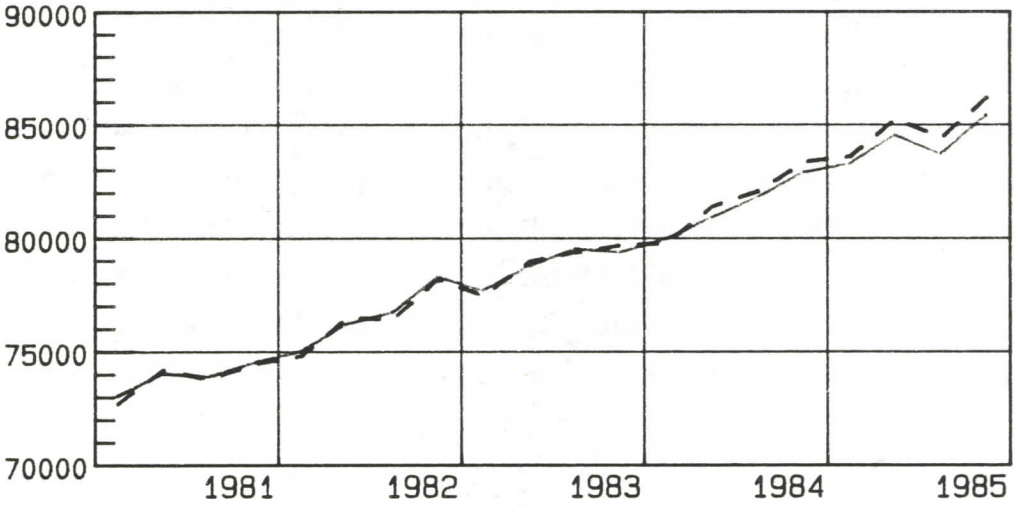


Actual ———

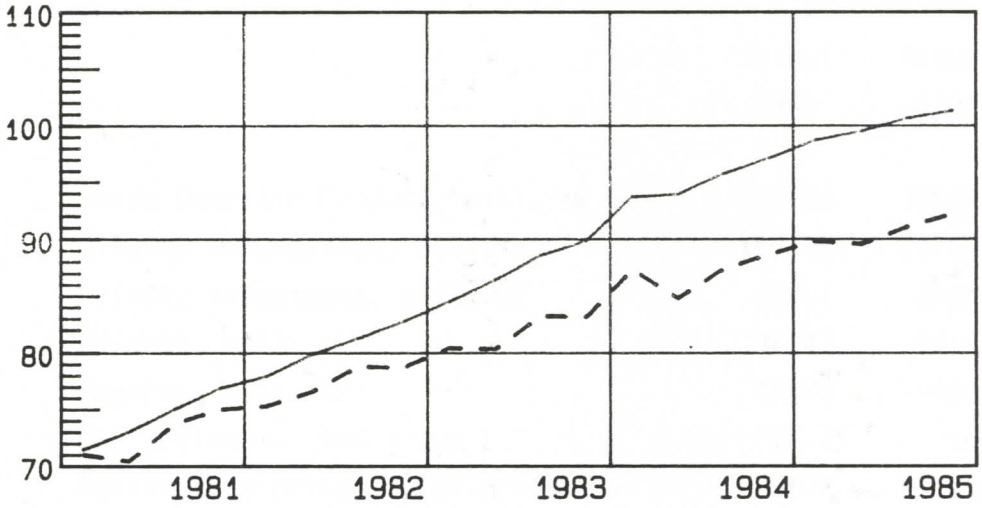
Policy alternative - - - -

Figure 2 Simulation results

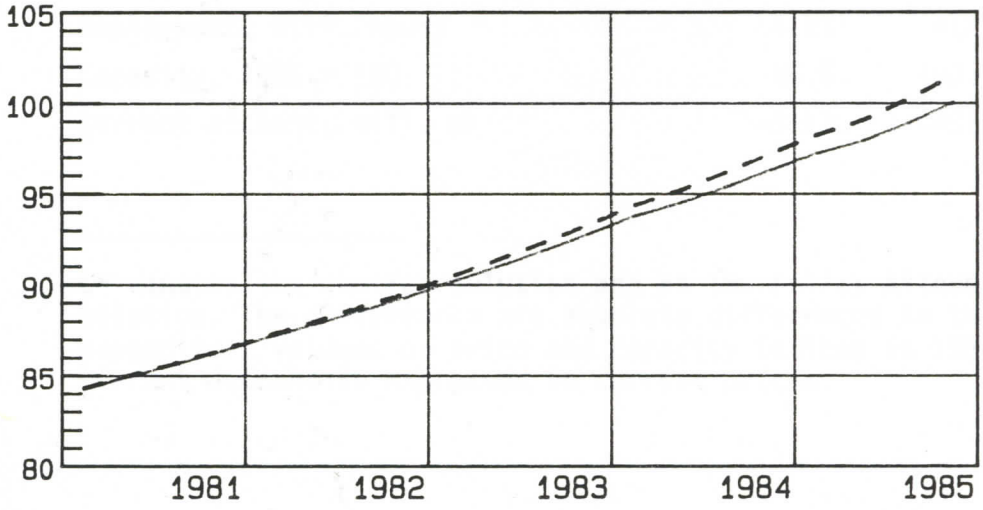
GDP, millions of 1985 FIM



GDP deflator, 1985=100



Capacity, 1985=100



Actual ———

Policy alternative - - - -

Our model is solved using both the actual values of these exogenous variables (this case is called the control solution, C*) and these alternative exogenous values. The results, which are presented in Figure 2, make use of dynamic simulation in such a way that the simulation error of the control solution is added to the values of both the control solution and the AP solution (in the same way as e.g. in Brinner (1985)). The following variables are displayed in this figure: 1) GDP at constant 1985 prices, 2) GDP deflator, and 3) the level of (manufacturing) capacity. Table 3, in turn, contains data on these and some other key variables for the years 1980 and 1985.

Table 3. Summary of the Effects of Alternative Policy

	Actual 1980	Actual 1985	C*-PA 1985
Gross Domestic Product, mill. mk	290682	336824	-2455
Private consumption, mill. mk	157702	181664	907
Private investment, mill. mk	62501	69599	-885
Exports, mill. mk	86543	98141	-3095
Imports, mill. mk	87473	94856	3497
GDP deflator, 1985 = 100	66.3	100	9.4
Consumption prices, 1985 = 100	66.2	100	8.4
Export prices, 1985 = 100	73.4	100	3.9
Wage rate, 1985 = 100	61.2	100	13.0
Employment, mill. hours	4123	4127	2
Capacity, 1985 = 100	86.4	100.0	-1.2
Current account, mill. mk	-5113	-4516	-3028

C* denotes the control solution and PA the Policy Alternative solution. The differences are absolute differences in the respective expenditure volumes or price and capacity indices in 1985. The current account is expressed in current prices.

Some comments on these results are clearly called for. First, it can be seen that the alternative policy would produce a much better situation in terms of competitiviness. Given the very moderate growth of labor costs, there should not be any pressures for devaluing the Markka; in fact, the current account would be almost in balance in the alternative policy scenario. This is true even though increased investment stimulates domestic (manufacturing) demand - and this crowds out some exports - and increases imports. Obviously, the export industry could exploit the better competitiveness by lowering export prices (more than takes place in the alternative policy scenario) and thus increasing market shares. In our model, however, export prices reflect more the competitors' prices than domestic costs and hence this kind of effect occurs only partially.[6] Second, the important point in terms of future growth prospects is the fact that the level of productive capacity is about 1.2 per cent higher than in the control solution. Finally, employment would not change very much so that the unemployment rate would not deviate from the actual rate of 6.2 per cent at the end of 1985.[7]

4. CONCLUDING REMARKS

Our simulations with the QMED model indicate that if the model which is used can take into account not only flexible wages and prices but also supply-side effects, many new interesting policy alternatives can be focussed on. For example, in terms of public consumption, such contractionary policies can be designed which do not necessarily decrease economic activity but rather create more productive capital and decrease inflationary pressures. In the case of a small open country like Finland incomes policy is obviously of crucial importance. And, in fact, it turns out that the advantages of wage moderation are very clearly revealed: not only do lower wage settlements directly affect the level of competitiveness but they also affect the need for monetary policy restraints.

FOOTNOTES

1) Finland is characterized by a strongly unionized labour market (the overall unionization rate is about 80 per cent), which makes wage settlements (which are typically made once a year and, equally typically, are very similar for all sectors of the economy) at least seemingly very important in terms of overall price developments.

2) A considerable proportion of manufacturing firms in Finland is owned by the state. These firms typically obtain their additional financing directly from the state budget (for instance, due to the fact that these firms have no access to the stock market). Thus, we assume here that the state can directly affect manufacturing investment by transferring money to state-owned companies. Alternatively, we could assume some corporate tax decuctions, but we are not able to properly model their impact on private investment. We therefore adopt this simpler assumption. Another reason is that we do not want to change the basic assumptions in terms of the public sector financing situation.

3) As one can see from Table 1, an essential ingredient of the model is, in addition to the rational expectations formulation, the existence of generalized Error Correction Mechanisms a lá Kloek (1984) which take care of both the short-run dynamics and the long-run constraints. Finally, we can point out that the model produces quite sensible results in terms of various policy multipliers. Thus, for instance, the real GDP multiplier of public consumption slightly exceeds one in year one and two but reduces to zero in about 10 years. As far as the estimated equations are considered, a considerable amount of diagnostic testing was carried out, and only in a few cases the equations failed to pass all of these tests. To be more precise, the following tests were carried out: the Durbin-Watson autocorrelation test, Godfrey's LM autocorrelation test with 4 lags, the Jarque-Bera test for normality of residuals, Engle's autocorrelation conditional heteroscedasticity test (ARCH) with 4 lags, the Chow-test, the Cusum and Cusum Squares tests, the Farley-Hinich test for the hypothesis that the parameters follow a linear trend, and the Breusch-Pagan heteroscedasticity test (see Krämer and Sonnberger (1986) for details of these tests). Moreover, the correlation matrix of the OLS residuals indicated that only 4 coefficients of correlation were significantly different from zero at the 5 per cent level of significance. See Lahti and Virén (1987) for details.

4) See e.g. Virén (1986) for empirical evidence on the real interest rate effects.

5) To be more precise, the exogenous (commercial banks') lending rate, which the Bank of Finland could more or less

control during the period 1981 - 1985, was lowered so that the endogenous interest rate in the model decreased roughly to same level as the reference rate.

6) This result presumably reflects the fact that thus far export industry has always tried not to exceed "market prices" in the export market and the competitive position has been corrected by devaluing the Markka (Finland has a fixed exchange rate system with a currency index). Thus, here the "policy rule" would say that the value of the Markka should have been appreciated.

7) Employment tends to increase because of lower real wages but this effect is more or less offset by an increase in unused capacity.

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