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PREFACE

This study was originally prepared for an international conference on macroeconomics which took place in Sannäs, Finland, June 23 - 27, 1980. We are grateful for comments received at the seminar and discussions at the Bank of Finland. We also wish to thank Seija Leino for typing the paper, Pirjo Kivilahti for computational assistance and Malcolm Waters for checking the language.

The views put forward in the paper are those of the authors and do not necessarily reflect those of the Bank of Finland.

Helsinki, January, 1981

Hannu Halttunen Sixten Korkman

CONTENTS

1. INTRODUCTION

There is an extensive theoretical literature dealing with the role of economic policy in small and open economies. The models employed in this literature often seem to yield simple and strong conclusions: under fixed exchange rates and in the long run monetary and fiscal policy will be unable to affect the level of output and employment, a change in the exchange rate similarly has effects only on the price level and other nominal magnitudes etc.[1] The relevance of these conclusions is generally admitted to be confined to the "long run". From the point of view of macroeconomic management, however, the essential question is not whether economic policies have effects in the long run, but rather whether they have "sufficiently fast" and "sufficiently enduring" effects (so that they affect demand and output during this year and next). This is clearly an empirical question. Seldom, however, are the models used to derive far-reaching policy conclusions confronted in any way with empirical data.

1. These propositions are not advanced solely by monetarists but typically arise within Keynesian models as well. For monetary policy, see, e.g., Swoboda (1973), for fiscal policy, see McKinnon (1976), for exchange rate policy, see Dornbusch (1973). Cf. also Branson (1975) and Turnowsky (1977).

The aim of this study is to consider the significance of central bank policy (by which we mean monetary and exchange rate policy) for the cyclical behaviour of an economy with particular reference to Finland. The structure of the study is as follows. In Section 2 we specify a model of an open economy which is simple and yet includes variables reflecting the operation of exchange rate and monetary policy. The model forms the basis for a discussion of the characteristics of long-run equilibrium as well as of the significance of the monetary and exhange rate policy pursued for the short-run effects of various exogenous disturbances. At the end of Section 2, we also make some observations on the consequences of policy for the dynamics of adjustment. In Section 3 a partially condensed version of the model is estimated and used for simulation experiments that illustrate the quantitative significance of policy issues discussed in Section 2. Section 4 concludes.

2. CENTRAL BANK POLICY AND DOMESTIC STABILITY IN A SIMPLE MODEL

In this section a model of a small open economy is formulated[1] and used to analyze the effects of exogenous disturbances under various assumptions about monetary and exchange rate policy. The model employed is a highly simplified one, and the specification of the asset side, in particular, is crude. While having the drawback of abstracting from some of the real-world complications that may be relevant when assessing the consequences of alternative macroeconomic policies, a simple specification has nevertheless been found useful not only in facilitating analysis, but also in providing a manageable starting point for the estimation and simulation experiments that are presented in Section 3. We proceed as follows. First, we set out the model subsequently to be employed (2.1). Next, we outline some of the characteristics of its long-run equilibrium (2.2). Then we analyze the consequences of various kinds of policy behaviour for the "automatic stability" of the model or for the short-run effects of exogenous

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1. The model is basically similar to the model used in Korkman (1980, ch. 4). Differences relate mainly to the treatment of income distribution and the role of monetary conditions.

disturbances (2.3). Finally, we make some observations on the dynamics of the model (2.4).

2.1. The Model

The sectoral aggregation of the model is such as to make a distinction between the central bank, the rest of the domestic economy (households, firms and private banks as well as the government sector[1]) and the rest of the world (the foreign sector). The aggregation of households, firms and private banks implies that the model abstracts from the private domestic credit market and that the domestic non-central bank sector finances its expenditures by means of its disposable income (GNP) or by net borrowing from the central bank and/or abroad.[2] With respect to commodity aggregation, it is assumed that the economy under consideration produces only one commodity, which may be either consumed or invested domestically or exported, and imports two commodities: a final good which is substitutable for the domestic commodity in consumption and investment, and a pure intermediate input (raw materials or energy).
The equilibrium condition for the domestic commodity is:

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1. The government sector is not treated separately, because here we are interested in only central bank policy.

2. In contrast to many other countries, in Finland commercial bank borrowing from the central bank was (on the margin) a very important source of finance for the private sector during most of the 1960s and 1970s.

$$(1) \quad Q = \underset{+}{D}(\underset{+}{E}, \underset{+}{\frac{eP^*_M}{P_D}}) + D_0 + X(\underset{+}{M^*}, \underset{+}{\frac{eP^*_X}{P_D}}) \quad ,$$

where Q is gross output of the domestic commodity (net of domestic intermediate goods but not of imported inputs). The symbol D denotes domestic demand for the domestic commodity consisting of an autonomous component D_0 and an endogenous part which depends positively[1] on real domestic expenditure E (in terms of the domestic good) and the price ratio between foreign and domestic final output (P^*_M = foreign currency price of final imports, e = price of foreign exchange and P_D = price of the domestic commodity). The volume of exports X is taken to be an increasing function of foreign activity M* (total foreign production, expenditure or imports) and relative export prices (P^*_X = price of competing exports). The balance of payments on current account B (in terms of domestic goods) equals real national income Y less real domestic expenditure E:

$$(2) \quad B = Y - E \, .$$

Real domestic expenditure is written:

$$(3) \quad E = E(\underset{+}{Y}, \underset{-}{\frac{eP^*_M}{P_D}}, \underset{-}{r}, \underset{-}{r^* + \Pi_e}, \underset{+}{\Pi_P}) + E_0 \quad ,$$

1. Assumptions about the sings of partial derivatives are as indicated below the equations.

where E_0 is an autonomous component and where r is the (marginal[1]) rate of interest on central bank lending to the domestic private sector, r* the rate of interest on foreign debt, Π_e the expected rate of depreciation of the currency and Π_p the expected rate of inflation. Domestic demand is assumed to be a positive function of income and expected inflation (which, given r, r* and Π_e, reduces expected real rates of interest) and a negative function of the domestic rate of interest, the foreign rate of interest (corrected for exchange rate expectations) and the ratio of foreign to domestic prices (terms-of-trade effect). National income, which is taken to be the variable relevant for domestic expenditure, equals (abstracting from interest payments on the foreign debt) gross output less imports of intermediate inputs R:

$$(4) \quad Y = Q - \frac{eP_R^*}{P_R} \cdot R ,$$

(P_R^* = foreign currency price of imported inputs). The latter, as well as employment L, is for simplicity assumed to be proportional to gross domestic output:

$$(5) \quad R = \beta Q$$

$$(6) \quad L = \alpha Q .$$

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1. Cf. note 1 below on p. 49.

Turning to prices and wages, the price of the domestic commodity is taken to depend on the money wage W, the price of imported inputs and the price of competing exports[1]:

$$(7)\quad P_D = \underset{+}{\phi}(W,\ \underset{+}{eP_R^*},\ \underset{+}{eP_X^*}) \ .$$

The ϕ-function is assumed to be homogeneous of degree one, implying $P_D = W\phi_W + eP_R^*\phi_R + eP_X^*\phi_X$ ($\phi_R = \partial P_D/\partial(P_R^*)$ etc). Money wage behaviour is described by a Phillips-curve:

$$(8)\quad \hat{W} = \underset{+}{g}(L) + \Pi_P \ ,$$

where $\hat{W}$ is the relative rate of change of money wages[2] and where g(L) indicates the relation between employment (or, given the supply of labour, unemployment) and wage inflation. Expectations of inflation may, for instance, be assumed to be formed adaptively:

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1. The price setting behaviour of exporters is known to be influenced by prices set by competitors (possibly "price leaders"). If firms demand the same price to be paid by domestic and foreign customers, it follows that the domestic output price level is directly affected by the price behaviour of competing exports even when the commodities are not imported to the country under consideration. This link is presumably of some importance primarily for small economies with exports heavily dependent on a few goods.

2. In the following a "dot" or "." denotes the rate of change or time derivative of a variable (e.g., $\dot{W} = dW/dt$) and a "hat" or "^" its relative rate of change (e.g., $\hat{W} = \dot{W}/W$).

$$(9)\quad \dot{\Pi}_P = \lambda(\hat{P} - \Pi_P) \quad ,$$

where $\hat{P}$ is the proportional rate of change of a price index reflecting (with constant weights) the development of domestic and foreign prices (for final imports):

$$(10)\quad \hat{P} = a\hat{P}_D + (1-a)(e\hat{P}^*_M) \quad ,$$

(and where $\hat{P}_D$ may be derived by using equation (7)). Exchange rate expectations will be treated as exogenous.

With respect to asset (or debt) behaviour, recall first that private domestic money and credit is eliminated from the analysis by the consolidation of the budget restrictions and balance sheets of households, firms and banks. The portfolio of the domestic non-central bank sector will therefore consist of real capital (which is treated as being constant), net foreign debt and net debt to the central bank (base money being treated either separately or netted from the total central bank debt). The (stock) demand for central bank debt H is assumed to be:

$$(11)\quad H = H(\underset{+}{Z}, \underset{-}{r}, \underset{+}{r^* + \Pi_e}) \quad ,$$

where Z is the non-central bank sector's total net financial position, i.e., the sum of its net foreign and domestic debts.[1] The demand for central bank debt is thus assumed to be a function of the total debt as well as of the interest rates and exchange rate expectations determining the relative cost of domestic as compared to foreign debt. The supply of central bank debt is specified as:

$$(12)\quad r = \underset{+}{h}(H,S) + r_0 ,$$

where r_0 is an autonomous component of the interest rate and where S denotes any target variable (such as the balance of payments on current account, employment or inflation) that affects the central bank's lending policy.

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1. Observe that Z is predetermined in the short run but changes over time through saving, i.e., through the current account. At each point in time, the level of foreign debt may thus be determined by using (11) and the balance sheet restrictions. Observe also that the demand for central bank debt is assumed to be independent of output and income. This would seem to imply one of the following assumptions: base money is abstracted from, an increase in the demand for base money caused by an increase in the level of output is reflected in the foreign debt only or the cost of central bank debt is a function of the total central bank debt less outstanding base money. Observe, finally, that in continuous time analysis the rate of interest and central bank debt may be determined independently of output and the current account since Z is momentarily given. In period analysis, however, the current account surplus will affect end-of-period stocks of foreign exchange reserves and central bank debt and therefore the rate of interest.

Given the exchange rate, prices of foreign goods, the level of the money wage etc., the equations given above determine the short-run equilibrium of, e.g., the price level, the rate of interest, output, income, domestic expenditure and the current account (which, over time, changes the economy's net financial position) as well as the rate of change of wages and prices (which, over time, lead to changes in the corresponding levels). In the following we will focus mostly on the short-run comparative statics of the model under various policy assumptions. Before turning to the short-run analysis, however, we shall briefly outline the characteristics of the long-run equilibrium and at the end of the section we shall make some comments on the dynamics of the model.

2.2. Inflation and Employment in the Long Run

The model set out above has a definite short-run emphasis. Hence it is not very meaningful to analyze the long-run characteristic of the model per se. Instead, the aim of the present subsection is to point out some simple long-run conclusions which would seem to be robust in that they can be generalized beyond the particular model employed, and which at the same time may be considered useful in providing a perspective on the subsequent short-run analysis.

Assume that the economy tends towards a unique long-run equilibrium, i.e., a state in which real stocks, real rates of interest, output levels and relative prices are constant at their stationary values. The first observation to be made is then that the constancy of relative prices associated with equilibrium immediately implies that the domestic rate of inflation at fixed exchange rates must equal the foreign rate of inflation. Another simple and direct implication is that a low domestic rate of inflation in a high inflation world can only be achieved by a policy involving a more or less continuous appreciation of the currency.

Observe next that the existence of long-run equilibrium implies that all the equations of the model must be homogeneous of degree zero (real demands and supplies) or one (nominal demands and supplies).[1] A further observation is then that a once-and-for-all shift in the foreign price

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1. Take, e.g., a function $y = f(x_1, x_2, z)$ where y, x_1 and x_2 denote some nominal magnitudes and z a real variable. In growth terms this equation reads $\hat{y} = (f_1 x_1/y)\hat{x}_1 + (f_2 x_2/y)\hat{x}_2 + (f_z z/y)\hat{z}$ where the f_i's denote partial derivatives. In a long-run (stationary) equilibrium all real variables are constant ($\hat{z} = 0$) and all nominal magnitudes must grow at the same rate (which excludes "rigidities" in the long run) so that ratios may remain constant ($\hat{y} = \hat{x}_1 = \hat{x}_2$). The equation then implies $y = f_1 x_1 + f_2 x_2$, which means that f is homogeneous of degree one.

level or in the price of foreign exchange will leave all equilibrium real values unaffected, i.e., the system exhibits neutrality. A final observation is that abstracting from base money and assuming a constant foreign real rate of interest implies a model which also exhibits "superneutrality", i.e., the long-run real equilibrium is independent of the foreign rate of inflation and the rate of depreciation of the currency.

The message emerging from the preceding observations is that, as a first approximation and in the long run, exchange rate policy in a small economy will determine only the rate of inflation without any real effects being involved, while at the same time, e.g., contractionary monetary policy under fixed exchange rates is futile in the longer run as an anti-inflationary device.[1] While these conclusions are to some extent independent of particular behavioural assumptions, there are nevertheless two reasons why they may not be very important. The first is simply that their validity is conditional on the existence of a unique long-run equilibrium. The second is that their relevance presumes that adjustment towards the long-run equilibrium is relatively rapid. This question of the speed

1. This conclusion holds in the long run. In the short and medium run monetary policy will affect inflation even under fixed exchange rates.

of convergence is an important empirical issue to be returned to in an empirical context in Section 3. For the rest of this section, however, it will be assumed that adjustment is sufficiently slow so that there is scope for (beneficial or harmful) demand management policies and so that exchange rate policy affects not only inflation but competitiveness, trade flows and employment as well. The next subsection thus turns to an analysis of the short-run equilibrium of the model.

2.3. Monetary Policy and the Short-Run Effects of Exogenous Disturbances

In the following we shall focus on the short-run effects of some conceivably important macroeconomic disturbances under alternative assumptions about monetary and exchange rate policy. The short-run or instantaneous equilibrium refers to a state with a given level of money wages (W) and inflation expecations (Π_p) as well as a given net financial position or level of indebtedness (Z). The disturbances considered are: a change in foreign demand (M^*), an increase in the foreign price level (an equal relative increase in P^*_M, P^*_X and P^*_R), an increase in the price of imported inputs (P^*_R), an increase in money wages (W), a domestic demand shift (a shift in D_0 for a given level of E) and an autonomous increase in the level of domestic demand (an increase in E_0).

We shall first assume fixed exchange rates and consider the significance of monetary policy, only then turning to the potential role of exchange rate policy.

2.3.1. Externally-Oriented Monetary Policy

A deficit in the balance of payments on current account will over time lead to a weakening of the financial position of the domestic non-central bank sector, and this is likely to involve both an increase in foreign indebtedness and an increase in the net debt to the central bank. A current account surplus correspondingly constitutes positive financial saving that reduces the total net debt of the private and government sector. Given that the cost of central bank credit is a function of its amount, this implies that a current account imbalance will have automatic effects on domestic monetary conditions.[1] In the short run or instantaneous equilibrium, on the other hand, the total debt is given and monetary conditions depend only

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1. The dependence of the cost of central bank debt on its amount implies a corresponding link between the (rate of change of the) cost of central bank credit and the balance of payments on current account; cf. section 2.5 below.

on its allocation between central bank and foreign debt.[1] This does not mean, however, that the domestic rate of interest must necessarily be independent of the balance of payments on current account even in the short run, since external balance may well be a target variable which influences the behaviour of the monetary authority.

Assume, therefore, first that $S = B$ with $h_B < 0$, i.e. that monetary policy is externally oriented in the sense that it aims at furthering an equilibration of the balance of payments on current account (by raising the rate of interest when the current account is in deficit and lowering the interest rate when a surplus is recorded). One of the questions then arising is: how does this effect the (short-run) multiplier effects of exogenous disturbances on other targets like the price level or the rate of inflation and output or employment. (In our simple model an externally-oriented monetary policy will always contribute to external stability in the sense that the short-run current account effects of exogenous disturbances are diminished.)

The effects of externally-oriented monetary policy on domestic stability are easily calculated by differentiating the model and the results are summarized in Table 1. In the table the letter "s" indicates "stabilizing" in the

1. Cf. note 1 above on p. 15.

sense that $h_B < 0$ as compared to $h_B = 0$ reduces the absolute value of the multiplier effect of the exogenous variable in the column on the endogenous variable in the row (level of output Q and employment L, price level P or rate of inflation $\hat{P}$). The letter "d" correspondingly denotes "destabilizing", indicating that exogenous disturbances have greater (absolute) domestic effects with $h_B < 0$ than for $h_B = 0$. The entries for "d" and "s" given without brackets are based on the assumptions about the sign of partial derivatives made above and the assumption that the economy's marginal propensity to spend is below one ($E_Y < 1$), while the entries given in brackets additionally require "large enough" elasticities.

Table 1. ($h_B < 0$)

	M^*	P^*	P^*_R	W	D_0	E_0
Q or L	d	(d)	d	(d)	d	s
P or $\hat{P}$	d	(d)	s	(s)	d	s

The findings of Table 1 are simple and pose no problems of interpretation. Take as an example the effect on the level of output of an increase in foreign demand. This effect is:[1]

1. X_M, h_B etc. denote partial derivatives. For simplicity it has been assumed that $W = P_D = e = P^*_M = P^*_R = P^*_X = 1$ initially.

(13) $\frac{\partial Q}{\partial M^*} = \frac{1}{\Delta}[(1 + \delta h_B)X_{M^*}] > 0,$

$\Delta = 1 - D_E E_Y(1-\beta) + [1-D_E(1-\beta)]\delta h_B > 0,$

$\delta = E_r/(1-h_H H_r) < 0,$

which is positive whether $h_B < 0$ or not, but greater in the former case. Externally-oriented monetary policy will thus be destabilizing for output and employment (as well as the rate of inflation) if the dominating source of disturbances is foreign demand fluctutations. The reason is that growth of foreign demand will now increase domestic output both directly via exports and indirectly via the fall in the rate of interest induced by the strengthening of the balance of payments on current account which is taking place and which is given by:

(14) $\frac{\partial B}{\partial M^*} = \frac{1}{\Delta}(1-E_Y)(1-\beta)X_{M^*} > 0.$

Consider next an increse in the prices of all foreign goods. The effects on output and the current account are given by:

(15) $\frac{\partial Q}{\partial P^*} = \frac{\phi_W}{\Delta}\Big((1+\delta h_B)\varepsilon - D_E\delta h_B[E_P + (1-E_Y)R]\Big),$

(16) $\frac{\partial B}{\partial P^*} = \frac{\phi_W}{\Delta}\Big((1-E_Y)(1-\beta)\varepsilon - [E_P + (1-E_Y)R][1 - D_E E_Y(1-\beta)]\Big),$

where $\varepsilon = X_P + D_P + D_E E_P - D_E E_Y R$ which gives the direct effect of an increase in foreign prices on demand for domestic output ($E_P = \partial E/\partial (eP^*_M/P_D)$, $X_P = \partial X/\partial (eP^*_X/P_D)$, $D_P = \partial D/\partial (eP^*_M/P_D)$. Obviously $\varepsilon > 0$ if substitution effects are strong enough.[1] Since the multipliers are positively related to ε, sufficient price elasticity of demand may also ensure that $\partial Q/\partial P^*$ and $\partial B/\partial P^*$ are both positive. If so, then externally-oriented monetary policy will be domestically destabilizing by the mechanism described above.[2]

For the case of an increase in the price of imported inputs only, the result is less ambiguous:[3] both output and the current account will be negatively affected and domestic employment will suffer more to the extent that monetary policy reacts on the balance of payments. A restrictive

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1. It is easy to show that $\varepsilon > 0$ reduces to the standard Marshall-Lerner condition if input imports and the terms-of-trade effect are disregarded and if balanced trade is initially assumed.

2. Externally-oriented monetary policy will also be destabilizing with respect to output if an increase in foreign prices is both deflationary and worsens the balance of payments. It will be stabilizing, however, in the conceivable case in which it is expansionary but weakens the current account. Cf. note 1 on p. 62.

3. This is a simple case of an adverse shift in the terms of trade. It may of course be unrealistic to assume that an increase in the price of imported inputs does not effect the price of final imports or of competitors' exports.

monetary policy will, however, serve to dampen inflation which explains the s-entry in the second row.[1]

Since we are abstracting from real balance and wealth effects, an equal relative fall in domestic money wages will have precisely the same real effects as an equal relative increase in the foreign price level. The presumed monetary policy will then be destabilizing with respect to output if elasticities are high enough so that the increase in money wages is deflationary and worsens the current account. The restrictive policy thus induced will, however, add to the tendency for wages and prices to fall back or rise less and may thus be considered stabilizing with respect to price developments.

The case of domestic demand fluctuations is clearcut. Fluctuations in the composition of domestic demand will cause a positive correlation between the output level and the current account and thus externally-oriented monetary policy will be destabilizing (by adding to domestic demand when it is high anyway and vice versa). Fluctuations in the

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1. Observe that an increase (upward shift) in P_R^* in the model will raise the price level P while monetary policy will only affect its rate of change $\hat{P}$. To say that restrictive monetary policy induced by an increase in the price level of imported inputs is stabilizing with respect to the domestic price situation means therefore only that it will contribute to the tendency for at least a partial return of the price level or a deceleration of its rate of increase.

overall level of domestic demand, on the other hand, will cause a negative relationship between output and the current account surplus and a monetary policy which aims at external balance will therefore be internally stabilizing as well.

2.3.2. Output-Oriented Monetary Policy

Consider next the case of internally-oriented monetary policy in the sense that S = Q with $h_Q > 0$, i.e., monetary policy aims at stabilizing output and employment. The consequences for the multiplier effects of the exogenous disturbances on the balance of payments on current account and price developments are as indicated in Table 2 (output stability in the comparative static sense will always increase):

Table 2. ($h_Q > 0$)

	M*	P*	P^*_R	W	D_0	E_0
B	d	(d)	d	(d)	d	s
P or $\hat{P}$	s	(s)	d	(d)	s	s

The results are largely self-explanatory. Monetary policy which stabilizes output will always be destabilizing for external balance in the case of foreign demand fluctuations, domestic demand shifts and terms-of-trade changes (because these affect output and net exports in the same direction) and stabilizing in the case of fluctuations in the level of domestic demand. Output-oriented monetary policy will also be helpful with respect to inflation in the case of foreign and domestic demand fluctuations since such demand disturbances affect output and inflation in the same direction, but not in the case of an adverse terms-of-trade shift since this will raise prices and simultaneously reduce output. Given high enough elasticities, output-oriented monetary policy will also be destabilizing with respect to both the current account and the price situation in the case of money wage disturbances, but stabilizing with respect to the price situation in the case of foreign price shifts (affecting output and the price level in the same direction).

2.3.3. Inflation-Oriented Monetary Policy

Consider, finally, the consequences for output and current account stability of a monetary policy which reacts on price developments, i.e., assume $S = P$ or $\hat{P}$ and $h_P > 0$ in the case when a shift in the price level occurs and $h_{\hat{P}} > 0$ when only the rate of inflation is affected.

Table 3. (h_P or $h_{\hat{P}} > 0$)

	M^*	P^*	P^*_R	W	D_0	E_0
B	d	(d)	s	(s)	d	s
Q or L	s	(s)	d	(d)	s	s

The consequences for external and internal stability are in the same direction as in the case of output-oriented monetary policy except that an internally (inflation)-oriented monetary policy may now be stabilizing with respect to the current account in the face of terms-of-trade or money wage shifts (since an upward shift in P^*_R or W leads to a deterioration in the current account which is partly offset by the effects of the increase in the interest rate triggered by the rise in the domestic price level).

In summary, the general point that the preceding observations illustrate is that the consequences for macroeconomic stability of monetary policy systematically related to a target variable like output, inflation or the balance of payments will depend not only on the particular target chosen but also on the source of disturbances and the functioning of the economy. Conclusions will of course depend on the precise specification of the model. In terms of the simple model used above, however, it may be said that externally-oriented monetary policy is likely to be destabilizing for output and employment (except for the case of domestic demand shifts). Such a policy is also likely to be destabilizing with respect to the price situation unless the dominating source of disturbances is domestic demand shifts or increases in input or labour costs that simultaneous worsen competitiveness and therefore increase the current account deficit. Internally-oriented monetary policy, by contrast, is likely to be conducive both to output and price stability (except for terms-of-trade or money wage shifts) and externally destabilizing particularly in the case of monetary policy which stabilizes output and employment.

The consequences of monetary policies will of course also depend importantly on the length of various time lags, which implies that the issue should properly be investigated in a dynamic setting (Cf. section 2.5). It is thus certainly possible that, e.g., internally-oriented monetary policy actually turns out to be (internally) destabilizing. It is also conceivable that time lags happen to be such that externally-oriented monetary policy is beneficial on all accounts even if foreign disturbances dominate. As demonstrated by the simulation experiments reported in Section 3, however, it seems that the importance of foreign shocks for the cyclical development of the Finnish economy in combination with externally-oriented monetary policy has contributed to the domestic instability actually experienced.

2.4. Exchange Rate Policy and the Short-Run Effects of Exogenous Disturbances

It is common to assume exchange rates to be either permanently fixed or fully flexible. If the latter assumption were made, then the domestic inflation rate in the model would be directly influenced by factors affecting desired asset or debt positions (such as the foreign interest rate). Another consequence of free exchange rates would be that the consequences of exogenous disturbances would depend importantly on the resulting covariation between the level of output and the balance of payments.

The case of free exchange rates does not, however, seem to us to be very relevant: small economies have typically opted for pegged exchange rates in one form or another. We shall therefore not investigate the behaviour of the model with free exchange rates, but instead consider the consequences of two alternative rules for exchange rate policy that relate it to foreign and domestic inflation. These two policy rules, or norms, which we will designate as the "inflation norm" and the "purchasing-power-parity (PPP) rule", may be said to embody suggestions or ideas which have repeatedly been put forward by economists in popular discussions in Finland as well as in other countries.

The background to these alternative policy rules is the observation that fixed exchange rates leave the price level and the competitive position of an economy highly vulnerable to monetary disturbances. Thus the idea arises that exchange rate policy should actively contribute to the stabilization of the price level or of competitiveness.

2.4.1. The Inflation Norm

In the case of the inflation norm we will assume that the authorities' aim is to stabilize the domestic currency value of a price index of foreign goods (or the rate of inflation of such an index) implying:

$$(17) \quad e = e_0 (P^*)^{-\gamma} ,$$

$$P^* = (P^*_M)^{c_M} (P^*_R)^{c_R} (P^*_X)^{c_X} ,$$

where γ is the coefficient which shows the degree to which shifts in the foreign price level will be met with counteracting changes in the exchange rate.[1]

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1. Differentiation of (17) with respect to time gives $(e\hat{P}^*) = (1-\gamma)\hat{P}^*$.

The consequences of exchange rate policy following an inflation norm for the short-run effects of exogenous disturbances are simple. First, it does not directly affect the consequences of foreign or domestic demand shocks or of an increase in domestic money wages.[1] Second, it unambiguously reduces the output and inflation effects of an upward shift in the foreign price level. The output effect, for example, is in this case:

$$(18)\quad \frac{\partial Q}{\partial P^*} = (1-\gamma)\,\frac{\phi_W \varepsilon}{1 - D_E E_Y (1-\beta)}\ ,$$

which is zero if the neutralization coefficient is one. Third, it diminishes the inflationary consequences of an adverse shift in the terms of trade (an increase in the price of imported inputs) but only at the cost of aggravating its deflationary impact:

$$(19)\quad \frac{\partial Q}{\partial P^*_R} = \frac{-(D_E E_Y R + \phi_W \varepsilon) - \varepsilon \phi_W \gamma c_R}{1 - D_E E_Y (1-\beta)} < 0\ ,$$

the size of the negative effect depending on the weight given to imported inputs in the price index that exchange

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1. Observe that the exchange rate is assumed to be related to only a price index of foreign goods. If domestic tradeables were also included, and if the price of such goods reflected domestic costs rather than world market conditions, then exchange rate policy pursued according to the inflation norm would clearly aggravate the negative consequences for competitiveness of an increase in domestic money wages.

rate policy focusses upon. Exchange rate policy pursued according to the inflation norm would make the problem more difficult by leading to an appreciation of the exchange rate (unless prices of imported inputs lacking domestic substitutes are excluded from the relevant price index) and thereby slowing down the downward adjustment of the real wage which is actually required (if the adverse shift in the terms of trade is permanent and if no other compensating changes in the structure of the economy are taking place).

2.4.2. The Purchasing-Power-Parity Rule

While policy conducted according to the inflation norm would insulate the economy from foreign price level fluctuations, it would be much like fixed exchange rates in other respects and it would not shield the economy from real shocks. In addition, it would do nothing to offset the harmful consequences of a domestic wage inflation which leads to a deterioration of the economy's competitive position. Given the importance of competitiveness, it indeed seems natural to go further and suggest that exchange rate policy be used to offset foreign inflation only to the extent that it is greater than domestic inflation. Such a purchasing-power-parity rule for exchange rate policy implies:

$$(20)\quad e = e_0 P_D^{\gamma}(P^*)^{-\gamma} \quad (\text{or } \hat{e} = \gamma(\hat{P}_D - \hat{P}^*)),$$

where γ is the fraction of the inflation differential which is offset by exchange rate changes so as to diminish the effects of foreign and domestic price developments on the "real exchange rate". How does policy according to the PPP-rule modify the short-run effects of shocks?

First, as a rough approximation it will not affect the consequences of foreign or domestic demand shocks.[1] Second, it reduces the output effect (and the inflation effect) of an upward shift in the foreign price level and it also reduces the real effects of an increase in domestic money wages (but increases its effect on the price level). The effects are given by the expression:

$$(21)\quad \frac{\partial Q}{\partial P^*} = -\frac{\partial Q}{\partial W} = \frac{(1-\gamma)\phi_W \varepsilon}{[1 - D_E E_Y(1-\beta)]\,[1-\gamma(1-\phi_W)]},$$

which is zero if the policy is such that the rate of change of the exchange rate equals exactly the inflation differential ($\gamma = 1$). Third, policy according to the PPP-rule diminishes the deflationary effect of an adverse terms-of-trade shift provided that the weight of imported inputs is

1. An increase in autonomous foreign or domestic demand will affect the domestic rate of inflation positively. With rational exchange rate expectations this would induce depreciation expectations, increasing the (covered) cost of foreign debt.

smaller in the price index P than in domestic costs (in (in P_D):

$$(22)\quad \frac{\partial Q}{\partial P_R^*} = \frac{1}{1-D_E E_Y(1-\beta)}\left[-(D_E E_Y R + \phi_R \varepsilon) + \frac{\phi_W \varepsilon\gamma(\phi_R - c_R)}{1-\gamma(1-\phi_W)}\right].$$

In summary, exchange rate policy according to an inflation norm would clearly be beneficial for price stability if price disturbances are of external origin. This is arguably an important aspect in an economy like Finland where raw materials occupy an important position in both imports and exports and where fluctuations in the price level of tradeable goods are therefore considerable (but terms-of-trade shifts minor). The possible magnitudes of the consequences involved are illustrated by way of simulation of the empirical model in Section 3 below. The PPP-rule superficially looks even more useful (by offsetting the real effects of domestic wage inflation as well). As pointed out in the next section, however, it would seem to have the drawback of impairing the dynamic stability of an economy.[1]

1. In real terms a PPP-rules behaves very much like a system of wage indexation. In the former case competitiveness is fixed and this has definite consequences for the real wage; in the latter case the real wage is fixed with implications for competitiveness. Both systems would prevent an increase in the price level of foreign goods from having real effects: the former by inducing an appreciation of the currency and the latter by causing (speeding up) domestic inflation so as to re-establish the real wage and relative prices.

2.5. Observations on the Dynamics of the Model

In the preceding section the consequences of policy for "automatic stability" or for the size of the short-run multiplier effects on target variables of exogenous disturbances were dealt with. In this section we shall instead be concerned with the implications of policy behaviour for "dynamic stability" or, more generally, for the character of the dynamic interactions by which the endogenous variables develop over time. As is well known, the time path that constitutes the solution to a dynamic model is often quite sensitive to its precise specification, and therefore a multitude of possible outcomes arises even in relatively simple models. We do not, however, aim at any comprehensive taxonomic treatment. We focus instead on a couple of simplified cases, designed to bring out the consequences of some dynamic interrelationships that we think are particularly relevant.

The first dynamic interaction to be emphasized is the combined outcome of the following two relations: the importance of current account developments for monetary conditions, on the one hand,[1] and the time lag between

1. The link, i.e. the monetary mechanism of adjustment, is a crucial element in the monetary approach to the balance of payments, see Frenkel and Johnson (1976).

interest rate changes and the effects on output, inflation and the current account that they give rise to, on the other.

Observe, first, that the domestic interest rate will be related to the balance of payments on current account not only in the case when external balance is a target variable influencing the behaviour of the monetary authorities, but also if monetary policy is "passive" in the sense that the cost of central bank credit only moves automatically (according to some predetermined rules) as a function of the amount of central bank credit. This is most simply seen by assuming constant prices and exchange rates (and assuming $h_S = 0$), differentiating equations (11) and (12) with respect to time and using the relation:

$$(23)\quad \dot{Z} = -B$$

to get

$$(24)\quad \dot{r} = -h_H H_Z B \ ,$$

where B, the balance of payments on current account, is a function of wages and prices (for the moment treated as fixed), foreign demand, monetary conditions etc. (cf. the previous section).

The other dynamic relation assumed is that the cost of central bank credit affects domestic demand for goods and services only after a certain time lag. The assumption may be formalized by, e.g., specifying that changes in the interest rate only gradually affect the "expected interest rate" or that there is an intervening variable, "credit market tightness" ρ, which adjusts to changes in the rate of interest on central bank credit and which "transmits" the effects of changes in the stance of monetary policy on aggregate demand:

$$(25)\quad \dot{\rho} = \theta(r-\rho) \ .$$

In (25) θ is the speed of adjustment and r is a function (derived by using (11) and (12)) of the total debt Z and the foreign interest rate r* (together determining the amount of the debt owned to the central bank).

Using the reduced form solutions for B and r which may be derived by analyzing the short-run equilibrium of the model, equations (23) and (25) constitute a dynamic model with Z and ρ as the state variables. The slopes of the $\dot{z} = 0$ - and $\dot{\rho} = 0$ - curves are given by:

$$\left(\frac{\partial \rho}{\partial z}\right)_{\bar{z}} = 0 \ ,$$

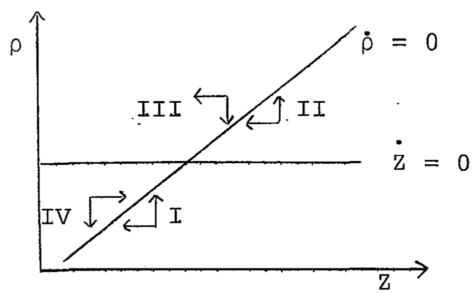
$$\left(\frac{\partial \rho}{\partial z}\right)_{\bar{\rho}} = \frac{\partial r}{\partial Z} = \frac{h_H H_Z}{1 - h_H H_r} > 0 \ ,$$

which in combination with

$$\frac{\partial \dot{Z}}{\partial \rho} = - \frac{\partial B}{\partial \rho} = \frac{\rho\,[1 - D_E(1-\beta)]}{1 - D_E E_Y(1-\beta)} < 0$$

$$\frac{\partial \dot{\rho}}{\partial \rho} = -\theta < 0;$$

implies the following phase diagram:



It is easily shown that the model is always stable irrespective of the speed with which changes in central bank policy are transmitted to the economy (θ), the size of the effects arising and the strength of the dependence between the cost of central bank credit and its amount. More interesting, however, is that the model will approach equilibrium cyclically rather than asymptotically if:

$$(26)\quad \theta(\theta - 4\,\frac{\partial B}{\partial \rho}\cdot\frac{\partial r}{\partial Z}) < 0 ,$$

which will always hold if θ is small enough and if $\partial B/\partial \rho$ or $\partial r/\partial Z$ are (in absolute terms) large enough. Thus the combination of lags in the effects of monetary policy (widely believed to be empirically important) and a positive dependence between the cost of central bank credit and its amount (which has typically prevailed in Finland) may give rise to cyclical fluctuations of the economy.

In this case the economy will successively experience the following states: Starting in zone I (in the phase diagram), the current account is in deficit, i.e., indebtedness (domestic as well as foreign) is increasing and the domestic interest rate therefore rising (and credit markets getting tighter). In zone II the restrictive effects of the high interest rate has turned the current account into surplus but due to the time lag "tightness" is still increasing. In zone III the current account surplus continues but is getting smaller due to the increasingly strong effects on aggregate demand of the easing of the stance of monetary policy. Finally, in zone IV the current account is already in deficit and the cost of central bank credit is therefore rising, but due to the lagged effects of "cheap money" aggregate demand is still increasing and the current account deteriorates further.

Observe that monetary policy which is seemingly "passive", but actually related to current account developments (cf., e.g., (24) above), will (in the oscillatory case) give rise to a system where every balance-of-payments surplus subsequently leads to a deficit (through the monetary repercussions induced) and vice versa. The case outlined is of course a strongly simplified one since in reality the balance of payments is affected not only by monetary conditions but by other (cyclically related) variables as well, and since the feedback from the balance of payments to monetary conditions is likely to be more complicated than we have assumed. At times the domestic monetary implications of current account developments will, for instance, be dominated by capital flows (in our model associated with foreign interest rate changes or exchange rate expectations). Nevertheless, we think that the "overshooting" phenomenon discussed above is of relevance when interpreting Finnish cyclical developments and the role of monetary policy in this context.

The second dynamic interaction to be emphasized arises from the dynamics of wages and inflation expectations.[1] Assume for simplicity that monetary policy is such as to fully stabilize the domestic rate of interest. (This assumption

1. See, e.g., Turnowsky (1977) and Laidler and O'Shea (1980).

eliminates the kind of dynamics that was already considered above). Equations (8) for money wages and (9) for inflation expectations can then be combined to form a dynamic system in W and Π_P by using the reduced form solution for the level of employment (expressed as a function of the exogenous variables as well as the level of money or real wages and the state of inflation expectations):

$$(27)\quad \hat{W} = g(\alpha Q(\;)) + \Pi_P$$

$$(28)\quad \dot{\Pi}_P = \lambda(a\phi_W\hat{W} - \Pi_P)\;,$$

(foreign prices are for simplicity assumed constant).

This model may or may not be stable, one of the necessary conditions for (local) stability being that an increase in money wages has a deflationary effect on output and employment. Similarly, the time path of the solution may or may not be oscillatory depending on the speed of adjustment of inflation expectations as well as the size of the short-run effects on output of changes in the level of wages and in the expected rate of inflation.

Assume now that exchange rate policy reacts to changes in competitiveness according to the PPP-rule outlined above. Such a policy will modify the dynamics only by diminishing the impact on output and employment of changes in the level of money wages. The reduced responsiveness of real wages to the employment situation will reduce stability in the sense that the absolute value of the trace and determinant of the model's coefficient matrix both become smaller. It may also be shown that a reduction in wage responsiveness might sooner or later change a cyclical economy into one which approaches equilibrium directly. In the end (when exchange rate policy fully stabilizes competitiveness and the real wage), the economy will not be stable (since the value of the determinant of the coefficient matrix will be zero). Exchange rate policy following a PPP-rule (or wage indexation) may thus in some cases be useful from the point of the automatic consequences of exogenous shocks (cf. the preceding section) and in dampening cycles caused by "overshooting effects" associated with time lags, but will simultaneously be destabilizing by preventing the real wage from adjusting in the face of real disturbances.

The above analysis only provides a couple of examples of the dynamic interactions that may affect cyclical developments and that monetary and exchange rate policies may have implications for. Another essential dynamic complication arises, for instance, from the lags associated with the effects of changes in competitiveness on trade flows. The fact that there are several relevant dynamic interactions to consider is a source of some difficulty since the analysis rapidly becomes interactable. A way out of these difficulties is, however, provided by simulation experiments. To be meaningful, however, these require that the model simulated is a reasonably realistic description of the features of the economy that are essential for the problem at hand. In the next section we therefore turn to the estimation and simulation of a small set of equations describing the determination of inflation and output in Finland.

3. CENTRAL BANK POLICY AND DOMESTIC STABILITY IN FINLAND: 1961 - 1979

This section attempts to assess empirically the role of central bank policy (monetary and exchange rate policy) in the determination of output fluctuations, inflation and the current account for Finland during the period from 1961 to 1979. The aim of the empirical exercise is not to construct a complete structural macroeconomic model based on the theoretical framework set out above, but to estimate a condensed, reduced form model which is still capable of explaining the short-run movements of output, prices and the current account[1] and which can be used for simulation experiments to illustrate the quantitative significance of some of the policy issues discussed in Section 2. The following simplifications made above should be recalled. First, the aggregation of the government sector with the private sector implies that the role of fiscal policy is

1. The empirical model set out here has many features in common with other small scale empirical models for open economies. See, in particular Agheveli and Rodriques (1979) and Laidler and O'Shea (1980) and references therein.

abstracted from.[1] Second, all domestic production is aggregated. A third simplification is the aggregation of banks and firms and the consequential fact that we do not investigate the credit creation process. In addition, the empirical model does not treat explicitly the determination of wages and employment, and on the import side the distinction between final goods and intermediate inputs is not carried out.[2] Finally, our estimates are based an annual data. A less aggregated treatment would clearly be desirable, but the above simplifications are not, we think, crucial for the main results reported.

3.1. The Empirical Model

The set of equations constituting the model forms a recursive system and was thus estimated equation by equation using the ordinary least squares method. Annual data for the

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1. The government sector is not treated separately, first because in the model we are interested only in monetary and exchange rate policy, and second because we think that the spending behaviour of the Finnish public sector has not been too different from the spending behaviour of the private sector. It has to be stated, however, that while facilitating the analysis the complete disregard of fiscal policy may put too much emphasis on the role of central bank policy in affecting output fluctutations and inflation. This reservation should be borne in mind when interpreting the simulation results.

2. For relevant theoretical and empirical analysis of the working of the Finnish credit system, see Kukkonen (1975), Koskela (1976), Oksanen (1977) and Tarkka (1979).

period 1961 - 1979 was used in the estimation except for the price equation, which uses the longer sample period from 1956 to 1979. The year 1961 was chosen as the initial year of the sample period because various trade restrictions were abolished in the beginning of the 1960s when Finland became an associated member of EFTA. The estimated equations are as follows (t-statistics are shown below the parameter estimates, $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom and DW is the Durbin - Watson statistic.):

(I) Output gap

$$g = \underset{(6.46)}{.459}\, g_{-1} + \underset{(8.44)}{.456}\, g^* - \underset{(4.55)}{.141}\, r_{-1} + \underset{(2.30)}{.184}\, \Delta logp_{-1}$$

$$- \underset{(4.87)}{.185}\, logp_{-1} + \underset{(4.55)}{.173}(logp^*_{-1} + loge_{-1})$$

$\bar{R}^2 = .966$ DW $= 2.027$

(II) Inflation rate

$$\Delta logp = \underset{(5.50)}{.352}\, [.5(\Delta logp^* + \Delta loge) + .5(\Delta logp^*_m + \Delta loge)]$$

$$+ \underset{(7.27)}{.611}\, \Delta logp_{-1} + \underset{(2.85)}{.285}\, g_{-1}$$

$\bar{R}^2 = .803$ DW $= 1.911$

(III) Relative current account

$$b = \underset{(6.27)}{-2.670}\ \text{logy} + \underset{(4.45)}{1.472}\ \text{logy*}$$

$$- \underset{(2.89)}{.573}(\text{logp} - \text{logp*} - \text{loge}) + \underset{(2.03)}{.024}\ \text{time} + \underset{(5.68)}{14.2}$$

$$\bar{R}^2 = .675 \qquad DW = 1.914$$

(IV) Relative net foreign debt

$$\frac{z - b}{z_{-1}} = \underset{(44.29)}{1.063} - \underset{(8.33)}{2.373}\ \Delta\text{logy} - \underset{(4.29)}{.652}(\Delta\text{loge} + \Delta\text{logp}^*_m)$$

$$- \underset{(1.30)}{.396}\ \Delta\text{logp}$$

$$\bar{R}^2 = .893 \qquad DW = 2.014$$

(V) Marginal cost of central bank finance

$$r = \underset{(4.69)}{-.553}\ b - \underset{(2.62)}{.131}\ z + \underset{(2.50)}{.682}\ r^* + \underset{(2.58)}{.098}\ D67$$

$$\bar{R} = .718 \qquad DW = 2.252$$

The endogenous variables are

g = $\log y - \log\bar{y}$;

y = real gross domestic product,

$\bar{y}$ = exponential trend of GDP (annual rate of growth = 4.8 per cent)

$\Delta \log p$ = domestic inflation rate ;

p = implicit GDP deflator

b = current account relative to the value of total imports

z = net foreign debt relative to the value of total imports

r = marginal rate of interest on central bank lending[1]

The exogenous variables are

g^* = $\log y^* - \log\bar{y}^*$;

1. During most of the period 1961 - 1979, monetary policy in Finland has essentially consisted of the manipulation of the terms at which commercial banks are permitted to borrow at the central bank. The borrowing facility has typically been such as to imply an increasing interest rate cost for each bank (or group of banks) according to the extent to which borrowing has exceeded a certain basic quota. The marginal cost of central bank finance has therefore deviated from its average cost. We have constructed a time series for the marginal interest rate by using the relation between the average and marginal cost of central bank finance and by employing data for the average cost of central bank lending, the size of the basic quota (within which the central bank's discount rate applies) and the discount rate. For further details, see Huomo and Korkman (1979).

y^* = volume index of Finland's export markets (a weighted average of import volumes of Great Britain, Sweden, the Federal Republic of Germany, France and the United States with 1974 export shares as weights),

$\bar{y}^*$ = exponential trend of y^* (annual rate of growth = 6.7 per cent)

p^* = competitors' prices in foreign currency (a weighted average of import prices of five OECD countries important for Finland's exports with 1974 export shares as weights)

p_m^* = price index of imports of goods and services in foreign currency (calculated by dividing import prices in local currency by the currency index)

e = exchange rate index (domestic/foreign currency, calculated as a weighted average of five important bilateral rates with 1974 export shares as weights)[1]

r = three-month Eurodollar rate

D67 = dummy variable (1967 = 1, otherwise zero) for devaluation expectations in 1967.

The output gap equation (I) is a reduced form equation for the demand for domestic output by domestic and

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1. In reality, 18 countries and 15 currencies are at present included in the calculation of the Bank of Finland currency index, for details see Puro (1978). For our purposes, the inclusion of only the five most important ones is a sufficient approximation.

foreign residents. These demands are related positively to total domestic and foreign demands and negatively to the domestic price relative to the foreign price. The interest rate variable, the marginal rate of interest on central bank lending, as well as the "expected inflation rate" (actual inflation lagged one year), enter the output gap equation through their effects on total domestic demand.

All the variables implied by the theoretical model, except for the foreign interest rate and import prices, enter the output gap equation significantly. The lagged output gap imposes a geometrically declining lag distribution on each ondependent variable. The "short-run" interest "semi"-elasticity of output is .145 after a lag of one year and the long-run elasticity is about .3. The mean lag from the marginal interest rate to the output gap is about a year and a half. In the estimation experiments the actual inflation rate lagged one year performed most satisfactorily as a proxy for the expected rate of inflation.[1] The levels of domestic and foreign prices lagged one year stand for a measure of "price competitiveness". As one would expect, the absolute values of their coefficients are nearly the same.

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1. The absolute value of its effect on output is bigger than that of the domestic interest rate. This may be interpreted as capturing, the effect of the (real) foreign interest rate on output even though the nominal foreign interest rate (proxied by a three-month Eurodollar rate) did not work in the estimation.

Equation (II) gives the domestic inflation rate as a function of the foreign inflation rate (measured as an average of competitors' inflation rates and Finland's relative import price changes adjusted for changes in the exchange rate), the domestic inflation rate and the output gap lagged one year.[1] The sum of the coefficients of the "foreign inflation rate" and the lagged domestic inflation rate is approximately one, implying long run homogeneity. An external price shock or of a change in the exchange rate is felt (almost) in full in the domestic price level within four or five years.

It may be noted that the present specification of the price equation imposes a restriction according to which the domestic price level is equivalently affected by equiproportionate changes in foreign prices and in the exchange rate. There are, however, some reasons to think that the speed of adjustment of domestic prices with respect to devaluations may have been slower than with respect to changes in foreign prices (in foreign currency), because incomes policy measures aimed at curbing inflation and safeguarding the positive effects on international competitiveness were implemented after the two big devaluations in 1957 and 1967 and also after the devaluations in 1977 and

1. This specification is consistent with the assumption that inflation expectations are a function of foreign inflation and/or the domestic rate of inflation lagged one year.

1978.[1] Consequently a revaluation may dampen domestic inflation more rapidly (than implied by our estimates) and its real effects might be smaller. This should be kept in mind when interpreting the exchange rate policy simulations later on in the study.

The current account equation (III) is a reduced form equation based on export and import equations where the export market share and the import share (out of GDP) respond to relative prices as well as to foreign and domestic demand pressures.[2] The estimated value of the coefficient for the relative prices variable (the sum of the export and import price elasticities plus one) is -.573, implying that the Marshall - Lerner conditions holds and that a devaluation

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1. Initial empirical experiments along these lines give some support for this hypothesis.

2. Consider the following conventional export (x) and import (m) functions:

(i) $\log \frac{x}{y^*} = a_0 + a_1 \log(y^*/\bar{y}^*) + a_2 \log(e \cdot p^*/p)$

(ii) $\log \frac{m}{y} = b_0 + b_1 \log(y/\bar{y}) - b_2 \log(e \cdot p_m^*/p)$

Using an approximation for the relative current account surplus (b),

(iii) $b = \frac{p \cdot x - e \cdot p_m^* \cdot m}{e \cdot p_m^* \cdot m} = \frac{p \cdot x}{e \cdot p_m^* \cdot m} - 1 \sim \log \frac{p \cdot x}{e \cdot p_m^* \cdot m}$.

Inserting (i) and (ii) into (iii), assuming a close covariation between p_m^* and p^* and denoting the trend growth of y and y* by ρ and ρ^* respectively, gives the estimating equation for b:

$$b = \text{constant} + (1 + a_1)\log y^* - (1 + b_1)\log y + (1 - a_2 - b_2)\log(p/e \cdot p^*) + (b_1\rho - a_1\rho^*)\ \text{time}.$$

improves the current account. The coefficient of the time trend reflects the difference between trend growth of domestic output and export markets and any (autonomous) trend in the export market share or in the import share.

In order to obtain the relative foreign debt for the interest rate equation we need an equation (IV) for the cumulative current account surplus z.

Rewriting the definition for z as:

$$\text{(i)} \qquad z = b + z_{-1} \cdot \frac{1}{1 + \Delta \log m + \Delta \log p_m^* + \Delta \log e},$$

using the approximation, $\frac{1}{1 + z} \simeq 1 - z$, (to keep the model linear) and inserting the import function in footnote 2, p. 53 into (i), we obtain

$$\text{(ii)} \qquad \frac{z - b}{z_{-1}} = \text{constant} - b_1 \Delta \log y$$

$$- (1 - b_2)(\Delta \log e - \Delta \log p_m) - b_2 \cdot \Delta \log p \; .$$

This is the estimating equation for the relative foreign debt. The estimated equation behaves satisfactorily in the sense that the coefficient for the domestic inflation rate is approximately one minus the coefficient for the import price variable and the output elasticity, -2.4, is close to the estimate obtained in the relative current account equation (-2.7).

The equation for the marginal interest rate (V) is a reduced form of the demand for and the supply of central bank debt, which relates the interest rate to the cumulative current account (i.e., the net financial debt of the non-central bank sector), the foreign interest rate and exchange rate expectations (proxied by a devaluation dummy in 1967). In addition, the current account was found to have an effect on the interest rate (in addition to the effect via z), whereas other conceivable targets (like output and inflation) turned out to be insignificant. The estimated equation is admittedly crude but nevertheless reflects the importance attached to the external balance as a policy target as well as the automatic monetary consequences of external imbalances.

The model forms a recursive system. First the output gap is determined by its past experience and by foreign demand in the same period as well as by the interest rate, domestic and foreign prices and the exchange rate in the previous period. The inflation rate is given by its past experience and by the development of foreign prices and the exchange rate and by the output gap of the previous period. Domestic output and prices together with foreign demand, foreign prices and the exchange rate then explain the balance of payments on current account (and thereby also the cumulative current account), which in turn together with the foreign interest rate determine domestic monetary conditions (the marginal interest rate on central bank lending). After a one-year lag the interest rate change starts to effect domestic output and the dynamic interaction goes on as explained above.

The equations fit the empirical data satisfactorily. All estimated coefficients have correct signs and all (but one) are statistically significant at the 5 per cent level. The D-W statistics do not indicate presence of first order serial correlation (even though its usefulness is limited due to the own lagged endogenous variable in the output gap and price equations).

3.2. The Control Solution

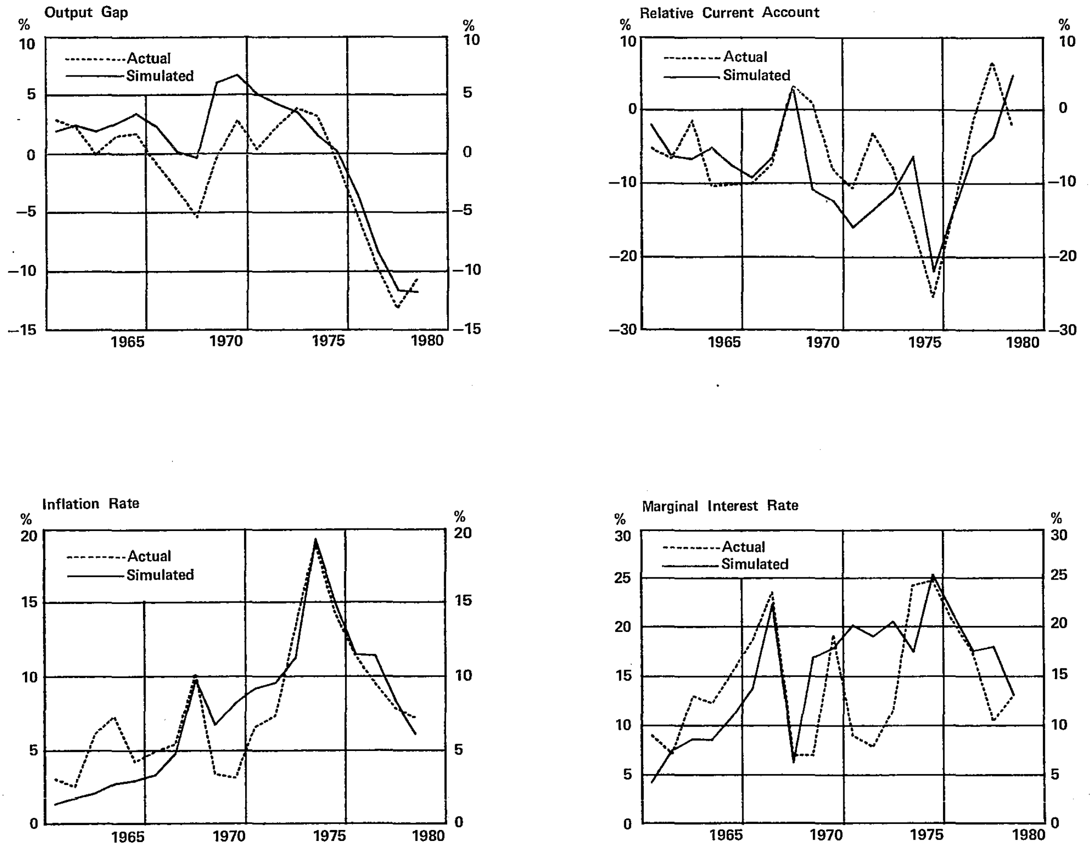
The performance of the model (including the interest rate equation) as a complete system is analyzed with the aid of the dynamic simulation for the sample period 1961 - 1979. This simulation is called a control solution. It is a deterministic complete model solution using the actual values of lagged endogenous variables at the beginning of the sample period as initial conditions and setting the exogenous variables at their actual values throughout the period.

The results of the control solution are shown in Chart 1. Because the chart is self-explanatory we comment only briefly on the results.

In general the model explains fluctuations in the endogenous variables satisfactorily. There is a tendency for the solution to catch up with the cyclical fluctuations of the economy at the actual turning points (with few exceptions), although there are some areas of divergence between actual and simulated values. However, part of this divergence can be explained easily. For example, the underestimation of inflation in 1964 could be corrected by a "sales tax dummy" to capture the effect of an increase in the sales tax rate. The overestimation of inflation in 1969 - 1970 could in turn be reduced by "an incomes policy dummy" to capture the dampening effect on inflation through "comprehensive incomes policy agreements", an effect which is supported by earlier Finnish studies.[1] This would also help to put the simulated output gap and current account on track in the late 1960s and early 1970s. The weakest explanation is obtained for the

1. Cf. Molander - Aintila - Salomaa (1970) and Halttunen (1974).

Chart 1.
CONTROL SOLUTION : 1961 – 1979



marginal interest rate, which is natural given the crude specification of the present equation. Nevertheless, it provides an important link for the dynamic interactions in the model and helps to clarify the effects of externally-oriented monetary policy in the policy simulations which we turn to in the following sub-section.

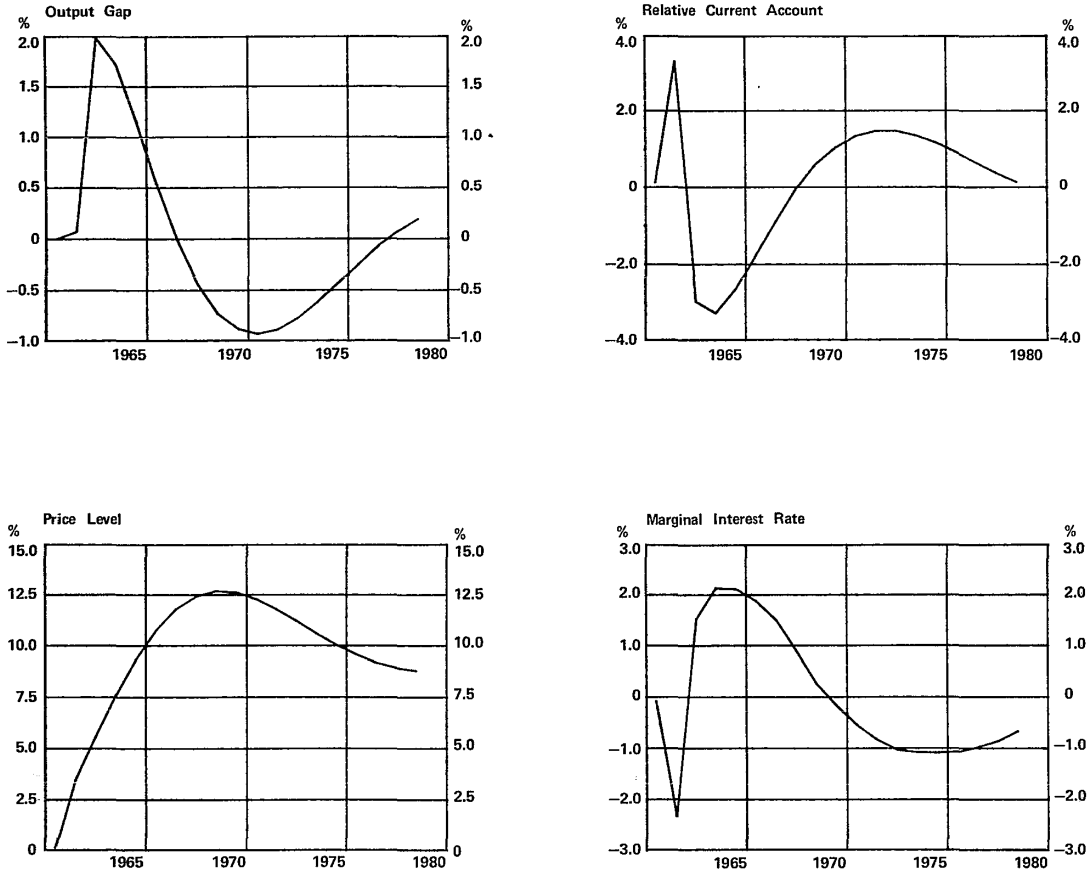
3.3. Policy Simulations

Using dynamic simulation as an analytical tool, this sub-section presents four experiments involving various shocks arising externally or from monetary and exchange rate policy decisions. The simulations illustrate the theoretical considerations discussed in Section 2. The results are shown with the aid of charts indicating the effects of these shocks on the endogenous variables of the model. Technical details are explained in each chart separately.

3.3.1. Devaluation

As is well-known, the effects of a devaluation on the level of output and the balance of trade are ambiguous even in relatively simple theoretical models (like ours). Futhermore, the effects of a change in the exchange rate typically

Chart 2.
EFFECTS OF 10 PER CENT DEVALUATION



Explanations:

The solid line (———) measures the dynamic response of a variable X_t to a 10 per cent devaluation (in 1962) as the difference between the disturbed solution (devaluation) and the control solution value of a variable. For each variable X_t the dynamic response (DX_t) is

(i) $XD_t = XS_t - XC$, where XS = disturbed solution value of a variable X at time period t
XC = control solution value of a variable X at time period t

Formula (i) has been used for all variables except the price level, which is in relative difference form

(ii) $$PD_t = \frac{PS_t - PC_t}{PC_t}$$

emerge as a dynamic sequence of events such that the short-run, medium-run and long-run consequences are quite different and may even work in opposite directions.

In Chart 2 we present the simulation results for a 10 per cent devaluation in 1962 (or an equivalent increase in foreign prices). Because the model is linear, the initial conditions are not important. Also, the effects of a revaluation are symmetric to those of a devaluation. In all cases, the solid lines measure the dynamic effect of the devaluation on the variable concerned as the difference between the disturbed solution (the devalution paths) and the model's control solution. According to the simulation, the sequence of events initiated by the devaluation is broadly as follows:

In the year the devaluation occurs, the domestic price level increases by 3.5 per cent and the relative current account improves by more than 3 per cent, while the level of output is practically unchanged.[1]

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1. In our empirical experiments competitiveness affected output with a lag of only one year. This may reflect time lags associated with the multiplier processes, which make it reasonable that a devaluation should affect the trade balance more rapidly than the level of output. It is also possible that the expansionary substitution effect in the short run is counteracted if the increase in the profit share caused by the devaluation is deflationary (by decreasing the share of total income devoted to purchases of domestic goods).

In the second year the level of output increases by almost 2 per cent. The expansionary effect is due primarily to the improved competitiveness but it is also somewhat strengthened by the fact that the initial improvement in external balance reduces monetary tightness and thereby influences aggregate spending.[1] Due to the higher level of demand and output as well as the partial restoration of original price ratios caused by the increasing domestic price level, the current account swings into a deficit.

In the third year the domestic price level has already increased by the full amount of the devaluation but continues to rise more rapidly than foreign prices because of the relatively high level of economic activity. Thereafter the level of output falls, however, both because the earlier gain in competitiveness is eroded through domestic inflation and because of the tightening of monetary conditions induced by the deterioration in the current account.

Since the model is cyclical, there then emerges a phase during which the price level "overshoots" its equilibrium

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1. This is the length of the "short run" in which the externally-oriented monetary policy aggravates the domestic consequences of foreign shocks (cf. pp. 21 - 24 above). With a longer time horizon, the monetary policy assumed instead dampens the expansionary process set in motion by the devaluation. This is a consequence of the current account deficit which arises when output has expanded to the extent that its effect outweighs the relative price effect (with respect to the trade balance).

level while the dynamic output effect (somewhat later) becomes negative. The relative current account largely reflects the evolution of domestic demand and output. In the "long run" the output and current account effects will be zero and the only sustainable effect of the devaluation is a 10 per cent increase in the domestic price level.

While the results demonstrated above should not be taken too literally (they are "stylized facts"), the main message conveyed by the simulation may nevertheless be relevant: A devaluation will temporarily change relative prices and will therefore have expansionary effects in the medium term. In the longer run, however, relative prices will be restored through a process of internal inflation. Thus, with a greater perspective the main outcome of the devaluation may prove to be a permanently higher price level as well as the emergence of a relatively long cyclical movement associated with the devaluation.[1]

---

1. Observe that the length of the cycle of output would seem to be a little more than 10 years. Hence the simulation accords well with the Finnish literature of the so-called "devaluation cycle"; cf. Korkman (1980) and references given there.

3.3.2. The Inflation Norm

As a second exchange rate policy simulation we investigate the consequences of tying exchange rate policy to the price behaviour of foreign goods. The motivation for this simulation experiment is the strong relation between inflation and exchange rate policy which has led some economists in the Nordic countries[1] to suggest that occasional revaluations should be used to offset foreign inflationary disturbances, or that exchange rate policy should be used systematically to control and stabilize inflation. Here two separate issues should be distinguished.

First, more or less continuous revaluations might be used to bring down the trend rate of inflation. During the transition period such a policy may have undesirable real effects, but in the longer run the only sustainable effect is likely to be a reduced average rate of inflation. Second, exchange rate changes might be used to even out fluctuations in the domestic currency development of foreign prices and thus to help stabilize the rate of inflation for any given trend rate. This may well be considered useful since it is probably unexpected changes in the rate of inflation which account for much of the costs

1. See, e.g. Calmfors (1977) or Lundberg, Lundgren, Mathiessen and Ohlin (1974).

of inflation. When pursing such an "inflation norm" the authorities responsible for exchange rate policy were therefore assumed to react to variations in trade prices (average of import and export prices) since 1974[1] by revaluing and devaluing the exchange rate so that the average of import and export prices in domestic currency developed steadily and so that trade prices and the exchange rate in 1979 were at the same level as in the real world.[2]

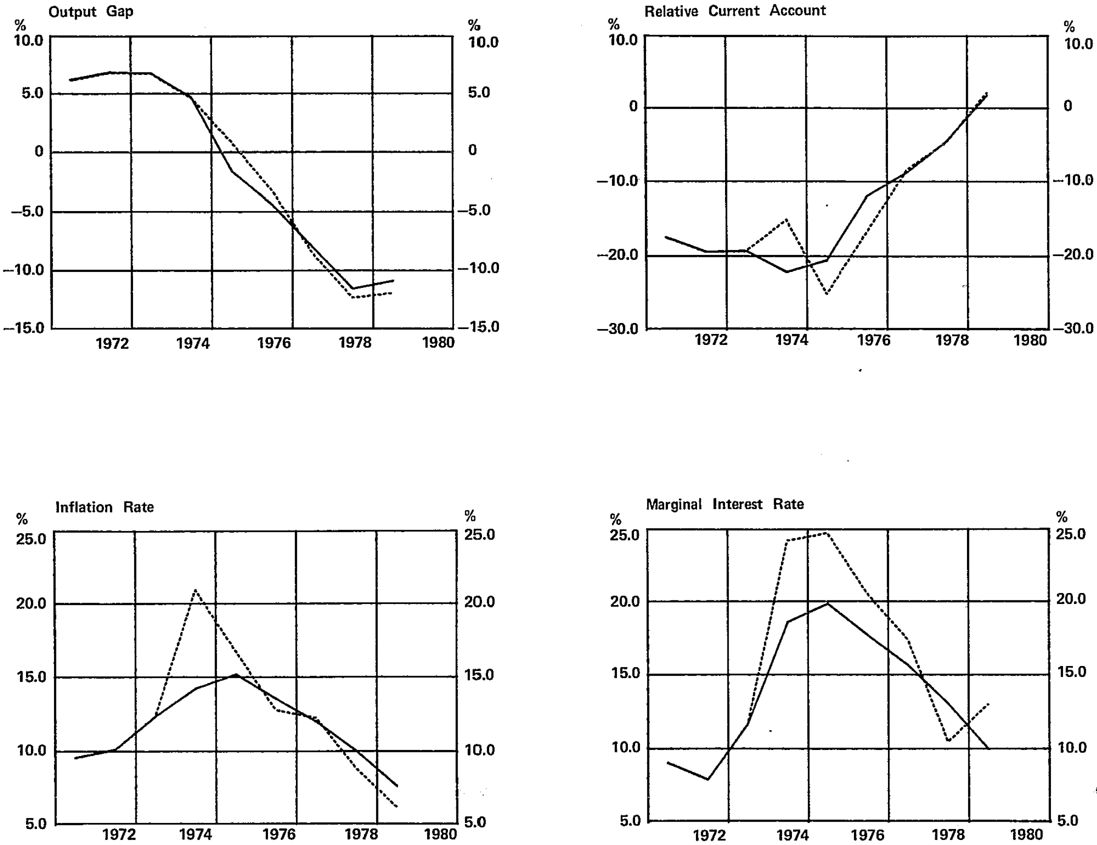
Given the foreign price developments actually experienced during this time period, the assumed policy would have implied the following percentage changes in the exchange rate (actual changes of the exchange rate index are given within brackets):

1974	-30	(-3)	1977	5	(6)
1975	8	(1)	1978	14	(10)
1976	4	(-3)	1979	1	(0)

1. After the so-called "oil-crisis", Finland experienced a period of high inflation induced by extraordinary increases of import and export prices by some 40 per cent (in domestic currency). Thus the effect of trade prices on the whole economy resembled that of devaluation by an equal amount.

2. To isolate the role of changes in competitiveness, the domestic rate of interest was also varied so that the "real" rate of interest was unaffected by the choice of the exchange rate policy rule.

Chart 3.
EFFECTS OF INFLATION NORM



Explanations:
The broken line (----------) is the control solution value of a variable X_t. The solid line (———) is the disturbed solution value of a variable X_t (Inflation norm with pegging the real interest rate monetary policy).

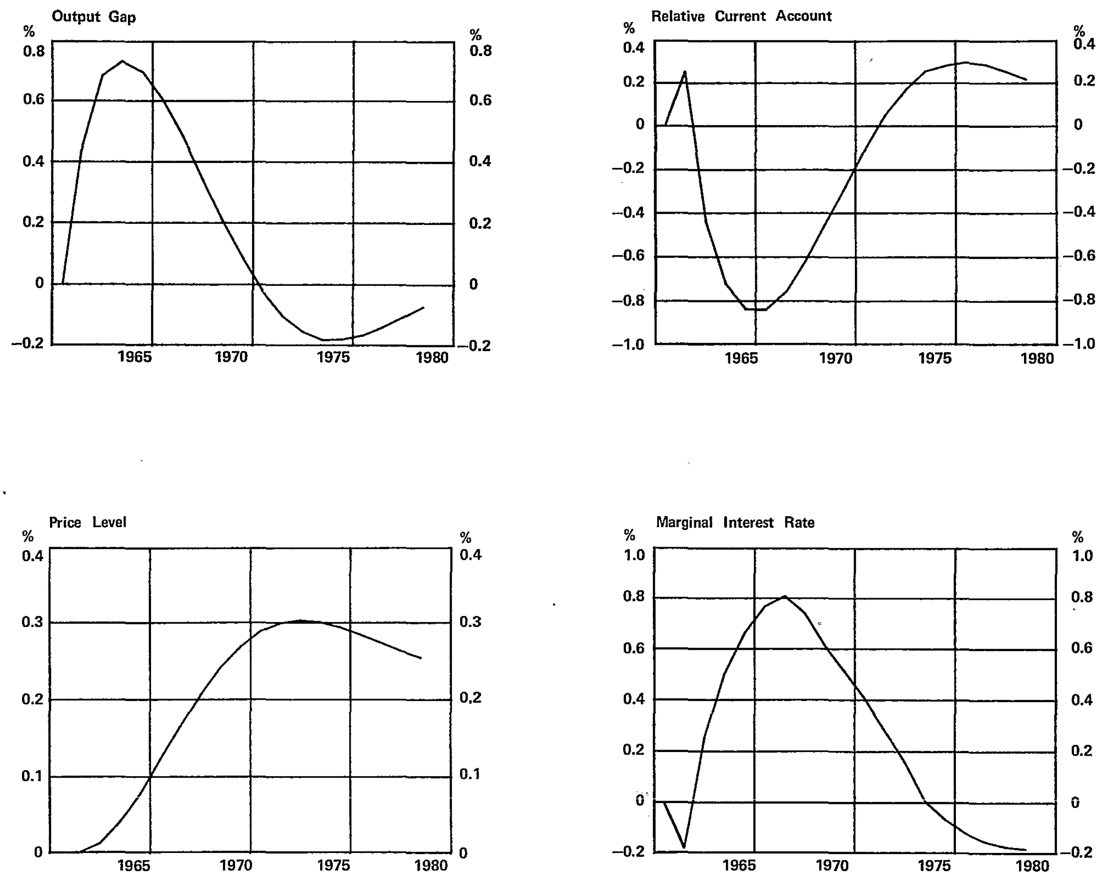
The main differences are that the hypothetical policy would have led to a considerable revaluation in 1974 (to offset the extraordinary foreign price shock which at that time impinged upon the Finnish economy) and some devaluation of the exchange rate already in 1975 - 1976.

The results are shown in Chart 3. The broken line (----) refers to the control solution value of each variable and the solid line (——) is the inflation norm solution. As can be seen, the exchange rate policy assumed would have increased price stability considerably. The inflation norm would also have helped to stabilize external balance and it would have had a harmful effect on output only in 1975 (due to the large appreciation of the Finnish markka in 1974 induced by the assumed policy rule). In fact, domestic prices would have been at a lower level in 1979 and thus the competitive position of the economy would have been better within this (restricted) time horizon.

Thus exchange rate policy according to an inflation norm would seem to be beneficial particularly as a means of stabilizing inflation if price disturbances originate externally, as they did in Finland during the period under consideration.

Chart 4.

EFFECTS OF 1 PER CENT INCREASE IN THE LEVEL OF FOREIGN DEMAND



Explanations:
The solid line (———) measures the dynamic response of a variable X_t to a 1 per cent increase in the level of foreign demand with externally-oriented monetary policy. For further details see explanations in Chart 2.

3.3.3. Foreign Demand Shock

The effects of a sustained one per cent increase in the level of foreign demand in 1962 is shown in Chart 4.

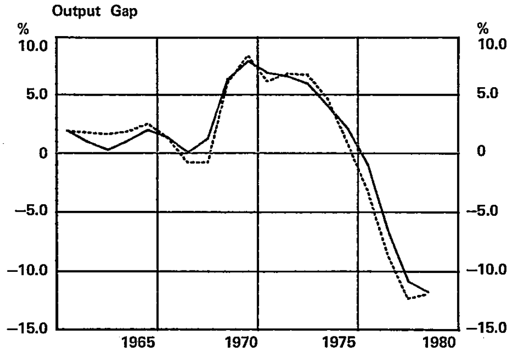
As can be seen, domestic output goes up by half a per cent and the current account strenghens slightly at first, which also induces a minor fall in the interest rate. The impact effect on inflation is naturally zero. In the next year following the shock the effect on output is slightly strengthened by the fall in the interest rate in the previous year. (In the somewhat longer run, on the other hand, externally-oriented monetary policy is stabilizing; cf. note 1 on p. 62.)

3.3.4. A Monetary Policy Simulation

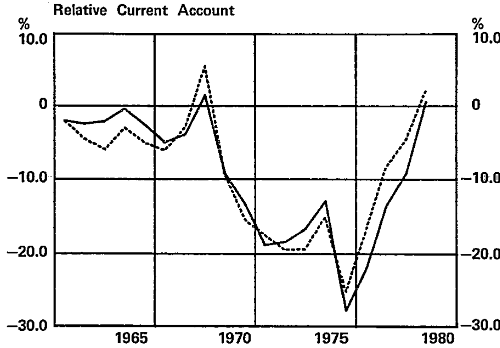
A 10 per cent annual increase in the marginal rate of interest on central bank finance (which is within the practically feasible region) will, according to our equations, reduce the level of output in the following year by approximately one and a half per cent. This will improve the current account and therefore put downward pressure on the interest rate in the subsequent year. We shall not, however, simulate the effects of once-and-for-all change in the interest rate.

Chart 5.
EFFECTS OF KEEPING THE MARGINAL INTEREST RATE CONSTANT

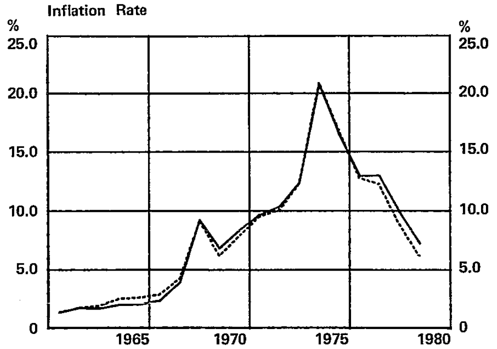
Output Gap



Relative Current Account



Inflation Rate



Explanations:
The broken line (----------) is the control solution value of a variable X_t. The solid line (———) is the disturbed solution value of a variable X_t to a "monetary policy rule" of keeping the marginal interest rate constant (at its historical average of 14.4 per cent).

The simulation presented in this section investigates instead the effects of a monetary policy that keeps the marginal interest rate constant (at its historical average, 14.4 %). The results are shown in Chart 5. The broken line (----) again gives the "actual" (control solution)[1] value, and the solid line (———) gives the corresponding solution when the interest rate is assumed constant.

Chart 5 clearly indicates that the constant interest rate policy has a stabilizing effect on output and the current account, or that variations in the marginal interest rate (associated with fluctuations in the balance of payments) are destabilizing in the sense of increasing the variation of output and the current account. (The magnitudes of the effects are rather modest - the maximum effect on output being about two per cent). A constant interest rate would thus have dampened demand and output for most of the years when the output gap was positive (up to 1966 and in 1972 - 1974) and would have been expansionary in the recession years (1967 - 1968 and 1976 - 1978). The effects on the inflation rate would have been very small and current account fluctuations would in many instances have been reduced, though the deficits in 1975 - 1977 would have been aggravated.

---

1. The control solution here refers to the model solution where the marginal interest rate is exogenized (kept at its historical level).

The view that the external orientation of monetary policy in Finland has added to domestic instability is in agreement with the arguments put forward in Section 2 above (pp. 21 - 25 and 40 - 41). This agreement is, however, to some extent superficial and conceals the fact that the outcomes of various policy rules are more complex in our empirical model than in the simplified cases analyzed in Section 2.

The sequence of interactions responsible for this may be outlined as follows. The typical Finnish business cycle has a length of 5 years. An export-led upswing initially improves the balance of payments which puts downward pressure on the interest rate (within the same year). The effects of the fall in the interest rate strengthens the boom (in the following year), during which, on the other hand, the current account swings into deficit and the interest rate rises. This rise in the interest rate would be stabilizing if the export boom were "long enough" or if the time lag between the rise in the interest rate and its demand dampening effect were "short enough". In actual fact, however, the economy is typically hit by an export-led recession at approximately the same time as the contractive effects of the rise in the interest rate are gradually being felt.

Later in the recession, a cyclical improvement of the current account occurs and the interest rate is lowered. This would be stabilizing were it not for the fact that the fall in the interest rate typically adds to domestic demand primarily at the stage when a new export-led upswing is already well under way. The destabilizing effect is thus the outcome of the export-led business cycle in combination with lagged monetary policy effects.

4. SUMMARY AND CONCLUSIONS

This study is an attempt at a unified theoretical and empirical analysis of the role of central bank policy in the cyclical behaviour of the Finnish economy. In Section 2 we formulated a simple theoretical model of an open economy, which was then used to analyse the comparative static and dynamic effects of various exogenous shocks as well as the consequences of the exchange rate and monetary policies pursued. In Section 3 we turned to the estimation and simulation of a small macroeconomic model of the Finnish economy.

Our main contention is that a specification broadly consistent with open-economy theoretical modelling would also seem to be empirically applicable as a framework for analysis of Finnish exchange rate and monetary policy. Major conclusions on the basis of the particular model applied to the Finnish case are as follows.

First, the stance of monetary policy affects the level of output in the subsequent year(s), the mean lag being a year and a half. Second, monetary policy seems to be strongly influenced by the state of the balance of payments on current account. This probably reflects the "monetary mechanism of adjustment" (the influence of the balance of payments on domestic monetary conditions) as well as the importance attached to current account developments as a policy target. Third, the external orientation of monetary policy in combination with the lag between changes in the stance of monetary policy and their ultimate effects on output and external balance seems to have been cyclically destabilizing in the sense of increasing the variance of (the trend deviation of) the level of GDP.[1] Neutralization of monetary effects of balance-of-payments imbalances would thus be desirable for cyclical reasons even if it were true that such neutralization is "futile in the long run". Fourth, the domestic price level will increase by the full amount of a devaluation within three or four years.[2] A devaluation will nevertheless also have short-run and

1. Our finding, according to which monetary policy may have been cyclically destabilizing, is not a new observation. It is often argued, for instance, that the failure of fiscal and incomes policies to prevent "overheating" of the economy in the upswing implies the necessity for tight monetary policy irrespective of its employment consequences during the subsequent recession. The difficulties in the timing of monetary policy are often also explained by referring to problems associated with forecasting and decision making.

2. As discussed in Section 3 above, we think that our estimate of the speed of adjustment of the domestic price level may to some extent be influenced (reduced) by the incomes policy packages associated with the large devaluations. A revaluation might then dampen the rate of increase of the domestic price level even more rapidly and its real effects might correspondingly be smaller.

medium-term effects on the output level and the trade balance. Fifth, exchange rate policy might usefully contribute to domestic price stability. We find that the cumulative increase in the domestic price level from 1974 - 1979 could have been substantially reduced by pursuing the exchange rate policy analyzed without major consequences for the level of output.

Finally, it should be observed that a ten per cent change in the exchange rate and in the marginal interest rate have approximately equal effects on output, while the price effects in the former case are much stronger. Thus our results imply that exchange rate policy has a comparative advantage as an instrument for controlling the rate of inflation.

REFERENCES

Agheveli, B. and Rodriguez, C. (1979): Trade, Prices and Output in Japan: A Simple Monetary Model, IMF Staff Papers, Vol. 26, March.

Branson, W.H. (1975): Keynesian and Monetarist Models of the Transmission of Inflation, American Economic Review, Papers & Proceedings, Vol. LXV.

Calmfors, L. (1977): Inflation in Sweden in Krause, L. and Salant, W. (eds.), Worldwide Inflation: Theory and Recent Experience, Brookings Institution, Washington D.C.

Dornbusch, R. (1973): Devaluation, Money and Non-traded Goods, American Economic Review, Vol. 63.

Frenkel, J. and Johnson, H.G. (1976, eds.): The Monetary Approach to the Balance of Payments, London.

Halttunen, H. (1974): Phillipsin käyrä ja inflaatio Suomessa, Kansantaloudellinen aikakauskirja 1974:2.

Huomo, A. and Korkman, S. (1979): Keskuspankkirahoituksen kireysindikaattoreista ja Suomessa harjoitetusta rahapolitiikasta, Suomen Pankin kansantalouden osaston keskustelualoitteita, KT 1/80.

Korkman, S. (1980): Exchange Rate Policy, Employment and External Balance, Bank of Finland, B:33, Helsinki.

Koskela, E. (1976): A Study of Bank Behaviour and Credit Rationing, Helsinki.

Kukkonen, P. (1975): The Transmission of Monetary Policy through Credit Rationing, The Case of Finland, Conference on the Monetary Policy in Open Economies, Helsinki, Finland, August 4 - 9.

Laidler, D. and O'Shea, P. (1980): An Empirical Macro-model of an Open Economy under Fixed Exchange Rates: The United Kingdom, 1954 - 1970, Economica, 47.

Lundberg, E., Lundgren N., Mathiessen, L. and Ohlin, G. (1974): Kris eller Konjunkturuppgång? Konjunkturrådets rapport 1974/75 (Stockholm, SNS, 1974; processed).

McKinnon, R.I. (1976): The Limited Role of Fiscal Policy in an Open Economy, Banca Nazionale del Lavoro Quarterly Review, June, No. 117.

Molander, A., Aintila, H. and Salomaa, J. (1970): Vakautuksen vaikutus hinta- ja palkkatasoon, SITRA, sarja B, n:o 5, Helsinki.

Oksanen, H. (1977): Bank Liquidity and Lending in Finland, Helsinki.

Puro, I. (1978): The Amendment of the Currency Act, Bank of Finland Monthly Bulletin, Vol. 52, No. 2, February.

Swoboda, A.K. (1973): Monetary Policy under Fixed Exchange Rates: Effectiveness, The Speed of Adjustment and Proper Use, Economica, May.

Tarkka, J. (1979): A Test of Credit Rationing in Finland: An Experiment with the Data of 1967 - 1977, University of Helsinki, Department of Economics Discussion Papers, No. 130.

Turnowsky, S.J. (1977): Macroeconomic Analysis and Stabilization Policy, Cambridge.

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