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ABSTRACT

The paper deals with the problem of repeated devaluations in the Nordic countries with the help of a simple rational expectations macroeconomic model. It is assumed that, after the latest devaluation, the private sector starts to expect a new future devaluation. With imperfect international asset substitutability, interest rate pegging and sufficient foreign exchange reserves, a small open economy reacts to an expected devaluation by a short-run expansion of output and an inflationary process which worsens price competitiveness and leads to a need to devalue. Interest rate policy geared to competitiveness can be used to put an end to the repeated devaluations. If this policy norm is known and credible, no interest rate adjustments are called for, except shortly before and during the expected devaluation phase. In contrast, a compeletely unanticipated interest rate policy demands that the rate of interest be raised continuously as the expected devaluation date is approached.

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I. Introduction

Devaluations have traditionally played an important role in the stabilization policies of all Nordic countries (Denmark, Finland, Iceland, Norway and Sweden). As a matter of fact, the frequency by which monetary authorities in these economies have resorted to this policy measure has clearly increased during the last ten years. This can hardly be said to be due to the fact that, after the breakdown of the Bretton Woods system of fixed parities, these countries have adopted, following the lead of Finland, some sort of a basket peg system, though in this period individual exchange rates have fluctuated considerably. Instead, in this context one can still speak of exchange rates which are normally fixed but occasionally changed in a discrete manner. And because there are problematic beggar-thy-neighbour and macroeconomic adjustment issues associated with devaluations, it is worthwhile to ask why they have occurred, in order to be able to find ways to avoid repeating them.

In this paper, we will concentrate on the reasons for repeated devaluations with the Nordic experience as our background. Generally speaking, there is no compelling reason why a country should devalue its currency more or less regularly, unless it has some economic or political constraints on the use of alternative economic policies. There are two basic explanations for devaluations more widely discussed in the literature, each with its special assumptions concerning these constraints. One of them may be called the monetary, or speculative attack hypothesis, and the second is known as the vicious circle, or devaluation cycle hypothesis.

The speculative attack hypothesis was first formalized by Krugman (1979), and its empirical application has been pioneered recently by Blanco & Garber (1986). Put simply, it says that a country with a fixed exchange rate and faster growth of money supply than abroad gradually uses up its reserves of foreign currency, until speculators begin to anticipate a devaluation and, by a sudden

attack, acquire the remaining reserves and force the authorities to abandon the fixed exchange rate. Most of this literature has been written with the Latin American countries in mind; there many governments have been quite constrained in their financing of budget deficits by other means than money creation, and their access to international capital markets for loans which could support their reserves has had its limits as well. However, this explanation has not gained much support in the Nordic countries, as they have normally been able to limit domestic credit expansion and protect their foreign reserves by various means, though the scope for speculative attacks has clearly widened during recent years.

As regards the second explanation for repeated devaluations, the vicious circle hypothesis, a specific Nordic debate was initiated somewhat more than ten years ago when Finnish economists began to pay attention to the large devaluations undertaken fairly regularly with an interval of approximately ten years.[1] As a result of this, an explanation or perhaps only a description of this process was presented and the term "devaluation cycle" introduced. It has gained some support in the other Nordic countries as well, and, to contrast it with a more recent hypothesis discussed below, we will call it "the traditional view". According to this hypothesis, it is the latest actual devaluation which triggers off a process of compensatory, sometimes even overcompensatory income claims by both wage earners and capital owners. It is widely recognized that a devaluation, while improving competitiveness and employment, changes the distribution of income in favour of capital owners. The traditional view seems to depend upon the assumption that the level of competitiveness attained through the devaluation is not a long run equilibrium one; consequently, wage earners start a process of wage increases, backed by the improved employment situation, to reestablish the pre-devaluation distribution of income. As firms respond by raising prices, a struggle over income shares results,

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[1] See e.g., Korpinen & Kykkänen (1974) and Korkman (1980). Cf. also the recent critical review by Pekkarinen & Sauramo (1985).

leading to a cost and price development which exceeds that of competitor countries. The pre-devaluation level of price competitiveness is restored or even undercut.[2] It is then explained that, perhaps following the demands emanating from some export-oriented industries, the authorities are not satisfied with this level of competitiveness and its consequences, and a new devaluation is undertaken.

An important feature in the traditional view is that devaluations are always unanticipated; the public is repeatedly surprised by them. In contrast, the development of the rational expectations literature has led to a new, third explanation, emphasized by Lybeck (1985), which starts from the recognition that people have adjusted themselves to the repeated devaluations by building them into their expectations of future exchange rates. Although Lybeck does not want to deny the importance of the effects of the previous devaluation, he rightly points out that the traditional view does not really explain why a country has fallen into the cycle in the first place. According to his view, which we will call "the new view", it is the generally known and proved willingness of governments to undertake devaluations which leads both wage earners and firms to set wages and prices under the expectation that the authorities will devalue the currency at some date in the future. These expectations make the wage earners to try to compensate for the expected future losses, and firms, perhaps following a mark-up pricing rule, behave similarly. This means that a devaluation will affect the behaviour of economic agents well before it is undertaken and even if it is not undertaken at all but only expected.[3]

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[2]In this context, Oksanen (1978) has pointed out that expectations of devaluation may lead to a speculative attack on the country's foreign reserves. It is thus possible to see the speculative attack hypothesis as an explanation for the final phase of the devaluation cycle, in which reserves are exhausted and a new devaluation is called for.

[3]Turnovsky (1980; 1981) also underlines these effects of expected devaluations but does not refer to the devaluation cycle.

Thus, there is an important difference between the traditional and the new explanation of the devaluation cycle. According to the traditional view, a new devaluation is called for because the gains in comeptitiveness and employment are lost during the adjustment process following the previous devaluation. The effects of devaluations will always work themselves through - the best that other economic policies can do is to lenghten the period of adjustment, by slowing down the rise of domestic costs and prices. In Lybeck's new explanation, on the other hand, it is the expected future devaluation which triggers off the inflationary process leading to a deterioration of competitiveness and employment and to the need for a devaluation. Now it may be asked whether other economic policies help to curb the expectations of devaluation.

The truth may very well lie somewhere in the middle; however, it is easy to agree that the new view deserves more careful economic analysis on its own right. For one thing, a more cogent corroboration of Lybeck's hypothesis involves a great deal of scrupulous empirical research. Before such studies, however, the so far only loosely formulated new explanation must be submitted to a rigorous theoretical analysis. This paper aims to start this project by examining the effects of devaluation expectations in a skeletal macroeconmic model. Simple as our model is, it can still be used to illuminate several interesting points. Section 2 examines the effects of devaluation expectations in the context of unchanged economic policies. The possibility to obviate the need to devalue and thus to cut the cycle with the help of interest rate policy[4] is scrutinized in section 3. It turns out that if the expectations-oriented explanation is valid, there is more hope that the authorities, pursuing a continuous and credible interest rate policy, can put an end to the devaluation cycle. Finally, section 4 offers a summary and some suggestions for future research.

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[4]We are fully aware of the fact that a policy mix including monetary, fiscal and incomes policies might well be more appropriate in most circumstances. Our focus on monetary policy can be justified, at least, on the well-known grounds that it is usually the most flexible of these policies.

II. Expectations of Devaluation in a Simple Macroeconomic Model

Consider a small open economy with a fixed exchange rate and free capital movements. If its domestic assets were perfectly substitutable for those of the rest of the world, then it could not pursue independent monetary policy. However, since we want to look at interest rate policy as a response to expectations of devaluation, we shall assume imperfect asset substitutability. As capital is freely mobile, the covered interest parity condition holds:

$$i_t = i_t^* + f_t - e_t, \qquad (1)$$

where i_t = domestic nominal rate of interest, i_t^* = foreign nominal rate of interest, f_t = logarithm of the one-period forward exchange rate and e_t = logarithm of the spot exchange rate.

If domestic monetary authorities peg the spot exchange rate and the interest rate, whereas the foreign rate of interest is given to the small country, then the forward exchange rate must adjust to maintain the parity condition. It is evident that changes in the forward exchange rate as well as in expectations of devaluation will give rise to capital movements and changes in the central bank's foreign currency reserves. However, we shall assume that the monetary authorities can always secure a sufficient amount of reserves by e.g., borrowing abroad. This allows us to ignore the financial sector of the economy.

To focus on essentials, the rest of the model will be highly simplified:[5]

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[5]The model is a skeleton version of the standard Keynesian small open economy model; for the global version, see, e.g., Obstfeld (1985), who also discusses its limitations. Notable omissions are the absence of stock adjustments and wealth effects, and the nonindexation of wages to import prices.

$$y_t^d = \delta q_t - \sigma r_t, \tag{2}$$

$$q_t = e_t - p_t, \tag{3}$$

$$r_t = i_t - (p_{t+1,t} - p_t), \tag{4}$$

$$y_t^s = \theta(p_t - w_t), \tag{5}$$

$$w_t = p_{t,t-1}. \tag{6}$$

All symbols with the exception of those for interest rates are defined as logarithmic deviations from their initial steady state values and are as follows: y_t = domestic output, q_t = competitiveness (real exchange rate), p_t = domestic price level, r_t = domestic real one-period rate of interest and w_t = domestic nominal wage rate. We also define $x_{\tau+j,\tau}$ = expectation of variable x in period $\tau+j$ conditional on information available in period τ. Economic agents are assumed to possess knowledge of the structure (as described by the model) and history of the economy - price expectations are rational.

According to equation (2), aggregate demand for domestic output depends on competitiveness and the real rate of interest. For simplicity, the foreign price level has been normalized to 1, and other exogenous factors have been suppressed. The supply of output in equation (5) depends negatively on real output wages. Nominal wages are negotiated in period t-1, and they are predetermined as of period t.

We are now interested in the time paths of output, prices and competitiveness as responses to exogenous expectations of devaluation.[6] The model is conveniently solved as follows.

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[6]How do people form their expectations of devaluation? We shall not take pains to answer to this important question in this paper, though some hints are given below.

Substitute (3) and (4) in (2) and (6) in (5) and assume that output is in equilibrium, to get an expression for the price level:

$$p_t = \frac{\Theta}{\Theta+\delta+\sigma} p_{t,t-1} + \frac{\sigma}{\Theta+\delta+\sigma} p_{t+1,t} - \frac{\sigma}{\Theta+\delta+\sigma} i_t + \frac{\delta}{\Theta+\delta+\sigma} e_t. \quad (7)$$

Suppose that expectations of devaluation arise in period t, which implies that $p_{t,t-1} = 0$. Applying the familiar method of recursive forward substitution and ruling out speculative "bubbles" in the price level, the "market fundamentals" solution[7] is:

$$p_t = \frac{\delta}{\Theta+\delta+\sigma} e_t - \frac{\sigma}{\Theta+\delta+\sigma} i_t + \frac{\delta}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j e_{t+j,t} - \frac{\sigma}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j i_{t+j,t}. \quad (8)$$

The solution for competitiveness is easily obtained by substituting (8) in (3):

$$p_t = \frac{\Theta+\delta}{\Theta+\delta+\sigma} e_t + \frac{\sigma}{\Theta+\delta+\sigma} i_t - \frac{\delta}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j e_{t+j,t} + \frac{\sigma}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j i_{t+j,t}. \quad (9)$$

Substituting (7) in (5), we get for output:

$$y_t = \frac{\Theta\delta}{\Theta+\delta+\sigma} e_t - \frac{\Theta\sigma}{\Theta+\delta+\sigma} i_t + \frac{\Theta\delta}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j e_{t+j,t} - \frac{\Theta\sigma}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j i_{t+j,t}. \quad (10)$$

The same method helps us to determine subsequent values for p_t, q_t and y_t. Rather than going into this in detail, we shall instead take some representative simple cases of an expected future devaluation without any policy response. In the next section we will relax the assumption that current and expected nominal interest rates stay constant forever.

In the first example we assume that there has been no recent devaluation and that, in period t, people begin to expect a single future devaluation to happen in period t + T. The same expectation is carried forward till period t + T - 1. Using equation (8), equilibrium price level in period t is given by:

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[7] For the distinction between "market fundamentals" and "bubble" solutions, see e.g. Flood and Garber (1980).

$$p_t = \frac{\delta}{\Theta+\delta+\sigma} \sum_{j=1}^{\infty} \left(\frac{\sigma}{\delta+\sigma}\right)^j \bar{e} = \left(\frac{\sigma}{\Theta+\delta+\sigma}\right) \left(\frac{\sigma}{\delta+\sigma}\right)^{T-1} \bar{e}, \qquad (8')$$

where $\bar{e}$ is the expected deviation of the exchange rate from its initial level (= 0). That is, the price level jumps up by less than the expected devaluation. This effect is due to the fact that devaluation expectations lead to an incrase in the expected rate of inflation and to a decrease in the real rate of interest, which means a boost to current aggregate demand. The higher price level implies a corresponding deterioration of competitiveness:

$$q_t = - \left(\frac{\sigma}{\Theta+\delta+\sigma}\right)\left(\frac{\sigma}{\delta+\sigma}\right)^{T-1} \bar{e}, \qquad (9')$$

and, furthermore, output increases by:

$$y_t = \left(\frac{\Theta\sigma}{\Theta+\delta+\sigma}\right)\left(\frac{\sigma}{\delta+\sigma}\right)^{T-1} \bar{e}, \qquad (10')$$

This last result may seem paradoxical. In Turnovsky's (1981) model, expectations of devaluation lead to a decline in output, but the outcome clearly depends on assumptions concerning asset substitutability and monetary policy. He assumed perfect substitutabiity and money supply targeting, so that expectations of devaluation must raise the domestic rate of interest - a contractionary effect on output follows. In our model the domestic rate of interest remains intact and rising output and prices are fully accommodated by the monetary authorities.

Between periods t + 1 and t + T - 1, the price level is given by:

$$p_{t+j} = \left(\frac{\sigma}{\delta+\sigma}\right)^{T-j} \bar{e}, \quad j = 1, \ldots, T-1, \qquad (8'')$$

and the rate of inflation,

$$p_{t+j} - p_{t+j-1} = \left(\frac{\sigma}{\delta+\sigma}\right)^{T} \left(\frac{\delta+\sigma}{\delta}\right)^{j-1} \bar{e},$$

is increasing in each period up to T - 1, exceeding that of the rest of the world. Competitiveness deteriorates all the time but

output returns to its normal level in period t + 1 as wages are adjusted to expected rates of inflation.

What happens in period t + T? Prior to this date, the economy was driven solely by the expectations of devaluation, but now it all depends on what the authorities choose to do. If they actually devalue by the amount $\bar{e}$, i.e., if expectations turn out to be correct,[8] then $p_{t+t} = \bar{e}$ and $y_{t+T} = 0$, and the same equilibrium levels will persist indefinitely. In other words, with correct expectations, a devaluation has no real effects, nor will domestic inflation thereafter deviate from the world rate of inflation.

However, real effects in period t + T arise if the authorities choose to devalue by an amount which is different from the expected one. Let the unanticipated component of the devaluation be $\bar{e}^* \gtrless 0$, and assume that the public expects the resulting exchange rate to persist. The equilibrium price level in period t + T will then be:

$$p_{t+T} = \left(1 + \frac{\Theta\delta}{(\delta+\sigma)(\Theta+\delta+\sigma)}\right) \bar{e} + \bar{e}^*, \qquad (8''')$$

and thereafter $p_{t+T+j} = \bar{e} + \bar{e}^*$ for all j = 1, 2,... If the devaluation is underpredicted ($\bar{e}^* > 0$), then p_{t+T} rises clearly above $\bar{e}$, the price level with correct expectations. But even if it is overpredicted up to a certain extent ($\bar{e}^* < 0$ and $-\bar{e}^* < \frac{\Theta\delta}{(\delta+\sigma)(\Theta+\delta+\sigma)} \bar{e}$), the price level rises above $\bar{e}$. The reason for this slightly surprising result can be traced to the wage-setting process; wages for period t + T are set in period t + T - 1 according to the overpredicted exchange rate (or, to put it more accurately, according to the corresponding higher expected price level) in and after period t + T. Otherwise, if the overprediction error turns out to be "big", it happens that $p_{t+T} < \bar{e}$. In every case, $p_{t+T+j} = \bar{e} + \bar{e}^*$ for all j = 1, 2,...

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[8] Remember that expectations of devaluation are totally exogenous and hence not necessarily correct.

Corresponding observations apply to equilibrium output, which in period t + T is:

$$y_{t+T} = \Theta\left(\frac{\Theta\delta}{(\delta+\sigma)(\Theta+\delta+\sigma)}\,\bar{e} + \bar{e}\right), \qquad (10''')$$

and back to its initial full employment level thereafter. That is, output increases in period t + T, if the devaluation is underpredicted or if it is overpredicted up to a certain extent. Otherwise it will fall. As a special case, we may note that if the monetary authorities do not devalue at all, then $-\bar{e}^* = \bar{e}$, and $p_{t+T} < \bar{e}$, which implies that output must fall in period t + T.[9]

How does this simple model fit into the new concept of a devaluation cycle? First of all, since correctly anticipated devaluations do not affect output, we have to explain any real effects following a devaluation by two alternative but not mutually exclusive factors: the recent devaluation was mispredicted (part or all of it came as a surprise), or immediately after one devaluation the public begins to expect a new future devaluation. It is not entirely clear what Lybeck (1985) wanted to hypothesize. If he (rather unrealistically, to our mind) meant that the devaluation cycle exhibits a complete perfect foresight of all future devaluations, no real effects should arise, whereas underprediction errors with their positive effects on output would lead us back to the traditional view. However, it may be that people do not expect repeated future devaluations but, instead, they want to have their current expectations to be fulfilled by the devaluation, and if that occurs, they begin to expect the next one. This behaviour produces real effects after every devaluation implemented, although the recent devaluation was their "cause" only in a special way. At the same time, if expectations of devaluation must be confirmed repeatedly in this manner, the possibility comes to mind that the need to devalue

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[9]Another special case is one in which no devaluation is expected, i.e., it is completely unanticipated. The result is then fully conventional: both prices and output rise in period t + T.

might be obviated with the help of other economic policies which would prevent price competitiveness from deteriorating.

III. Interest Rate Policy and Expectations of Devaluation

Having studied the economy's response to expectations of devaluation under the assumption of unchanged economic policy, we are now prepared to look at how interest rate policy can be used to obviate the need to devalue.

In the literature representing the traditional view of the devaluation cycle, there has been some discussion on alternative exchange rate policy norms that would lead to a more satisfactory pattern of automatic reactions in the face of various exogenous disturbances. However, in this paper we are interested only in expected devaluations which have not been included in the list of disturbances, and, moreover, we want to see whether it is anyhow possible to avoid exchange rate policy measures. Nevertheless, these policy norms merit some discussion here.

Sixten Korkman (1980), in his influential dissertation, considered three alternative exchange rate policy norms. The first of these is a fixed exchange rate. If the exchange rate really were credibly fixed from there to eternity, no expectations of devaluation would ever emerge. True, but the point now is that in the case where this credibility is not achieved, a policy of keeping the exchange rate fixed can do nothing to curb the adverse effects of devaluation expectations, at least until the time when the devaluation was expected to occur. As the authorities then in fact stay inactive, we have the case of an overpredicted devaluation discussed above; output will fall in the short run. This experience of an expected devaluation which was not carried out may then lead to an end of the devaluation cycle. Exactly the same considerations apply to Korkman's second norm, which he, somewhat misleadingly, calls the inflation norm but which actually only means the stabilization of

the domestic currency price of foreign goods. As we do not deal with foreign price disturbances, this rule reduces to the above-mentioned fixed exchange rate norm.

Thus, it can be said that under the fixed exchange rate norm (without credibility) as well as with recurrent devaluations, expectations of devaluation lead to a deterioration of competitiveness. Policy makers wanting to get rid of this trouble may then consider interest rate policy as a means to maintain competitiveness. Korkman's third and last rule, the competitiveness norm, seems to be the one most frequently followed in exchange rate policy. But, in fact, if one does not want to use exchange rate policy, this norm actually dictates that the domestic rate of inflation should not exceed that of the rest of the world. Interest rate policy, as far as there is any monetary autonomy, should then be used to control domestic inflation.

The behaviour of the economy depends, first of all, on whether this interest rate policy norm is known and thus fully anticipated or unknown and thus unanticipated. If the econmic agents have learned the rule, and trust in it, they will take account of it in forming their rational expectations and behave accordingly. In this case, we can set $q_t = 0$ and notice that $p_t = e_t$ and $p_{t+j,t} = e_{t+j,t}$ for all t, j. Solving for the rate of interest under this rule, we find:

$$i_t = e_{t+1,t} - \frac{\Theta+\delta}{\sigma} e_t + \frac{\Theta}{\sigma} e_{t,t-1}. \qquad (11)$$

Assume again that, in perod t, expectations arise that a devaluation will occur in period $t + T$, $T > 1$. Because people know that the authorities would use interest rate policy to maintain $p_{t+j} = e_{t+j} = 0$ in all periods up to $t + T - 1$, they will not raise wages and prices; thus, competitiveness, the real rate of interest and output will remain intact. But this means that the domestic nominal rate of interest should also stay the same. Only in period $t + T - 1$ should the rate of interest be raised according to the expected devaluation, or, since $p_{t+1,t} = e_{t+1,t}$, according to expected inflation. Furthermore, to maintain competitiveness in period $t + T$, the rate

of interest should be kept at $\frac{\Theta}{\sigma} e_{t+T,t+T-1}$, which is, of course, higher than prior to period t + T - 1 and after period t + T. In this way, even an overprediction of the devaluation looses its effects on competitiveness and output. The troubles caused by expectations of devaluation are fully abolished.

We may thus conclude that, if the new view of the devaluation cycle is correct, the authorities wanting to do away with the cycle by means of interest rate policy should make a credible commitment to the competitiveness norm. However, there are two main problems with this approach, closely related to its implementation in practice. First, there is the problem of knowing the amount and timing of the devaluation that the public is expecting. Although the amount of expected devaluation could be substituted for by expectations of inflation, the difficulty is a real one and could be relieved only by constructing a reliable model of the determination of devaluation expectations. Second, even if an accurate interest rate policy rule could be formulated, it may not gain credibility, so that it is not built in the expectations of economic agents.

There are thus two major issues of credibility associated with using interest rate policy to cut the expectations-based devaluation cycle. On the one hand, the whole problem can be said to be due to the fact that the public does not regard the prevailing fixed exchange rate as credible, though, as we have pointed out, this distrust may need reinforcing. If the authorities choose not to devalue, contrary to the private sector's expectations, it would not be unreasonable to assume that no new expectations emerge. We can then say that the fixed exchange rate policy has become credible.[10] On the other hand, interest rate policy will be credible only if it is recognized that every possible deterioration of competitiveness will be curbed by raising the nominal rate of

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[10] However, as Obstfeld (1985) suggests, it may be that the only realistic fixed exchange rate is one which is not always credibly fixed!

interest. Again, this policy may need some reinforcing through experience.

Rather than trying to model these issues of credibility in this context,[11] we shall next take only some interesting examples of appropriate interest rate policy in the case where the competitiveness norm is unknown or not relied upon among private econmic agents. In this framework, the results will be different depending on the expected permanence of the change in interest rate policy.

Let us now go back to equation (8) and assume that $e_t = e_{t+j,t} = 0$ $(j = 1,\ldots, T-1)$ and $e_{t+T+j,\ t+h} = \bar{e}$ $(j = 0,1,\ldots;\ h = 0, 1,\ldots, T - 1)$ - i.e., the devaluation is expected for period $t + T$. Suppose also that interest rate policy is expected to be only transitory, i.e., $i_{t+j,t} = 0$ $(j = 1, 2,\ldots)$. The competitiveness norm again dictates that $p_t = e_t = 0$. It is straightforward to show that, in period t, the nominal rate of interest must be raised to:

$$i_t = \left(\frac{\sigma}{\delta+\sigma}\right)^{T-1}\bar{e}. \qquad (12)$$

But also in subsequent periods, when interest rate policy is expected to remain transitory, the rate of interest should be kept above the level which prevailed before expectations of devaluation emerged. In periods $t + 1,\ldots, t + T - 1$, the rate of interest should be set according to:

$$i_{t+j} = \frac{(\theta+\delta+\sigma)\sigma^{T-j-1}}{(\delta+\sigma)^{T-j}}\bar{e},\ j = 1,\ldots, T - 1. \qquad (13)$$

Clearly, the rate of interest must rise as the expected date of devaluation is approached. This policy of a gradually rising

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[11] We are looking forward to be able to do this in a subsequent paper. Problems of credibility have recently been studied in the closed economy monetary policy context by, e.g., Barro and Gordon (1983) and Backus and Driffill (1985a; 1985b). Horn and Persson (1985) have looked at the credibility of exchange rate policy associated with a Government-Trade Union repeated game.

interest rate is, at the same time, a response to the gradually rising expected rate of inflation. In fact, as we have

$$p_{t+j} - p_{t+j-1} = \left(\frac{\delta}{\delta+\sigma}\right)\left(\frac{\sigma}{\delta+\sigma}\right)^{T-j}\bar{e},$$

interest rate policy could be started at any time with the realized rate of inflation in mind:

$$i_{t+j} = \frac{(\delta+\sigma)(\Theta+\delta+\sigma)}{\delta\sigma}\,(p_{t+j} - p_{t+j-1}) \qquad (14)$$

This means that the rate of interest need not be raised by as much as the actual inflation rate.

In period t + T, as the expectations of devaluation are not fulfilled, the contractionary effect can be avoided if the rate of interest is lowered to:

$$i_{t+T} = \frac{\Theta\delta}{\sigma(\delta+\sigma)}\,\bar{e}. \qquad (15)$$

If no new expectations arise, the rate of interest can then come down to the same level on which it was prior to period t.

One could easily imagine that this "surprise" interest rate policy would not be able to presist for a long time. Sooner or later the public begins to anticipate higher interest rates. If this happens, there are of course many possibilities. But if the public learns that the policy will be used to maintain competitiveness, we are back to our first case in which the policy norm was fully incorporated in their expectations. Another possibility, though to some extent peculiar, is that the rate of interest becomes to be expected to remain permanently on its new, higher level after period t. In this case, the rate of interest in all periods should be set according to:

$$i_t = \frac{\delta}{\sigma(\Theta+\delta+\sigma)}\left(\frac{\sigma}{\delta+\sigma}\right)^{T}\bar{e}. \qquad (16)$$

This level may be higher or lower than in the previous case of transitory, "surprise" interest rate policy, depending on the parameters. It is clear that if this rule is obeyed idefinitely, then the effects of the overpredicted devaluation cannot be handled. Of course, it is more realistic to assume that people do not expect the higher rate of interest to persist, so that the rate should actually be set somewhat higher than that indicated by equation (16).

IV. Conclusion

The problem of repeated devaluations in the Nordic countries has not been seen as one of recurrent speculative attacks on foreign currency reserves, an explanation applied to some other countries. Instead, the traditional Nordic explanation is based on the assumption that a devaluation leads to compensating income claims and inflation which more or less restore the pre-devaluation state of the economy. In the spirit of the rational expectations approach, however, a new view has emerged which assumes that people have started to expect future devaluations, and these expectations cause an inflationary process which develops the need to devalue. The paper examines, with the help of a skeleton macroeconomic model, the effects of expected future devaluations and the possibility to cut the devaluation cycle by using interest rate policy.

With imperfect international asset substitutability and interest rate pegging, a small open economy reacts to an expected devaluation by a short run expansion of output and an inflationary process which continues until the expected devaluation takes place. If the devaluation turns out to be underpredicted or to a certain extent overpredicted, a new short run expansion of output and a rise in prices will result. If the devaluation was overpredicted over a certain extent or does not occur at all, output and prices will fall in the short run.

Interest rate policy geared to competitiveness can be used to obviate the need to devalue. If this policy norm is known and credible, no interest rate adjustments are called for except shortly before and during the expected devaluation phase. The problem of policy credibility is serious, however, and we also looked at the appropriate interest rate policy in the absence of credibility. A complete surprise interest rate policy demands that the rate of interest be raised continuously as the expected devaluation date is approached. Other rules for interet rate policy are also conceivable depending on the public's expectations.

The highly tentative character of our study needs to be underlined. The macroeconomic model is clearly too simple to give anything close to a complete picture of the devaluation cycle. This simplicity also hampers its empirical application. Both defects can be alleviated at least partly by incorporating exchange rate expectations in large macroeconometric models. However, the determination of these expectations, which was not examined in this paper, is on particularly shaky grounds at present, and much research should be devoted to this area. Finally, we have not investigated the possibility to use a broader monetary-fiscal-incomes policy mix to deal with the cycle, nor is there any discussion on optimal policy responses in the face of various exogenous stochastic disturbances.

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