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I Introduction

Following the floating of the major currencies in March 1973, the Nordic countries - Finland, Norway and Sweden - gradually adopted a system of pegging their currencies adjustably to a basket of other currencies. By adjustability is meant that the authorities sometimes change the value of the home currency vis-à-vis the basket by a discrete decision. Under this system, such a change is defined as a de- or revaluation of the home currency.

The respective weights of the foreign currencies in the baskets used for determining the exchange rates are based principally on relative trade shares, although the weight structures have undergone certain revisions on a few occasions. The most recent major change was the exclusion of the Soviet rouble from the Finnish basket as from the beginning of 1984. Prior to this the rouble had had a weight of almost 25 per cent (see **Oksanen,** 1984a and 1984b).

Table 1 shows the weight structures as they stood in the spring of 1984. As can be seen, the number of currencies included in each basket varies between 12 and 15. The table also reveals the important fact that the Nordic currencies are partially interlinked, since each currency is included in the baskets of the others. The largest bilateral weight is the 20 per cent of the SEK in the basket of the FIM.

The purpose of this paper is to consider two separate normative questions related to the basket-peg system. First, we

Table 1.

Composition of the Baskets to Which the FIM, NOK and SEK Are Pegged (Spring 1984)

	FIM	NOK	SEK
USD	10.4	11.0	19.1
CAD	-	3.6	1.1
GBP	14.7	14.7	13.2
SEK	20.0	15.0	-
NOK	5.6	-	9.4
DKK	5.0	6.8	8.2
DEM	18.9	17.7	16.2
NLG	5.2	4.6	5.1
BEC	2.7	2.4	3.8
CHF	2.5	1.2	2.2
FRF	6.1	9.2	5.5
ITL	3.9	3.3	3.6
ATS	-	1.5	1.5
ESB	-	-	1.2
JPY	5.0	6.0	2.7
FIM	-	3.0	7.2
TOTAL	100.0	100.0	100.0

Sources: various publications of the Nordic central banks.

discuss certain properties of the basket-peg system which serve as a useful guide for some operations related to the foreign exchange risk management of individual firms. Second, we discuss the question of the currency baskets which are most stable vis-à-vis goods transacted in world markets. This question is not only related to foreign exchange management in individual firms, but is also one approach among others to the normative question of the composition of the currency baskets which the Nordic authorities should apply in their system of basket-pegging.

II Simplified Baskets for Private Economic Use

The official basket-peg system has relevance for individual firms in their foreign exchange risk management (FXRM). Any analysis which is meant to serve in risk management has to be based on some notion of what is considered to be riskless. If consumption is taken to be the ultimate goal of economic behaviour, a basket of consumption goods should be used as the numeraire in analysing economic performance.

This is not commonly the case however. Instead, some monetary unit is used as the numeraire, and in almost all cases "the monetary habitat" is the home currency, or the legal tender in the country where the firm is established. We also follow this real-life practice, in this paper, and make the assumption that the firm seeks to avoid the risk attached to the value of its foreign currency exposure measured in the home currency.

We start with a couple of useful definitions. The rate of return (or the cost of borrowing), c_{hj}, in currency j measured in terms of the home currency h (FIM, NOK or SEK) can be written as

$$(1) \qquad c_{hj} = e_{hj} + r_j = e_{hb} + e_{bj} + r_j$$

where e_{hj} = rate of change in the price of currency j in terms of h (in log per cent)

r_j = rate of interest of currency j

e_{hb} = rate of change in the price of the basket

in terms of the home currency (de- or revaluation against the basket)

r_{bj} = rate of change in the price of currency j vis-à-vis the basket b.

By definition, the rate of return on a basket in the hands of a private economic agent which has the same weights w_j as the official basket is

(2) $\Sigma w_j c_{hj} = e_{hb} + \Sigma w_j r_j$.

Thus, the rate of return (or the cost of borrowing) is dependent only on the effects of a devaluation of the home currency and the weighted average of the interest rates of each currency j, while being independent of changes in the relative prices of the foreign currencies.

Using the same basket as the official one is also the solution at the firm level, if in addition to the monetary habitat assumption and risk aversion the following assumptions also hold:

(1) the expected yield of an asset (or cost of borrowing) is the same for all foreign currencies, or so-called uncovered interest rate parity (UIRP) prevails (technically, the expected $e_{bj} + r_j$ is the same for all j).

(2) a de- or revaluation of the home currency against its basket is independent of changes in the relative values of the foreign currencies and their interest rates (technically, e_{hb} is independent of any $e_{bj} + r_j$); and

(3) transactions between currencies can take place freely and without cost.

Under these assumptions, a risk-averse agent can divide its FXRM problem into two separate stages.

First, it must decide upon the distribution of its assets or liabilities as between denomination in the home currency and foreign currencies. Note, that if assumption (1) also held for the home currency, then the firm would not have any foreign currency exposure at all. However, we are interested in a case where there are imperfections in the linkage between the markets for the home currency and the foreign ones, so that the firm may face quantitative restrictions on one or both, and where, moreover, there may well occur deviations from UIRP. Under these conditions the choice between home currency assets or liabilities versus foreign exchange is made on the basis of the difference between expected yields or costs, the perceived risk, the rate of risk aversion, availability constraints and transaction costs.

Second, the agent must decide upon the distribution of its foreign currency assets or liabilities among the various foreign currencies. Interestingly, under assumptions 1-3 above the optimal solution is to use the same basket as the official one, i.e. the weights w_j. Whether or not this is advisable will depend on the validity of assumptions 1-3. There is an extensive literature on assumption 1, which provides fairly strong support for uncovered interest rate parity in respect of the major currencies (e.g. **Frankel**, 1979, **Levich**, 1979, **Phaup**, 1981, and **Meese** and **Rogoff**, 1983). Even if the agent thinks that there

might be a case for a deviation from interest rate parity, the strategy which is presented here can be regarded as a good point of reference.

The validity of assumption 2 is both a theoretical and empirical question. If one were to argue that it does not hold, then the authorities would, in practice, use a different basket from the official one. This immediately raises the question as to why the authorities do not then change the official basket weights.

Assumption 3 clearly does not hold since transaction costs are always encountered, and hence it would obviously not be advisable for a private economic agent to include in its basket those currencies with a small weight in the official basket. This leads us to the following question: what would be the simplified baskets of major currencies which would most closely resemble the official basket of each Nordic currency? To answer this question we must choose a priori the currencies $j = 1, \ldots, m$ which we want to be included in the simplified basket and then find the weights v_j, $j = 1, \ldots, m$ such that the total deviation from the official basket is as small as possible. Technically, the problem of computing the weights v_j is solved by minimizing the variance $V[v_j(e_{bj} + r_j - \Sigma w_j r_j)]$. The result depends on the variances and co-variances of the terms in brackets for each currency j.

For the calculation we need a sample of past observations which are assumed to be generated by an economic structure which will also prevail in the relevant future. This decision is always somewhat arbitrary. The data chosen for the calculations reported below are based on observations from January 1976 to December 1983. The unit period to which the yields (or costs) are assigned

must also be defined. In our calculations it is three months, i.e. the yields are the rates of change in the exchange rates over three months (at annual rate) plus the 3-month interest rates for each currency.

Although other alternatives may also be interesting, we report in Table 2 the calculations for three-currency risk-reducing baskets, in which we include the three major currencies with the most open markets, namely, the USD, GBP, and DEM. The table shows that in the baskets for all the Nordic currencies the USD and GBP each receive a weight of somewhat more than 20 per cent and the DEM a weight of 55 - 57 per cent.

The results of these calculations should not be strictly adhered to in applications to the FXRM-strategies of individual firms since they depend on the currencies and the time period chosen for the present excercise. However, rounded to the nearest ten or five they do at least give an impression of the order of magnitude of the major currencies in a risk-reducing basket.

Figure 1 illustrates quantitatively the effect of a basket strategy for the value of a foreign currency asset or liability in the case of the FIM during the period 1976 - 1983. The heavy solid line is the weighted average 3-month interest rate for the present 12-currency basket. Hence it is the yield of such a basket measured in terms of the 12-currency basket itself, or the yield in FIM if there are no changes in the value of the FIM vis-à-vis the official basket.

For reference, the yields on 3-month USD and DEM deposits are also shown in the figure. Their volatility illustrates the high risk related to an individual currency, the 3-month yields

Table 2.

The Three-currency Baskets Resembling the Official FIM-, NOK- and SEK-baskets

	FIM	NOK	SEK
USD	19.6	21.0	22.6
GBP	24.8	23.3	20.5
DEM	55.5	55.7	56.9
TOTAL	99.0	100.0	100.0

Period: January 1976 - December 1983.

Data: monthly; rates of change in exchange rates over three months and 3-month interest rates from various sources.

The interpretation of the standard error of the residual is that 95 per cent of the observations of the annual yields of the simplified basket lie within the range of the yield of the official basket ± two times the standard error.

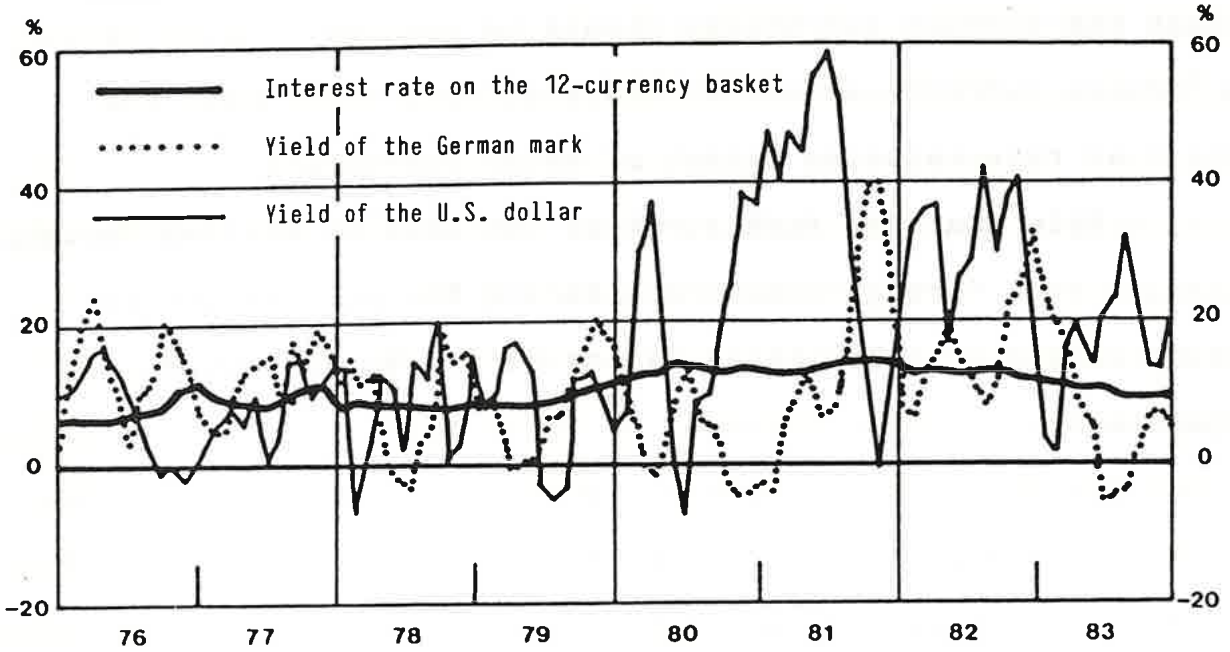
ranging between -5 and +60 per cent at annual rate.

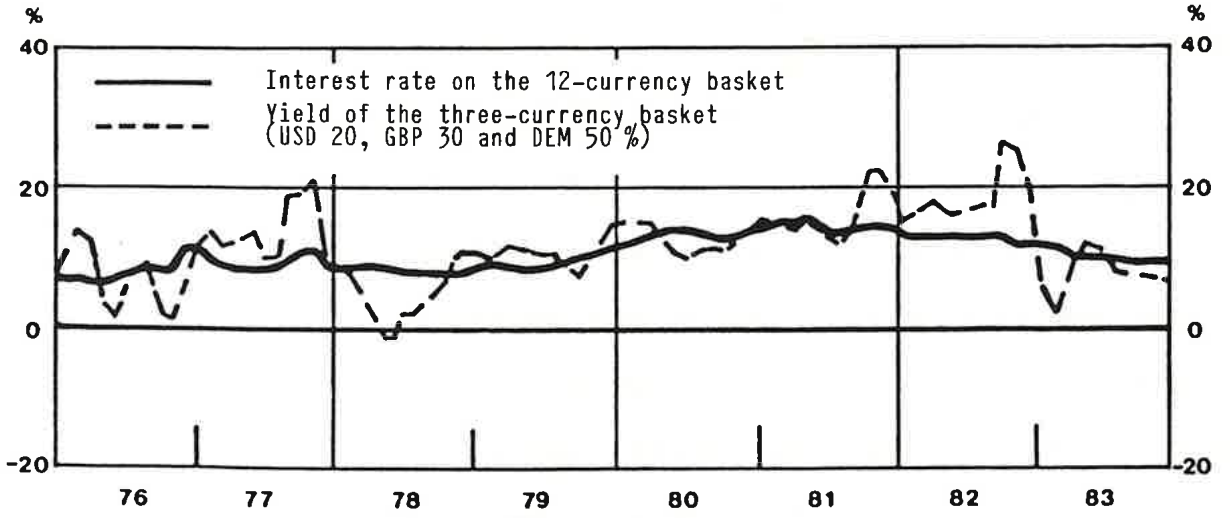
The fourth line, shown in the lower panel, represents the yield on a three currency basket with the following weights: USD 20, GBP 30 and DEM 50 per cent. It indicates the risk - reducing effect of such a simplified basket. The major deviations of the yield of this basket from the interest rates on the complete 12-currency basket in 1976-78 and 1981-82 mainly reflect devaluations of the Swedish krona, which has a relatively large weight in the official Finnish basket.

Similar illustrations for the simplified three-currency baskets for the NOK and the SEK would show a slightly better performance than in the case of the FIM. This is evident from the figures for the standard error of the residual reported in Table 2, which measures the deviation of the yield of the simplified basket from that of the official 14 and 15 currency baskets, respectively.

This analysis completes the set-up of the two-stage FXRM-strategy. The first stage is to monitor the weighted average interest rate of the official basket and the interest rate on the home currency faced by the firm, and to compare the difference between these two with the subjective expectation of the likely de- or revaluation of the home currency vis-à-vis the official basket. Due to covered interest rate parity, the same information is also embodied in the comparison of the currency index calculated from the prevailing forward rates and the subjective expectation of the currency index at the relevant point of time in the future. This is the informational basis for the decision to choose between the home currency and the foreign currencies in

Figure 1. Interest rate on the Finnish 12-currency basket, yields of the U.S. dollar and the German mark, and yield of the three-currency basket, measured by the 12-currency basket





aggregate as the currency of denomination of assets or debts or forward operations.

Second, the risk associated with exchange rate changes between the foreign currencies should be reduced by distributing the foreign currency assets or debts in accordance with the simplified risk-reducing basket of major currencies.

Note that the same strategy can also be applied, mutatis mutandis, by a foreign agent considering the possibility of holding claims or liabilities in one of the Nordic basket-peg currencies.

III Currency Baskets and World Market Prices

The foregoing analysis applies only to foreign exchange risk management in the case of a well-defined foreign exchange risk, such as a foreign currency asset or liability, or, to use the prevailing terminology in the FXRM-literature, it solves the problem of managing an accounting exposure. It does not, however, solve the problem of determining the currency denomination of net liabilities for a firm which is constantly buying and selling goods and services. In general, the prices of different goods are affected differently by movements in the relative values of currencies. Therefore, in distributing its liabilities a firm should give preference to those currencies which are important in determining the prices of its outputs and avoid currencies which dominate the price formation of its inputs.[1] Most firms have their own specific inputs and outputs, and hence there is no general quantitative solution to this problem. However, the calculations presented below give some hints as to which currencies seem to dominate the price formation of certain categories of goods traded in world markets.

These calculations also have a bearing on the unresolved question as to which basket the authorities should peg their currency to under the system now prevailing in the three Nordic countries. The various alternatives described in the literature and applied in the real world are based on bilateral trade flows,

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[1] The formulation and solution of this problem is found in **Kawai** (1981). The formula used in the calculations presented below is given in **Kouri** and **de Macedo** (1978).

multilateral trade flows calculated according to various criteria, the MERM-weights (the IMF-model) etc.

One variant, which although intuitively simple has received little attention, is based on the essential property of money: money buys goods. There might therefore be some grounds for the notion that the basket should be chosen so that it is/as stable as possible vis-à-vis the prices of goods traded in world markets.

In Table 3 we report the results of such calculations for the world-market prices of three categories of goods: energy raw materials, other raw materials (HWWA-publications) and manufactured goods (UN statistics).

The data used in the calculations cover the period 1976 I-1983 II. In the first round of calculations; the basket for energy raw materials was somewhat unexpected, giving the highest weight to the GBP. However, in this type of calculation it is possible that the value of some particular currency quite accidentally displays a strong correlation with an exceptionally large price change in a way which is unlikely to be repeated in the future. Thus, it may be prudent to make calculations using data in which periods of such abnormally large price changes are excluded. Therefore, we only report calculations where periods during which there was a major change in the oil price are excluded. The general result is that the USD has a large weight in the basket for energy raw materials, the weight of the DEM being negative, whereas the DEM receives the biggest weight in the baskets for other raw materials and manufactured products.

Table 3.

Three-currency Baskets Which Were Most Stable vis-à-vis Certain World Market Prices in 1976 I-1983 I Excluding Periods of Major Change in Oil Prices

	Manufactured Goods	Energy Raw Materials	Other Raw Materials
USD	36.1	96.2	37.4
DEM	52.0	-19.6	61.7
GBP	11.9	23.4	0.9
TOTAL	100.0	100.0	100.0

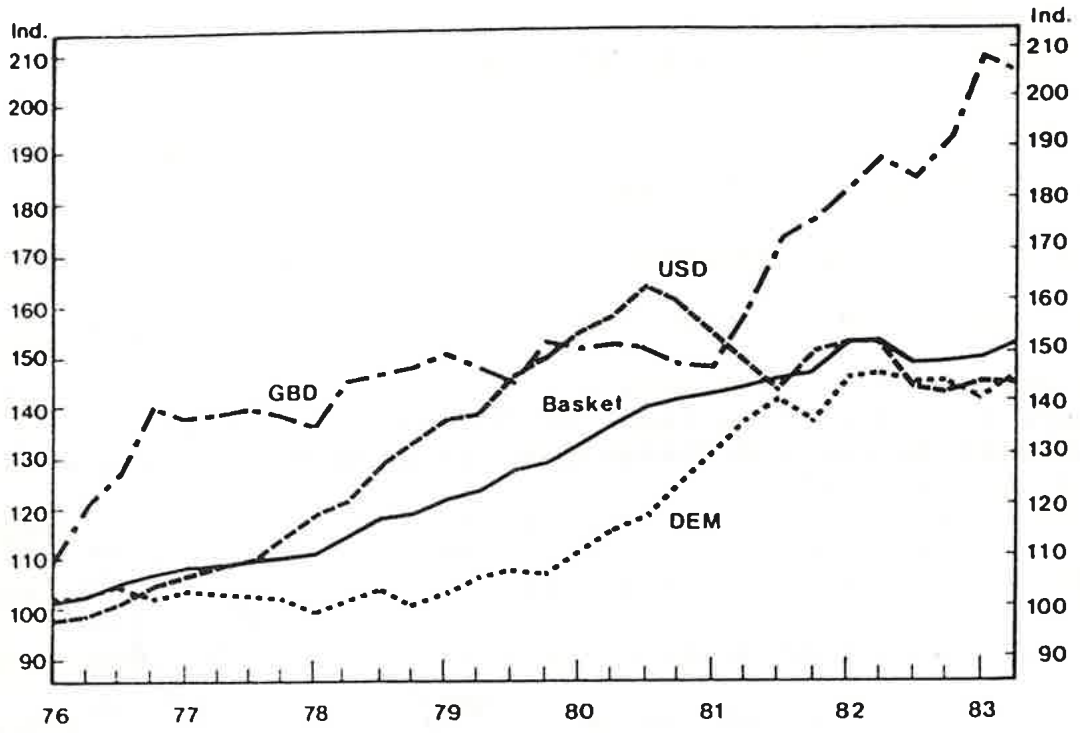
Data: quarterly; rates of change calculated over two quarters. Observations excluded 1979 II - 1980 III.

Figures 2A-C illustrate the results of these calculations. Figure 2A shows movements in the world-market price level of manufactured products expressed in USD, DEM, GBP and a basket of the three which is more stable vis-à-vis these prices than any of the currencies individually. The figure shows that price movements expressed in terms of such a basket were actually fairly steady during the period concerned.

Figure 2 B also reveals that a simple basket of the USD and the DEM was clearly more stable vis-à-vis prices of raw materials other than energy.

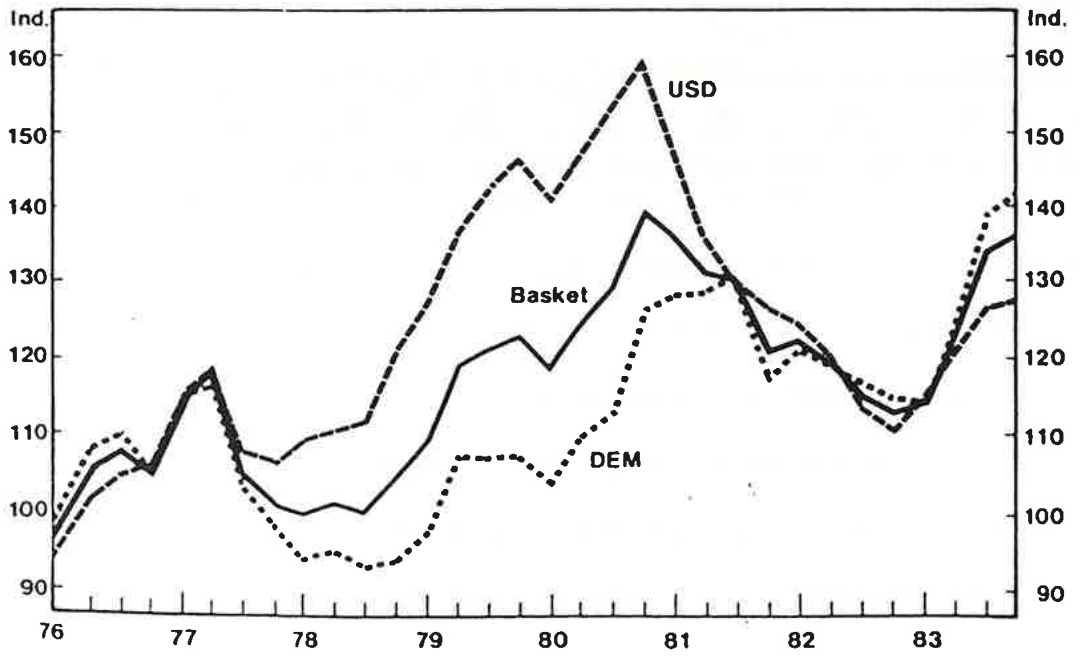
Movements in the prices of energy raw materials (Figure 2 C) are more difficult to interpret since the DEM takes a negative weight in the calculations. Technically, we obtain a basket which is more stable vis-à-vis this price index, but for a more conclusive answer we would need to carry out a thorough study of the effects of the changes in the oil price on different national economies and currencies.

Figure 2A. The Price Level of Manufactured Products in World Trade Expressed in Certain Currencies and a Basket, 1976 I to 1983 IV, 1975 = 100



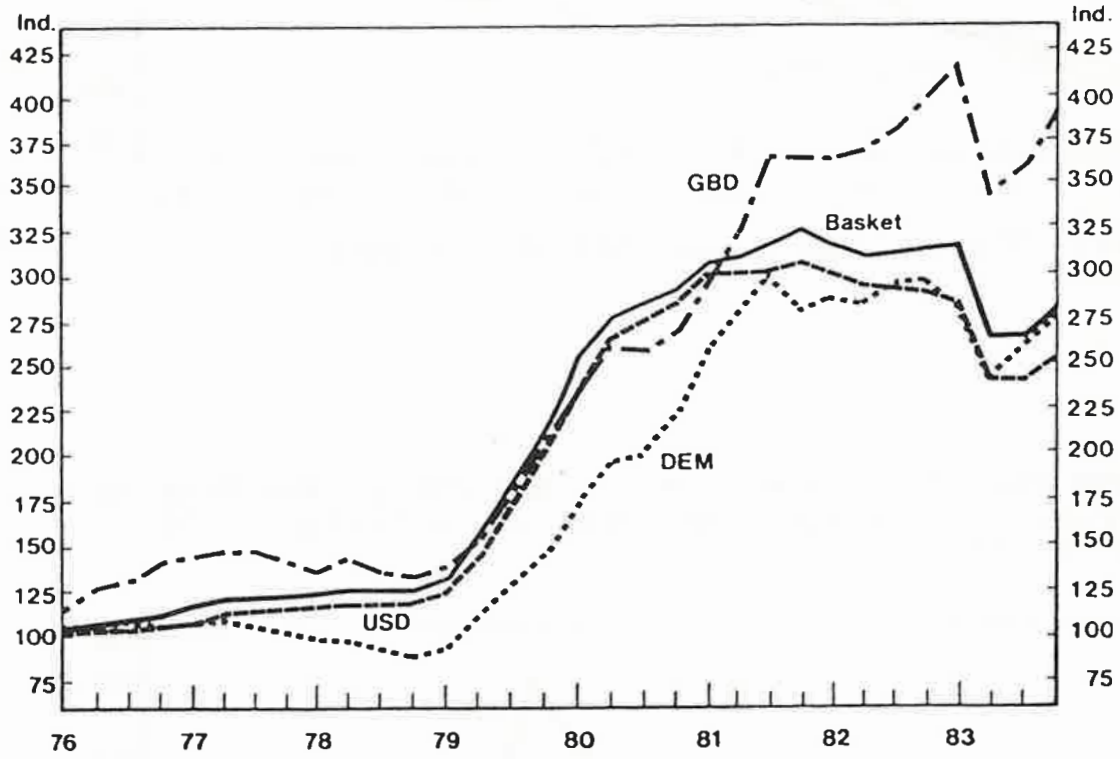
Basket: USD 40, DEM 50 and GBP 10 per cent.

Figure 2B. The Price Level of Non-energy Raw Materials Expressed in Certain Currencies and a Basket, 1976 I - 1983 IV, 1975 = 100



Basket: USD 40 and DEM 60 per cent.

Figure 2C. The Price Level of Energy Raw Materials Expressed in Certain Currencies and a Basket, 1976 I - 1983 IV, 1975 = 100



Basket: USD 95, DEM -20 and GBP 25 per cent.

IV Summary and Further Questions

The Nordic currencies, the FIM, NOK and SEK, are adjustably pegged by the respective national authorities to baskets of foreign currencies. In the first part of this paper, we considered the implications of this system for the foreign exchange risk management strategies of individual economic agents. An approach for monitoring the market conditions of the respective Nordic currencies was presented, and a basket of three major currencies was derived which would serve as a simplified, risk-reducing basket vis-à-vis each Nordic currency.

Next, we carried out some calculations to determine which baskets of the major currencies seem to be most stable vis-à-vis certain world-market prices. We obtained some - albeit not very definite - answers.

These calculations also have some relevance for the determination of the composition of the basket to which the authorities should peg their individual national currencies. However, this question is of much broader scope, and we confine ourselves here to some further considerations.

The baskets to which the three Nordic currencies are now being pegged are fairly similar except insofar as each currency appears in the baskets of the others, thereby making their values partially interdependent. This interdependence means that, to a certain extent, the value of each Nordic currency adjusts automatically to changes in the values of the others resulting from a re- or devaluation.

This raises the question as to whether such automatic interdependence is desirable. There are numerous pros and cons, related to both economic issues and international politics. It suffices here to note that without automatic adjustment there would be a greater need for synchronizing the discrete decisions of the authorities in the three countries.

If the automatic interdependence were eliminated, then a second question would be whether it would be advisable to harmonize the baskets of the three currencies. They are rather similar now anyway, so why not to make them equal.

If the answer is yes, then the next question concerns the composition of such a common basket. There is no firm basis for such a basket: the alternatives are numerous, nor do the results of the analysis in section III provide any definite conclusions in this respect. The authorities must therefore choose one and make any necessary corrections by discrete decisions. Why then not choose a basket which would as generally as possible serve the functions of money internationally. Such a basket could very well be the SDR. This would also help to promote the use of the SDR in private economic transactions. The more widespread use of the SDR, both by the authorities and by the private sector, would perhaps contribute, if only modestly, towards finding new solutions to the problems of the international exchange rate system.

If the Nordic countries were to peg the values of their currencies to the SDR and eliminate the present automatic partial interdependence, then there would be a greater need to synchronize foreign exchange policies in the three countries. Needless to

say, even in this case each country would still preserve its sovereignty in determining the external value of its currency.

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