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A Currency Basket as an Exchange Rate Standard

I. Introduction

Among larger industrial countries, the exchange rate system that emerged following the major realignment of the world's major currencies in 1973 is characterized as that of generalized floating. From the standpoint of the smaller countries, however, the post-1973 system has continued to be characterized as that of pegged exchange rates. Although many of the smaller countries have continued to peg their currencies to a single major currency, an increasing number of them have also adopted a new type of pegged exchange rate system that became known as a basket peg – an exchange rate arrangement in which the value of the home currency is pegged to some composite (or a basket) of foreign currencies. During the period of 1973–86, over 60 countries have at one time or another adopted a basket peg. This paper presents a brief review of major theoretical and practical issues relevant to such an exchange rate policy.

The paper is organized as follows. Section II presents the concept of a basket peg as a way of stabilizing the effective exchange rate. Section III discusses theoretical and practical aspects of designing a currency basket. Section IV describes different methods of valuing a currency basket, and section V compares a currency basket with a portfolio of financial assets. Section VI discusses implications of stabilizing nominal versus real effective exchange rates, and section VII operational issues involved in the administration of a basket peg policy. Section VIII presents a summary and conclusion. Finally, the Appendix highlights the process of obtaining the optimal weights for a financial portfolio and compares the SDR peg with a single currency peg.

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II. Currency Pegging and the Effective Exchange Rate

It is generally believed that smaller countries face a greater cost of adopting independent floating and, consequently, tend to prefer a system of pegged exchange rates. The cost of independent floating is believed to be greater because the foreign exchange market in smaller countries is more likely to be 'thin' (i.e., the volume of transactions is small), so that it may not function smoothly when it is left completely to market forces. In a thin foreign exchange market, the difficulty of matching selling and buying orders may cause dealers to charge a large spread; or it may cause quoted exchange rates to display large movements to clear the market. Moreover, in many developing countries, trade flows tend to be price-inelastic, seasonal or undiversified, so that a thin foreign exchange market makes the exchange rate unnecessarily volatile in the absence of adequate capital flows[1].

Whatever the reason may be, most smaller countries of the world have indeed shown preference for a system of pegged exchange rates since 1973. Prior to 1973, these and other countries had maintained the fixed values of their currencies against each other by intervening in the foreign exchange market, that is, by selling or buying a chosen currency (called the intervention currency) against home currencies at the fixed rates. When the major currencies began to float in 1973, most smaller countries simply continued to peg their currencies to the

same intervention currencies that they had previously used. In time, however, it became clear to some that the policy of pegging to a single currency had a different implication when all other major currencies were floating: the benefit of exchange rate stability against one currency was to a greater or lesser extent offset by the cost of greater exchange rate variability against all other currencies. A single currency peg in a system of floating exchange rates, unlike that under a system of pegged exchange rates, could not stabilize what is known as the effective exchange rate.

The concept of the effective exchange rate, first developed at the International Monetary Fund (IMF) as an attempt to measure the impacts of the currency devaluations of 1949[2], is an index that measures some relevant average value of a currency; it is expressed as a weighted average of bilateral exchange rates. As an example, suppose that the Swiss franc depreciates aginst the U.S. dollar by 10 percent, appreciates against the Japanese yen by 10 percent, and remains unchanged against all other currencies. According to the concept of the effective exchange rate, the average value of the Swiss franc has depreciated, appreciated or remained unchanged, depending on whether the weight of the U.S. dollar in the index is greater than, less than, or equal to the weight of the Japanese yen.

As will be discussed more fully later, several factors are involved in the choice of currency weights in the effective exchange rate. However, it is generally true that the weight of a currency largely reflects its importance in the country's external transactions. Thus, to the extent that policymakers desire to stabilize the effective exchange rate, the cost of a single currency peg would be smaller if the country had one dominant trading partner, because the weight of one currency would be likely to be large in the effective exchange rate. On the other hand, the cost of a single currency peg would be considerably larger if the country had a diversified pattern of external transactions, such that the effective exchange rate index would be made up of several equally important currencies.

As expected, during the course of 1973, several small countries with diversified trading patterns abandoned a single currency peg and began to manage the value of home currencies in such a way as to stabilize the effective exchange rates defined in terms of the currencies of their major trading partners. The first group of countries to adopt such a basket peg policy included Malta (March), Morocco (May), Finland (June), Cyprus (July) and New Zealand (September). Many other countries followed subsequently.

III. Design of a Currency Basket

A basket peg amounts to a policy of keeping the value of the home currency stable in terms of the chosen effective exchange rate. Thus, in the implementation of a basket peg policy, the choice of currency weights in the effective exchange rate index becomes crucial. The weight of a particular currency in the index reflects the relative importance the authorities attach to that currency in their pursuit of a policy objective. For example, if the exchange rate variability of the home currency against the U.S. dollar is considered to have a large adverse effect on the target variable of the policy (e.g., maintenance of balance of payments equilibrium), the weight of the U.S. dollar should be large enough to reflect that relative importance. On the other hand, if the variability against the South African rand is considered to be of no consequence to the policy objective, the rand should have a zero weight.

In principle, a formal economic model can be used to obtain the optimal weights in the basket. In practice, however, a satisfactory macroeconomic model may not exist when there is little consensus among economists about the way the economy should be modeled. Moreover, even if such a theoretical model existed, the numerical solutions for the weights would be made difficult by the absence of reliable empirical estimates of the underlying equations in the model. Thus, many countries have used various types of more simple proxy weighting schemes according to subjective judgement based on the direction and composition of trade and other quantitative considerations.

A few examples might help explain some of the issues involved in this process. First, the weight of a currency should ideally reflect the extent to which commodity prices are set in that currency. For manufacturers, it is generally

thought that the prices are set in the currencies of the producing countries, regardless of whether trade contracts are actually denominated in those currencies. For agricultural, mineral or other homogenous goods, the prices are set not in any one particular currency but in a well-integrated world market[3], so that, adjusted for the exchange rate, they are more or less independent of a particular exchange rate arrangement. To the extent that exchange-rate-adjusted prices are the same across countries, homogeneous goods should be excluded from total trade[4].

Second, it is necessary to consider both direct (bilateral) and indirect (third country) effects in measuring the relative importance of a currency. For example, the home country may not have direct trade with South Africa. However, the absence of direct trade does not in itself mean that the South African rand should have a zero weight, because South Africa may well be an important exporter or importer of the type of goods that are produced by the home country, so that fluctuations in the exchange rate of the rand against the home currency may indirectly affect the domestic balance of trade or other pertinent target variables. These and other factors make the designing of a conceptually well-defined currency basket a potentially complex exercise.

Partly reflecting this complexity, over a dozen countries (e.g., Burma and Jordan) have decided to peg their currencies to the Special Drawing Right (SDR), a ready made currency basket composed of the world's five major currencies[5]. The SDR peg is particularly attractive because the IMF quotes the daily value of the SDR in terms of most major currencies, so that little resource is required to administer the peg; moreover, a simultaneous adoption of the SDR peg by a large number of countries would create a sizable common currency area and thus generate additional incentives for intra-regional trade among these countries (Crockett and Nsouli, 1977). Although the SDR peg is inferior to a peg to the optimal basket, it generally outperforms a single currency peg in terms of minimizing the variance of the effective exchange rate. This follows from the fact that the SDR includes the currencies of the five largest trading countries and many currencies are pegged to two of them (the U.S. dollar and the French franc), making it likely that the covariance of the effective exchange rate and the SDR is positive.

IV. Basket Peg Rules

The same currency weights can result in different values of the basket, depending on how the weights are used to average the component currencies. With geometric weights, the average value of the component currencies in the basket would be independent of the way exchange rate indices are defined and the initial currency shares in the basket remain constant. With arithmetic weights, the average value of the component currencies in the basket depends on how exchange rate indices are defined: if an increase in the index is defined as a depreciation, the currency share of a depreciating currency increases; and if an increase is defined as an appreciation, the currency share of an appreciating currency increases. The variability of currency shares under the arithmetic average method can be made more intuitive by noting that, given the same arithmetic weight, a hypothetical 10 percent change in a component index from 150 to 165, for example, has a greater impact on the average value of the total index than an equal percentage change from 80 to 88. In contrast, equal percentage changes are given equal weight under the geometric average method, irrespective of their initial levels.

The choice of a valuation method has more than academic interest. It has been found that, for the kind of exchange rate fluctuations observed since 1973, the choice of a valuation method would have made a large quantitative difference for the value of a currency basket over a few years (Brodsky, 1982). As a confirmation of this, in July 1984, Norway switched from the arithmetic average method (of the second type) to the geometric average method, because the share of the then appreciating U.S. dollar had been increasing too rapidly for the stabilization of what the authorities considered to be the appropriate effective exchange rate.

More explicitly, a currency can be pegged to a basket consisting of fixed units of actual currencies, called the 'standard' basket (Polak, 1979). The SDR and the European Currency Unit (ECU) are two examples of the standard basket of currencies. It can be verified that the share of an appreciating currency in the basket

increases under the standard basket method of valuation, making it equivalent to the second arithmetic average method in terms of the calculated value of the basket. The advantage of the standard basket method is that, as a basket consisting of fixed units of actual currencies, it retains the currency characteristics of the component currencies: it is in itself a currency. This currency characteristic of the standard basket makes it possible to conduct forward transactions in the basket by means of transactions in the component currencies in their exact composition in the basket, even when no formal forward market exists for the home currency itself.

V. A Currency Basket as a Portfolio of Assets

A currency basket as an exchange rate standard can be compared to a portfolio of financial assets as an investment vehicle in the sense that both are in some sense optimally weighted composite assets. To extend the analogy, a currency that is pegged to a currency basket can be compared to a share of a mutual fund that stands ready to redeem shares at net asset value at all times; and a currency that is pegged to the standard basket can likewise be compared to a share of a fixed unit trust with a portfolio that is fixed for the life of the fund[6].

There are, however, some conceptual differences between a currency basket and a financial portfolio, the most obvious one being that the former is a portfolio of non-interest bearing assets, while the latter consists of interest bearing assets[7]. On a more fundamental level, the differences between the two types of composite assets can be formalized by thinking of a risk-averse investor who is constructing a portfolio of interest bearing assets so as to maximize return and minimize risk (Appendix). As a rough measure, such an exercise suggests that the weight of an individual asset in the portfolio would be greater if its expected return is higher and is more negatively correlated with the expected returns from holding other assets. The latter condition follows from the risk-averse behavior of the investor who wants to hold assets whose returns are in some sense offsetting.

As to the currency basket, the weight of an individual currency would be greater if its exchange rate (relative to the home currency) is more negatively correlated with the exchange rates of other currencies in a way analogous to the way risk aversion operates in the construction of the financial portfolio; this follows from the fact that, in order to stabilize the effective exchange rate, policymakers desire to peg the home currency to a basket that consists of currencies whose movements are offsetting. However, the construction of the optimal basket differs from that of the optimal portfolio in two important respects. First, the weight of an individual currency in the basket would be greater if the impact of its exchange rate on the target variable (i.e., its elasticity) were greater. In contrast, these elasticity considerations are absent in the construction of the optimal portfolio because the investor would equally value a given return from one asset and the same return from another. Second, in the usual formulation where policymakers are assumed to stabilize the variance of the target variable, the optimal currency weight does not involve a term analogous to the rate of return in the construction of the optimal portfolio. That is to say, whereas the investor is concerned with both the level and the variance of the portfolio return, policymakers are generally assumed to be concerned only with the variance of the target variable. However, if the level of the target variable entered the objective function of policymakers, the analytical solution for the optimal currency weight would become more similar to that of the optimal portfolio weight. For example, if policymakers are concerned with the improvement (as well as the stability) of the trade balance, the weight of a currency that is expected to depreciate relative to others should be increased, just as the weight of an asset with a higher expected rate of return should be increased in the optimal portfolio[8].

VI. Nominal versus Real Peg

In the long run, when all prices are fully flexible, the choice of a currency basket will only affect the long-run rate of monetary expansion and inflation. This is so because, in the long run, the exchange rate of a small open economy becomes primarily a mechanism by which foreign prices are translated into domestic prices,

and the externally determined domestic price level in turn determines the stock of money supply that is compatible with the choice of an external currency standard (TAKAGI, 1987a). For example, if domestic credit expands too fast relative to the compatible rate of monetary expansion, the price of nontraded goods will rise and demand will shift to traded goods whose relative price has fallen, resulting in a loss of foreign exchange reserves. The continuation of such monetary expansion will inevitably lead to a devaluation or complete abandonment of the nominal basket peg policy.

Thus, the monetary constraint of a basket peg is as binding as that of a single currency peg in the sense that policymakers cannot fix both the level of the exchange rate and money supply at the same time. The difference between the two regimes is that, with a basket peg, a country does not have to accept the inflation rate of one country but can choose its own desired rate of inflation by the choice of a basket. Some have emphasized this type of monetary consideration in the choice of a currency basket, suggesting that, if a country desires a low rate of inflation, it should give greater weight to the currency of a low inflation country (CONNOLLY, 1982).

In the short run, when prices may not be fully flexible, a basket peg can become effective in minimizing the real effect of nominal exchange rate changes. However, the usefulness of a basket peg is diminished by the extent to which a nominal exchange rate movement is offset by a price movement. For example, if the home currency appreciates against the U.S. dollar by 10 percent but the price level in the United States increases by 10 percent relative to the domestic price level, the relative price between the two countries has remained unchanged; in such a situation purchasing power parity (PPP) is said to hold and the real (i.e., price-adjusted) exchange rate said to remain unchanged. If the objective of policymakers is to minimize the real effect of nominal exchange rate changes, more weight should be given to the currencies of those countries with which there is a greater PPP deviation, and no weight should be given to the currencies of those with which PPP holds. Thus, some have argued that a peg should be designed to stabilize the real effective exchange rate by adjusting the nominal effective exchange rate on the basis of relative inflation differentials – a real peg policy.

As a practical matter, however, a real peg policy is not feasible because, if such a policy is to be strictly followed, price indices must be constantly made available not only for the home country but also for its trading partners. In practice, therefore, the most a country can do to approximate a real peg policy is to adjust the nominal exchange rate periodically on the basis of the most recent – albeit lagged – price indices. In fact, New Zealand followed such a lagged real peg policy between 1979 and 1982 by adjusting the exchange rate monthly on the basis of the most recent data on inflation differentials vis-à-vis its major trading partners.

This policy of minimizing the real effect of short-run PPP deviations, however, has longer-run adverse implications. First, a real peg policy is not desirable when changes in underlying real variables (e.g., productivity and taste) require changes in the real exchange rate; a real peg not only would jeopardize the needed adjustment but also may exacerbate the effect of changes in real variables. Second, a policy of strictly maintaining the real exchange rate amounts to a policy of fully indexing both the nominal exchange rate and the money supply to the price level, and it can lead to unbounded inflation (ADAMS and GROS, 1986). Suppose that the domestic price level increases by 10 percent relative to the price levels in all other countries. In this case, a real peg policy would immediately depreciate the nominal exchange rate by 10 percent, thus accommodating the initial 10 percent price increase by one-to-one; in such a system, therefore, there is no mechanism to tie down the price level. In contrast, under a nominal peg, the domestic price cannot diverge for too long and too much from the level that is consistent with the fixed nominal exchange rate. This suggests that an exchange rate regime should be defined strictly as a nominal standard. If the link between rapid inflation and a secular real appreciation is to be minimized, a crawling peg – under which the rate of *nominal* depreciation is specified – should be preferred[9].

VII. Some Operational Issues[10]

The operation of a basket peg differs from a single currency peg because, in the former, the standard to which the home currency is pegged

is not an actual currency that is traded in the foreign exchange market. Under a single currency peg, the fixed par value of the home currency in terms of any single currency can be supported by sales and purchases of that currency at a fixed rate. In contrast, under a basket peg, the rule-determined value of the home currency changes constantly against any single currency. Thus, whichever currency is chosen as the intervention currency, the strict operation of a basket peg requires constant updating of exchange rate quotations as well as constant sales or purchases of the intervention currency at ever-changing rates.

As a practical matter, constant updating of exchange rate quotations and constant market intervention at ever-changing rates are not feasible. However, if exchange rate quotations are not continuous, there will be a deviation between the quoted exchange rate and the theoretical exchange rate. Thus, the smooth operation of a basket peg requires a minimum margin on either side of parity in terms of the intervention currency. Under certain conditions, this deviation can promote disruptive speculation, as dealers try to use short selling or short buying by guessing the exchange rate that is likely to be quoted at the next quotation. In order to minimize the potential for such speculative activities, most countries have decided to keep the composition of the basket undisclosed to the public. Moreover, in order to prevent speculators from successfully estimating the composition of the basket by observing the movements of the home currency against all others, some countries have decided to vary margins in an unpredictable fashion.

It should be noted that, although keeping the basket undisclosed with a variable margin may minimize the potential for speculation, it may also lead to a loss of monetary credibility and discipline. In contrast, the clearly announced policy of pegging the home currency to a well-disclosed basket with a minimum margin will signal the commitment of policymakers to pursue a credible monetary and exchange rate policy. Norway and Sweden, for example, have followed the policy of fully disclosing the composition of the basket. In addition, Sweden announced in June 1985 that it had decided not only to disclose the width of margins for the first time but also to narrow the margin from (the previously unannounced) 2¼ percent to 1½ percent, with the objective of reducing uncertainty regarding the exchange rate.

VIII. A Summary and Conclusion

The paper has discussed major theoretical and practical issues relevant to the exchange rate policy of pegging a currency to a basket of foreign currencies. Such a basket peg policy was shown to amount to the policy of keeping the value of the currency stable in terms of the effective exchange rate – the relevant average value of the currency. The determination of the currency value depends on the choice of currency weights in the basket and on how those weights are used to average the values of the component currencies. The currency can also be pegged explicitly to a basket consisting of fixed units of actual currencies. It was argued that this method had the advantage of enabling forward transactions in the basket by means of transactions in the component currencies in their exact composition in the basket.

In one sense, the concept of the optimal currency basket resembles the concept of the optimal portfolio of financial assets, and a currency that is pegged to the currency basket similarly resembles a share of a mutual fund that stands ready to redeem shares at net asset value at all times. However, an important conceptual difference exists: while the overwhelming concern of policymakers in designing a currency basket is to minimize the variance of the target variable as determined by a macroeconomic model, the concern of the investor in constructing a portfolio is to maximize the level, as well as minimize the variance, of its return. Thus, the derivation of the optimal currency weight in its usual formulation is distinguished by the absence of concern with the level of the target variable analogous to the rate of return in the derivation of the optimal portfolio weight. Nonetheless, it remains true that, when major currencies float against each other, some smaller countries would find it useful to peg their currencies to a weighted composite of the floating currencies, just as risk-averse investors would find it useful to diversify their holdings of risky assets. Thus, a basket peg is likely to remain a viable exchange rate arrangement as long as the current system of floating exchange rates among the major currencies continues.

Appendix: The optimal financial portfolio and the optimal currency basket

1. The Optimal Portfolio

Let w_0 be the initial wealth, r_i the random real return (one plus the rate of return) of the i^{th} asset, and s_i the weight of the i^{th} asset in the portfolio. Assuming mean-variance optimization (as a special case of expected utility analysis), the optimal portfolio can be obtained as follows:

$$\underset{s_i}{\text{Maximize}}\ U\ (\underset{+}{Ew}, \underset{-}{\sigma_w^2}) \qquad (1)$$

$$\text{subject to } \sum_i s_i = 1,$$

where U (˙˙) is a utility function, Ew the expected value of the terminal wealth, σ_w^2 the variance of the terminal wealth, and the terminal wealth (w) is a random variable given by $w_0 \Sigma s_i r_i$. From the first-order conditions, the weight of the i^{th} asset in the portfolio can be expressed as,

$$s_i = \frac{(Er_i - Er_n) - \theta \left[\sum_{j \neq i} s_j (\sigma_{ij}^2 - \sigma_{nj}^2)\right]}{\theta\ (\sigma_{ii}^2 - \sigma_{in}^2)}, \qquad (2)$$

where $\theta \equiv -2\, w_0\ (\partial U / \partial \sigma_w^2)\ (\partial Ew / \partial U) > 0$, σ_{ii}^2 is the variance of the i^{th} return, and σ_{ij}^2 is the covariance of the i^{th} and j^{th} returns. If the utility function included only the variance of the terminal wealth, $(Er_i - Er_n)$ would drop out of the numerator and the expression would become simply the ratio of the two covariance expressions. Such an expression would be similar to the analytical solution for the currency weight in the optimal currency basket, except that the latter would be modified by the appropriate ratio of elasticity terms.

2. The Optimal Basket

Assuming that the correct currency shares (d_i's) are already known, the effective exchange rate (EER) can be expressed as,

$$EER = \sum_i d_i (e_i - e), \qquad (3)$$

where e_i is the log of the i^{th} exchange rate and e (without a subscript) is the log of the home exchange rate both in terms of a numeraire currency, such that $(e_i - e)$ is the log of the i^{th} exchange rate in terms of the home currency. The log of the home currency exchange rate under a basket peg is given, without loss of generality, by the following geometric average method,

$$e = \sum_i x_i e_i, \qquad (4)$$

where x_i is the i^{th} currency share in the basket. Substituting (4) into (3), we have,

$$EER = \sum_i d_i e_i - \sum_i x_i e_i. \qquad (5)$$

From equation (5), it is immediately clear that the basket peg can be used to eliminate the variance of EER by setting $x_i = d_i$ for all i.

However, if x_i is not set equal to d_i for all i, the variance of EER can be expressed as,

$$\text{Var (EER)} = \text{Var (DEER)} + [\text{Var (XEER)} - 2\ \text{Cov (DEER, XEER)}], \qquad (6)$$

where DEER is the log of the 'correctly weighted' effective exchange rate ($\Sigma d_i e_i$), XEER the log of the effective exchange rate weighted by the shares in the currency basket ($\Sigma x_i d_i$), both expressed in terms of the numeraire currency.

Equation (6) can be used to compare the SDR peg and a peg to the numeraire currency. First, we note that the first term is independent of the choice of an exchange rate standard. Second, because, under a peg to the numeraire currency, $x_i = 0$ for all i except for the numeraire currency (for which it is unity), the value of XEER in logarithm becomes constant, rendering the values of Var (XEER), Cov (DEER, XEER) and hence the entire bracketed expression all zero under a single currency peg. This means that, as long as the value of the expression in the bracket is negative, the SDR peg dominates a peg to the numeraire currency. While this is an empirical matter, the value of Cov (DEER, XEER) under the SDR peg is likely to be sufficiently positive to make the bracketed expression negative. The likely positive covariance follows from the fact that the SDR includes the five largest trading countries and many currencies are pegged to the U.S. dollar or the French franc.

Footnotes

[1] In the presence of perfectly offsetting capital flows, anticipated trade flows should not affect the exchange rate. Such a possibility, however, is unlikely in developing countries with limited financial markets.

[2] In September and October of 1949, twenty countries devalued their currencies against the U.S. dollar by different degrees. It was immediately recognized that the net valuation change of a devalued currency was not equal to the magnitude of its devaluation against the U.S. dollar when nineteen other currencies had also been devalued against the U.S. dollar.

[3] The fact that the prices of many homogeneous goods are quoted in U.S. dollars does not mean that their prices are entirely set in the United States.

[4] Because a typical developing country exports homogenous goods (whose prices are set in the world market) and imports manufactures (whose prices are set in exporting countries), it has often been argued that the optimal currency weights for such a country are simple import weights (Crockett and Nsouli, 1977).

[5] As another example of a peg to a ready-made basket, the Austrian schilling has been pegged to the ECU.

[6] These terms are explained, for example, in Sharpe (1981), chapter 18.

[7] This distinction may not be useful when we recognize that an interest-bearing asset (such as an ECU bond) can be denominated in a currency basket.

[8] Another example may be a multinational firm that is minimizing the impact of exchange rate fluctuations on earnings expressed in the home currency and is thus concerned with the level as well as the variance of earnings. Makin (1978) has argued that portfolio theory is directly applicable to a firm manager's problem of dealing with exchange risk.

[9] If feasible, independent floating – under which *nominal* money supply growth is a choice variable – is another option.

[10] These and other operational issues are more fully discussed in TAKAGI (1987b).

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