SM/94/57

March 1, 1994

To: Members of the Executive Board

From: The Secretary

Subject: Approaches to Assessing the Consistency of Exchange Rates with Economic Fundamentals

Attached for consideration by the Executive Directors is a paper on the approaches to assessing the consistency of exchange rates with economic fundamentals, which is tentatively scheduled for discussion in a seminar on Friday, March 25, 1994.

Mr. P. B. Clark (ext. 34613) or Mr. Symansky (ext. 37479) is available to answer technical or factual questions relating to this paper.

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INTERNATIONAL MONETARY FUND

Approaches to Assessing the Consistency of Exchange Rates with Economic Fundamentals

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(In consultation with other departments)

Approved by Michael Mussa

February 28, 1994

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I. Introduction

Article IV of the Fund's Articles of Agreement stipulates, inter alia, that the Fund "... shall exercise firm surveillance over the exchange rate policies of members...." An integral part of that mandate is the close monitoring and careful evaluation by the Fund of exchange rates and of their underlying determinants--no matter what the member's chosen exchange rate arrangements. The substantial overvaluation of the U.S. dollar in 1984-85, the turbulence and sudden adjustments of parities and margins within the European Monetary System (EMS) in 1992-93, and the large realignment of the CFA franc earlier this year, all bear eloquent testimony to the proposition that exchange rates can get out of line with economic fundamentals. One aim of Fund surveillance activities (Article IV consultations, the World Economic Outlook, and Board meetings on World Economic and Market Developments) is to decrease the frequency and size of such exchange rate "misalignments" by encouraging a more timely adjustment of macroeconomic policies and/or exchange rates themselves.

This paper provides a summary of the methodologies and types of indicators that are often employed, both inside and outside the Fund, to assess whether existing exchange rates are broadly in line with economic fundamentals. Much of the present conceptual framework represents refinements and extensions of earlier contributions to the analysis and surveillance of exchange rate policies. 1/ A number of considerations in applying this framework to the assessment of exchange rates warrant explicit mention at the outset.

As far back as 1945, Nurkse defined the equilibrium exchange rate as the rate that would yield equilibrium in the balance of payments, but with the three following important qualifications: that there be no undue restrictions on trade flows, no special incentives for inflows or outflows of capital, and no excessive unemployment. 2/ In other words, the equilibrium in the balance of payments should reflect appropriate policies and underlying economic conditions, and not be achieved by policy distortions or by unsustainable rates of resource utilization; by implication, a balance of payments position associated with chronic excess demand and high rates of inflation would likewise be regarded as an inappropriate external position. 3/ In this framework, therefore, it is the balance of payments that is the key "economic fundamental" determining equilibrium exchange rates--but only after that balance of payments position has been adjusted for temporary influences, for special factors, and for

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1/ In some sense, the present paper might be considered an update of the 1984 IMF Occasional Paper, Issues in the Assessment of the Exchange Rates of Industrial Countries (IMF, 1984).

2/ See his Princeton Essay published in 1945 entitled "Conditions of International Monetary Equilibrium."

3/ The principles of Fund surveillance over exchange rate policies mention the types of distortions and policies that are inconsistent with balance of payments equilibrium. See "Biennial Review of the Fund's Surveillance Policy" (December, 1992b).

movements in other key economic variables closer to their longer-term values. This distinction between observed outcomes and the "underlying" equilibrium, and the relationship between this underlying equilibrium and the "fundamentals," is at the heart of most equilibrium exchange rate exercises.

A second key issue that arises in any effort to evaluate the consistency of exchange rates with economic fundamentals is the time dimension over which exchange rates, and their determinants, are to be assessed. This is important for two reasons. To begin with, those factors that have the most influence on exchange rates over the short term are not necessarily the same ones that will exercise the most influence over the long term. For example, if the relevant time horizon were two months, it might well be changes in the near-term stance of monetary policy and the resultant behavior of short-term interest rates that would constitute the main driving force on exchange rates; at the other end of the time dimension, e.g., a decade, greater attention would need to be paid to such factors as underlying saving and investment propensities, which would be affected by such slow-moving factors as changes in demographics and technology. Alternative methods of assessing the consistency of exchange rates with economic fundamentals often employ different time horizons and therefore implicitly select different sets of economic fundamentals.

Another relevant consideration in the time dimension of assessing exchange rates is the distinction between backward and forward-looking approaches. Should, for example, an estimate of the present equilibrium rate be generated by searching for an equilibrium period in the past and then updating that rate for the changes that have taken place between the base period and the present, or should that estimate be based on the rate that would produce an equilibrium, given our best guess as to what will happen to fundamentals over the medium-term? Models which view exchange rates as asset prices imply that they are inherently forward-looking variables. This in turn implies that the current value of the exchange rate reflects expectations of the future evolution of the fundamentals, and that exchange rates will change when there are changes in expectations about the future path of these fundamentals (that is, when there is "news"). In Sections II and III below, both backward- and forward-looking approaches are examined.

A third dimension of the analysis is the extent to which it is multilateral in nature. In other words, how many foreign variables should appear in the list of "economic fundamentals"? The analysis of equilibrium exchange rates necessarily involves the use of effective exchange rates (that is, of weighted averages of bilateral exchange rates) rather than an analysis of individual bilateral rates by themselves. The need to account for the effects of a wide array of foreign variables has put a premium on methodologies that highlight interactions of the fundamentals among a country and many of its trading partners. This has encouraged the development of some of the early multilateral exchange rate models and has continued to generate high demand for later generation, multi-country,

macroeconomic models (such as the Fund's MULTIMOD). The continuing relevance of multilateral interactions is well illustrated by the dynamic, sequential nature of exchange rate pressures in the Exchange Rate Mechanism (ERM) of the EMS during the fall of 1992. The currencies that first came under pressure and subsequently devalued altered somewhat the "fundamentals" (e.g., the competitive position) of other currencies in the arrangement that had not been attacked, and presumably affected in part the exchange rate pressures that the latter subsequently faced. The wider and stronger are such interdependencies, the more important it is to adopt a multi-country approach to the analysis of the fundamentals.

A fourth key point underlying the analysis is that as the primary concern is with real exchange rates, the methodological issues explored in the paper are as relevant for countries that adopt policies of freely-floating nominal exchange rates, as for countries that target nominal exchange rates at a particular level or within a particular band. Nonetheless, some differences in the assessment of real exchange rates do arise between floating and pegged exchange rate systems. In the former, fluctuations in nominal exchange rates represent an important source of real exchange rate variability--in addition to movements of domestic prices--that is not present in pegged exchange rate systems. On the other hand, floating rate systems are endowed with an additional channel for real exchange rate adjustments--namely continuous movements in nominal exchange rates--that is unavailable to pegged rate systems (barring recourse to periodic, sometimes traumatic, discrete adjustments in parities). Thus, significant real exchange rate fluctuations are more likely to arise in a floating rate system, but the flexibility of the nominal rate is also an important mechanism for macroeconomic adjustment. By contrast, when the nominal exchange rate is maintained within a narrow band, movements in real exchange rates tend to be more moderate. However, when the real exchange rate gets out of line with fundamentals, either an explicit decision must be taken to change the nominal exchange rate, or other policies or mechanisms must be employed to adjust the underlying fundamentals to be consistent with the existing nominal exchange rate. Thus if it is desired to maintain a pegged nominal rate that has become inconsistent with, for example, international competitiveness considerations, then there must be adjustments in other areas of the economy, e.g., domestic prices and wages, in order to achieve a real exchange rate consistent with an equilibrium position.

A number of restrictions have been placed on the scope of this paper in order to keep it within manageable proportions. First, no attempt has been made to assess the overall functioning of the international monetary system, to provide a comprehensive survey of the Fund's surveillance over exchange rate policies or to analyze the policy issues that arise when exchange rates are out of line with economic fundamentals. Each of those

subjects has been treated in other recent Board papers. 1/ Instead, the aim is simply to give the Executive Board an up-to-date summary of some of the relevant analytical tools for assessing the consistency of exchange rates with economic fundamentals. An unavoidable consequence of providing a certain degree of specificity on "how" such exercises are done is that the paper contains a somewhat more technical treatment of issues than is customary in Board papers. Second, the focus in the paper is on the exchange rates of industrial countries. This is not because the assessment of exchange rate policies in developing countries is any less important to the Fund, or even any less amenable to traditional methods of exchange rate analysis. Rather, the focus reflects the view that structural differences between industrial and developing countries (including the degree of diversification in the range of goods and services produced, susceptibility to terms of trade shocks, the degree of capital mobility, and trend rates of inflation) and differences in the models currently available for assessing country interactions, make it preferable to treat the two groups separately. To some extent, this has already been done in earlier work (see particularly, Aghevli, Khan, and Montiel (1991), and the 1993 review of ESAF, "Operational Modalities and Funding Alternatives for an ESAF Successor-Preliminary Considerations" (IMF, 1993b). Moreover, exchange rate policies of developing countries will soon be addressed by the Board in connection with the forthcoming review of conditionality.

The plan for the rest of the paper runs as follows. Section II discusses the assessment of exchange rates based on measures of international competitiveness. Such an assessment involves a comparison of past movements in prices or costs at home and abroad, taking into account changes in nominal exchange rates; the focus is thus on developments in a country's real exchange rate. If such an examination reveals a substantial gain or loss in competitiveness relative to a base period in which the external position was regarded as in equilibrium, there is a presumption that the exchange rate is no longer consistent with the underlying external position of the country. While a country's international competitive position is clearly one important determinant of its current account, as it is a key relative price determining the choice between domestic and foreign goods and services, other factors are also relevant. As this approach assumes unchanged equilibrium real exchange rates and ignores future developments, it provides only a partial and incomplete analysis. A full assessment of exchange rates therefore requires a more general framework suitable for the analysis of the determinants of equilibrium real exchange rates.

1/ See Strengthening the International Monetary System: Exchange Rates, Surveillance, and Objective Indicators (IMF, 1987); Characteristics of a Successful Exchange Rate System (IMF, 1991); Policy Issues in the Evolving International Monetary System (IMF, 1992a); "Biennial Review of the Fund's Surveillance Policy," and Supplement 1 (IMF, 1992); World Economic Outlook: Interim Assessment (IMF, 1993a); and International Capital Markets, Part I. Exchange Rate Management and International Capital Flows (IMF, 1993c).

Such a framework is provided in Section III. It is based on a macroeconomic approach of internal and external balance that abstracts from short-term cyclical fluctuations in output, inflation, and interest rates and focuses on exchange rates that are consistent with economic fundamentals over the medium term. By "internal balance," we mean a situation in which real output is at its potential level and inflation is at a low and nonaccelerating rate. By "external balance," we mean a current account position that would be generated by the economic fundamentals of national saving and investment when the economy is in internal balance, with the additional requirement that the resulting path of net foreign assets must be sustainable. An integral part of the notion of macroeconomic balance as used in this paper is that the appropriate monetary and fiscal policies are being followed over the medium term. The calculation of real exchange rates consistent with internal and external balance provides a framework for assessing the consistency of the actual exchange rate with economic fundamentals, which are those key variables underlying the macroeconomic balance position. Illustrative calculations from the existing literature on this topic are discussed; this discussion highlights the important point that while this approach can yield estimates of equilibrium exchange rates, such estimates are subject to a considerable margin of uncertainty. As such, it is only possible to generate a fairly broad range of equilibrium exchange rates that can serve as a benchmark for judging whether a country's present exchange rate is consistent with economic fundamentals.

Section IV offers some concluding remarks. Anticipating those conclusions, the staff argues that while each of the methods of assessing the consistency of exchange rates with economic fundamentals has certain drawbacks that preclude precise estimation of the "right" exchange rate, those methodologies--when applied in concert--can nevertheless be useful in identifying exchange rates that are relatively far divorced from economic fundamentals, as well as in raising relevant questions about the sustainability of exchange rates that are less obvious "outliers." Finally, Section V offers some issues for discussion that Executive Directors may wish to consider in framing their interventions.

II. International Competitiveness Indicators

1. Purchasing power parity: basic concepts

An important determinant of a country's external payments position is its competitiveness. The most common approach to the analysis of competitiveness involves a comparison of trends in exchange rates and prices, based on the concept of Purchasing Power Parity (PPP). This approach assumes that equilibrium real exchange rates remain constant over time and therefore that there is a tendency for nominal exchange rate movements to offset relative price movements. Three versions of PPP have traditionally been used in the literature: the *law of one price*, which relates exchange rates to prices of individual goods in different countries; *absolute PPP*, which relates exchange rates to overall price levels; and *relative PPP*, which relates exchange rate changes to inflation rates.

The law of one price states that when there are no transportation costs and no impediments to trade (such as tariffs or quotas), the prices of identical goods sold in different countries should be the same when expressed in a common currency. Empirically, the law of one price appears to hold quite well for homogeneous primary commodities traded on major organized exchanges, when appropriate adjustments for contract differences and delivery lags are made. 1/ In contrast, differentiated products (such as manufactured goods and services) subject to international competition tend to follow the law of one price much less closely, at least over the short and medium run. 2/

Absolute PPP extends the law of one price to the general price level: under the same assumptions underlying the law of one price, the same basket of goods and services should cost the same in all countries, when expressed in a common currency. If the law of one price held for every good, then absolute PPP between similar baskets of goods should also hold. Absolute PPP, however, only requires the parity relationship to hold on average for all goods--not strictly for each good.

Absolute PPP provides a specific equilibrium concept of nominal exchange rates, the *PPP exchange rate*. This is defined as the rate that equalizes the prices of common baskets of goods in two different countries. When the market exchange rate is lower than this value, profits can be made by purchasing home goods and selling them abroad, thus pushing the exchange rate back toward its equilibrium value. Such arbitrage in trade is posited to provide an anchor for the nominal exchange rate, thereby ensuring that departures of the actual real exchange rate from its PPP level will be relatively short-lived. 3/

Although the law of one price and its multi-good counterpart--absolute PPP--are intuitively appealing, their usefulness as a guide to exchange rate behavior is limited. Transportation and information costs, as well as institutional impediments to trade such as tariffs and quotas, limit the response of consumers and firms to even substantial cross-country price differences and thus prevent absolute price levels from being equalized. Relative PPP is yet a weaker condition than absolute PPP and assumes only that the rate of change in the nominal exchange rate will be equal to the difference between the domestic and foreign rates of inflation on equivalent baskets of goods. 4/ If PPP is judged to hold in some particular year,

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1/ See, for instance, Goodwin, Grennes, and Wohlgenant (1990).

2/ See, for instance, Isard (1977) and Kravis and Lipsey (1977).

3/ See Chapters X and XI in Officer (1982) and Chapter IV in Turner and Van't dack (1993) for comprehensive surveys of the sizable empirical literature on absolute PPP.

4/ See Ohno (1990) for an estimation of equilibrium PPP rates for the yen/dollar and the mark/dollar rates. The OECD also provides periodic calculation of relative PPP exchange rates; see OECD (1987) for a description of the underlying methodology.

one can obtain a time series of the implied PPP nominal exchange rate from a time series of the inflation differential, which can then be compared to the market exchange rate.

2. Causes and effects of deviations from PPP

Most economic theories suggest that PPP should hold in the long run for traded goods, assuming that measurement problems involved in constructing comparable price deflators can be resolved (see the discussion below). Empirical evidence on the validity of PPP is mixed, however. On one hand, a growing amount of empirical evidence suggests that PPP does represent a useful reference for long-run movements in industrial countries' nominal exchange rates and traded goods' prices. For example, Lee (1976), Hakkio (1992), and Lothian and Taylor (1993) have examined exchange rates and prices of traded goods dating back to 1900 and have detected a tendency for the exchange rates of major currencies to revert toward their PPP value over horizons of three to twelve years. These findings, however, contrast with other evidence indicating that PPP does not explain the behavior of exchange rates in the short run (see, for instance, Frenkel (1978) and Krugman (1978)). When exchange rates and price movements are compared between industrial and developing countries--be it in either the long run or the short run--PPP is clearly rejected. 1/

In sum, the evidence as a whole indicates that PPP is generally a poor guide for short- and medium-run exchange rate behavior. There are four main reasons for this: hysteresis effects due to adjustment costs in trade; price rigidities in terms of the currency in which the goods are sold; imperfectly substitutable traded goods; and structural changes in technology and demand, particularly between traded and nontraded goods. The first two reasons explain why PPP can fail over short horizons, while the last two can be associated with persistent changes in equilibrium real exchange rates.

1/ Evidence on PPP among industrial countries is also mixed when real exchange rates are computed on the basis of price deflators that include prices of nontradable goods (such as the CPI and the GDP deflator). For instance, Officer (1982) and Abuaf and Jorion (1990) report evidence in support of a CPI-based PPP among industrial countries, while opposite evidence is reported in the empirical literature following Balassa (1964). The recent study by Mark (1990) provides negative evidence on a CPI-based PPP, while Dueker (1993) reports inconclusive evidence. Using a sample of 34 industrial and developing countries, Kravis and Lipsey (1983) show that aggregate price deflators tend to be rather uniform among industrial countries, whereas they decline sharply as the stage of development (measured by real per capita income) falls, with the price of nontradables largely explaining the correlation.

Temporary deviations from PPP are generated in hysteresis models of trade. 1/ These models emphasize that trade flows may not fully respond in the short run to a change in the real exchange rate because of the presence of adjustment costs. These costs include marketing of new products in a foreign country, expanding or reducing existing production or distribution lines, and altering brand recognition. 2/ When such adjustment costs are present, only large departures from PPP trigger a response on the part of exporters that corrects the initial relative price shock.

A second explanation for temporary deviations from PPP is provided by sticky price models of exchange rates (see Dornbusch (1976)). While originally aimed at explaining short-term volatility of nominal exchange rates, this class of models has gained status as a broad interpretative tool for gauging the effects of monetary policy in a world with sticky prices. This approach recognizes that prices react sluggishly in the short run to unanticipated changes in monetary conditions, thus inducing compensatory overshooting responses in nominal exchange rates. For instance, in response to a permanent increase in the domestic money supply, the nominal exchange rate would first depreciate by jumping to a value lower than its long-run equilibrium level, and then gradually appreciate toward that equilibrium. Overshooting of the exchange rate (relative to its equilibrium value) results from differences in the speed of adjustment between financial markets and goods markets; the former respond swiftly to exogenous shocks, while the latter adjust over the medium run. 3/

Yet a third factor motivating departures from PPP is imperfect substitutability among traded goods, which implies that differences in growth rates and in income elasticities across countries can become

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1/ Similar to its use in the physical sciences, the term "hysteresis" has been used in economics to describe a phenomenon (such as a trade imbalance) that fails to disappear once the causes that brought it into existence (such as an appreciated real exchange rate) have been removed.

2/ See, for instance, Baldwin (1988), Baldwin and Krugman (1989), Dixit (1989), and, for an informal review of the issues, Krugman (1990).

3/ A broader class of models, the so-called portfolio balance models, extends the overshooting literature by allowing for imperfect substitutability among different countries' financial assets. Even in this type of models, temporary deviations from PPP may arise. See Dornbusch (1982) for a discussion of both approaches and Artus (1977) for a related approach.

important determinants of long-run trends in real exchange rates. 1/ If, for example, world demand for the goods produced by the home country declines, there will be a tendency for the prices of these goods to fall and for the equilibrium real exchange rate to depreciate. In this case, however, it would be misleading to regard this real depreciation as an improvement in international competitiveness, as both the market-determined real exchange rate and its equilibrium value have declined by the same amount. Thus, it is not always easy to distinguish empirically when a change in the real exchange rate reflects a change in competitiveness or a structural change that leads to a fall in the equilibrium real exchange rate.

A different rate of technological change in the traded versus nontraded goods sectors has long been recognized (Balassa (1964)) as a cause of sustained movements in equilibrium real exchange rates and, therefore, as a reason for the failure of PPP to hold. In a world with traded and nontraded goods, demand and supply for traded goods are brought into equilibrium on a worldwide basis, while demand and supply for nontraded goods are equated in each country's domestic market. 2/ While competition in goods' markets may keep prices of traded goods broadly aligned across countries, prices of nontraded goods in different countries need not move together. Thus, if the real exchange rate between two countries is computed using deflators that include both traded and nontraded goods (such as the CPI or the GDP deflator), then countries with faster growth of productivity in the manufacturing (i.e., traded goods) sector than in the service sector will exhibit a tendency toward real appreciation.

This phenomenon is often advanced as an important factor underlying the secular appreciation of industrial countries' real exchange rates

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1/ The mere existence of heterogeneous traded goods, however, does not necessarily invalidate PPP as a long-run proposition. Countries facing less elastic import and export demand (such as Japan) have to some extent offset the resulting tendency to real exchange rate appreciation by growing at a faster rate than their trading partners. See Krugman (1990) for a model that rationalizes this tendency, based on recent developments in the analysis of trade in differentiated products.

2/ As resource allocation is driven by the relative price of traded to nontraded goods, this price will tend to reflect the relative efficiency of production in these two sectors and the relative demands for traded and nontraded goods. For this reason, the relative price of traded to nontraded goods is often referred to as "the" real exchange rate. For consistency with the previous terminology, we shall continue to define the real exchange rate as the price-adjusted nominal exchange rate. As discussed below, the two are closely related when the GDP deflator is used as the price deflator.

relative to developing countries. 1/ Even among industrial countries, different trends in productivity among traded and nontraded goods can be significant in explaining movements in equilibrium real exchange rates over horizons that are relevant for policy consideration. Japan is often cited as the classic case of a country where faster growth of productivity in the traded vs. nontraded goods sector, relative to its trading partners, has been associated with a real appreciation of the currency. Chart 1, which displays real effective exchange rates of the yen for both a composite tradable-nontradable index (the CPI) and a tradable-only index (the export unit value index) over the 1971-93 period, highlights this phenomenon; note the significant real appreciation of the yen for the composite price index and the contrasting approximate constancy for the tradables-only price index. 2/ In short, in a world with structural changes leading to shifts of equilibrium real exchange rates, a country's competitiveness can only be fully assessed by explicit consideration of the factors leading to such changes. Section III examines these economic fundamentals and their effects on equilibrium real exchange rates.

3. Real exchange rate indicators and competitiveness

The main purpose of an analysis of competitiveness is to assess the effects of exchange rate changes on a country's external position by examining how such changes relate to the incentives faced by consumers and investors in their consumption and production decisions. Several measures of real exchange rates have been considered, at the Fund and elsewhere, as useful indicators of competitiveness. 3/

As hinted at earlier in this section, a real exchange rate index based on the prices of tradable goods could be a useful indicator of potential exchange rate misalignment. For exports, such an indicator is defined as

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1/ See, for example, Kravis and Lipsey (1983). Recognition of this secular trend also underlies the recent Fund recalculation of national outputs based on the principle of PPP. In this approach, goods and services are converted into a common currency not at the current exchange rate, but rather at the PPP rate that equates domestic prices with world prices for each country's domestic product. See Gulde and Schultze-Ghattas (1992) for a description of this methodology, and Annex IV in the World Economic Outlook (May, 1993d) and Chapter VI in Staff Studies for the World Economic Outlook (December, 1993e), for its application to cross-country real income comparison.

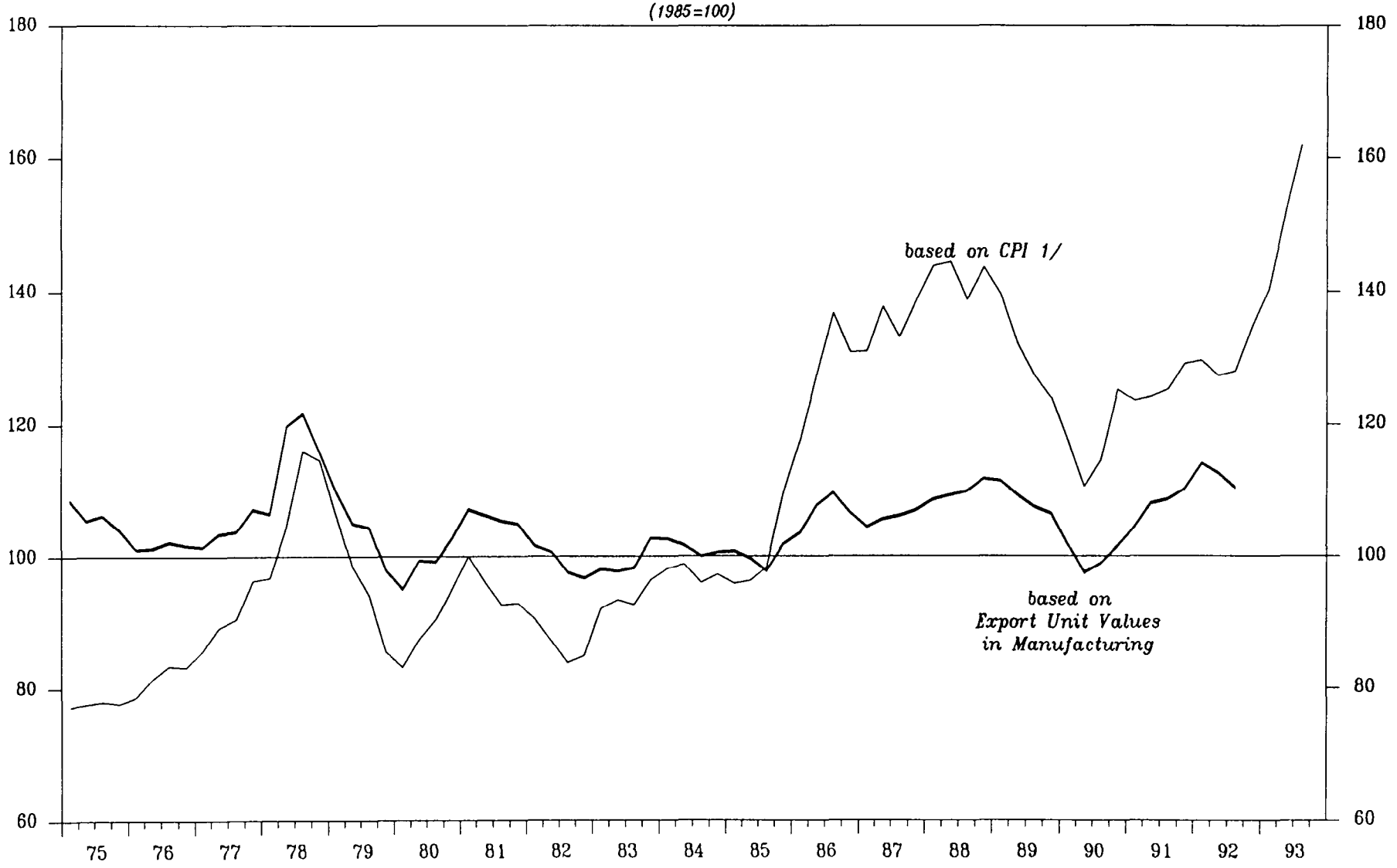
2/ Marston (1987) provides an extensive discussion of this development.

3/ Six series for real effective exchange rates are published by the Fund in the International Financial Statistics. These are based on wholesale, consumer, and export prices, value added, unit labor costs, and normalized unit labor costs. See IMF (1984) and Turner and Van't dack (1993) for a more complete discussion than that in the text. Turner and Van't dack also assess current trends in international competitiveness based on several of the indicators discussed here.

Chart 1.

Japan: Real Effective Exchange Rates

(1985=100)



1/ The real effective exchange rate based on the CPI does not include China from 1975 to 1980.

the ratio of a weighted average of foreign export prices to the weighted average of the prices of exports of the home country, all expressed in the same currency. A rise in this indicator would signal a loss of competitiveness for the home country in its export markets.

The main practical shortcoming of a conventional export-based index of competitiveness is that it may be subject to a sampling bias. Specifically, such an indicator does not include all potentially exportable goods; rather it covers only those tradable goods that are priced sufficiently low--*at the current exchange rate*--to be exported. Although sampling biases may also affect other indicators (e.g., a good may be priced too high to be consumed in a particular country, and will thus be excluded from the CPI), export deflators are more narrowly defined than other price indices, and thus are more susceptible to this problem. More importantly, if traded goods are close substitutes, then the export-based real exchange rate is likely to show little variation. This is because exporters of homogeneous goods will adjust prices quickly in response to exchange rate changes--even though the relative profitability of producing the goods included in the export basket may vary considerably. Exporters can "price to market" by squeezing profits in the short term--but this is not a sustainable strategy in the long term. An export-based index of competitiveness may therefore provide little information on the relative profitability of domestic versus foreign traded-goods, and therefore on the incentives to shift resources into these sectors.

More comprehensive measures of price competitiveness can be obtained by constructing real exchange rates based either on aggregate price deflators or on unit labor costs. For example, as a GDP-based real exchange rate reflects the ratio of the relative prices of nontraded to traded goods at home and abroad, an increase in this index would reflect either a loss of competitiveness in the traded goods market, or a greater incentive to allocate resources to the nontraded good sector at home than abroad. Thus, movements in this indicator would usefully reflect movements in important determinants of trade flows and real exchange rate pressure. In addition to GDP deflators, the candidates include wholesale price indices, value added indices, and consumer price indices (CPIs). The main practical disadvantage of wholesale and value added indices is the lack of cross-country comparability with regard to both concept and commodity composition; also, they are typically available only for the manufacturing sector, and often with a substantial delay. CPIs are available on a more timely basis and with greater frequency, but reflect taxes and other institutional distortions, as well as prices of imported goods; this latter feature makes CPI-based indices less indicative of the prices faced by producers.

A real exchange rate index defined in terms of relative unit labor costs (ULC) in the traded goods' sector (typically identified with manufacturing) compares the relative profitability of nonlabor factors in producing manufacturing goods at home and abroad. Implicit here is the notion that the real exchange rate should be instrumental in equilibrating the rate of return to nonlabor factors across countries. In this respect,

unit labor cost indicators are useful for assessing competitiveness in terms of incentives to shift nonlabor factors domestically and internationally. They also have the advantage of being defined similarly across industrial countries.

Again, however, there are drawbacks. First, because they are defined in terms of unit (or average) labor costs, such indices provide only a rough approximation to the relative incentives for labor allocation at home and abroad, which should be measured by marginal labor costs. Because the relationship between marginal and average labor costs varies with capital/output ratios, changes in the unit labor cost index may just be signalling changes in capital/output ratios that are unrelated to competitiveness. For example, a rapid shift of resources toward more capital-intensive industries may lead a country's ULC-based real exchange rate to overestimate its competitiveness gains. A good case in point is the Irish experience, summarized in Chart 2, where the rapid inflow of capital-intensive multinationals during the 1980s led to a substantial decline in the ULC-based indicator that reflected neither a decline in costs at the firm level, nor an exchange rate depreciation--but rather in part a shift in the relative factor content of output. A second problem associated with the use of ULC-based indicators is that nonlabor costs in production include not only the remuneration to capital, but also other costs, such as the rental of land and the cost of intermediate goods and primary commodities. As shown by Lipschitz and McDonald (1991), a suitable correction of the labor cost index for the share of value-added domestically can be made in principle, but would be difficult to carry out in practice. Furthermore, two practical shortcomings of ULC-based indicators are the relatively long delay in their availability and the likelihood of relatively large errors in the measurement of their components.

Finally, the attempt to forecast future changes in competitiveness (rather than simply assess past developments), underlies the so-called "structural" forecasting models of exchange rates. These models typically try to predict future movements of exchange rates by using a set of variables derived from models of exchange rates such as the monetary and the portfolio balance approaches. 1/ In general, the empirical success of these approaches has been limited, and the general perception of this effort has changed little since the negative assessment provided by Meese and Rogoff (1983).

Given the empirical problems involved in constructing models of exchange rates that adequately predict future exchange rate movements, greater effort has been placed, at the Fund and elsewhere, in exploiting market-based indicators of anticipated movements in exchange rates and in their fundamental determinants. These indicators typically include forward exchange rates, interest rate differentials, forward interest rates, yield

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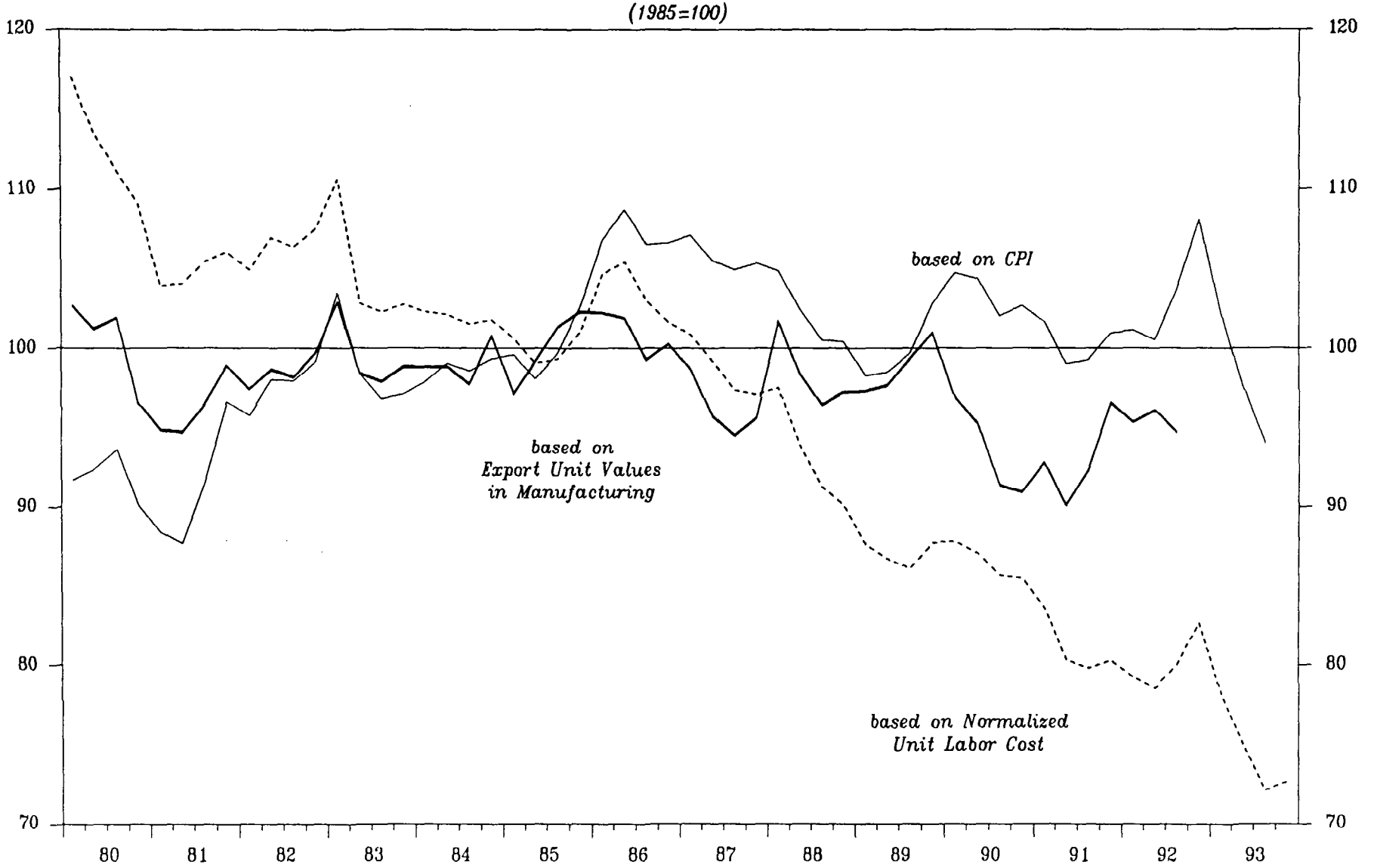
1/ For a discussion of these models, see Frenkel and Mussa (1985), MacDonald and Taylor (1992), and Taylor (1994).

Chart 2.

Ireland: Real Effective Exchange Rates

(1985=100)



curves, and option-based estimates of future exchange rate volatility. While these indicators have proven useful in certain circumstances in identifying incipient sources of exchange rate pressure, they also suffer from weak empirical performance. Additionally, as these indicators typically provide only estimates of nominal exchange rate movements, they must be supplemented by forecasts of inflation differentials. In general, use of market-based exchange rate indicators is a promising--yet rather undeveloped--area of research that may prove helpful in the assessment of exchange rates.

4. Analysis of competitiveness at the Fund and recent experience with real exchange rate indicators

Two frameworks for the construction of measures of competitiveness are currently used at the Fund. 1/ The first framework, the Information Notice System (INS), is maintained by the Policy Development and Review Department, and involves calculation of CPI-based real effective exchange rates (REER) for almost 140 countries. 2/ Trade weights are constructed using data on trade flows in manufacturing and primary (non-oil) commodities. A second framework, maintained by the Research Department, uses unit labor costs in manufacturing for 17 industrial countries to construct REER. 3/

Given the availability of a range of indicators of competitiveness, it is of interest to assess the relative usefulness of different indices as predictors of exchange rate pressure and changes in trade volumes. 4/ In this connection, Lipschitz and McDonald (1991) study the evolution of Germany's competitiveness during the 1980s vis-à-vis its EMS partners. They show that the ability of ULC-based real exchange rates to predict changes in European trade shares can be enhanced by adjusting this indicator to account for movements of value added deflators in Germany and in her EMS partners. That study also suggests that the inability of standard GDP and CPI-based

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1/ These frameworks are based in part on the model of imperfect substitutes of Armington (1969), and on its empirical implementation by McGuirk (1987) and Wickham (1987).

2/ As part of the INS, the Executive Board is notified of changes in real effective exchange rates of more than 10 percent since a given reference period.

3/ Both the INS and ULC-based weights currently reflect trade data from the 1980-82 period, although a revision based on updated trade data is ongoing and is expected to become operational in 1994.

4/ Recently the Research Department has developed a Surveillance Data Bank which brings together data useful for the surveillance of industrial countries. This data bank does not contain new measures of competitiveness, but allows users to calculate real exchange rates between groups of countries in a simple and efficient manner. This is useful for examining regional issues, such as movements in competitiveness between members of the ERM of the EMS.

indicators of competitiveness to predict the pattern of market shares during this period can be explained by the slower rate of productivity growth in Germany's traded goods sector vis-à-vis her EMS partners. Differential productivity effects in EMS countries are also analyzed by Micossi and Milesi-Ferretti (1993), and by De Gregorio, Giovannini, and Krueger (1993).

A summary of the behavior of different indicators of competitiveness in developing countries is provided by Wickham (1993). Using data for Colombia and Kenya as an example, that study discusses the difficulties encountered in constructing empirical counterparts to various theoretical concepts of real exchange rates. The study notes that despite the differences between the various approaches, different indicators end up being fairly similar in construction and behavior (more so for developing countries, where large exchange rate movements tend to outweigh the relative volatility of the price deflators).

Recent studies, including several at the Fund, have tried to establish a link between market-based expectations of exchange rate changes and macroeconomic "fundamentals," including competitiveness. 1/ Caramazza (1993), for example, finds that investors' anticipations of a realignment of the French/German ERM parity from 1987 to 1991 can be explained in large part by several macroeconomic variables, including relative inflation rates and export competitiveness. Similarly, Bartolini (1993) studies the links between the competitive position of Ireland and market anticipations of a devaluation of its exchange rate from 1987 to 1993. He finds strong links between anticipated devaluations and both a CPI-based measure of competitiveness and a measure of expected devaluation of the currencies of Ireland's main trading partners. Rose and Svensson (1993) also find a strong link between inflation differentials and anticipated exchange rate devaluations, although their results are more mixed for a number of other macroeconomic variables. In general, evidence from these and other studies tend to support the predictions of PPP-based theories on the correlation between expected changes in exchange rates and inflation differentials. 2/

The links between competitiveness and trade volumes are explored by Marsh and Tokarick (1994). They estimate import and export equations for the G-7 countries from 1973 to 1991 at different levels of aggregation using indicators of real exchange rates based on consumer prices, export unit values, and unit labor costs. The study finds evidence of a long-run response of trade to real exchange rate behavior, but finds little evidence of a significant linkage in the short run. In addition, the study finds

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1/ In these studies, market-based measures of anticipated devaluations of ERM currencies are obtained by correcting interest differentials with an estimate of anticipated movements of exchange rates within their fluctuation bands. See Svensson (1993) for a discussion of the methodology. Isard (1994) provides a theoretical analysis of unemployment as a determinant of expectations of a change in a currency peg in a policy-optimizing framework.

2/ See, for instance, Thomas (1993) and Chen and Giovannini (1993).

that either all of the three indicators work well, or none of them do. Thus the main conclusion of this study is that it is difficult to discriminate among these indicators. One reason for this would appear to be the large volatility of nominal exchange rates, which tends to swamp the difference in volatility among the individual underlying indicators. 1/

To shed further light on these issues, it is instructive to examine the evidence on the behavior of the real exchange rate indices discussed above and of the trade balance in the two largest industrial countries from 1980 to 1993. 2/ Chart 3, which graphically summarizes this evidence, reveals two main features. First, because of the strong volatility of nominal exchange rates relative to the volatility of prices, the different indicators of competitiveness tend to be highly correlated in the short run. The main exception is the slow response of Japan's export-based index to the appreciation of the yen in the second half of the 1980s, which partly reflects the attempt of Japanese firms to maintain market shares in response to fluctuations in the yen/dollar rate. The second notable feature of Chart 3 is that whereas losses of competitiveness are clearly associated with a declining trade balance in the case of the United States, the opposite is true for Japan, where current competitiveness losses are correlated with improvements in the trade balance. 3/ Clearly, however, this should not be interpreted as suggesting that changes in competitiveness produce perverse effects on a country's trade balance. 4/ Rather, it shows that examination of trends in competitiveness alone--independent of considerations of structural and cyclical developments in output and demand, changes in policies, and financial market conditions--generally provides only a partial account of developments in external trade.

In summary, while aggregate indicators of competitiveness may not by themselves be strongly correlated with changes in external imbalances, these

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1/ In a study of U.S. trade flows, Marquez (1992) finds that unit labor costs and consumer prices dominate some other indicators of competitiveness, but that the empirical results do not discriminate between these two indicators themselves.

2/ A discussion of the ability of alternative competitiveness indicators to explain external imbalances in selected industrial countries from 1963 to 1983 is given in IMF (1984).

3/ Similar pattern arise for other countries. For instance, losses in measured competitiveness tend to be associated with a worsening trade balance in Italy during the 1980s and early 1990s, but with an improving trade balance in the United Kingdom. For the remaining G-7 countries, the evidence on the simple correlation between competitiveness and trade balance is at best mixed.

4/ In this connection, it should be realized that there is ample empirical evidence that real exchange rates, after taking proper account of other relevant factors, including J-curve effects due to the lagged response of trade volumes, do have a significant effect on trade balances. See, for example, Hooper and Marquez (1993) and Meredith (1993).

indicators nonetheless are useful in signaling the emergence of market pressure toward adjustment of nominal exchange rates. Relative costs and prices are an important underlying determinant of external positions, and consequently large changes in competitiveness generate economic forces that move real exchange rates toward their equilibrium levels. An analysis of international competitiveness, however, constitutes only one ingredient in the assessment of exchange rates because it takes the level of equilibrium real exchange rates as given. As there is little reason to believe that real exchange rates should remain constant over time, it is necessary to incorporate the analysis of international competitiveness in a more comprehensive framework that can explain changes in the equilibrium rates themselves. The next section describes an approach that focuses directly on the equilibrium real exchange rates.

III. Macroeconomic Balance Approach

This approach uses the current macroeconomic position of the economy relative to positions of internal and external balance to calculate equilibrium exchange rates. Equilibrium exchange rates are assumed to depend upon the current set of exchange rates and degree of macroeconomic imbalances across economies. Accordingly, the macroeconomic balance approach includes a number of other macroeconomic indicators in addition to competitiveness in the assessment of exchange rates.

The analytical basis of the macroeconomic balance approach was initially outlined in Swan (1963). It was refined by Fund staff during the 1970s, and has been used more recently by John Williamson and others in their work on "fundamental equilibrium exchange rates" (FEERs). 1/ It defines the equilibrium real exchange rate as that value which is consistent with *internal and external balance* over the medium term. Internal balance is normally defined in terms of achieving the underlying level of potential output, while external balance is defined in terms of achieving an equilibrium position in the current and capital accounts.

A diagram can be used to highlight the key relationships involved. In Chart 4, the real exchange rate is measured on the vertical axis and real domestic demand on the horizonal axis. Internal balance is represented by the upward sloping Y* line, which represents those combinations of the exchange rate and real domestic demand at which the economy is at its full employment level, Y*. It slopes upwards because, as the exchange rate appreciates, more domestic demand is diverted from domestic to imported goods and foreign demand is switched away from exports; hence, more domestic demand is required to achieve the same level of output. Points to the right of Y* indicate that output is above potential, with higher internal demand

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1/ See Artus (1977), IMF (1984), and Williamson (1990). A useful survey of the issues related to equilibrium exchange rates is contained in Krugman (1990).

Chart 3.
United States and Japan: Selected Indicators

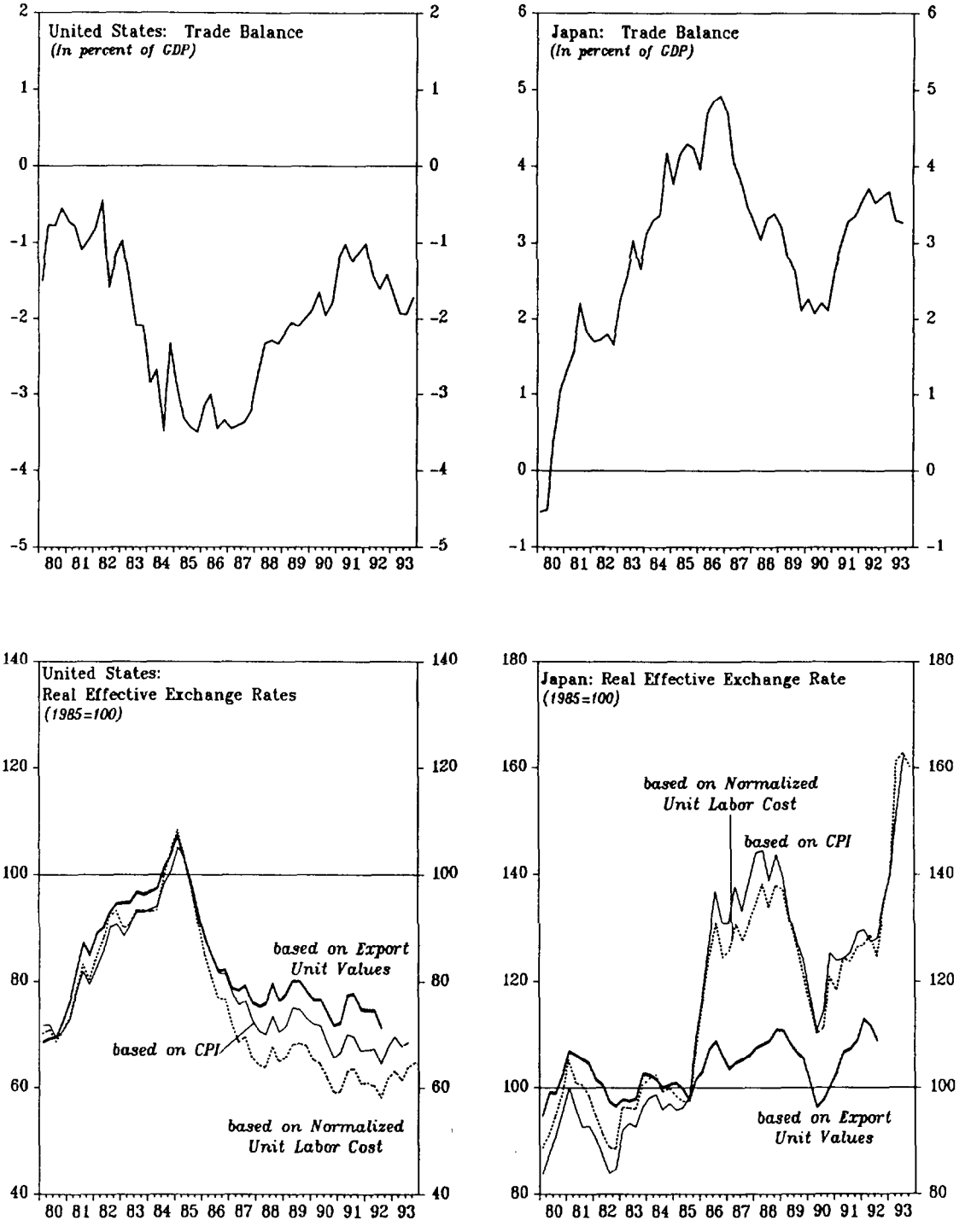
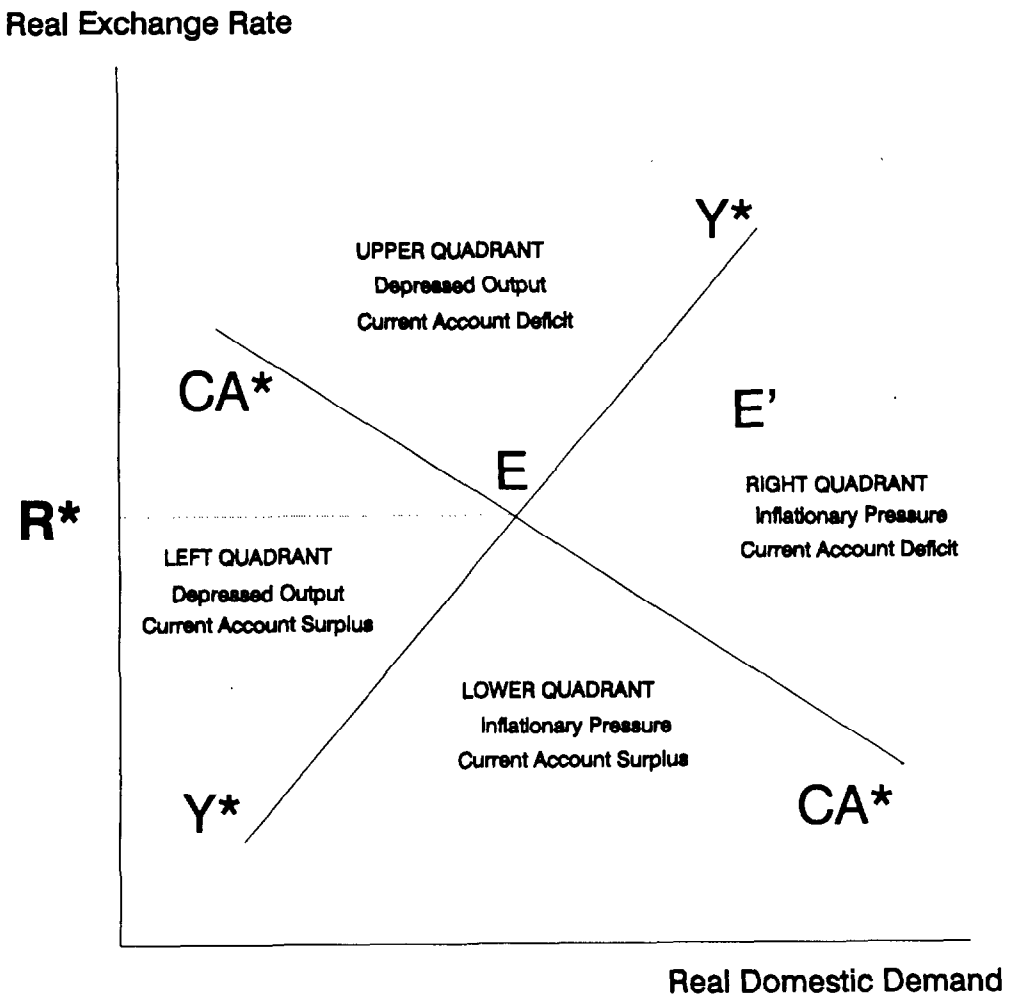


Chart 4
Macroeconomic Balance and the Real Exchange Rate



being satisfied by domestic output rather than imports, while points to the left of Y* indicate that output is below potential. External balance is defined by the CA* line, which shows the combinations of the exchange rate and domestic demand at which the current account is equal to its equilibrium level, CA*. It is downward sloping because higher domestic demand, which worsens the current account, needs to be offset by a depreciation in the real exchange rate to keep the external position unchanged. Points above CA* indicate that the real exchange rate is above (more appreciated than) the level required to achieve external balance, and hence that the current account is less than the equilibrium level, while points below CA* indicate a current account above its equilibrium value.

The intersection of the two lines at point E determines the real exchange rate R* which is simultaneously consistent with both internal (Y*) and external (CA*) balance, and hence with appropriate underlying macroeconomic policies. The regions around E represent four types of disequilibrium. A point such as E' in the right-hand quadrant of the diagram corresponds to a position where output is above potential and the current account is below its equilibrium (E' is to the right of Y* and above CA*). This combination of inflationary pressure and current account deficit (relative to equilibrium) could reflect a rise in domestic demand caused, for example, by an expansionary fiscal policy. As an illustration of this situation, in 1985 the United States was in the upper half of the quadrant with output above potential, the current account below equilibrium, and an overvalued real exchange rate. The left-hand quadrant shows the opposite combination; depressed output and current account above the equilibrium level. This would be the typical position of a country in recession; Japan's current situation would be a relevant example.

Points in the upper quadrant also indicate depressed output, but in this case it is combined with a current account below its equilibrium level due to an appreciated exchange rate. This combination of depressed output and an overvalued exchange rate appears to have characterized the macroeconomic positions of the United Kingdom, Sweden, Italy, and Spain prior to September 1992. Chart 5 shows that up to September 1992, the real exchange rate of these countries had, on average, appreciated considerably since 1987, which contributed to a deterioration in their current account positions that is masked by the weakness in domestic demand in 1991-93. The cyclical increase in unemployment from 1990 to 1993 in these countries was exacerbated by the need to raise interest rates in order to maintain their parities in the ERM (or peg to the ECU in the case of Sweden). Market participants focused on these developments and exchange market tensions emerged which ultimately resulted in these countries giving up their parities or peg in the summer and fall of 1993.

This episode illustrates that important policy issues arise when considerations of macroeconomic balance appear to indicate that there is a misalignment of exchange rates. As noted in the Introduction, it is beyond the scope of this paper to discuss the range of policy actions, and the circumstances under which particular actions would be appropriate, in cases

where the current real exchange rate appears to be outside a range of values that could reasonably be expected to be consistent with economic fundamentals. Nonetheless, a few brief observations are warranted. First, a more careful analysis of the underlying situation could reveal that a misalignment does not exist and that no policy actions are called for. Second, if indeed a judgment is reached that the exchange rate is out of line with fundamentals, the answer to the question of what policy actions are called for depends in part on whether the exchange regime is one of pegged or floating rates. Third, in this case under either regime two main courses of action need to be considered: (1) adjustments in macroeconomic policies may well be needed in order to correct the misalignment by bringing the economic fundamentals in line with the nominal exchange rate; and (2) in the case of a pegged rate regime, an inconsistency between the real exchange rate and positions of internal and external balance may warrant an adjustment in the nominal peg.

As the equilibrium exchange rate, R*, depends upon the internal and external balance of the economy, it will change in response to shocks that alter these balances. Consider the case of a rise in the price of oil for an oil exporting country (such as Norway). The boost to nominal exports implies an improvement in the current account balance. If the increase in oil prices raises the equilibrium surplus on the current account--on the grounds that some of the economic windfall is used to build up net foreign assets to provide income in the future--the CA* line will shift upwards. Hence, an increase in the price of oil will lead to a rise in the equilibrium exchange rate of oil exporting countries and an increase in domestic demand. This framework can be used to analyze other disturbances, such as discovery of natural resources, German unification, and technological change. For example, German unification resulted in a large transfer of resources from west Germany to rebuild the economy of the eastern half of the country, and thus a redirection of German saving from abroad to the domestic economy. This reduction in the equilibrium current account implies an upward movement in the CA* line, and hence an appreciation in the equilibrium real exchange rate. 1/

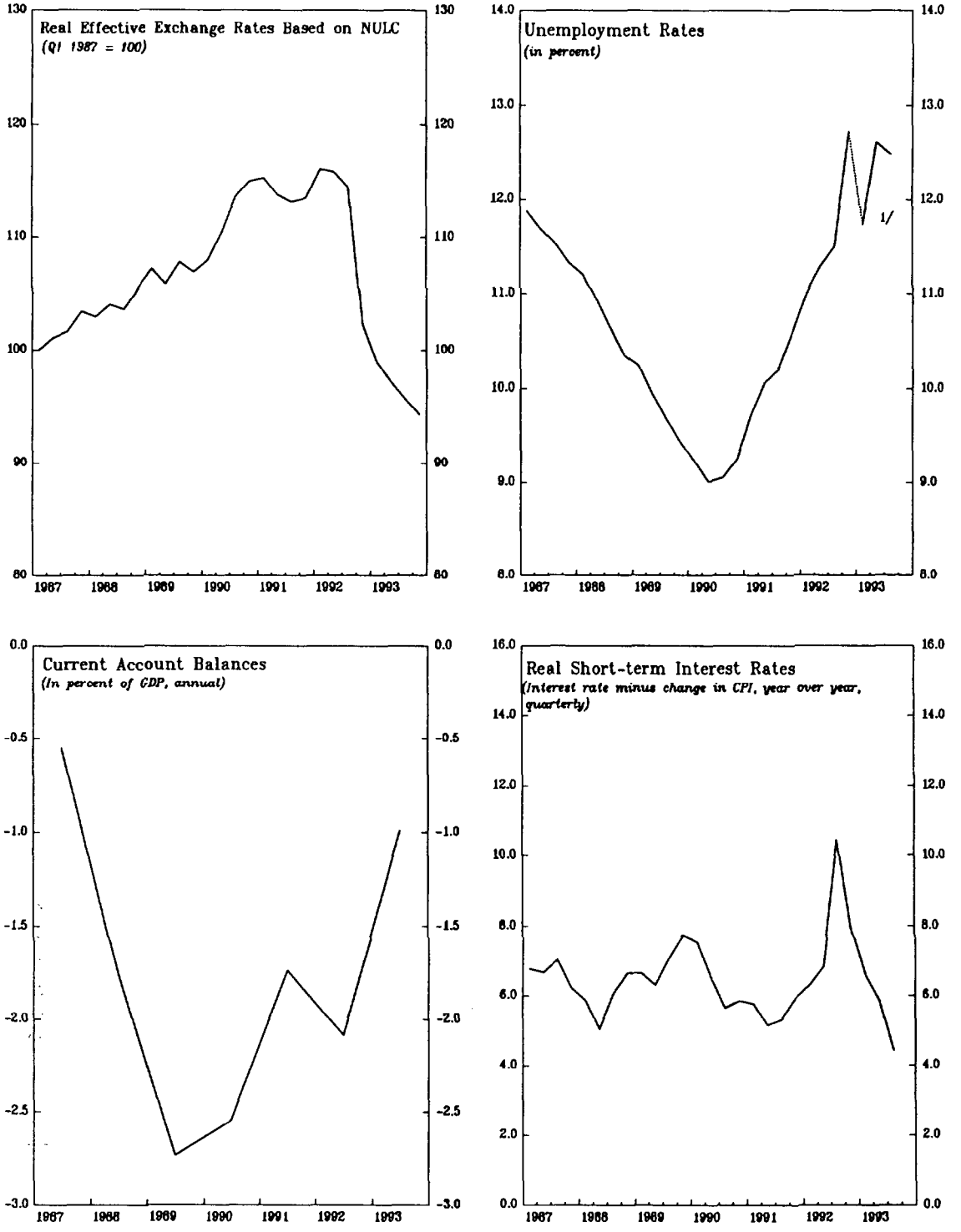
In addition to analyzing changes in the equilibrium exchange rate, this framework is also useful in assessing the underlying reasons for deviations from equilibrium. Such an assessment is crucial in framing the appropriate policy response to an exchange rate misalignment. For example, if an overvaluation of the exchange rate is accompanied by excess domestic demand, the solution might well be to take steps to reduce demand. Such a policy, however, is less likely to be appropriate if demand is already low relative to potential. This underlies the need for judgment in reaching the appropriate policy response to exchange rate misalignments.

1/ For an empirical analysis of the economic effects of German unification, including estimates of the real appreciation of the deutsche mark, see Masson and Meredith (1990).

Chart 5. Selected Indicators: Average of Italy, Spain, Sweden and the United Kingdom

(GDP weights)

1987-1993



1/ The break in the series reflects a change in the definition of the unemployment rate for Italy at the end of 1992.

Implementing the macroeconomic balance approach requires two pieces of information. The first is a definition of internal and external balance, a subject which will be explored in the next section. The second piece is a set of estimates of the parameters which define the relationship between the current account, output, real demand, and the real exchange rate.

1. Defining internal and external balance

Calculation of the exchange rate corresponding to macroeconomic balance involves estimating the levels of output and the current account associated with internal and external balance. Internal balance is defined as the level of output consistent with both full employment and a low, sustainable rate of inflation. External balance is less easily specified. A broad definition would be the net flow of international capital that corresponds to equilibrium levels of national saving and investment over the medium-term.

Internal balance is closely connected with the concept of macroeconomic stability, and in particular with the level of unemployment consistent with a nonaccelerating rate of inflation (NAIRU). The NAIRU is the level of unemployment consistent with nominal stability, since at this rate there is no pressure for inflation to rise or fall. Using this framework, potential output can be defined as the level of real output consistent with the NAIRU. 1/ Empirical estimates of potential output in different countries have been done for some time within the Fund. Indeed, deviations of output from potential are routinely provided for the major industrial countries as an input into the fiscal impulse calculations in the WEO exercise, and work on potential output is currently being extended to the other industrial countries. 2/

As noted above, external balance is more difficult to define. As the counterpart to the current account on external transactions is the capital account, external balance can be approached in terms of the desired net flow of assets between economies in the absence of significant institutional or governmental distortions. Seen in this light, the equilibrium current account represents the desired *intertemporal reallocation of resources* between countries, and identifying the preferred path for the current account involves identifying the preferred path for international debt. As with any intertemporal analysis, this path depends upon current assessments

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1/ Deviations from internal balance provide the justification for using cyclically-adjusted current account balances as an indicator to identify underlying current account positions.

2/ Annex II of the October 1993 World Economic Outlook (IMF, 1993a), reports some potential output estimates.

of future variables. 1/ Several alternative methods for identifying this path are discussed below.

One approach is to identify external balance with a zero current account, and hence with an unchanged level of nominal net claims on the rest of the world. While having the virtue of simplicity, such an assumption is without any firm analytical or empirical basis. Net flows of capital between countries can provide the same benefits for the international economy that domestic financial markets provide within an economy; namely, an efficient mechanism for moving capital between savers and investors. Identifying a zero current account balance as the equilibrium external position would fail to recognize these gains from allocating international resources. There have been numerous historical examples of persistent nonzero current accounts. The gold standard period provides a useful case in point. Between 1880 and 1913, the United Kingdom and Germany ran average current account surpluses of 4.5 percent of output and 1.8 percent of output, respectively, while Australia, Sweden, Denmark, and Norway all ran average current account deficits of between 2.5 and 3.7 percent of output. The persistent external deficits of many developing countries in the postwar period are another example.

An alternative approach, discussed in IMF (1984), is to use data on international capital flows to differentiate between persistent transfers of long-term capital and more reversible short-term funds. The long-term flows are taken to represent the "normal balance" and are assumed to be sustainable over time, while the short-term capital transactions are taken as volatile flows that are transitory and reversible. In practice, however, it is extremely difficult to differentiate between these different flows. The reason is that this distinction between flows applies to the motives of the investor, which are very imperfectly correlated with any objective characteristics which can be measured using capital account data.

Given these problems with identifying the equilibrium level of the current account directly from data on the external accounts, most recent calculations of the exchange rate associated with macroeconomic balance have approached the issue in a less direct fashion. Rather than looking at the current account *per se*, the desired current account has been derived from theoretical considerations regarding economic behavior in the rest of the economy. For example, Williamson (1990) discusses the saving and investment position of the major industrial countries using the debt cycle theory of investment, in which less developed countries borrow capital from more developed countries in order to industrialize, and the life-cycle theory of savings, which predicts that demographic differences across countries will systematically affect private saving.

1/ The type of approach dates back to Sachs (1981). Mendoza (1992) provides a more recent framework, while Razin (1993) provides an overview of the literature. Ghosh (1990) provides some empirical results for the intertemporal approach to the current account using a highly stylized model.

Although Williamson uses a relatively informal approach to these calculations, it is possible to formalize such computations using empirical estimates of the impact of various factors on saving and investment. Bosworth (1993) provides a useful survey of the existing empirical literature on saving and investment, as well as several new results on the determinants of saving and investment using data across a number of industrial countries. These results confirm, inter alia, the importance of demographic factors for saving rates, and output growth for investment. 1/

An alternative to the regression analysis used by Bosworth is to use macroeconomic simulations to estimate the effect of underlying disturbances on the world economy. Masson and Tryon (1991) use a modified version of the MULTIMOD macroeconomic model to estimate the impact of an aging population on the world economy. As the population ages, the private saving rate will tend to decline. Hence, cross-country differences in demographic trends imply movements in the equilibrium value of the current account. Similarly, Masson and Meredith (1990) use MULTIMOD to analyze the consequences of German unification on the world economy. Yet another alternative is to employ small theoretical models, using empirical estimates of underlying parameters, to provide estimates of the relationship between macroeconomic disturbances, the current account, and the real exchange rate (Ostry, 1988).

One related issue worth mentioning is the impact of the government balance on the current account. At one extreme, the Ricardian model (Barro, 1979) predicts that changes in taxation will be associated with offsetting changes in private saving, and hence that there will be no net impact on the current account. 2/ Alternatively, if private sector behavior is unaffected by the actions of the government, then changes in the government balance would feed into the external accounts on a one-for-one basis. The empirical evidence appears to lie somewhere between these extremes, showing a partial private-sector offset of changes in the government balance, and hence implying that the current account does depend, inter alia, on the fiscal policy of the government. 3/ The calculation of the equilibrium level of the current account then requires a projection of future fiscal balances. Other aspects of fiscal policy can also affect the saving-investment balance. This is most obvious in the case of policies which directly effect private saving or investment decisions, such as the incentive to save caused by the introduction of Individual Retirement Accounts (IRAs) in the United States, or a reduction in the retirement age. In general, fiscal policies pose a significant practical problem for the macroeconomic balance methodology, as implementation requires both estimates of the effect of these policies on actual saving and investment, as well as

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1/ For an analysis that explains movements in the current account in terms of the determinants of private saving and investment, see Knight and Masson (1989).

2/ Note, however, that even in the Ricardian model changes in real government spending will affect the economy, and hence the current account.

3/ Bernheim (1987).

some conclusion about the change in the underlying equilibrium levels of these variables.

As the current account equals the change in net foreign assets (excluding the impact of valuation effects), it is necessary to ensure that the saving-investment approach to the current account is consistent with the equilibrium path of net foreign assets. While the saving-investment approach focuses on flow equilibrium, the net foreign asset approach involves identifying the underlying stock equilibrium of the economy. Here, the key is to determine the underlying demand for net foreign assets and the speed of adjustment towards this equilibrium. Masson, Horne, and Kremers (1993) provide some empirical work along these lines. Looking at the underlying stock of net foreign assets also focuses attention on the need to ensure that the level of international debt is kept within values that markets are willing to accept, and in particular that it is not exploding over time. 1/

2. Calculating the Macroeconomic Balance Exchange Rate (MBER)

Once positions of internal and external equilibrium have been identified, the next step is to calculate the underlying exchange rate consistent with these values. Since this is a real exchange rate calculation, anticipated changes in domestic and foreign prices feed through directly into the equilibrium nominal exchange rate; thus, different inflation rates across countries are taken into account in the same manner as in the assessment of exchange rates based on international competitiveness considerations. At the same time, however, other economic fundamentals enter the calculation via their effect on the level of the external-balance position.

Two approaches to this calculation have been taken in the literature: comparative static calculations and simulations using large macroeconomic models. As comparative static calculations often involve explicit consideration of many of the assumptions underlying both approaches, they are discussed below in some detail. This is followed by a discussion of how macroeconomic model simulations can be used to carry out the same calculations, together with an assessment of the comparative advantages of both approaches. Clearly, in practice neither method will produce an unambiguously unique value for the equilibrium exchange rate. Rather, these calculations will produce a range within which the underlying equilibrium exchange rate is likely to lie.

1/ The relevance of stock equilibrium is illustrated, for example, by the situation of the United States in early 1985. If the U.S. dollar had remained at its highly appreciated level in January 1985, the implied future stock of U.S. liabilities to foreigners would have become implausibly large. Krugman (1989), for example, estimates that in 20 years the foreign debt/GNP ratio would peak at 50 percent.

The macroeconomic balance exchange rate (MBER) depends upon the underlying relationship between the current account and its determinants namely, domestic output, foreign output, and the real exchange rate. This functional relationship can be derived from estimated equations for trade volumes and prices. The volume of exports and imports depend mainly on the levels of economic activity (at home and abroad) and on the real exchange rate. This relationship is the empirical counterpart to the CA^* line in Chart 4, with foreign output included since it affects the current account through the demand for exports. It is then straightforward to calculate the level of the real exchange rate which is consistent with estimated equilibrium values of the current account, domestic output, and foreign output.

While this calculation provides an estimate of the deviation of the exchange rate from equilibrium, it does not explain the reasons for any such misalignment. For example, an appreciated exchange rate could reflect an unsustainable fiscal policy, a monetary policy oriented towards disinflation, divergent cyclical positions, speculative movements in the market exchange rate, or any of a number of other causes. Clearly, the appropriate policy response will depend upon the underlying causes for the misalignment, which requires a detailed judgment of the particular circumstances of the country in question. The Fund, with its surveillance expertise, is well placed to provide such an assessment. This paper is only concerned with the crucial first step in this process, namely how to identify whether there is an exchange rate misalignment or not.

The chief complication in implementing the comparative static approach involve parameter uncertainty, time lags in the estimated equations, trends in the real exchange rate, the relationship between the real and nominal exchange rate, and the impact of the adjustment path on the final result. These will be discussed in turn.

The accuracy of any estimated equilibrium exchange rate depends on the correctness of the empirical specification and on the precision of the underlying trade elasticities. Estimates of the elasticities associated with both activity and relative prices vary significantly across empirical trade models. 1/ This range of estimates needs to be taken into account in any assessment of the precision of equilibrium exchange rate calculations. Most estimated trade equations also show that there are time lags before changes in output and changes in the real exchange rate exercise their impact on the current account. This means that the current account relationship must take account of the impact of past changes in output and in the real exchange rate, as well as any trend in the level of the real exchange rate caused by underlying factors, such as differential rates of

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1/ Goldstein and Khan (1985) provide a survey of estimated trade equations.

productivity growth. 1/ In addition, the calculated real exchange rate will not translate into a one-for-one change in the nominal rate, as the change in the nominal exchange rate required to achieve this real value will depend upon the sensitivity of domestic prices and wages to exchange rate changes. In particular, if the economy is very open to international trade, changes in import prices will have a significant impact on consumption prices, real incomes, and wages. The nominal exchange rate component of the equilibrium exchange rate needs to reflect these domestic price responses. Finally, the equilibrium exchange rate may also depend upon the speed at which the economy moves back to equilibrium, due to the impact of the adjustment path on the external net assets of the country. An economy which has a current account which is below its desired level also has net foreign assets that are falling below their desired path. This implies higher interest rate payments to foreign creditors, a lower current account, and hence a larger eventual real exchange rate adjustment. 2/

Several papers have applied the comparative static approach to estimate underlying equilibrium exchange rates. Barrel and Wren-Lewis (1989) use the approach to estimate equilibrium rates across the major industrial countries. Using an equilibrium current account deficit of 1 percent of GDP for the United States, and a desired surplus of 2 percent of GDP for Japan and Germany, they conclude that in 1989 the U.S. dollar was above its equilibrium value by 5-15 percent, while the yen and deutsche mark were below theirs by 5-17 percent. Bayoumi et al. (1994) carry out a similar exercise for the major industrial countries during the break-up of the Bretton Woods, fixed exchange rate system; however, the primary focus is on methodological issues rather than producing estimates of equilibrium exchange rates. Church (1992) and Wren-Lewis et al. (1991) use the approach to evaluate the ERM parity chosen by the United Kingdom when it entered the Exchange Rate Mechanism (ERM) of the European Monetary System. 3/

1/ For example, if all countries had the same output elasticities for exports and imports, but in one country the growth of potential output were lower than the rest of the world, exports would tend to grow faster than imports over time, implying a widening current account surplus. To offset this secular trend, the real exchange rate would have to appreciate steadily over time. In practice, however, differences in growth rates of output across countries appear to have been largely offset by differences in estimated output elasticities for exports (Krugman, 1990).

2/ Artis and Taylor (1993) estimate that if an economy moves back to equilibrium (in a linear fashion) over five years, then the magnitude of the eventual exchange rate adjustment will be 15 percent larger than the adjustment required if the economy were to move to equilibrium immediately.

3/ Both papers concluded that the exchange rate at the time of entry into the ERM was overvalued compared to its equilibrium value.

In principle, a similar approach to that suggested here could be used to analyze the equilibrium exchange rate of developing countries. 1/ This is particularly true for some of the middle income developing countries with relatively diversified open economies and low tariffs, such as Korea, Thailand, Malaysia, and (more recently) Mexico. For other types of developing countries the analysis is still relevant, but account needs to be taken of several factors which are more important for these types of economies than for industrial countries. In particular, the effect of external disturbances to the terms of trade, reform of tariff policy, capital market constraints, and high and variable levels of inflation should be considered in detail in calculating the equilibrium exchange rate. 2/

Thus far, the exposition has outlined a comparative static approach to calculating the exchange rate consistent with macroeconomic balance. An alternative approach, utilized by Williamson (1985 and 1990), is to use macroeconomic model simulations to calculate the exchange rate associated with internal and external equilibrium. An advantage of the macro model approach is that it provides a consistent framework in which the interactions discussed above are taken into account automatically. Williamson (1990) provides a comprehensive examination of this approach. Several large macroeconomic models are used to estimate equilibrium exchange rates for the major industrial countries in 1990. His preferred estimates indicate significant deviations between actual real exchange rates and their underlying equilibrium values, particularly for the largest three industrial countries. 3/

An advantage of using a macroeconomic model in this way is that many of the issues associated with the comparative static approach are accounted for automatically, such as the interactions between the level of net foreign assets and the current account, or the interaction between changes in the nominal exchange rate and domestic prices. Large macroeconomic models can also take better account of the way in which the economy moves back towards equilibrium. Potential output depends upon the capital stock and the NAIRU, which in turn depend upon many other factors, including government consumption, taxation, and structural policies. As internal equilibrium

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1/ See Edwards (1989) for a discussion of this approach. Ostry and Reinhart (1992) provide useful estimates of some important underlying parameters. See Ghosh and Ostry (1993) for an application to developing countries of the intertemporal approach to the current account.

2/ See Khan and Ostry (1991) for an analysis of some of these types of disturbances on the equilibrium exchange rate.

3/ In 1990, Williamson's figures suggest that the United States had a real exchange rate some 11 percent above its equilibrium value, while the real exchange rate for Japan and Germany were 13 and 15 percent, respectively, below their equilibrium values; the estimates were based on current account targets of a deficit of 1 percent of GDP for the United States and surpluses of 1.5 percent of GDP for Japan and Germany.

depends upon achieving full employment output, any endogenous movements in the level of potential output will influence the equilibrium exchange rate. Bayoumi et al. (1994) find that even in cases where the size of the exchange rate adjustment is similar, the effect on key economic variables such as output and absorption, can vary significantly depending on how the change in the exchange rate is brought about.

On the negative side of the ledger, large macroeconomic models are complex. Because the exchange rate depends upon all of the interactions within the model, it also depends upon the degree to which these interactions have been properly specified. The size and complexity of these models often makes it difficult to check the appropriateness of these specifications. In addition, it can be time-consuming to carry out sensitivity analysis of the results.

The value of such sensitivity analysis is illustrated by results reported in Bayoumi et al. (1994). Illustrative equilibrium exchange rates for the major industrial countries are calculated for 1971 (the period of the break-up of the Bretton Woods, fixed exchange rate system) under a number of different assumptions about the underlying elasticities, lags, and desired current accounts. Depending on the country, the estimated change in the equilibrium exchange rates varied by between 10 and 30 percent. 1/

This uncertainty, however, has to be compared with the size of real exchange rate movements over the floating rate period. For example, the real effective exchange rate for the U.S. dollar fell by roughly one third between 1985 and 1988 (see Chart 3). While this is an extreme case, it does illustrate the size of the movements in the real exchange rate that have occurred during the floating exchange rate period. Faced by such large changes in competitiveness, the estimated equilibrium exchange rate calculations may still provide some guidance in assessing the extent to which actual exchange rates are in line with the economic fundamentals underlying internal and external balance.

The approach adopted here can be compared with that outlined in earlier work on industrial-country exchange rates in IMF (1984). As might be expected, the overall approach described there is similar to that outlined in this section. However, there are also some important differences in emphasis. One is in the approach to the equilibrium current account. This paper has suggested that the equilibrium current account should be derived in the context of a more general macroeconomic approach to the balance of payments. The 1984 analysis compared underlying current account balances (which were actual current account balances adjusted for the effects of temporary disturbances, recent relative price changes, and

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1/ Using a somewhat different methodology, Williamson (1990) finds a similar level of uncertainty from the estimates of different macroeconomic models. This indicates a significant degree of uncertainty in these estimates.

cyclical positions) to the normal level of capital flows, which was based on extrapolations from past trends in international capital flows. The overall conclusion was that it was extremely difficult to arrive at a view of the normal pattern of capital for the industrial countries. Another difference is the discussion of the impact of the adjustment path upon the results. The earlier work contained little discussion of the impact of changes in levels of net international debt or in potential output.

Finally, it should be noted that there have been some empirical studies in both an industrial and developing country context that estimate relationships between real exchange rate and a given set of fundamental determinants. 1/ Although the selection of explanatory variables has differed across these studies, the investigations share a general framework wherein the real exchange rate--affected by speculative and cyclical factors in the shorter term--eventually tends toward its sustainable equilibrium path--determined by underlying structural components over the longer term. Emphasizing the role of variables such as trade and productivity disturbances, and the equilibrium stock of net foreign assets, these studies can in principle provide estimates of a sustainable equilibrium path for the real exchange rate based on a longer run perspective.

When all is said and done, the key issues in implementing the macroeconomic balance approach remains the degree of confidence with which the equilibrium level of the current account can be identified. If the equilibrium current account can be specified within a relatively narrow range, then the approach would appear to offer concrete guidance in identifying disequilibria in the international economy. On the other hand, if the plausible range for underlying external positions is very wide, then this approach will be capable of catching only quite large misalignments.

This chapter has suggested an approach to equilibrium current accounts based on the fundamental determinants of national saving and investment across countries. This in turn requires a judgment about the particular fiscal policy considered appropriate for achieving macroeconomic balance over the medium term. Some of the elements needed to reach such a judgment are available from ongoing staff surveillance activity, but the prospective dividends from refining that judgment remain considerable.

1/ Stein (1994) studies the case of the United States and links the real exchange rate to productivity and thrift proxies. Preliminary staff estimates support the finding of a long-run empirical relationship between the U.S. dollar real exchange rate and the economic fundamentals that underlie stock-flow equilibrium. Edwards (1989) estimates equilibrium exchange rates for a broad sample of developing countries.

IV. Summary and Concluding Remarks

There is widespread agreement that continuing efforts to strengthen Fund surveillance over members' exchange rate policies would be welcome. As part of these efforts, the analytical framework that is used to assess the consistency of exchange rates with economic fundamentals needs itself to be examined periodically and to be improved in light of both theoretical developments and the practical lessons of experience. This remains a challenging task--particularly in the face of evidence that structural models of exchange rate determination have thus far displayed only limited ability to explain actual movements of exchange rates.

This paper has provided a critical survey of the main methodologies that are being employed both inside and outside the Fund to assess the consistency of exchange rates with fundamentals.

The focus of Section II was on one of the key variables often used in evaluating a country's present exchange rate, namely, its international competitive position. Such an evaluation typically entails a comparison of past movements in prices or costs at home and abroad with nominal exchange rates. If such a comparison reveals a substantial gain or loss in competitiveness relative to a base period in which a country's external position was regarded as in equilibrium, there is a presumption that the current exchange rate is out of line with the equilibrium exchange rate. Study of earlier periods of external disequilibria and of exchange market pressure suggests that large changes in competitiveness were often an important factor in the generation of such pressures, thereby lending some support to this presumption. Each of the available measures of international competitiveness carries its own strengths and weaknesses. Much of the time, these different indicators of competitiveness will behave in a similar fashion, especially during periods of large swings in nominal exchange rates. That being said, the tendency of these different indicators to capture different aspects of competitiveness, as well as differences in data availability, timing, and coverage, usually make it desirable to examine them as a group to determine whether they are sending a robust signal. In a similar vein, selection of an appropriate base period (when the external position was in equilibrium) requires some sifting of alternatives, particularly since what is a good base period for the home country may not be a good base period for the partner countries involved in the comparison. The biggest problem, however, with the competitiveness approach (that is, with purchasing-power-parity calculations) is its assumption of an unchanging equilibrium exchange rate. In the real world, the equilibrium real exchange rate is affected by a host of factors--ranging from permanent changes in the terms of trade to alterations in saving and investment propensities. Other factors also contribute to significant deviations from purchasing power parity, especially over the short to medium term. In the end, therefore, competitiveness and purchasing-power-parity considerations are best viewed as an important component of any serious assessment of exchange rates--but are far from the whole story.

To get around many of the shortcomings of the competitiveness model, a more comprehensive, "macroeconomic" approach is needed. Section III of the paper described the basic elements of such a macroeconomic approach. This approach attempts to abstract from cyclical and other short-term influences on the current account by focusing on positions of internal and external balance over the medium term. The former is identified as a level of output close to potential, while inflation is being maintained at a low level. External balance is best interpreted as a current account position that reflects equilibrium levels of national saving and investment under conditions of internal balance. Shifts in fundamental economic conditions--be it the discovery of oil, or sustained inter-country differences in labor productivity, or changes in the age distribution of the population--are permitted under this approach to alter the underlying external balance and the equilibrium exchange rate as well. Suffice to say that, given the present state of the art, figuring out by how much changes in fundamental economic conditions would alter the underlying current account--country by country--remains a difficult task. The fairly wide variation in existing estimates of price and income elasticities for traded goods injects an additional source of uncertainty in the calculation of what is the required change in the exchange rate that will deliver the desired current account position.

Nonetheless, the macroeconomic balance approach represents a significant improvement over the narrower, competitiveness approach. While it cannot be expected to generate a very precise estimate of the "right" or "equilibrium" exchange rate, it yields a useful framework for drawing informed inferences about large present or prospective exchange rate misalignments. Because exchange rates are driven by financial market conditions as well as by real underlying economic fundamentals, because one cannot be very precise in identifying positions of external and internal balance, and because the role of the exchange rate in overall economic policy is different under fixed than under floating rate regimes (a nominal anchor role versus a shock absorber or external adjustment role), a considerable degree of judgment is necessary to interpret the exchange rates that are derived from the macroeconomic balance approach as being "consistent with economic fundamentals." Given the uncertainties and sources of error inevitably associated with calculating equilibrium or fundamental real exchange rates, it is clearly more realistic to think of "ranges" rather than point estimates for surveillance work.

This does <u>not</u> mean that the potential contribution of the macroeconomic balance approach is minimal. The identification and correction of relatively large misalignments at an earlier stage would itself be helpful. In this regard, the costs of a misaligned exchange rate--especially when it involves a major currency--may increase more than proportionally with the size of the misalignment. All the more reason for trying to encourage earlier adjustments in either underlying macroeconomic policies and/or exchange rates. It is also likely that as work continues on the methodology, it may well be possible to narrow the confidence bands surrounding the estimates. And last but not least, the present methodology

has to be compared to the alternatives: few would argue that the market exchange rate is always the right rate, especially in view of the past decade's experience; the performance of short-hand indicators (interest rate differentials, exchange market intervention, etc.) as predictors of exchange market pressures has been less than impressive, and back-of-the-envelope estimates of equilibrium exchange rates are typically subject to more extreme assumptions and longer leaps of faith than those associated with our approach. For now, it's the best we have.

V. Issues for Discussion

1. Do Directors agree that although indicators of competitiveness are needed for the appraisal of exchange rates, they do not completely determine the equilibrium value of the real exchange rate?

2. Do Directors view the macroeconomic balance approach as a useful supplement to the analysis of a country's international competitiveness position? In this connection, Directors may wish to comment on the characterizations of internal and external balance in the paper.

3. As the estimates of a country's equilibrium real exchange rate will necessarily lie within a fairly broad range of values, do Directors view this as vitiating the entire approach, or do they view such a range as providing useful guidance for the assessment of exchange rates and of macroeconomic and exchange rate policies in the home and partner countries?

4. As Article IV of the Articles of Agreement stipulates a particular focus of the Fund's surveillance responsibilities on the exchange rate policies of members, the staff plans to continue its analytical work on the fundamental determinants of exchange rates, including the role of macroeconomic policies. Do Directors have suggestions for avenues that they regard as particularly promising and appropriate for the staff to pursue in their efforts in this area?

References

Abuaf, N., and P. Jorion, "Purchasing Power Parity in the Long Run," Journal of Finance, Vol. 45 (1990), pp. 157-174.

Aghevli, Bijan B., Mohsin S. Khan, and Peter J. Montiel, Exchange Rate Policy in Developing Countries: Some Analytical Issues (International Monetary Fund: Washington), Occasional Paper No. 78 (March 1991).

Armington, P.S., "A Theory of Demand for Products Distinguished by Place of Production," (International Monetary Fund: Washington), Staff Papers, Vol. 16 (1969), pp. 159-78.

Artis, Michael J., and M.P. Taylor, "DEER Hunting: Misalignment, Debt Accumulation, and Desired Equilibrium Exchange Rates" (International Monetary Fund: Washington), Working Paper No. WP/93/48 (June 1993).

Artus, Jacques R., "Methods of Assessing the Long-Run Equilibrium Value of an Exchange Rate" (International Monetary Fund: Washington), Research Department, No. DM/77/124 (December 19, 1977).

Balassa, B., "The Purchasing Power Parity Doctrine: A Reappraisal," Journal of Political Economy, Vol. 72 (1964), pp. 584-596.

Baldwin, R., "Hysteresis in Import Prices: The Beachhead Effect," American Economic Review, Vol. 78 (1988), pp. 773-785.

Baldwin, R., and P. Krugman, "Persistent Trade Effects of Large Exchange Rate Shocks," Quarterly Journal of Economics, Vol. 104 (1989), pp. 635-654.

Barrell, R., and S. Wren-Lewis, "Equilibrium Exchange Rates For the G7," Discussion Paper No. 323 (Centre for Economic Policy Research: London, 1989).

Barro, Robert J., "On the Determination of the Public Debt," Journal of Political Economy, 87:5 (October 1979), pp. 940-71.

Bartolini, L., "Devaluation and Competitiveness in a Small Open Economy: Ireland 1987-1993" (International Monetary Fund: Washington), Working Paper No. WP/93/82 (1993).

Bayoumi, Tamim, Peter Clark, Steven Symansky, and Mark Taylor, "Robustness of Equilibrium Exchange Rate Calculations to Alternative Assumptions and Methodologies" (International Monetary Fund: Washington), Working Paper No. WP/94/17 (February, 1994).

Bernheim, Douglas B., "Ricardian Equivalence: An Evaluation Theory and Evidence," in Stanley Fischer (ed.), NBER Macroeconomics Annual, No. 2 (Cambridge, MA.: MIT Press, 1987), pp. 203-304.

Bosworth, Barry P., Saving and Investment in a Global Economy, Brookings Institution (Washington, 1993).

Caramazza, F., "French-German Interest Rate Differentials and Time-varying Realignment Risk" (International Monetary Fund: Washington), Staff Papers, Vol. 40, No. 3 (1993), pp. 567-583.

Chen, Z., and A. Giovannini, "The Determinants of Realignment Expectations Under the EMS: Some Empirical Regularities," NBER, Working Paper No. 4291 (1993).

Church, Keith B., "Properties of the Fundamental Equilibrium Exchange Rate in Models of the UK Economy," National Institute Economic Review (August 1992), pp. 62-70.

De Gregorio, J., A. Giovannini, and T. Krueger, "The Behavior of Nontradable Goods Prices in Europe: Evidence and Interpretation" (International Monetary Fund: Washington), Working Paper No. WP/93/45 (1993).

Dixit, A., "Hysteresis, Import Penetration, and Exchange Rate Pass-Through," Quarterly Journal of Economics, Vol. 104 (1989), pp. 205-228.

Dornbusch, R., "Equilibrium and Disequilibrium Exchange Rates," Zeitschrift fur Wirtschafund Socialwissenschaftent (1982), pp. 573-599.

_____, "Expectations and Exchange Rate Dynamics," Journal of Political Economy, Vol. 84 (1976), pp. 1161-1176.

Dueker, M.J., "Hypothesis Testing with Near-Unit Roots: The Case of Long-Run Purchasing Power Parity," Federal Reserve Bank of St. Louis (1993).

Edwards, Sebastian, Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries (Cambridge: MIT Press, 1989).

Frenkel, Jacob A., and Michael L. Mussa, "Asset Markets, Exchange Rates, and the Balance of Payments," Handbook of International Economics, Vol. II (Ch. 14), International Monetary Economics and Finance (North-Holland Press, 1985).

_____, "Purchasing Power Parity Doctrinal Perspective and Evidence from the 1920's," Journal of International Economics, Vol. 8 (1978), pp. 169-191.

Ghosh, A.T., and J.D. Ostry, "Do Capital Flows Reflect Economic Fundamentals in Developing Countries?" (International Monetary Fund: Washington), Working Paper No. 34 (April 1993).

_____, "International Capital Mobility and Optimal Current Account Behavior: An Empirical Investigation," Princeton University, Ohlin Discussion Paper No. 50 (February 1990).

Goldstein, Morris, and Mohsin Khan, "Income and Price Effects in Foreign Trade," in R.W. Jones and P.B. Kenen (eds.), Handbook of International Economics, Volume II (Elsevier Science Publishers, 1985).

Goodwin, B.K., Grennes, T., and M.K. Wohlgenant, "Testing the Law of One Price When Trade Takes Time," Journal of International Money and Finance, Vol. 9 (1990), pp. 21-40.

Gulde, A.M., and M. Schulze-Ghattas, "Aggregation of Economic Indicators Across Countries: Exchange Rate Versus PPP-Based GDP Weights" (International Monetary Fund: Washington), Working Paper No. WP/92/36 (1992).

Hakkio, C.S., "Is Purchasing Power Parity a Useful Guide to the Dollar?" Federal Reserve Bank of Kansas City Economic Review, Vol. III (1992), pp. 37-51.

Hooper, Peter, and Jaime Marquez, "Exchange Rates, Prices, and External Adjustment in the United States and Japan," Board of Governors of the Federal Reserve System (Washington), International Finance Discussion Paper No. 456 (October 1993).

International Monetary Fund (1993a), World Economic Outlook: Interim Assessment (January 1993).

_____ (1993b), "Operational Modalities and Funding Alternatives for an ESAF Successor-Preliminary Considerations," EBS/93/32 (February 26, 1993).

_____ (1993c), International Capital Markets, Part I. Exchange Rate Management and International Capital Flows (April 1993).

_____ (1993d), World Economic Outlook, Annex IV (May 1993).

_____ (1993e), Staff Studies for the World Economic Outlook, Chapter VI (December 1993).

_____ (1992a), Policy Issues in the Evolving International Monetary System, Occasional Paper No. 96 (June 1992).

_____ (1992b), "Biennial Review of the Fund's Surveillance Policy," SM/92/234 (December 30, 1992), and Supplement 1 (January 19, 1993).

_____, Characteristics of a Successful Exchange Rate System, Occasional Paper No. 82 (July 1991).

_____, Strengthening the International Monetary System: Exchange Rates, Surveillance, and Objective Indicators, Occasional Paper No. 50 (International Monetary Fund: Washington, 1987).

_____, Issues in the Assessment of the Exchange Rates of Industrial Countries, Occasional Paper No. 29 (International Monetary Fund: Washington, 1984).

Isard, Peter, "Realignment Expectations, Forward Rate Bias, and Sterilized Intervention in an Adjustable Peg Exchange Rate Model with Policy Optimization (International Monetary Fund: Washington), Working Paper forthcoming, 1994.

_____, "How Far Can We Push the Law of One Price?," American Economic Review, Vol. 67 (1977), pp. 942-48.

Khan, Mohsin S., and Jonathan Ostry, "Response of the Equilibrium Real Exchange Rate to Real Disturbances in Developing Countries" (International Monetary Fund: Washington), Working Paper No. WP/91/3 (January 1991).

Knight, Malcolm D., and Paul R. Masson, "Fiscal Policies, Net Saving, and Real Exchange Rates: The United States, the Federal Republic of Germany, and Japan," ed. by Jacob Frenkel, International Aspects of Fiscal Policies (Chicago: University of Chicago Press, 1989).

Kravis, I.B., and R.E. Lipsey, "Toward an Explanation of National Price Levels," Princeton Studies in International Finance, No. 52 (1983).

_____, and R.E. Lipsey, "Export Prices and the Transmission of Inflation," American Economic Review, Vol. 67 (1977), pp. 155-63.

Krugman, Paul R., "Equilibrium Exchange Rates," in William H. Branson, Jacob A. Frenkel and Morris Goldstein (eds.), International Policy Coordination and Exchange Rate Fluctuations (University of Chicago Press: Chicago, 1990).

_____, Exchange Rate Instability, The MIT Press (Cambridge, Massachusetts: 1989).

_____, "Purchasing Power Parity and Exchange Rates: Another Look at the Evidence," Journal of International Economics, Vol. 8 (1978), pp. 397-407.

_____, "Differences in Income Elasticities and Trends in Real Exchange Rates," European Economic Review, Vol. 33 (1989), pp. 1031-1054.

Lee, M.H., Purchasing Power Parity, Marcel Dekker (New York: New York, 1976).

Lipschitz, L., and D. McDonald, "Real Exchange Rates and Competitiveness: A Clarification of Concepts, and Some Measurements for Europe" (International Monetary Fund: Washington), Working Paper No. WP/91/25 (1991).

Lothian, J., and M.P. Taylor, "Real Exchange Rate Behavior: The Recent Float From the Perspective of the Past Two Centuries," mimeo (International Monetary Fund: Washington, 1993).

MacDonald, Ronald, and Mark P. Taylor, "Exchange Rate Economics: A Survey" (International Monetary Fund: Washington), Staff Papers, Vol. 39 (March 1992), pp. 1-57.

Mark, N., "Real and Nominal Exchange Rates in the Long Run: An Empirical Investigation," Journal of International Economics, Vol. 28 (1990), pp. 115-136.

Marquez, J., "Real Exchange Rates: Measurement and Implications for Predicting U.S. External Imbalances," International Finance Discussion Papers No. 427, Federal Reserve Board (1992).

Marsh, I., and S. Tokarick, "Competitiveness Indicators: A Theoretical and Empirical Assessment" (International Monetary Fund: Washington), mimeo (1994).

Marston, R., "Real Exchange Rates and Productivity Growth in the United States and Japan," in S. Arndt (ed.), Real-Financial Linkages in the Open Economy (American Enterprise Institute: Washington, 1987).

Masson, Paul R., Jerome Kremers, and Jocelyn Horne, "Net Foreign Assets and International Adjustment" (International Monetary Fund: Washington), Working Paper No. WP/93/33 (1993).

_____, and Ralph W. Tryon, "Macroeconomic Effects of Projected Population Aging in Industrial Countries" (International Monetary Fund: Washington), Staff Papers, Vol. 37, No. 3 (1991), pp. 453-485.

_____, and Guy Meredith, "Domestic and International Macroeconomic Consequences of Germany Unification," in German Unification: Economic Issues, edited by Leslie Lipschitz and Donogh McDonald (International Monetary Fund: Washington), Occasional Paper No. 75 (1990).

McGuirk, A.K., "Measuring Price Competitiveness for Industrial Country Trade in Manufactures" (International Monetary Fund: Washington), Working Paper No. WP/87/34 (1987).

Mendoza, Enrique, "The Terms of Trade and Economic Fluctuations" (International Monetary Fund: Washington), Working Paper No. WP/92/98 (1992).

Meredith, Guy, "Revisiting Japan's External Adjustment Since 1985" (International Monetary Fund: Washington), Working Paper No. WP/93/52 (June 1993).

Meese, R.A., and K. Rogoff, "Empirical Exchange Rate Models of the Seventies. Do They Fit Out of Sample?," Journal of International Economics, Vol. 14, pp. 3-24 (1983).

Micossi, S., and G.M. Milesi-Ferretti, "Real Exchange rates and the Prices of Non-Tradable Goods," International Monetary Fund, mimeo (1993).

Nurkse, R., "Conditions of International Monetary Equilibrium," reprinted in Peter B. Kenen, editor, The International Monetary System: Highlights from Fifty Years of Princeton's Essay's in International Finance, Westview Press: Boulder, Colorado (1993).

OECD, Purchasing Power Parities and Real Expenditures 1985 (Paris, 1987).

Officer, L.H., Purchasing Power Parity and Exchange Rates: Theory, Evidence and Relevance (Greenwich, CT: JAI Press, 1982).

Ohno, K., "Estimating Yen/Dollar and Mark/Dollar Purchasing Power Parities" (International Monetary Fund: Washington), Staff Papers, Vol. 37, No. 3 (1990), pp. 700-725.

Ostry, Jonathan D., "The Balance of Trade, Terms of Trade, and Real Exchange Rate" (International Monetary Fund: Washington), Staff Papers, Vol. 35, No. 4 (1988), pp. 541-73.

_____, and Carmen M. Reinhart, "Private Saving and Terms of Trade Shocks" (International Monetary Fund: Washington), Staff Papers, Vol. 39, No. 3 (1992), pp. 495-517.

Razin, Assaf, "The Dynamic-Optimizing Approach to the Current Account: Theory and Evidence," NBER Working Paper No. 4334 (April 1993).

Rose, A.K., and L. Svensson, "European Exchange Rate Credibility Before the Fall," Centre for Economic Policy Research, Discussion Paper No. 852 (1993).

Sachs, Jeffrey, "The Current Account and Macroeconomic Adjustment in the 1980s," Brookings Papers on Economic Activity, Vol. 12 (1981), pp. 201-68.

Stein, Jerome L., "The Natural Real Exchange Rate of the U.S. Dollar and Determinants of Capital Flows," forthcoming in John Williamson (ed.), Equilibrium Exchange Rates, Institute for International Finance (Washington, 1994).

Svensson, L., "Assessing Target Zone Credibility: Mean Reversion and Devaluation Expectations in the EMS," European Economic Review, No. 37 (1993), pp. 763-802.

Swan, T.W. (1963), "Longer-Run Problems of the Balance of Payments," in: H.W. Arndt and W.M. Corden, eds., The Australian Economy: A Volume of Readings, Cheshire Press, Melbourne, pp. 384-395. Reprinted in: R.E. Caves and H.G. Johnson, eds., Readings in International Economics, Irwin, Homewood (1968), pp. 455-464.

Taylor, Mark P., "Exchange-Rate Behavior Under Alternative Exchange Rate Regimes," forthcoming in Peter B. Kenen (ed.), Understanding Interdependence: The Macroeconomics of the Open Economy, Princeton: New Jersey (Princeton University Press, 1994).

Thomas, A., "Expected Devaluation and Economic Fundamentals" (International Monetary Fund: Washington), Working Paper No. WP/93/83 (1993).

Turner, P., and J. Van't dack, Measuring International Price and Cost Competitiveness, BIS Economic Papers, Basle (1993).

Wickham, P., "A Revised Weighing Scheme for Indicators of Effective Exchange Rates" (International Monetary Fund: Washington), Working Paper No. WP/87/87 (1987).

_____, "A Cautionary Note on the Use of Exchange Rate Indicators," (International Monetary Fund: Washington), Paper on Policy Analysis and Assessment, PPAA/93/5 (1993).

Williamson, John, "Equilibrium Exchange Rates: An Update," unpublished paper (Institute of International Economics: Washington, 1990).

_____, The Exchange Rate System, Institute for International Economics (Washington, 1985).

Wren-Lewis, Simon, P. Westaway, S. Soteri, and R. Barrell, "Evaluating the United Kingdom's Choice of Entry Rate Into the ERM," Manchester School, Vol. 59, Supplement (1991), pp. 1-22.