SPECIAL PAPERS IN INTERNATIONAL ECONOMICS
No. 13, DECEMBER 1979

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LOUKA T. KATSELI-PAPAEFSTRATIOU

INTERNATIONAL FINANCE SECTION
DEPARTMENT OF ECONOMICS
PRINCETON UNIVERSITY · 1979

*This is the thirteenth number in the series* SPECIAL PAPERS IN INTERNATIONAL ECONOMICS, *published from time to time by the International Finance Section of the Department of Economics at Princeton University.*

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**Library of Congress Cataloging in Publication Data**

Katseli-Papaefstratiou, Louka T 1952-
The reemergence of the purchasing power parity doctrine in the 1970s.

(Special papers in international economics ; no. 13 ISSN 0081-3559)
Bibliography: p.
1. Foreign exchange—Mathematical models. I. Title. II. Title: Purchasing power parity doctrine in the 1970s. Princeton University. International Finance Section. Special papers in international economics ; no. 13. III. Series.
HG3821.K36 332.4'5 79-25140



Printed in the United States of America by Princeton University Press at Princeton, New Jersey.

International Standard Serial number: 0081-3559

Library of Congress Catalog Card Number: 79-25140

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"Each generation must rekill its phoenixes."

*Samuelson, "Theoretical Notes on Trade Problems"*

# 1 Introduction

In June 1977 the Ford Foundation, in collaboration with the Central Bank of Greece, sponsored a two-day conference on Purchasing Power Parity (PPP). The papers presented at that symposium were published by the *Journal of International Economics* in its May 1978 issue. They cover a wide area related to exchange rates and prices, from analyses of the historical evidence in the early 1920s to the use of PPP as partial guidance for exchange-rate management.

The conference in Athens was the most recent round of a debate that formally started in the 1920s and continued in the 1940s and later on in the 1960s.[1] The resurgence of interest in PPP in the 1970s can be attributed mainly to our recent experience with flexible exchange rates and, more specifically, to the highly volatile nature of their movement. The wide and often unanticipated fluctuations in the prices of key currencies have increased uncertainty in international financial markets and intensified the search for the "fundamental relationships" that determine the equilibrium value of real exchange rates both in the short and the long run. In such an environment, the PPP doctrine provides a convenient starting point for analyzing the determinants of the equilibrium value of the real exchange rate.

Despite the extensive literature on the subject, PPP remains an elusive concept, defined and used differently by different authors. While it is probably true that "under the skin of any international economist lies a deep-seated belief in some variant of the PPP theory of the exchange rate" (Dornbusch and Krugman, 1976, p. 540), the variants cover a wide range from simple truisms to more sophisticated theories of exchange-rate determination.

The theoretical foundations of PPP have been further obscured by the form of the empirical tests of the relationship. The very nature of regression analysis, the econometric tool most often used in recent empirical studies, has sometimes conveyed the erroneous impression

I am grateful to Jacques Artus, William H. Branson, Carlos Díaz-Alejandro, Rudiger Dornbusch, Hans Genberg, Dwight Jaffee, Irving B. Kravis, and Paul Krugman for their helpful comments and suggestions.

[1] For a comprehensive survey of the literature and the debates surrounding PPP as it has evolved historically, see Officer (1976) and Isard (1978).

that PPP is a causal relationship between relative price levels and the exchange rate (the absolute version of PPP) or between their rates of change (the relative version of PPP), even though a regression, per se, cannot establish causation between variables. Given this framework, debates on either version of PPP have focused on such issues as the appropriate price vector (or index) to be used, the appropriate base period for time-series analysis, and the presence of systematic divergences of internal price ratios that would involve consistent biases in the computation of PPP from general price levels. However important such issues might be for meaningful empirical tests of the PPP doctrine, they have overshadowed a number of more fundamental theoretical questions.

It is the objective of this paper to focus on and disentangle the sometimes implicit and foggy statements about PPP that have been submerged by attempts to prove or disprove its empirical validity. In that respect, at least methodologically, this review paper is an extension, if not a restatement, of Samuelson's 1964 paper on the subject, in the sense that more emphasis is placed on the underlying theoretical structure than on the characteristics of competing versions of PPP. This approach is also in line with the spirit of the most recent literature (Myhrman, 1976; Isard, 1978; Michaely, 1978), as well as the papers that were presented in Athens. A related concept, cost parity, is not discussed in this paper, since a good summary and evaluation of the major studies can be found in Officer (1976).

Chapter 2 provides a survey of competing interpretations of PPP: (a) as a spatial- or commodity-arbitrage relationship; (b) as an imposed condition within the context of the monetary approach to the balance of payments, a condition that is usually identified with a "causal" relationship running from relative price levels to exchange rates; and, finally, (c) as a reduced-form relationship between two endogenous variables (the relative price level and the exchange rate), both of which are determined jointly as functions of exogenous variables. There are important differences across these views regarding the kinds of disturbances that are assumed to be prevalent (real vs. monetary), the process of exchange-rate determination, and the time horizon pertinent to the analysis. As will be seen in Chapter 2, these give rise to different hypotheses as to the nature of the PPP relationship, its validity, and its relevance as a policy tool.

Chapter 3 reviews recent empirical studies on PPP, in terms of both methodology and most important findings. The theoretical distinctions drawn in Chapter 2 carry over to the empirical work, which can be

divided into (a) tests of the commodity-arbitrage relationship, (b) tests of the international propagation of disturbances under fixed exchange rates, (c) "causality" tests that run from prices to exchange rates, and (d) tests of real exchange-rate variability. Chapter 3 also reviews the typical methodological questions that have been raised in reference to empirical work on PPP, such as the choice of the price index, weighting scheme, and base year; the identification of commodities and historical periods; and the process by which results are evaluated.

The concluding section evaluates the usefulness of PPP in light of recent events and in the context of a wider search for meaningful criteria for exchange-rate management.

# 2 Purchasing Power Parity: Alternative Interpretations

Starting from the premise that exchange rates are generally kept in line with relative price levels, PPP states that the equilibrium values of currencies should be intimately linked to their internal purchasing power. In its *absolute* version, PPP implies that the equilibrium value of the exchange rate between the currencies of any pair of countries should be equal to the ratio of the countries' price levels; in its *relative* version, that the rate of change of the exchange rate should be equal to the difference in the rates of inflation. In logarithmic terms, the absolute version asserts that

$$lnS_t = ln\,(P_t / P_t^*), \tag{1}$$

while the relative version asserts that

$$\Delta lnS_t = \Delta lnP_t - \Delta lnP_t^*, \tag{1'}$$

where $S_t$ = ratio of domestic to foreign currency units at time $t$
$P_t$ = domestic price index
$P_t^*$ = foreign price index.

Thus PPP is both a positive and a normative hypothesis about the value of bilateral or effective real exchange rates, which, if the theory holds, should be unity in long-run equilibrium.

As was suggested in the Introduction, a careful review of the literature would indicate that there are at least three theoretical interpretations of PPP.

*PPP as a Spatial-Arbitrage Relationship*

The view of PPP as a spatial-arbitrage relationship equates it with what is commonly known as the "law of one price." At the individual commodity level, perfect arbitrage would ensure that the price of each commodity is equalized across countries. In that case, the domestic price of a foreign currency would equal the ratio of the internal price of the commodity in question to its foreign price, and the same holds true for its rate of change. In other words, for each commodity $j$,

$$S_t = P_{j,t} / P_{j,t}^* \qquad j = 1,2,3, \ldots, \tag{2}$$

or, in the relative version,

$$\Delta lnS_t = \Delta lnP_{j,t} - \Delta lnP^*_{j,t}, \qquad (2')$$

where $P_j$ = domestic price of commodity $j$
$P^*_j$ = foreign price of commodity $j$

It should be clear that equation (2) would hold only in the case of perfect information in the commodity markets and in the absence of transport costs, trade impediments, and price discrimination. Equation (2′) would hold only in the absence of asymmetric changes in transport costs and trade impediments. As shown in Chapter 3, the presence of market imperfections is significant enough to put seriously in question the validity of perfect commodity arbitrage even on an individual commodity level.

Even if arbitrage could ensure that export prices of identical goods originating in different countries but denominated in a common currency were the same, this would not necessarily imply an invariant competitive relationship among countries or invariant relative opportunity costs of production. Thus PPP calculations based upon the price of homogeneous commodities come close to being trivial.

Moving from spatial arbitrage for individual commodities to larger subsets of homogeneous goods, one is faced with even more serious problems. If equation (2) holds for each commodity, then it will hold for any equally weighted price index. As Samuelson (1964) points out, if individual countries use different weights in computing price indexes, there can be no reason to expect the "law of one price," as reflected by equation (2), to hold for indexes across countries.

These aggregation problems tend to be significant, since countries' tastes, economic structures, and accounting practices vary widely. Along with informational imperfections and the presence and asymmetries of trade impediments, they make the international equalization of traded-good prices highly improbable both on the individual and aggregate commodity levels.

The assumption of equalization of traded-good prices through PPP obscures the distinction between the actual and the equilibrium real exchange rate. As Samuelson (1964, p. 147) points out, if trade costs and impediments were zero and accounting practices were identical, "every ruling exchange rate would turn out to be the PPP equilibrium rate." In econometric applications, computed results turn out to be different from those predicted by PPP precisely because of such different weights and the presence of transportation costs and trade

impediments. Testing the "law of one price" thus becomes a test of the magnitude and importance of trade distortions, cross-country asymmetries, and information lags.

Frenkel (1978, p. 172) notes that those who adopt a strict view of PPP as a traded-good arbitrage relationship tend to advocate the use of traded-good prices rather than more general price series for meaningful tests of PPP. Emphasis on individual commodity prices, however, is not synonymous with espousal of a commodity-arbitrage view. For example, the following statement by Ohlin (1967, p. 290) is quoted by Frenkel (1978) as representative of the commodity-arbitrage view: "Foreign exchange rates have nothing to do with the wholesale commodity price level as such but only with individual prices. . . ." Ohlin's point, however, taken in context, is that the use of aggregate price levels does not imply anything about the equilibrium exchange rate and that "changes in individual prices may be relevant [for exchange-rate determination], even though the level of commodity prices happens to be constant."

The spatial-arbitrage hypothesis has also been applied to broader price indexes; in such cases, a wider definition of PPP is invoked, where the use of aggregate price levels or indexes such as the consumer price index or the GNP deflator is justified on the ground that prices of traded and nontraded commodities move together. The extreme position often typical of monetarist models is that countries produce one homogeneous good whose price is equalized across countries through perfect commodity arbitrage. More frequently, nontraded goods are explicitly introduced, but their prices are kept in line with those of traded goods through high degrees of substitution in consumption or production.

The price adjustment for nontraded goods is assumed in most cases to be instantaneous; as Dornbusch (1978, p. 5) notes, this assumption disregards the potential limited substitutability between supply sources, the overall state of slack in the economy, and the expected persistence of relative price changes. It also disregards the presence of biases in the calculated PPP relationship due to systematic divergences of internal price ratios across countries. Balassa (1961, 1964) and others have demonstrated (see Officer, 1976, for an extensive review) that even if perfect commodity arbitrage ensures the equalization of prices of traded goods, higher productivity growth in the nontraded-good sector of advanced countries, relative to that in less advanced countries, would require a rising internal price ratio of traded to nontraded goods in the advanced country. Thus, high substituta-

bility in demand among goods is not a sufficient condition for the use of general price indexes to test for PPP. Officer (1976, p. 22) points out that a similar shortcoming would arise in tests of the relative version of PPP if there is a systematic "increase (decrease) over time in the advanced country's productivity advantage." The fact that productivity or other structural differences across countries can cause differences in internal relative prices is one of the most serious criticisms of the PPP relationship. As we shall see, this criticism applies equally well to both "causal" and "equilibrium" views of the PPP doctrine.

The preceding discussion leads to the conclusion that the spatial-arbitrage hypothesis, which might be valid for a subset of homogeneous commodities, should not be invoked on behalf of a broader definition of PPP unless one is prepared to argue that prices of traded and nontraded goods always move in unison.

Despite these criticisms, the spatial-arbitrage approach to PPP is widely adopted in studies concerning the international transmission of inflation under fixed exchange rates. According to Genberg (1978),

> Discussions of the transmission of inflation naturally start with a price increase abroad and then try to identify the channel by which domestic prices are affected. The most common such channel is probably that suggested by the arbitrage hypothesis. This hypothesis, which is also referred to as the traded goods model of the 'law of one price,' simply states that the price of a homogeneous commodity must be the same in all countries provided the market for this commodity is internationally integrated . . . (p. 248).

Thus,

> PPP under fixed exchange rates implies that inflation rates must, subject to certain reservations, be equal in all countries of an integrated world economy . . . (p. 252).

A similar view of PPP under fixed exchange rates characterizes a number of other studies on the international transmission of price disturbances, such as those by Dornbusch (1973), Connolly and Taylor (1976), Swoboda (1977), and Katseli-Papaefstratiou (1979). Aside from differences in the particular structure of the models, all of these studies share the same underlying assumptions—perfectly integrated commodity markets for traded goods and high substitutability of nontraded and internationally traded commodities.

The identification of PPP with a spatial commodity-arbitrage relationship also applies to models of flexible exchange rates. For example, in their study of short-run exchange-rate determination, Dornbusch and Krugman (1976) identify and evaluate the PPP doctrine as essen-

tially a spatial-arbitrage relationship. Their criticism of PPP focuses on the unrealistic nature of such assumptions as the perfect integration of commodity markets (the "law of one price"), no transport costs or duties (pertinent to the absolute version of PPP), and constant terms of trade following external disturbances (pertinent to the relative version of PPP). As they themselves note, however, these assumptions are not necessary in a Casselian "neutral-money" model in which PPP is not at all dependent on arbitrage.

Haberler (1975, p. 24) adopts a view similar to Dornbusch and Krugman's as to the nature of the PPP doctrine: "The proposition that general price levels in different countries are connected through the prices of internationally traded goods is the foundation of the PPP doctrine. . . ." Similarly, Wihlborg (1978, p. 4) argues that "PPP between two currencies/countries, holds when *all* commodities have the same price in both countries. . . ." In their studies, Kravis and Lipsey (1971, 1974, 1977, 1978) identify their tests of the "law of one price" and the behavior of relative prices as tests of the PPP relationship and the pure monetarist approach to the balance of payments. Thus, the identification of PPP with perfect commodity arbitrage is quite common even in recent literature. The accompanying table summarizes the main objections raised in reference to this view.

*PPP within the Context of the Monetary Approach to the Balance of Payments*

In their writings on PPP, Cassel (1916, 1918, 1921, 1928) and Keynes (1923) focused on the determination of the equilibrium value of exchange rates. Cassel (1921, p. 38) wrote:

> The purchasing power parities represent the true equilibrium of the exchanges, and it is of great practical value to know those parities. It is in fact to them we have to refer when we wish to get an idea of the real value of currencies whose exchanges are subject to arbitrary and sometimes wild fluctuations. . . .

In some of his earlier writings, Cassel used for PPP the equivalent term "theoretical rate of exchange." It is thus apparent that PPP, at least for its originator,[1] was the equilibrium value of the real exchange rate quite distinct from the observed real exchange rate. Despite this view, neither the separation between short run and long run nor the distinction between an equilibrium and a causal relationship are alto-

[1] Whether or not Cassel was the founder of the PPP doctrine is still a disputable point; he was the first, however, to formalize the concept as it is presently known and to test it empirically.

| *Argument* | *Major Objections* | |
|---|---|---|
| | *Absolute Version* | *Relative Version* |
| Perfect arbitrage on the individual commodity level for traded goods | $S_t = P_{j,t} / P^*_{j,t}$<br>Imperfect information<br>Absence of transportation costs and trade impediments<br>Price discrimination | $\Delta lnS_t = \Delta lnP_{j,t} - \Delta lnP^*_{j,t}$<br>Imperfect information<br>Asymmetric changes in transportation costs and trade impediments |
| Perfect arbitrage of traded goods, where $P_{T,t} = \sum_{j=1}^{n} w_j P_{j,t}$ | $S_t = P_{T,t} / P^*_{T,t}$<br>All of the above *and*<br>Differences in weights<br>Distinction between actual and equilibrium exchange rates | $\Delta lnS_t = \Delta lnP_{T,t} - \Delta lnP^*_{T,t}$<br>All of the above *and*<br>Asymmetric changes in weights |
| Perfect arbitrage across all goods | $S_t = P_t / P^*_t$<br>All of the above *and*<br>Biases due to systematic differences in levels of productivity in the nontraded-good sectors<br>Low substitutability between traded and nontraded goods in consumption or production | $\Delta lnS_t = \Delta lnP_t - \Delta lnP^*_t$<br>All of the above *and*<br>Biases due to systematic differences in rates of changes of productivity in nontraded-good sectors |

gether clear in the literature. This is mainly due to the fact that PPP was, and still is, seen by many authors as an extension of the quantity theory of money in an open economy.[2] In his insightful review of the early debates on exchange-rate determination, Myhrman (1976) stresses the similarities between the positions held by the Cap party in eighteenth-century Sweden or by the Bullionists in England fifty years later and those held in our day by the proponents of the monetary approach to the balance of payments. According to both Ricardo (1810, 1817) and Wheatley (1803, 1807, 1819), two of the most prominent Bullionists, both the price level and consequently the exchange rate were determined by the quantity of note issues; the effects of real disturbances such as food shortages, changes in emigrant remittances, or military expenditures could be only temporary, since they were fully anticipated by private market participants.

If at some initial equilibrium position PPP holds, so that the ex-

[2] The evaluation of Cassel's position is harder (see Holmes, 1967).

change rate for two countries is inversely proportional to the ratio of their price levels, an expansion in the monetary base will increase the overall domestic price level under full-employment conditions without affecting relative commodity prices. The same might possibly hold true, as Michaely (1978) points out, in the case of some real disturbances such as economic growth or an increase in the foreign price level, if their effects are "neutral," that is, succeed in maintaining the same level of excess demand in the system for all commodities and assets. As this "neutrality" tends to be unlikely, however, in the presence of real disturbances, the theory has been cast traditionally in terms of monetary shocks.

The ensuing change in the internal price level following a monetary disturbance will then be completely offset by a change in the nominal exchange rate, "there being no other reason for the fluctuations of exchange than to maintain the par of produce. . ." (Wheatley, 1819, p. 21). Thus, PPP in this framework is intimately linked to (a) the dominance of monetary disturbances, (b) the quantity theory of money, and (c) the notion that the purpose of purchasing foreign exchange is to secure purchasing power in some particular currency (Kalamotousakis, 1978, p. 164).

This version of PPP theory is consistent with a clearly established causal relationship that, as we have seen, runs from monetary disturbances to the price level and then to exchange rates. So long as the price level is determined by the money stock, and velocity and real income are held constant, the only truly endogenous variable is the exchange rate. This line of argument is also at the core of the monetary theory of the balance of payments (Frenkel, 1976; Bilson, 1978a) and is implicit in a number of econometric tests of the PPP relationship that regress the exchange rate on relative prices (see Chap. 3 for an extensive review).

As was pointed out in the discussion at the Athens conference, the issue raised here is analogous to that posed by interest parity, or even by the Phillips-curve relationship in a closed-economy framework. In all three cases there is a stipulated reduced-form relationship between two variables that requires a theory behind it to become operationally meaningful.

Even as early as the 1920s, criticism of the PPP causal relationship, as presented schematically above, developed along the following distinct lines:

On the empirical side, the operational validity of the concept was

questioned in view of the inherent econometric problems posed by tests of either the absolute or relative versions of the PPP relationship (choice of base period, change in trade impediments, productivity differences, etc.).

On the theoretical level, the major objections focused either on the value of the long-run equilibrium real exchange rate, most notably by Keynes (1923) or, more typically, on the specified process of short-run exchange-rate determination. Regarding the first set of objections, the main point of contention had to do with the importance of the exogenous disturbances and their implication for the reestablishment of PPP.

In his *Tract on Monetary Reform*, Keynes (1923), argued that if disturbances are monetary, "then we may expect that purchasing power parity and exchange value will come together again before long" (p. 95). If, however, disturbances are on account of movements of capital, or reparation payments, or changes in the relative efficiency of labor, "then the equilibrium point between purchasing power parity and the rate of exchange may be modified permanently" (p. 97) as a result of disturbances in the "equations of exchange." A similar point was made later by Taussig (1941, pp. 357ff.), who argued that "If something happens to disturb the conditions of demand for export or imports; or if invisible items enter which disturb the barter terms of trade—then the purchasing power parity does not hold." Thus, the dominance of monetary disturbances was shown to be crucial for the continuation of PPP as the equilibrium value for the real exchange rate. Nonmonetary disturbances and real structural changes would, in all probability, change relative prices internally and cause substantial deviations of the equilibrium real exchange rate from its PPP level (Samuelson, 1964; Officer, 1976).

The traditional formulation of PPP was more widely questioned, however, for its stipulated links between prices and exchange rates (Zolotas, 1928; Einzig, 1935). It was argued that both government and private participants can intervene in the foreign-exchange market for portfolio-allocation purposes rather than for the procurement of foreign exchange to meet current-account flows. Kalamotousakis's (1978) review of Zolotas's contribution to the PPP debate, for example, points to the latter's discussion of "qualitative factors" behind the process of exchange-rate determination. As early as 1928, Zolotas argued that under conditions of "instability" in international financial markets, the desire to secure purchasing power becomes less important than "quali-

tative motives," namely, the desire to place funds abroad and to hedge or even speculate against losses from a potential devaluation of the national currency (Kalamotousakis, 1978, p. 165). This view is essentially the same as the asset-market view expounded and formalized recently by Branson (1975), Dornbusch (1976), Kouri (1976), and others. In such a world, expectations about future exchange-rate developments are important determinants of activity in the foreign-exchange markets and can cause substantial deviations of the real exchange rate from its PPP level.

There were also objections to the specified lines of causality from the price level to the exchange rate. According to Angell (1926, p. 447):

> Neither prices nor the exchanges can properly be regarded as having been the "cause" of the general movement in any specific case. Nor was the level of either, except in a very immediate sense, even the "result" of the other's fluctuations. Rather, both prices and exchange movements were common products of a common antecedent condition. . . .

Since the monetary view of PPP is intimately linked to the theoretical framework underlying it, similar objections could be, and have been, raised against recent tests of the PPP relationship that adopt the monetary approach to the balance of payments. Even though the authors talk of PPP as a long-run equilibrium relationship and even though, as Frenkel (1978, p. 183) notes, "there is no statistical method that is capable of determining causality in its conventional sense," they still assume a causal argument running from the money stock to the exchange rate through the price level. PPP is not a truly reduced-form relationship that can be tested only by regressing the real exchange rate on a number of exogenous variables. Instead, PPP is invoked by imposing spatial arbitrage as an independent behavioral condition that constrains to unity the equilibrium value of the real exchange rate. Such a use of spatial arbitrage, however, would be permissible only under the very restrictive assumptions specified earlier.

As a final point, it should be noted that the distinction between short and long run was at best implicit in early theoretical formulations. The focus on the steady-state or long-run properties of the system bypassed issues concerning the short-run adjustment process and the time lag involved before reestablishment of PPP. Furthermore, the distinction between short and long run was assumed to depend solely on the speed of adjustment of participants. Some of these issues have been directly addressed and resolved in models that adopt an asset-market approach to exchange-rate determination.

*PPP as a Reduced-Form Relationship*

The causal view of PPP described earlier has been traditionally linked to a world view in which exchange rates clear commodity markets and are thus determined by current flows of goods and services across countries. Changes in the aggregate price level give rise to changes in comparative advantage and through trade flows inversely affect the price of domestic currencies. Thus, according to Cassel (1921, p. 36), ". . . our willingness to pay a certain price for a foreign money must ultimately and essentially depend on the fact that this money has a purchasing power as against commodities and services in the foreign country. . . ."

Most of the recent literature on exchange-rate determination views exchange rates as being determined jointly with interest rates in asset markets. It is thus the values of the existing *stocks* of money, real capital, bonds, and foreign assets, together with the rate of flow of government purchases, the tax structure, and expectations, that determine short-run equilibrium values for the flow of real income, the vectors of interest rates and prices, and the values of nominal exchange rates. These in turn yield values for investment, the government deficit, and the current account which cause gradual changes in the initial stocks of assets that were assumed constant in the short run. Long-run stock equilibrium can thus be identified as the state in which saving, investment, and the government and current-account deficits are all zero (Tobin, 1969; Branson, 1972, 1976; Kouri, 1976; Dornbusch, 1976).

What is the place of PPP in such a view? The asset-market approach fully recognizes and integrates in a consistent framework most of the objections reviewed earlier against a monetary approach to real exchange-rate determination. It focuses on the endogenous and simultaneous determination of exchange rates and prices; it incorporates the role of government and private exchange-market participants as portfolio holders of domestic and foreign-denominated assets; it explicitly introduces expectations as an important determinant of real exchange rates; finally, it draws a sharp distinction between short-run and long-run equilibrium real exchange rates. The long-run equilibrium real exchange rate is that rate which is consistent with a zero current-account balance.[3] Its value will depend on all the real de-

[3] In a growing world, long-run equilibrium for a single country can be identified with a positive accumulation of foreign assets. The current-account balance need not be zero.

terminants of the current account. There is no *a priori* reason to expect this to be the PPP value of unity.

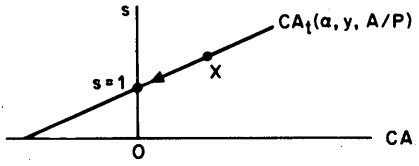
To clarify this point, it might be helpful to think of the current-account balance ($CA$) as a function of the real exchange rate ($s$), real income ($y$), the real value of assets ($A/P$), and a shift parameter ($a$), so that

$$CA = CA(s, y, A/P, a). \tag{3}$$

It should be noted that, in the absence of nontraded goods, the real exchange rate is equal to the terms of trade.

Assuming PPP to hold at some initial period and noting that the current-account balance is, *ceteris paribus*, an increasing function of the real exchange rate, equation (3) can be presented diagrammatically as in Figure 1. If spatial arbitrage is imposed as an independent condition, as in the monetarist models described earlier, the real exchange rate is constrained to be unity and the $CA$ function is infinitely elastic with respect to $s$; the $CA$ curve is then horizontal and cuts the $s$ axis at unity.

FIGURE 1
RESPONSIVENESS OF THE CURRENT ACCOUNT TO THE REAL EXCHANGE RATE




A neutral disturbance in Michaely's (1978) sense causes a depreciation of the short-run exchange rate and leaves domestic relative prices unchanged; it thus improves the current-account balance if trade elasticities are not too low (point $x$). In the long run, PPP could be reestablished as the current-account surplus induces a net accumulation of foreign assets and causes the real exchange rate to appreciate back to its initial value. Whether or not PPP is reestablished, even in the case of a monetary disturbance, depends critically on whether or not the $CA$ curve has shifted in the process owing to wealth effects or to interest payments on holdings of foreign assets. If it is assumed that these are negligible or that they cancel each other, then PPP will in fact be reestablished.

If the disturbance is identified instead with a change in the shift parameter ($a$), the value of the long-run equilibrium real exchange rate is even more unclear. In terms of Figure 1, such a disturbance will necessarily involve an upward or downward shift of the *CA* function. A permanent decrease in emigrant remittances, for example, will shift the *CA* function upward, causing a long-run depreciation of the real exchange rate. Thus, even though the portfolio-balance approach makes both prices and exchange rates truly endogenous, PPP's validity as an equilibrium condition critically depends, once again, on the nature of external disturbances.

Transmission lags are also important. Even in the case of monetary or neutral disturbances, the long-run equilibrium real exchange rate might deviate from PPP if the "balance of payments is quickly affected by monetary policy measures whereas price level influences are subject to longer lags" (Genberg, 1978, p. 262). Alternatively, the long-run equilibrium real exchange rate might be close to PPP even in the case of real disturbances if these are quickly transmitted across countries and affect the two economies symmetrically (Genberg, 1978, p. 262). In that case, the current-account balance between the relevant countries will not be affected and the *CA* function will not shift.

These points are not always clear in the literature. Officer (1976, p. 3), for example, argues that PPP "is either the long-run equilibrium exchange rate or the principal determinant of it," even though PPP might have nothing to do with the long-run equilibrium real exchange rate, as we have seen. An excellent summary of the asset-market approach is presented by Artus (1978), who points out its consistency with the large exchange-rate fluctuations observed since 1973. But his analysis of the role of PPP in such a system is confusing:

> As to the evolution of the exchange rate in the longer run . . . the asset-market view is fully consistent with the traditional view that it is essentially determined by the purchasing power of the currency in the goods markets. . . . Deviations of the exchange rate from its PPP value will be self-correcting in the long run because they will give rise to current account imbalances and a gradual change in the exchange rate . . . (p. 283).

And later on,

> The long-run equilibrium value of the exchange rate is, of course, a function not of the current PPP value of the currency, but of its prospective value. There are as many such values as sets of alternative monetary and fiscal policies . . . (p. 283).

Artus apparently identifies PPP with the long-run equilibrium real exchange rate, that is, with the value of the exchange rate that will cause the current-account balance to equal its desired long-run value, given the domestic and foreign price levels. As we have seen, however, the PPP value of the exchange rate need not coincide with the long-run equilibrium exchange rate. Thus, his statement that "the long-run equilibrium exchange rate $S^*$ is defined as the expected purchasing power parity between the currencies of the country considered and those of the rest of the world one to two years ahead" (Artus, 1978, p. 285) will be true only if certain restrictive assumptions are made regarding the nature and subsequent effects of exogenous disturbances.

Despite these and similar statements regarding the nature of PPP, there seems to be a consensus in the literature as to the limitations of the theory and its dependence on monetary or "neutral" disturbances. In their criticism of the PPP relationship, for example, Kravis and Lipsey (1978, p. 198) argue that the theory "precludes the possibility that a country as a matter of policy maintains an (exchange-rate converted) price level that is lower than that of its rivals and thereby achieves export-led growth for any sustained period." According to these authors, this approach "tends to minimize the possibility of lasting changes in the quantity composition of exports and imports or in their price structure." Similar reservations are shared by Genberg (1978, p. 273) in the conclusion of his empirical study:

> On the other hand serious problems could arise if a true bias were ignored in the design of target zones or surveillance indicators for exchange rates based on PPP. A similar difficulty, which is probably harder to handle, appears if PPP relationships, measured by commonly used indexes, tend to shift with changes in relative prices of traded goods as it appears that they do based on the preliminary estimates presented here. . . .

Finally, Thygesen (1978, p. 315) uses similar reasoning to caution against strict adherence to PPP rules for exchange-rate management:

> The second [objection] is that the rule would hinder changes in real exchange rates, i.e. departures from PPP, which are necessary for better external equilibrium. . . . If, indeed, real exchange-rate changes are necessary, because real disturbances are sizeable . . . external imbalances would be perpetuated by a rule which systematically blocked departures from PPP. . . .

These reservations and the preceding discussion give us the theoretical perspective to appraise empirical tests of the PPP relationship—tests that have been numerous and often inconclusive.

# 3 Purchasing Power Parity: Recent Empirical Findings

Empirical studies of the PPP relationship have been used for a variety of purposes by policy makers and academic economists. Thus PPP has been used as a test of the commodity-arbitrage relationship, as a criterion for setting new exchange rates, as a tool for assessing exchange-rate disequilibria under both fixed and flexible exchange-rate regimes, and finally as a method of evaluating the rationality of exchange-rate policies of state trading economies. Officer (1976) has presented a comprehensive overview of the literature up to the early 1970s. Since then, a number of new studies have applied either more rigorous econometric techniques to the study of traditional questions or existing methodology to the analysis of recurrent processes, such as the transmission of external disturbances across countries and the determination of real exchange rates.

The objective of this chapter is not to review the methodology and findings of each of these studies but rather to present selectively examples of econometric tests and applications of the PPP relationship in light of the theoretical foundations presented in Chapter 2. For this purpose, empirical work on PPP is divided into tests of the commodity-arbitrage relationship, tests of the international propagation of disturbances under fixed exchange rates, "causality" tests running from prices to exchange rates, and, finally, tests of the variability of real exchange rates.

A number of methodological problems are common to most empirical studies of the PPP relationship:

*Choice of the price index.* Where a broadly inclusive price index is used to assess PPP, the choice is between the GDP deflator, which is the broadest of them all but not always available; the wholesale price index, which concentrates on "commodities" and thus gives a greater weight to tradables; and the consumer price index, which applies only to consumer goods (Kravis and Lipsey, 1978, p. 200; Thygesen, 1978, p. 304-305).

*Identification of commodities.* Even in the case of physically identical goods, "differences in the terms of sale may involve such different bundles of benefits in two purchases that the prices would not be the same even under perfect competition" (Kravis and Lipsey, 1978, p.

203). Cross-country product differentiation makes the application of the "law of one price" even harder. Empirical work also requires consistent and operational definitions of such subsets of commodities as exports, imports, and traded and nontraded commodities (Kravis and Lipsey, 1978, p. 201).

*Choice of base year.* The choice of a base year is critical for tests of the relative version of PPP, because the exchange rate is assumed to be at its equilibrium level during the base year (absolute PPP holds). The researcher can arbitrarily pick a year of "general stability" or let the data choose it through the introduction of a constant (Genberg, 1978, p. 264).

*Identification of historical periods.* Given the choice of the base year, any test of the PPP relationship should also address itself to the following issues: the choice of the terminal year, the choice of a period when disturbances are consistent with the theoretical framework (usually requiring the dominance of monetary disturbances), and the establishment of criteria to determine how large exchange-rate fluctuations should be before identifying them with significant appreciations or depreciations of any particular currency (Kravis and Lipsey, 1978, p. 205; Thygesen, 1978, p. 306).

*Bilateral or multilateral measurements of PPP.* The choice between bilateral and effective exchange rates and prices in econometric tests of PPP can affect the results. In the Optica report, for example, "conformity to PPP is considerably closer multilaterally than bilaterally" (Thygesen, 1978, p. 306). The use of effective rates, however, requires a decision as to the weights that should be used to build up the relevant averages.

*Evaluation of results.* In econometric studies of the PPP relationship, the researcher must determine whether or not fluctuations of price movements across countries are similar. The determination is usually made by comparing cross-country price variations with interregional or intercity variations within specific currency areas (Vaubel, 1978, p. 324). The evaluation of econometric findings also gives rise to a broader question pertaining to misspecification. Krugman (1978) has shown, for example, that simple empirical tests of PPP would provide biased results if the system of equations is indeed simultaneous. Specifically, if neither prices nor exchange rates can properly be regarded as endogenous, one could be led to reject PPP "in a world in which it is in fact valid" (p. 398). This problem is particularly important in the presence of real disturbances. Besides questioning the validity of PPP on theoretical grounds in the presence of real disturbances, the argu-

ment points to the deficiencies of ordinary least squares for estimating a simultaneous system.

These questions apply to all empirical studies of the PPP relationship and are at the center of the debate on the empirical validity of PPP.

*Tests of the Commodity-Arbitrage Relationship*

Recent empirical tests of the "law of one price" have produced negative results. In a series of studies, Kravis and Lipsey (1971, 1974, 1977, 1978) question the assumption of perfect commodity arbitrage for both individual commodities and specialized subsets of goods. They show, for example, that there are substantial deviations from the "law of one price" for traded commodities, as well as explicit price discrimination on the part of sellers, who often charge different prices for products depending on the destination point (Kravis and Lipsey, 1978, p. 234). Isard's (1974) comparisons of monthly Japanese, German, and U.S. export prices for the period of January 1968 to November 1973 also show significant variability in cross-country export prices, pointing to low substitutability among export commodities across the major industrial countries. Nor do Bordo and Choudhri's (1977) comparisons of quarterly price indexes for eighteen industry groups in the United States and Canada give much support to the arbitrage model. The coefficient of the change in foreign prices in simple one-equation estimates is significantly different from unity, while the bilateral price-adjusted exchange rate varies substantially over time. In a recent study involving comparisons of major commodity prices in Canada and the United States over the period 1965-74, Richardson (1978, p. 347) shows that perfect commodity arbitrage can be rejected with 95 per cent confidence for *every* commodity group in his sample.

In another recent study, Isard (1977) makes a useful distinction that applies to most empirical work on spatial commodity arbitrage: The "law of one price" seems to hold well in comparisons either of the relative dollar prices charged by different countries for well-defined items delivered at a common port or of the dollar prices of primary commodities in general. Also, the produce of any single country sold competitively in two different markets seems to obey the "law of one price," so that its dollar-equivalent price in the two markets does not differ by more than the cost of transportation. Isard shows, however, that perfect arbitrage does not hold for manufacturing goods of the major industrialized countries even on the 4- and 5-digit level of the SITC classification. This suggests that manufacturing goods originating in

different countries are not as close substitutes as is usually assumed. Given Isard's conclusions about primary vs. industrial goods, Genberg's (1975) relatively positive results are not surprising; he finds that quarterly price changes of a cluster of primary commodities[1] in eight locations follow similar patterns.

Overall, however, with the possible exception of goods traded in the major commodity exchanges, the evidence suggests that spatial commodity arbitrage is far from perfect.

*Transmission of Foreign Price Disturbances under Fixed Exchange Rates*

As we saw in Chapter 2, PPP under fixed exchange rates would imply the eventual convergence of cross-country inflation rates. Genberg (1978) and Hooper and Lowrey (1979) present comprehensive reviews of existing empirical tests on the international transmission of price disturbances. In the simplest kind of model, relative PPP would indicate that the long-run value of the coefficients $a_1$ and $b_1$ in equations (4) and (4′) would be equal to unity, while coefficient $b_0$ would be equal to zero:

$$lnP_t = a_0 + a_1 lnP_t^* + u_t \qquad (4)$$

$$\Delta lnP_t = b_0 + b_1\, \Delta lnP_t^* + u_t, \qquad (4')$$

where $u_t$ is a random error term.

Genberg (1977) estimates these equations for ten European countries using yearly data on consumer price indexes from 1955 to 1970. The results conform to expectations.

A number of recent econometric studies attempt to capture not only the transmission of foreign price disturbances but also the effects of expectations and of excess demand, and the influence of domestic policies on the domestic price level.

Dornbusch and Krugman (1976) do a number of tests for major industrial countries to determine the elasticity of domestic export and consumer prices to foreign competitors' prices from 1960 to 1972. Their results vary substantially across countries. They find that in the United States the principal determinant of export unit values for manufactured goods is unit labor cost rather than foreign prices. In Canada and France, on the other hand, there is substantial sensitivity to foreign competitors' prices, with elasticities of 0.64 for Canada and 0.66 for France. Their tests of the impact of import prices on domestic

[1] Cocoa, copper, copra, jute, rubber, and tin.

consumer prices from 1955 to 1975 are also revealing. Whereas the effect of import prices on the consumer price index is not negligible, the elasticity coefficients are much below unity.[2] Other independent variables such as the GDP gap, a labor-market variable, and a lagged dependent variable are equally, if not more, significant (p. 571).

Similar tests were conducted by Modigliani and Papademos (1975). According to their estimates for the period 1953-71, the price elasticity in the United States of the nonfood component of the consumer price index with respect to import prices was about 0.1 after one year and 0.3 in the long run. Similarly, Spitäller's (1978) estimate for the steady-state elasticity of domestic prices with respect to import prices is about 0.27.

These findings are consistent with those of other authors (e.g., Krause and Salant, 1977), who in general report low elasticities of the consumer price index with respect to import prices for a number of OECD countries. One of the most significant explanatory variables in most one-equation regression estimates seems to be the excess-demand variable. As Genberg (1978, p. 255) points out, this could be interpreted as evidence that even under fixed exchange rates there is substantial scope for inflation rates to diverge. It is important to note, however, that if cycles in economic activity tend to be synchronized internationally, then "excess demand in any particular economy is merely a reflection of generalized excess demand the world over" (p. 255). If that is indeed the case, the presence of multicollinearity between the foreign price and the excess-demand variable might substantially decrease the significance of the relevant coefficients.

A few models estimate a whole system of simultaneous equations. The focus of the so-called Scandinavian model (Aukrust, 1972; Edgren, Faxen, and Odhner, 1973) and more recent work in this same tradition (Calmfors, 1977) links foreign prices directly to the price of traded goods in the economy; the effect of foreign prices is then transmitted to the nontraded-good sector via the wage level, which is determined in the traded-good sector. The coefficient for changes in world market prices in the traded-good price equation is not significantly different from 1 (0.78) at the 5 per cent level, while price changes for nontradables seem to be determined exclusively by unit labor costs and expected price increases (Calmfors, 1977, pp. 507-509).

Price equations are also included in most macroeconomic models of the major industrial countries (Genberg, 1978, p. 258). It can be

[2] The highest is 0.33 for Switzerland; the coefficient for the United States is 0.14.

concluded that in general the impact or long-run effect of foreign prices on the domestic price level is quite low and significantly lower than unity.

*"Causality" Tests of the PPP Relationship*

The early tests of the PPP relationship under floating exchange rates involved time-series comparisons of PPP with the actual exchange rate. The methodology and findings of these early studies, which include articles by Cassel (1916), Keynes (1923), Angell (1926), Heckscher (1930), and others, have been reviewed thoroughly by Officer (1976). While there seems to be substantial disagreement among authors, Officer concludes that the PPP doctrine appears on average to hold quite well.

Recent empirical studies have increasingly used regression analysis as the major methodological tool. In the early studies, causality was implicit in the conduct of empirical tests, but the use of independent variables in regression analysis of necessity implies the exogeneity or predetermination of some variables, at least in a statistical if not theoretical sense.

Frenkel (1978) uses monthly data on exchange rates ($S_t$) and domestic ($P_t$) and foreign ($P_t^*$) price indexes from February 1922 to May 1925 to estimate the following equations:

$$lnS_t = a + blnP_t - b^*lnP_t^* \tag{5}$$

and

$$\Delta lnS_t = b\Delta lnP_t - b^*\Delta lnP_t^*. \tag{5'}$$

Adopting the hypothesis that $b = b^* = 1$, he then compares the results obtained with the hypothetical values using a standard $F$-test. Three different kinds of price index are used in the process, the wholesale, material, and food-price indexes. The evidence is uneven for both the absolute and relative versions of PPP; some bilateral exchange rates follow PPP closely while others do not. Frenkel (1978, p. 180) argues that overall the results seem to be positive.

In the same study, Frenkel also finds that causality tests, in which there is an attempt to see if either the price or exchange-rate time series can be viewed as econometrically preceding the other, point to specification of "price equations." That is, exchange rates should be viewed as exogenous to the price levels and thus be treated as independent variables "causing" price-level fluctuations. In a world where exchange rates are determined in asset markets, this viewpoint would

be consistent with the observation that asset markets typically clear faster than commodity markets. It would also be theoretically consistent with a whole cluster of arguments that point to exchange-rate fluctuations as a major determinant of domestic price-level fluctuations, either through their effects on import prices and the whole macrosystem (for a recent review, see Hooper and Lowrey, 1979) or their effects on price-setting behavior by firms (Saidi, 1977).

In early tests of the PPP relationship, no distinction was drawn between short and long run. In emphasizing this distinction, Frenkel (1978, p. 181) assumes a long-run PPP relationship where the long-run exchange rate ($S'_t$) is regressed on relative prices ($P_t / P^*_t$),

$$lnS'_t = a + bln\ (P_t / P^*_t)\ , \tag{6}$$

and then a short-run partial-adjustment process, according to which the percentage rate of change of the exchange rate is proportional to the logarithm of the ratio of the long-run value to the actual exchange rate:

$$lnS'_t - lnS_{t-1} = \gamma(lnS'_t - lnS_{t-1}). \tag{7}$$

Combining (6) and (7), he then estimates equation (8):

$$lnS_t = a\gamma + b\gamma ln(P_t / P^*_t) + (1-\gamma)lnS_{t-1}\ . \tag{8}$$

The long-run elasticity ($b$) turns out in fact to be close to unity.

In evaluating the results obtained by earlier but similar studies by Frenkel (1976) and Bilson (1978a), Krugman (1978) argues that favorable results are obtained for those countries which in the 1920s experienced rapid, if not hyper, inflation and which pursued expansionary monetary policies. But results from equivalent tests in the 1970s, when the major disturbances have been real, are not as supportive of the PPP hypothesis as Frenkel's conclusions would lead one to expect (Krugman, 1978, p. 400).

A number of recent studies explicitly test the monetary approach to exchange-rate determination (Bilson, 1978a, 1978b; Hodrick, 1978). Their analysis incorporates the quantity theory of money with a strict PPP relationship between domestic and foreign price levels.[3] The equations estimated by Hodrick (1978) on monthly data for Germany (April 1973 to September 1975) and the United Kingdom (July 1972 to June 1975) are based on the following formulation:

[3] For an excellent review, see Dornbusch (1978).

$$S_t = c_0 + c_1 m_t + c_1^* m_t^* + a_1 ln\,(1 + r_t) + a_1^* ln(1 + r_t^*) + a_2 y_t + a_2^* y_t^* + u_t\,. \quad (9)$$

In equation (9), the logarithm of the exchange rate ($S_t$) is regressed against the logarithms of the domestic and foreign money stocks ($m_t$ and $m_t^*$), the logarithms of domestic and foreign interest rates ($r_t$ and $r_t^*$), the logarithms of real per capita domestic and foreign permanent incomes ($y_t$ and $y_t^*$), and a random error term ($u_t$). According to the monetary theory, the coefficients $c_1$ and $c_1^*$ are expected to be plus and minus unity, respectively. The coefficients of the domestic interest rates and foreign income level are expected to be positive, while the coefficients of foreign interest rates and domestic income are expected to be negative.[4] Even though estimates have the right sign, the results are mixed for both countries. Some coefficients are not significant while there is also evidence of serial correlation.

More important, in a similar study Bilson (1978b, p. 89) compared his results, based on a version of equation (9), with those derived from a strict PPP relationship and those from a random-walk model. He concluded:

> Although [the "monetary approach" equation] appears to fit the data more closely than the Purchasing-Power Parity equation, it is noticeably inferior to the random-walk model in terms of R-squared, standard error, and the extent of the autocorrelation of the residuals. Consequently, although the monetary model does explain over 90 percent of the variation in the exchange rate, these results lead to the rejection of the monetary model as a complete description of the determination of the exchange rate.

*Variability of Real Exchange Rates*

Tests of the long-run variability of real exchange rates have been a convenient method for assessing departures from PPP. In cases where exchange-rate changes have been shown to conform to inflation differentials, so that real exchange rates have remained constant, a PPP-based intervention rule has been proposed as the main criterion for managing exchange rates (Thygesen, 1978).

Tests of the long-run variability of real exchange rates have also been used by some authors (e.g., Vaubel, 1978) as comprehensive and

[4] An increase in the domestic interest rate is assumed to lead to a depreciation of the currency rather than an appreciation, for the following reason: The increase in $r_t$ will reduce demand for real money balances, which will induce an increase in the price level to maintain equilibrium in the money markets. With prices getting out of line internationally, a depreciation is required to restore PPP (Dornbusch, 1978, p. 8).

operational criteria of the comparative costs and benefits of monetary unification. Such studies are outside the realm of PPP and therefore beyond the scope of this essay.

Genberg (1978) has investigated the relationship between exchange rates and their corresponding PPP levels to determine the bias in PPP when measured by the consumer price indexes, the speed of adjustment toward PPP following a disturbance, and the potential shifts in the PPP relationship owing to intercountry differences in index construction. He has estimated the following equation for fourteen industrialized countries for the whole period 1957-72:

$$ln(S_{i,t}P_{i,t} / P^{*}_{i,t}) = a + bt + u_t, \qquad (10)$$

where $S_{i,t}$ = effective exchange rate for country $i$
$P_{i,t}$ = trade-weighted or effective foreign price index
$P^{*}_{i,t}$ = price index for country $i$.

The constant $a$ is included so that the data can determine the appropriate base year, while the time trend is a proxy for factors that may produce a bias in PPP calculations. The error term $u_t$ serves as an indicator of departures from PPP.

Genberg finds that the average absolute percentage deviation from PPP increases from 1.3 per cent in 1957-66 to 2.2 per cent in 1966-72, and to 4.1 per cent in 1973-76. This increase can be attributed largely to the move toward flexible exchange rates and the prevalence of real disturbances during the 1970s.

Genberg also finds longer time lags between the original disturbance and the reestablishment of PPP under flexible exchange rates than under fixed exchange rates, as well as systematic biases in PPP when measured by the consumer price index. He attributes the latter to an income elasticity of demand for nontraded goods higher than unity and to a higher share of government vs. private expenditures in total consumption expenditures on home commodities (p. 267).

Overall, his results point to a "marked inferiority of the PPP relationship during the flexible exchange rate years as compared to the earlier years of fixed or adjustable exchange rates" (p. 268).

In contrast, the Optica report written for the Commission of the European Communities seems to adopt the view that PPP can be used as an objective criterion for exchange-rate adjustments. This conclusion is based on a cross-section of changes in effective exchange rates for eighteen countries during the 1963-75 period. The study, which uses the wholesale price index as its main index, indicates that conformity to PPP was considerably closer multilaterally than bilaterally and

about as close in a wide group of sixteen industrial countries as it is among the members of the European Communities (see Thygesen, 1978, p. 306-307). It suggests that "the mechanisms which align national inflation rates measured in a common numeraire in a floating rate system have worked more efficiently than the mechanisms which align national inflation rates . . . when exchange rates are largely fixed" (Thygesen, 1978, p. 307). It is thus in sharp contrast with the earlier results obtained by Genberg (1978).

In an effort to evaluate PPP, Dornbusch (1978) has looked at the real exchange rate for the United States and Germany, using the consumer price index. He finds that the real exchange rate showed substantial variations that were systematically associated with movements in the nominal exchange rate, contrary to what strict adherence to PPP would indicate (p. 24). Furthermore, deviations from PPP lasted for a considerable period of time. Dornbusch attributes these deviations to sectoral changes in relative prices over time, different pricing strategies, and differences in price and wage rigidities across countries.

Finally, in an interesting study Dervis and Robinson (1978) compute Turkey's "equilibrium" exchange rates under specific levels of borrowing and net capital inflows by assuming different exogenous shocks and domestic responses. They conclude that "differential inflation, while an important explanation of the underlying changes, only explains about a third of the change in the equilibrium exchange rate . . ." (p. 57). Changes in workers' remittances, changes in the investment rate, and residual factors turn out to be important determinants of the equilibrium exchange rate; their share in the total change in the equilibrium exchange rate exceeds 50 per cent. These are the disturbances that semi-industrialized countries typically face. One would thus expect PPP to hold even less for countries that in the process of development undergo structural changes and are subjected to real as well as monetary disturbances.

# 4 Conclusions

One of the most important questions that emerges from the analysis of theoretical and empirical studies on PPP is the nature and significance of disturbances in the international monetary system. This question divided economists as early as the eighteenth century. In the 1930s it was the focus of the debate between Keynes (1929) and Ohlin (1929) in relation to the German reparation payments. It is also the central issue that distinguishes the different approaches to the balance of payments. In addressing this question, Tobin (1977, p. 57) stresses what he views as the prevalence of real disturbances in recent economic history:

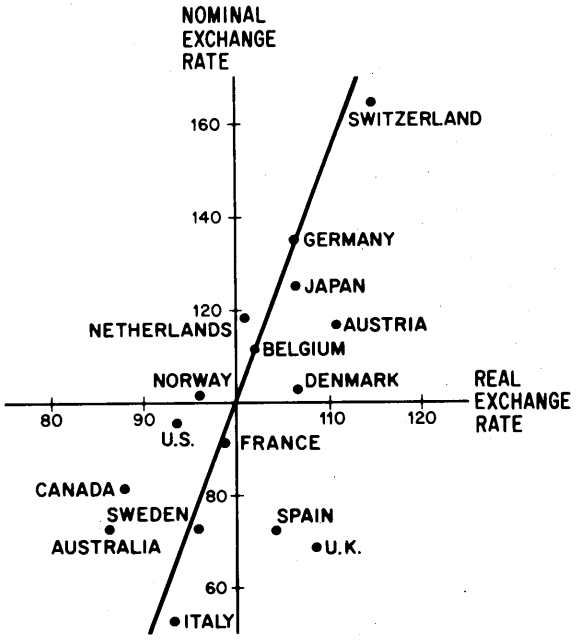
> . . . In the twenties, the disturbances had to do with reparations and war debts, the transfer problem, protectionism in the United States, and such matters. They had monetary consequences, but they were not monetary in origin. Then came the Great Depression, for which a model that assumes real output and employment to be constant in every country at full employment levels is not particularly helpful. My mind jumped to the dollar shortage of the 1950s, and I tried to think how that was monetarily determined.
>
> Next was the structural disequilibrium between the United States and Europe and Japan, which characterized the late fifties and early sixties, the dollar glut following the dollar shortage. The dollar glut produced virtually no inflation, even in the United States. The "monetary" model did not seem to illuminate this balance of payments disequilibrium any better than it did previous disturbances. The inflation set off by the financing of the Vietnam War seems at least equally the result of bad fiscal policy as of monetary policy.
>
> Finally, there are the oil and food crises. At a 1974 conference on monetarism—domestic monetarism—somebody asked how I knew that the quadrupling of oil prices by the Organization of Petroleum Exporting Countries was not a response to increases in the world money supply. I suppose I do not!

Such a view differs sharply from views held by the monetarist school.

The nature of disturbances is intimately linked to the validity of the PPP doctrine. As we have seen, the argument that the equilibrium exchange rate will tend, in the long run, to equal its PPP level can be made only in the case of monetary disturbances and even then only under restrictive assumptions regarding expectations, interest payments, and wealth effects. In the case of real shocks, deviations from PPP could be large and in the short run could be even more substantial independently of the source of disturbance.

During the 1970s, the real exchange rate responded differently across countries to changes in nominal exchange rates, possibly owing to different degrees of wage indexation. While some countries like the United States gained substantially in competitiveness with only a modest depreciation, others like Italy gained only a little with much larger depreciations of the nominal rate (Dornbusch, 1979, p. 11). Figure 2 points to the positive correlation between nominal and real

FIGURE 2
NOMINAL AND REAL EXCHANGE RATES, 1978, 3RD QUARTER
(1973 = 100)




SOURCE: Dornbusch (1979, p. 10) using data from *World Financial Markets*, published by Morgan Guaranty Trust Co.

effective exchange rates across the major industrialized countries (i.e., to a positive correlation between appreciation and loss of competitiveness) and to substantial differences across countries in the responsiveness of the real exchange rate to nominal exchange-rate movements. It is fair to conclude that PPP does not seem to hold in the short run and would hold in the long run only under the very restrictive assumptions specified above.

These theoretical shortcomings and questions tend to be overlooked in empirical tests, which often involve circular reasoning. If the results are favorable to PPP, they are used to support the contention that disturbances are mainly monetary; if the results are not favorable, and assuming people can agree about that, then real and structural disturbances are likely to be emphasized as the important shocks in the system. Thus, evaluation of the empirical work on PPP can become both difficult and misleading.

In conclusion, I am afraid there is an important element of truth in Samuelson's (1964, p. 153) statement that "unless very sophisticated indeed, PPP is a misleading, pretentious doctrine, promising us what is rare in economics, detailed numerical predictions. . . ." This observation and the preceding discussion serve to underline the importance of the following questions:

1. By what process is the long-run real exchange rate determined in an economy?

2. In what ways can policy affect the actual or predicted equilibrium exchange rate?

These questions have become central to any meaningful evaluation of our experience with flexible exchange rates and to the appraisal of the diverse proposals that have been advanced concerning the restructuring of the world monetary system.

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