

THE PURCHASING POWER PARITY DOCTRINE

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Prominent among the many competing explanations that have been advanced to account for foreign exchange rate movements in the post-Bretton Woods era of floating exchange rates is the so-called *purchasing power parity* (PPP) theory. One of the most popular, simple, and durable explanations of exchange rate behavior, the purchasing power parity doctrine holds that currencies are valued for what they will buy. Therefore the relative external value of two currencies, i.e., the exchange rate between them, is determined by their relative internal purchasing powers as measured by the ratio of the general price levels in the two countries concerned. From this it follows that changes in relative national price levels determine changes in the exchange rate. In particular, the theory predicts that the percentage rate of change of the exchange rate will tend to equal the differential between the relative rates of price inflation at home and abroad. Thus if the domestic rate of inflation in the U. S. is, say, five percentage points higher than the comparable rate of inflation in Switzerland, the theory maintains that the dollar will tend to depreciate on the foreign exchanges at a rate of five percent relative to the Swiss franc. It follows from the theory that the way to strengthen a currency's external value is to strengthen its internal value by reducing the domestic rate of inflation. In terms of the preceding example, the way to arrest the fall of the dollar relative to the Swiss franc is to bring the U. S. rate of inflation down into equality with the lower Swiss rate. With both currencies experiencing the same rate of inflation (or fall in internal purchasing power), their relative purchasing power will remain unchanged and the exchange rate will stabilize.

The foregoing view is scarcely new. Rather it is the product of at least 175 years of past theorizing about the connection between money, prices, and exchange rates. It is no exaggeration to say that the PPP doctrine has attracted the attention of some of the leading monetary theorists of all time, including Thornton, Wheatley, Ricardo, Marshall, Cassel, von Mises, Keynes, and Viner. As proponents or critics, these economists helped formulate, develop, modify, and refine the central analytical propositions of the PPP doctrine. The purpose of this article is to identify and explain these propositions, to trace

their development in the history of economic thought, and to indicate the extent of their survival in modern versions of the theory.

What is the PPP Doctrine? In essence, the PPP doctrine is a theory of the determination of the nominal exchange rate and its movements in long-run equilibrium when the trade balance is zero and the real barter terms of trade and its underlying real determinants are presumed to be constant. Given these conditions and assuming that all goods are exportables, the equilibrium exchange rate can be expressed as the product of the terms of trade and relative general price levels, respectively. In symbols,

$$(1) \quad E = T P/P^*$$

where E is the exchange rate (defined as the domestic currency price of a unit of foreign currency), T the terms of trade (defined as the real export cost per unit of imports, i.e., the quantity of exports given up to obtain a unit of imports), P the home country price level, and P* the foreign price level.¹ Via an appropriate choice of units, the terms-of-trade variable can be normalized and set equal to unity. This step permits the PPP theory to be stated conventionally in its so-called absolute and relative versions.

The *absolute* version of the doctrine states that the equilibrium exchange rate will equal the ratio of domestic to foreign general price levels, i.e.,

$$(2) \quad E = P/P^*.$$

¹ The derivation of Equation 1 is particularly simple in the case where each country produces only one good, part of which it exports to the other. Trade balance equilibrium requires that the total value of each country's exports must exactly equal the total value of its imports measured in terms of the same money. For the home country, this condition can be expressed as $QP = Q^*P^*E$, where Q is the quantity of physical exports of the home country, Q^* the physical quantity of its imports (i.e., the quantity of the foreign country's exports), P the home currency price of home country product, P* the foreign currency price of foreign country product, and E the exchange rate defined as the home currency price of a unit of foreign currency. This expression says that the values (quantity times price) of exports and imports are the same measured in terms of the home country's money. Solving this expression for the exchange rate yields $E = (Q/Q^*)(P/P^*)$, where the first term on the right hand side is the real terms of trade, i.e., the quantity of exports given up to obtain a unit of imports. Denoting the terms of trade variable as T, the foregoing expression reduces to $E = T P/P^*$, which is Equation 1 of the text.

Original formulators of the doctrine stated it this way, arguing that since currencies are valued for what they will buy, the exchange rate between them must equal their relative internal purchasing powers measured by relative general price levels.

The *relative* version of the doctrine states that changes in the equilibrium exchange rate will equal changes in the ratio of general price levels, or, more generally, that the percentage rate of change of the exchange rate will equal the differential between the percentage rates of price inflation at home and abroad. In symbols, the relative version is

$$(3) \quad e = p - p^*$$

where the lower-case letters denote percentage rates of change of the variables in Equation 2.

The foregoing brief statement of the doctrine, however, is hardly sufficient. More than just the bare conclusion that the exchange rate and its movements tend to equal relative national price levels and their movements, the doctrine also consists of a number of interrelated propositions that support that conclusion. The most important of these propositions refer to (1) the international equalization of price levels measured in terms of a common currency, (2) the corresponding international equalization of the value of money, (3) the stability of PPP equilibrium, (4) the neutrality of equilibrium exchange rate changes, and (5) the causal role of money. Taken together these propositions constitute the central analytical core of the PPP doctrine.

Price Level Equalization The first proposition states that the equilibrium floating exchange rate must equalize foreign and home country general price levels measured in terms of a common currency unit at the rate of exchange. General prices must be equalized across countries because if they were not, goods would be a bargain in one country compared to the other. Everybody would want to buy in the low-price country and sell in the high-price one. The resulting excess demand for the currency of the former and the corresponding excess supply of the currency of the latter would force the exchange rate into PPP equilibrium thereby eliminating the price disparity.

That the condition of price equalization is implied by PPP can be seen by rearranging Equation 2 to read $P = EP^*$, which says that home and foreign price levels are the same when expressed in terms of home currency units at the equilibrium rate of exchange. Likewise, price levels are also the same when expressed in foreign currency units as can be seen by arranging the equation to read $P/E = P^*$. In short,

the PPP doctrine implies that a representative bundle of goods will cost the same everywhere measured in terms of either money. Neither country will enjoy a price advantage over the other at the PPP exchange rate. Nor will residents of either country be able to purchase goods more cheaply at home with local currency than abroad after converting local into foreign currency. Neglecting transport costs, Londoners will find goods to be as cheap in New York as in London and vice versa for New Yorkers.

Equalization of the Value of Money A second PPP proposition refers to the international equalization of the value (purchasing power) of money. According to the PPP doctrine, the equilibrium value of money must be everywhere the same. For if it were not, people would demand more of the high- and less of the low-purchasing power money on the market for foreign exchange. The resulting excess demand for the former money and the corresponding excess supply of the latter would cause the exchange rate between the two moneys to adjust until purchasing power was equalized and both money stocks were willingly held. Equalization of the value of money across countries is therefore a necessary prerequisite of international monetary equilibrium. For only if such equalization prevails would there be no inducement to switch from one currency to the other. Only then will both money stocks be willingly held and the markets for money balances in both countries be cleared simultaneously.

Note that equalization of the value of money is the exact counterpart of price level equalization. By definition, the value of money is nothing other than its purchasing power over goods. And since the purchasing power of money in terms of a representative market basket of goods is simply the inverse of the general price level $1/P$, it follows that equalization of price levels automatically implies equalization of the value of money. That is, when PPP prevails, any currency tends to command roughly the same amount of goods and services whether spent at home or converted into foreign currency at the equilibrium rate of exchange and then spent abroad. Thus a dollar will purchase no more in the U. S. than it will buy in the U. K. after conversion into pounds sterling at the equilibrium rate of exchange and vice versa for sterling.

Stability of Equilibrium A third proposition refers to the stability of PPP equilibrium. Regarding stability, the PPP doctrine contends that when the actual rate of exchange deviates from the PPP equilibrium, automatic responses tend to eliminate

the deviation and restore the exchange rate to parity. With respect to disturbances to equilibrium, the PPP theory readily admits a host of factors—real shocks, expectations, speculation, capital flows and the like—that may cause the exchange rate to deviate temporarily from PPP. But it also describes strong stabilizing pressures that work to correct such deviations and push the exchange rate back toward equilibrium.

More specifically, the doctrine postulates an automatic self-correcting mechanism that keeps the actual exchange rate hovering close to its equilibrium level. This mechanism relies on the corrective influence of price-induced shifts in international trade and the associated shifts in the demand for and supply of foreign exchange. For example, suppose the dollar price of the pound falls below its PPP equilibrium. On the market for foreign exchange, the pound is now undervalued and the dollar overvalued relative to their actual internal purchasing powers. The undervalued pound makes British goods seem underpriced to Americans whose eagerness to purchase them deluges the foreign exchanges with dollars seeking to buy pounds. Conversely, the overvalued dollar makes American goods appear overpriced to Britons whose reluctance to buy them dries up the supply of pounds seeking to buy dollars. The resulting surplus of dollars and the corresponding shortage of pounds would quickly bid the exchange rate back to PPP where the external and internal values of the currencies correspond. Via this self-adjusting mechanism the actual exchange rate would tend toward its equilibrium value, i.e., the exchange rate would tend to hover about the PPP.

Neutrality of Exchange Rate Changes A fourth tenet of the PPP doctrine is that equilibrium exchange rate movements that merely reflect differential inflation rates have no effect on real variables such as exports, imports, the trade balance, or the terms of trade. These real variables are determined by real (exchange rate-adjusted) relative prices. According to Equation 2, however, the real relative price term P/EP^* is a fixed constant equal to one. This means that movements in the equilibrium exchange rate exactly offset changes in the nominal price ratio P/P^* , thereby preserving the real terms of trade between foreign and domestic goods.

For example, Equation 2 says that a doubling of domestic prices relative to foreign prices will be accompanied by a corresponding doubling of the exchange rate leaving real (exchange rate-deflated) relative prices unaltered. Since the real relative price of domestic goods compared with foreign goods is the same after inflation as before, the general rise

in domestic prices will not affect imports or exports. The physical quantities of those variables will be the same as originally and only the monetary units in which they are measured will have changed. In short, the PPP doctrine holds that exchange rate movements serve the purpose of offsetting differential rates of inflation and thus leave real relative prices and all real variables undisturbed. Provided the exchange rate corresponds to PPP, its changes will not affect real economic magnitudes. Being perfectly synchronized with price movements, such exchange rate changes are entirely neutral in their impact on the real economy.

Causal Role of Money The fifth proposition refers to the direction of causality between price levels and the equilibrium exchange rate. Although strictly speaking the PPP price-exchange rate equality is an equilibrium condition between two endogenous variables, it is often interpreted as a cause and effect relationship. Causation is typically viewed as running from price levels to the exchange rate rather than vice versa. In particular, many PPP theorists argue that, in the long run when the determinants of the demand for money have stabilized at their steady-state equilibrium values, national money stocks determine national price levels which in turn determine the equilibrium exchange rate. If true, this means that the ultimate determinant of the equilibrium exchange rate is relative national money stocks and that the exchange rate moves over time as the differential in the growth rates of the money stocks. It also means that depreciation of the equilibrium exchange rate is a consequence rather than a cause of domestic inflation.

Henry Thornton and the Origin of the PPP Doctrine The foregoing propositions are hardly new. They were enunciated early in the 19th century to explain the behavior of the floating paper pound following Britain's suspension of the gold convertibility of its currency in 1797. Henry Thornton (1760-1815) was the first economist to clearly explain the operation of the self-adjusting mechanism that keeps the exchange rate close to its purchasing power par. In his classic *The Paper Credit of Great Britain* (1802) he argued that a rise in the price level in a country with an excess stock of paper money would automatically produce a roughly equivalent rise in the exchange rate. He explained how a rise in British prices relative to foreign prices would, at the preexisting exchange rate, make foreign goods seem relatively cheap to the British whose desire to acquire them would increase the supply of

pounds seeking to buy foreign exchange. At the same time, British goods would become relatively expensive to foreigners whose unwillingness to purchase them would reduce the supply of foreign currency seeking to buy pounds. The resulting excess supply of pounds and the corresponding excess demand for foreign money would immediately bid the exchange rate up to the new PPP equilibrium consistent with the higher level of British prices. [11, pp. 198-9]

Thornton was also the first to advance the notion of the neutrality of equilibrium exchange rate changes. He noted that the rise in British prices would not act as an obstacle to British exports because the corresponding change in the equilibrium exchange rate would "obviate the dearness of our articles" and "serve as a compensation to the foreigner" for the higher price of British goods. In this manner, he said, the offsetting rise in the exchange rate would "prevent the high price of goods in Great Britain from producing that unfavourable balance of trade, which, for the sake of illustrating the subject was supposed to exist." [11, p. 199] Here is the origin of the proposition that PPP exchange rate changes cannot affect real variables like the balance of trade since they merely offset divergent nominal inflation rates and thus leave real (exchange rate-adjusted) relative prices unaltered.

John Wheatley Thornton's discussion of PPP took the foreign money stock and price level as given constants. On this basis he concluded that the equilibrium exchange rate moves with the domestic price level alone. His contemporary John Wheatley (1772-1830), however, extended his analysis by considering variations in money and prices abroad as well as domestically. Wheatley concluded that the relative quantity of money operating through general prices is the sole determinant of the exchange rate so that the latter varies in strict proportion to relative money stocks. He reached this conclusion via the following route.

First, he asserted that "the course of exchange is exclusively governed by the relative state of prices, or the relative value of money, in the different countries between whom it is negotiated." [13, p. 85] This, of course, is the absolute version of the PPP theory stating that the equilibrium exchange rate equals the ratio of domestic to foreign price levels according to the relationship

$$(4) \quad E = P/P^*$$

Second, he argued that under purely paper monetary standards the level of prices in each country

varies in strict proportion to the quantity of money. This, of course, is the rigid version of the quantity theory of money which may be expressed as

$$(5) \quad P = kM \text{ and } P^* = k^*M^*$$

where M is the money stock, k is a constant coefficient equal to the ratio of the circulation velocity of money to real output (both variables treated as fixed constants by Wheatley), and the asterisks denote foreign country variables.

Third, he substituted Equation 5 into Equation 4. This gave him the result that the exchange rate varies in strict proportion with relative money supplies, i.e.,

$$(6) \quad E = kM/k^*M^* = K(M/M^*)$$

where K is the ratio of the constants k and k^* . He stated this result when he declared that "the course of exchange is the exclusive criterion of how far the currency of one country is increased beyond the currency of another." [14, p. 207]

Wheatley commented at length on the key propositions of the PPP doctrine. Regarding the direction of causation between price levels and exchange rate he asserts that "variation in the state of the exchange . . . is the effect, not the cause" of variation in price levels. [13, p. 88] With respect to equalization of price levels and the value of money he asserted that "prices are everywhere the same" and that money serves "as a uniform measure of value over the whole world." [13, p. 59] Two things, he said, operate to ensure price equalization across countries. The first is exchange rate adjustment, which equalizes the common currency value of any given local currency price levels. The second is commodity arbitrage, which equalizes the common currency prices of internationally traded goods at any given exchange rate. Regarding the equalization of prices by commodity arbitrage, he contended that the openness of modern national economies rendered the law of one price applicable to general price levels as well as to the specific prices of internationally traded goods. As he put it,

The facility with which the reciprocal communications of nations is carried on has a necessary influence on the markets of all, and approximates the price of their produce to a general level. [13, p. 45]

Nevertheless, he insisted that the essence of the PPP concept consists of more than just the law of one price. Specifically, he interpreted PPP as a condition of international monetary equilibrium in which the value of money is equalized across countries and exchange rate variations are the means by which this result is achieved. That this is indeed his view is

evident from his statement that "the course of exchange constitutes the practical means, by which money is enabled to discharge its functions over the whole world as a uniform measure of value." [13, p. 25] To Wheatley the central role of the exchange rate is to clear all markets for money balances by equalizing the internal purchasing power of various currencies. It therefore follows that

fluctuations in the exchange exclusively arise from the efforts of the different individuals of different countries to reduce their respective currencies to the same relative amount for the purpose of maintaining the general equivalency [of purchasing power]. [13, p. 25]

Wheatley also discussed the stability of PPP equilibrium and the neutrality of equilibrium exchange rate changes. His treatment of these issues is among the more rigid and uncompromising in the literature. Regarding temporary deviations from PPP, he flatly denied they could occur. In his view, the exchange rate is always at its equilibrium level and thus it is impossible for currencies to be temporarily over- or undervalued on the market for foreign exchange. In other words, the self-equilibrating mechanism works perfectly and instantaneously to maintain the exchange rate at its PPP equilibrium. Here is a supreme example of Wheatley's tendency to apply the PPP theory of long-run equilibrium to the short run as well. This tendency is also manifest in his treatment of the neutrality issue. Regarding neutrality, he argues that, because the exchange rate is always in equilibrium, its fluctuations will not affect trade in the slightest.

To summarize, Wheatley's version of the PPP doctrine is among the more extreme in the history of monetary analysis. Not only did he argue that the exchange rate is determined solely by relative money supplies operating through relative price levels, he also emphatically denied that real shocks could ever affect the exchange rate. His position was that such shocks, by affecting real national incomes, would immediately alter each country's demand for the other's product sufficient to maintain equilibrium in the trade balance and the exchange rate. For example, he argued that a domestic crop failure requiring increased food imports would, by reducing British real income and capacity to purchase, tend to force a compensating contraction of nonfood imports leaving the trade balance undisturbed. Conversely, if imports were not curtailed the resulting rise in British purchases from abroad would itself increase the income of foreign exporters and so their demand for British goods. Exports would rise to match imports thus leaving the trade balance and the exchange rate undisturbed. Either way, adjustment would occur

frictionlessly through income changes without affecting the exchange rate.² By ruling out real disturbances, Wheatley was able to assert that the exchange rate never deviates even momentarily from PPP and that causation runs in a strict unidirectional channel from money to prices to the exchange rate. In his view, exchange rate movements are always and everywhere solely a monetary phenomenon.

Others adhering to this extreme monetarist version of the PPP doctrine were David Ricardo (1772-1823) and Walter Boyd (1764-1837). They too denied that real shocks could affect the exchange rate even temporarily. Such shocks they regarded as automatically and instantaneously self-correcting having no impact on the exchange rate. That is, they simply assumed that the slightest real pressure on the exchange rate would, by making British goods cheaper to foreigners, result in an immediate expansion of exports sufficient to eliminate the pressure.³ In their view the exchange rate is always at the PPP equilibrium determined by relative money stocks, and rises in the exchange rate are solely and completely the result of an overissue of currency. Consequently they regarded exchange rate depreciation, together with the premium on gold bullion, as constituting both proof and measure of excessive money creation. In other words, if the exchange rate is 5 percent above its old gold standard par, then this is prima facie evidence that the money stock is also 5 percent in excess of its noninflationary level and should be contracted.

The PPP doctrine also appears in the famous *Bullion Report* (1810) where it is expressed in the following words.

In the event of the prices of commodities being raised in one country by an augmentation of its circulating medium, while no similar augmentation in the circulating medium of a neighboring country has led to a similar rise in prices, the currencies of the two countries will no longer continue to bear the same relative value to each other as before. The exchange will be computed between these two countries to the disadvantage of the former. [6, quoted in 1, p. 91]

Like Ricardo and Boyd, the *Bullion Report* concludes that exchange rate movements, together with the premium on gold bullion, "form the best general criterion from which any inference can be drawn as to the sufficiency or excess of paper currency in circulation." [6, quoted in 1, p. 91]

² Regarding Wheatley's notion of the frictionless income adjustment mechanism see Fetter [4, p. 47], Metzler [8, p. 217], O'Brien [10, p. 149], and Viner [12, pp. 138-9, 295-7].

³ On this point see Fetter [4, p. 47], Metzler [8, p. 217], and O'Brien [10, p. 149].

Gustav Cassel The preceding has specified the key propositions of the PPP theory and has traced their origin to Thornton and Wheatley in the early 1800's. For the classic statement of these propositions, however, it is necessary to turn to the writings of the Swedish economist Gustav Cassel during and immediately following World War I. It was Cassel who introduced the phrase "purchasing power parity" into the literature. He did so when he resurrected the theory to explain the behavior of the dislocated European exchanges during the war and afterward in the hyperinflation episodes in the early 1920's. His forceful and systematic exposition of the theory was largely responsible for the popularity it enjoyed in the 1920's. His contributions to the doctrine include the following.

First, as previously mentioned, he christened the theory with the name it bears today. Second, he clarified the concept of the PPP exchange rate, defining it in its absolute version as "the quotient between the general levels of prices in the two countries" and in its relative version as "the old rate multiplied by the quotient of the degree of inflation" in both countries. [2, p. 62; 3, p. 140] Third, he redefined the somewhat vague notion of equalization of the value of money to mean that "a certain representative quantity of commodities must cost the same in both countries, if the exchange rate . . . stands at its equilibrium." [3, p. 175] He points out, however, that this statement is strictly true only if the representative market basket of commodities is identical for both countries.

Fourth, he reformulated and refined the neutrality proposition in the following words.

. . . the purchasing power parity represents an indifferent equilibrium of the exchanges in the sense that it does not affect international trade either way. Thus a country's export is not checked by low rates of exchange, provided only these rates correspond to a high price level abroad, or a low level at home; nor . . . is export particularly stimulated by high foreign exchange rates, so long as they only correspond to the relative purchasing power of the different currencies. Similarly, low prices of foreign currencies do not mean the encouragement of import from abroad or keener competition for the home producers, so long as these rates are merely a true expression for the purchasing power parity of the foreign currencies. On the same hypothesis high prices of foreign currencies do not in any way act as a check on import. [3, p. 157]

Here is the classic statement of the proposition that PPP exchange rate changes leave the real (inflation-adjusted) exchange rate unaltered and so do not affect real exports and imports. From this Cassel drew the practical policy conclusion that no country could increase its competitiveness in foreign markets simply by deflating its price level. The deflation, he

said, will be matched by an identical fall in the equilibrium exchange rate, leaving the real exchange rate and hence real exports unchanged. [3, p. 143]

Cassel's fifth contribution was his identification of the sources of temporary deviations from PPP and his description of the self-correcting mechanism that operates to eliminate such deviations. Regarding causes of temporary deviations from PPP, he specified (1) expectations of future depreciation of the currency owing to anticipations of future inflationary money growth, (2) speculation against the currency, (3) forced sales of a country's currency abroad at arbitrarily low prices, (4) failure of export prices to move equiproportionally with general prices in response to monetary shocks, and (5) random real disturbances to the balance of payments. For all these reasons, he notes, a country's currency may be temporarily undervalued on the foreign exchanges. Regarding the operation of the self-correcting mechanism in such cases, he writes that

as soon as a country's currency is undervalued compared with its purchasing power parity, it will be of peculiar advantage to buy this currency, and to employ the money thus obtained in procuring commodities from that country. This stimulus thus applied to demand will necessarily very soon raise the price of the currency to the level of the purchasing power parity. [3, p. 149]

Conversely, the corresponding overvaluation of the currency of the other country will, by making its goods seem overpriced on international markets, reduce the demand for its exports and thus for its currency. If country A's currency is overvalued and B's currency undervalued, then the

export from A to B must be largely checked At the same time the import from B to A would be artificially stimulated by such a valuation. Indeed, both these influences would tend to raise the value of B's currency in A, and to restore it to the purchasing power parity, which shows that this parity is the true equilibrium of the exchanges. [3, p. 158]

In short, deviations from PPP affect trade flows in a direction that counteracts the deviation and represents a corrective to it.

Finally, Cassel elaborated on the issue of price-exchange rate causality and its implications. Like Wheatley, he repeatedly states that causation runs from price levels to the equilibrium exchange rate, i.e., that the latter variable is "determined by" or "dependent upon" the ratio of the price levels. [3, pp. 141, 185, 186] More precisely, he invokes the quantity theory of money to assert that money determines prices which in turn determine the exchange rate. In short, he argues that the exchange rate is determined by relative national money stocks operating through relative price levels. This means that

relative national money stocks are the ultimate determinant of exchange rates. In his words, the exchange rate between two countries "must vary as the quotient between the quantities of their respective circulating media." [2, p. 62]

From the foregoing he drew two implications. The first is that in a regime of floating exchange rates, inflation is entirely homemade and cannot be imported from abroad. "An important consequence of the . . . dependence of the exchange on the purchasing power parity," he said, "is . . . that a rise in prices in a foreign country can never cause a rise in prices at home." [3, p. 145] For, assuming the exchange rate is at PPP,

a rise in prices in a foreign country should have no other effect than that of the country's currency being quoted so much lower that the prices on goods imported therefrom remain unaltered. If the influence of the rise in foreign prices is carried further, it is a sign that it has found support in an independent domestic inflation. [3, p. 167]

In sum, a rise in foreign prices will be offset by a corresponding drop in the equilibrium exchange rate leaving the price of imports, and so the domestic price level, unchanged. If the domestic price level does indeed rise, it is because of domestic monetary expansion and not the rise of foreign prices.

The second implication is that exchange rate depreciation itself cannot cause domestic inflation. A rise in the equilibrium exchange rate, he said, is the result, not the cause, of domestic inflation. He did acknowledge that a rise in the exchange rate above the PPP could produce import price increases. But he denied that these import price increases could be transmitted to general prices provided the money stock and total spending were held constant. He maintained that, given a fixed money stock, the rise in the particular prices of imported commodities would be offset by compensating reductions in other prices leaving the general price level unchanged. As he put it

Only if the B currency were quoted above the PPP . . . could the high price of this currency have any influence to raise the prices in country A. But even this influence would not be able to raise the general price level unless it had the support of a more plentiful supply of means of payment [3, p. 168]

Ludwig von Mises Rivaling Cassel as the principal proponent of the PPP doctrine in the 1920's was the famous Austrian economist Ludwig von Mises. It is not necessary to give a lengthy summary of his writings on the subject. Three quotations will suffice. The first refers to equalization of the value of money, the second to the stability of equilibrium, and the third to the causal role of money—all key

propositions of the PPP doctrine. Regarding equalization of the value of money, he states that

exchange rates must eventually be established at a height at which it makes no difference whether one uses a piece of money directly to buy a commodity, or whether one first exchanges this money for units of a foreign currency and then spends that foreign currency for the desired commodity. [9, p. 30]

The operation of the self-equilibrating mechanism is described by von Mises in the following words.

Should the rate deviate from that determined by the purchasing power parity . . . an opportunity would emerge for undertaking profit-making ventures. It would then be profitable to buy commodities with the money which is legally *undervalued* on the exchange, as compared with its purchasing power parity, and to sell those commodities for that money which is legally *overvalued* on the exchange, as compared with its actual purchasing power. Whenever such opportunities for profit exist, buyers would appear on the foreign exchange market with a demand for the undervalued money. This demand drives the exchange up until it reaches its "final rate" [i.e., the PPP]. [9, pp. 30-1]

Finally, with respect to the causal role of money in the determination of the equilibrium exchange rate, he states the "exchange rates rise because the quantity of the domestic money has increased and commodity prices have risen." [9, p. 31]

Criticisms of the PPP Doctrine Even at the height of its popularity in the 1920's the PPP doctrine was the target of severe criticism. Critics such as Frank Taussig, J. M. Keynes, A. C. Pigou, and Jacob Viner contended that the theory suffered from certain crippling defects. For one thing, it overlooks factors other than relative price levels that determine exchange rates. Consisting of the terms of trade, obstacles to trade (tariffs, transport costs and the like), and the structure of prices in both countries, these factors may produce a permanent disparity between the equilibrium exchange rate and the calculated absolute PPP. Moreover, their movements over time tend to generate a persistent discrepancy between exchange rate movements and those of the PPP thus invalidating the relative version of the doctrine. For example, changes in the terms of trade caused by shifts in international demand would produce permanent changes in the equilibrium exchange rate even if PPP remained unchanged. Likewise changes in tariffs and transport costs as well as alterations in the relationship between export prices and general prices in either country would prevent the equilibrium exchange rate from adhering to the path dictated by PPP. Discrepancies may also stem from the existence of nontraded (purely domestic) goods whose prices have no close connection with the ex-

change rate although they do enter the general price levels used to compute the PPP. For these reasons the critics argued that the doctrine is incorrect when applied to general price levels. They held that it was valid only when restricted to the prices of internationally traded goods in which case, to use Keynes's expression, it becomes a "truism, and as nearly as possible jejune." [7, p. 75]

Bresciani-Turroni's Critique The foregoing criticisms were themselves evaluated in a famous 1934 paper by the Italian economist Costantino Bresciani-Turroni. In what is perhaps the most rigorous and systematic analysis of the PPP doctrine to be found in the economic literature, Bresciani-Turroni concluded (1) that the absolute version of the doctrine is indeed generally incorrect, (2) that the relative version, however, is theoretically correct in the case of monetary but not real shocks, and (3) that, as an empirical matter, the relative version may be approximately correct even in the latter case. In so doing he provided a masterful defense of the relative version of the theory.

The foregoing conclusions were derived by Bresciani-Turroni on the basis of a simple analytical model which he constructed via the following steps. First, he assumed that tariffs, transport costs, and other obstacles to trade tend to raise the supply price of each country's exports by a certain fraction. Thus if P_x and P_x^* are the domestic prices of a unit of home and foreign country exportables, respectively, and t and t^* represent the fraction by which those prices are raised by obstacles to trade, then the total supply prices to buyers of the countries' exports will be $P_x(1+t)$ and $P_x^*(1+t^*)$, respectively. These expressions state that the price of goods in the buying market must exceed the price in the selling market by the cost of transport and tariffs.

Second, he argued that long-run equilibrium requires that the total value of each country's exports be exactly equal to the total value of its imports measured in terms of a common currency. For the home country, this zero trade balance equilibrium condition can be expressed as

$$(7) \quad QP_x(1+t) = Q^*P_x^*(1+t^*)E$$

where Q is the quantity of physical exports of the home country, Q^* the physical quantity of its imports (i.e., the quantity of the foreign country's exports), $P_x(1+t)$ the home currency supply price (including transport costs) of home country exports, $P_x^*(1+t^*)$ the foreign currency supply price of foreign country exports, and E the exchange rate

defined as the home currency price of a unit of foreign currency.

Third, he assumed that the domestic price of each country's exportables can be linked to general price levels P and P^* via the following relationships

$$(8) \quad P_x = RP \text{ and } P_x^* = R^*P^*$$

where R and R^* denote the equilibrium ratio of export prices to general prices in each country, as can be seen by expressing the equations in the form $R = P_x/P$ and $R^* = P_x^*/P^*$. Representing the equilibrium relative prices of exportables in terms of general price levels at home and abroad, these equations summarize the equilibrium *structure* of prices in the two countries concerned.

Finally, he substituted Equation 8 into Equation 7 and solved for the equilibrium exchange rate thereby obtaining the expression

$$(9) \quad E = \left[\frac{Q}{Q^*} \right] \left[\frac{1+t}{1+t^*} \right] \left[\frac{R}{R^*} \right] \left[\frac{P}{P^*} \right]$$

which says that the equilibrium exchange rate is the product of four determinants, namely the unobstructed barter terms of trade, relative transport and tariff costs, relative price structures, and the PPP, respectively. Regarding these determinants, note that the terms of trade variable shows the quantity of exports the home country must give up in the absence of tariff and transport costs to obtain a unit of imports (the other country's exports) and thus represents the real cost of obtaining the latter in terms of the amount of the export good sacrificed. Determined by real factors such as tastes, technology, and resource endowments, the terms of trade variable captures nonmonetary influences affecting the exchange rate.

The relative tariff and transport cost variable shows the impact on the exchange rate of natural and artificial obstacles to trade. Note that when these obstacles are identical both for exports and imports such that $t=t^*$, the ratio reduces to one and thus cannot distort the exchange rate from the PPP. Only if trade barriers are more severe in one direction than another, i.e., exports and imports are hampered unequally, would such distortion exist.

The remaining determinants can be summarized briefly. The price structure variable compares the relationship between export prices and general price levels at home and abroad. Unless both countries possess identical price structures, this determinant will cause a persistent discrepancy between the equilibrium exchange rate and the PPP. Note also that the price structure variable is determined not by monetary but by real factors (e.g., tastes, technology,

resource supplies), which means that it is largely invariant to monetary changes. By contrast, the PPP variable is, in Bresciani-Turroni's own words, determined by "the monetary conditions particular to each country" and thus varies with changes in relative money stocks. [1, p. 93]

On the basis of Equation 9, Bresciani-Turroni reached the following conclusions regarding the validity of the PPP theory. First, the absolute version of the theory is generally incorrect. Evidently the equilibrium condition is not "exchange rate equals PPP" but rather "exchange rate equals PPP multiplied by the terms of trade, relative obstacles to trade, and relative internal price structures." These other things may cause the equilibrium exchange rate to deviate permanently from the PPP.

Second, the relative version of the doctrine remains valid if these other factors are constant. That is, other things remaining the same, the exchange rate varies equiproportionally with relative price levels as predicted by the theory. This can be demonstrated by holding the other factors constant in Equation 9 and letting the PPP double or quadruple. The changes in the PPP will be matched by a corresponding doubling or quadrupling of the exchange rate.

Third, whether other things remain the same depends upon whether disturbances emanate from the monetary or real sectors of the economy. Purely monetary disturbances will not affect the long-run equilibrium values of the non-PPP determinants of the exchange rate. These determinants are real variables. As such they are largely invariant to monetary shocks. In long-run equilibrium the latter affect only price levels and the PPP. It therefore follows that the relative version of the theory holds in the case of monetary changes.

Fourth, in sharp contrast to purely monetary disturbances, real disturbances will indeed alter the non-PPP determinants of the exchange rate, thus producing systematic divergences between exchange rate variations and those of the PPP. This means that the relative version will not hold exactly in the case of real changes. Nevertheless, it may hold at least *approximately* if the real effects are small. And, according to Bresciani-Turroni, that is exactly what one would expect to find. He maintained that there are limits to how far away from the PPP real disturbances can distort the exchange rate. These limits are set by the price sensitivity (elasticity) of international demands. If this sensitivity is high, then even slight deviations from PPP will invoke large price-induced shifts in trade sufficient to check further deviations. It follows, he said, that "when international demands are very elastic, which happens in

the case of modern industrial countries with a considerable resourcefulness of supply," the influence of real changes on exchange rates is "likely to be confined within narrow limits." If so, "there will be for exchange rate indexes a tendency to settle at a level approximately equal to the ratio of . . . price indexes." [1, p. 122] In short, provided international demand elasticities are high, the relative version of the doctrine remains approximately valid even in the case of real economic changes.

Finally, mention should be made of Bresciani-Turroni's rejection of the so-called commodity arbitrage interpretation of PPP. This interpretation sees PPP as an extension of the law of one price, according to which the operation of goods arbitrage equalizes the common currency price of internationally-traded goods across countries. Since this reasoning only applies to internationally traded goods, its proponents advocate restricting the PPP concept solely to the prices of traded goods.

Bresciani-Turroni, however, emphatically rejected this interpretation as a trivial truism devoid of economic content. He argued that because internationally-traded goods have a single world price, their common currency prices by definition must everywhere be the same (transport costs aside). In other words, the ratio of their prices in domestic currencies must, shipping costs aside, move with exchange rates purely as a matter of arithmetic. Moreover, since arbitrage by definition equalizes prices of traded goods at *any* given exchange rate, it fails to explain how a unique equilibrium exchange rate is determined. He, of course, took it for granted that arbitrage would occur, but he insisted that the essence of the PPP doctrine was not the law of one price but rather the notion that exchange rates accurately reflect the monetary conditions in the countries concerned. And if the purpose of PPP is to indicate relative monetary conditions, then one should compare not the prices of traded goods alone but rather general price levels that measure the value of money.

Friedman and Schwartz The principal contribution to the PPP doctrine since Bresciani-Turroni's analysis has been Milton Friedman's and Anna Schwartz's 1963 generalization of the price-induced PPP self-equilibrating mechanism to apply to all items in the balance of payments. This was a new development. Prior to Friedman and Schwartz, stabilizing price pressures were viewed as operating solely or primarily through the trade accounts alone. Cassel, for example, argued that the exchange rate would be brought into conformity with PPP via price-induced changes in commodity trade. In his

account, a doubling of U. S. prices relative to foreign prices at the existing exchange rate would, by making U. S. goods twice as expensive to foreigners and foreign goods half as expensive to Americans, discourage U. S. exports and encourage U. S. imports thereby resulting in an increased supply of dollars seeking to buy a reduced supply of foreign currency on the market for foreign exchange. The resulting excess demand for foreign currency and the corresponding excess supply of dollars would bid the exchange rate to double its original level. In this way changes in exports and imports and the corresponding shifts in the supply and demand for foreign exchange would raise the exchange rate to the level dictated by PPP. Thus, in the traditional view, price-induced changes in commodity trade constitute the primary means by which the exchange rate is restored to the PPP equilibrium.⁴

Friedman and Schwartz, however, argued that such adjustment is not restricted to the trade accounts alone. In particular, price-induced changes in unilateral transfers and capital movements also play a role. Regarding unilateral transfers, they contended that a doubling of wages and prices in the U. S. relative to those abroad

would mean that a given number of dollars transferred by immigrants, for example, to their families abroad would constitute only half as large a fraction of the immigrants' wages and so would tend to increase the amount sent. [5, p. 61]

On the market for foreign exchange, this increased desire to make unilateral transfers would translate into an increased supply of dollars seeking to buy foreign currencies, thereby putting upward pressure on the exchange rate.

The same holds true for capital flows. Regarding such flows, Friedman and Schwartz state that, given the U. K. price level and the dollar/pound exchange rate, a doubling of U. S. prices

would mean that a given number of pounds sterling intended for capital investment in the United States would buy only half as much physical capital while still commanding an unchanged amount at home and so would discourage capital investment in the U. S. [5, p. 61]

On the market for foreign exchange, this reluctance to invest in the U. S. would be reflected in a reduced supply of pounds seeking to buy dollars. Likewise, the corresponding increased desire of Americans to invest in Britain would be manifested in an increased supply of dollars seeking to buy pounds. The resulting excess demand for pounds and the corresponding

excess supply of dollars would help bid the exchange rate up toward its PPP equilibrium. In this manner the self-equilibrating mechanism operates through the capital account as well as the current account of the balance of payments. More generally, since all items in the balance of payments are critically dependent on relative national price levels, all contribute to the stability of PPP equilibrium.

Concluding Comments This article has traced the evolution of the PPP theory of exchange rates from its initial formulation by Thornton and Wheatley in the early 1800's to its definitive critique and restatement by Bresciani-Turroni in the mid-1930's. It is now time to summarize the views of current proponents of the doctrine.

With the exception of Friedman and Schwartz, modern proponents have added little beyond Bresciani-Turroni's analysis. Like him they hold that the long-run behavior of the equilibrium exchange rate is chiefly, but not solely, determined by the behavior of relative money stocks operating through relative price levels.⁵ Like him they readily acknowledge that a variety of factors—tariff changes, output disturbances, shifts in demand, capital movements and the like—impinge on the equilibrium rate and force it to deviate from the path dictated by the PPP. And like him they argue that price parities operate to limit these deviations and hold them in check. In particular, they contend that divergences from PPP will trigger the restraining force of price-induced trade and capital flows that arrest further deviations. For example, they argue that real factors that push the external value of a currency below its PPP will inevitably generate price incentives tending to spur exports and check imports. The resulting trade balance improvement and the associated strengthening of demand for the currency on the foreign exchanges will halt further deviations from price parity. In this manner, the PPP mechanism tends to constrain systematic distortions between the equilibrium rate and price parity.

The same mechanism, proponents note, also works to correct random rate variations and to keep the actual rate tending toward the equilibrium rate whether or not the latter differs from PPP. That is, suppose the equilibrium rate is permanently distorted from price parity as indicated by the expression $E = K(P/P^*)$ where K is the divergence between the two variables. Notwithstanding this distortion, the self-corrective mechanism will eliminate all devi-

⁴ Recall, however, that in Wheatley's view income adjustments also play a role.

⁵ What follows draws heavily from Yeager [15, pp. 210, 214-23].

ations from PPP up to the factor K and the equilibrium exchange rate will remain powerfully related to the PPP.

Finally, proponents note that the PPP theory completely explains equilibrium exchange rate movements stemming from purely monetary changes. Moreover, they contend that it applies, albeit approximately, when monetary changes dominate real changes. They point out that a money-induced rise in the PPP tends to be reflected to its full extent, without modification, in the exchange rate. By contrast, a real shock operating through the balance of payments provokes compensations that limit its effect on the exchange rate. In the long run, therefore, exchange rate movements will largely reflect changes in relative money stocks as predicted by the theory. For these reasons proponents hold that the PPP theory remains a valid and useful concept.

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