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Toward an Explanation of National Price Levels

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1 INTRODUCTION

It would be only a slight exaggeration to claim that a theory of comparative price levels does not exist. Most theoretical discussions assume that price levels tend toward equality. They have thus directed attention toward what have been regarded as temporary divergences from equal price levels and diverted attention from the large and systematic differences in price levels that actually exist. The main purpose of this Study is to call attention to the need for a theory of comparative national price levels and to explore some of the elements that should be included.

The reality and extent of the differences in national price levels can be seen in the data presented in Table 1 on the following page, which indicate that 1975 price levels in high-income countries were more than double those in countries with very low incomes. We suggest here that price levels are affected not only by the short-run factors that have received the most attention from economists but also, and to an important degree, by long-run structural factors. The levels of the structural characteristics of the individual countries—and possibly even the structural relationships with price levels—change, albeit slowly. Because they change, and because price levels and exchange rates are interdependent, these long-run factors should be taken into account in explaining changes in exchange rates and competitiveness. This Study is a beginning in that direction.

The research reported on is part of the National Bureau of Economic Research program in international studies. Earlier versions of this paper were prepared for the International Association for Research in Income and Wealth Special Conference on Purchasing Power Parities, held in Luxembourg in September 1982, and for an unpublished NBER working paper. It is part of the NBER's studies of U.S. Trade Policy, Competitiveness, and Capital Mobility in the World Economy (NSF Grant No. PRA-8116459) and draws to a substantial extent also on work done under NSF Grant No. SES-7913980-A01 to the University of Pennsylvania. We have had the benefit of helpful comments from Arthur Bloomfield and are indebted to Martin Shanin, Robert Levinson, and Linda Molinari for statistical assistance and to Kathleen Conway and James Hayes for the preparation of the manuscript. Any opinions expressed are those of the authors and do not necessarily represent those of the National Bureau of Economic Research or the National Science Foundation.

TABLE 1

NATIONAL PRICE LEVELS FOR 34 COUNTRIES CLASSIFIED BY REAL GDP PER CAPITA, 1975

(*U.S. = 100*)

Income Class [a]	*No. of Countries* (1)	*Real GDP per Capita*[b] *Range* (2)	*Mean* (3)	*Nominal GDP per Capita (Mean)*[c] (4)	*GDP Price Level (Mean)*[d] (5)
1	8	Less than 15	9.0	3.7	40.7
2	6	15-29.9	23.1	12.1	51.7
3	6	30-44.9	37.3	24.2	64.5
4	4	45-59.9	52.4	38.7	73.6
5	9	60-89.9	76.0	82.3	107.4
6	1	90 & over	100.0	100.0	100.0

[a] The countries in each class are:

1. Malawi, Kenya, India, Pakistan, Sri Lanka, Zambia, Thailand, Philippines
2. Korea, Malaysia, Colombia, Jamaica, Syria, Brazil
3. Romania, Mexico, Yugoslavia, Iran, Uruguay, Ireland
4. Hungary, Poland, Italy, Spain
5. U.K., Japan, Austria, Netherlands, Belgium, France, Luxembourg, Denmark, Germany
6. U.S.

[b] GDP converted to dollars at purchasing power parities.

[c] GDP converted to dollars at exchange rates.

[d] PPP for GDP divided by the exchange rate. See Chap. 3 below. Means of columns (3) to (5) are simple arithmetic averages.

SOURCE: Kravis, Heston, and Summers (1982); hereafter, KHS (1982).

2 ANTECEDENTS

Most discussions of price levels by economists have assumed that price-level differences are evidence of disequilibrium and have been concerned with the mechanism by which deviations from equilibrium are erased. David Hume's exposition of the factors determining the distribution of specie is an early treatment of price levels along these lines. Hume concentrated more on the mechanism by which disequilibrium differences in price levels would be adjusted than on an effort to describe the nature of the equilibrium levels themselves. Indeed, he was sufficiently vague to have been subsequently interpreted by some writers as an early advocate of the law of one price and by others as describing changes in relative price levels as part of the adjustment process (see Collery, 1971, pp. 25-26, for an example of the latter).

In the very large literature on the adjustment mechanism that relies on price elasticities, which may be regarded as a logical outgrowth of Hume's work, the nature of the world price structure has seldom, if ever, been clearly specified. In much of this work, the basic assumption has been that changes in exchange rates could alter the prices of one country's goods relative to those of another country and consequently produce changes in the balance of trade. But it has been rarely, if ever, specified whether prices for identical goods do or do not have to be the same (after allowance for transfer costs) in different countries (Kravis and Lipsey, 1978).

Price levels also play a prominent role in the purchasing-power-parity theory of exchange rates. Since the main thrust of the theory is that exchange rates will adjust so as to equalize price levels (or changes in price levels), price-level differences are regarded as deviations from normal conditions. It is true that Cassel recognized that exchange rates could deviate from purchasing power parity (PPP) owing to the unequal impact of the trade restrictions imposed by different countries on exports and imports, and, in the short run, to capital movements and expectations (Cassel, 1922, pp. 147-162; Holmes, 1967). But PPPs remained as the "normal" exchange rates (Cassel, 1922, p. 156), and even these qualifications were often lost sight of by subsequent supporters of the theory.

In recent years, the PPP theory has been revived as part of the monetary approach to the theory of the balance of payments. Once again,

the main purpose of the theory was not to explain price levels. Rather, a "law of one price" was invoked to help demonstrate the dominant role of the supply of money in determining balance-of-payments deficits and surpluses and exchange-rate changes. The law of one price, it may be noted, has usually been held to apply particularly among the more industrialized countries and particularly to tradable goods. In some versions of the monetary approach, differences in the relative prices of home goods were given a crucial, though transient, role in the adjustment mechanism (Frenkel and Johnson, eds., 1976; Whitman, 1975).

There is a very different literature in which contrary assumptions were made about the possibility of price-level differences. The reference here is to writings on export-led growth, particularly for advanced industrial countries. In one variant, the idea of export-led growth for such countries, with their varied exports, rests on the assumption that relative national price levels are not necessarily determined as endogenous variables but can be used as policy instruments. A widely held interpretation of the rapid recovery and growth of Western Europe after World War II was based on a reading of events along these lines (Lamfalussy, 1963). Alternatively, cost-reducing technological change may improve a country's price competitiveness. Though the price level is not held down as a matter of deliberate policy, the result, under a system of fixed exchange rates, may be price-induced export-led growth. For example, "a favourable export position requires, above all, that exports be 'competitive' " and competitiveness is "basically a question of price and technological superiority" (Beckerman, 1965, p. 46).

Despite the dominant tendency to treat price levels as an incidental facet of balance-of-payments and exchange-rate problems, structural explanations of price-level differences did appear. The kernel of the idea that price levels might be a function of real per capita income is found in a statement by Ricardo (1817, p. 87) that home goods would be more expensive "in those countries where manufactures flourish." A reasonably full account of a real theory of comparative national price levels was set out by Harrod (1939), in a chapter entitled "Comparative Price Levels," and restated by Balassa (1964).

These writers assumed that, at least as a first approximation, internationally tradable goods would tend to obey the law of one price. That is, local-currency prices of tradable goods were proportional to exchange rates. Each set out some version of what has been called the "differential

productivity model" (KHS, 1978). The essence of the model lies in differences in price formation and in productivity for tradable and nontradable goods. Prices for tradable goods are set in world markets, while prices for nontradable goods are determined in the home market. With similar prices for tradable goods in all countries, wages in the industries producing tradable goods in each country depend on productivity. The wage level established in the tradable-goods industries prevails also in the nontradable-goods industries, but international productivity differences are smaller for the latter. This means that in poor countries the low wages established in the low-productivity tradable-goods industries apply also to the not-so-low-productivity nontradable-goods industries. The consequence is low prices in low-income countries for nontradable goods. Since the price level is a weighted average of prices of tradable and nontradable goods, price levels tend to be lower in low-income than in high-income countries.

Harrod (1939, p. 62) stressed an additional point of great importance: retail prices (and, by implication, final product prices for all commodities) are amalgams of prices of tradable and nontradable goods. Indeed, it is not easy to think of a tradable good that reaches its final purchaser without the addition of nontradable services such as distribution and local transport. This substantially widens the possible gap for differences in national price levels. Jones and Purvis (1981) have recently explored this source of differences in national price levels in a model in which each country transforms imported tradable inputs into final goods by adding nontradable inputs. The imported inputs are obtained in exchange for exports that are used as inputs for the production of final goods in other countries; final products are produced by adding nontradable factors to these imports of intermediate goods. Even if the law of one price is assumed to apply to "middle products"—the tradable inputs—it does not necessarily follow that the same law will hold for final product prices.

Balassa (1964) and Clague and Tanzi (1972) were among the first to draw on new statistical studies of purchasing power and comparative levels of real per capita GDP that provided direct comparisons of price levels. These studies began to appear in the 1950s (Gilbert and Kravis, 1954; Gilbert and associates, 1958); the most recent is the source of the data in Table 1 (KHS, 1982). For the most part, this work concentrated on the empirical problems of measurement rather than on explanation

of the differences observed, although some analysis of price and quantity relationships was included.[1]

[1] A skeptical view of the existence of a relationship between income levels and what are referred to here as price levels was presented in an article by Officer (1976) challenging Balassa's (1964) finding of a "productivity bias" in "purchasing power parity as a measure of the equilibrium exchange rate." While the emphasis of Officer's article on purchasing power parity and on changes over time was different from the concerns of this Study, it did include cross-section results that gave little support to the relationship so clearly found here between price levels and income levels. There seem to be several reasons for the differences in results. One is that, at the time he wrote, Officer did not have the results that are now available for 16 benchmark countries for 1970 and 1973 and 34 for 1975 from the United Nations International Comparison Project. He therefore had to rely on dubious PPP comparisons or fit equations to very small numbers of observations. The latter problem was particularly acute because he excluded developing countries from his equations, for reasons that do not seem relevant to the present purpose. With a larger number and wider range of countries, including or excluding the United States, a very strong positive relationship is found between price levels and real per capita GDP.

It may be added that Officer's procedure of eliminating the base country from the regressions destroys the transitivity that is built into the price measures. As long as the base country is always included, the results of regressions will be the same no matter which country is used as the base. If the base country is excluded, the choice of the base will affect the conclusions—a strong argument against that procedure.

3 DEFINING NATIONAL PRICE LEVELS FOR COMPARATIVE PURPOSES

The basic approach to international income and product comparisons of Gilbert and Kravis (1954) and all the major ensuing studies rests on the identity: price (P) times quantity (Q) equals expenditure (PQ). For a pair of countries (the asterisk indicating the numeraire country), for a single good,

$$\frac{P}{P^*} \times \frac{Q}{Q^*} = \frac{PQ}{P^*Q^*},$$

where the Ps are in each country's own currency. The ratios PQ/P^*Q^* for detailed categories of goods are obtained from national-accounts data. The P/P^* ratios are from a sample of goods in each category obtained from existing or special-purpose price collections in which the quality of each item in the price comparisons is carefully matched across countries. The Q/Q^* ratios are then derived from the other two ratios. Quantity comparisons could, in principle, be made in lieu of or in addition to price comparisons, but their sampling variance is likely to be higher and the data more difficult to obtain.

The use of the national-accounts framework in these comparative studies provides the answers to some important conceptual questions that plagued earlier efforts to produce an operational definition of the "general price level" (Snyder, 1928; Keynes, 1930, pp. 76-94). What prices to include and what weights to assign to each price fall into place once it is decided to base the comparisons on the national-accounts concept of final expenditure on GDP. Each price is, in principle, the weighted national average price; that is, it is the P that is embedded in the national-accounts expenditure figure PQ. In other words, the weights are determined by relative importance in expenditures on GDP. There are, to be sure, problems about how the weights of the different countries will enter into the weights used in the comparison, but at least the conceptual problem of what data to start with at the country level is clearly resolved.[1]

[1] It is not unusual to find consumer price indexes and wholesale price indexes used in empirical work on the determination of exchange rates, often in a context in which the explanatory theory is couched in terms of tradable and nontradable goods. Sometimes the relative movements of tradable- and nontradable-goods prices are inferred from the differ-

In the absence of such a comparative price study, the Ps and Qs are unknown, and all that can be done for comparative purposes is to convert the expenditures to a common currency via the exchange rate. For example, where PQ = GDP in own currency, and e is the number of units of a country's currency required to buy one unit of the numeraire currency on the foreign-exchange market, a GDP comparison (n) is obtained by

$$\frac{PQ}{\Sigma\, P^*Q^*} \div e = n\ .$$

This, indeed, is still the most common way of comparing GDP among countries; it is used, for example, in the standard compilations of comparative GDPs such as World Bank (1982). This approach implicitly assumes that average $P/P^* = e$; that is, the relative purchasing powers of the currencies are reflected in the exchange rate.

If the latter equality held, exchange-rate-converted prices in the two countries would be equal; there would be only a world price level, and national price levels would all be the same. In fact, the equality does not hold; the purchasing power of a currency relative to a numeraire currency may be two or three times the exchange rate (see Table 1), and comparisons based on exchange-rate conversions are often far from the correct relationship. If average $P/P^* > e$, the country's prices are higher than those of the numeraire country and an exchange-rate conversion will overstate its real GDP relative to the numeraire country. If average $P/P^* < e$, an exchange-rate conversion will understate the country's real GDP.

If P/P^* is known for every category of GDP, a country's relative real GDP can be obtained from

$$\frac{\Sigma\, PQ}{\Sigma\, P^*Q^*} \div PPP = r\ ,$$

---

ences in the behavior of these two indexes, on the ground that the wholesale price index is more heavily weighted with tradable goods. Reasons have been given elsewhere for preferring GDP implicit deflators over consumer and wholesale price indexes as measures of the changes in the price level (Kravis and Lipsey, 1978, pp. 199-201). On the other hand, the price comparisons used in this Study are calculated on the basis of products in final expenditures on GDP. Their computation thus does not involve intermediate products, which are so important in international trade. In principle, however, the estimate of the relative purchasing power of two currencies should be the same whether prices are compared on the basis of final products or on the basis of outputs originating in each industry.

where r is the country's real GDP relative to the numeraire country and PPP is an appropriately weighted average of the P/P^*s. PPP is expressed in terms of units of a country's currency per unit of the currency of the numeraire country. Price levels may be more conveniently compared by dividing the PPPs by the exchange rates:

$$PPP \div e = PL ,$$

where PL is a country's price level relative to that of the numeraire country. PL can be compared both for detailed category levels and for aggregations such as GDP.

The fact that national price levels can be compared only by converting prices to a common currency by means of exchange rates calls attention to the connection between price levels and exchange rates. In the literature on the determination of exchange rates, as well as in that dealing with PPP theory, the term "real exchange rate" is often used to refer to an index of exchange-rate changes corrected for relative-price changes.[2] The real exchange rate is the reciprocal of the *change* in PL.[3]

Our decision to use the United States rather than some other country as the numeraire country for the purposes of the calculations in this Study does not affect the results except in a trivial scaling sense.

[2] In models based on small-country assumptions, in which all tradables prices are determined outside the country, the only possible effect on relative prices of a small country's devaluation stems from a change in tradables prices relative to nontradables prices within the country. That change itself is sometimes described as the "real rate of exchange" in balance-of-payments models (see, e.g., Berglas and Razin, 1973, and Bruno, 1976). The relationship between that definition and the one used here, which involves no assumptions about the fixity of price relationships, depends on the movement of tradables prices and nontradables prices in the rest of the world and on the share of nontradables in the country being observed.

[3] The index of the real exchange rate (IRE) in the year t, taking year 0 as a base, is $IRE_t = e_t/e_0 \div (P_t/P_0 \div P^*_t/P^*_0)$, where the asterisk refers to the numeraire country. The change in PL, which is an index of the movement in the domestic price level adjusted for exchange-rate changes (IPL), may be formulated as $IPL = (P_t/P_0 \div e_t/e_0) \div P^*_t/P^*_0$. The numerator terms in this expression, were they available in absolute rather than index-number form, could be used to form PL, that is, $PL_t = (P_t \div e_t) \div P^*_t$. In order to simplify these expressions, the fact that the prices and price relatives must be weighted averages has been ignored. Frenkel (1981a) has used the price terms in the form of intertemporal indexes to test the absolute version of the PPP theory. But this procedure does not permit the comparison of absolute price levels that is contemplated in this version of the theory.

4 ELEMENTS IN A THEORY OF NATIONAL PRICE LEVELS

The elements that determine differences in national price levels at a given time may be classified in different ways. A distinction might be made, for example, between real and monetary factors or between long-run and short-run influences. Another possible classification would divide the influences according to which of the two factors that enter into the formula for the price level ($PPP/e = PL$) they affect—that is, whether they operate on the relative domestic price level (PPP) or through the exchange rate (e). From a general-equilibrium standpoint, however, this may be viewed as a misleading dichotomy, since PPPs and exchange rates jointly determine relative price levels and are jointly determined by them in an interdependent set of relationships. Our position is that the best research strategy is to focus on the explanation of the price level. We argue that it is possible to identify a long-run equilibrium price level toward which the combination of the price level in domestic currency and the exchange rate must tend.

The simple monetary approach to the balance of payments assumes that price levels are the same everywhere (with exceptions for nontradables, in some versions). The world price level is the controlling parameter. A policy designed to alter the domestic-currency price level will merely produce compensating changes in the exchange rate. It has already been established, however, that in the real world price levels are not the same in different countries, and it is preferable to avoid imposing a fixed, or nearly fixed, offsetting relationship between domestic-currency prices and the exchange rate. It is now generally accepted that prices in goods markets adjust more slowly than exchange rates: the possibility should be left open that some influences operate on exchange rates, with an incomplete or delayed adjustment in domestic-currency price levels, and others on domestic-currency price levels, with an incomplete, more than complete, or delayed adjustment in exchange rates.

In the exploratory empirical work that follows, influences on the price level (PL) are viewed as consisting of long-run factors that determine the underlying price level and short-run factors that cause deviations from the basic level. The long-run factors are regarded as real variables, and the short-run factors as mainly monetary variables.[1]

[1] Mussa (forthcoming, 1984) suggests that monetary models are useful in explaining nom-

Long-Run Structural Factors

The long-run factors are structural variables that characterize the comparative economic framework of the country. One key structural variable, real per capita GDP, has already been shown to be positively correlated with the price level. Other structural characteristics that merit examination for possible links to price levels are the industrial composition of GDP, including the distribution of the labor force across industries, and factor endowments, including the skill composition of the labor force. The size of the country and the influence this has in leading it to more or less participation in international trade are also relevant. These variables are, for the most part, long run in character in the sense that they change only gradually over time.

As we pointed out in our discussion of the productivity-differential model, some of these factors affect the price level primarily through a differential impact on the prices of tradable and nontradable goods. The distinction between these two with respect to price behavior is similar to that in "Scandinavian" models of price- and wage-setting behavior between "exposed" and "sheltered" sectors of the economy (Aukrust, 1970). Prices in the exposed sector are set in international markets and determine wage levels in all sectors, and prices in sheltered sectors are set by markups over cost. The exposed sectors are essentially tradables, and the sheltered sectors essentially nontradables.

It has long been a matter of casual empirical observation that services and nontradables generally are relatively cheap in low-income countries. This is confirmed in the results of the UN International Comparison Project (ICP). The price indexes for tradable and nontradable goods for the 34 countries included in the 1975 ICP benchmark study are classified by increasing income levels in Table 2.

Of course, if tradable-goods prices are linked more or less closely to world price levels but nontradables are cheap in low-income countries, the low-income countries will be characterized by low price levels for GDP as a whole, again a finding of the ICP studies that is evident in Table 2.

The productivity-differential model ascribes low nontradable-goods prices to relatively high productivity in the poor countries' service industries, which account for most nontradable goods (KHS, 1978, 1982). That is, although the productivity of poor countries is low relative to that of rich

inal exchange rates and that models taking balance-of-payments equilibrium as the final determinant of exchange rates are most relevant to real exchange rates.

TABLE 2

PRICE INDEXES FOR TRADABLE AND NONTRADABLE GOODS, 34 COUNTRIES, 1975

	Price Indexes (U.S. = 100)		
Income Class[a]	*GDP*	*Tradables*[b]	*Nontradables*[c]
1	40.6	60.0	24.9
2	51.7	70.7	37.2
3	64.7	86.6	46.5
4	73.5	97.9	53.4
5	107.5	118.5	96.7
6	100.0	100.0	100.0

[a] See Table 1 for income ranges and numbers of countries.

[b] Final-product commodities excluding construction.

[c] Final-product services and construction. These entire categories are being treated as nontradable, although of course some are traded.

SOURCE: KHS (1982, p. 196).

countries in both service and commodity-producing industries, the productivity differentials are smaller in the service industries. Empirical evidence supporting this pattern of productivity differences was first offered by Kuznets (1957, pp. 33 and 41; 1971, pp. 208-248) through the use of sectoral productivity ratios—sectoral shares in output divided by sectoral shares in employment. Confirmation is found in Chenery and Syrquin's "stylized" presentation of relationships for 101 countries covering the period 1950-70 (Chenery and Syrquin, 1975, pp. 20-21; Chenery 1979, p. 20). Productivity in this model is usually interpreted in the Ricardian sense, that is, as a partial productivity measure—output per unit of labor input—and that is what is measured in the data cited.

This explanation of differences in service/commodity price ratios between rich and poor countries can be reconciled with an explanation based on a standard factor-proportions trade model even if there are no differences in total productivity ratios or production functions. The factor-proportions model explains the differences in service/commodity price ratios in the same way as the differences in price ratios among tradable goods, as a consequence of the relative abundance and prices of the factors of production in rich and poor countries.

The factor-proportions explanation runs as follows. Service industries are relatively labor intensive, on the average, in all types of countries, as can be seen in Table 3. Because capital is abundant in rich countries, labor is highly productive and expensive. As a result, rich countries produce and export capital-intensive tradables to poor (labor-abundant) countries, and poor countries produce and export labor-intensive trad-

TABLE 3

CAPITAL/LABOR RATIOS FOR COUNTRIES WITH VERY LOW AND VERY HIGH INCOMES

(in thousands of dollars per man year)

Income Level[a]	*Commodities*	*Services*
Low-income	4.39	2.48
High-income	21.94	10.96

[a] Low- and high-income countries are those in income classes 1 and 6, respectively, of Table 1.

SOURCE: KHS (1983).

ables to rich countries. Nontradables, however, must be produced by each country for its own use. Since services (nontradables) are labor intensive and labor is expensive in rich countries, the price of services tends to be high in rich countries relative to the price of commodities, just as the price of labor-intensive goods is high relative to that of capital-intensive goods. There is thus an alternative explanation of the price structure that does not require the assumption that productivity, with respect to all factors or in the production-function sense, is more similar between rich and poor countries in services than in goods. This explanation is compatible with identical production functions in all countries. (See Bhagwati, 1984, forthcoming, for a more formal model of the factor-proportions explanation.)

In commenting on the reasons for the differences in labor productivities in services and commodities, Kuznets (1957, pp. 33ff.) mentions several factors affecting the supply of and demand for services and commodities and the types of labor that produce them. He includes the possibility that some of the professions providing services may be able to extract higher incomes in low-income countries that have relatively little national investment in human capital. KHS (1983) find some evidence of higher income differentials for educated people in low-income countries but conclude that the primary influences at work are differences in physical-productivity ratios in commodities and services rather than compensation. This raises the possibility that the explanation may be found in differences in the diffusion of technology. The technological gap separating productive practices in poor and rich countries may be smaller in service production than in commodity production, especially in countries where backwardness in overpopulated rural areas may be a severe problem in commodity production.

A possible further explanation of the high prices of services relative to commodities in developed countries is that the elasticity of substitution

between capital and labor is lower in service industries. This has been suggested, for example, as the reason for rising prices for the performing arts in developed countries (Baumol and Bowen, 1966). If that is the case, then in tradables industries rich countries can adapt to high labor prices by substituting capital for labor and thus achieve higher labor productivity in tradables than poor countries even if they are all on the same production function, but this alternative is not available in nontradables industries. There the substitution possibilities are absent or lower, and labor-productivity differences are therefore also absent or lower.

Although productivity differentials between tradables and nontradables have been described as a function of the level of per capita income, there could be other determinants of such differentials. One country's tradables sector may include a protected, backward agriculture, while another's may be composed entirely of highly efficient and competitive manufacturing. One country's service sector may be filled with small, inefficient retailing units protected by laws restricting mass retailers, while another's may permit vigorous competition that eliminates inefficient units. Rational efficient growth should eliminate these intersectoral differences. But, meanwhile, large dispersions in sectoral-productivity ratios should, other things being equal, lead to high prices in the low-productivity sectors, which would be more shielded from international competition than high-productivity sectors. Consequently, the price level should vary directly with the dispersion of sectoral-productivity ratios of each country. Unfortunately, it is difficult to develop accurate sectoral-productivity measures for large numbers of countries, particularly for industries subdivided into more than eight or ten branches.

Among the structural factors not related to the productivity-differential model is the strength of the country's economic links with the rest of the world, which has been referred to as "openness." Openness, which proved useful in efforts to estimate real GDP from nominal GDP,[2] is defined as the ratio of exports plus imports to GDP. It can be thought

[2] The reference is to "short cut" estimates of real per capita GDP, which are formed by extrapolating to other countries the relationship between exchange rates and PPPs found in benchmark studies such as those of the ICP. The need for short-cut estimates arises because benchmark studies such as those relied upon here will not soon, if ever, be feasible for all the countries of the world. If a comprehensive system of real product comparisons is to be developed, therefore, short-cut methods will have to be applied to nonbenchmark countries. The proper identification of the variables that explain the price level would be useful in improving these estimates (see KHS, 1978).

of as the combination of two characteristics: the proportion of tradables actually traded and the ratio of tradables output to GDP.

The degree of openness may affect the price level through its influence on prices of the factors of production. The higher the degree of openness, the higher the price of the abundant factor, abstracting from differences in elasticity of factor supply. If services tend everywhere to be labor intensive relative to commodities or tradables, the more open a labor-abundant country, the higher its price of services and the higher its price level, because openness would increase the price of labor. The more open a capital-abundant country, the higher the price of capital and the lower the relative price of services and the overall price level. In comparisons with the United States, the effect of openness should be positive on all countries' price levels if the United States is the most labor scarce (capital abundant). However, the effect should be stronger on the price levels of low-income countries.

If low incomes and labor abundance are associated with low elasticities of labor supply, the effect of a high degree of openness in producing a high price level is enhanced. This would not be the case, however, in surplus-labor economies with very high labor-supply elasticities and comparative advantage in labor-intensive industries.

The share of nontradables in output or employment may have an influence on the price level apart from the role of the tradables share in openness. This influence would reflect the fact that the total price level is an average of the tradables and nontradables price levels, weighted differently in each country. If these weights are simply a function of per capita income, the coefficient for per capita income will include the influence of the nontradables share. To the extent they are not, the nontradables-share effect will depend on the relation between nontradables shares and nontradables price levels. If high nontradables shares were associated with relatively low nontradables prices for a given per capita income, as they might be if elasticities of substitution between goods and services were large, the effect of nontradables shares on price levels would be negative. If high nontradables shares were associated with high nontradables prices, as they would tend to be if the elasticities of substitution were low, the effect of nontradables shares would be positive. What evidence there is (KHS, 1983) suggests a low elasticity, and we therefore expect a positive relationship on this account.

There is another possible channel of influence of nontradables shares. If nontradables tend to be high priced in rich countries and low priced

in poor countries, a large share of nontradables should tend to raise the price level of a rich country but lower that of a poor one. However, since all of the countries have lower incomes than the numeraire country, the United States, the effect may be in the same direction for all countries but strong on the poor countries' price levels and weaker on the richer countries' price levels relative to the United States. To observe this interaction, the share of nontradables should be introduced in the form of an interaction between income per capita and the nontradables share of output.

The productivity-differential model described above points to variables such as real per capita GDP (r) that may capture the direct impact of the operation of the model, or to measures of relative productivity in commodity and service production. An alternative approach, first tried by Clague and Tanzi (1972) and more recently by Isenman (1980), is to use the relative quantity or prices of skilled labor to reflect differential productivity. Isenman assumes that services are intensive in skilled personnel; a relatively large proportion of educated or highly skilled personnel or low incomes for educated and skilled personnel would therefore have a negative influence on a country's price level.

A number of other structural factors have been suggested.[3] The possibility that a country's trade restrictions could lower the price level of a partner country has already been mentioned in connection with Cassel's work. Usher (1968, pp. 108-113) has offered a somewhat broader treatment of this influence, and Clague (1980) has modeled the relationship. Clague and Tanzi (1972) argue that a country rich in natural resources in apt to have a higher price level, other things equal. Abundant resources relative to human skills should make commodity prices (which tend to be resource intensive relative to services) relatively cheap and service prices relatively dear. Tradable natural-resource products will sell at or near world price levels, and high service prices will lead to a

[3] A structural factor that played a prominent role in the history of economic thought is the position of a country as an exporter or importer of capital. In the classical theory of the mechanism of adjustment, particularly as expounded by Viner (1937), the capital-importing country experienced a rise in prices relative to the capital-exporting country. The currently accepted view of the transfer problem (the context in which this issue has come to be discussed) eschews any generalization about price-level changes. The terms of trade will change in favor of the capital-exporting country if the sum of the marginal propensities to import exceeds unity and in favor of the importing country otherwise (Caves and Jones, 1973). However, it is difficult to make any generalization about the effects on national price levels of changes in the relationship of export to import prices.

high average price level for GDP. Other influences that have been suggested include transport costs (Usher, 1968, pp. 78ff.), the importance of tourist expenditures, and the relative importance of indirect taxes (the latter two by Balassa as cited by Clague, 1980).

Short-Run Factors

In contrast to the relatively small literature dealing with long-run determinants of national price levels, short-run influences have been subjected to close and extensive scrutiny in the literature on exchange-rate determination. The unexpected volatility of the nominal exchange rates of the main currencies since the end of the Bretton Woods era has led to a continuing search for improved explanations of exchange-rate determinants. The volatility of the nominal exchange rates of the industrial countries relative to the movements of national price levels implies that short-run factors have had a substantial impact on exchange rates without offsetting adjustments in domestic-currency price levels. If this is the case, short-run variations in price levels (*PL*) may well have been dominated, at least in a proximate sense, by exchange-rate influences.

The monetary approach to the explanation of exchange rates views the exchange rate as the relative price of two monies, the price of each dependent on its supply and demand. Since the law of one price is held to prevail, the exchange rate (*e*) must equal PPP. Given the assumptions that prices are determined by nominal money supply and real money demand and that real money demand is determined by real income and nominal interest rates (Dornbusch, 1980), changes in the exchange rate are a function of changes in these variables. Increases in the country's money supply or interest rates relative to those of the numeraire country will raise the exchange rate (a depreciation), while an increase in its real income will have the opposite effect. The increases in interest rates and real income are held to work through their impact on money balances, the former decreasing the demand for money balances and thus raising prices and causing a depreciation and the latter increasing the demand for money balances with the opposite consequences. If the assumption of the law of one price is abandoned in favor of the more realistic view that national price levels are not so tightly linked, intercountry differences in money-market conditions can influence price levels substantially (McKinnon, 1981).

The extensions of the monetary model to cope with the volatility of exchange rates have led to formulations based on a view of the exchange

rate as the price of an asset and therefore to a central role for expectations. The enhanced role of expectations in explaining the volatility of exchange rates relative to goods prices rests on the idea that current exchange rates reflect "expectations about *future* circumstances while prices reflect more *present* and *past* circumstances as they are embedded in existing contracts" (Frenkel, 1981a; see also Frenkel, 1976 and 1981b, and Mussa, 1976). The current price of foreign exchange is closely linked to its future price, because foreign exchange can be held at small storage cost and traded at small transactions cost, as is typical of financial assets. Because of this link, changes in supply or demand conditions, particularly unexpected changes based on new information, have magnified impacts on exchange rates. Empirically, expectations have been measured by interest-rate differentials or by the relationship of the forward to the spot rate, and unexpected "news" by the unexplained variation in interest-rate differentials (Frenkel, 1981b).

The fact that exchange rates respond to changes in "the fundamentals" more quickly than goods prices makes it appear that exchange-rate changes explain changes in price levels (in contrast to the line of causation favored by the PPP theory, running from domestic-currency price levels to exchange rates). Frenkel (1981a) warns against accepting the notion of causality in these relationships. Exchange rates only "reflect the underlying circumstances rather than [create] them. . . ."; they respond to the same set of shocks as domestic price levels.

Various models of exchange-rate determination differ, too, in their treatment of relative prices—across sectors and across countries. The Dornbusch (1976) overshooting model does not assume any long-run inflation differential between the country considered and the rest of the world. A monetary expansion leads to an immediate depreciation of the exchange rate to, or even beyond, the equilibrium rate. Because goods prices lag behind, there will be an initial fall in the exchange-rate-converted price level of domestic goods followed by a rise as their prices come finally to increase in proportion to the money growth. In this model, the extent of overshooting in the depreciation depends on the degree to which the money growth reduces interest rates; a large reduction implies a large overshooting because a low interest rate must be associated with expectation of an appreciating currency. Thus, low price levels relative to those suggested by long-run influences should be associated with recent monetary expansion and low nominal interest rates.

Long-run differences in inflation rates, matched by differences in

nominal interest rates, are incorporated in a model offered by Frankel (1979). The short-run effects of money growth are similar to those of Dornbusch, with money growth causing the same initial overshooting of depreciation. The deviation of the exchange rate from PPP is proportional to the differential in real interest rates and is not necessarily associated with high or low nominal rates. Such a model suggests both monetary variables and real interest rates as explanatory variables for the price level.

While these models do not explicitly introduce the dichotomy between tradable and nontradable goods, that distinction has become common in balance-of-payments models (see, e.g., Berglas and Razin, 1973, and Bruno, 1976). A recent article by Craig (1981) treats tradable-goods prices, but not those of nontradables, as determined instantaneously by world prices. An increase in money supply, which produces an excess demand for all goods, leads to an increase in imports, a decrease in exports, a temporary increase in prices of nontradable goods, and therefore a temporary increase in the price level (see also Frenkel, 1981a).

Clearly, these models point to the growth in money supply as an important influence on the price level in general and on the price level for nontradable goods in particular. The nominal or real rate of interest is also involved in the process as an indicator of expectations regarding exchange rates and rates of inflation. The share of nontradable goods in output is a factor in the sensitivity of prices to foreign influences.

In any case, it is difficult to translate from theories designed to trace the movements of a country's nominal exchange rate over time to an explanation of changes in price levels (real exchange rates) that incorporate both nominal exchange rates and own-currency price movements. It is even more difficult to draw inferences about country-to-country differences in price levels. It may not be justifiable to carry over to an interspatial context the implicit assumption that a variety of other influences can safely be ignored because they tend to be relatively constant over time within a given country. For example, the velocity of circulation, implicitly assumed to be constant in most time-to-time analysis, may vary widely across countries.

In the ensuing empirical work, we assume that the structural determinants of price levels are constant over the whole period or change only along a trend. They are viewed as associated with long-run equilibrium differences in price levels, which are not expected to show any tendency to disappear, although they may gradually increase or de-

crease. On the other hand, the short-term determinants of price levels are viewed as reflecting mainly timing differences. These include, for example, differences in the speed with which tradable-goods prices and nontradable-goods prices respond to changes in domestic monetary variables or exchange rates and with which domestic prices in general and exchange rates respond to changes in domestic monetary variables or expectations about them. The structural and short-run influences together are regarded as producing a changing equilibrium price level toward which the combination of domestic-currency prices (PPPs) and the exchange rate tends to move within short- or intermediate-term periods, perhaps extending over five years or even more. The structural influences alone are regarded as producing a fixed or slowly changing equilibrium toward which this combination of prices and exchange rates eventually gravitates.

A reasonably definitive analysis of short-run influences on price levels will eventually require the estimation of time series on price levels rather than the occasional cross-sections now available. Without time series we are forced to make what are, in effect, arbitrary assumptions about lags in adjustment, because we can observe price levels only at one time for all 34 countries and at no more than three periods even for a few countries. The estimation of these annual price-level data is a task for future research. In the meantime, we can do no more in our empirical work than illustrate the measurement of deviations from structural relationships and a few possible relationships with short-run influences.

5 THE EMPIRICAL EXPLANATION OF PRICE LEVELS

In our exploration of the large uncharted field of empirical analysis of price levels, we rely primarily on a data set defined by the ICP coverage of benchmark countries—6 for 1970 and 1973 and 34 for 1975. The ICP data we use are price-level estimates for GDP as a whole and for traded and nontraded goods, and corresponding estimates of real per capita quantities of GDP.

Structural Variables

As a starting point we test the implications of the productivity-differential and factor-proportions models, using real GDP per capita (r) as the independent variable explaining the price level (PL). We then add measures of the openness of the economy and the nontradable share of GDP.

The coefficient for r may reflect the lower relative productivity in nontradables (services plus construction) that is associated with higher real income, because countries with higher real income enjoy a larger productivity margin over lower-income countries in tradables than in nontradables. Or it may reflect the higher price of labor and therefore of labor-intensive nontradable goods associated with higher real income. In either case, the coefficient should clearly be positive. Openness, which measures the extent of ties with the rest of the world and the share of nontradables in output, should be positively associated with the overall price level, although the strength of the effects may vary by income level.

Equation (1) gives a relationship between PL and r, both of them defined relative to the United States (= 1.0), across 34 countries in 1975.[1] (The numbers in parentheses are t-statistics; SEE is the standard error of estimate.)

$$PL = \underset{(7.6)}{0.3081} + \underset{(11.6)}{0.9365}\, r \qquad \bar{R}^2 = 0.801 \qquad SEE = 0.1297 \qquad (1)$$

[1] In view of the interdependence between PL and r, errors of measurement in one produce equal and opposite errors in the other. In equations incorporating PL as a dependent variable and r as the independent variable, the coefficient of r is biased toward -1.

Neither the addition of a squared term in r nor the fitting of a logarithmic equation with or without a squared term adds to the explanatory power of the relationship.[2]

When openness is included with r as an independent variable, the result is

$$\begin{array}{lll} PL = 0.2374 + 0.8977\, r + 0.1663\, OP & \bar{R}^2 = 0.829 & (2) \\ \quad\quad (5.0) \quad (11.7) \quad\quad (2.5) & SEE = 0.1204 & \end{array}$$

As expected, openness is positively related to the price level.

The role of the share of nontradable goods in GDP (S) is tested in equation (3):

$$\begin{array}{lll} PL = -0.0611 + 0.6753\, r + 0.0997\, OP + 0.9982\, S & & \\ \quad\quad (0.5) \quad (6.4) \quad\quad (1.5) \quad\quad (2.8) & & \\ & \bar{R}^2 = 0.859 & (3) \\ & SEE = 0.1092 & \end{array}$$

The share of nontradable goods adds to the explanation of PL in part by diminishing the influence of real income and openness. The effect on the openness coefficient, in particular, is not surprising, since, as mentioned earlier, the share of nontradables in production is a component of openness, as measured here. When the nontradables share is introduced in the form of an interaction term—the product of the nontradable-goods share and per capita real product—the $\bar{R}^2$ is reduced. (This equation is not shown.)

To determine whether the relationship between price level and the independent variables remained the same in the three years for which data are available—1970, 1973, and 1975, equations (4), (5), and (6) are fitted to data for the identical group of 16 countries in the three years:

$$\begin{array}{lll} PL(75) = 0.0246 + 0.8325\, r + 0.1756\, OP + 0.4928\, S & & \\ \quad\quad (0.1) \quad (5.7) \quad\quad (1.7) \quad\quad (0.9) & & \\ & \bar{R}^2 = 0.885 & (4) \\ & SEE = 0.1058 & \end{array}$$

[2] If a logarithmic form is desired because it explains percentage differences in price

$$PL(73) = \underset{(0.4)}{0.0666} + \underset{(5.2)}{0.7456}\, r + \underset{(1.1)}{0.1201}\, OP + \underset{(1.2)}{0.6750}\, S$$

$$\bar{R}^2 = 0.868 \qquad SEE = 0.1042 \qquad (5)$$

$$PL(70) = \underset{(0.6)}{0.0778} + \underset{(7.3)}{0.5242}\, r - \underset{(0.1)}{0.0037}\, OP + \underset{(2.1)}{0.7651}\, S$$

$$\bar{R}^2 = 0.921 \qquad SEE = 0.0570 \qquad (6)$$

Equation (4) does not differ significantly from equation (3); that is, restriction of the data to only 16 of the 34 countries does not change the relationship. The equation for 1970 is significantly different from those for both 1973 and 1975, but the observations in the latter two years could belong to the same relationship. The conclusion is that there was a shift in the relationship between price level and income after 1970. However, in all the equations, real income per capita explains most of the differences in price levels.[3]

Given the structural explanations of the price level, the influence of real income per capita should be larger on the price levels of nontradables than of tradables. At the extreme, if there were pure tradable goods and if trade equalized their prices in different countries, no correlation at all would be expected between their prices and income levels, and the observed differences mentioned earlier would have to be thought of as reflecting the nontradable element in all tradable-goods prices. Since tradables prices, or at least the prices of goods actually traded, are closely linked to the exchange rate, the main effect of openness is on the rela-

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levels, a squared term does improve the explanation. The equation in logs relating price level to income per capita is

$$\ln PL = \underset{(2.7)}{0.2546} - \underset{(5.5)}{0.8937}\, \ln r + \underset{(2.9)}{0.1631}\, \ln r^2 \qquad \bar{R}^2 = 0.771 \qquad SEE = 0.2193$$

[3] Although the coefficients in the equations for 16 and 34 countries in 1975 do not differ substantially, the $\bar{R}^2$ is much reduced by the addition of the 18 countries. One difference in the two data sets is that while 8 of the original 16 were OECD countries with developed economies and statistical systems, the additional 18 consisted of only 5 developed OECD countries and of 2 centrally planned economies and 11 developing countries. It may be that the centrally planned and developing countries do not fit the model as well as the developed countries or that the prices set in the centrally planned economies depart further from the structure of costs than in the other countries.

tionship between nontradables prices and tradables prices and therefore on nontradable prices. There could, however, be some effect on tradables prices too. Costs of transport or trade restrictions may turn some products considered here as tradable into nontradables, the prices of which are detached from world levels. Furthermore, the prices calculated for tradables include some nontradable elements.

These expectations are tested in equations (7) and (8), using 1975 data for 34 countries:

$$PN = \underset{(1.2)}{0.0502} + \underset{(14.5)}{0.9839}\, r + \underset{(2.9)}{0.1733}\, OP \qquad \bar{R}^2 = 0.881 \quad SEE = 0.1068 \qquad (7)$$

$$PT = \underset{(7.7)}{0.4732} + \underset{(7.1)}{0.7619}\, r + \underset{(1.7)}{0.1590}\, OP \qquad \bar{R}^2 = 0.640 \quad SEE = 0.1688 \qquad (8)$$

where *PN* is the price level for nontradables and *PT* the price level for tradables.

Expectations are met in several respects. The price levels for nontradable goods are explained more successfully, in terms of both the degree of correlation ($\bar{R}^2$) and the standard error of estimate (*SEE*). Also, the coefficient of *r* (real per capita income) is higher for nontradable goods, presumably because in the tradable-goods equation it reflects the influence of *r* only on the nontradable component of these goods' prices. Openness has the expected positive coefficient in each equation and the two coefficients are very similar, but the 5 per cent level of statistical significance is met only in the equation for nontradable goods.

In general, high prices for tradable goods were associated with high prices for nontradable goods when assessed relative to what would be expected from the levels of real income per capita and openness. That is, the residuals from equations (7) and (8) were positively correlated. For some countries, they were large and both positive or both negative. In such cases, it could be said that exchange rates were high or low relative to price levels. Brazil, Jamaica, Kenya, and Zambia seemed to belong to the category of relatively high price levels for both types of goods in 1975. Colombia, Korea, Sri Lanka, and Uruguay were all on the low side.

For some countries, differences between the relative levels of non-

tradable and tradable prices were particularly large, as indicated by residuals from equation (9):

$$\frac{PN}{PT} = \underset{(7.9)}{0.3164} + \underset{(8.8)}{0.5717\, r} + \underset{(1.3)}{0.0745\, OP} \qquad \bar{R}^2 = 0.722 \quad SEE = 0.102 \qquad (9)$$

The three centrally planned economies and Sri Lanka had the lowest price levels for nontradable goods relative to tradable goods, reflecting low prices for medical care, education, and compensation of government employees. At the other extreme, Syria and Japan had low prices for tradable goods and high prices for nontradable goods. This relationship suggests that in these countries productivity in nontradable goods was lower relative to productivity in tradable goods than would be expected of countries at their level of real income per capita. For Japan, at least, this finding confirms a widely held belief in the existence of a backward service sector side by side with an advanced tradables sector.

Variables designed to measure the quality of the labor force, such as enrollment ratios at various levels of schooling and numbers of teachers, contributed little or nothing to the explanation of the variation in *PL*. Thus, the surviving structural variables are real income per capita, openness, and the share of nontradable goods, all positively correlated with the price level, as in the relationship described in equation (3).

Nonstructural Variables

Our analysis in this section is intended mainly to illustrate how the structural relationship described above can provide the basis for introducing nonstructural influences. We therefore limit it to the money supply, which is probably the most widely used variable in this literature and the one most frequently treated as a policy variable. In particular, we ask whether the price-level data give any evidence of the exchange-rate overshooting implied in many of the models mentioned earlier. Other key variables such as nominal or real interest rates and the net current balance are not included at all. Even the money-supply variable is considered only in the simplest way, ignoring, for example, the distinction between anticipated and unanticipated variations in the money supply and between the growth of the money supply by itself and its growth relative to the demand for money. We concentrate on explaining 1975

price levels by events between 1970 and 1975, because that is the period for which price levels are available. An obvious disadvantage of this limitation is that results based on only these years may reflect particular events rather than general relationships. During this period, changes in exchange rates were a mixture of the initial officially determined revaluations, some made under pressure to remove deviations from long-term disequilibrium, and the later largely market-determined changes. Furthermore, without continuous price-level data it is impossible to follow the unfolding of events, to observe lags in response, for example.

Assume, to start with, that the changes in exchange rates between 1970 and 1975 represented largely deliberate choices of rates by governments. The changes may have moved price levels away from the structural relationships, part way toward them, or completely to them. If exchange-rate changes moving price levels away from the structural relationships had not been fully absorbed into own-currency price levels by 1975 (that is, offset by changes in own-currency prices), they should be negatively related to the residuals (*RPL*) from the 1975 structural equation (equation 3). If the exchange-rate changes had partially removed the disequilibria of the fixed-rate regime, there would be a positive relationship, and if they had totally removed such disequilibria or were unrelated to them, there would be no significant coefficient.

In fact, the 1975 residuals from the structural equation are significantly and negatively correlated with the exchange-rate changes from 1970 to 1975. The relationship is

$$\begin{array}{lll} RPL = 0.0400 - 0.0298\,\overline{ER} & \bar{R}^2 = 0.184 & (10) \\ \quad\quad (1.8) \quad\quad (2.7) & SEE = 0.0904 & \end{array}$$

where $\overline{ER}$ is the ratio of 1975 to 1970 exchange rates (domestic price of foreign exchange). The negative correlation between price-level residuals in 1975 and the preceding exchange-rate changes indicates that the full effects of, say, an appreciating currency, were not absorbed in contemporaneous relative price declines. The opposite direction of influence is, of course, also not supported: exchange-rate changes did not simply offset concurrent price changes.

Equation (10) indicates that the 1970-75 exchange-rate movements did not eliminate deviations from long-run relationships that had been sustained by fixed exchange rates. As a further test of this hypothesis, the 1970-75 exchange-rate changes were correlated with the 1970 deviations

from the structural relationship—residuals from an equation like (6) with 1970 data for 15 countries. There was no correlation between the 1970 deviations and the subsequent changes in exchange rates: the 1970 deviations did not represent disequilibria, or the 1970-75 changes in exchange rates did not move exchange rates toward equilibrium levels, or the equilibrium levels themselves had changed by 1975.

If the exogenous policy variable is taken to be the money supply rather than the exchange rate, the 1975 residuals from the structural equations might be expected to be correlated with money-supply growth, provided that own-currency price changes were not immediately and exactly offset by exchange-rate movements. In fact, the data reveal such a correlation and it is negative. (With *RPL* as the dependent variable, the coefficient of the growth in money supply has a *t*-statistic of -2.8.) The negative deviation from a country's "expected" price level associated with larger than average increases in money supply suggests that high money growth in this period affected exchange rates more than own-currency prices (PPPs).

It is also possible to test the hypothesis that differences in money-supply growth have a stronger influence on nontradable-goods prices than on tradable-goods prices. Whether *RPT* or *RPN* is taken as the dependent variable, the coefficients of money-supply growth are almost the same, but only the one in the equation for nontradable-goods price levels is statistically significant, and the degree of explanation of the price-level residuals is much higher for nontradable goods ($\bar{R}^2 = 0.17$ vs. 0.05). Presumably, international competition limited the impact of changes in the money supply on tradable-goods prices.

The contribution of other short-run variables to the explanation of residuals from the structural equations remains to be investigated. For the time being, the growth in the money supply ($\bar{M}$) may be added as a nonstructural variable to the structural elements identified earlier:

$$\begin{aligned} PL = {} & \underset{(0.03)}{-0.0359} + \underset{(7.3)}{0.7164}\, r + \underset{(2.7)}{0.2137}\, OP \\ & + \underset{(2.7)}{0.8848}\, S - \underset{(2.2)}{0.0179} - \bar{M} \end{aligned} \qquad (11)$$

$$\bar{R}^2 = 0.911 \qquad SEE = 0.0914 \qquad N = 29$$

Changes in money supply were not related to contemporaneous changes in price levels in a simple regression (not shown). However, as equation (11) shows, the short-run influence of the money supply on price levels stands out after allowance is made for the long-run influences. Furthermore, the addition of the money-supply-growth variable also raises the coefficient of the openness variable, which becomes clearly significant in this equation.

When the change in the money supply is added to the structural equations for tradables and nontradables, (7) and (8), the results are

$$\begin{array}{lllll} PLN = & 0.0347 + & 1.017\, r + & 0.2946\, OP - & 0.0141\, \overline{M} \\ & (0.8) & (20.4) & (5.0) & (2.1) \end{array}$$

$$\begin{aligned} \bar{R}^2 &= 0.943 \\ SEE &= 0.0768 \end{aligned} \qquad (12)$$

$$\begin{array}{lllll} PLT = & 0.4023 + & 0.7856\, r + & 0.3499\, OP - & 0.0151\, \overline{M} \\ & (4.5) & (8.2) & (3.0) & (1.2) \end{array}$$

$$\begin{aligned} \bar{R}^2 &= 0.742 \\ SEE &= 0.1482 \end{aligned} \qquad (13)$$

As before, it is the price level for tradable goods that is least successfully explained, although more successfully than earlier; the $\bar{R}^2$ for that equation is the lowest and the standard error of estimate the highest among the three equations.

6 CONCLUSIONS

Real income per capita is the major source of variation among countries in the price levels of both tradable and nontradable goods and in the total price level. But openness, as measured by the ratio of trade to output, is always significant. Both high income per capita and a high degree of openness are associated with high price levels. In addition, the share of nontradable goods in output is significant in the equation for the total price level, with a higher share associated with a higher price level. These are the long-run, or structural, influences that have been identified. A short-term, or nonstructural, variable that adds to the explanation is the growth rate of money. A high rate of past growth is associated with a *low* price level. In other words, whatever the inflationary effect in domestic currency of a country's rapid rate of money growth, it was more than offset during this period by changes in the exchange rate.

Much remains to be explained about the factors that determine differences in national price levels. In this first reconnaissance, we have taken only a cursory look at what may prove to be substantial differences in the operation of explanatory factors for different circumstances. We have in mind particularly the differences between periods when exchange rates were fixed and the period since 1973 when major currencies floated, between countries that peg their exchange rate and those that have a managed float, between countries that are price takers and those that are large enough to influence prices, and between countries whose currencies are widely used in international asset portfolios and those that are not. Nor have we explained the interest-rate link between money growth and exchange-rate changes, the distinction between expected and unexpected money growth (also linked to interest rates), the relationship between money growth and the demand for money, and the role of capital flows, partly in response to interest rates and partly autonomous, in determining exchange rates and price levels. These are subjects for future study.

What seems clear from the exploratory work we have accomplished to this point is that efforts to explain changes in exchange rates over a moderately long period—say five to ten years—are unlikely to succeed if structural factors are ignored.

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