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Taxes and the Price Level: A Further Examination of the PPP Hypothesis

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Abstract

The effects of taxation on the general price level have traditionally been regarded as reflecting monetary policy, rather than fiscal factors. This view abstracted from the possible endogeneity of monetary expansion with respect to tax hikes, and from the effects which taxation may have on the reserve price of entrepreneurial labor. An analysis of Purchasing Power Parity data for 51 countries from stage IV of the ICP project supports the hypothesis that domestic indirect taxes tend to raise the general price level. In contrast to the accepted view, other prices do not seem to decline to offset the effect of such taxes on the price of tradables. The paper also presents some new evidence on the other factors which cause national price levels to diverge from PPP.

JEL Classification Numbers

E31; F31; H22

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Summary

The effects of taxation on the general price level have traditionally been thought to reflect monetary rather than fiscal policy. This view derives from the possible endogeneity of monetary expansion with respect to tax hikes and from the possible effects of taxation on wages, particularly on the reserve price of entrepreneurial labor. This paper examines the extent to which international differences in taxation may explain departures of national price levels from purchasing power parity (PPP) .

Investigating a sample of 51 (out of a total of 60) countries for which price level data were available from stage IV of the project on the international comparison of purchasing powers and the real products for 1980, the study finds, as did earlier research, that real per capita income explains most differences in price levels. However, some factors identified in previous studies of the PPP hypothesis, such as trade openness, fail to show significant effects in the present study, while other factors, hitherto untried or discarded, notably, transportation costs and size of the economy, do reveal such effects.

The study also suggests that the overall burden of central government taxation, especially of indirect domestic taxes, raises the general price level. Consistent with the accepted view that direct taxes cannot be shifted forward, no such effect is associated with the direct tax burden. Contrary to expectations, however, the burden of domestic indirect taxes expresses itself in the prices of tradables rather than of nontradables. Another unexpected result--that import duties seem to have no discernible effect on the price level--is consistent with earlier findings. The study finds no evidence that tax-induced higher prices are offset by lower prices in the untaxed sectors as the price neutrality of taxation would require. It suggests some possible explanations for these phenomena.

Introduction

The purpose of the present research is to establish whether an empirical relationship exists between the burden of taxation, its structure, and the price level. It does so by investigating the extent to which international differences in taxation may explain departures from purchasing power parities. It is hoped that the results will also provide some insight into the relationship which may exist in a single country at any given moment, and which, because other things do not remain equal (or because taxation parameters do not vary often enough), is not easily isolated in a time-series context.

The plan of this paper is as follows. Sections 1 and 2 present some a priori considerations of the relationship between taxes and the general price level. Section 3 surveys the literature dealing with the departure of national price levels from their purchasing power parities in general. Following a description of the data and their sources in section 4, the general independent variables tested are discussed in section 5, and the fiscal ones in section 6. The results of regression analyses explaining international price level variations by nonfiscal and fiscal variables are presented in sections 7 and 8, respectively. Finally, in section 9, the main findings are summarized and evaluated.

1. The traditional view of taxation's effect on the general price level

Economic theory pays considerable attention to the effects of taxation on prices of individual goods, interest in which is by no means restricted to public finance literature. Because it provides good exercise in manipulating supply and demand curves, the analysis of excises (and of product subsidies) came to constitute a basic component of microeconomic training. Taxation's effect on the price level, on the other hand, has been usually dismissed as being due to monetary, rather than fiscal, causes. The view of this effect may be best summed up as one of indeterminacy. Though depending ultimately on some assumption of a downward price flexibility long abandoned in macroeconomic theory, this view seems to persist to this day in mainstream fiscal thought.

Briefly, the indeterminacy argument runs as follows. As a result of an (indirect) tax imposed on some particular good, the price paid by consumers will rise by an increment varying between zero and the whole (per unit) tax, depending on the corresponding demand and supply elasticities. However, an unchanged money supply will be unable to accommodate a generally higher price level. Consequently, some other prices will have to come down. The excise will thus change relative product prices, but not their general level. The latter can rise only if the tax is accompanied by an expansion of the economy's money stock. Thus, while taxation affects the relative price structure, any price level effects should be attributed to a presumably discretionary monetary policy: "[An inquiry] into the absolute changes in price and income that result from budgetary adjustments . . . is

essentially a monetary problem and, more specifically, an exercise in quantity theory." (Musgrave, 1959, p. 365).

A similar, perhaps even more dismissive, attitude is held with respect to what are known as "direct" taxes. Traditionally, they were regarded as practically unshiftable, that is, as falling fully on the money income of the owners of factors of production. The presumption seems to have been that the competitive process precludes the differential, individual-specific wage (and profit) hikes in which the (full) shifting of direct taxes would have to express itself. Even when, in the presence of market imperfections, such a possibility was admitted, it was assumed to be of limited occurrence: "The salary . . . for top executives or the fee for . . . highly paid professional services is usually an administered price, and may be subject to compensatory adjustments when tax rates rise." "[But] corresponding adjustments are less likely to be found at the lower end of the scale" (Musgrave, 1959, pp. 362-63). 1/ Even if they did affect relative prices, the effects of direct taxes on the price level were presumably subject to the quantity theory proviso in the same manner as those of the indirect ones.

2. An alternative view of taxation's price-level effect

These views of the price effects of taxes abstract from the potential endogeneity of the money supply, as well as from other departures of real-life conditions from the assumptions of the theoretical model. Strictly speaking, the quantity theory argument is, of course, correct. But a distinction desirable for analytic or didactic purposes is not always observed also in real life. This may well be true of the distinction between the fiscal and the monetary aspects of a tax, without which (or without some assumption regarding the relationship between the two), no analysis of the tax's price effect would be possible. Because of downward price inflexibilities, tax-induced rises in the price of some goods will not usually be accommodated by a fall in the absolute price of others, which would offset the formers' effect on the general price level. The inability of the existing money stock to support the new price level may result in its endogenization, causing it to expand either through economics-wise discretionary, but politically endogenous policy decisions, or through the response of the commercial banking system to the business community's increased demand for credit.

1/ Musgrave's contention, in this context, that "union policy may allow for personal income tax payments as a factor in wage demands, but this hardly has been a major factor to date," may have been true at the time of the U.S. labor market, but not of many of the European ones. Where, as for example, in the Netherlands or in Sweden, wages were set through tripartite negotiations between employers, unions, and the government--taxation rates often explicitly entered the wage setting formulas. See, for example, A. Lindbeck (1974).

Once this happens, the barrier is raised that otherwise restrains cost pushes from expressing themselves in the price level. The channels through which tax hikes in particular may then become translated into general price increases are surveyed in Tanzi (1983), who also summarizes the relevant literature. We shall describe here briefly only a few of these channels. It hardly needs pointing out that, under full monetary accommodation, sellers of a taxed good may easily succeed, in a closed economy, in raising its market money price by the whole amount of the tax (though, unless supply is completely inelastic, not its relative price), or even in "overshooting" it. To put it more generally, the political and institutional structure of modern economies may make significant changes in relative prices virtually impossible without monetary expansion, and therefore also without changes in the price level. 1/ With the price level not independent of relative price changes, we cannot preclude its being affected by indirect taxes.

In a world of organized labor and collective bargaining, much of the above argument applies also to direct taxes. With unemployment above certain levels considered politically unacceptable, monetary accommodation of price hikes owing to wage increases used to constitute a perennial policy issue in most Western economies in the two or three decades following World War II. The recognition of the role that tax shifting could play in generating pressures to raise wages prompted many a government to turn collective bargaining into a tripartite process, participating in it not as an employer but as a tax collector. The "income policies" and "package deals," in vogue at one time or another in, for example, the Scandinavian countries, the United Kingdom, the Netherlands, and Israel, often contained some trade-off element between personal, that is, direct, taxes and gross wages, and ultimately also prices.

It could be argued that a forward shift of the nonidentical direct tax liabilities of different individuals is inconsistent with a competitive market's pressure to equalize wages for given qualities of labor. This argument obviously does not hold when the sum of the tax is the same for all, as, for example, under a poll tax, because a uniform wage hike does not disturb the uniformity of the wage rate across the labor market. With direct tax liabilities not uniform, that part of them may then still be shifted which corresponds to the sum paid by the lowest-taxed individual, or

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1/ The oft-observed positive association between the overall rate of inflation and its dispersion across individual goods is a point in case (though it can be due also to the reverse causality from that suggested here).

to that paid by some "representative" taxpayer. Hence, some, even if not full, forward shifting of direct taxes cannot be ruled out. 1/

In an open economy, competition from abroad may contain some of the pressure of domestic taxes on prices, but cannot offset it altogether except in trade-wise small countries facing an infinitely elastic supply of imports and, which is rarer, an infinitely elastic demand for their exports. On the other hand, however, taxes on imports mean higher prices not only of actual imports, but of potential importables as well. In the absence of a firm monetary barrier, these prices will not be fully offset by a compensating fall in other prices, and will result in a generally higher price level.

Taxes may also affect the price level in more indirect ways, through their effect on efficiency and on the supply of entrepreneurship. Losses in allocative efficiency owing to tax avoidance and tax evasion--the excess burden of taxation--express themselves in rises in the market prices both of the goods or services taxed and also (because of the increased demand for them) of those goods and services to which consumers switch. Insofar as avoidance or evasion necessitates changes in production modes or, especially in the case of evasion, in marketing and distribution, or restrict the use of the proceeds, they result in losses of X-efficiency as well. In the case of evasion, the effects on prices of lowered efficiency might be offset, or even outweighted, by that of an effectively lower tax rate. No such offsetting, however, is possible of the X-efficiency losses resulting from taxes lowering the net cost, in terms of profit forgone, of higher production outlays: with profits taxable, the cost of extra outlays (and the savings from eliminating them) is smaller to the firm than to the purchasers of its output, to whom it is shifted. 2/

Another channel through which taxes may raise prices is that of their effects on the supply of factors of production, and consequently on the volume of output. In an internationally increasingly mobile world, the flight of factors from high to low tax economies has been drawing more and more attention in recent years. Factor supplies are affected also by taxes

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1/ The traditional distinction between direct and indirect taxes has been called into question in recent years with the widespread introduction of the value-added tax. VAT can be regarded as an improved form of a sales or turnover tax, that is, an indirect one. But as the base on which it is levied is equal to the sum of wages, salaries, interest payments, and profits emanating from the firm, it may also be viewed as a flat-rate direct tax on factor incomes.

2/ Tanzi, who points out some blatant examples of costs that would not otherwise have been incurred, speaks of high marginal tax rates causing "something [to] happen to the psychological climate of a country that may lead to an increase in costs." (1983, p. 424). Though Tanzi categorizes these as "psychological effects," the increase in such costs may be viewed simply as due to tax-induced reductions in the return on entrepreneurial effort. See also the discussion of entry barriers below.

distorting the trade-off rates between present and future consumption, and between income and leisure. However, as is well known, the direction of these tax effects is not unambiguous, so that whether the pressures they generate are to push prices up or to depress them depends on whether substitution dominates income effects along the relevant supply curves.

One effect of taxation that has failed so far to receive much attention in the literature is its influence on the supply of entrepreneurial effort. Taxes may reduce the incentives to set up and operate businesses, thereby raising entry barriers and pushing up industry's long-run equilibrium prices. A factor determining the price at which firms will attempt entry into an industry is the reserve price of entrepreneurial labor. The minimum reward for their time, which potential entrepreneurs require, depends first of all on the remuneration which they may expect in alternative occupations. For the entrepreneurial class as a whole, the most obvious alternative seems to be paid employment (as well as the profits they expect to be able to earn abroad). A differential treatment, for tax purposes, of corporations and of the self-employed, relative to wage and salary earners, can be expected to affect the overall supply of entrepreneurial activity, as will also the social security safety net available to employees. Such discrimination may sometimes be intentional. Often, however, it originates in institutional arrangements reflecting mainly administrative considerations. Its net effect on the price level cannot be ascertained on purely a priori grounds. Thus, for example, a system of PAYE-at-source deductions for salary and wage earners may be regarded as reducing their "tax visibility," relative to business firms, and their owners-managers, or the self-employed. Taken by itself, this could be expected to raise the hurdles of the entry barriers, with a corresponding effect on prices. On the other hand, the fact that wage and salary earners usually have a much smaller scope for tax avoidance and tax evasion may be expected to operate in the opposite direction.

Under some tax systems, the tax liabilities of businessmen and of firms are negotiable. This probably increases the chance for tax rebates, thereby making self-employment or the running of a firm more attractive. 1/ But it also expands the friction area to which entrepreneurs are exposed, thereby raising the transaction costs of operating a business and ultimately restricting the price-lowering entry of firms into the market. The form filling, bookkeeping, and other compliance requirements of taxation are another source of such transactions costs. 2/

1/ This, most probably, is true only at the individual level, and at the existing tax rate schedules. It can be argued that under a regime which did not allow tax liability assessments to become the subject of negotiations between the taxpayer and the tax authorities, the scheduled tax rates would have been lower. But unless we are ready to take a very deterministic view of fiscal politics, it would be far-reaching to argue that the effective tax burden would have remained the same.

2/ See Vaillancourt (1987) for a survey of the evidence on compliance costs.

The effects that taxation may have upon entry barriers, and consequently on prices, result from the way potential entrepreneurs perceive them ex ante as affecting their net income or their leisure. This means that misconceptions bred by imprecise information, and even more so by the lack of firm fiscal rules, may in themselves play a role in deterring entry. More generally, we may perhaps speak of overall "fiscal risk," pertaining to both tax legislation and the manner of its application, as affecting entry and, ultimately, also the price level. 1/

In view of these considerations, the possibility that taxes may affect the price level cannot be easily rejected. Rather than be dismissed out of hand, it seems to merit some empirical, as well as perhaps some further theoretical investigation.

3. The purchasing power parity "doctrine"

As has already been stated in the introduction, the empirical examination of the effect of taxes on the price level will be carried out here within the framework of purchasing power parity analysis. The purchasing power parity (PPP) theorem, or, as it has been sometimes dubbed, "doctrine" has evolved around attempts to realign currencies after the markets for them were thrown out of equilibrium, usually in the wake of prolonged armed conflicts. Though the notion of PPP can be traced to much earlier times--"The [PPP] theory is older even than Ricardo" (Haberler, 1936, pp. 32-8)--its modern usage, as well as the term itself, are due to Cassel's application of it to the situation resulting from the World War I (Cassel, 1918, 1922). For the same reason it again attracted attention in the wake of World War II.

To put it in a nutshell, the PPP doctrine contends that in equilibrium the exchange rates between different currencies equalize prices in the corresponding countries. For as long as they do not, there will be a profit to be made by exporting goods from the country where they are cheap to the country where they are expensive, thereby raising their price in the former and lowering it in the latter. 2/ Yet, as we all know from personal experience, real life obstinately refuses to behave according to the book in this respect. In case we distrust our own impressions, there come inter-

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1/ This, of course, is due to estimates of alternative costs being, almost by definition, basically subjective, or "perceptional" ones. See Buchanan (1969). The argumentation of the last section hinges on certain assumptions regarding entrepreneurial perception of the alternative value of their time or of their peace of mind. See, in this context, Scitovsky (1943, 1952).

2/ See, for example, Balassa (1964), who provides also a brief summary of the literature. It should be pointed out that we are discussing here the PPP in its absolute version, as distinguished from the weaker, relative one, of changes in the exchange rate being equal to those in the ratio of the respective countries' price levels over time.

national price level compendia, published for the benefit of peripatetic businessmen and international civil servants, or The Economist's tongue-in-cheek "McDonald's hamburger standard" calculations, to support them. 1/

As pointed out by Balassa (1964), the argument for international price equalization abstracts from the existence of nontraded goods and from differences in productivity. Labor immobility prevents international price equalization in nontraded goods, notably in services. The opportunity costs of such services are higher in countries which are relatively less efficient in their production, that is, which have a comparative advantage in the production of traded, relatively to nontraded goods. As, at a given exchange rate, trade equalizes the absolute price of the traded goods, the absolute price of nontradables will also be higher in these countries, as will be that aggregate of the prices of tradables and of nontradables, which constitutes the overall price level. Balassa hypothesized that the production of nontradables is, relatively speaking, inefficient in the developed, high-income countries, so that the price level will be positively associated with per capita income.

Other authors have shown that for the opportunity cost of nontradables to rise with income it is sufficient for them to be labor intensive, relative to tradables, and for income to rise as the economy becomes more capital intensive (Kravis and Lipsey, 1983; Bhagwati, 1984), or for economies of scale to exist in the production of tradables (Panagariya, 1988). Most recently, it has been demonstrated that the rise in the relative price of nontradables, and hence in the general price level, as income rises, may be due to the higher income elasticities of the former (Bergstrand, 1991).

The empirical examination of departures from PPP, first undertaken by Balassa (1964) for 12 OECD countries in 1960, and extended to 19 Latin American countries by Clague and Tanzi (1972), was greatly advanced by the increased availability of international price data from the successive stages of the project on the international comparison of purchasing powers and real products (ICP), conducted by Kravis, Heston, Lipsey, and Summers. 2/ These studies focused mainly on the link between income and the price level through income's effect on the relative price of nontradables, searching for factors that could account for a rise in the

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1/ See, for example, Union Bank of Switzerland (1988); also The Economist, April 15, 1989.

2/ See Kravis, Heston, and Summers (1978), Summers and Heston (1984, 1988), U.N. (1986). Much of the work on PPP violations was carried out by the authors of the ICP studies themselves, in the hope of identifying variables which could be used to predict price levels (and therefore calculate corrected GNP figures), for countries or for periods for which no benchmark data could be collected. See, for example, Kravis and Lipsey (1983, 1988). The other studies referred to here are Clague (1986, 1988), Isenman (1980), Bergstrand (1991), and Falvey and Gemmel (1991).

latter. Among the variables tested, with varying degrees of success, were various measures of the endowment of natural resources and of physical and human capital; balance of payments items, such as the foreign trade ratio, the trade balance, and receipts from tourism; structural variables such as the product share of minerals and of services; and short run monetary variables, such as the growth in the stock of money or the net indigenous rate of inflation.

International differences in price levels may stem, of course, not only from differences in the relative price of nontradables, but also from market imperfections, which hamper the price equalization of tradables across the world market. For this reason, and also because there are hardly any pure tradables or pure nontradables, it is the general price level which most of the studies in this field tried to explain. In fact, some of the explanatory variables listed above may also represent the prizing away of individual markets from the world market, affecting the general price level through their effect on the domestic price of tradables as well.

Nevertheless, perhaps because such imperfections are of little theoretic interest, not lending themselves to model building, they received little explicit attention in this literature. The two most recent studies of PPP violations are illustrative of this lack of interest, focusing on the determinants of the price of nontradables only, rather than of the price level as a whole, to the exclusion of any consideration of market imperfections altogether (Bergstrand, 1991; Falvey and Gemmell, 1991). Taxation was no exception to this rule, probably because of the traditional view of taxes as affecting relative prices but not their general level. Though import duties, for one, obviously drive a wedge between the prices of tradables in different countries, their effect on deviations from PPP was empirically examined only by Clague and Tanzi (1972), and recently by Salazar-Carillo (1990). The latter was actually the first to make the effects of duties and of indirect taxes, in a PPP context, the subject of a special, albeit limited, study.

4. Framework and data of the statistical investigation

To establish whether taxation may help explain differences in national price levels, we have conducted a cross-country multiple regression analysis of deviations from PPP, with measures of fiscal burden and fiscal structure among the explanatory variables. For this purpose we were able to utilize the results of phase IV of the ICP study, on international price comparisons for 1980 (see U.N., 1987, Part Two, pp. 1-16). Of the 60 countries of the ICP study we had to exclude 9 because of the unavailability of one or another of the explanatory data. 1/ The remaining 51 country sample

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1/ For the reasons for the exclusion of individual countries, see Appendix II, which also shows the country composition of the various subsamples examined in the paper, referred to here as Samples A through G, respectively.

(Sample A) consists of 12 African countries, 8 Asian, 15 European, 14 Central and South American, and 2 North American ones. Some specific calculations necessitated a further restriction of the sample. But to test for their sensitivity to choice of sample, all regressions were run also for the largest sample available in each case. The 1980 ICP data have not been yet extensively analyzed, insofar as the explanation of the general price level is concerned. The main exception is Clague (1988), who experimented also with a variable representing the pressure of population on agricultural resources, as well as with dummy regional ones. 1/ We shall, therefore, first establish the effect on price levels in 1980 of variables of the type found significant in earlier PPP studies, and then proceed to test the additional explanatory performance of taxation.

In international comparisons, national price levels are often expressed relative to that of the United States. The accepted convention of PPP studies is to express also all explanatory variables in a similar manner. To facilitate comparison with the results obtained in earlier studies, we have followed this procedure here. 2/

5. The general independent variables tested

a. Income

All previous studies which introduced GDP per capita as an explanatory variable in cross-country regression analyses of the price level found it to explain a major part of the variance in the latter. This is defined here as PL = PPP/e, where PPP is the exchange rate which would have equalized prices in a given country with those of the numéraire one, the United States, and *e* is the actual rate of exchange between that country's currency and the U.S. dollar.

The theoretical constructs relating the price level to income do so via differentials in the relative price of nontradables, given that other prices are equalized through trade. If this is indeed so, then income's effect on the price level of tradables, PT, can be expected to be weaker, and the effect on the price of nontradables, PN, to be stronger, than on the general price level, PL.

With the exception of the differential demand growth one, these models are based on the observation that economic growth within individual

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1/ Clague's 1988 article came to my attention only after the main work on this study had been concluded, so that I was unable to plan my investigation so as to test his conclusions directly against those of the present paper. Two other papers already mentioned here, Bergstrand (1991) and Falvey and Gemmel (1991), restricted themselves to the price of services, or nontradables only.

2/ Though for the sake of convenience we have preferred to express these relatives as percentages, rather than as ratios.

countries was due to increases in either or both capital endowment and total factor productivity; and that, across industries, such increases were negatively associated with labor intensity, resulting in a rise in the relative price of the labor intensive, nontradable, services. (See, for example, the arguments and evidence brought forward in Baumol [1966].) If this holds also across countries, then product per person employed, GDP/L, which reflects productivity differentials more closely, should explain departures from PPP better than product per head, GDP/N.

Because of the high correlation between GDP/N and GDP/L = GDP/N•N/L, a comparison of the results obtained using these alternative variables may fail to establish any significant difference between them. But if GDP/L is, in fact, the right variable, then the overall labor participation rate, PAR=L/N, when introduced along GDP/N, should be negatively associated with the price level.

Whichever the income measure used, there arises the question of the rate of exchange, at which the figures for the different countries should be compared. Estimated at the monetary rate of exchange, per capita GDP in, say, Belgium exceeded by some 4 percent the U.S. per capita GDP in 1980. But the ICP calculations also showed prices in Belgium, at these rates, to have been about 25 percent higher. Belgium's per capita income could, therefore, purchase only about 83 percent of what could have been purchased with the U.S. per capita income. 1/ This suggests that it is "real income," that is, per capita GDP corrected for the country's price level, GDP/Np, that should be used in our investigation.

Earlier investigators, who were aware of this problem, found the latter measure to provide a much poorer statistical explanation of the PL index than the conventional, dollars at monetary exchange rate, measure of GDP/N. At first blush, the fact that the corrected measure, though still significant, performs more poorly than the uncorrected one, may seem to put in question the correction itself, that is, the reliability of the PL estimates themselves. This, however, is not really so. Supposing GDP/Np to be the correct measure of the "true" per capita product, Y*, then the conventional dollar estimate of GDP/N is nothing but Y*•PL. Regressing PL on Y*•PL will obviously yield a higher positive correlation then, than regressing it on Y*. 2/ Thus, which is the correct income variable to be used is a conceptual, or definitional, question and cannot be decided simply by referring to its performance as an explanatory variable.

1/ We have ignored here the obvious index numbers problem involved in such calculations. This is dealt with in considerable detail in the various reports emanating from the ICP project. See the relevant references listed at the end of this paper.

2/ This has been already pointed out by Kravis and Lipsey (1983), who observed that the regression coefficient of PL on price-adjusted income is biased toward -1.

In the regressions estimated here we have preferred to use the "real income" measure, GDP/Np, on conceptual grounds. But we experimented also with the gross domestic product per capita at its exchange rate dollar value, GDP/N, to see whether its use could elicit some further information about the relationship of income to the price level. And similarly for GDP/L and GDP/Lp.

b. "Openness"

Some of the previous studies in the field hypothesized that the more open the economy, the higher will be its price level:

> 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. (Kravis and Lipsey, 1983, p. 15).

Openness was represented in these studies by the foreign trade ratio--the combined share of the imports and exports of goods and services in GDP--and appeared with the hypothesized positive sign in some of the regressions (Kravis and Lipsey 1983; but compare Clague, 1988).

This view of the effects of openness stems from the consideration of international variations in price levels as owing mainly, if not even exclusively, to variations in the price of nontradables. But as has been pointed out earlier, international price differentials also reflect impediments to the equalization of the prices of tradables. The trade ratio can be regarded as representing the outcome of all such impediments--transportation costs, market specificity, tariffs, trade monopolization, etc.--and, therefore, as a summary measure of their combined net effect on the domestic cost of traded goods. But while imports impose a ceiling on the price of importables, exports provide a floor to the price of exportables. Thus, the direction of the effect which their combined ratio to GDP has on the prices of tradables and, consequently, on the price level in general, cannot be predicted on purely a priori grounds. 1/

This last conclusion is inherent in the price equalizing role of trade. The more thoroughly are a country's markets integrated in the world economy, and the closer, presumably, the prices of its tradables to the world ones, the lower will be the price of tradables in a high-price country, and the higher it will be in a low-price one. If this effect dominates the one of factor price equalization, openness will be associated not with the price level itself, but with the absolute magnitude of its departure from par, and the association between the two may be expected to be negative.

1/ The indeterminacy of the trade ratio effect has also been put forward, albeit on different grounds, by Clague (1986, 1988).

To differentiate between these alternative hypotheses, we will test the effects of trade both on the price level variables (PL, as well as PT and PN), and on the residuals from their regressions on income. Openness will be measured, alternatively, by the combined trade ratio, (M+X)/GDP, by those of imports and of exports separately, and by that of net imports, (M-X)/GDP. To minimize the influence of short-run trade fluctuations, we shall use averages of the trade ratios in the five-year period ending in 1980. As the effect of merchandise trade on prices might be more pronounced than that of the trade in services, these measures will also be calculated for goods alone.

c. Transportation costs

Transportation costs drive a wedge between the domestic and the world prices of tradables. The pressures they exert on prices may be expected to be of opposite signs for imports and for exports. 1/ To test their possible net effect, we have introduced a direct measure of transportation costs in the form of the difference between the estimates of merchandise imports valued inclusive, and those valued exclusive, of shipping costs--the c.i.f./f.o.b ratio, denoted by CIF.

d. Population and product size

Size can be expected to be one of the factors determining the degree of internal competitiveness in an economy. A wide territorial dispersion of economic activity, which raises internal transportation costs, may confer a degree of local monopoly on some enterprises. Population size, on the other hand, may be expected to have the opposite effect: the larger the number of economic agents constituting an economy, the less favorable, other things being equal, the conditions for the operation of competition-restricting practices. Furthermore, the bigger the economy's product (and the wider its territory), the greater the probability that it can reap the benefits of specialization without recourse to international trade, so that a given degree of measured openness may have a lesser impact on prices in small than in big economies.

The effects of territorial size are ultimately due to the settlement pattern, or to the variety of natural or climatic resources--neither of which yields itself easily to quantification, and which may be operating in opposite directions. Size will be represented here alternatively, by population, POP, and by price-level corrected total product, GDPp. Because

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1/ This point, which seems to have escaped some earlier investigators, has already been made by Falvey and Gemmel, who observed that "Transport costs will raise (lower) the domestic price of importables (exportables) relative to world prices . . . . The net impact on the aggregate price of 'tradables' will depend on the balance of these 'impediments'." (1991, p. 1297).

size affects mainly internal competitiveness, we may expect its effect on PN to be more pronounced than on PT or PL.

e. Shares of services and of tradables

As described earlier, the relative price of nontradables, services in particular, has been hypothesized to rise with income through a number of alternative, though not necessarily mutually exclusive, mechanisms. For this reason, earlier researches in the field introduced the product share of services, S/GDP, into their estimation equations.

But the share of services may itself be a function of income. If this is the case, the price level will rise with per capita income, not only because of the rising relative price of nontradables, but also because of their increasing weight in the overall price aggregate. Denoting the general price level by P, and normalizing in terms of the price of tradables, $P = 1 + (P_s - 1)W_s$, where P_s is the (relative) price of services, and W_s is their share in output. If $P_s = f(Y)$ and $W_s = g(Y)$, this price-weighting identity becomes $P = 1 - g(Y) + f(Y) \cdot g(Y)$. We may thus expect some higher power of the per capita income variable, with a positive sign, to crowd out S/GDP in explaining the price level. 1/

Services, for the present purpose, are conventionally defined as the service industries proper, plus construction (see e.g., Clague, 1986). All other output, that is, that originating in agriculture and industry, is regarded as tradable. But not all tradables are exposed to the same degree to competition from outside. In particular, in view of the monopoly position enjoyed by some countries in certain extractive industries, we may expect the share of nonservice output net of these industries to have a more moderating effect on PL than has the complement of S/GDP. Similarly, because of both perishability and protectionist policies, farm produce may, perhaps, be less tradable than manufactured goods. If this is the case, then the share of agriculture in the tradable sector, A/TRAD = AGR/[1-S/GDP], should have a positive effect on the price level, once the relative size of the whole tradable sector has been accounted for.

f. Size of government sector

The identification of nontradables with services is neither exclusive nor all-embracing. Some goods are practically untradable, while the advances made in telecommunications cause more and more services, especially business and financial ones, to be traded internationally. One group of

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1/ In the special case, where $P_s = a_s + b_s Y$, and $w_s = a_w + b_w Y$, $P = [1 - a_w(1 - a_s)] + [a_w b_s - b_w(1 - a_s)]Y + b_s b_w Y^2$. As $b_s > 0 < b_w$, Y^2 will enter the estimating equation for P with a positive sign. On the other hand, as a_w, $a_s \gtrless 0$, the sign with which Y itself will enter the equation (as well as that of the constant) cannot be predicted on purely a priori grounds.

services which cannot be traded are government services, partly because their provision is often restricted to a country's nationals, and partly because of their public good characteristics. Thus, the product share of government consumption, G/GDP, provides an alternative, more restrictive, measure of the size of the nontradable sector. With governments probably less price conscious in their purchases than either businesses or households, the effect of G/GDP on PL could be expected, perhaps, to exceed that of S/GDP.

Government consumption being, on the whole, financed out of tax revenues, any price effect attributed to it as a nontradable sector might, actually, represent the price-raising effect of taxation. But if government services are, in fact, significantly less tradable than services at large, we should expect their share of all services, G/S, to be positively associated with PL when introduced together with either S/GDP or the total tax burden variable discussed below.

6. The fiscal variables

Basic to the PPP theorem is the assumption that trade equalizes the price of tradables throughout the world market. This is, of course, subject to the proviso, that there are no wedges interposed between the different parts of this market. Some such wedges, for example, transportation costs, were already discussed here. Taxation is another one. If a customs duty is levied on one imported good but not on another, then the prices of these two goods in the importing country will not be simultaneously equalized with their world prices at any rate of exchange. Thus, taxes collected on imports can be expected to raise the price level above par. The same is true of export subsidies, which allow the domestic prices of exports to stay above world prices.

As has been pointed out in section 2, the above conclusion tacitly implies an absence of a firm monetary barrier which could force a compensatory reduction in the prices of nontradables, leaving the general price level unaffected by import duties. However, the arguments raised in section 2 against the alternative assumption, that is, of the perfect exogeneity of the money supply, apply probably even more strongly to cross-country analysis; and we have also seen that, in the absence of a monetary barrier, other taxes may affect the price level and may do so in diverse ways. Our earlier discussion also suggests that the price effect may vary with the type of the tax, some taxes lending themselves more easily than others to forward shifting.

In view of our earlier discussion, we expect the general price level, PL, to be positively associated with the overall tax burden, as expressed in the ratio of the government's total tax receipts to GDP, denoted here by TTAX. But the real burden of government finance--the transfer of resources that it effects--may be underestimated by TTAX. As an alternative upper limit we shall consider the ratio to GDP of the total expenditures of the

central government, TEXP, which probably overestimates the share of all resources appropriated by the government. 1/

Under the rational expectations hypothesis, the tax burden perceived by the public also includes the present value of taxes which will have to be collected in the future to repay debt contracted by the government to finance present budgetary deficits. If this indeed is the case, the fiscal deficit, DEF, defined as the excess of total expenditures over total tax revenues, relative to GDP, should have an effect on PL similar (but for the discount factor) to that of TTAX.

The traditional view of indirect taxes as more easily shifted forward leads us to expect their total burden, TIND, to have a stronger effect on PL than that of direct taxation, DIR. Because import duties, DIMP, fall by definition on tradables, we expect their effect on PT to be more pronounced than on PN. Domestic indirect taxes, DIND, on the other hand, can be also imposed on services, so that the difference between their impact on PT and PN should be smaller. Finally, because it consists also of direct taxation, we may expect the total tax burden on domestic economic activity, DOM, to have a weaker effect on the price level than DIMP.

Taxes are usually collected at least at two levels, at the central government and local government, or, as in the United States, also at the state level. Unfortunately, both the availability and the quality of fiscal data pertaining to levels other than the central government are much inferior to data on the taxes and expenditures of the local governments. The implications of having had to restrict our fiscal data to central government finances are discussed briefly later.

7. Results--the general determinants of the price level

a. Income

The results of regressions of the price level on income are summarized in Table 1. They reproduce the very strong relationship, observed in earlier studies, between the price level and per capita GDP. As can be seen from equation [1.1], this variable alone explained over 70 percent of the variance in national price levels in our sample of 51 of the 60 countries covered by stage IV of the ICP project.

1/ TEXP overstates the value of (central) government purchases in that it includes transfer payments, though it may be argued that redistribution is also part of the resource transfer burden of government finance. To the extent that the interest rate on public debt falls short of the public's discount rate, TEXP overstates the present value of present and future taxes necessitated by present government activities.

Table 1. Regressions of the Price Level on Income 1/

Eq. No.	[1.1]	[1.2]	[1.3]	[1.4]	[1.5]
Dependent variable	PL	PL	PN	PT	PN/PT
Constant	56.2641 (18.25)	52.9502 (12.54)	32.8186 (9.25)	82.8415 (15.37)	41.5330 (15.70)
GDP/N	0.6283 (11.14)				
GDP/Np		0.7067 (8.32)	0.7276 (10.19)	0.5936 (5.48)	0.3668 (6.89)
SEE	15.9486	19.3003	16.2259	24.6309	12.0901
Adj. R^2	0.7112	0.5771	0.6728	0.3670	0.4820

1/ Figures in parentheses are *t* values.

If the PL indices obtained in the ICP studies provide a correct measure of the extent to which price levels deviate from exchange rate parities, the income figures of the countries covered should be adjusted correspondingly. (This adjustment is, in fact, the main objective of the whole ICP project.) As has been argued earlier, in section 5(a), the fact that previous studies have shown GDP/Np not to "explain" variations in price levels as well as GDP/N, need not impair its claim to be the right variable for this purpose.

The present study was no exception to the general rule, in that product per capita performed much more poorly when corrected for price level differences, than when valued conventionally at monetary rates of exchange. On the other hand, the magnitude of the income effect in [1.2] is about one tenth larger than that obtained for the unadjusted income figure. 1/

The assumption underlying much of the PPP literature, that the prices of tradables are equalized internationally while those of nontradables are not, is strongly supported by the ICP data. As can be seen from Table 2, on the average for the 51 countries of our sample, the price level of tradables, PT, was much closer to the U.S. level, and varied, relatively, much less than the price level of nontradables, PN.

A comparison of the two penultimate columns of Table 1 shows also that, as has been hypothesized, income's effect on the prices of nontradables is much stronger than on that of tradables: income's coefficient in equation [1.4] is both smaller and statistically less significant than in [1.3], and income explains only half as much of the variance in PT as in PN. The present findings are, thus, consistent with the assumption, that the mechanism relating the price level to income operates through income's effect on the relative price of nontradables. Equation [1.5] shows the ratio PN/PT to fall (rise) by about 3.7 percent points, relative to the United States, for every 10 percent a country's per capita income falls short of (exceeds) the U.S. one.

The income effect in [1.2] is only about three quarters that implied by the equation estimated by Kravis and Lipsey (1983), from data for 34 countries in 1975: 2/

$$PL = \underset{(7.6)}{30.81} + \underset{(11.6)}{0.9365}\ GDP/Np \qquad \text{Adj. } R^2 = 0.801 \qquad \text{SEE} = 12.97 \qquad [K\&L]$$

1/ This "real income" effect seems to be nonlinear: as will be seen in (7e) below, a combination of squared and cubic (and of cubic and fourth-powered) income terms, replaces GDP/Np in the above equations with improved results. There is, however, no correlation whatsoever between the residuals from [1.2] and GDP/Np.

2/ In the Kravis and Lipsey study, the data were standardized to U.S.=1, rather than the U.S.=100 used here. The constant of their equation presented here has been corrected accordingly.

Table 2. International Price Variability 1/

	Average (U.S.=100)	Coefficient of variation
PT	105.4	29.0
PN	60.6	46.3

1/ 51 country sample (Sample A).

This difference is not due to the world economy becoming more closely integrated. The coefficient of variation in the price level index, PL, for the 27 countries (out of a total of 34) of the 1975 ICP stage III study covered also by stage IV, remained unchanged--40.8 percent in 1980 as against 40.9 percent in 1975. Most of the difference seems to be due to the present sample including many more African and Latin American countries. As can be seen from Table 3, the difference between the regression coefficients on (price-corrected) income derived, respectively, from the 51 and 27 country samples for 1980 greatly exceeds that between the results for the smaller sample in the two years. Some part of the difference could have been also due to changes in the relative position of the numéraire country. It can be seen from the table that the mean PL index of the 27 country sample rose from 73 percent of the U.S. price level in 1975 to 82 in 1980, that is, by 13 percent, the corresponding mean GDP per capita rose by 16 percent, while that corrected for price-level differences rose only by as little as 3.5 percent.

b. Product per person employed

We have hypothesized that if the rise in the relative price of nontradables with income is due to productivity differentials, then product per person employed, GDP/L, should provide a better explanation of the price level than product per capita, GDP/N. Data on the economically active population in 1980 were available for a subsample (Sample E) of 40 out of the 60 countries of the ICP study, covering 32 (Sample F) out of the 51 countries of our basic sample (Sample A). GDP/L varies, relatively, much more than the overall participation rate, PAR = L/N, which relates it to GDP/N, and is also positively associated with it. Consequently, its correlation with GDP/N is close to unity, and the regression coefficients on GDP/L are practically identical with those obtained for income per capita in the same sample.

PAR itself entered equation [1.2] only in the smaller, 32 country subsample, where it was not quite statistically significant and had the "wrong," that is, positive sign. On the other hand, when introduced along GDP/Lp, its positive sign was significant in both subsamples. 1/ Thus, at any given level of labor productivity, PL will be higher the higher the participation rate, that is, the fewer dependents per person employed, and the higher, therefore, per capita income. This suggests that, contrary to the traditional hypothesis, these are income differentials per se, rather

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1/ The corresponding t values for the 40 and 32 countries' samples, respectively--1.77 and 2.45--are significant, in a one-tail test, at the 5 and 1 percent levels, respectively.

Table 3. The Income Effect--Different Samples

Sample	Means of variables			Regression coefficients on	
	PL	GDP/N	GDP/Np	GDP/N	GDP/Np
A. 1980, 51 countries	79.9	37.7	38.2	0.6283	0.7276
G. 1980, 27 countries	82.5	48.5	47.4	0.7252	0.8877
G. 1975, 27 countries 1/	73.0	41.8	45.8	0.8089	0.9439
1975, 34 countries 2/	--	--	--	--	0.9365

1/ Variables expressed as indices to U.S.=100. Data for 27 countries' sample for 1975 are taken from Salazar-Carillo and Tirado (1988).
2/ As reported by Kravis and Lipsey (1983).

than those in labor productivity, which are the cause of the international variability in price levels. 1/

c. Population and product size

We have hypothesized population, as an index of the size of the economy, to affect the degree of internal competitiveness, especially with respect to nontradables. This effect, and even more so its expression in the price level, need not be linear. In view of the fact that earlier researchers reported negative results for this variable (Clague 1986 and 1988), we experimented with various alternative forms, in particular with 1/POP, and with some squared and logarithmic transformations. The results, however, were inferior to those obtained for POP itself, which entered the regression equations with the hypothesized negative sign.

The left-hand panel in Table 4 presents the equations obtained when POP was introduced in conjunction with GDP/Np. As can be seen from a comparison of equations [4.2a] through [4.4a] with equations [1.2] through [1.4] in Table 1, POP's entry was not achieved at the expense of the income variable: neither the regression coefficients on income nor their *t* values are affected by its addition. In contrast to our hypothesis, the coefficient on size was both higher, and more significant in tradables than in nontradables.

With product per head included in the regression, the introduction of POP may be equivalent to regressing the price level on GDP as a whole. But the correlation between the total product (deflated by PL), GDPp, and the price level itself is insignificant; 2/ and when GDPp is substituted in the regressions for POP, it does not displace product per head. The results, which are shown in panel B of Table 4, differ from those of panel A in that GDPp practically fails to enter the equation for PN, but is more highly significant than POP in that for PT. With the price of nontradables

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1/ In addition to its effect on the structure of demand, pointed out by Bergstrand (1991), per capita income may also affect prices through its role in determining the reserve price of labor.

2/ The correlation, R=0.23, is not significant at the 5 per cent level. In contrast, Panagariya (1988) reported a positive correlation of close to 0.50 between the price of services, PS, and total (unadjusted for the price level) GDP for the 1975 ICP sample. But as has been shown in 5(a) above, regressing PL on nominal income is tantamount to regressing it on the product of real income and of PL itself; unless real income is negatively associated with prices, the correlation will be positive. In view of the close association between PL and PS, this is true also of the latter. A similar calculation for the present sample yielded a somewhat lower, but still statistically significant, spurious correlation between PS and total nominal GDP.

Table 4. The Size Effect

	A. Population			B. Gross Domestic Product 1/			
Eq. No.	[4.2a]	[4.3a]	[4.4a]	[4.2b]	[4.3b]	[4.4b]	[4.5b]
Dependent variable	PL	PN	PT	PL	PN	PT	PN/PT
Constant	54.8109 (12.61)	34.2468 (9.34)	85.6403 (15.59)	52.4682 (12.49)	32.7024 (9.10)	81.8563 (15.76)	42.0090 (16.45)
GDP/Np	0.7018 (8.36)	0.7238 (10.22)	0.5862 (5.52)	0.7643 (8.12)	0.7415 (9.21)	0.7113 (6.11)	0.3100 (5.42)
POP	-0.0926 (1.51)	-0.0711 (1.38)	-0.1393 (1.80)				
GDPp				-0.2704 (1.37)	-0.0652 (0.38)	-0.5526 (2.26)	0.2670 (2.22)
SEE	19.0516	16.0802	24.0870	19.1308	16.3687	23.6582	11.6318
Adj R^2	0.5879	0.6787	0.3946	0.5845	0.6670	0.4160	0.5206

1/ Deflated by PL.

unaffected, while that of tradables is lowered, their ratio, PN/PT, is seen in [4.5b] to rise with GDPp, though it is insensitive to POP.

These results suggest that the size effect might be ascribable to the volume of economic activity rather than, or as well as, to the number of economic agents conducting it. Its limitation to tradables might be due to the advantage enjoyed by service suppliers often being localized (or, if not, restricted by regulation), so that their competitiveness is not affected by the size of the economy as a whole. To put it differently, domestic competition probably matters more in nontradables; but its dependence on size may be greater in the markets for goods than in services and construction.

As all the variables are expressed as indexes to U.S.=100, equation [4.3a] suggests that a country's prices will be lower by 7 percent than in the United States for each 10 percent shortfall of its per capita real income below the U.S. income; and that they will be higher by about one percent for each 10 percent shortfall of its population below the U.S. population. (Or, alternatively, higher by about 3 percent for each 10 percent shortfall of its total real GDP.) 1/

d. Openness and transportation costs

In contrast to the findings of earlier studies, the traditional measure of the economy's openness--the ratio of the sum of imports and exports to GDP--failed to appear in any significant way in the estimating equations for 1980. 2/ We have hypothesized earlier that imports provide a ceiling for the prices of importables and exports a floor for the prices of exportables. When both were considered simultaneously, in conjunction with GDP/Np and POP, the import ratio did, indeed, enter the equation with a negative sign, and the export ratio with a positive one. But even the best results, those for trade in merchandise introduced along GDP/Np and POP fell short of the 5 percent level.

The present data provide some support for the alternative hypothesis raised in subsection 5(b) above, that openness affects not the price level itself, but the absolute magnitude of its departure from par, and that this absolute deviation is associated negatively with imports and positively with exports. Regressions of the absolute value of the residuals from equations [1.2] and [4.2a] on the various measure of openness discussed here, yielded

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1/ Unlike in the case of per capita income, the income variant of the size effect is sample sensitive. The exclusion of the two by far most populous countries in our sample, India and the United States, completely vitiates the significance of the coefficients on GDPp. But the significance of the negative coefficient on POP, which is practically wiped out in the equation for PN, is considerably increased in the equation for PT; and though reduced, still holds at the margin in that for PL.

2/ This has been already reported by Clague (1988).

coefficients with the expected (though not always statistically significant) signs. The best results were obtained for the merchandise trade ratios, Mg/GDP and Xg/GDP.

It should, however, be kept in mind that the trade ratios are derived from balance of payments figures valued at world prices, and GDP figures valued at domestic-market ones. Insofar as a country's general price level exceeds the U.S. level, so that PL>100, its openness relative to the United States may be argued to be overestimated by the conventional measures; and to be underestimated for PL<100. Correcting Mg/GDP and Xg/GDP accordingly did, in fact, considerably improve the regression on them of the residuals from [1.2], raising the *t* values of the corresponding coefficients to -2.6 and 2.4, significant, respectively, at just above and just below the 1 percent level; and similarly for the residuals from [4.2a]. This relationship continued to hold, in a slightly weakened form, also after the introduction of some further explanatory variables, such as transportation costs. 1/

The direct measure of transportation costs suggested earlier, the c.i.f./f.o.b. ratio for 1980, was derived from commodity import data valued both inclusive and exclusive of shipping costs. Viewed in a purely mechanical manner (and abstracting from their negative effect on the price of exportables), transportation costs may be expected to raise the general price level in accordance with the share of imports in GDP. Contrary to what might have been expected, CIF was negatively correlated with PL (R=-0.58). But when added to the equations of Tables 1 and 4, with the price-level corrected per capita income already allowed for, CIF enters them with the hypothesized positive coefficients. The best results were obtained in conjunction with GDP/Np, with GDPp as an index of size. The effect of CIF can be observed in the equations of Table 5, where it has been introduced together with measures of the economy's service sector, discussed below. As may have been expected, CIF seems to operate via the prices of tradables, PT, where its effect is both the largest, compared to those on PN and PL, and the one which is statistically significant.

e. Shares of services and tradables in output

The share of services, S/GDP, defined for the present purpose as that of all product-generating sectors other than agriculture and industry, was positively associated with the general price level, with R=0.57. But once

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1/ Unlike the actual trade ratios, the revalued ones enter also the regression equations for PL itself. But as the revalued, say, import ratio, M/GDPp, is equal to M/(GDP/PL) = (M/GDP)·PL, this reflects the same spurious relationship which was shown earlier also to enter the correlation between PL and GDP/N = (GDP/Np)·PL. This, however, should not affect the correlations with the absolute value of the residuals from [1.2] or [4.2a].

Table 5. Transportation Costs and the Share of Nontradables and of Government Consumption

Eq. No.	[5.1]	[5.2]	[5.3]	[5.4]	[5.5]	[5.6]
Dependent variable	PL	PL	PN	PN	PT	PT
Constant	-119.5982	-89.7224	-84.3640	-73.3958	-168.4631	-134.5303
	(1.24)	(0.94)	(1.02)	(0.86)	(1.44)	(1.14)
GDP/Np	0.8378	0.7842	0.7730	0.7534	0.8434	0.7827
	(5.54)	(5.17)	(5.90)	(5.60)	(4.56)	(4.21)
GDPp	-0.2577	-0.2086	-0.0504	-0.0324	-0.5425	-0.4868
	(1.31)	(1.07)	(0.30)	(0.19)	(2.26)	(2.03)
CIF	1.3306	0.9445	0.8708	0.7290	1.9832	1.5446
	(1.62)	(1.13)	(1.22)	(0.98)	(1.97)	(1.50)
S/GDP	0.3771	0.3147	0.2796	0.2714	0.4214	0.3960
	(1.23)	(1.17)	(1.18)	(1.13)	(1.26)	(1.20)
G/S		0.1339		0.0491		0.1520
		(1.69)		(0.70)		(1.57)
SEE	18.8175	18.4478	16.2828	16.3738	22.9877	22.6330
Adj R^2	0.5980	0.6136	0.6705	0.6668	0.4486	0.4655

per capita income is accounted for, its coefficient, though it has the hypothesized positive sign, just about fails to be significant at the 10 percent level. Basically the same results are also obtained when S/GDP is introduced alongside both income and size or, as in Table 5, transportation costs as well.

Contrary to our hypothesis, the share of agriculture in the tradable sector, A/TRAD, when introduced along S/GDP, appeared with a coefficient that was both not significant statistically ($t \leq 1.1$) and of the "wrong," that is, negative sign. Statistically better results were obtained when S/GDP was substituted with the two components of its complement (the tradable sector): the product shares of agriculture and of industry. However, while both of both of these entered the regression equations with the expected negative signs, only the share of agriculture, AGR, did so with some semblance of statistical significance ($t \geq 1.2$). It may perhaps be argued that agricultural products actually traded internationally being much more homogeneous than manufactured goods, they may also have a stronger equalizing effect on the overall price level. But it seems more reasonable that the regressions on AGR simply reflect the negative association between the share of agriculture in GDP and both income ($R=-0.77$) and S/GDP ($R=-0.70$). Experiments with a narrower definition of the tradable sector, which excluded the extractive industries, failed to yield more meaningful results. 1/

As hypothesized in 5(f), the effect of the product share of government consumption on the price level was more pronounced than that of S/GDP. When substituted for the latter in equations [5.1], [5.3], and [5.5] in Table 5, G/GDP entered the first and the last of these with t values significant at the 5 percent level. But this was not just due to government services constituting an alternative measure of nontradability. As can be seen from Table 5, the share of government in the service sector, G/S, enters the equations for PT and PL (but not for PN) alongside S/GDP, both with a positive sign.

Thus, the size of government seems to matter. However, its expressing itself in the prices of tradables, rather than of nontradables, runs contrary to our hypothesis that it affects the price level because of the nontradability of its services. We cannot, therefore, reject at this stage the alternative hypothesis made in 5(f), that the government consumption effect observed here represents the price effects of the taxes raised to finance it.

f. An alternative formulation of the role of the service sector

Had income affected only the relative price of nontradables, but not their product share, S/GDP, the latter variable could have been expected to

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1/ Data on the product share of manufacturing proper, MAN, were available (Sample D) for 46 of the 51 countries of our sample.

perform better in explaining the general price level once income has been accounted for. But while it explains, on its own, one third of the variance in PL in our sample, S/GDP adds only one percent to the nearly 60 percent explained by GDP/Np. This suggests that the association between S/GDP and the price level is not due only to variations in the weight with which the prices of nontradables enter the general price average.

It has been argued earlier that the regression coefficient of PL on S/GDP may reflect income's combined effect on both the relative price of nontradables and their product share. The correlations between PN/PT and both S/GDP and GDP/Np are, in fact, positive, with R=0.49 and R=0.70, respectively. As has been shown in 5(e), in the presence of such an association between these variables some higher power (or powers) of income per head (in the linear case the squared one) can be expected to enter the estimating equation with a positive sign, crowding out the share of nontradables.

The addition of higher powers of GDP/Np, up to $(GDP/Np)^3$, does, in fact, improve the results for the regression of PL on income. A similar improvement being observed in PT, but not in PN, can be explained if we assume the share of the nontradable component in the price of tradables to vary with its share in the product in general, while the share of the tradable component in nontradables remains constant. However, at variance with the hypothesis, these higher power terms do not completely crowd out S/GDP. The fact that they appear with alternating signs, and that the sequence of these signs changes with the addition of a further term, suggests that they may only reflect some nonlinearity of the income effect. 1/

8. Results--the fiscal variables

a. The overall tax burden

Estimates both of the overall tax burden and of some of its sub-categories were derived from data on government revenues and expenditures contained in the IMF's Government Finance Statistics (GFS). The GFS local currency figures, adjusted for calendar years, were related to the corresponding GDP, to turn them into tax burden ratios, and were then expressed as indexes to the base of U.S.=100.

In view of the discussion in section 6 above, we first examined the effect of the overall tax burden as represented by the total tax revenues of

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1/ Compare the results reported for the 34-country sample of stage III of the ICP study, where it was found that "neither the addition of a squared [real income] term, nor the fitting of a logarithmic equation . . . adds to the explanatory power of the relationship"; but where a squared term was said to improve the explanation in the logarithmic form. See Kravis and Lipsey (1983), p. 22.

the central government, TTAX. The results are summarized in Table 6. As equation [6.1] shows, with TTAX introduced into the regression for PL together with the variables of Table 5, other than G/S, all the coefficients have the expected signs; but the only ones to be statistically significant are those on the income level and on transportation costs. 1/ Considered only in conjunction with these two variables, TTAX enters equation [6.2] with a positive coefficient significant at about a 6 percent level. Thus, the general hypothesis that taxes do matter cannot be dismissed out of hand.

As the third and fourth columns of Table 6 indicate, the tax effect did not operate through the prices of nontradables: the t values of the TTAX coefficient in [6.3] and [6.4] are negligible. On the other hand, the existence of an overall tax effect is seen to be more certain in the case of PT, with the regression coefficient on TTAX in [6.6] statistically significant at the 3 percent level. Thus taxes seem to affect the general price level through their effect on the prices of tradables. This may be indicative of the type of taxes which affect prices, to which question we return later.

The last conclusion is important because it seems to contradict what has been called here the "indeterminacy argument," considered at the beginning of our paper. As this argument goes, in the absence of a monetary expansion, tax-induced price rises can be sustained only through some offsetting price falls, leaving the general price level unaffected. But the positive coefficient on TTAX in equations [6.5] and [6.6] implies any such offsetting within the tradable sector to have been far from complete. Furthermore, in the presence of a positive tax effect on PT, compensatory price offsetting would have required TTAX to enter the equations for PN with a negative coefficient. But with those observed in [6.3] and [6.4] not statistically different from zero, no such offsetting seems to have taken place between these two sectors either. 2/

In an international setting, we may, perhaps, interpret these findings to indicate that countries with higher overall tax burdens have larger money supplies (or higher circulation velocity) than low-tax ones. This hypothesis might be worth investigating.

b. Alternative measures of the total tax burden

It has been speculated earlier that, in its effect on the price level, the product share of government consumption, G/GDP, might represent not only the importance of the nontradable sector but also the overall tax burden.

1/ In these regressions, unlike in those summarized in Table 5, somewhat better results were obtained with the size of the economy represented by POP than by the (price-corrected) total product, GDPp. For a justification of the exclusion of G/S, see below, in 8(c).

2/ Except insofar as we would have expected the TTAX effect on tradables to reflect itself in PN through the latter's tradable component.

Table 6. The Price Effect of the Overall Tax Burden

Eq. No.	[6.1]	[6.2]	[6.3]	[6.4]	[6.5]	[6.6]
Dependent variable	PL	PL	PN	PN	PT	PT
Constant	-92.3368	-75.6292	-64.8132	-47.8453	-124.3522	-107.9099
	(0.93)	(0.84)	(0.76)	(0.61)	(1.00)	(0.96)
GDP/Np	0.7027	0.7532	0.7684	0.8018	0.5897	0.6301
	(4.66)	(5.05)	(5.92)	(6.34)	(3.14)	(3.45)
POP	-0.0529		-0.0548		-0.0820	
	(0.82)		(0.99)		(1.02)	
CIF	1.1102	1.0948	0.7373	0.7227	1.6080	1.6205
	(1.32)	(1.35)	(1.02)	(1.02)	(1.53)	(1.59)
S/GDP	0.2429		0.2489		0.2993	
	(0.84)		(0.99)		(0.83)	
TTAX	0.0675	0.0953	-0.0158	0.0129	0.1079	0.1462
	(1.05)	(1.58)	(0.29)	(0.24)	(1.34)	(1.93)
SEE	18.9276	18.8670	16.3011	16.3761	23.6011	23.6326
Adj R^2	0.5933	0.5959	0.6698	0.6667	0.4188	0.4173

Substituted for TTAX in PL and PT in the equations of Table 6, this variable did actually yield better results, both in terms of its statistical significance and in those of the general explanatory power of the regression. The product share of government consumption seems thus, indeed, to reflect also the burden of taxation or perhaps, more broadly, of the total resources appropriated by the government.

The real burden of government finance is the transfer of resources it effects. Insofar as nontax financing is resorted to, it is not fully represented by TTAX. An alternative measure of this real burden may be provided by the product share of all government purchases. The upper limit of these purchases is provided by the ratio to GDP of the total expenditures of the central government, TEXP. 1/ However, when introduced as a substitute for TTAX, this variable failed to enter significantly any of the estimation equations used. 2/

Under the rational expectations hypothesis, the tax burden perceived by the public includes the present value of taxes which will be collected in the future to repay debt contracted by the government to finance present budgetary deficits. We have introduced, therefore, a measure of the deficit, DEF, defined as the excess of total expenditures over total tax revenues, relative to GDP (standardized, again, in terms of the corresponding value for the United States). But though DEF enters the estimating equation for PL, it does so with the "wrong," negative sign! 3/ It is difficult to think of an economic rationale for this result, and we can only point to the positive correlation between DEF and TTAX, R=0.47, for a possible explanation. Once the tax variable is removed, DEF loses all statistical significance whatsoever.

c. Indirect domestic taxation and the price of tradables

The findings of Table 6 suggest that the overall tax burden raises the price level of tradables, but not that of nontradables. This could be due to (a) tradables, or the factors producing them, being taxed more heavily than nontradables; (b) the type of tax imposed on tradables being more easily shifted forward than that levied on nontradables; and (c) tradables lending themselves more easily to forward tax shifting than nontradables. The available data do not extend to the respective tax burdens of these two

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1/ TEXP overstates the value of (central) government purchases in that it includes also transfer payments, though it may be argued that redistribution is also part of the resource transfer burden of government finance. To the extent that the interest rate on public debt falls short of the public's discount rate, TEXP overstates the present value of present and future taxes necessitated by present government activities.

2/ Data on TEXP (and, consequently on the fiscal deficit, DEF) were available (Sample B) for all but two countries of our main sample.

3/ Added to equation [6.2], DEF enters it with a t value of 2.0, and raises that for TTAX from 1.6 to 2.5. Similar results obtain for PT.

sectors. But assuming direct taxes not to discriminate between them, the overall tax burden may be assumed to be lower on nontradables than on tradables, the former consisting in part of presumably nontaxable government services. If this were the reason for taxation not having any effect on PN, we would have expected G/S, the share of government consumption in the nontradables sector, and the total tax burden, TTAX, to enter the estimation equation for PN with opposing signs. However, when added to the equations of Table 6, G/S only tended to partly crowd out TTAX in explaining PL and PT, neither variable entering the equation for PN with anything but a negligible *t* value.

We have to consider, therefore, the possibility that some taxes are more easily shifted forward than others, either because of their own characteristics, or of those of the goods or services on which they are levied. To test the former hypothesis, and to identify these shiftable taxes, the total tax burden was decomposed into successive subcategories, these being then introduced as independent variables in the regression equations in place of TTAX.

The first distinction drawn was the traditional one between direct and indirect taxes. The direct tax variable, DIR, includes all taxes on income and property, as well as social security contributions, collected by the central government. The indirect tax variable, TIND, consists of revenues from both domestic indirect taxes and taxes on imports, including those levied on the purchase of foreign exchange. When these two constituents of TTAX were considered together, in conjunction with GDP/Np and CIF, the direct tax variable practically failed to enter the regression equations for either PT and PN, or PL ($t \leq 0.2$). Considered on its own, TIND can be seen in Table 7 to enter the equations for PL with statistically significant coefficients. As in the case of the total tax burden, this seems to reflect exclusively the effect which indirect taxation has on the prices of tradables: TIND's effect on PT can be seen in equations [7.4] and [7.5] to be more pronounced than that on PL, observed in equations [7.1] and [7.2], while it fails completely to enter the equations, not shown here, for PN.

In a similar manner, TIND was decomposed, to distinguish between indirect taxes on domestic production, DIND, and those on imports, DIMP. 1/ In contrast to the scenario in the hypothesis, DIMP's effect on both PT and PL is by far less pronounced than that of DIND, its coefficient failing to be statistically significant in any of the regressions considered ($t<1$). Equations [7.3] and [7.6] present the results obtained, for PL and PT respectively, when only DIND is considered. Their comparison with the rest of the table suggests that the burden of domestic indirect taxes is reflected in the prices of the tradable sector, and through tradable prices

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1/ TIND includes an element of export taxes, not accounted for in this decomposition. This, however, was negligible in most of the countries included in our sample.

Table 7. The Price Effect of Indirect Taxes

Eq. No.	[7.1]	[7.2]	[7.3]	[7.4]	[7.5]	[7.6]
Dependent variable	PL	PL	PL	PT	PT	PT
Constant	-92.4128 (0.95)	-85.2470 (0.98)	-89.6532 (1.01)	-124.4685 (1.04)	-123.0803 (1.14)	-133.0003 (1.24)
GDP/Np	0.7968 (5.70)	0.8407 (6.68)	0.7770 (5.97)	0.7409 (4.32)	0.7919 (5.12)	0.6843 (4.32)
POP	-0.0441 (0.70)			0.0676 (0.87)		
CIF	1.1150 (1.36)	1.2900 (1.43)	1.2267 (1.54)	1.6156 (1.60)	1.6783 (1.72)	1.8445 (1.90)
S/GDP	0.1580 (0.54)			0.1605 (0.45)		
TIND	0.0135 (1.76)	0.0163 (2.34)		0.0218 (2.32)	0.0254 (2.96)	
DIND			0.0123 (2.17)			0.0208 (3.01)
SEE	18.5302	18.3207	18.4588	22.7489	22.5374	22.4791
Adj R^2	0.6102	0.6189	0.6132	0.4600	0.4700	0.4728

in the general price level. As the latter, PL, is a composite of PN and PT, we may expect the effects of the above-considered tax aggregates on PL to fall between the positive effects observed for the tradable sector, and the zero effect observed in the nontradable sector. The figures in Tables 6 and 7 show this indeed to be the case, the regression coefficients of PL on the various tax-burden measures examined there amounting to only about 0.6 those of PT, besides being also of lower statistical significance.

The absolute lack of effect of DIMP on prices persists also when, in an alternative break-up of the total tax burden, we distinguish between DIMP and the total burden of domestic taxation, both direct and indirect, DOM. Unlike what might have been expected, DOM exerted an effect on PT, but not on PN, rather than the other way around.

Figure 1, which summarizes these results, illustrates the fact that in the successive distinctions made here we are closing in on that group of taxes which translates themselves into higher prices. Thus, the left-hand part of the figure shows that the random probability for the regression coefficient of PT on TTAX being of the size and sign reported here is 3 percent; but that this is reduced to less than 1/2 of 1 percent, when only indirect taxes are considered, falling ultimately to only 0.2 percent, once import duties are excluded. PN not being similarly affected, the corresponding probabilities for the effects of taxation on PL are considerably higher, and no improvement is achieved by isolating domestic taxes from those on imports. In view of the effect of the former on PT, it is nevertheless possible that a further break-down of DIND, not provided for in this study, can help to establish more narrowly the identity of the price affecting taxes.

Our findings thus support the conventional wisdom regarding the different forward-shifting potentials of indirect and direct taxes. While indirect taxes raise the price of tradables, direct ones seem to raise the price neither of tradables nor of nontradables. On the other hand, it is the domestic component of indirect taxes which has been seen to matter. Thus, contrary to what has been hypothesized earlier, the wedge which taxes on imports drive between domestic and world prices seem to have a smaller effect on the price level than that which indirect taxation introduces between the prices facing domestic producers and consumers.

It may be recollected that the traditional explanation of price-level differentials revolved around the proposition that international trade tends to equalize the prices of tradables across the world market. Deviations from PPP can then be due only to corresponding deviations in the prices of nontradables. Consequently, the study of these deviations tended to focus on the factors affecting the relative (and because of the assumed equalization of the price of tradables also the absolute) price of nontradables. In contrast, we have found here a source of price-level differentials operating via the prices of tradables. Considering that this source is domestic indirect taxation, the effect on PT is obvious. Because export opportunities provide a floor for the domestic price of exportables,

tradability prevents domestic taxes on them from being shifted backward. At the same time, domestic indirect taxes, unless they discriminate in favor of imports, raise the ceiling which tradability imposes on the price of importables, allowing them to be shifted forward. Consequently, the price of the tradables taxed will be raised, at any rate of exchange, above its international level.

Although the price of nontradables, on the other hand, is subject to no ceiling except the macroeconomic, monetary, one discussed earlier in this paper, it also lacks the floor provided by export opportunities. The fact that no tax effects on PN were observed suggests that taxes on nontradables may have been shifted backward, into lower remuneration of the factors of production.

d. Some other variables and considerations

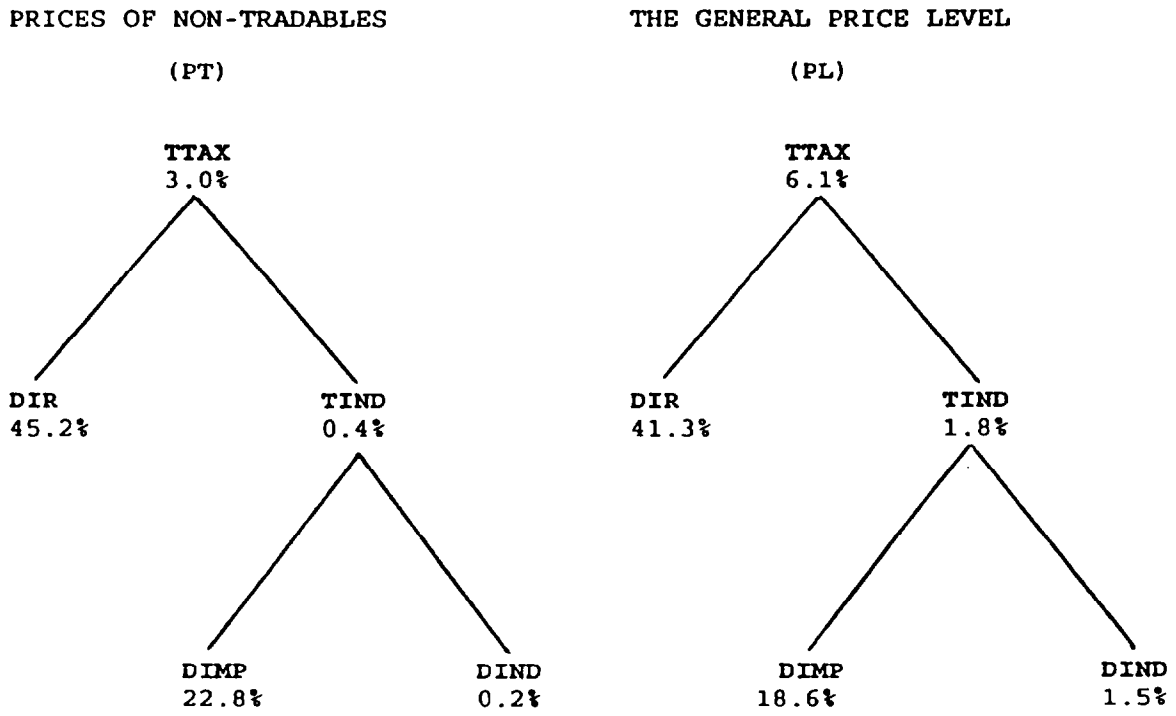
Another group of fiscal variables examined was that of what can be regarded as negative taxes, that is, product subsidies and transfer payments, the separately classified social security payments, and the central government's outlay on housing. None of these variables, whether singly or in some combination with the others, proved significant in explaining PL. In an alternative approach, subsidies were deducted from the various tax aggregates examined. But the use of the net tax figures derived in this manner did not improve the results.

The import tax burden variable used here, DIMP, is the product of the customs tariff rate and the ratio of imports to GDP. In view of our failure, contrary to expectations, to discern any statistical association between DIMP and PL, we experimented with introducing the ratio of commodity imports to GDP as an additional explanatory variable. But neither with DIMP, nor with the alternative measure of the actual effective tariff rate on commodity imports, did Mg/GDP prove in any way significant in explaining PL, nor did its introduction improve the performance of any of the other variable.

The present fiscal data are all restricted to central government finances. In some countries the tax revenue collected at the state and local-government levels is far from negligible. As this is true in particular of the United States, we repeated our calculations, excluding it from the sample. But besides a reduction in the statistical significance of the tax effects, the results were hardly affected by this exclusion. 1/

1/ That all data were expressed here on the base of the U.S. data is of no importance in this context. Because the choice of the numeraire affects the data for all countries proportionally, it affects the magnitudes of the regression coefficients, but not their significance or the value of R^2.

Figure 1: Isolating the Price Raising Tax Component



TTAX - Total tax revenue

DIR - Direct taxes

TIND - Total indirect taxes

DIMP -Import taxes

DIND - Indirect taxes on domestic production

Numerals under tax initials show the random probability for the corresponding price effect.

9. Summary of results and evaluation

In this paper, the purchasing power parity (PPP) hypothesis has been examined on the base of the stage IV of the ICP data for 1980, with special emphasis on the role of taxes in explaining diversions from the law of one price. In sections 1 through 3, the factors causing national price levels to diverge from parity were discussed. Sections 4 through 8 tried to identify the operational statistical variables representing some of these factors, and tested their effect on the price level by means of a multiple regression analysis.

As in all previous studies of international differences in the price level, income, represented by per capita GDP corrected for price-level differences, proved the main explanatory variable.

Openness, as traditionally measured by the foreign trade ratio, failed to provide any explanation of the price level, in contrast to its successful performance in studies for earlier years. This seems to be in line with our argument, that there is no clear reason for openness to be systematically associated with PL (though it does not explain why such an association was observed in earlier studies). On the other hand, some support was found for the alternative hypothesis outlined here, that it would be positively associated with PL's absolute diversions from par, after income's influence has been accounted for.

An attempt, which has not been made before, was the inclusion of international transportation costs in the analysis. The summary measure of such costs suggested here, the ratio of c.i.f. to f.o.b. prices, behaved as expected.

Earlier researchers who experimented with country-size variables found no systematic association between any of them and the price level. A failure to find the positive association hypothesized by one researcher was recently reported for the present data in a sample not much different from our main sample. 1/ But the size of the population, as an indicator of the degree of competition within the economy, appeared with the expected negative signs in our regressions for both PT and PN, as well as for PL. An alternative size indicator, total GDP, suggested nontradables to be less susceptible to the size effect.

The size of the (nontradable) service sector seems to exert a positive pressure on the price level. Somewhat unexpectedly, the size of agriculture seems to have a much more pronounced negative effect on prices than the size of industry. This could indicate that farm produce traded internationally is much more homogeneous than most of traded manufactured goods and,

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1/ Clague (1988). But the variable he used was the logarithm of the population size, not population size itself, which we found to perform much better than any of its transformations experimented with here.

therefore, exerts a stronger pressure on international price equalization. As hypothesized, better results were obtained when services were defined more narrowly, as is the case for the virtually almost completely nontradable government services. This could also reflect the costs of providing them through taxation.

Somewhat surprisingly, with the exception of Clague and Tanzi (1972) who tried unsuccessfully to relate price levels to import duties, no attempt has been made until quite recently to examine the potential effects of taxation on the price level. This neglect (or the failure to report meaningful results) may have been due to the choice of income variable used. The total tax revenues of the central government provide, in fact, no explanation of the price level when introduced together with nominal per capita income. But, as we have seen, they are significant in explaining it once income is adjusted for differences in the price levels. We therefore conclude that, insofar as the price level is considered, the total tax burden does seem to matter.

Turning to identify the tax revenue components most closely associated with the price level, we found, contrary to expectations, that domestic indirect taxes, rather than import duties, were significant in this respect. This counter-intuitive result is supported by the results reported most recently by Salazar-Carillo (1990) with respect to five Central American countries. Using, because of the size of his sample, a methodology different from the one used here, his findings parallel ours in that "it seems that tariffs do not have an appreciable influence on cross-country price levels . . . while indirect taxes apparently do." (Salazar-Carillo (1990), p. 106). 1/

Certain reservations are called for. As mentioned earlier, the fiscal data used here pertain only to the central government. To the extent that other levels of government finance themselves only out of property rates and licensing and permit fees, their exclusion should not seriously impair our results. But where income and sales taxes are levied also on the municipal or, as in the United States, the state-level, central-government data may considerably underestimate the total tax burden, and even more so, probably, its composition. One direction of research worth pursuing, therefore, may be that of improving the fiscal data set used, to include all government levels.

Per capita GDP, which has been found in all studies to provide most of the statistical explanation of cross-country variations in the price level, has been corrected here for price level differences. Many of the countries included in our samples are, however, widely believed to have a large unreported, "unofficial" sector, not covered by their national

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1/ Negative results for import duties were also reported by Clague and Tanzi (1972) who, however, did not examine the effect of other indirect taxes.

accounts data. Variations in the size of this sector across countries may significantly distort the real differences in the main explanatory variable of our investigation.

Multicolinearity among many of the variables tested makes it difficult to ascribe to each of them its true role in explaining national price levels. More generally, it may result in different investigators coming up with alternative, conflicting, explanations on the basis of different sets of variables, all of them equally significant statistically. Thus, for example, for a considerably overlapping sample, Clague (1988) found the price level to be explained by, in addition to income, the size of the minerals sector, the level of education and, to a lesser degree, the population pressure on farming land, as well as by regional dummy variables. In the present study itself, we have no reasonable explanation for the negative association observed here between the price level and government deficit.

As may already have been observed from the comparison of the results presented in Tables 1, 4 and 5, the introduction of other variables in addition to GDP/Np resulted only in small improvements in the explanatory power of the regression equations. With the exception of variables related to size, most of these variables entered the regressions at the expense of the statistical significance of per capita income, or of one another. This, of course, is due to some of these variables being systematically associated with income, and some of them being thus also associated with one or more of the others. This means, however, that we are faced with alternative behavioral models, which cannot be ranked on purely statistical grounds. The present findings are, therefore, inconclusive, in that they represent only one of a number of alternative explanations of international variations in price level, all of more or less equal statistical validity.

The investigation of the question raised in this paper could, perhaps, be furthered by research distinguishing more clearly between the tax burdens falling on the tradable and the nontradable sectors of the economy. Another promising line of inquiry may be that of reexamining the data for earlier years, to see whether the taxation effects established, or at least suggested, here could have been discerned in them as well. The results of such investigations could go a long way in helping us to decide whether the present findings are merely spurious statistical curiosities, or reflect real functional relationships.

Data Sources

As mentioned in the text, phase IV of the ICP study provides price comparisons, relative to the United States, for 60 countries for 1980 (U.N., 1987, Part II, pp. 1-16), from which our PL figures were taken. For the data on PN and PT we utilized the aggregations, by alternative definitions, of the ICP data by tradables and nontradables, conveniently provided in Falvey and Gemmel (1991, Table A1).

Unless otherwise indicated, the data on general macroeconomic magnitudes used here are those of the IMF International Financial Statistics (IFS), and were taken from the IMF's data bank. GDP figures in local currency, from line 99b in the IFS tables were turned into U.S. dollars using the annual average exchange rates of line rf; and into per capita ones using mid-year population estimates from line 99z. Figures on government consumption are from line 91f. With the exception of the foreign trade ratios, which are triennial averages, all data are for 1980. Where the data period was other than the calendar year, the data were prorated accordingly. For lack of a figure on c.i.f. valued imports for Luxembourg, we ascribed to it the simple arithmetic average between the c.i.f./f.o.b. ratio for Belgium and that for the Netherlands.

Internationally comparable (insofar as possible) figures on central government revenues and expenditures, used to test the main hypothesis of the paper, were taken from Government Finance Statistics (GFS), also compiled by the IMF, and were similarly derived. The GFS local currency figures, adjusted for calendar years, were related to the corresponding GDPs, to turn them into tax burden ratios and, in line with the accepted practice in PPP studies, were then expressed as indexes to the base of U.S.=100. In the following, the figures in parentheses are those of the corresponding EIS code classification: total tax revenues (81YA); direct taxes (81A+81B+81C+81D); domestic indirect taxes (81E); taxes on international trade (81F); export taxes (81FC); and total expenditures (82).

Data on the economically active population, as a proxy for persons employed, were taken from the U.N. Demographic Yearbook 1984, Table 26, and loc. cit., 1988, Table 36. Where no figure for 1980 was available, we used an estimate obtained by applying to the population figure in 1980 the participation ratio for the year closest to it within the preceding five-year period.

Figures on the distribution of GDP by industry were obtained from the U.N. Yearbook of National Accounts Statistics, 1985, Table 5.

Of the 60 countries covered by the ICP study, two--Hong-Kong and Mali--had to be excluded from our sample because of the unavailability or insufficiency of the IFS data. Lack of the necessary GFS data resulted in the exclusion of another four countries--the two "socialist" ones, Hungary and Poland, as well as Nigeria and Bolivia. Tanzania and Guatemala had to be excluded because of lack of data on the industrial structure of their

product, and Yugoslavia because of the unavailability of consistent estimates for the prices of tradables and of nontradables separately. The remaining 51 countries constituted our main sample. The data coverage, and the country composition of the various subsamples used are given in Appendix II.

The data used in the regressions described in this paper are available from the author on request.

Coverage and Sample Composition

	Coverage						Sample						
	ICP	IFS	ACC	GFS	GFS1	PNT	A	B	C	D	E	F	G
No. of countries	**60**	**58**	**57**	**55**	**53**	**59**	**51**	**49**	**49**	**46**	**40**	**32**	**27**
Belgium	•	•	•	•	•	•	•	•	•	•	–	–	•
Denmark	•	•	•	•	•	•	•	•	•	•	•	•	•
France	•	•	•	•	•	•	•	•	•	•	•	•	•
Germany	•	•	•	•	•	•	•	•	•	•	–	–	•
Greece	•	•	•	•	•	•	•	•	•	•	•	•	–
Ireland	•	•	•	•	•	•	•	•	•	–	•	–	•
Italy	•	•	•	•	•	•	•	•	•	–	–	–	•
Luxemburg	•	•	•	•	•	•	•	•	•	•	•	•	•
Netherlands	•	•	•	•	•	•	•	•	•	•	•	•	•
Portugal	•	•	•	•	•	•	•	•	•	•	–	–	–
Spain	•	•	•	•	•	•	•	•	•	–	•	–	•
U.K.	•	•	•	•	•	•	•	•	•	•	•	•	•
Austria	•	•	•	•	•	•	•	•	•	•	•	•	•
Finland	•	•	•	•	•	•	•	•	•	•	•	•	–
Norway	•	•	•	•	•	•	•	•	•	•	•	•	–
Canada	•	•	•	•	•	•	•	•	•	•	•	•	–
Japan	•	•	•	•	•	•	•	•	•	•	•	•	•
U.S.A	•	•	•	•	•	•	•	•	–	•	•	•	•
Israel	•	•	•	•	•	•	•	•	•	–	–	–	–
Hungary	•	•	•	–	–	•	–	–	–	–	•	–	•
Poland	•	•	•	–	–	•	–	–	–	–	•	–	•
Yugoslavia	•	•	•	•	•	–	–	–	–	–		–	•
Botswana	•	•	•	•	•	•	•	•	•	•	•	•	–
Cameroon	•	•	•	•	•	•	•	•	•	•	•	•	–
Cote d'Ivoire	•	•	•	•	•	•	•	•	•	•	•	•	–
Ethiopia	•	•	•	•	•	•	•	•	•	•	–	–	–
Kenya	•	•	•	•	•	•	•	•	•	•	–	–	•
Madagascar	•	•	•	•	–	•	•	–	•	•	–	–	–
Malawi	•	•	•	•	•	•	•	•	•	•	•	•	•
Mali	•	–	•	–	–	•	–	–	–	–	•	–	–
Morocco	•	•	•	•	•	•	•	•	•	•	–	–	–
Nigeria	•	•	•	–	–	•	–	–	–	–	–	–	–
Senegal	•	•	•	•	•	•	•	•	•	•	•	•	–
Tanzania	•	•	–	•	•	•	–	–	–	–	–	–	–
Tunisia	•	•	•	•	•	•	•	•	•	•	–	–	–
Zambia	•	•	•	•	•	•	•	•	•	•	–	–	•
Zimbabwe	•	•	•	•	•	•	•	•	•	•	•	•	–
Argentina	•	•	•	•	•	•	•	•	•	•	•	•	–
Bolivia	•	•	•	–	–	•	–	–	–	–	•	–	–
Brazil	•	•	•	•	•	•	•	•	•	•	•	•	•
Chile	•	•	•	•	•	•	•	•	•	•	–	–	–
Colombia	•	•	•	•	•	•	•	•	•	•	–	–	•
Costa Rica	•	•	•	•	•	•	•	•	•	–	•	–	–

Coverage and Sample Composition (concluded)

	Coverage						Sample						
	ICP	IFS	ACC	GFS	GFS1	PNT	A	B	C	D	E	F	G
No. of countries	60	58	57	55	53	59	51	49	49	46	40	32	27
Dominican Rep.	•	•	•	•	•	•	•	•	•	•	–	–	–
Ecuador	•	•	•	•	•	•	•	•	•	•	•	•	–
El Salvador	•	•	•	•	•	•	•	•	•	•	–	–	–
Guatemala	•	•	–	•	•	•	–	–	–	–	•	–	–
Honduras	•	•	•	•	–	•	•	–	•	•	•	•	–
Panama	•	•	•	•	•	•	•	•	•	•	•	•	–
Paraguay	•	•	•	•	•	•	•	•	•	•	•	•	–
Peru	•	•	•	•	•	•	•	•	•	•	–	–	–
Uruguay	•	•	•	•	•	•	•	•	•	•	•	•	•
Venezuela	•	•	•	•	•	•	•	•	•	•	•	•	–
Hong Kong	•	–	•	–	–	•	–	–	–	–	–	–	–
India	•	•	•	•	•	•	•	•	–	•	•	•	•
Indonesia	•	•	•	•	•	•	•	•	•	•	•	•	–
Korea	•	•	•	•	•	•	•	•	•	•	•	•	•
Pakistan	•	•	•	•	•	•	•	•	•	•	•	•	•
Philippines	•	•	•	•	•	•	•	•	•	•	•	•	•
Sri Lanka	•	•	•	•	•	•	•	•	•	•	•	•	•

Coverage:

ICP — National price levels (to U.S. = 100), from Phase IV of the International Comparison Project.

IFS — National accounts, foreign trade and exchange rate data from International financial Statistics.

ACC — Product composition data from National Accounts Statistics.

GFS — Central government revenue data from Government Finance Statistics.

GFS1 — Central government expenditure data from Government Finance Statistics.

PNT — National price levels for the tradable and non-tradable sectors. From Falvey and Gemmel, 1991.

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