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International Price Discrimination: The Pharmaceutical Industry

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Summary. — It is generally asserted that price discrimination is a common feature of the international pharmaceutical market, resulting in unnecessarily high medical costs to developing countries, since it is pharmaceuticals that are the largest component of their health care expenditures. However, little comprehensive empirical research has been carried out to test this hypothesis. This article compares the prices of identical packages of pharmaceutical products for 32 countries for the year 1975 and examines which factors contribute to the huge price differences. A strong positive relationship between price level and per capita GDP is found, a 10% increase in per capita income being associated with on average 8% higher drug prices. The implementation of direct price control measures by the government results on average in a 20% price reduction, while government policies such as bulk purchasing through a centralized government agency, promotion of the use of generics and, to a lesser extent, excluding patent protection seem to be successful in lowering the general price level of pharmaceuticals. These results suggest that the pharmaceutical industry charges what the market "will bear."

1. INTRODUCTION

For years the pharmaceutical industry has been severely criticized for charging too high a price for its products, prices which held no relation to "true" scarcity or production costs. "Excessive" or "abnormal" profits, absence of significant price competition, high concentration in production, exceptional expenditure on marketing and promotion as well as price discrepancies for identical products are said to be common features of the pharmaceutical market. Therefore, the pharmaceutical industry is often characterized as highly oligopolistic, effectively exercising market power and charging whatever price the market will bear.

For developing countries, which as a group spend some 1% of their Gross Domestic Product (GDP) on pharmaceuticals, an oligopolistic markup implies high opportunity costs due to a loss of foreign exchange and investment opportunities foregone.

Several authors have suggested policies to reduce these costs for developing countries. However, evidence for the existence of international price discrimination by the pharmaceutical industry and for the effectiveness of the suggested policies has been based on random studies typically considering only a few drugs and a limited number of countries. Systematic empirical research into the causes of the observed price discrepancies is hardly available.[1]

The purpose of this paper is to test the hypothesis that the pharmaceutical industry practices international price discrimination. This will be done by means of a cross-country analysis based on prices of packages of pharmaceutical products.

First, the relationship between structure and pricing behavior of the pharmaceutical industry will be discussed. Next, the price levels of pharmaceuticals in 32 countries will be compared. Finally, the international price discrepancies will be explained by means of a cross-country analysis.

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2. STRUCTURE OF THE INTERNATIONAL PHARMACEUTICAL MARKET

Since drugs are by their very nature rather heterogeneous (a gastric ulcer should not be healed with aspirin), the pharmaceutical market can be divided into a large number of independent sub-markets (characterized by low cross elasticities of demand), which correspond to certain therapeutic classes. A low level of concentration for the industry as a whole (some 5% market share for the largest drug firm) thus conceals the real market power which is exercised at sub-market level, where "the four firm concentration ratio is quite high. (. . .) There are several in the 90 percent range, and the unweighted average was 68 percent."[2] The resulting monopolistic power leads to a behavior in which "competitive forces do not play a major role in determining prices,"[3] so that competition is mainly pursued by means of innovation and product differentiation, supported by trademarks and heavy promotion. Being one of the most innovating industries, the pharmaceutical industry is confronted with extreme uncertainty on the supply side of the market and seeks to protect itself against this phenomenon through intensive use of patents (protecting the innovation), trademarks (protecting the product against me-too-duplication) and impressive marketing budgets, thus reducing the influence and possibilities of price competition even further.

In addition the drug market is characterized by low price elasticity of demand, due to the intransparency of the market and the nature of the pharmaceutical product, which should be considered as a commodity often purchased out of necessity. Moreover, in most developed countries the decision to buy is taken by a doctor who has little or no incentive to economize, since he does not have to pay for the goods he orders and seldom has knowledge over the costs of drugs,[4] while consumers too are not very cost-conscious because drugs costs are often paid by a third party. According to several authors the described structure of the pharmaceutical industry has caused severe price discrimination within and among countries, the latter being the subject of this article. Muller for instance ascertains: "What is significant is not just the huge variations between the quotations of different companies, but the fact that the same companies asked prices which varied by 400 per cent from one country to another."[5] (See Table 1.)

Table 1. *Differences in price quoted for the same drug (by different companies and by the same company)*

Drug	Price (US$)			
	All companies		Same company	
	Highest	Lowest	Highest	Lowest
Tetracycline (1,000 250 mg caps)	44.28	9.32	37.68	17.77
Chlorpropamide (1,000 250 mg tabs)	69.90	7.33	54.28	13.00
Furosemide (1,000 40 mg tabs)	150.76	8.07	150.76	36.60
Diazepam (1,000 5 mg tabs)	48.66	2.74	48.66	15.02

Source: UNCTAD (1980).

3. THE COMPARISON OF PHARMACEUTICAL PRICE LEVELS BETWEEN COUNTRIES

As a consequence of the high degree of product differentiation (leading to a vast amount of often almost identical drugs) and the reluctance of the pharmaceutical industry to publish comprehensive data about their actual transaction prices, information about prices of pharmaceutical products is often very scattered, especially when developing countries are concerned. In addition to the availability of price data, the comparability of price levels between countries is an important problem.[6] It is widely recognized that comparing domestic prices of various countries by simply converting them at market exchange rates into a common currency unit is a very unsatisfactory method, since exchange rates usually do not reflect the relative purchasing-power of the currencies.[7] First, the market exchange rate only applies to internationally traded goods, so comparing non-traded and non-tradable goods, converted at official exchange rates, can produce misleading results. It is indeed a well-known fact that relative prices of non-tradable goods and services tend to be substantially lower in low-income countries. Second, the official exchange rate is often a poor indication of the relative scarcity of a currency, when it is not freely convertible against other currencies. In many developing countries overvaluation of the currency, attributed to rapid rates of domestic inflation not compensated for by devaluation, is a common phenomenon. In the case of Ghana, for instance, it has been ascertained that:

> If imported drugs — which are the bulk of those used in Ghana — were valued at a rate of exchange which more realistically valued the relative resource cost of producing goods domestically and abroad, the drug bill in domestic currency would undoubtedly be very much higher than that shown in the Ministry's account.[8]

Finally, the big fluctuations in currency values since the early 1970s would result in unreasonably large fluctuations in the relative price levels of pharmaceuticals, if prices were simply converted at market exchange rates.[9]

Fortunately, the recently published report on the United Nations International Comparisons Project (ICP) by Kravis, Heston and Summers[10] (1982) offers a unique opportunity to overcome both the problems of availability and comparability of pharmaceutical prices. The ICP provides an alternative yardstick for international price and income comparisons, the so-called Purchasing-Power Parity (PPP). A PPP is essentially an international price index.[11]

In order to compare the price levels of the pharmaceuticals between the 32 considered countries[12] we used the PPP of each country for the category "Drugs and Medical Preparations" to construct price indices with regard to the United States as base-country (Table 2).

According to Kravis, the "organization and execution of the price collection is easily the most resource-absorbing phase of the work, as well as the most critical."[13] For binary comparisons Kravis *et al.* (1982) strictly apply the criteria of common usage and product comparability to select relevant drugs. However, if a large number of countries, widely differing with respect to income level and culture, are included in multilateral comparisons (as in this article) an effort to produce a common list of drugs will result either in too short a list or in pricing items that are not representative for all countries. In the case of multilateral comparisons therefore, Kravis *et al.* followed an alternative approach, inviting each country to choose particular drugs from a list that is larger than the target number desired. This method produced an incomplete price matrix. The approach followed by Kravis *et al.* in the case of missing prices is a weighted form of Least Squares, the weight of each country being selected so as to correct for the number of drugs with missing price data in that country.[14]

Because of the large number of methodological problems and conceptual ambiguities that needed to be resolved to arrive at a set of relative international prices, it is not surprising that the study of Kravis *et al.* (1982) is not free from criticism.[15] "Yet," as Theil remarks,

> as far as the construction of the basic data is concerned, their work is better than what anyone before has performed. Of course, this does not mean that their figures are perfect; it is up to the user of these figures to apply his own judgements, which is considerably simplified by the authors' frank admission of the difficulties which they faced and the implied limitations.[16]

In our judgement the reliability of the price data of pharmaceutical products is presumably relatively good: when one compares pharmaceutical commodities with services like health care or education it is clear that the criteria of common usage and product comparability are relatively easily applicable to drugs, which can be defined with rather high accuracy (e.g. by chemical formula or by patent description). In any case, the price indices of Table 2 ought to be regarded as indicative, rather than precise measures of the relative price differences among countries.

4. SCOPE AND METHOD OF THE CROSS-COUNTRY STUDY

In the next section relative price discrepancies in the pharmaceutical world market, as represented by the price indices in Table 2, will be explained by means of a cross-section study in which several demand and institutional variables serve as explanatory variables. The relationship between price level and explanatory variables, expressed in a linear reduced form equation, will be estimated by the Ordinary Least Square (OLS) method. The choice of the explanatory variables is based on those factors of demand and those government policies, which are generally considered to be determinants for the pricing behavior of the drug industry. Variables describing the supply side of the market are left out of consideration, since the available data are predominantly of an extremely aggregated nature, thereby prohibiting the exposure of monopolistic power, which is, as stated before, exercised at sub-market level.

With regard to our previous discussion on the structure of the pharmaceutical market, the following explanatory variables are distinguished.

(a) *GDP per capita* (GDP/N)

Proceeding from the oligopolistic features of the drug industry, which sets prices according to

Table 2. *Prices indices and explanatory variables for the cross-country analysis on the pricing behavior in the pharmaceutical world market for the year* 1975

No. Country*	Price index pharmaceuticals (*P*)	GDP per capita (index) (*GDP/N*)	Volume of consumption (index) (*CV*)	Population (index) (*N*)	Volume of per capita consumption (index) (*CV/N*)	Patent protection (dummy) (*PP*)†	Indirect price control (dummy) (*IPC*)‡	Direct price control (dummy) (*DPC*)§
01 Malawi	60.83	4.90	0.014	2.36	0.6	1	0	0
02 Kenya	50.63	6.56	0.07	6.27	1.1	1	0	0
03 India	31.71	6.56	18.66	282.76	6.6	0	0	1
04 Pakistan	38.76	8.23	3.42	32.9	10.4	0	1	1
05 Sri Lanka	15.22	9.30	0.42	6.32	6.7	1	1	1
06 Zambia	96.58	10.3	0.05	2.33	2.2	1	0	0
07 Thailand	48.01	13.0	2.21	19.60	11.3	0	0	0
08 Philippines	51.14	13.2	0.77	19.70	3.9	1	0	0
09 South Korea	35.10	20.7	2.20	16.52	13.3	0	0	0
10 Malaysia	70.74	21.5	0.50	5.58	8.9	1	0	0
11 Colombia	48.07	22.4	1.56	11.09	14.1	0	1	0
12 Jamaica	46.13	24.0	0.21	0.96	22.0	1	0	0
13 Brazil	63.83	25.2	10.48	50.17	21.6	0	1	0
14 Mexico	69.68	34.7	7.77	28.16	27.6	0	0	0
15 Yugoslavia	48.24	36.1	3.83	9.42	40.6	0	1	1
16 Iran	70.42	37.7	3.27	15.33	21.3	0	0	0
17 Uruguay	65.95	39.6	0.44	1.30	33.8	0	0	0
18 Ireland	73.58	42.5	0.57	1.49	38.0	1	0	0
19 Hungary	57.25	49.6	2.36	4.94	47.8	0	1	1
20 Poland	53.98	50.1	8.08	15.93	50.7	0	1	1
21 Italy	69.01	53.8	12.02	26.14	45.9	0	0	1
22 Spain	69.68	55.9	9.01	16.63	54.2	0	0	0
23 United Kingdom	71.19	63.9	9.96	26.21	38.0	1	1	1
24 Japan	81.88	68.4	28.58	52.24	54.7	0	0	1
25 Austria	139.53	69.6	1.24	3.52	35.2	0	0	0
26 Netherlands	137.29	75.2	1.54	6.40	24.1	1	0	0
27 Belgium	101.73	77.7	3.49	4.59	76.0	1	0	1
28 France	91.56	81.9	25.14	24.70	101.8	1	0	1
29 Luxembourg	100.27	82.0	0.10	0.17	60.5	1	0	1
30 Denmark	157.56	82.4	0.70	2.35	29.5	1	0	0
31 Germany, Fed. Rep.	152.52	83.0	24.29	28.95	83.9	1	0	0
32 United States	100.00	100	100	100	100	1	1	0
Mean	74.00	42.81	8.84	25.78	33.95	0.50	0.28	0.38
SD	34.20	28.16	18.13	50.27	27.49	0.50	0.45	0.48

Sources: Chudnovsky (1983), p. 189; Kravis *et al.* (1982), pp. 10, 12, 208–209, 212–213, 216–217, 220–221; Melrose (1982), pp. 152, 153, 157, 158; O'Brien (1979); UNCTAD (1975); UNIDO (1978), pp. 10–15, 23.

*Two of the 34 ICP countries, Romania and Syria, are left out since data on several explanatory variables are lacking.

†*PP* = 1, if patents for pharmaceutical products are recognized;
= 0, if not.

§*IPC* = 1, if the government stimulates price competition by means of a centralized purchasing policy or promotion of the use of generics;
= 0, if not.

‡*DPC* = 1, if the government applies strict price controls;
= 0, if not.

"what the market will bear,"[17] a positive relation between price level of pharmaceuticals (P) and the purchasing-power of a country is expected, where GDP/N (converted by Kravis's PPP[18]) serves as a standard. This relation is enforced by the fact that the price consciousness of a consumer with great purchasing-power, or, for that matter, of a doctor with relatively many patients with great purchasing-power, will probably be low: when income rises, the incentive to ransack the market for the cheapest type of a drug needed diminishes and hence demand becomes more price-inelastic.

(b) *Volume of consumption* (CV)

Total drug consumption is considered as an indication for the size of the actual market of a specific country. The size of the market is of particular interest when economies of scale can be reaped. Given the extant importance of economies of scale in marketing as well as in research and development to the drug industry and the resulting possibilities to reduce average overhead costs,[19] a negative relation between price level (P) and actual size of the market (CV) is expected.

(c) *Population* (N)

Attractiveness of a market is not only based on the actual size of the market, but also on potential demand. The number of inhabitants is chosen as a proxy for the number of potential consumers and, consequently, of future sales. Within attractive markets more competition is likely.[20] Hence we expect a negative relation between price level (P) and population (N).

(d) *Volume of consumption per capita* (CV/N)

This quantity indicates the extent to which a market is developed. An increase in quantity demanded by a consumer, generally implies that the composition of the consumption outlays becomes more differentiated: in general the need for necessities (i.e. essential drugs) tends to be satisfied first before one passes on to the purchase of luxuries (e.g. tranquilizers), which are of more interest to the pharmaceutical industry. Based on the premise that a well-developed market attracts more firms and thus shows more competition, a negative relation between price level (P) and average level of consumption (CV/N) is expected.

(e) *Patent protection* (PP)

Patents are an important way to strengthen market power: the producer of a patented drug is more or less safeguarded against both indigenous and foreign competition and certainly will take advantage of the resulting monopolistic power by commending a higher price. Hence a positive relation is expected between price level (P) and strong patent protection ($PP = 1$, here defined as recognition of product patents).[21]

(f) *Indirect price control* (IPC)

Patent protection is limited to the legal duration of the patent, but its effect can be extended if brand loyalty is built up during the patent period. Statman (1981) concluded for the United States that "generic and brand name competitors were not successful in capturing a significant market share from the original (patented) brand."[22] Reducing the use of trademarks in favor of generics may thus lower barriers to entry and stimulate price competition.

Price competition is also stimulated by the establishment of a centralized import policy, which offers a country the possibility to ransack the market by tenders for the cheapest supplies of sufficient quality. Thus a negative relation between price level (P) and government policies that stimulate price competition ($IPC = 1$) is expected.

(g) *Direct price control* (DPC)

Finally, government policies aiming to set maximum prices for either pharmaceuticals or raw materials are expected to lower the general price level in the drug industry. Consequently, a negative relationship between price level (P) and direct price control policies ($DPC = 1$) is expected.

Summarizing, the following three linear equations are estimated (ordinary least squares):

$$P = P\,(GDP/N,\ CV/N,\ PP,\ DPC,\ IPC) \quad (1)$$

$$P = P\,(GDP/N,\ CV/N,\ CV,\ PP,\ DPC,\ IPC) \quad (2)$$

$$P = P\,(GDP/N,\ CV/N,\ N,\ PP,\ DPC,\ IPC). \quad (3)$$

With *a priori* expected signs:

$$dP/d(GDP/N) > 0,\ dP/dCV < 0,\ dP/dN < 0,$$

$$dP/d(CV/N) < 0,\ dP/dPP > 0,\ dP/dIPC < 0,$$

$$dP/dDPC < 0.$$

Data sources are to be found in Table 2.

5. RESULTS OF THE CROSS-COUNTRY STUDY ON PRICE LEVELS OF PHARMACEUTICALS

The empirical results are reported in Table 3. The coefficients of determination, all above 0.80, indicate a firm relationship between dependent and explanatory variables. The signs of the estimated regression coefficients in each of the three equations conform to our predictions. In the discussion of the regression results we will concentrate on the first equation.

(a) *GDP per capita* (GDP/N)

The estimated coefficient of per capita GDP is highly significant (at 1% level) indicating a positive relationship between the price level of drugs in a country and the purchasing-power of the population. A 10% increase of purchasing-power is associated with about 8% higher drug prices on average. This result implies that the pharmaceutical industry is successfully creaming off the international consumer surplus and thus supports the widely held view that the pharmaceutical world market is highly oligopolistic.

(b) *Volume of consumption* (CV)

The fact that the total volume of consumed drugs in a country (*CV*) (added in the second equation), which stands for the actual market size, has hardly any significant effect on the price level, suggests that economies of scale in the pharmaceutical market (mainly concerning marketing and R&D) only serve as a barrier to entry.

(c) *Population* (N)

The complete insignificance of the coefficients of the population index (*N*) in equation (3) implies that the potential size of the market, for which *N* serves as proxy, exercises no influence on the general pricing behavior of the pharmaceutical industry.

(d) *Volume of consumption per capita* (CV/N)

The per capita consumed quantity of drugs seems to be of ample significance for the determination of the price level of pharmaceuticals, thereby suggesting that a well-developed pharmaceutical market attracts more price competition.[23] However, the effect of an increase in the per capita drug consumption (*CV/N*) is quite moderate (a 10% increase is associated with only about a 3% fall in drug prices), which is consistent with the assertion that competition in the pharmaceutical industry does not play a major role in the determination of prices and occurs mainly through innovation and product differentiation.

(e) *Government policies* (DPC, IPC, PP)

Of the considered government policies direct price control (*DPC*) seems to be most successful in lowering the price level of pharmaceuticals.

Table 3. *Results of the OLS estimation of several price equations for pharmaceuticals based on cross-section data of 32 countries for the year* 1975

Eq.	Estimated regression coefficients and *t*-ratios (in parentheses) for several explanatory variables* and a constant term (*C*)									
	GDP/N	*CV/N*	*CV*	*N*	*PP*	*DPC*	*IPC*	*C*	R^2	$\bar{R}^2$†
(1)	1.43‡	−0.60§			7.08	−15.72§	−11.12	38.53‡	0.81	0.78
	(6.69)	(−2.68)			(1.16)	(−2.30)	(−1.50)	(6.04)		
(2)	1.41‡	−0.49	−0.20		7.19	−17.90§	−8.67	37.93‡	0.82	0.77
	(6.48)	(−1.91)	(−0.68)		(1.17)	(−2.44)	(−1.08)	(5.89)		
(3)	1.43‡	−0.60§		−0.001	7.07	−15.70§	−11.12	38.56‡	0.81	0.77
	(6.50)	(−2.61)		(−0.01)	(1.12)	(−2.22)	(−1.46)	(5.61)		

*See Table 2 for the meaning of the used symbols.
†$\bar{R}^2$ is the adjusted R^2, corrected for degrees of freedom, which is often preferred above the R^2, because, contrary to the latter, it penalizes the inclusion of variables which explain very little (i.e. when the *t*-ratio < 1).
‡Denotes significant *t* test at 1% level.
§Denotes significant *t* test at 5% level.

Implementation of direct price control measures implies, on average, a more than 20% decrease in drug prices. Although the other two government policies — indirect price control measures (*IPC*) and excluding pharmaceutical products from patent protection (*PP*) — also appear to influence the price level of drugs in a downward direction (by about 15 and 10%, respectively), their effect is less convincing because of the rather low significance of their estimated coefficients. This may be partly due to the fact that dummy variables are a very crude measure of the government policies considered, because the "all-or-nothing approach" of a dummy variable implies an unavoidable simplification of reality in which usually a broad range of measures within a policy can be discerned. In the case of patent protection, for example, not only the exclusion from patentability of pharmaceutical products may be of importance for determining the price level of drugs, but also the exclusion from patent protection of pharmaceutical production processes (although considerably weaker patents), the duration of the granted patent protection and the possibilities to evade the patent law. However, the modest effect of excluding patent protection on the price level of pharmaceuticals, as seen before, supports Chudnovsky's expectation, when he argues:

> although the subject deserves more empirical research it would appear that the lack of patent protection or weak patent protection has not seriously affected the mode of operation of TNCs in developing countries. Patents are an important instrument to reinforce the market power of leading firms — but they are not the sole or main source of that power.[24]

Chudnovsky therefore considers a mere change in patent legislation insufficient to modify the structure of the pharmaceutical industry in developing countries or to reduce the prices of pharmaceutical products and imports.[25] Instead he suggests that a combined policy of excluding patent protection and promoting the use of generics (or reducing the legal protection of trademarks) will be more successful in reducing the price level of drugs.[26] Unfortunately, however, policies on patents and trademarks have not yet been applied together, so there exists no concrete evidence to evaluate this hypothesis. Nevertheless, the supposition is supported by Patel (1983) who estimated up to 60% potential savings in total drugs expenditures through the implementation of a combination of five policy options.[27] Indeed, Sri Lanka has proved that a comprehensive drug policy can lower price level of drugs dramatically. During the period 1972–76 Sri Lanka reformed the structure of production, importation and distribution of pharmaceuticals. The introduction of a system of centralized purchasing of imports of finished drugs and intermediate chemicals (to avoid transfer pricing) by competitive tender through the State Pharmaceutical Corporation (SPC) achieved a 40% overall saving in just one year (some TNCs — Hoechst and Beecham — reduced their prices by 50–70% from one year to the next).[28] This centralized import policy in combination with other policy measures was responsible for the fact that Sri Lanka had by far the lowest price level of drugs in 1975 amongst the 32 countries under discussion (Table 2).

6. DISCUSSION

The sensitivity of the price level of pharmaceuticals with respect to the purchasing-power of the population and the implementation of a national drug policy, strongly supports the assertion that international price discrimination is a common feature of the pharmaceutical world market. Of course, international price discrimination often results in lower prices for poorer countries, because of their lack of sufficient purchasing-power. However, the fact that drug prices vary arbitrarily, depending on the existence and degree of success of a national drug policy,[29] implies much higher prices than necessary for many poor countries with little or no possibilities to establish a successful drug policy. Although the drug prices in developing countries are often lower than in developed countries, the real costs of these products, relative to the purchasing-power of the population, are considerably higher (the real costs of drugs in Malawi are more than 12 times higher than in the United States and even Sri Lanka experiences about 60% higher real costs). Moreover, 40% of the total health care expenditures in developing countries consists of pharmaceuticals, compared with only about 8% in developed countries,[30] thereby putting a relatively severe constraint on other vital health care needs. Hence a fair price in relation to the production costs is of extreme importance to developing countries or, as UNIDO (1978) states:

> The objective of developing countries should be to set the lowest possible prices for the desired number of drugs consistent with the encouragement of production and relevant research. This objective cannot be achieved with a free market, which allows too many drugs to be sold, with enormous price variations on identical products (and so a large rent accruing to more heavily promoted, brand-named or patent-protected products), profits often in

> excess of a reasonable return, wasteful promotional spending and a confusion of proper information flows to prescribers.[31]

7. CONCLUDING REMARKS

Our empirical research, based on the data of the International Comparison Project (ICP), provides evidence for the existence of considerable price discrimination in the pharmaceutical world market. Drug prices seem to be highly influenced by the purchasing-power of a country — a 10% increase in per capita GDP being associated with on average 8% higher prices — and by the implementation of a successful national drug policy (e.g. direct price control measures taken by the government result on average in a 20% price reduction). This perceived price discrimination implies a severe burden to poor countries with little institutional and market power.

The method used to explain the price level of drugs, which is based on aggregated data, means, of course, a simplification of the complex nature of the pharmaceutical world market. Hence the results of our study should be interpreted with caution.

Bearing this reservation in mind, the established price discrimination points out to developing countries the need for a rational drug policy, especially when future trends in drug consumption are concerned:

> Total pharmaceutical expenditure by developing countries increases by almost four times, from 1981 to the year 2000. It increases from US$19 billion, in 1981, to over US$71 billion in the year 2000 (in 1981 prices). This is both a high level of expenditure, and a massive increase to occur over such a short span of historical time. Expenditures on this sector will, therefore, continue to place severe constraints on the development of other vitally needed health services.[32]

Our findings support the idea that the application of price control policies, especially those which directly regulate the price level of drugs, possibly in combination with an exclusion of (some) drugs from patent protection, might be successful to reverse this trend. Of course price reduction is only one side of the coin. For a successful containment of pharmaceutical expenditures a more rational purchase of drugs is also imperative. In 1982, 5 years after the WHO produced the first model list of essential drugs,[33] 70 countries already had restricted lists of essential drugs based on local needs.[34] Many of these lists, however, represent little more than policy goals and are all intended to apply only to the public sector (with the exceptions of Sri Lanka, Mozambique, Afghanistan and Bangladesh which have also taken measures to restrict the private market to a selection of essential drugs). Drug policies for developing countries should focus on the provision of essential drugs at reasonable prices, but, according to Melrose (1983):

> Their adoption depends on the political will of Third World governments to put the health needs of the majority before the commercial interests of a minority (and) on active support from governments of the major drug-producing nations and a readiness amongst manufacturers to adopt more farsighted marketing policies.[35]

NOTES

1. So far, the only comprehensive empirical research into differences in pharmaceutical prices between countries, has been carried out by the BEUC (Bureau Européen des Unions de Consommateurs). The BEUC Report (1984) compares the price level of drugs between seven EC-countries (i.e. Belgium, Federal Republic of Germany, France, Ireland, Italy, the Netherlands and the United Kingdom). In order to do so, the BEUC selected 84 drugs, together representing at least 20% of the pharmaceutical sales value in each country. The BEUC Report established huge price discrepancies, even within such a relatively homogeneous group of economically cooperating countries. For less than 20% of the 84 considered drugs the difference between the lowest and highest price is less than 100%. The general price level of drugs is about two times as high in the most expensive country (Germany) as compared to the cheapest country (France). See BEUC (1984, pp. 309–325).

2. Feldstein (1983), p. 449.

3. Mote *et al.* (1972), p. 1369.

4. Lall (1974), pp. 150–151.

5. Muller (1982), p. 88.

6. The comparison might further be complicated by the fact that usually three parties are involved in the pricing of a drug: the manufacturer, the wholesaler and the chemist. However, the BEUC Report concludes that the different margins for wholesaler and chemist in each country are of minor importance in explaining the perceived price discrepancies between countries (BEUC, 1984, pp. 316–320, 344).

7. Comparing manufacturer's prices of eight leading multinational pharmaceutical firms between Europe,

the United States and Japan, Reekie (1983, p. 176) remarks that "the simple purchasing-power of money in its domestic environment does not necessarily explain its foreign exchange value." He tries to overcome this problem by examining the prices in terms of minutes of work required to purchase the products. Whether this method reflects the relative purchasing-power of the population rather than only that of the workers in the pharmaceutical industry seems dubious, especially in the case of developing countries.

8. Barnett *et al.* (1980), p. 481.

9. Reekie shows how sensitive international price comparisons are to exchange rate fluctuations by comparing the same domestic drug prices converted at the ruling exchange rates in 1980 and 1981. The appreciation of the yen and the depreciation of the European currencies (except the pound sterling) against the US dollar causes an increase in the pharmaceutical price level of Japan relative to that of Europe of nearly 35%, when prices are measured in US dollars (Reekie, 1983, pp. 179–180).

Exchange rate movements will probably be of minor influence on the results of the BEUC Report because of the European Monetary System (of the considered countries only the United Kingdom did not participate in the EMS).

10. Kravis *et al.* (1982). The 1982 volume reports on phase III of the ICP, covering data collected from 34 countries for the year 1975. (In phase I of the ICP 10 countries were considered, which were extended to 16 in phase II.)

11. Starting with data on prices p_{ij} in domestic currency units and quantities q_{ij} for a list of products i and countries j, the procedure involves solving a system of equations for an international price X_i for each product and simultaneously a purchasing power parity PPP_j for each country's currency. PPP_j equals the ratio of the cost of country j's total bill of goods at national prices to the cost at international prices and X_i is a quantity weighted sum of purchasing power adjusted prices.

12. Two ICP countries, Romania and Syria, were left out because of insufficient data concerning several explanatory variables.

13. Kravis (1984), p. 12.

14. The BEUC Report (1984) tried to solve the problem of absent prices in a different (less satisfactory) way. The sum of the prices (in ECU) of the available drugs in the considered country is compared with the sum of the average prices of the same drugs in all countries. The price of the absent drug in the considered country is then obtained by assuming that it is equal to the average price level of that drug in the other countries corrected for the deviation between the two price totals.

15. See e.g. Marris (1984).

16. Theil (1983), p. 515.

17. Melrose (1982), p. 48.

18. Using exchange rates tends to overstate the poverty of poor nations because of the fact that services, which are cheaper relative to commodities in other countries, are modestly represented in international trade and hence in exchange rate. Besides, as mentioned before, the volatility of many exchange rates makes them unsuitable as conversion factors.

For 1975, one of the most sensitive comparisons among the 34 sampled countries is between the per capita GDPs for Denmark and India: by the ICP measure Denmark's per capita GDP is about 12 times higher than India's, whereas Denmark's exchange rate converted per capita GDP was more than 50 times as high as that of India.

19. Lall (1974), pp. 146–147.

20. Muller (1982), p. 87: "Indeed, the first impression in many countries, especially those, which by virtue of their population or wealth are regarded as important future markets, is one of chaotic excess of competition."

21. Since established production processes are easily to be circumvented in the drug industry, process patents (which only protect the process of production) are inferior to product patents, which protect the formulation of the drug.

22. Statman (1981), p. 145.

23. This straightforward interpretation however must be considered with some caution because of the rather high collinearity between *CV/N* and *GDP/N*. The R^2 between *CV/N* and *GDP/N* varies between 0.67 and 0.75 for the three concerned equations. For the rest, the collinearity among the regressors is very low, the R^2 being in all cases below 0.20.

24. Chudnovsky (1983), p. 190.

25. This view is shared by several other authors, see for instance: Lall (1974), pp. 159–160.

26. Chudnovsky (1983), p. 193.

27. Patel (1983), pp. 195–204.

28. Lall *et al.* (1977).

29. Their empirical analyses led the BEUC as well as Reekie to similar conclusions. The first carefully stated that "it is more than clear that absent or minor price control by the government certainly does not lead to the provision of the cheapest drugs" (BEUC, 1984, p. 345); whereas the latter argues that the consistently higher drug prices in Japan seem to be the result of the fact "that price controls are in many countries strict and rigid except in Japan" (Reekie, 1983, p. 180).

30. Patel (1983), p. 196, Table 1.
31. UNIDO (1978), p. 23.
32. Patel (1983), p. 200.
33. WHO (1977).
34. WHO (1982), p. 30.
35. Melrose (1983), p. 185.

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