Market Organization and Pricing Behaviour of Oligopolistic Firms in tne Ethical Drug Industry

MARKET ORGANIZATION AND PRICING BEHAVIOUR OF OLIGOPOLISTIC FIRMS IN THE ETHICAL DRUGS INDUSTRY

AN ESSAY IN THE MEASUREMENT OF EFFECTIVE COMPETITION

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I. THE GERMAN PHARMACEUTICALS' MARKET

1. Market Organization

The organization of the German pharmaceuticals' market is illustrated in *Figure 1*. *Figure 1* shows the major sectors of the pharmaceutical market. The importance of the public health insurance system is clearly evident from the fact that 90.6% of the German population is covered by this system which provides pharmaceuticals to the patient free of charge.

Roughly 88 per cent of the total sales in prescription drugs is made in specialties. Specialties are defined as products with an unchanging content and with a specific name. The producers offer them in packages ready for sale to the patient.

In 1974 24,063 specialties were registered with the Federal Health Commission. This number reduces to about 15,000 if different presentations of the same drug are left out of account. The discrepancy between this great number and the number of products with which a doctor is familiar and which form the range of products from which he prescribes is remarkable. General practitioners are believed to

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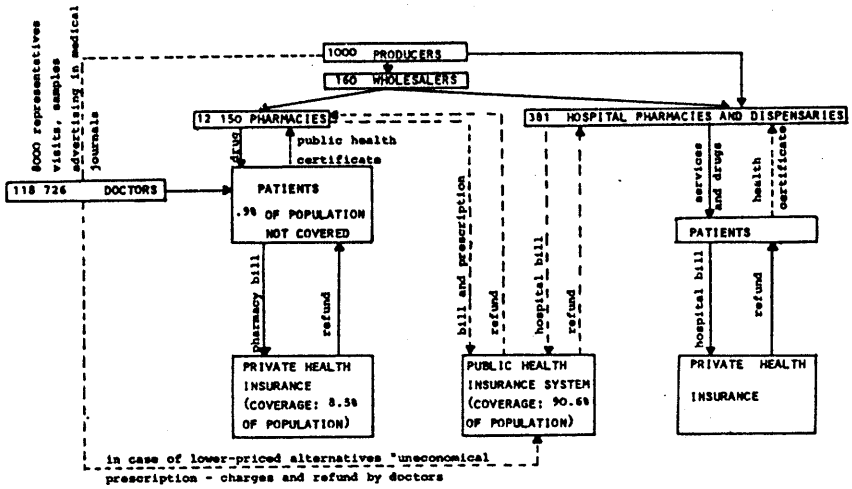
Figure 1

Organization of Market for Pharmaceutical Products in Germany[a]



[a] Figures are for 1973 in general. Source: G. D. FRERICHS, 'Zur Neuordnung des Arzneimittelrechts und des Arzneimittelmarktes', Pharmadialog 34, Dec. 1974; figures for number of doctors are for 1975; Source: 'Statistisches Jahrbuch der Bundesrepublik Deutschland 1977'.

prescribe no more than 100, specialists up to 150 different drugs[1]. Other sources have found, however, that there is no significant difference between general practitioners and internists in their command of drugs. Recent surveys show that they prescribe from a range of over 400 drugs. Others specify a range of 300–500 pharmaceuticals from which prescriptions are made regularly[2].

2. *Market Information*

Doctors have many sources of information on drugs and their prices. KAUFER reviews several empirical studies of sources of information carried out in the United States[3]. Similar studies have not been

1. W. BRAUN, 'Der Arzneimittelmarkt in der BRD', *Beiträge des deutschen Industrieinstituts,* 10 (1972), Nr. 8/9, S. 46.

2. Bundesverband der Pharmazeutischen Industrie, Pharma-Daten 77, S. 36.

3. E. KAUFER, *Die Ökonomik der pharmazeutischen Industrie,* Baden-Baden 1976, S. 16 *et seq.*

carried out in Germany, but from the sketchy evidence available one can fairly conclude that there are several major sources of information:

- information made available by the producers,
- the 'Rote Liste',
- the 'Die Liste-Pharmaindex',
- the Medical Press,
- circulars distributed regularly by the Federal Chamber of Doctors (Bundesärztekammer),
- the 'Moebius-Liste' with price comparisons, a publication started very recently,
- correspondence with the public health insurance system (Sickness Funds).

The information provided by the producers comes in the form of advertising in the professional journals, of correspondence with the producers and, most significantly in the form of visits by the medical representatives of the producers. The total number of representatives in Germany is estimated at 8,000.

The 'Rote Liste' is an annual publication which contains a classification of specialty drugs on the German market, classified by therapeutic action. The 'Rote Liste' 1976 lists 8,060 preparations produced by 464 firms which are members of the Bundesverband der Pharmazeutischen Industrie. A comparison of the prices of different branded products has been simplified by a reorganization of the 'Rote Liste'. It no longer shows products in alphabetical order as it used to but lists together all branded products in the same field.

The Sickness Funds have brought increasing pressure to bear upon doctors to prescribe cheaper products. The pressure is exerted by writing to doctors and informing them that they could have saved certain amounts if they had prescribed a cheaper product and, in cases, even holding them liable to reimburse the Sickness Funds out of their own pockets.

Two opposing views of price information on the pharmaceuticals' markets are being offered in discussions:

- On the one hand doctors are considered to be only partially informed about existing drugs and their therapeutic value. This

information is, according to this view, heavily biased in favor of branded products. Doctors are at the same time considered to be ignorant about prices of pharmaceuticals.

- On the other hand doctors are seen to be well informed not only about the pharmaceuticals available on the market for a particular indication but also about prices of ethical drugs. However, they relate therapeutical value to price when making their informed judgements in the prescribing process.

Differences among prices for drugs prescribed for the same indication are according to the first view attributed to the ignorance of the doctors which prevents price competition. According to the second view price differences do not contradict the full information hypothesis: Price differences are an indication of differing therapeutic value of different products. Competition brings about identical price per unit of therapeutic value-ratios rather than identical prices per unit weight or per daily dose.

The first view implies the hypothesis that price elasticity of demand is zero. The second view implies that demand for pharmaceuticals is price elastic and influenced by the prices of competing drugs.

The policy recommendations emanating from these differing views of the information processes on the pharmaceuticals' markets may be summarized as follows:

- If the first view is correct, then clearly a system of centralization of market information and in particular of price information combined with centrally directed price comparisons should be brought into effect.
- If the second view holds, then evidently any attempt to centralize price information is counter-productive and a decentralized system of market information about prices is superior to any centralized system.

In the following section I report on empirical tests of price elasticities on two different markets for pharmaceuticals. These tests shed some light on the validity of the two views on market information and thus help to evaluate the advantages and disadvantages to be derived from centralization of price information.

II. PRICE COMPETITION ON DRUG MARKETS WITH DECENTRALIZED INFORMATION

1. Basic Assumptions and Hypotheses

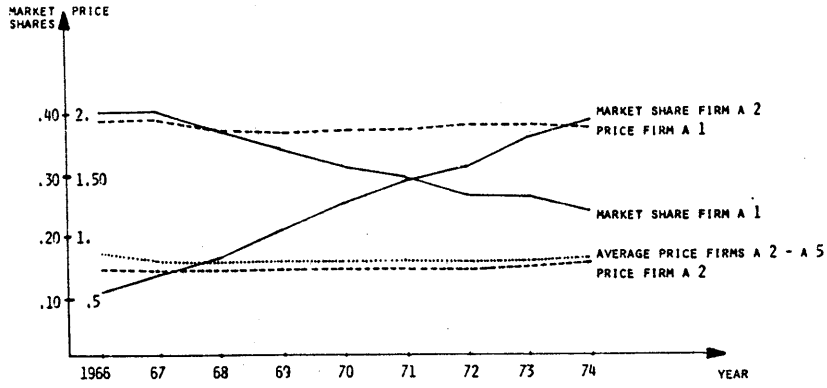
Figure 1 shows the structure of the pharmaceutical market in Germany, but it does not indicate the market process and its efficiency in providing the public with satisfactory health services at minimum cost. The first proposition advanced here is that the functioning of the competitive process on the market cannot be studied by looking at the pharmaceutical market as a whole or at classes of therapeutic action. It can only be evaluated by looking at the 'relevant markets'. It is a generally accepted definition of the relevant market for pharmaceutical prescriptions that it comprises all the products which are considered by the doctors as applicable for the same indication.

Attempts to centralize price information and price comparisons go on the assumption that price differentials are due to deficiencies in market transparence and a lack of price consciousness on the side of the doctors. Instead I advance the hypothesis that price differentials will continue to exist on a highly transparent market with great price consciousness of the doctors because doctors do not compare prices but compare price-benefit-relationships. Benefits are subjective magnitudes made up of preferences and are derived from a bundle of services, objective and subjective, provided by the drug.

A third assumption which underlies the proposals for centralized information and the enactment of one of them is that a centralized information system is more effective than the decentralized information system or, to put it more precisely, that a combined system with an official 'evidence list' and centralized price comparisons is more efficient than a combined system with a 'Rote Liste' and decentralized price comparisons. The future will tell, but I will advance the hypothesis that a decentralized system with a high rate of newcomers on the market is more effective. Attempts to tear down administrative barriers between the different national markets and to facilitate entry of foreign drugs on the national markets would therefore seem more advisable than further attempts at centralization.

Figure 2

Development of Market for Product *A*



In the following two subsections two examples of pharmaceutical markets will be presented. The first example relates to a stagnant market for drugs without patent coverage. The rate of entry on this market was nil. The second example presents an expanding market for drugs with only partial patent coverage for only part of the period under investigation. The rate of entry on this market was significant.

2. Polypolistic Competition on a Stagnant Market

The market for product *A* is a stagnant market for a prescription-free drug. Patents have long expired. 10 producers offer their products with identical substances on the market. The top 5 producers held market shares – measured on the basis of quantities sold – of 82.6 per cent in 1966 and of 88.6 per cent in 1974. Time series were available for prices and quantities sold for these five producers for the years of 1966 through 1974.

Figure 2 presents information on the development of the market during the period under consideration. Prices remained fairly stable. Firm *A* 1 demanded a price which was significantly above the prices of its competitors. It accepted a loss in market share. Its major competitor, firm *A* 2, demanded a price which was significantly lower

and as a result experienced a remarkable increase in its market share. Other competitors, however, who demanded prices only marginally higher than those of firm *A* 2, suffered losses in market share.

The test of market interdependence was performed on the basis of the theory of polypolistic price competition. The demand for product *A* 1 was assumed to be influenced by the relationship of price *A* 1 and the average market price on the rest of the market. In addition it was assumed that demand was influenced by imitation, which, however, was assumed to be subject to obsolescence[4].

The estimation equations for product *A* 1 are as follows

$$x_t = a_0 + a_1 \alpha^{t-1} x_{t-1} - a_2 (p_t/\bar{p}_t) \tag{1}$$

$$x_t = b_0 + b_1 \alpha^{t-1} x_{t-1} - b_2 \sinh b_3 (p_t/\bar{p}_t) \tag{2}$$

where

x_t stands for sales volume *A* 1,

p_t for market price *A* 1, and

$\bar{p}_t$ for average price on the rest of the market.

While the first hypothesis assumes a linear demand curve of the individual firm (KRELLE-type demand function for heterogeneous polypolistic competition), the second hypothesis is based on the theory of a double-kinky demand curve (GUTENBERG-type demand function for heterogeneous polypolistic competition).

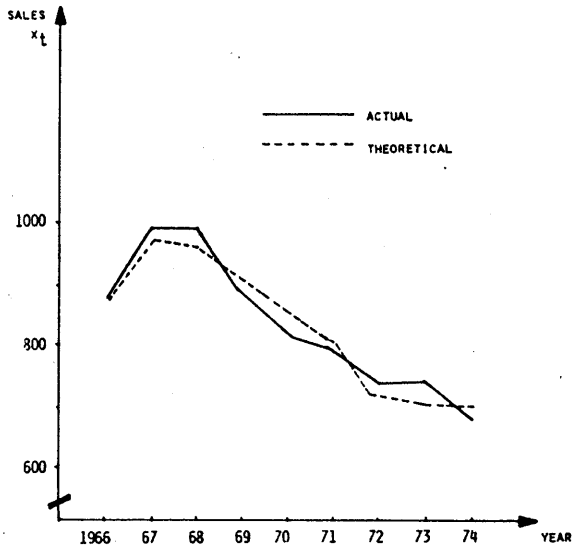
The numerical results of the estimation procedure for the parameters in (1) and (2) are of no interest in this context. The measures of statistical fit do not differ substantially between (1) and (2). *Figure 3* shows the development of actual volume of sales and theoretical volume for firm *A* 1.

The intensity of competition on the market for product *A* can be measured by the price elasticities between the drugs offered on the market. *Figure 4* shows the direct price elasticity of product *A* 1 which measures the relative change in sales volume effected by a relative change in prices as well as the cross-price-elasticity which

4. See H. SIMON, *Preisstrategien für neue Produkte,* Opladen 1976, S. 129.

Figure 3

Sales Volume Firm *A* 1, *Equation* (2)

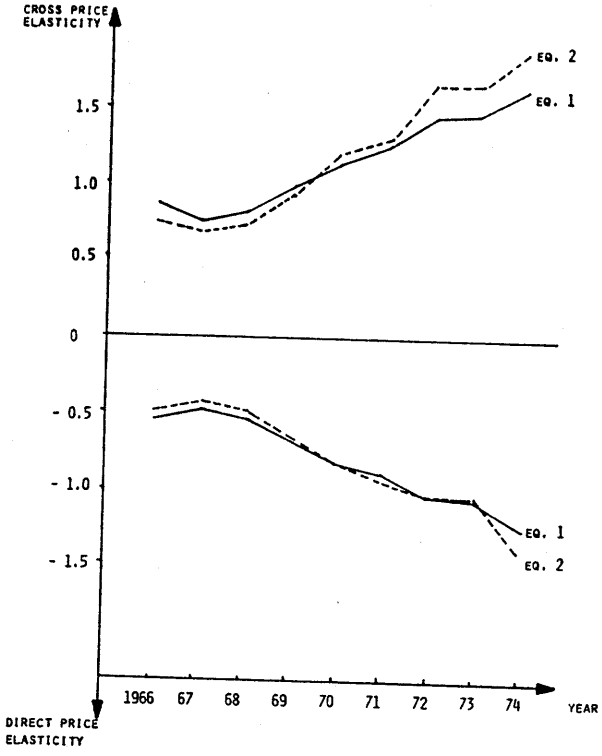


shows the relative change in sales volume for product *A* 1 induced by a relative change in the average price of its competitors.

As a result we note that despite the fact that prices remained fairly stable over the years, the intensity of competition increased. The shifts in demand between different suppliers have to be attributed to the marked differences in prices. Whether the shifts in demand should have been more dramatic and whether the losses in market share should have been so severe and so fast as to make it more profitable for firm *A* 1 to reduce its prices than to accept losses in sales volume is an open question. If it is answered in the affirmative it is still an open question whether these changes can be brought about by a centralization of price comparisons. It goes without saying that price differentials of the magnitude shown here cannot go unnoticed by doctors. But, as one hospital pharmacist put it: 'I am willing to accept significant price differentials if this keeps me in contact with research-based company *A* 1. The value of an enduring business relationship with this firm is significantly

Figure 4

Development of Price Elasticities for Product *A*



higher than the potential savings from shifting to another supplier – particularly in view of the small amounts of product *A* we need.'

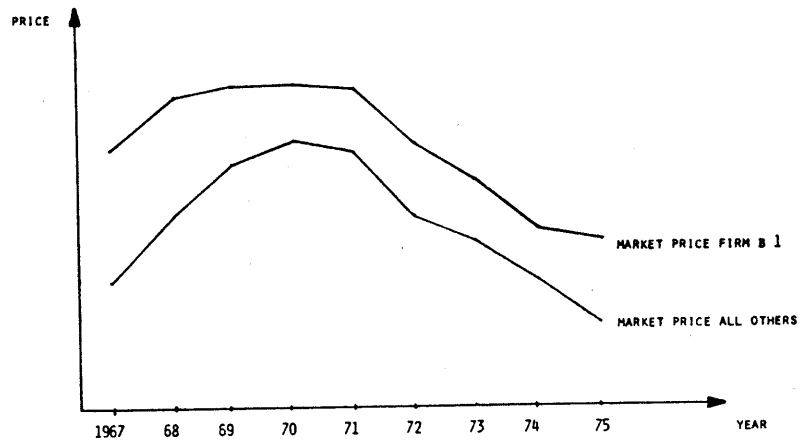
3. Polypolistic Competition on an Expanding Market

3.1 The Case

The second example is that of product *B*. Product *B* is sold in an expanding market. The investigation covers the period from 1967 through 1975. The average annual growth rate was slightly below 100 per cent, with higher rates in the earlier years of the period.

Figure 5

Development of Prices for Product *B*



One of the products was covered by a patent for a substance which, however, had to compete against another substance applicable for the same indication. The patent was rendered economically ineffective in 1970 and expired in 1974. The number of products sold on the market increased from 3 in 1967 to 17 in 1975. The increase was slow in the years from 1967 to 1971. By then the market had reached a total sales volume which was attractive to new suppliers of the drug. It was then that the number of entries of new products increased rapidly. The supply push increased to the extent that sales per patient have continued to decline ever since 1972. Patients per product, however, continued to increase until 1974 when the additional products launched on the market brought the growth in the number of patients per product to a standstill.

Figure 5 shows that prices for product *B* increased from 1967 to 1971 and declined in later years. While price movements of product *B* 1 and of all the other products followed a similar pattern, prices for product *B* 1 were significantly above the average price of all other products during the whole period. Here again the question is raised whether centrally administered price comparisons could have contributed to narrow the gap.

3.2 Price Elasticities

In answering the question we follow the same line of reasoning as in the example of product *A*. We computed price elasticities to measure the intensity of competition on market *B*.

The estimation is based on the theory of heterogeneous polypolistic competition. However two models are presented which are slightly different from the model estimated for product *A*:

- single equation estimation for disaggregated price interdependence,
- simultaneous equations estimation for aggregate market interdependence.

3.2.1 Single Equation Estimation

It seems plausible to assume that the prescribing habits are different for different product groups applicable for the same indication. Therefore the prices of the competing products are not combined in an overall average market price. Equation (3) formulates the hypothesis for the single equation estimation approach.

$$\begin{aligned} x_t^{B1} = {} & c_0 + c_1 \alpha^{t-1} x_{t-1}^{B1} - c_2 p_t^{B1} \\ & + c_3 \sinh \{c_6 (\bar{p}_t^{B2} - p_t^{B1})\} \\ & + c_7 \sinh \{c_6 (\bar{p}_t^{B3} - p_t^{B1})\} \\ & + c_5 \sinh \{c_6 (\bar{p}_t^{B4} - p_t^{B1})\} \end{aligned} \tag{3}$$

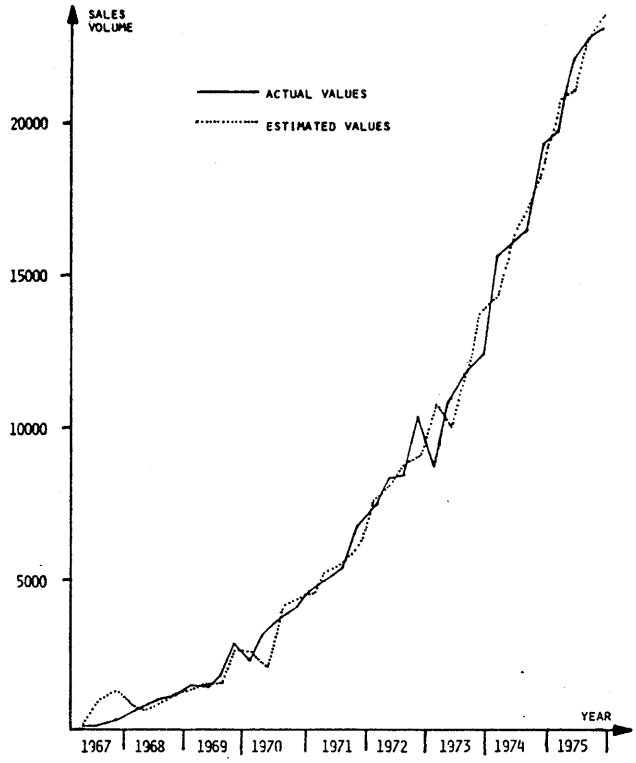
B 1 is a particular product which belongs to the group of products with the index *B* 3. *B* 3 is the group of branded products of a particular substance. *B* 4 is the group of generic products of the same substance. *B* 2 denotes the group of branded products of a different substance competing on the same market.

Figure 6 shows the statistical fit between actual and theoretical values for the sales volume of product *B* 1. The indicators of statistical acceptability are very satisfactory.

The results of the statistical estimation of equation (3) indicate that price differentials exert a significant influence on the demand for product *B* 1.

Figure 6

Sales Volume of Product *B* 1, *Equation* (3)



3.2.2 Simultaneous Equations Estimation

In order to cast more light on the competitive process it was attempted to explain the behaviour of the demand side as well as the pricing decisions on the supply side by a system of demand and supply equations. The hypotheses tested are given in equations (4) through (7) in general form.

The demand equations are

$$x_t^{Bj} = a_{0j} + a_{1j}\,\alpha^t\,x_{t-1}^{Bj} - a_{2j}\,p_t^{Bj} + a_{3j}\sinh\{a_{4j}\,(\bar{p}_t - p_t^{Bj})\} \qquad (4)$$
$$j = 1, 2, 3, 4$$

Demand therefore depends on the demand for the same product (product group) in the previous quarter, on the current price charged for the product, and on the difference between the prices charged for the product and the average market price for all the drugs in the market. In (4) we go back to the hypotheses of equations (1) and (2) in the previous example and assume that the market price which governs demand in the polypolistic market is the average price over all the competing products and not the average price of different product groups taken separately.

The supply equations are ($j = 1, 2, 3, 4$)

$$p_t^{Bj} = b_{0j} + b_{1j}\bar{p}_t + b_{2j}x_t^{Bj} - b_{3j}x_t^T \tag{5}$$

The system of supply equations follows basically the traditional assumptions about the supply curve. Supply rises with the price accepted by the market. It is the market supply curve which governs the systematic component of individual supply to the market. The individual supplier increases his supply above this systematic component if a positive price differential over the average price level is accepted by the market.

Two definition equations complete the system[5]

$$\bar{p}_t = \sum_j p_t^{Bj} x_t^{Bj} / \sum_j x_t^{Bj} \tag{6}$$

$$x_t^T = \sum_j x_t^{Bj} \tag{7}$$

The system (4) through (7) was estimated by the two-stage least squares method. The numerical results for the parameters are not interesting here. All the signs in the demand and supply equations are as expected. The statistical fit of the theoretical curve to the actual figures is satisfactory by all standards. *Figures 7* and *8* show the development of actual and theoretical sales and prices for product *B* 1 and for the generic products *B* 4.

Various measures of price elasticities were derived from the numerical system of supply and demand functions. They are presented

5. In fact the summation procedure in (6) and (7) goes over the individual products rather than over the product groups.

Figure 7

Product *B* 1: Sales and Prices

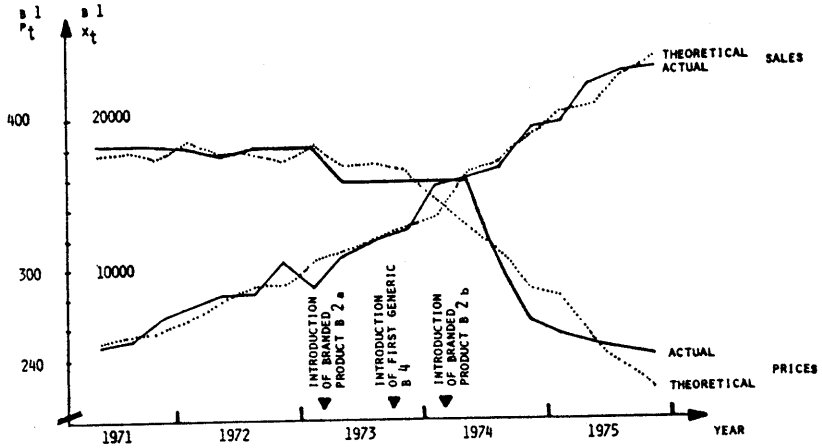
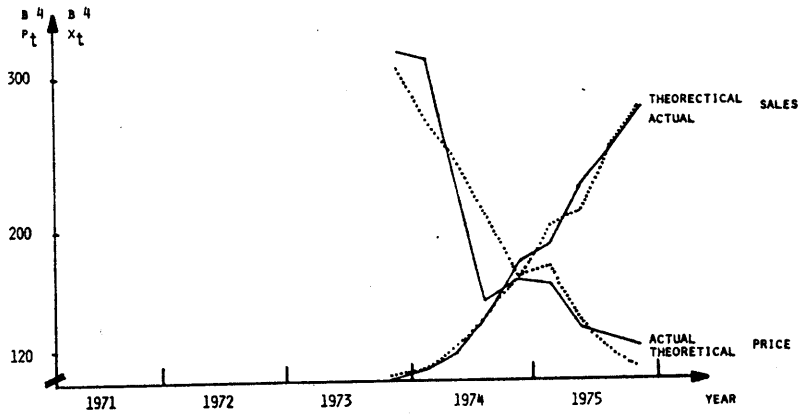


Figure 8

Product *B* 4: Sales and Prices



graphically in *Figures 9* and *10*. The figures show total cross-price-elasticity of product *B* 1 with respect to a one per cent change in the average price of all the competing products. The partial cross price elasticities measure the relative change in the demand for product

Figure 9

Price Elasticities and Cross Price Elasticities

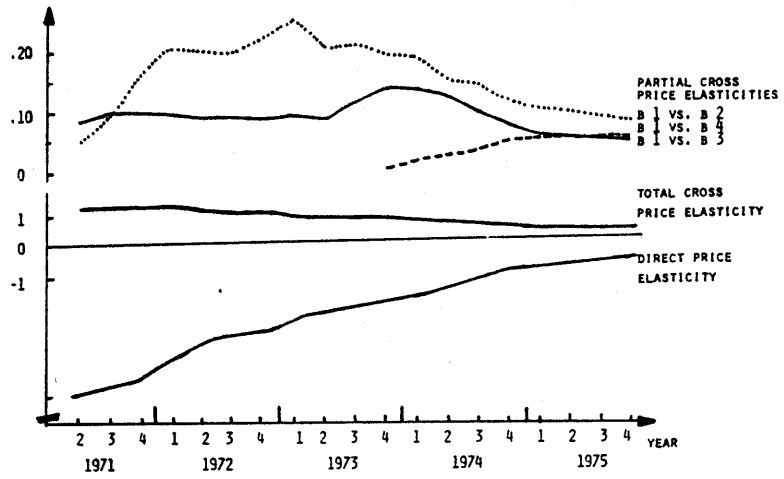
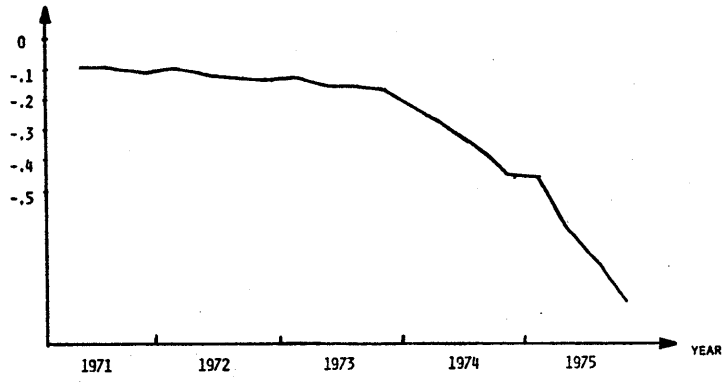


Figure 10

Elasticity of Price *B* 1 with Respect to the Supply of all Competitors



B 1 as a result of a one per cent change in the prices of one of the groups of products *B* 2, *B* 3 or *B* 4. Direct price elasticity is defined as above. *Figure 10* shows the elasticity of the supply function which measures the relative change in the supply price of product *B* 1

which is brought about by a one per cent change in the quantity of supply of competing products. It thus measures how firm B 1 reacted with its price parameter to a change in the availability of competing products on the market.

Price elasticities estimated indicate significant competitive forces at work on market B. The changes in the development of the price elasticities point to periods when new products entered the market. New entries seem to be instrumental in the increase of the partial cross-price-elasticities.

III. CONCLUSION

The results obtained from the empirical study of pricing behaviour on the market of the two drugs under investigation run counter to the widely held belief that price elasticity on this market is practically nil. The mere fact that an opinion cannot claim to be shared by the majority should not rule it out as less convincing. On the contrary, the empirical findings should draw attention to the shaky foundations of bias and prejudice on which the commonly held belief of price-inelastic demand for ethical drugs rests.

The findings of a pronounced market interdependence of pharmaceutical firms and of significant price sensitivity may be interpreted within the framework of the theory of heterogeneous competition on imperfect polypolistic markets. It seems economically plausible that price elasticity should be higher on a stagnating market where additional sales can only be made at the expense of the competitors than on an expanding market where gains in volume achieved by one competitor do not necessarily prevent growth in sales by any of the other suppliers. It seems convincing, however, that even on an expanding market newcomers on the market bring about an increase in the price-elasticity of demand and significantly higher intensity of competition.

Therefore I venture to conclude that it is unfair to doctors to charge them with ignorance of prices. Price differentials between pharmaceutical products are not due to price ignorance. They would prevail even if one assumed perfect market and price information. Price consciousness on the side of the doctors is compatible with

differing prices because of consciousness of differences in therapeutical value. If this conclusion is true, attempts at centralization of market information and at providing price comparisons by a centralized agency will not bring about the desired result of uniform pricing.

In the light of the findings presented here it seems unwise to push the market towards uniform pricing by centralization of market information and by the inevitably following central control of prices for ethical drugs. It seems more reasonable to reorganize the pharmaceutical market in Germany with an emphasis on increased financial responsibility on the side of the prescribing doctors and their patients. It seems regrettable that the attempts in this direction which were made in the 'Krankenversicherungs-Kostendämpfungsgesetz' have run into such strong opposition from industry and from the doctors.

SUMMARY

The hypothesis that doctors prescribe drugs without taking price into consideration is tested empirically and refuted. Price elasticities of competing drugs are derived from single-equation estimates and from estimates of systems of supply and demand functions. Price differences on a stagnant market, though fairly stable over time, lead to significant changes in market shares. Cross price elasticities rise. On an expanding market, however, cross price elasticities tend to decline with market entries of new prescriptions pushing them up again. The conclusion to be drawn from the empirical analysis is that price differentials are not so much due to price ignorance on the side of doctors but rather due to price consciousness in the face of heterogeneous products on polypolistic drug markets.