The Impact of Generic Competition on Brand Name Market Shares - Evidence from Micro Data*

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Abstract

This paper analyses how market shares for brand name drugs are affected by generic competition. The analysis is based on micro data for twelve different original drugs, which are all subject to generic competition. For five of these drugs, we find that the price of the original relative to the average price of the generic substitutes significantly affects the market share of the original. In addition, the introduction of a so called "reference price" system appears to have had a significant impact on the market shares of five original drugs.

Key Words: Pharmaceutical industry, patent expiration, micro data.
JEL classification: L65, I11

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1 Introduction

Throughout the industrialized world, the cost for pharmaceutical drugs raise concern. Typically, pharmaceutical costs account for a tenth of all health expenditures, or approximately 1 percent of GDP. Potentially, these costs could be reduced if government regulations could foster a more powerful competition between the original manufacturers and the manufacturers of generic substitutes. Shorter patent terms would achive this objective, but would, on the other hand, reduce the incentives to invest in the development of new drugs. However, once the patent has expired, increased competition is likely to be beneficial. In this paper we address the issue of generic competition, and, in particular, the alleged inability of generic drugs to capture significant market shares in most pharmaceutical markets, dispite large price discounts relative to the original drug. We also present some results on the effects of a new reference price system - one of the regulatory reforms that has been used in order to stimulate generic competition.

Policies designed to improve the efficiency of pharmaceutical markets have been undertaken both in the US and in Europe. The (US) Drug Competition and Patent Term Restoration Act of 1984 (also known as the Waxman-Hatch Act)[1] had two objectives: to restore the effective patent terms, which had eroded substantially over the years due to more complex and time-consuming approval procedures (Hartley et al, 1986, and Andersson and Hertzman, 1993)[2] and to increase generic competition once the patents expire. The second goal was achieved by simplifying the approval procedures for generic products. Apparently, the Act has been effective in this respect: the market share of generic drugs in the US increased from 23 percent in 1980 to 40 percent (and 13 percent of value) in 1993 (CBO 1994).

In Europe, governments have long sought to curb pharmaceutical prices through price regulation. Prices are negotiated prior to the introduction of a new drug, and price increases are typically only allowed to compensate for cost increases. Various forms of price regulations have been used in, e.g., Belgium, France, Italy, Sweden and Switzerland. Spain and the UK

[1]The history of US pharmaceutical industry regulation is provided in Comanor (1986) and Craig and Malek (1995).

[2]In the mid-1960s, mean effective patent life was 16 years, compared with a nominal patent life of 17 years. Around 1980, the mean effective patent life had shrunk to 7-9 years. (Grabowski and Vernon, 1988.)

have strived towards cost control by allocating maximum target profits to pharmaceutical firms. As long as the profit rate stays below the target profit rate, the firms are free to choose prices (Hutton *et al.*, 1994). The successes of these strategies have apparently been mixed. In 1989 Germany introduced a "reference price" system. The reference price is taken to be the price of the least expensive (generic) drug, and costs are only reimbursed up to the reference price. Costs above the reference price must thus be borne by either the patient or the prescribing physician. Similar systems have been introduced in the Netherlands, Finland, Norway and Sweden, among other countries. The Swedish reference price system came into effect on January 1, 1993, and specifies that any costs exceeding the price of the least expensive generic substitute by more than 10 percent must be borne by the patient.[3]

The producer of a patented drug is likely to set the prices over time so as to maximize the present value of the profit from the drug. Up until patent expiration, the firms wish to set the monopoly price. When the patent has expired, the firm recognises that a high price may result in a more rapid loss of market shares, and this may induce the manufacturer of the pioneering drug to lower its price.[4] We believe that the market for prescription drugs has been largely inelastic with respect to prices. However, the market shares of competing producers may be affected by relative prices. For example, even though neither the prescribing physician, nor the patient above a certain level, is affected by the cost of the drug, very high prices may make the physician reluctant to prescribe a drug, and may result in negative reputation effects.

In this paper we use Swedish quarterly time series data, from 1972 to 1996, to analyze the impact of generic competition on the market share of twelve pioneering prescription drugs. The paper differs from almost all previous studies in several important ways. First, we have access to long

[3]During 1996, the patient had to pay the whole cost up to 170 Swedish kronor (approximately $25) for the first drug, and up to 70 kronor for each subsequent drug, on the same prescription. Furhermore, once a patient's total expenditures on drugs and medical fees during a single year reaches 2200 kronor, additional drug prescriptions and medical treatments will be free of charge during that year. In real terms, the patients' maximum costs were fairly stable between 1972 and 1990, but rose by more than 50 percent between 1990 and 1996. On January 1 1997, a new system was introduced.

[4]Grabowski and Vernon (1992) report that the prices of a sample of original drugs *rose* during the first years of generic competition.

data series, with prices and quantities of individual drugs (both original and generic). Therefore, our data refer to individual drugs, and not to groups of similar drugs. To our knowledge such disaggregate data have not been used in previous studies on the impact of generic competition on the market shares of original drugs. Second, contrary to the main part of the previous studies, we use European data, which is interesting from the point of view of international comparisons. Finally, we are able to analyse the effects of the introduction of a reference price system on the market shares of original drugs. The results imply that the price of the original drug relative to the average price of the generic substitutes significantly affects the change in the market share of the original drug in five out of twelve cases.

The outline of the paper is as follows. Section 2 briefly reviews the earlier literature. Section 3 contains the model, which is based on assumptions about incentives facing prescribing physicians. Then, in Section 4, we present the data and the estimation results. Section 5 concludes the paper.

2 Earlier literature

The pharmaceutical industry has been the subject of numerous economic studies (for reviews, see Comanor, 1986; Scherer and Ross, 1990; and Scherer, 1993). In the 1960s, a number of papers studied the relation between marginal cost and the price of drugs, and found that the mark-up was substantial, indicating market power. In the 1970s, an often-recurring theme was a comparison of the profit rate in the pharmaceutical industry with that of other manufacturing firms, accompanied by attempts to attribute the relatively high profit rate to a systematic bias in the reported profits vis-à-vis true profits.[5] More relevant to this paper is a strand of literature that assesses the impact of generic competition, in terms of prices and market shares of the original drug and its generic competitors. Schwartzman (1976) was the first such study. He reports that the only pharmaceutical market, in which the generic competition had a significant impact, was the antibiotics market. In other classes of pharmaceuticals, the manufacturer of the original drug could maintain virtually the whole market, without lowering its price.

[5]One source of bias arises as the effect of the practice to immediately subtract R&D expenditures from reported profit, and not treat them as investments in intangible assets.

Similar findings were subsequently reported by Bond and Lean (1977) and Statman (1981).

A number of more recent papers have focused on the role of the pharmacist and the question of whom the legal liability falls on (the physician, the pharmacist or the producer of the generic drug) and such practical matters as the design of the prescription pad. A predominant conclusion is the large impact of the legal structure, while the relative price difference is found to have no effect (McRay and Tapon, 1985, Masson and Steiner, 1985, and Anis, 1994), or only a small effect (Gorecki, 1987, Carroll et al, 1987a and 1987b).

The above papers study the pharmaceutical market from a static perspective: the market shares of the generic drugs are estimated for a single year, or for a short interval of years. Huruwitz and Caves (1988) find that the market share captured by the generic firms is not significantly affected by the price differentials to the original drug. Instead, it increases slowly as time passes, and as the number of generic competitors increases. The first study to focus on the post-1984 period is Grabowski and Vernon (1992). They find that during this period, the generic firms did capture a large share of the market very soon after the expiration of a patent. Two years after the entry of the first competitor, the average generic market share in their sample of 18 drugs was 49 percent. In spite of the dramatic loss of market share, the average price of the pioneering drug rose by 11 percent during that period. Contrary to previous authors, Grabowski and Vernon attribute the market-share gains of the generic drugs mainly to the price differential: two years after entry, the price of the generic substitute is on average 63 percent lower than that of the original. Frank and Sakever (1992) analyse the conditions under which it can be rational for the pioneering firm to raise prices upon entry. If the market can be considered to consist of two distinct sub-markets - one elastic market, consisting of hospitals, HMOs and Medicaid, and one inelastic, consisting of individuals with prescriptions from office-bases physicians - then the observed behavior can be consistent with profit maximization.

All studies mentioned this far have relied on data from the US or Canada. Hudson (1992) uses European data to analyse the impact of generic competition. His model is explicitly dynamic, and is applied to data from the US, UK, West Germany, and France. Unfortunately, the dependent variable (price, or price change) is highly aggregated, and includes both pioneering and generic drugs in the same therapeutic class. With this important caveat, Hudson reports that the entry of new products into a therapeutic class reduces the

price of the incumbent drugs significantly in Germany and France.

3 The model

As a first approximation, we assume that the market demand for a given drug (i.e., the combined demand for both the original drug, and its generic substitutes) is perfectly inelastic with respect to prices. The market shares of the competing producers are determined by relative prices.

A physician has no direct pecuniary incentives to choose less expensive, generic products, or on the whole to inform himself about generic alternatives. However, in his professional activity, he can hardly avoid being reached by the pharmaceutical industry's marketing. According to an estimate presented by Bleidt (1992), the pharmaceutical industry spends slightly more on marketing and promotion than on R&D. In many instances, the bulk of this effort promotes the brand-name product, increasing the likelihood that a physician will patronise the original manufacturer's product[6]. The physician may feel loyalty towards the original manufacturer, or sheer inertia may stop him from changing prescription habits. However, out of consideration for the national health budget, the physician may, nevertheless, react to price differences. Also, as time goes by, new physicians enter the profession and may decide to patronise either the brand name product, or some of its generic substitutes.

We assume that the physician feels a disutility from prescribing an original drug that is more expensive than an available generic substitute. To make this idea operational, suppose that the disutility is proportional to the price of the original, p^o, relative to the average price of the generic substitutes, p^g. The discounted total disutility from using the more expensive original drug is $\omega n(p^o/p^g)/(1-\delta)$, where ω is a preference parameter, n is the number of times the physician prescribes the drug per period, and δ is the discount factor. It is quite intuitive to think that the preference parameter changed

[6]Fridman et al (1987) reports that only half of 245 surveyed physicians believed generic drugs to be as reliable as trade name drugs. Consistent with this result, a relatively low fraction of physicians report to prescribe generics often, except in the case of antibiotics. Although 60 percent of physicians often comply with patients, should patients request a generic prescription, the impact of this is not large, since patients do not often make such request. In contrast, Kendall et al (1991) reports that "generic substitution is highly acceptable to (patients)"; even more so if their costs are not fully reimbursed.

when the reference price system was introduced. If a physician persisted in prescribing an original drug with a price more than 10 percent above the least expensive generic substitute, he would perhaps have to argue with some patients who shunned the extra cost, and he would probably receive phone calls from pharmacists wanting to substitute the original drug with a generic equivalent. We suppress this complication in the formal analysis, but account for the reform by introducing a dummy variable in the empirical section. To simplify the analysis, normalise $\omega n/(1-\delta)$ to 1[7].

In addition, it is reasonable to believe that the physician incurs a switching cost, c, (in utility terms) if he changes his prescription habits. We assume that the switching costs for the physicians that prescribe the more expensive original drug are uniformly distributed in all periods and independent of the market share of the original drug. That is, in every period, a new switching cost is drawn from a uniform distribution.

Formally, suppose that the uniform distribution for switching costs is defined over the interval $[a_t, a_t + b]$ in period t, which allows the limits to vary with time. If physician j prescribed the original in period $t-1$, he will switch to the generic drug in period t if:

$$p_t^o/p_t^g - c_t^j > 0 \tag{1}$$

i.e., if:

$$c_t^j < p_t^o/p_t^g \tag{2}$$

where p_t^o and p_t^g are, respectively, the price of the original and the average price of the generic substitute in period t. If, at the end of period $t-1$, a share s_{t-1} of the physicians patronise the original drug, then the fraction out of that share for whom $c_t^j < p_t^o/p_t^g$ is given by:

$$-\frac{s_t - s_{t-1}}{s_{t-1}} = \frac{p_t^o/p_t^g - a_t}{a_t + b - a_t} = -\frac{a_t}{b} + \frac{1}{b}p_t^o/p_t^g \tag{3}$$

Rewriting equation (3), we have:

$$\frac{s_t - s_{t-1}}{s_{t-1}} = \alpha_t + \beta(p_t^o/p_t^g) \tag{4}$$

[7]The product $\omega n/(1-\delta)$ can be subsumed in the parameters a and b below.

where $\alpha_t = a_t/b$ and $\beta = -1/b$. Equation (4) gives the relative change of the market share for the original drug as a linear function of the price of the original drug relative to the average price of the generic substitutes. This relationship will serve as a starting point for the empirical analysis in Section 4 below.

4 Empirical Analysis

4.1 Data

We have access to quarterly data from 1972 to 1996, which have been provided by the Swedish Medical Product Agency. Information is available both for the original product and the generic substitutes. Out of a sample of fifteen substances, three substances were removed due to missing data or obvious measurement errors. For the remaining substances, we use the package size with the largest sales as our measure of quantity. Each substance in our sample has a minimum sale of ten thousand packages each quarter for the chosen package size.

Our data then refers to prices and sold quantities for twelve different substances. Table 1 contains information about average market shares during the estimation period for each original substance and for its generic substitutes. We also present sample means and standard deviations for the relative prices corresponding to each such substance (i.e. the price of the original relative to the average price of the generic substitutes).

TABLE 1 ABOUT HERE.

To give the reader an idea about what has happend with market shares of the originals and relative prices during the estimation period, we select two of the substances, Furosemide and Propranolol, which are polar cases in terms of the influence of generic competition on brand name market shares during the estimation period. The time series patterns for the market shares of these two original drugs and the corresponding relative prices are given in Figure 1.

FIGURE 1 ABOUT HERE

Figure 1 implies that the market shares for the two drugs have developed very differently during the studied period. Furosemide, on the one hand, has lost almost the whole market to its competitors. The fall in market share

came when the relative price increased sharply as additional competitors entered the market. Propranolol, on the other hand, has been able to keep over 90% of its market, despite the fact that it has a very high price relative to its competitors.

4.2 Results for a basic model

This subsection contains estimation results corresponding to equation (4), which is the starting point for the analysis. In the next subsection, this "basic" model will be extended by allowing the introduction of the reference price system to affect the relative change in market shares. The basic regression model (applied to substance i) is

$$\frac{s_{it} - s_{it-1}}{s_{it-1}} = \alpha_{i0} + \alpha_{i1} T + \beta_i \left(p^o_{it}/p^g_{it}\right) + u_{it} \tag{5}$$

where u_{it} is a random term. The disturbance is assumed to be i.i.d. across substances. The "variable" T represents a time trend, the purpose of which is to capture possible time dependence (other than via the random term) of the distribution for switching costs facing prescribing physicians. For each substance, this equation is estimated using a Cochrane-Orcutt technique to avoid problems of serial correlation. In addition, to facilitate comparison with previous studies, we also estimate a version of the model where the data for all twelve drugs have been pooled together. The results are presented in Table 2.

Let us begin with the estimation results corresponding to the case of pooling. Contrary to many previous studies referred to above, we find that relative prices have a significant effect on the change of market share of the original product. The higher the price of the original product relative to the average price of the generic substitutes, the larger the decrease in the market share of the original product. The point estimates imply that the manufacturer of the original drug looses 0.30 per cent of the market share every quarter, when the prices of the original and the generic substitute are equal, and 2.20 per cent when the price of the original is twice as high as that of the substitute.

To gain further insight into the relationship between changes in market shares for the original product and relative prices, let us turn to the estimation results corresponding to the different substances. We find that in five

out of twelve cases, the relative price has a significant (and negative) effect on the change in the market share of the original. These five substances are Atenolol, Diazepam, Furosemide,Naproxen and Propranolol. An important conclusion is that the impact of generic competition differs substantially across markets, which makes the use of disaggregate data very important in order to understand how the market shares of brand name drugs are affected by generic competition. It is also clear from Table 2 that the ability of the "basic" model to explain the changes in market shares differs considerably across substances. The latter means that the model set out in the previous section may not always provide a suitable basis for the analysis[8].

TABLE 2 ABOUT HERE.

4.3 Extentions of the model

It has been argued that the reference price systems may increase the price sensitivity of the physicians. If this argument is correct, consistent estimation of the parameter β_i makes it necessary to explicitly consider the reference price system in the analysis. The basic model is extended in the following way:

$$\frac{s_{it} - s_{it-1}}{s_{it-1}} = \alpha_{i0} + \alpha_{i1} T + \alpha_{i2} D + \beta_i \left(p^o_{it}/p^g_{it}\right) + u_{it} \qquad (6)$$

where D is a dummy variable, which equals zero prior to the introduction of the reference price system and one after the introduction. The natural interpretation of D in terms of equation (4) is that it may affect the distribution of switching costs for the prescribing physicians. For the purpose of comparison with Table 2, equation (6) is also estimated for each individual substance as well as for the case when the data are pooled together. The results are presented in Table 3.

[8] A problem is the potential endogeneity of the relative prices, i.e. the relative price may correlate with the error term of the equation for the change in market share. To address the endogeneity problem, we have reestimated the model in Table 2 under the assumption that the relative prices are endogenus by applying a version of two-stage least squares. Lagged values of relative prices were used as instruments. These instruments appear to have a significant effect on relative prices, and the explanatory power in the first stage was found to be high. However, the results in the second stage were very similar to those reported in the paper. There are two possible interpretations: either that endogeneity is not an important problem in the empirical analysis, or that we are not able to correct for endogeneity in a satisfactory way.

When the data for all individual drugs are pooled together, the point estimate of β is only slightly different from Table 2, whereas the estimate of α_2 is not significant. However, by looking at the estimation results corresponding to each individual substance, we find that the reference price system significantly affects the change of market share in five out of twelve cases. For two of these substances, Allopurinol and Cimetedine, the reference price dummy variable has an unexpected positive sign. This may provide an indication of a missing variable problem. However, for Furosemide, Clomipramine and Naproxen, the effect of D is negative as expected, and the estimates are higly significant. The estimates of β_i are negative and significant for Furosemide, Naproxen and Propranolol, while the estimate for Allopurinol is positive and significant. In addition, by comparing Tables 2 and 3, we find substantial differences in the point estimates of β_i corresponding to Furosemide, Naproxen and Propranolol. This suggests that the basic model, which neglects the impact of introducing the reference price system, is not always a suitable basis for identifying the effect of relative prices on the change of market share of the original. For the remaining seven drugs, D has no significant effect on the change in market share, although the point estimates suggest a negative sign for Diazepam and Propranolol leaving Paracetamol/Codeine, Atenolol, Indometacine, Pindolol and Timolol with positive and insignificant point estimates.

TABLE 3 ABOUT HERE.

4.4 Relative Prices and the Impact of the Reference Price System

As we mentioned in the last subsection, if the reference price system affects the changes in market shares of brand name drugs, there is a missing variable problem in the basic model. This is further emphasized by the possibility that the reference price system influences the price of a brand name drug relative to the price of the generic substitute, which would imply that the estimates of β_i in the basic model actually represents a mixture of "pure" relative price effects and effects of introducing the reference price system. To study this issue a bit further, let us estimate the following equation for each relative price:

$$\frac{p_{it}^o}{p_{it}^g} = \rho_i + \mu_i T + \lambda_i D + \epsilon_{it} \tag{7}$$

The results are given in Table 4. When all data are pooled together, the results suggest that the introduction of the reference price system lowered the price of the original relative to the price of the generics. The negative effect of the reference price system appears to be reasonable, since the introduction of this system may have provided strong incentives for manufacturers of brand name products to lower their prices. Similar qualitative results are found for a majority of the individual substances: the price of the original relative to the price of the generic substitute fell in nine out of twelve cases. For the remaining substances, except Diazepam, the introduction of the reference price system appears to have had no significant influence on the relative price.

TABLE 4 ABOUT HERE.

Finally, it is interesting to test whether the relative price responses following the introduction of the reference price system originate from price resposes of brand name or generic products. Therefore, as a complement to the results in Table 4, we also present results from the estimation of the following equation:

$$\frac{p_{it}^o}{p_{i0}^o} = \kappa_i + \phi_i T + \pi_i D + \nu_{it} \tag{8}$$

where p_{i0}^o is the "initial price" of the original (or brand name) product. The results are presented in Table 5. Looking at the estimates corresponding to the individual drugs, we find that eight out of twelve prices decreased significantly, when the reference price system was introduced[9]. Only for one of the drugs, Allopurinol, did we obtain the opposite result - a significant increase in the price. The results in Table 5 also provide a possible explanation as to the descrepancy of Diazepam in Table 4, in the sense that the price of Diazepams was not significantly affected by the introduction of the reference price system. This is discussed further below.

TABLE 5 ABOUT HERE.

[9]Descriptive evidence suggesting that manufacturers of originals lowered their prices as a response to the introduction of the reference price system have been presented by Jönsson (1994).

By comparing Tables 4 and 5, it follows that the introduction of the reference price system significantly reduced both the relative price and the "own" price associated with seven original drugs: Paracetamol/Codeine, Atenolol, Furosemide, Indomethacine, Pindolol, Propranolol and Timolol. Hence, these manufacturers appear to have lowered their prices to conform to the new system.

Let us finally turn to Diazepam, Allopurinol and Naproxen. For Diazepam, the results in Table 4 indicate that the price, relative to the price of the generic substitute, increases significantly as a reponse to the introduction of the reference price system, whereas the "own" price effect for Diazepam is insignificant according to Table 5. If the generic competitors (incorrectly) expected that the Diazepam manufacturers may lower their price, and if these generic competitors were trying to keep the relative price constant by lowering their prices, we would observe this pattern. Similarly, for Allopurinol the price relative to the generic price fell significantly, although manufacurers of Allopurinol seem to have raised their own price as a response to the introduction of the reference price system. This means that the generic competitors raised their prices more than the manufacturers of Allopurinol. Finally, a reversed patters emerges for Naproxen: the generic competitors has lowered their price (on average) about as much as the manufacturers of Naproxen.

5 Summary

This paper concerns the impact of generic competition on the market share of brand name drugs. We derive and estimate a model, where the relative change of market share of the original drug depends on the price of the original relative to the price of the generic substitute. A novelty of the paper is that the analyses is based on quartely time series data for several different substances, which makes it possible to relate the change in market share to the relative price for each such substance. Another novelty is that we are able to assess the impact of a reference price system. The most important results are summarized below:

•In the basic model (which does not control for the effects of the reference price system), we find that relative prices have a significant impact on the market shares of Atenolol, Diazepam, Furosemide,Naproxen and Propranolol, with the expected sign.

•The introduction of the reference price system appears to have decreased the market shares of Furosemide, Clomipramine and Naproxen. In addition, it is important to control for the introduction of the reference price system, in order to identify how the change of market share is affected by the relative price. The differences in results between the substances also underlines the importance of using disaggregate data.

•To study the consequences of the reference price system, we also estimate how the introduction of this system may have affected the prices of original drugs relative to prices of generic substitutes, as well as how it affects the own prices of originals. The results suggest that the introduction of the reference price system is an important determinant of the price paths. Therefore, if we neglect the reference price system in the estimation, as in the basic model, estimated relative price effects on changes in the market shares most likely reflect a mixture of "pure" relative price effects and effects caused by the reference price system.

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Table 1 Market Shares and Relative Prices

Substance	M-share Brand	M-share Generic	Relative price (std. dev)
Paracetamol/Codiene	92,85%	7,15%	1,23 (0,10)
Atenolol	85,51%	14,49%	1,58 (0,44)
Cimetedine	64,57%	35,43%	1,62 (0,66)
Diazepam	41,68%	58,32%	1,17 (0,12)
Furosemide	47,40%	52,60%	1,57 (0,45)
Allopurinol	93,03%	6,97%	1,33 (0,22)
Indomethacine	63,56%	36,44%	1,15 (0,10)
Clomipramine	39,53%	60,47%	1,44 (0,19)
Naproxen	44,30%	55,70%	1,44 (0,37)
Pindolol	97,63%	2,37%	1,36 (0,18)
Propranolol	96,98%	3,02%	1,87 (0,55)
Timolol	82,08%	17,92%	1,75 (0,40)

Note: The figures refer to average market shares and relative prices (p^o/p^g) during the estimation period.

Table 2 Estimation Results for the Basic Model

Drug	α_0	α_1	β	R^2
Paracetamol/Codeine	0,027	$-0,00013$	$-0,022$	0,21
	(1,01)	$(-0,87)$	$(-1,17)$	
Atenolol	0,026	$-0,00035$	$-0,017$	0,39
	(3,25)	$(-1,81)$	$(-4,79)$	
Cimetedine	$-0,025$	0,000018	0,30	0,06
	$(-1,53)$	(0,0063)	(0,49)	
Diazepam	0,048	0,000063	$-0,055$	0,16
	(1,77)	(0,56)	$(-2,17)$	
Furosemide	0,040	$-0,00018$	$-0,039$	0,46
	(5,54)	$(-2,32)$	$(-8,74)$	
Allopurinol	$-0,0029$	$-0,000074$	0,0011	0,18
	$(-0,45)$	$(-1,19)$	(0,27)	
Indomethacine	0,014	0,000063	$-0,019$	0,43
	(0,42)	(0,64)	$(-0,65)$	
Clomipramine	1,40	$-0,018$	$-0,93$	0,44
	(1,13)	$(-0,59)$	$(-1,35)$	
Naproxen	0,16	$-0,0012$	$-0,12$	0,52
	(2,90)	$(-1,12)$	$(-4,55)$	
Pindolol	0,0092	$-0,000093$	$-0,0063$	0,14
	(0,77)	$(-0,72)$	$(-0,86)$	
Propranolol	0,014	$-0,00023$	$-0,053$	0,38
	3,17	$(-3,67)$	$(-3,32)$	
Timolol	$-0,031$	0,0014	0,00064	0,40
	$(-1,96)$	(4,44)	(0,087)	
POOLED	0,016	$-0,000085$	$-0,019$	0,03
	(2,11)	$(-1,11)$	$(-4,27)$	

Table 3 Estimation Results for the Extended Model

Drug	α_0	α_1	α_2	β	R^2
Paracetamol/Codeine	0,0062	$-0,00015$	0,0041	$-0,0062$	0,24
	(0,19)	$(-0,99)$	(1,03)	$(-0,25)$	
Atenolol	0,017	$-0,00070$	0,010	$-0,011$	0,40
	(1,21)	$(-1,43)$	(0,77)	$(1,30)$	
Cimetedine	$-0,015$	$-0,00099$	0,044	0,0049	0,52
	$(-1,62)$	$(-4,78)$	(7,48)	(1,42)	
Diazepam	0,048	0,000063	$-0,000082$	$-0,055$	0,16
	(1,25)	(0,54)	$(-0,0065)$	$(-1,61)$	
Furosemide	0,068	0,00049	$-0,062$	$-0,072$	0,64
	(12,65)	(4,44)	$(-7,02)$	$(-12,65)$	
Allopurinol	$-0,031$	$-0,00028$	0,018	0,023	0,35
	$(-3,25)$	$(-3,63)$	(3,57)	(3,28)	
Indomethacine	0,000039	$-0,000018$	0,0092	$-0,0047$	0,44
	(0,0011)	$(-0,13)$	(0,83)	$(-0,14)$	
Clomipramine	1,40	$-0,0052$	$-0,50$	$-0,66$	0,83
	(1,88)	$(-0,19)$	$(-5,04)$	$(-1,75)$	
Naproxen	0,40	0,0015	$-0,17$	$-0,28$	0,72
	(5,97)	(1,40)	$(-4,67)$	(7,08)	
Pindolol	0,0057	$-0,00011$	0,0014	$-0,0038$	0,14
	(0,27)	$(-0,68)$	(0,21)	$(-0,26)$	
Propranolol	0,020	$-0,00024$	$-0,0033$	$-0,0080$	0,40
	(3,28)	$(-3,97)$	$(-1,42)$	$(-3,23)$	
Timolol	$-0,032$	0,0014	0,0021	0,0018	0,40
	$(-1,53)$	(1,54)	(0,10)	(0,13)	
POOLED	0,020	$-0,000062$	$-0,0062$	$-0,021$	0,03
	(2,42)	$(-0,78)$	$(-1,31)$	$(-4,45)$	

Table 4 Estimation Results for the Relative Price Equation

Drug	ρ	μ	λ	R^2
Paracetamol/Codeine	1,3410	$-0,0040$	$-0,0876$	0,87
	(52,37)	$(-3,03)$	$(-2,84)$	
Atenolol	2,0894	0,0088	$-1,0673$	0,97
	(7,73)	(0,70)	$(-12,95)$	
Cimetedine	2,6797	$-0,0338$	$-0,2595$	0,82
	(5,70)	$(-2,06)$	$(-0,86)$	
Diazepam	1,1704	$-0,0012$	0,3052	0,87
	(11,24)	$(-0,73)$	(6,62)	
Furosemide	1,6772	0,0041	$-0,9024$	0,97
	(2,45)	(0,47)	$(-11,98)$	
Allopurinol	1,4991	$-0,0011$	$-0,4109$	0,95
	(10,02)	$(-0,26)$	$(-7,04)$	
Indomethacine	0,9495	0,0047	$-0,2852$	0,81
	(10,06)	(3,08)	$(-6,65)$	
Clomipramine	1,7996	$-0,0385$	$-0,0353$	0,94
	(46,89)	$(-10,01)$	$(-0,72)$	
Naproxen	2,1665	$-0,0386$	$-0,0018$	0,85
	(7,65)	$(-2,64)$	$(-0,01)$	
Pindolol	1,5360	$-0,0012$	$-0,4086$	0,93
	(14,76)	$(-0,26)$	$(-7,63)$	
Propranolol	2,2826	$-0,0049$	$-1,1519$	0,96
	(8,41)	$(-0,57)$	$(-10,01)$	
Timolol	1,5059	0,0413	$-1,1780$	0,76
	(8,34)	(3,34)	$(-5,63)$	
POOLED	1,6801	$-0,0026$	$-0,4414$	0,89
	(9,63)	$(-0,79)$	$(-11,12)$	

Table 5 Estimation Results for the "Price of Brands" Equation

Drug	κ	ϕ	π	R^2
Paracetamol/Codeine	1,1298	0,0086	$-0,1653$	0,85
	(16,88)	(3,40)	$(-5,13)$	
Atenolol	1,7421	$-0,0052$	$-0,8348$	0,99
	(52,13)	$(-2,85)$	$(-51,69)$	
Cimetedine	2,1769	$-0,0248$	$-0,2801$	0,82
	(5,59)	$(-1,84)$	$(-1,14)$	
Diazepam	0,7623	0,0119	$-0,0187$	0,99
	(4,63)	(5,20)	$(-0,55)$	
Furosemide	1,6841	0,0003	$-0,9195$	0,99
	(7,44)	(0,10)	$(-37,01)$	
Allopurinol	1,0637	0,0131	0,0894	0,98
	(7,07)	(3,16)	(1,92)	
Indomethacine	2,0248	$-0,0002$	$-0,6984$	0,98
	(2,68)	$(-0,02)$	$(-11,11)$	
Naproxen	1,5002	$-0,0115$	$-0,6028$	0,92
	(27,71)	$(-2,67)$	$(-7,46)$	
Pindolol	5,1966	$-0,0844$	$-0,6335$	0,99
	(6,69)	$(-4,31)$	$(-11,01)$	
Propranolol	2,0928	$-0,0143$	$-0,7986$	0,99
	(12,89)	$(-3,99)$	$(-43,78)$	
Timolol	1,9956	0,0299	$-1,2826$	0,87
	(2,92)	(0,97)	$(-4,72)$	
POOLED	2,1213	$-0,0042$	$-0,4659$	0,95
	(3,25)	$(-0,52)$	$(-13,54)$	

Note: The equation for Clomipramine could not be estimated because of too little variation in the dependent variable.

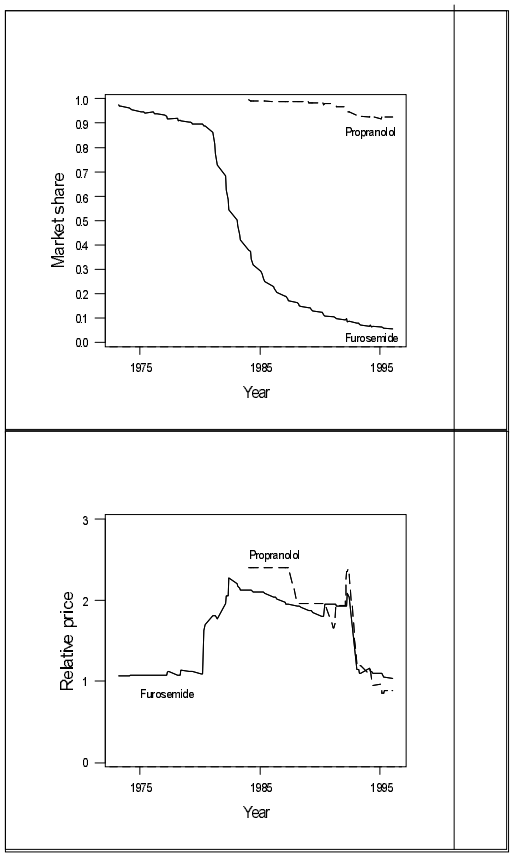

Figure 1: Prices and market shares for Furosemide and Propanolol