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An Empirical Model of the Demand for Health Care in Belgium.

by

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Abstract

The paper presents an empirical model of the demand of health care in Belgium. The analysis pertains to 17 categories of medical care and to two subgroups of health insurance beneficiaries, viz. the 'active' and the 'widows, orphans, pensioners and invalids'. The estimation results show that income and relative prices matter in the demand for medical care. Supplier induced demand is also detected for a number of medical care categories. Other explanatory variables in the model include the size of the child population, climatic conditions and a time trend, representing technological advances in health care.

Contents

1. Introduction

The purpose of this paper is to search, by means of econometric modeling, for the important determinants of the demand for medical care in Belgium. The Belgian health insurance scheme consists of a scheme for blue and white collar workers and a scheme for the self-employed. In this paper we will restrict ourselves to the demand of the group of workers. In doing so, we will capture about 94 % of the expenditures of the insurance scheme for medical care. In order to give the reader a better understanding of health care demand and the institutional set-up, we give a brief description of the health insurance system for workers in the next section. In the third section we will specify the structural equations of the health care model. This model is of the macro-economic type and uses data from 1966 to 1980. The estimation results will be presented and commented upon in the fourth section.

2. Description of the health insurance system (HIS)

2.1. Beneficiaries

The econometric analysis pertains to the two subgroups of beneficiaries in the health insurance scheme for blue and white collar workers. The first subgroup includes the active persons and the persons at their charge (e.g. children). The second subgroup comprises widows, orphans, pensioners, invalid persons and the persons at their charge[1]. Note that the total number of beneficiaries has increased by 1.368.357 from 1966 to 1980. In 1980, the number of beneficiaries amounted to 8.491.479.

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[1]Henceforth this will be abbreviated to WOPI.

2.2. Financing of the HIS

The sources of revenue for the HIS consist of employers' and workers' contributions on the one and government subsidies and taxes on the other hand. More specifically, they are:

(i) The contributions of employers and workers that are calculated on total wages; there is no special ceiling for the calculation of these contributions. The employers' and workers' contribution rate is 3.75 % and 1.8 % respectively.

(ii) A government subsidy which is equal to 95 % of the costs of the treatment of the so-called social diseases[1] plus 27 % of the normal expenditures for medical treatment.[2]

(iii) A special government allowance that finances the health insurance of the unemployed.[3]

(iv) An excise tax on tobacco.[4]

2.3. Health insurance benefits

2.3.1. Out-patient medical care

The benefits include full or partial refunding of medical care expenses:

(i) For the general medical help, i.e. visits by and consultations with physicians (general practitioners and specialists), assistance by paramedical personnel, technical assistance by physicians (e.g. labo tests) and dental care, the reimbursement is 75 % of the official fees. For widows, orphans, pen-

[1] These include T.B.C., poliomyelitis, cancer, congenital and mental diseases.

[2] Applicable up to the end of 1981; from 1982 on, subsidies equal 80 % of the expenditures of the WOPI.

[3,4] From 1982 on, these sources of revenue no longer exist.

sioners and invalids below a certain income, the reimbursement is 100 %.

(ii) Technical assistance delivered by specialists (labo-tests and radiotherapy) is reimbursed at 100 %.

(iii) For drugs, a distinction is made between ready made drugs and pharmacists' drug preparations. For the preparations patients pay a fixed amount that varies according to the group of beneficiaries. The personal out of pocket contribution in the case of the first type of drugs depends upon the therapeutic value of the drugs and on the subgroup of beneficiaries to which the patient belongs. Note that pharmaceutical products are only reimbursable if they appear on the official list of accepted products.

2.3.2. In-patient medical care

(i) The government determines the prices of a hospital day in different hospital wards. These prices also differ according to the type of hospital; in Belgium one distinguishes mainly university and general hospitals. A supplement to the normal price[1] can be granted by the government if the hospital manager can show that the predetermined prices are not sufficient to cover the real costs in his hospital. From 1975 on, hospitals have also the possibility to calculate their own price in advance. The latter needs then to be approved by the Minister of Public Health.

[1]The price of a hospital day includes the following elements: depreciation, financial charges, overhead costs, maintenance costs, nurses' salaries, administration costs, the costs of drug preparations, hotel costs and the costs of laundry and linen.

(ii) The financing of the price of a hospital day is as follows: 25 % of the price is at charge of the Ministry of Public Health. The Ministry's subsidy is higher for university hospitals, however. Subsequently, there is a (relatively small) out of pocket contribution by the patient. This personal contribution varies according to the subgroup of beneficiaries to which one belongs: the personal share is higher for the active persons than for the other group. The patient also pays a fixed amount per drug (25 BF) that is administered at the hospital. Finally, the remainder of the price of a hospital day is paid to hospitals by the HIS.

2.4. The share of HIS benefits in Gross National Product

In the following table, we present the shares of health insurance benefits in gross national product over the period 1966 to 1980. The expenditures of the scheme for the self-employed are also given. From Table 1, it is clear that the share of total expenditures of the HIS for medical care (both schemes) in gross national product has increased from 2.25 % in 1966 to 3.87 % in 1980. This evolution can be explained by the increase in real benefits, the increase in the number of beneficiaries and partly by a higher demand for medical care. Note that there has not been a sufficient increase in the total revenues of the HIS so that budget deficits were created. The latter are reported in Table 2 for the years 1974 to 1980.

Table 1 Expenditures of the HIS for medical care, 1966-1980

Year	Expenditures scheme for workers (in 10^9 BF, current prices)	Expenditures scheme for self-employed (in 10^9 BF, current prices)	Total expenditures as % of Gross National Product
1966	19.7	0.9	2.25
1967	20.8	1.0	2.23
1968	23.8	1.4	2.40
1969	28.2	1.8	2.58
1970	32.7	2.2	2.70
1971	36.3	2.5	2.74
1972	41.5	2.9	2.80
1973	49.2	3.4	2.93
1974	59.6	4.1	3.02
1975	74.7	5.4	3.44
1976	88.8	6.5	3.60
1977	98.5	7.1	3.69
1978	110.0	7.7	3.84
1979	117.3	8.1	3.85
1980	125.4	8.8	3.87

Source: Various issues of Algemeen Verslag van het Rijksinstituut voor Ziekte en Invaliditeitsverzekering (RIZIV), Voornaamste financiële en statistische uitkomsten van de verplichte verzekering tegen ziekte en invaliditeit (Brussel, 1 juli 1981)

Table 2 Yearly deficit or surplus of the HIS workers.

Year	Deficit (-) or Surplus (+) in 10^6 BF, current prices
1974	+ 113.3
1975	+ 693.9
1976	- 2,823.2
1977	+ 227.9
1978	- 4,436.7
1979	- 5,979.1
1980	- 2,625.4
Cumulative deficit end of 1980	- 14,829.3

Source : Unpublished documents from RIZIV (Brussels).

3. Structural specification of the model

3.1. Categories of medical care

For each subgroup of beneficiaries in our model, the following categories of medical care are considered:

1a. Consultations at the general practitioner's office
1b. Consultations with the general practitioner at the patient's home
2a. Consultations with the pediatrician
2b. Consultations with a specialist physician (other than pediatrician)
3a. Preservative dental care (fillings)
3b. Other dental care (orthodontics, dental prostheses)
4. Prostheses
5a. Hospital bed-days due to surgery
5b. Hospital bed-days due to observation of patients
6. Technical medical treatment (physiotherapy, labo-tests)
7a. Special care (radiotherapy, X-rays)
7b. Labo-tests (performed by specialists)
8a. Surgery
8b. Anaesthesia
9. Drugs
10. Kinesitherapy
11. Nurses' care of outpatients
12. Special care for patients having T.B.C., cancer, poliomyelitis, congenital or mental diseases
13. Deliveries
14. Hemodialysis
15. Midwives' care
16. Hospital bed-days due to deliveries
17. Travel and supervision expenditures.

Note that for categories of medical care 1 to 11 behavioral equations are specified. The last four categories are exogenous in the model. To give the reader an idea of the relative importance of the different categories, we present in Table 3 the expenditures of each category and their share in health insurance expenditures for 1980. One can verify that the endogenous part of the model captures 88 % of the HIS' expenditures. It can also be seen that the expenditures for hospital bed-days, special care and labo-tests account alone for 40 % of total HIS expenditures. In Table 4 we present the share of the two subgroups in the expenditures related to each above mentioned category of medical care.

Table 3 Expenditures of different categories of medical care and their share in total HIS expenditures, 1980

Category of medical care	Expenditures in 10^6BF (current prices)	Expenditures as % of HIS total outlays
1a	4.943.6	3.94
1b	5.937.6	4.73
2a	601.9	0.48
2b	4.300.3	3.43
3a	2.490.3	1.98
3b	1.727.9	1.38
4	1.476.9	1.18
5a	9.020.4	7.19
5b	15.610.5	12.44
6	3.069.5	2.45
7a	14.028.3	11.18
7b	10.043.1	8.01
8a	4.948.6	3.95
8b	1.095.7	0.87
9	22.327.4	17.80
10	5.474.6	4.36
11	2.949.9	2.35
12	7.566.1	6.03
13	807.5	0.64
14	147.9	0.11
15	108.7	0.09
16	1.618.7	1.29
17	4.891.8	3.90

Source: Statistics of the RIZIV (Brussels)
Note: Due to rounding errors, the sum of the elements of the first and second column is not exactly equal to 125,4 billion and 100 % respectively.

Table 4 Share of the subgroups in medical care expenditures, 1980

Category of medical care	subgroup 1 (Active)	subgroup 2 (WOPI)
1a	71.6	28.4
1b	38.0	62.0
2a	95.9	4.1
2b	66.5	33.5
3a	89.5	10.5
3b	59.8	40.2
4	54.0	46.0
5a	48.4	51.6
5b	31.1	68.9
6	53.1	46.9
7a	64.9	35.1
7b	61.3	38.7
8a	58.1	41.9
8b	68.3	31.7
9	48.3	51.7
10	38.0	62.0
11	20.4	79.6
12	38.7	61.3
13	92.0	8.0
14	55.1	44.9
15	97.6	2.4
16	96.4	3.6
17	49.7	50.3

Source : Computation from statistics of the RIZIV (Brussels)

3.2. Behavioral equations of medical care categories 1 to 3

(i) Concerning these types of demand, we reason that a call on the general practitioner (GP), specialist doctor or dentist is in the first place the result of a spontaneous decision on the part of the individual patient. Such a decision is not only caused by a state of illness. Individuals may also demand medical care because they perceive their health status as deteriorating. They may also seek medical care in order to prevent future illnesses or to ask the doctor for general advice. We postulate now that a certain part of income is allocated to consultations and dental care. Furthermore we will maintain the hypothesis that, to a certain extent, individuals are sensitive to relative prices. This means that, if the price of medical care relative to that of a substitute increases, they may decide to adjust their demands downwards. It is clear that price sensitivity will be almost non-existent if medical care is both badly needed and hardly substitutable, however.

In view of the considerations above, we would have a demand equation of the following type:

$$\ln q^j_j = \alpha + \beta \ln(Y/P)_t + \sum_{k \in K} \gamma_k \ln(P^j/P^k)_t \quad (1)$$

where q^j_t is the demand for medical care (per beneficiary) of type j.

Y is disposable income per beneficiary (in current prices)
P is the consumption price deflator
P^j is the patient's price of medical care of type j
P^k is the price of a substitute commodity k
t indicates the year
K indicates the set of substitutes for j
Note that Y is put equal to the average earnings (WAGE) and the average pension (PENSION) in the case of subgroups 1 and 2 respectively. Note that the set K differs according to the medical care category treated.

[1] The same type of specification applies to both subgroups. Hence, no special subgroup index will have to appear in the equations explained in this and the following sections.

(ii) It has to be granted that determinants other than income and relative prices may play a role in patients' demand for medical care, however. First, medical care delivered to patients may be influenced by supply factors as well. In Belgium, doctors and dentists are paid by means of fees for services. This implies that they may have a monetary incentive to expand their services. This monetary incentive is likely to be strong whenever the ratio of doctors and dentists to population is high. Indeed, the higher these ratios the lower the average income per doctor or dentist is likely to be if patients' demand is not especially induced. This *supplier-induced demand effect* can be tested by including these ratios as determinants in equation (1). Secondly, the demand for pediatricians' care will be influenced by the *size of the child population*. In addition, it is likely that the latter variable encourages the consultations at patients' homes. This can be explained by the fact that parents frequently dislike transporting a sick child to a physician's office because the transport itself may enhance the child's illness. Furthermore examinations (in the physician's office) of sick children, having caught an infectious disease, may be discouraged by the physician himself in order to limit the transmittal of the disease. The influence of the child population will now be captured by introducing the ratio of the child population (of less than 15 years) to total population in the relevant equations. Thirdly, *climatic conditions* may affect the demand for medical care; for instance severe winters may boost the demand for consultations with physicians due to the widespread occurence of colds, influenza etc. We have therefore introduced temperature (in centigrade) as a determinant in the equations explaining consultations.

(iii) Let us now include the additional determinants in eq. (1) and present the completely specified equations. For *category 1* we have:

$$\ln q_t^{go} = \alpha_1 + \beta_1 \ln(Y/P)_t + \gamma_{11} \ln(P^{go}/P^{gh})_t + \gamma_{12} \ln(P^{go}/P^{os})t$$

$$+ \gamma_{13} \ln(P^{go}/P^{pe})_t + \delta_1 \ln R_t^g + \varepsilon_1 \ln TEMP_t \qquad (2)$$

$$\ln q_t^{gh} = \alpha_2 + \beta_2 \ln(Y/P)_t + \gamma_{21} \ln(P^{gh}/P^{go})_t + \gamma_{22} \ln(P^{gh}/P^{os})_t$$

$$+ \gamma_{21} \ln(P^{gh}/P^{pe})_t + \delta_2 \ln R_t^g + \varepsilon_2 \ln TEMP_t + \phi_2 \ln CHILD \; (3)$$

The superscripts go, gh, pe, os refer to medical care categories 1a, 1b, 2a and 2b respectively. R^g is the ratio of general practitioners to population covered, TEMP indicates temperature in centigrade and CHILD is the ratio of the number of children (of less than 15 years) to total population. The reader notices that we will test the hypothesis of substitution between GP's and specialist's care and between GP's consultations at home and at the office.

The equations for *category 2* are the following:

$$\ln q_t^{pe} = \alpha_3 + \beta_3 \ln(Y/P)_t + \gamma_{31} \ln(P^{pe}/P^{go})_t + \gamma_{32} \ln(P^{pe}/P^{gh})_t$$

$$+ \delta_3 \ln R_t^s + \varepsilon_3 \ln TEMP_t + \phi_3 \ln CHILD_t \qquad (4)$$

$$\ln q_t^{os} = \alpha_4 + \beta_4 \ln(Y/P)_t + \gamma_{41} \ln(P^{os}/P^{go})_t + \gamma_{42} \ln(P^{os}/P^{gh})_t$$

$$+ \delta_4 \ln R_t^s + \varepsilon_4 \ln TEMP_t \qquad (5)$$

In these equations, we also introduce substitution between GP's and specialist's care. R^s denotes the ratio of specialists to the total amount of beneficiaries.

The specification of the equations for *category 3* is as follows:

$$\ln q_d^{pd} = \alpha_5 + \beta_5 \ln(Y/P)_t + \gamma_5 \ln(P^{pd}/P)_t + \delta_5 \ln R_t^d \quad (6)$$

$$\ln q_t^{od} = \alpha_6 + \beta_6 \ln(Y/P)_t + \gamma_6 \ln(P^{od}/P)_t + \delta_6 \ln R_t^d \quad (7)$$

In this case, we have considered all other consumption to be the substitute for dental care, whence the use of the consumption price deflator in the relative price terms. The variable R^d represents the ratio of dentists to covered population.

(iv) A comment is in order about the relation between equations (2) to (7) and consumer demand theory. Notice that the equations satisfy the homogeneity property: this property implies that the demand for q^j is not sensitive to an identical percentage change of income and prices. Note that the coefficients β are real income elasticities whereas the coefficients γ are the cross price elasticities.

3.3. Behavioral equations of medical care categories 4 to 11

3.3.1. Basic specification

The medical care categories discussed here are different from those treated before. They are not the immediate result of patients' own demand. Rather, they are the result of *prescriptions* by general practitioners and specialists. Some types of medical care are also closely linked to hospital stays. The determinants of these medical categories will therefore include demand for medical care of categories 1 and 2 and, wherever appropriate, hospital stays (expressed in bed-days). In other words, these determinants reflect that one first needs to consult with doctors or to stay in a hospital in order to be referred to more specialized forms of medical care.

Another determinant is likely to be the price of medical care relative to the price of a substitute. The sign of the price coefficient is uncertain, however. On the one hand, there may be a negative price effect on medical care caused by patients who might consider the price as being too high and who would thence refuse or postpone a particular prescription. On the other hand, there may be a positive price effect if provides of medical care prescribe more whenever the price of medical care increases in order to maximize their incomes; the latter can be referred to as a kind of supplier-induced demand effect. Each estimated coefficient will finally be a weighted average of these two opposite effects: if it is negative, the patient's price effect dominates the provider's supply effect; if it is positive the supply effect is larger than the patients' price effect.

The basic specification can therefore be written as follows:

$$\ln q_t^i = \alpha + \beta \ln q_t^g + \gamma \ln q_t^s + \delta \ln q_t^h + \varepsilon \ln(P^i/P)_t \qquad (8)$$

where q^i is demand for medical care of type i(per beneficiary)
q^g is consultations with general practitioners (per beneficiary)

q^s is consultations with specialists (per beneficiary)

q^h is hospital bed-days (per beneficiary)

P^i is the patient's price of q^i
P is the consumption price deflator.

The coefficients β, γ and δ can be referred as to *prescription* elasticities whereas ε is the price elasticity. In the following subsections, we will treat the different medical categories in somewhat greater detail and adjust the basic specification (8) wherever necessary.

3.3.2. Prostheses (q^{pr})

We reason here that prostheses are prescribed by general practitioners and/or specialists. Relative prices are also supposed to have an effect upon q^{pr}. The specified relationship is therefore

$$\ln q_t^{pr} = \alpha_7 + \beta_7 \ln q_t^g + \gamma_7 \ln q_t^s + \delta_7 \ln(P^{pr}/P)_t \quad (9)$$

3.3.3. Hospital inpatient care

We make a distinction here between hospital stays due to surgery (q^{hs}) and those due to observation of the patient (q^{ho}). The most important determinants of q^{ho} are prescriptions by general practitioners and specialists. The main determinant of q^{hs} is q^{su}, reflecting the link between acts of surgery and the patient's stay in hospitals due to surgery. The prices of q^{hs} and q^{ho} are added to the equations as well. Note also that, in this case, the more valuable a patient's time is, the less days he is likely to stay in the hospital. We will capture this effect by introducing real income as an explanatory variable. The expected impact is negative in the sense that a higher real income induces patients to ask for a reduction of their hospital stay. The equations are the following:

$$\ln q_t^{ho} = \alpha_8 + \beta_8 \ln q_t^g + \gamma_8 \ln q_t^s + \delta_8 \ln(P^{ho}/P)_t + \varepsilon_8 \ln(Y/P)_t \quad (10)$$

and

$$\ln q_t^{hs} = \alpha_9 + \beta_9 \ln q_t^{su} + \gamma_9 \ln(P^{hs}/P)_t + \delta_9 \ln(Y/P)_t \quad (11)$$

3.3.4. Technical Medical Treatment (q^{tmt})

The equation for q^{tmt} is similar to that for q^{pr}. The only difference is that we introduce q^h as a determinant since acts of physiotherapy and labo-tests are the result of or are complementary with hospital stays. The equation is therefore:

$$\ln q_t^{tmt} = \alpha_{10} + \beta_{10} \ln q_t^g + \gamma_{10} \ln q_t^s + \delta_{10} \ln q_t^h + \varepsilon_{10} \ln(P^{tmt}/P)_t \quad (12)$$

3.3.5. Labo-tests (q^l) and Special care (q^r)

For these types of medical care q^h also figures as a co-determinant in the equations. In the present case, we also test the likelihood that technological advance has induced extra prescriptions for labo-tests and special care by specialists. In other words, supply of new possibilities may create its own demand. In order to account for this possible demand creation, a time trend has been inserted in the behavioral equation.
The equations are:

$$\ln q_t^l = \alpha_{11} + \beta_{11} \ln q_t^g + \gamma_{11} \ln q_t^s + \delta_{11} \ln q_t^h + \varepsilon_{11} \ln(P^l/P)_t + \phi_{11} t \quad (13)$$

and

$$\ln q^r = \alpha_{12} + \beta_{12} \ln q_t^g + \gamma_{12} \ln q_t^s + \delta_{12} \ln q_t^h + \varepsilon_{12} \ln(P^r/P)_t + \phi_{12} t \quad (14)$$

where p^l, p^r and t refer to the prices of labo-tests, special care and the time trend respectively.

3.3.6. Surgery (q^{su}) and Anaesthesia (q^a)

The variable q^s is a first determinant of q^{su} since there is a clear link between specialists' care and the likelihood that a surgical act is performed. The relative price (P^{su}/P) is also among the explanatory variables in the q^{su} equation. The ratio R^s is part of the explanatory variables as well. It is a proxy variable for the ratio of surgeons to total population, that is included in order to test the hypothesis that acts of surgery are performed more frequently as R^s becomes larger. Another explanatory variable is the time trend t that represents a technological trend in the art of surgery. The latter may account for some demand creation, as increasing know-how makes possible a greater variety and frequency of surgery. In view of the above, the specification is

$$\ln q_t^{su} = \alpha_{13} + \beta_{13}\ln q_t^s + \gamma_{13}\ln(P^{su}/P)_t + \delta_{13}\ln R_t^s + \epsilon_{13}t \quad (15),$$

where P^{su} is the price of surgery.

Anaesthesia is viewed as complementary to acts of surgery, whence the following specification was selected:

$$\ln q_t^a = \alpha_{14} + \beta_{14}\ln q_t^{su} \quad (16).$$

3.3.7. Drugs (q^{dr})

The consumption of q^{dr} is explained first by q^h in order to account for the fact that hospital inpatients are important consumers of drugs. Secondly, drugs are prescribed to outpatients by general practitioners and specialists, whence q^g and q^s are introduced in the specification for q^{dr}. Thirdly, a relative price variable may influence the drug consumption.

The specification is therefore

$$\ln q_t^{dr} = \alpha_{15} + \beta_{15}\ln q_t^h + \gamma_{15}\ln q_t^g + \delta_{15}\ln q_t^s + \varepsilon_{15}\ln(P^{dr}/P)_t \quad (17)$$

3.3.8. Kinesitherapy (q^k)

Kinesitherapy is performed mainly upon prescription by doctors and as a complementary service to hospital inpatient care. Therefore q^h, q^g and q^s are included as determinants in the q^k equation. Furthermore, we may again have a relative price effect from (P^k/P). In addition, we will investigate whether there is supplier-induced demand by introducing the ratio of kinesitherapists to beneficiaries (R^k) in the equation. The specification is now

$$\ln q_t^k = \alpha_{16} + \beta_{16}\ln q_t^h + \gamma_{16}\ln q_t^g + \delta_{16}\ln q_t^s + \varepsilon_{16}\ln(P^k/P)_t + \phi_{16}\ln R_t^k \quad (18)$$

3.3.9. Nurses' care of outpatients (q^n)

This type of care to an outpatient is often complementary to a previous stay in a hospital. q^n can also be prescribed by doctors to regular patients, so that q^s and q^g are included as determinants. We will also test whether the relative price is an explanatory factor in this case. The specification is

$$\ln q_t^n = \alpha_{17} + \beta_{17}\ln q_t^h + \gamma_{17}\ln q_t^g + \delta_{17}\ln q_t^s + \varepsilon_{17}\ln(P^n/P)_t \quad (19)$$

3.4. Identities

For each subgroup of beneficiaries, we have the following identities:

$$q_t^g = q_t^{go} + q_t^{gh} \quad (20)$$

$$q_t^s = q_t^{pe} + q_t^{os} \quad (21)$$

$$q_t^h = q_t^{ho} + q_t^{hs} + q_t^{hd} \quad (22)$$

$$E_t^i = q_t^i \cdot P_t^i \cdot B_t \quad (23)$$

$$E_t = \sum_{i=1}^{17} E_t^i \quad (24),$$

where i refers to each of the categories of medical care (including the exogenous ones), where E_t^i refers to the expenditures of category i, and where q_t^{hd}, E_t and B_t are the hospital bed-days per beneficiary (due to deliveries), the total expenditures and number of beneficiaries respectively. Summing E_t of both subgroups will, of course, give us total HIS expenditures.

4. Estimation results

4.1. The data

Data from 1966 to 1980 were used to estimate the equations. The data on medical care are taken from the 'RIZIV-statistieken' published by the 'Ministerie van Sociale Voorzorg'. The other data are taken from various issues of the 'Statistisch Jaarboek van de Sociale Zekerheid' and the 'Statistisch Jaarboek van België'.

Note that the prices of medical care that are directly available in the statistics are those that are reimbursed by the HIS to the patient. In view of the rather stable relationship between the patient's price and the reimbursed costs for medical care over the sample period, we decided to use the latter as proxies for the patient's price, without having to fear large approximation errors. The estimation technique used was basically ordinary least squares.

4.2. The results for categories 1 to 3

(i) The results for the active and the WOPI are presented in Tables 5a and 5b respectively. A first general remark is about the cross-price elasticities. In some equations these were rather difficult to estimate due, primarily, to multicollinearity problems. It was then decided to impose certain coefficient values in the relevant equations. A priori values were obtained by making use of the symmetry condition of consumer demand theory. For instance, between any two medical care commodities, say m and n, the symmetry condition dictates that

$$\left(\frac{\partial q^m}{\partial p^n}\right)_c = \left(\frac{\partial q^n}{\partial p^m}\right)_c \qquad (23)$$

where the subscript c indicates that the cross-price effects are compensated price effects. We now define the cross-price elasticities

$$\varepsilon_{mn} = \left(\frac{\partial q^m}{\partial p^n}\right)_c \frac{p^n}{q^m} \quad (24a)$$

and

$$\varepsilon_{nm} = \left(\frac{\partial q^n}{\partial p^m}\right)_c \frac{p^m}{q^n} \quad (24b)$$

Using (23), we can write (24a) as

$$\varepsilon_{mn} = \left(\frac{\partial q^n}{\partial p^m}\right)_c \frac{p^n}{q^m} \quad (25a)$$

or, using further (24b), as

$$\varepsilon_{mn} = \varepsilon_{nm}\left(\frac{q^n p^n}{q^m p^m}\right) \quad (25b).$$

The way we proceeded further is as follows. We estimated, in an unconstrained way, the equations for categories (2a) and (2b). Taking the estimated price elasticities and subsequently using (25b), we were able to calculate the assigned coefficients. For the ratio of $q^n p^n / q^m p^m$, we used an average of the ratios for 1966, 1974 and 1980.

Secondly, notice that for the WOPI, no estimation results are presented for q^{pl} and q^{od}. The reason is that the time series for these variables displayed an almost constant value throughout the sample period. These variables will therefore be considered as exogenous in our model.

(ii) One can see that the *income effects* are rather important in the demand equations. Only in the case of q^{gh} for the active did we have to impose a value for the income elasticity;

the latter was based upon the result obtained for the WOPI. One remarks that the income elasticities in the case of preservative dental care are persistently higher than for the other types of medical care. Since they exceed unity, it would mean that this type of medical care is a luxury good. Notice also that the income elasticities of the active exceed those of the WOPI. According to us, the latter indicates that income is less of a constraining factor on demand in the case of the WOPI due to the fact that medical care is virtually costless for this subgroup.

(iii) Concerning the *price elasticities*, we were unable to find significant substitution effects between GP's home and office consultations! Substitution effects were obtained between medical care offered by GP's and specialists, however. For instance, in the case of q^{os} for both subgroups, the price effects indicate that patients are more inclined to demand specialists' care if the GP's medical care becomes relatively more expensive. The results also convey that patients demand more pediatric care if the difference in prices of GP's and pediatric care is narrowing. Notice that the price elasticities in the case of dental care are also very significant.

(iv) The results further show that a supplier-induced demand effect could be detected in the case of pediatricians and dentists. The variable CHILD has further a significant impact in the equations for q^{gh} and q^{pe} of the active. The effect of climatic conditions is not to be neglected in the equations for q^{go} and q^{gh}.

4.3. The results for categories 4 to 11

(i) The results in Tables 6a and 6b clearly show, firstly, that there are strong *linkages* among the various medical care categories. The variables q^g and q^s are co-determinants in most equations. The variable q^{su} has a special impact upon q^{hs} and q^a. Hospital stays q^h has significant effects in the equations for q^l, q^{dr}, q^k and q^n. Comparing the results of the WOPI with those of the active, we notice especially that the prescription elasticities in the case of q^{pr} and q^{ho} for the WOPI exceed those for the active. This reflects a higher medical need by the WOPI for these particular types of medical care. Furthermore, we see that the elasticity of q^{su} on q^{hs} is also higher for the WOPI, conveying their need for longer hospital stays due to surgery.

(ii) Secondly, the *price elasticities* indicate that prices seem to matter in the allocation of medical care. Except for q^l and q^{ho} (for the WOPI only), these elasticities are negative. They show that patients or their doctors, being their patients' agents, have a demand for medical care that is price sensitive. The elasticities are especially high in the case of prostheses and kinesitherapy and indicate that strong substitution takes place if these types of medical care get dearer vis-à-vis other commodities. The positive price elasticities in the case of q^l imply that the suppliers strongly influence the demand for q^l. This finding can mainly be explained by the fact that labo-tests are free of charge whence abundant prescriptions do not harm the patient financially. Especially hospitals are known to react positively to price rises in order to boost their incomes. A similar behavior of hospitals can be detected in the q^{ho} equation for the WOPI. The estimation results for this equation convey that hospitals tend to lengthen patients' stay as the price of hospital stays increases. The latter is the result of the particular way in which hospitals are financed; hospitals are namely financed per patient-day whence the incentive to increase the number of hospital days per patient in order to improve the hospital's financial situation. This effect is not general, however: the price effects in equations (5a) and (5b) for the active and in equation (5b) for the WOPI remain negative.

(iii) Thirdly, the *wage effects* in the equations for the active explaining q^{ho} and q^{hs} show that there is tendency to shorten one's hospital stay as the opportunity cost in terms of lost wages in the market increases. The influence of *supplier-induced demand* could be detected in the case of surgery and kinesitherapy. Its impact is especially strong in the equations for q^k. Note that the improvement in medical technology, as captured by a time trend, has an impact on surgery, special care and labo-tests.

4.4. General comments

In general the explanatory power of the equations is rather high. We do find high standard errors of estimate, however, in the case of q^{tmt} for the active and of q^{tmt}, q^k and q^n for the WOPI. Note that in none of the equations the Durbin Watson statistics lead to the conclusion that there is a significant autocorrelation in the residuals. The major drawback from the present study is now, that the sample size is rather small. Abnormal values in such a sample may sometimes result in unattractive estimates. In other words, there is a risk that the estiamtes may not always be robust.

5. Conclusion

The model explained above is estimated using macro-data for all beneficiaries of the insurance scheme for workers. We have been able to show that real income and prices of medical care matter in the allocation of medical care. In some cases we also found effects on demand generated by suppliers of medical care. Furthermore, the progress in medical technology, captured by a time trend, creates extra demand for certain types of medical care. Climatic conditions and the size of the child population also seem to matter in a number of equations.

It is granted that the present paper represents only a first step in the construction of a comprehensive model of the health sector in Belgium. In addition, one could model the market for health personnel and the determination of medical care prices. Studies of the macro-economic type like this one can also be complemented by models using micro-data on patients and suppliers of medical care. Unfortunately, such information is as yet not available in Belgium. Finally, it is evident that the present model can and will be used in forecasting health care expenditures and in simulating alternative government policies.

Table 5a Estimation results of Medical care categories 1 to 3 - Subgroup of the active

Category	Explanatory Variables / Dependent Variables	Constant	WAGE/P	P^j/P	P^{gh}/P^{os}	P^{gh}/P^{pe}	P^{go}/P^{os}	R^j	CHILD	TEMP	Numbers of Observations	DW	SEE	$\bar{R}^2$
1a	q^{go}	-8.4371 (0.5011)	0.8126 (0.0453)				-0.3380 (a)			-0.0159 (0.0109)	14	1.13	0.030	0.893
1b	q^{gh}	-0.7140 (0.2490)	0.2100 (a)		-0.1589 (a)	-0.0586 (a)			0.8129 (0.1652)	-0.0298 (0.0117)	13	1.84	0.033	0.311
2a	q^{pe}	-5.2701 (1.4482)	0.8252 (0.0902)			0.2377 (0.0980)		0.3474 (0.1578)	1.9083 (0.4058)		15	1.82	0.022	0.963
2b	q^{os}	-3.2746 (2.3726)	0.3384 (0.2078)		0.1337 (0.2154)		0.3823 (0.2838)				15	2.17	0.018	0.986
3a	q^{pd}	-8.7403 (2.6980)	1.3163 (0.3385)	-0.6306 (0.3831)				0.4059 (0.1094)			15	1.67	0.053	0.956
3b	q^{od}	-0.3375 (1.2520)	0.1661 (0.0386)	-0.4481 (0.1776)							15	1.61	0.015	0.916

Notes: 1. All variables are expressed in natural logarithms. 2. The figures below the coefficients are standard errors. 3. The superscript j refers to the demand category j estimated. 4. DW, SEE and $\bar{R}^2$ are the Durbin-Watson statistic, the standard error of regression and the coefficient of determination (corrected for degrees of freedom) respectively. 5. The symbol a indicates that the coefficient value has been assigned.

Table 5b Estimation results of Medical care categories 1 to 3 - Subgroup of the W.O.P.I.

Category	Explanatory Variables / Dependent Variables	Constant	PENSION/P	P^j/P	P^{gh}/P^{os}	P^{go}/P^{os}	TEMP	Number of Observations	DW	ρ	SEE	$\bar{R}^2$
1a	q^{gc}	-0.1560 (0.8208)	0.0948 (0.0778)			-0.2630 (a)		15	0.971	0.6490	0.022	0.282
1b	q^{gh}	-0.1256 (0.3503)	0.1814 (0.0335)		-0.0256 (a)		-0.0173 (0.0089)	14	1.15		0.025	0.691
2b	q^{os}	-1.2795 (1.2135)	0.1872 (0.1074)		0.0625 (0.0357)	0.2502 (0.1430)		15	1.68		0.021	0.937
3a	q^{pd}	-12.5998 (0.6765)	1.2680 (0.1757)	-0.4704 (0.2926)				15	1.50		0.052	0.947

Notes: 1. See the notes of Table 5a 2. ρ is the coefficient of first-order autocorrelation between the residuals. An iterative technique was used to calculate ρ;iterations were stopped at the point where the DW indicated absence of autocorrelation.

Table 6a Estimation results of medical care categories 4 to 11 - Subgroup of the active

Category	Explanatory variables / Endogenous variables	constant	q^g	q^s	q^h	q^{su}	P^j/P	WAGE/P	R^j	t	Number of Observations	DW	ρ	SEE	$\bar{R}^2$
4	q^{pr}	4.3861		0.1495			-1.0905				14	2.25		0.024	0.982
		(0.2743)		(0.0565)			(0.0500)								
5a	q^{ho}	2.2911	0.2331	0.5440			-0.0333	-0.2999			13	2.42		0.017	0.653
		(1.0610)	(0.0624)	(0.1457)			(0.0113)	(0.1019)							
5b	q^{hs}	2.1462				0.7200	-0.1871	-0.1174			15	2.17		0.020	0.691
		(1.1964)				(0.1340)	(0.0566)	(0.1152)							
6	q^{tmt}	1.4905	1.8924	1.2616	0.2103		-0.9768				15	1.02		0.103	0.953
		(1.6629)	(0.4116)	(0.2744)	(0.0457)		(0.2911)								
7a	q^l	-5.0067	0.3323	0.5697	1.3292		0.8130			0.1510	15	1.60		0.049	0.995
		(1.2234)	(0.0855)	(0.1466)	(0.3421)		(0.2524			(0.0092)					
7b	q^r	2.3000	0.0431	0.1725	0.0739		-0.4609			0.0639	15	1.54		0.027	0.991
		(0.8777)	(0.0385)	(0.1540)	(0.0659)		(0.1567)			(0.0063)					
8a	q^{su}	2.5597		0.3019			-0.1657		0.4160	0.0182	15	2.57		0.012	0.993
		(0.6921)		(0.1586)			(0.1066)		(0.1056)	(0.0081)					
8b	q^a	-2.2609				0.6040					15	1.36	0.7082	0.029	0.941
		(0.1549)				(0.1623)									

Table 6a (continued)

Category	Explanatory variables / Endogenous variables	Constant	q^g	q^s	q^h	q^{su}	p^j/P	WAGE/P	R^j	t	Number of Observations	DW	ρ	SEE	$\bar{R}^2$
9	q^{dr}	-0.0110 (0.0154)	0.5120 (0.2101)	0.5632 (0.2311)	0.2150 (0.0882)		-0.3471 (0.2449)				13	1.88		0.035	0.277
10	q^k	12.4655 (1.6885)	0.6761 (0.3141)	0.2897 (0.1346)	0.4507) (0.2094)		-1.5888 (0.3011)		0.8934 (0.0819)		14	1.71		0.043	0.975
11	q^n	0.3723 (1.6560)	1.1136 (0.4909)	1.0567 (0.5010)	0.4772 (0.2104)		-0.6666 (0.4165)				14	1.89	0.5417	0.039	0.780

Notes: See the notes of Tables 5a and 5b.

Table 6b Estimation results of medical care categories 4 to 11 - Subgroup of the WOPI

Category	Explanatory variables / Endogenous variables	constant	q^g	q^s	q^h	q^{su}	p^j/P	R^j	t	Number of Observations	DW	ρ	SEE	$\bar{R}^2$
4	q^{pr}	4.3153 (0.2245)	0.3140 (0.0448)	0.7326) (0.1045)			-1.1186 (0.0177)			14	2.23		0.025	0.998
5a	q^{ho}	-3.7527 (1.2409)	0.7877 (0.5138)	0.9878 (0.4603)			0.4042 (0.1003)			15	2.20		0.040	0.970
5b	q^{hs}	1.7741 (0.7456)				1.2070 (0.2052)	-0.1903 (0.1044)			15	2.47		0.042	0.935
6	q^{tmt}	1.1275 (1.6410)	0.3879 (0.2325)	0.2586 (0.1550)	0.5818 (0.3488)		-0.2174 (0.2425)			15	0.91	0.8542	0.059	0.985
7a	q^{l}	-8.0553 (1.3150)	0.3316 (0.1184)	0.5685 (0.2030)	1.3264 (0.4736)		1.2671 (0.2411)		0.1181 (0.0289)	15	1.25		0.050	0.995
7b	q^{r}	3.3759 (0.6539)	0.0718 (0.0181)	0.2871 (0.0726)	0.1230 (0.0311)		-0.6122 (0.1355)		0.06 (a)	15	1.30		0.028	0.989
8a	q^{su}	1.8680 (0.6430)		0.5064 (0.1843)			-0.1086 (0.0594)	0.3247 (0.0711)	0.0314 (0.0056)	15	1.64		0.011	0.996
8b	q^{a}	-2.4917 (0.0578)				0.6774 (0.1307)				15	1.62	0.6798	0.029	0.967

Table 6b (continued)

Category	Explanatory Variables / Endogenous Variables	constant	q^s	q^s	q^h	q^{su}	p^j/p	R^j	t	Number of Observations	DW	$\dot{\rho}$	SEE	$\bar{R}^2$
q	q^{dr}	-0.0197 (0.0192)	0.4506 (0.2514)	0.4957 (0.2765)	0.1893 (0.1056)		-0.0897 (0.2921)			13	2.03		0.034	0.106
10	q^k	10.8749 (4.7996)	0.2169 (0.1756)	0.0964 (0.0780)	0.8678) (0.7024)		-1.0749 (0.3662)	0.8766 (0.3860)		14	1.22		0.065	0.978
11	q^n	1.5057 (3.0153)	1.2037 (0.4432)	0.3009 (0.1108)	0.8024 (0.2955)		-0.8424 (0.7968)			14	0.94	0.7025	0.075	0.900

Notes : See the notes of Tables 5a and 5b.

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