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HOSPITAL UTILIZATION IN BELGIUM

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In this paper we concentrate on the utilization of hospital facilities. Feldstein M.S. analysed this part of the medical care system for the US and the UK (4,5). A similar analysis was made for the Netherlands by J. van der Gaag, F.F.H. Rutten and B.M.S. Van Praag (7). In this research we attempt to estimate a preliminary econometric model for the Belgian hospital system.

HEALTH INSURANCE SYSTEM

In Belgium, insurance against illness and invalidity is compulsory by legislation (*). Employees have an all-risks insurance, whereas for self-employed only large-risks insurance is compulsory. Large risks policies cover hospital care and specialised services; all-risks policies cover all medical care and pharmaceutics. As the present study deals with the utilization of hospital facilities and as all persons are at least covered by a large-risks insurance contrary to other research, insurance as such does not enter into the analysis as a variable (4,7).

All employees are covered by an insurance against income losses due to illness. The degree of coverage differs somewhat between white-collars and blue-collars (**). Self-employed, however, do not enjoy such substitution income.

(*) Law of 9 August 1963 and a special law for self-employed of 1967.

(**) In case of disability to work, blue-collars receive 100 percent of their wages during the first week, 90 percent the second week and 60 percent thereafter. White-collars receive 100 percent of their salary during the first month of disability and 60 percent for subsequent months.

HOSPITAL LEGISLATION (1)

For the present purpose, it is sufficient to indicate merely the essential characteristics of hospital regulations, viz. those affecting the financing of investments and exploitation.
In 1963 a first attempt to regulate the hospital sector was made by the so-called "Custers-act". An indicative norm of beds per 1000 population was put forward. Hospitals were granted an investment subsidy, provided they were within the planning norms.

In 1973 a new act transformed indicative planning into imperative planning, so that all hospital investments were subject to government regulation. The financing of hospital exploitation is based on a compensation per patient-day. Three categories of hospitals are distinguished: ordinary, special and university hospitals. Each category has a particular compensation scheme.

MODEL

The subject of this paper is the utilization of hospital facilities, characterised by admissions and mean stay. It is well-known that at the level of hospital care, suppliers - more than consumers - determine the nature, quality and quantity of demand (3,6). Consequently, supply variables such as the capacity of the hospital system will enter into the decision-making process. On the other hand, it is evident that epidemiological factors will co-determine demand for hospital care.

Admissions depend first of all upon the disease pattern of the population (2). Two demographic variables viz. age and sex explain the larger part of the variation in the disease pattern . Some diseases more frequently attack older people, while for obstetrics younger women are important. For this reason we have included two age-sex variables: persons older than 60 years and females older than 15 years. These groups are the most frequently admitted at hospitals, as can be seen from the next table.

Table I. Age-sex structure of patients (1975)

Age \ Sex	ADMISSIONS/1000 Males	Females	Total
< 15	95.1	74.1	84.8
15-60	83.6	137.9	110.6
> 60	211.2	169.8	187.1
all ages	106.3	130.9	118.8

In this model income is entered as an explanatory variable for admissions. However, it is likely that income captures different opposing effects and is closely related at least to the age composition of population. On a priori ground one can argue that income has a negative influence on admissions for two reasons. First, higher income is usually associated with better hygiene and most important with more intensive use of first level medical care. Second, although the health insurance system dampens income losses due to illness, income reflects the opportunity cost of hospitalization.
As there is a difference in insurance coverage against income losses between employees and self-employed, it is clear that self-employed will be reluctant to hospital admission. Consequently, the number of self-employed per 1000 population is included as an explanatory variable.

Population density might be seen as a proxy for the willingness of patients to substitute home care for hospital care. These willingness to substitute home care for hospital care probably increases with greater distances between home and hospital facilities, fewer means of transportation, etc. Urbanization could be used to capture the same effects.

Concerning supply factors we incorporated the availability of general practitioners, specialists and beds. The relation between the availability of general practitioners and hospital admissions is somewhat ambiguous. Large availability of G.P.'s and consequently extensive home care possibilities will reduce hospital utilization as first line care and hospital care are substitutes to a certain extent. On the other hand, oversupply of general practitioners might lead to intensive examination of the patient and more referals to specialists (5). The relation between the availability of specialists and hospital admissions is positive due to the complementarity of specialists and hospital production.

Finally, bed availability should be introduced into the model as a possible capacity constraint. If beds are a scarce resource this will act as a break on the number of admissions and a positive coefficient will show up. In case of sufficient bed supply the influence of this variable will be small and insignificant.

The second endogenous variable is mean stay. It is evident that mean stay will predominantly be influenced by the nature and the seriousness of the disease. Unfortunately, data on morbidity are insufficiently accurate to include this variable into the model. Furthermore, it is unlikely that - apart from the age-sex structure of the population - morbidity varies within the country. Consequently, the age and sex composition of the population are used as proxy variables for the disease pattern. The expected sign for age is positive i.e. the older the patient the longer duration of hospitalization, while the share of females between 15 and 40 years of age is inversely related to mean stay due to deliveries.

The effect of income on mean stay is ambiguous. The same holds for the professional status (employed or self-employed) of the patient. One might argue that the higher the income the larger the opportunity cost of hospitalization and hence, the shorter the hospital stay will be. On the other hand,one might expect longer stay for higher income classes and for self-employed. As they are more reluctant to hospitalization - due to the higher opportunity cost in terms of lost income - it is likely that they will only be admitted in case of more serious diseases.

For population density a similar argument as for admissions holds here. The availability of general practitioners will have a negative effect on mean stay. Care by general practitioners is a substitute for hospital care. The likely effect of the availability of specialists on mean stay is also negative. More specialised care is likely to reduce the duration of hospital treatment. Furthermore, a substitution effect holds here too, albeit to a much smaller extent in comparison with general practitioners.

The number of beds available is entered as an explanatory variable for mean stay. It is clear that if there is a shortage of beds this will reduce mean stay. Hence, the larger the capacity constraint the larger will be the coefficient of the bed availability variable.

Finally, the number of admissions is included as an explanatory variable for mean stay. Hospitals 'produce' a quantity of patient-days, i.e. admissions multiplied by mean stay. On the one hand, production is bounded by available resources, i.e. beds, physicians, nurses, equipment, etc... and by certain standards of medicine. However, institutional-economic incentives influence hospital care production. Hospitals are paid a fixed amount per patient-day (see laws of 1963 and 1973). This method of hospital care financing might induce hospital management to produce at least that quantity of patient-days that balances the budget. It is plausible that in search of this budgetary equilibrium a trade-off between admissions and mean stay is made. A fall (rise) in admissions can be compensated with a rise (fall) in mean stay in order to balance the budget. Hence, the expected sign of admissions is negative.

The resulting recursive model is defined by equations (1) and (2).

$$ADM = A(GP,SP,BED,OLD,FEM1,INC,DEN^{-1},SELF) \quad (1)$$

$$MS = M(GP,SP,BED,OLD,FEM2,INC,DEN^{-1},SELF,ADM/BED) \quad (2)$$

where ADM = admissions per 1000 population
MS = mean stay
GP = general practitioners per 10 000 population
SP = specialists per 10 000 population

BED = acute beds per 1000 population

OLD = persons of 60 years and older per 1000 population

FEM1 = females of 15 years and older per 1000 population

FEM2 = females of 15 years to 39 per 1000 population

INC = mean income per capita (in 1000 B.fr.)

DEN^{-1} = area per 1000 population (km^2)

SELF = self-employed per 1000 population

DEFINITION OF VARIABLES AND DATA

The model is estimated on cross-section data. For the year 1975 a complete set of data on all variables is available covering 43 administrative districts (*). Two districts however had to be excluded as no hospital facilities were located in the area (**).

The endogeneous variables are admissions (ADM) according to place of residence of the patient per 1000 population and mean stay (MS) in days according to place of hospitalization (***). Admissions cover all sectors of hospitalization i.e. acute, geriatric, psychiatric, specialised services and sanatoria. Mean stay covers only the acute sector (****).

The number of beds (BED) is expressed per 1000 population and covers only the acute sector. General practitioners (GP) and specialists (SP) (with a private practice) are expressed per 10 000 population.

Admissions are entered in the mean stay equation as the number of patients per bed in the acute sector.
All these statistics are computed from data published by the Ministry of Public Health.

(*) Belgium is administratively organised in 9 provinces and 43 so-called "arrondissements". The largest district is Brussels and has about one million inhabitants; the smallest is Bastenaken with an habitation of 3500.

(**) Philippeville and Diksmuide.

(***) Data on mean stay according to place of residence of the patient are not compiled.

(****) The acute sector data cannot be isolated from admission statistics, whereas on mean stay only acute sector data are available.

The income variable (INC) is taxable income per capita in thousand B.fr. The age-sex composition variables are the number of persons of sixty years and older per 1000 population (OLD), the number of females of 15 years and older per 1000 population (FEM1), and the number of females between 15 and 40 years of age per 1000 population (FEM2).

The inverse of population density is entered into the regressions and is defined as the area per thousand population (DEN^{-1}). These statistics are based on published and non-published date of the National Institute of Statistics.

Finally, the number of self-employed per 1000 population was derived on statistics published by the National Institute for Social Security of Self-employed. The data are reported in appendix .

REGRESSION RESULTS

The equations, estimated by means of OLS, are linear in the logarithms of the variables. Consequently, coefficients may be interpreted as elasticities. In Table II estimation results are summarised.

Table II. Regression results (*)

	GP	SP	BED	OLD	FEM	INC	DEN^{-1}	SELF	ADM/BED	Cst	$\bar{R}^2$
ADM	.028	.088	.016	-.181	1.712	-.915	-.042	-.121	-	.002	.39
	(.118)	(.057)	(.046)	(.305)	(1.312)	(.231)	(.031)	(.101)		(2.833)	
MS	-.141	-.021	.043	.851	2.337	-.255	-.035	.085	-.614	-4.695	.74
	(.121)	(.060)	(.061)	(.331)	(1.054)	(.272)	(.030)	(.088)	(.139)	(3.054)	

(*) $\bar{R}^2$ = coefficient of determination corrected for degrees of freedom

Standard errors between brackets

The estimation results for admissions are fairly poor compared with the results for mean stay. However, apart from results found by J. van der Gaag et al (7) for the Netherlands, the quality of the regressions is comparable with other research findings (*). Most coefficients have the expected sign, but standard errors are fairly large.

The substitution between home care and hospital care does play a role through mean stay. This can be derived from the negative coefficient of GP in the regression on mean stay. The coefficient of GP in the regression on admissions is almost negligible. The coefficient of specialist, although small, has the expected sign in both regressions. Specialist have a small positive effect on hospital admissions, whereas their availability reduces mean stay slightly.

The supply of beds does not have an important effect on admissions. The net effect of bed availability on mean stay however, is important. If one combines the coefficients of the BED and ADM/BED variable, the total elasticity of bed availability is .657. The difference between our results and other research findings e.q. for the US, UK and the Netherlands (*)(**), is striking. In those cases bed availability had an important effect on admissions (elasticities ranging from .40 to .60) as well as on mean stay (elasticities from .20 to .40). In our regressions bed supply has almost no influence on admissions contrary to its effect on mean stay, which is very large. One might argue on the basis of these results that there is a tendency for oversupply of beds. This is also suggested by direct comparison of bed supply between countries (Table III.).

(*) See Feldstein M.S. (4,5)

(**) See van der Gaag J. et al. (7)

Table III. Bed availability per 1000 population

UK	4.87 and 5.06 in 1960 (*)
Netherlands	4.45 (1971) and the norm is 4 (**)
Belgium	5.16 (acute sector) and 8.93 (all sectors)

(*) see Feldstein M. (4,5)

(**) see van der Gaag J. et al. (7)

The budgetary incentive introduced by institutional arrangements with regard to hospital financing has a significant effect. Perfect manipulation of the budgetary trade-off between mean stay and admissions would lead to an elasticity of -1. The regression results show a lower, but still important elasticity between the two variables, e.q. -.61. One can say with a high degree of conficence (95 %) that the value of this elasticity lies between -.35 and -.85. Apparently, a rise or decline in the number of admissions is compensated, but not in full, by the inverse reaction on mean stay.

The sex composition variable in the admission regression and the age variable in the mean stay equation have the right sign and their effect is considerable. However the influence of age on admissions and of sex composition on mean stay is contrary to expectations. A probable explanation is that the age-sex variables are very collinear.

Income has a substantial and statistical significant effect on admissions as is expected. It is likely that higher income classes make more intensive use of first and second level medical care. Furthermore, they have an higher opportunity cost of hospitalization. This opportunity cost effect also works out in the regression on mean stay.

Self-employed, having a much higher opportunity cost of hospitalization due to the different insurance system against income losses, are clearly less frequently admitted. On the other hand, once they are in the system, the duration of stay seems to be somewhat larger.

Population density - affecting the willingness of patients to substitute home for hospital care - has the expected sign in both regressions.

CONCLUSIONS

From this preliminary analysis some tentative conclusions may be put forward. It is clear from the results that hospital utilization largely depends upon epidemiological characteristics. Age-sex composition variables account for 84 percent of total explained variance in admissions and for 64 percent in mean stay. However, economic factors still have an important influence on hospital utilization.

First, we found that a trade-off exists between admissions and mean stay due to the incentive structure of hospital financing legislation. A one percent decrease in admissions is compensated by a .6 percent increase in mean stay.

Second, there is an indication of substitution between hospital care and first-line care. A ten percent increase in the number of GP's would lead to a decrease in mean stay of about 1.6 percent (*), but has almost no effects on admissions.

Third, bed availability does not seem to have an effect on admissions, which is contrary to other research findings. This suggests sufficient supply of hospital facilities.
However, the quality of the regressions is rather poor in order to draw firm conclusions. Additional research based on disaggregate data, should improve evidence on substitution and supply effects.

(*) This result is derived from the reduced form.

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APPENDIX: DATA

Districts	ADM	MS	GP	SP	BED	OLD	FEM1	FEM2	INC	DEN^{-1}	SELF	ADM/BED
1. Antwerpen	117	13.28	8.20	7.60	6.05	197.4	406.6	168.8	125.2	1.08	56.52	20.71
2. Mechelen	109	14.04	7.31	4.58	6.22	190.7	395.8	170.5	103.8	1.76	61.18	21.34
3. Turnhout	107	10.61	6.67	3.54	3.81	135.2	360.1	186.3	93.8	3.97	56.57	25.41
4. Brussel-Hfdst.	137	10.27	14.97	18.21	5.48	227.9	437.1	161.2	138.1	.15	58.72	26.86
5. Halle-Vilvoorde	99	13.20	9.09	4.59	1.55	174.5	394.9	175.9	124.4	1.91	61.13	23.73
6. Leuven	98	11.81	17.54	9.74	6.47	178.7	393.5	176.4	108.6	2.89	61.60	25.69
7. Nivelles	109	11.20	12.24	11.52	2.53	182.9	398.9	176.3	130.4	4.28	55.88	23.35
8. Ath	132	12.37	8.44	4.69	4.01	228.6	409.1	155.1	90.9	6.57	72.53	28.70
9. Charleroi	153	12.65	8.98	8.48	6.96	199.3	407.5	162.6	97.0	1.23	41.98	24.81
10. Mons	133	11.90	8.64	6.21	4.75	208.0	417.5	163.4	91.5	2.33	45.50	27.31
11. Mouscron	163	14.92	7.52	4.51	4.87	218.1	408.8	163.2	86.5	1.39	55.02	25.79
12. Soignies	137	12.56	8.61	6.67	5.30	209.5	405.0	162.2	97.6	3.04	52.19	23.42
13. Thuin	124	10.11	9.66	6.64	1.40	201.6	403.2	165.3	89.6	6.58	59.58	29.54
14. Tournai	142	14.09	8.86	7.33	6.07	223.8	404.8	157.0	91.1	4.08	65.05	22.27
15. Huy	118	11.64	9.89	6.21	3.23	219.1	409.9	162.3	102.4	7.48	58.67	29.53
16. Liège	120	11.12	13.39	11.61	4.80	199.9	410.1	164.3	114.3	1.23	47.26	25.90
17. Verviers	110	12.62	9.14	6.56	4.76	197.2	398.6	164.3	98.0	8.28	76.34	21.01
18. Waremme	107	12.65	9.57	1.68	2.17	234.4	421.6	160.2	102.8	6.52	67.63	23.72
19. Hasselt	124	15.13	7.03	5.54	6.94	115.2	360.7	193.0	95.8	2.72	52.20	21.85
20. Maaseik	113	12.92	5.31	2.15	3.89	102.8	349.0	199.3	84.6	5.08	52.75	20.76
21. Tongeren	115	15.33	5.14	2.63	3.57	141.0	369.0	187.4	85.9	3.69	67.69	20.11
22. Arlon	117	9.33	7.49	5.46	3.52	178.8	392.3	168.7	86.7	6.50	53.53	33.03
23. Bastogne	113	8.20	8.11	4.35	3.91	202.9	385.5	159.4	73.1	28.66	121.33	32.61
24. Marche-enFamenne	110	9.84	9.44	3.23	2.17	199.5	394.0	159.6	86.9	23.36	99.91	32.39
25. Neufchateau	108	9.53	9.10	4.93	1.44	207.3	399.3	165.4	85.5	27.64	92.71	42.72
26. Virton	134	9.16	10.78	3.51	2.58	206.6	396.7	164.3	85.3	16.82	70.84	39.37
27. Dinant	128	14.89	11.25	5.51	6.89	202.3	404.7	170.6	89.1	18.47	81.03	18.81
28. Namur	128	10.26	12.68	8.85	4.76	195.9	403.0	166.9	103.8	4.61	56.45	27.97
29. Philippeville	124	-	9.52	2.84	.40	187.9	380.8	156.0	86.0	16.20	69.67	-
30. Aalst	99	16.42	7.28	3.92	5.31	188.4	393.6	168.7	99.0	1.78	65.05	18.66
31. Dendermonde	96	12.05	7.20	2.42	3.27	185.3	385.9	169.6	96.2	1.92	68.72	21.88
32. Eeklo	108	15.09	8.13	2.52	3.12	200.9	385.7	166.5	96.0	4.10	76.79	23.19
33. Gent	106	14.97	12.04	9.18	7.47	208.8	403.1	165.4	110.3	1.93	67.72	17.49
34. Oudenaarde	110	17.66	8.64	4.36	5.90	225.6	413.0	167.9	95.1	3.68	74.93	17.45
35. Sint-Niklaas	98	15.15	7.23	4.84	5.06	183.7	387.8	174.3	102.8	2.33	67.47	19.71
36. Brugge	124	15.47	10.55	7.13	8.22	181.4	392.9	175.5	105.9	2.62	72.26	20.28
37. Diksmuide	116	-	8.42	0.86	-	182.4	379.9	163.1	19.4	6.98	106.06	-
38. Ieper	137	16.04	7.53	4.29	4.52	189.3	390.1	165.6	84.1	5.22	93.24	20.86
39. Kortrijk	126	14.75	8.57	5.71	7.06	178.8	387.4	173.2	101.0	1.50	69.35	21.31
40. Oostende	94	17.56	7.91	6.77	6.15	195.2	402.5	170.0	103.2	2.20	68.12	22.05
41. Roeselare	128	16.28	8.33	5.79	8.13	175.6	385.7	173.5	98.9	2.09	85.47	18.78
42. Tielt	103	16.60	7.11	2.84	3.43	183.9	374.3	169.7	89.8	3.95	107.22	20.17
43. Veurne	115	12.97	11.46	4.30	3.24	200.9	403.7	168.0	94.1	6.37	100.41	27.73