What are the profiles and the determinants of physicians' activity? An empirical study.

The case of French GPs.

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1. Introduction

In the French health care system, both general practitioners (GPs) and specialists can choose private practice. They are paid on a fee-for-service basis. Physicians' federations and public health insurance funds negotiate fee schedules for each medical act. Three quarters of physicians receive their income from regulated fees only; their contractual status is called sector 1 (fully-regulated). Almost a quarter can charge fees without restriction above the regulated scale of charges; their contractual status is called sector 2 (free-pricing)[1]. Fees and surcharges are paid directly by the patient to the physician.

For each act, the conventional fee is the basis of reimbursement to the patient by his or her public health insurance and, for the co-insurance portion, by his or her private or mutual complementary insurance. Some complementary insurance companies also refund surcharges. A very minor group of physicians have no agreement with health insurance funds. In that case, patients are paid back at a very low level (barely 1 euro for a consultation charged 20 euros by general practitioners).

Within this framework, private physicians can practice freely, and they perform a number of different acts, providing consultations, making home visits (in the case of GPs), and providing technical services (particularly in the case of certain specialists). The volume of a physician's activity depends on his or her own decisions, on patients' demand, and on clientele size. Income depends on the volume and structure of activity in sector 1, and on the level of fees in sector 2.

[1] This sector was introduced in 1980 for all physicians. Since 1990, only specialists with particular in-hospital training can opt for this sector 2.

Private physicians' activity is not often investigated in the economic literature. A number of studies have given descriptive statistics about activity volume (*cf.* DREES n°9, 44, 83, 114, CNAMTS n° 23, 30, 108) or physicians' income (*cf.* DREES n°3, 15, 89, 146, 254, CREDES n°1321, CERC, 1994). Others have developed economic models focusing on physicians' activity. The traditional question of demand inducement is one way to explore physicians' activity (Delattre & Dormont, 2000, Rochaix, 1993, Rochaix & Largeron, 1989). The nature of the market for private medical services is another way to investigate physicians' decisions (Sloan, 1979, Wong, 1996). In France, the contractual choice of the physician has also been studied (Carrère, 1991, Lancry, 1989, Dubec & al., 2003), as have prescription practices (Lancry & Paris, 1997).

In these studies, physicians' activity is analysed assuming standard behaviour and through a one-dimensional variable, such as number of acts, levels of fees, or annual income. A notable exception is Delattre's study (2000), which sets out an indicator of activity that combines the proportion of technical acts and the level of fees. Nonetheless, in all cases, the question is then to identify the economic determinants of the dependant variable. The standard behaviour hypothesis becomes dissatisfying once we recognise the diversity of behaviours inherent in medical specialisation, in patients' characteristics, in motivations (Croxson & al., 2001, Hellinger, 1996, Davis & al., 2000), and in medical and economic context (Mossé, 1997, Ryan, 1994, Darbon & Letourmy, 1989).

The purpose of our empirical study is to test an alternative hypothesis. We assume that private physicians are not homogeneous in their motivations, their practical decisions, and their reactions to regulatory policies. We also assume that their activity cannot be explained through a one-dimensional model. The level of fees and the number of acts by physician are both indicators of activity; the number of acts by patient, the structure of activity, or the level of prescriptions are also indicators of this activity. Besides, we assume that not only economic determinants but also professional rules and economic and medical contexts influence a physician's decisions.

In order to test our hypothesis, we set out an empirical study focusing on physicians in two regions of France (Aquitaine and Burgundy). We used two complementary methods to test the heterogeneity of private physicians' behaviours: a cluster analysis to identify different practising profiles and econometric tests to exhibit the determinants of the multidimensional physicians' activity.

In the present paper, we focus on general practitioners, and we comment on the results relative to the heterogeneity hypothesis. The data we consider concern 4700 GPs of the two

regions and their activity for the year 2000. Our results show different ways of practising the same profession: among GPs, the clustering method shows that different groups can be distinguished according to their type of practice; otherwise, econometric results show that two different models can be drawn in order to understand rural GPs, on one hand, and urban GPs on the other.

2. Methods and models

Our empirical study focuses on supply behaviour in the private medical services market. The subject of our analysis is the individual activity of the physician, hereafter referred to as the GP. We assume that this individual activity is multidimensional. From an economic point of view, we can measure this multidimensional activity through the following variables: volume and structure of activity; fees and surcharges; and biological and pharmaceutical prescriptions. The number of acts is measured by both physician and patient. By physician, it indicates workload, which depends on personal motivations for work, available time, and size of clientele. The percentage of home visits made also gives an indicator of the GPs workload and, moreover, of the structure of his or her activity[2]. By patient, the number of acts indicates the intensity of health care. It depends jointly on demand and supply determinants: in making medical decisions, physicians may respond to personal motivations (for example, according to the demand inducement hypothesis, physicians can multiply the number of acts in order to increase their income) or to patients' demands and medical needs. Prescription decisions similarly depend on supply and demand determinants. For instance, we will see that physicians may adjust the length of consultation time and the length of prescription order.

As stated above, we assume physician behaviour to be heterogeneous. To understand their activity, then, we must take into account the diversity of these behaviours, diversity inherent in motivations, in clientele characteristics, and in social and economic context.

This diversity can be investigated through classifying variables such as specialization, gender, or location. For GPs, we set up different models of behaviour for rural and for urban physicians[3], since we assume that the behaviours, motivations, and decisions of rural GPs differ from those of urban GPs. In the range of determinants assumed to affect physicians'

[2] We have set out a specific indicator of the economic and technical intensity of the activity of specialists. See Béjean & Peyron 2002.

[3] For the specialists, we have set up different models for sector 1 and sector 2 practitioners.

behaviours, the influence and strength of one determinant may vary across physicians' categories and across different dimensions of their activity.

Another way to investigate diversity in behaviours is given by different clustering methods. Non-hierarchical clustering methods can produce homogeneous sub-groups inside a heterogeneous population: the aim is to identify these sub-groups according to selected variables. For GPs, we undertake such a classification in order to draw different "practising profiles". To our knowledge, this method has never been used to study medical decisions or physician activity. The variables chosen in order to set up the cluster analysis reflect the different dimensions of GP activity and supply. The classification is then interpreted and analysed through the variables that presumably influence this activity.

Cluster analysis

Classification has been carried out with a method of dynamic clustering. Clusters are formed by gradually maximising each cluster's homogeneity (Cubic Clustering Criterion) and maximising as well the discrimination performed by the analysis (Pseudo F Criterion)[4]. The clustering results depend on the choice of variables used for analysis. In our study, the clustering variables reflect the volume and structure of a GP's activity (number of acts, percentage of home visits); his or her clientele and the intensity of health care supplied by patient (clientele size, number of acts per patient, average total cost per patient); and prescription behaviour (percentage of patients with prescriptions in the period, average pharmacy cost per patient, average biology cost per prescription order).

The number of clusters may vary from 2 to 7. In our study, the statistical criteria (minimal distance inside each cluster and maximal distance between clusters) require selecting 4 clusters. This method gives several sets of clusters. The analyst has to choose one of them according to statistical criteria. This choice remains partly subjective, although all clustering results we have analysed exhibit the same characteristics. Differences between clustering results are for the most part minor.

The cluster analysis has been carried out on all GPs of each region separately. In the present paper, we will present the results for GPs living and working in Aquitaine.

The analysis gives 4 clusters that gather physicians sharing the same type of activity. These types represent dominant trends and not pure types. They must be interpreted by analysing the characteristics of each cluster. Individual characteristics of the physician (age, gender, seniority, contractual status), clientele characteristics (age, percentage of non-paying patients,

[4] See Chaudon & Pinson 1981 for more precision about this clustering method.

and so on), spatial context of the location (rural/urban, socio-economic characteristics of the population), and level of fees and surcharges can be used to analyse and specify each cluster.

Econometric analysis:

Econometric analysis is used here in order to make apparent regularities and correlations between variables that are supposed to influence physicians' behaviour. We do not want to measure the parameters of a theoretical maximising model supposed *a priori* to be true but to draw and test what can be related to the activity decision. We therefore adopt one of the epistemological stands facing statistics described by Desrosières (2000). We used econometric analysis in order to identify the determinants of GPs' activity and to test heterogeneity among rural and urban GPs. As noted above, we assume physicians' activity to combine different decisions: decisions relative to workload, activity volume, and income, decisions relative to the willingness to accept home visits, and prescription decisions. For each category of GP, 5 models have been estimated by the OLS method, using a stepwise regression to select the significant variables. The dependant variables are the following:

- Annual number of acts per GP
- Average number of acts per patient
- Percentage of home visits
- Average pharmacy cost per patient with prescriptions
- Average pharmacy cost per prescription order

Independent variables reflect individual characteristics of the GP, characteristics and size of the clientele, and medical and economic context. In some models, some activity variables assumed to be effective are added to the independent variables. For instance, the total number of acts is assumed to affect the percentage of home visits: urban GPs may refuse to make home visits if their income and workload are satisfying, whereas workload and proportion of home visits are positively connected for rural GPs because they cannot refuse home visits in rural areas.

Our empirical study associates these two complementary methods, econometric modelling and clustering, to explore the hypothesis of heterogeneity among GPs. These methods require individual data about GPs' activity.

3. Description of the data

For the year 2000, the data we consider concern 4695 GPs of the regions of Aquitaine (3225 GPs) and Burgundy (1470 GPs). This sample represents 95% of all private GPs registered in those regions. We concentrate on GPs strictly speaking (APE "à part entière"), i.e., physicians who began their activity before January 1, 1998, who are under 65 years old, who don't work full-time in hospitals, and who have a contract with health insurance funds. The data set is from the URCAM (health insurance groups) of Burgundy and of Aquitaine. It includes individual characteristics of the physicians, activity variables, and characteristics of the clientele. Data about spatial, medical, and economic context are from the data base supplied by the French national statistical institute (INSEE). Table 1 gives the list of the variables used in the clustering and econometric analyses.

Insert Table 1.

The health and medical contexts of Aquitaine and Burgundy are quite different. Aquitaine is a region where physician density is very high (345 physicians of all categories per 100 000 inhabitants in Aquitaine, compared to 332 in the whole of France; 118.4 private GPs per 100 000 inhabitants in Aquitaine, compared to 102.6 in the whole of France). Burgundy is, on the contrary, one of the regions where health service supply is very low (private GP density is 97.4 per 100,000 inhabitants) and where health care expenses are among the lowest. We will see later that, *ceteris paribus,* location in one or the other of these two regions affects the activity of GPs.

4. Results

Cluster analysis

Such personal characteristics as seniority and gender are known to affect physicians' choices relative to their professional activity, but the analysis of the individual impact of these characteristics does not reveal the actual diversity of the profession. For instance, it is well known that women more often choose certain specialities, like dermatology or pediatrics, and prefer part-time activity, and that physicians increase the volume of their activity with their seniority. Those explanations seem too simple to understand the diversity of physicians'

activity, however. Diversity depends not only on individual characteristics and selfish choices but also on the constraints of the economic and medical context and on the patients' demands.

As we noted above, the cluster analysis is based upon 8 variables relative to the multidimensional GPs' activity. The clustering results are then interpreted through all the variables assumed to affect their activity: individual characteristics, clientele characteristics, socio-economic context, and health care supply context.

The cluster analysis we have made shows that, inside the private GPs' category, 4 clusters of practising profiles can be distinguished. This result confirms that the hypothesis of a standard behaviour is not satisfying. For instance, physicians who have a very low volume of activity and a very limited clientele constitute one cluster (cluster 4) that represents 23.5% of the whole sample, which is not a minor part. Almost half of those physicians are women and 75% of them are located in urban areas, but the incidence of part-time activity among them is no higher than in their colleagues. They also have very low levels of pharmacy prescription. The characteristics of cluster 4 express one particular way of practising general medicine. These physicians attach more importance to the length of consultation time than to the length of prescription order, and the particular type of their practice is best suited to certain patient categories (more women and more adults in their clientele). The structure of the clientele, then, appears to be based on the type of practice chosen by the physician.

Another cluster (cluster 2 that represents 11% of the sample) is, on the contrary, composed of physicians who have very high volumes of activity. Those physicians are more often located in rural areas, and they practise under economic and sanitary constraints. They look after many patients and must accept making frequent home visits. The morbidity of their clientele and of the local population explains high prescription levels. Since these physicians have chosen their rural location, the opportunity to freely choose the volume of activity or the proportion of home visits appears to be restricted.

The four clusters given by the analysis are briefly described below. Tables 2 to 10 present the numerical results of the clustering analysis. Clusters 1 and 3 are nearest to the average of the sample, while clusters 2 and 4 represent extreme behaviours.

Cluster 1:

This cluster represents 33% of the sample. Only 10% of these physicians are women (21% in the whole sample); 93% of them belong to the fully regulated sector (sector 1). The volume of their activity is higher than the average (6450 acts compared to 5130 in the whole sample), and the number of acts per patient is also somewhat above the average (4.15 acts per patient).

Regional conditions are not good: the average distance to the nearest hospital is more than 13 kilometres, and the density of GPs is somewhat lower than the average. More than 60% of those physicians are located in urban areas. Their prescription behaviour differs little from the sample average.. Their clientele includes a higher proportion of young patients than in the whole sample.

Cluster 2:

Cluster 2 gathers physicians who have a very high activity according to all dimensions: 9303 acts per year, 2336 patients (the average in the whole sample is nearly 1500). This high activity is not balanced by a lower number of acts by patient. On the contrary, they make 4.76 acts per patient in the year (as compared to 4.15 in cluster 1 and 3.97 in the whole sample), and the costs of their pharmacy prescriptions are very high. The proportion of home visits is the highest (30% of their consultations are made in home). Income is also very high, but they do not surcharge their fees. They are older and have more seniority than their colleagues. Only 4% of them are women. Practising more often in rural areas (46%), regional health care supply is not very good: the density of GPs is the lowest of the 4 clusters of Aquitaine, although we should note that density and medical supply remain high when compared to other regions, in particular, Burgundy. No single characteristic can explain such high levels of activity. The characteristics of their clientele differ little from those of the whole sample, and they have the same proportion of young patients as in cluster 1.

Cluster 3:

Cluster 3 shows a particular practising profile. These physicians have a small clientele and low levels of annual activity, but they perform more acts per patient than the average (4.18 acts per patient as compared with 4.15 in class 1, 3.97 in the whole sample), and the cost of their pharmacy prescriptions is higher than the average. They represent 32.2% of the sample. Their individual characteristics and the context of their location are not different from the average. The characteristics of the clientele explain the higher costs per patient: the percentage of both older patients and of non-paying patients (i.e., patients with chronic or serious illness) is higher in their clientele than in the average.

Cluster 4:

As we have seen, cluster 4 gathers physicians with low levels of activity (more than half the number of acts per year fewer than the average, being only 3.07 acts per patient and 22% home visits). Their fees are also low, but the proportion of surcharges is higher in this cluster,

where 20% of the physicians belong to the free fees sector (sector 2). They are younger than their colleagues, and their seniority is lower than the average.

Insert Tables 2 to 10

The clustering analysis made with the Burgundy sample of GPs shows the same dominant trends. We notice that physicians who perform a high annual number of acts also have high costs per patient. Their high activity appears not only in their workload but also in the intensity of health services and in the costs per patient or per prescription order. If it is not explained by the morbidity of the clientele, this result is unexpected. The economic context and the level of health service supply could explain these trends, but according to our results, one may assume that there is a trade-off between the length of consultation time and the length of the prescription order and that physicians induce demand for their services. We shall comment on this hypothesis of induced demand in the next section which presents our econometric tests.

Econometric results

Five models have been estimated, first for all GPs, then for urban GPs and rural GPs separately. The results of their estimations are given in table 11. According to the influence of the dependant variables, the main results lead to the following comments where we consider first the results for all GPs, then the particular results for rural GPs only.

Results for all GPs

Individual characteristics of the GP

Seniority has a significant positive influence in the five models.
The annual number of acts of a GP grows with his seniority. It can be related to a larger clientele or to a different way of practising medicine among several generations of GPs. This effect of seniority might be expected, especially since our sample is censored at 65 years old, so the decline of older GPs' activity is not taken into account.

The average number of acts per patient, the percentage of home visits, and the average pharmacy cost per patient having prescriptions and the average pharmacy cost per prescription order also grow with seniority. Because the age structure of the clientele is significant in these models and is a proxy variable for clientele morbidity, these positive effects of seniority mean more about a GP's generational impact than about the influence of clientele morbidity.

The main feature of female physicians' activity is well known, their working time being shorter than that of male physicians. So, here, *ceteris paribus*, women GPs have an annual number of acts lower than their male counterparts. But the results also show that women have a lower number of acts per patient, a lower number of home visits in their practice, and a lower level of pharmacy cost both per patient and per prescription order. This leads us to the conclusion that, besides shorter working time, women physicians also have a particular way of practising medicine[5].

The number of acts, the average number of acts per patient, the percentage of home visits, and the level of pharmacy cost per patient or per prescription order are lower when the GP belongs to sector 2. By assuming that GPs are looking for a given income level, the higher remuneration per act in sector 2 can explain lower activity in this contractual sector. Moreover, GPs in sector 2 more often have specialised training like homeopathy or acupuncture that involves no or less expensive pharmacy prescriptions.

Insert Table 11

Characteristics and size of clientele

The structure by age of the clientele (percentage of 70-year-old patients or older and percentage of 16 or younger) can be interpreted as a proxy variable for higher morbidity and demand, but it can also be related to the age of the GP: the correlation is strong between these two variables.

The percentage of patients of 70 years old or older is significant for the number of acts, the number of acts per patient, the percentage of home visits and the level of pharmacy cost per patient or per prescription order. When his or her clientele is rather old, a GP performs fewer

acts but a larger number of acts per patient; it is possible that physicians with a larger share of old patients are also older, their clientele being somewhat smaller but with serious illnesses and intense needs. This is why a large part of the GP's activity is conducted in the patient home. Moreover, older patients also mean more pharmacy expenditures.

The percentage of patients 16 years old or younger is also significant for the number of acts and the number of acts per patient, but in the opposite way. A similar interpretation can be put forward concerning younger GPs and the morbidity of a rather young clientele (the parents of children).

The percentage of non-paying patients is a proxy variable of the percentage of seriously ill patients. The number of acts per patient, the percentage of home visits, and the level of pharmacy cost per patient and per prescription order increase with this variable.

The number of patients has been introduced as an independent variable in the number of acts per patient model. It is negatively significant. *Ceteris paribus*, a GP makes more acts per patient when he or she has fewer patients. In this case, we can conclude either that the GP has enough time to see his or her patients as often as they need or that patients are seen more often than needed in order for the physician to reach a target income.

Economic context

The economic context takes into account two variables: the unemployment rate and the average income tax in the GP's district. The unemployment rate is negatively significant for the number of acts and the number of acts per patient. It is well known that, despite generally worse health, the unemployed consult physicians less. But the employment rate is positively significant for the percentage of home visits; employment is associated with social and psychological hardships, which perhaps lead the patient to call for more home visits.
Average income tax is an indicator of the wealth of an area. It is significant and negative for the number of acts and significant and positive for the pharmacy cost per patient. These results are consistent with socio-economic studies that show that well-off households resort more to specialists than to GPs and have higher pharmacy consumption.

[5] Our data enable us to know if these differences between male and female physicians' activity are or are not lasting with the increasing representation of women in medical profession. See Dedobbeleer, Contandriopoulos

Medical context

The distance to the nearest hospital is positively significant for the number of acts, the number of acts per patient, the percentage of home visits and the pharmacy cost per prescription order. A GP far from a hospital has to take care of more patients and patients with more serious pathologies who need home visits and expensive pharmacy prescriptions.

Two measures of GP density are used in the models: the GP density in the district ("canton") and the GP density in the county ("department"). Both significant, they do not have the same influence.

District density is negatively significant for the number of acts and the number of acts per patient. When density is high in a small area around the GP's town, he performs fewer acts (because the district patients are shared out between many physician), and fewer acts per patient (because high density in a district means more medical facilities like hospital and more specialists where the GP's patients will be partly attended). GPs thus have a local market share.

County density is also significant for the number of acts per patient and the percentage of home visits, but positively. When density is high in a larger area around the GP's locality, *ceteris paribus*, physicians have a higher number of acts per patient and their activity is composed of more home visits. This reaction can be a response to competitive surroundings and restores the usual induced demand hypothesis.

Location

The dummy variable that specifies the GP's belonging to a rural or urban space is not significant in any models. Nevertheless, we will show below that rural GPs have specific determinants for their activity.

The dummy variable that specifies the GP's belonging to the Aquitaine region or the Burgundy region is on the contrary significant for the percentage of home visits and the pharmacy cost per prescription order. GPs in Aquitaine make more home visits and write more expensive prescription orders. For these two dependant variables, the presence of significant variables related to the number of acts, the clientele, and the area characteristics leads us to conclude for a regional local standard. In a regional area, physicians (and patients)

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and Desjardins (1995) on the convergence or divergence of male and female physicians' activity.

are used to a certain behaviour concerning home visits and a certain content for prescription order.

Number of acts

In the model of the percentage of home visits, the number of acts is negatively significant. When the number of acts grows, the percentage of home visits decreases; when the workload (or the income) is satisfying, the GP refuses or dissuades his patients from home visits. When workload is low, making home visits is a way to attract new patients.

In the model of pharmacy cost per patient and in the model of pharmacy cost per prescription order, the number of acts is positively significant. The pharmacy cost grows with the number of acts. We can assume that the consultation duration decreases with the number of acts and that there is a kind of substitution between consultation duration and pharmacy prescriptions.

Rural GPs

When models are estimated for rural GPs only, several features appear when comparing them with the models for all GPs.

Mainly, individual characteristics remain significant, but their t-statistics are slightly lower. Two variables are no longer significant, the contractual sector in the number of acts per patient model, and the gender in the percentage of home visits model. Despite gender having been very significant for all GPs' home visits model, it becomes non-significant for rural GPs' home visits model. In rural areas, being a woman does not change the percentage of a GP's home visits in the total number of acts. Women do not or perhaps cannot choose not to make home visits.

Insert Table 12

For medical characteristics, different modifications appear.
In every model, distance to the nearest hospital is now non-significant. This distance has a higher average and less variability in rural space compared to urban space. The hospital is always rather far in rural space, so the GP's activity is drawn with hospitalisation opportunities.

GP densities do not have the same influence in the percentage of home visits model. For all GPs, the country density is positively significant. For rural GPs it is no more significant, but the district density is now negatively significant.
In rural space, accepting or promoting home visits is not a response to perceived competitive surroundings, but a medical duty the strength of which depends on the nearby medical density.
Moreover, in rural GPs home visits model, the number of acts is still significant, but positively. For all GPs we saw that the percentage of home visits decreases with the number of acts; for rural GPs, when the number of acts grows, the percentage of home visits also increases. In rural space, for increasing his or her activity, the GP must make more home visits. The home visits model is the model that changes the most when only rural GPs are taken into account. In rural space, home visits cannot be a choice or a strategy; they are an integral part of a GP's activity.

The dummy variable "belonging to the *Aquitaine* region or the *Bourgogne* region" keeps the same sign but is more significant (considering t-statistics) in the number of acts per patient, in the percentage of home visits and in the pharmacy costs models. *Ceteris paribus,* the difference is greater between a rural GP from Aquitaine and a rural GP from Bourgogne than between two urban GPs from the two regions. Regional standards of practice are stronger and more specific in rural areas. Urban practice is more similar throughout all regions. Rural GPs have less continuing education and training and fewer contacts with distant colleagues, specialists, and hospitals. Their practices are built and change according to nearby local influences.

5. Conclusion

Our results show in several ways the heterogeneity of GP activity. The econometric results prove that the activity determinants arise from different fields with which the physicians must come to terms: his or her individual characteristics, clientele characteristics, location characteristics. Individual preference about medical practice, work time or income, medical constraints, and professional standards are all influential. Through these determinants' influence, the physician's decisions are partly free, partly forced. The econometrics results prove that each dimension of a GP activity has its own determinants or its own relationship to

a particular determinant. The results concerning rural GPs also show that each GP’s category can have specific determinants.

The clustering results also show that the practice of general medicine is not uniform. It depends both on physicians’ individual choices and on the constraints they must respect. The clustering analysis can reduce the complexity and the diversity of individual decisions and situations: each practising profile indicates one dominant trend in the multidimensional activity of GPs.

We have to take into account all these heterogeneous activity models in order to understand GPs' behaviours and reactions to regulatory policy. If an increase in regulated fees or an incentive policy is enacted assuming standard behaviours for all GPs, each category of physician will react in his particular way. The effective outcomes of the decision would then not be the expected ones.

Bibliography

BEJEAN S. & PEYRON C. (2002), *Comportements et activité des médecins libéraux : une approche conventionnaliste. Analyse théorique et empirique*. Rapport Mire, convention n°3/99.

CARRERE M.O. (1991) *"The reaction of private physicians to price deregulation in France"*. Social Science and Medecine, 1991, vol33, N°11, p1221-1128.

CERC (1994) (étude de C. Borrel, J.C. Malpot, I. Bridenne et C. Gasnier, sous la direction de G. Neyret) *"Le revenu des médecins libéraux et ses déterminants"*. Publication SESI, Ministère des affaires sociales, de la santé et de la ville, 354 pages.

CHANDON J.L. et PINSON S. *"Analyse typologique : théories et applications."* Masson, 1981.

CNAMTS Point Stat n°30 (2000) *"Disparités dans les évolutions des honoraires médicaux"*. C. Fivaz, S. Gariepuy, S. Le Laidier, Direction des statistiques et des études, CNAMTS.

CNAMTS. Carnets statistiques n°108 (2002*) « Le secteur libéral des professions de santé en 2000 »*.

CNAMTS. Point Stat n°23 (1999), *« Les gynécologues libéraux en 1997 »*, Fivaz C. CNAMTS.

CREDES (2000) (étude de F. Hensgen, V. Paris, B. Pierrard, A. Vergeau) *"Charges professionnelles des médecins libéraux*", CREDES 12/2000, biblio n°1321.

CROXSON B., PROPPER C., PERKINS A. (2001) : *" Do doctors respond to financial incentives ? UK family doctors and the GP fundholder scheme "* dans Journal of Public Economics Vol 79, p.375-398.

DARBON S. et LETOURMY A. (1989). *"Contextes communaux et marché de services de généralistes"*. Sciences Sociales et Santé, Vol 7, n°2, p 91-107.

DAVIS P., GRIBBEN B., SCOTT A., LAY-YEE R. (2000*), « The « supply hypothesis » and medical practive variation in primary care : testing economic anc clinical models of inter-practitioner variation »*, Social Science and Medicine, 50, 407-418.

DEDOBBELEER N., CONTANDRIOPOULOS A.P., DESJARDINS S. (1995), "Convergence or divergence of male and female physicians'hours of work and income". Medical Care, vol 33, issue 8, p 796-805.

DELATTRE E. (2000), « Comportements d'offre de soins des médecins français », Thèse de doctorat de science économique, Université de Paris X Nanterre, mai 00.

DELATTRE E. et DORMONT B. (2000). *"Induction de la demande de soins par les médecins libéraux français. Etude microéconométrique sur données de panel."*. Economie et Prévision, n°142.

DESROSIERES A. (2000) « La politique des grands nombre. Histoire de la raison statistiques », La Découverte, Paris.

DREES Etudes et résultats n° 89 (2000) *"L'évolution du revenu libéral des médecins en 1998"*. S. Audric et E. Roumiguières, Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°114 (2001) « *Le temps de travail des médecins : l'impact des évolutions socio-démographiques"*. Niel X., Vilain A.., Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°146 (2001) *« Les disparités de revenu et de charge des médecins libéraux"*. Audric S., Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°15 (1999*) "Les honoraires des médecins généralistes entre 1985 et 1995"*. M. Beudaert, Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°3 (1999) *"Le revenu libéral moyen des médecins varie, en 1997, de 300 000 à 900 000 francs selon la spécialité"*. E. Roumiguières, Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°44 (1999) *"Les effectifs et la durée du travail des médecins au 1-1-99"*. Simon M., Niel X., Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°83 (2000) « *Les ophtalmolgues : densités géographiques et tendances d'évolution à l'horizon 2020"*. Niel X., Simon M., Vilain A.., Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°9 (1999) *"Les médecins généralistes libéraux dans les aires urbaines"*. Rican, S., Simon M., Charraud A., Salem G., Ministère de l'emploi et de la solidarité.

DREES Etudes et résultats n°254 (2003). *Honoraires et revenus des professions de santé en milieu rural ou urbain*, Breuil-Genier P., Ministère des affaires sociales.

DUBEC I., LECONTE E., RUIZ-GAZEN A., *Determinants of physicians' fees: a Bayesian Probit model with spatial dependencies*. 2nd Spatial Econometrics Workshop, LATEC, may 13th 2003, Dijon.

HELLINGER F. (1996) : *" The impact of financial incentives on physician behaviour in managed care plans : a review of the evidence "* dans Medical Care Research Review, Vol 53, p. 294-314.

LANCRY P.J. (1989). "*Le secteur 2 de la médecine libérale, un élément de marché ?"* Revue d'Economie Politique, 99ième année, n°6.

LANCRY P.J. et PARIS V. (1997). *"Age, temps et normes : une analyse de la prescription pharmaceutique"*. Economie et Prévision, n°129-130, juillet-septembre 1997, n°3-4, p173-188.

MOSSE Ph. (1995). *"Induction de la demande et filières. Une étude de cas contextualisée."* Journal d'Economie Médicale, T.13, n°5, septembre, p 235-246.

ROCHAIX L. (1993). *"Financial incentives for physicians : the Quebec experience"*. Health Economics, vol.2, 163-176.

ROCHAIX L. et LARGERON C. (1989). *"Facteurs économiques et pratique médicale au Québec : vers un budget global en ambulatoire"*. Sciences Sociales et Santé, vol VII, n°2, p 45-65.

RYAN M.. (1994), *« Agency in health care, lessons for economists from sociologists* », American Journal of Economics ans Sociology, avril, vol.2, 207-218.

SLOAN F.A. (1979) : *" Is the market for physician services monopolistic or competitive ? "*, Profile of Medical Practice (American Medical Association, Chicago, Illinois), P.67-80.

WONG H.S. Wong (1996) : *" Market structure and the role of consumer information in the physician services industry : An empirical test "* dans Journal of Health Economics, Vol 15, p.139-160.

Table 1: variable definitions and origin

GP's individual characteristics			
age	Age of the GP	Years	Health insurance funds data base
anciennete_lib	seniority	Dummy variable 1 (less than 3 years) 2 (from 3 to 8 years) 3 (from 8 to 20 years) 4 (more than 20 years)	Health insurance funds data base
prasex_pra	gender	Dummy variable 1 (men) 2 (women)	Health insurance funds data base
cnvmtf_pra	Contractual sector	Dummy variable 1 (sector 1) 2 (sector 2)	Health insurance funds data base
	Type of practice	Dummy variable 1 (full-time private physician) 2 (part-time private physician)	Health insurance funds data base
GP's activity			
ACTO	Annual number of acts		Health insurance funds data base
partv	% of home visits		Health insurance funds data base
CTT	Clientele size	Number of patients	v
RA23	Annual number of acts per patient		Health insurance funds data base
RA14	% of patients with prescription order		Health insurance funds data base
RA 44	Cost of biology per prescription order		v
RA53	Cost of pharmacy prescriptions per patient		Health insurance funds data base
RA42	Cost of pharmacy per prescription order		Health insurance funds data base
RA46	Total cost per patient	Costs of acts and of prescriptions per patient	Health insurance funds data base
HOCO	Regulated fees		Health insurance funds data base
HONO	Total amount of fees		Health insurance funds data base
RA03	% of surcharges		Health insurance funds data base
Clientele characteristics			
RA07	% of less than 16 years old patients		Health insurance funds data base
RA08	% of 16 to 59 years old patients		Health insurance funds data base
RA09	% of 60 to 69 years old patients		Health insurance funds data base
RA10	% of more than 70 years old patients		Health insurance funds data base
RA11	% of non-paying patients		Health insurance funds data base
RA12	% of patients		Health insurance funds data base
Economic and medical context			
distmoy	Distance to the nearest hospital	Average distance by district (canton)	INSEE
exist-etab	Presence of a hospital	Dummy variable 1 (yes) 2 (no)	INSEE
denscan	GP density / district (canton)	Number of GP/100 000 inhabitants	INSEE and Health Insurance funds data base
densmed	GP density / county (département)	Number of GP/100 000 inhabitants	Eco-santé (CREDES)
Txcho	Unemployment rate	% per district	INSEE
IMPOT_MOYE	Average income tax	Per district	INSEE
REV_SAL_MO	Average wage-earnings	Per district	INSEE
POL99	Type of the GP location	Dummy variable 1 (urban area) 2 (rural area)	INSEE
Region	Region of the GP location	Dummy variable 1 (Burgundy) 2 (Aquitaine)	Health insurance funds data base

Table 2: cluster analysis of GPs from Aquitaine (average values per cluster), n=3225

class_4	ACTO	CTT	RA14	RA23	RA44	RA46	RA53	partv
Classe n° 1	6450,63	1833,09	90,69	4,15	175,21	2383,18	1290,33	0,29
Classe n° 2	9302,91	2336,65	92,10	4,76	185,73	2785,49	1507,11	0,30
Classe n° 3	4381,35	1266,54	90,72	4,18	177,86	2553,66	1372,76	0,29
Classe n° 4	2410,56	1051,45	81,27	3,07	183,97	1374,25	707,36	0,22
TOTAL	**5130,67**	**1517,40**	**88,53**	**3,97**	**179,29**	**2240,37**	**1200,58**	**0,27**

Table 3: activity and fees (average values per cluster)

class_4	ACTO	C	CTT	RA23	V	partv	HOCO	HONO	RA03	RA24
Classe n° 1	6450,63	4380,77	1833,09	4,15	1876,75	0,29	759228,02	774118,91	1,65	2,79
Classe n° 2	9302,91	6221,11	2336,65	4,76	2817,65	0,30	1080660,46	1094012,36	1,04	3,20
Classe n° 3	4381,35	2965,17	1266,54	4,18	1295,42	0,29	517295,33	536687,11	2,81	2,79
Classe n° 4	2410,56	1627,14	1051,45	3,07	609,14	0,22	333277,35	365772,33	7,33	2,18
TOTAL	**5130,67**	**3471,45**	**1517,40**	**3,97**	**1519,28**	**0,27**	**614497,22**	**634856,43**	**3,33**	**2,69**

Table 4: gender (% of women, % of men per cluster)

prasex_pra class_4	Féminin	Masculin	TOTAL
Classe n° 1	10,0%	90,0%	**100%**
Classe n° 2	4,0%	96,0%	**100%**
Classe n° 3	21,4%	78,6%	**100%**
Classe n° 4	43,9%	56,1%	**100%**
TOTAL	**21,0%**	**79,0%**	**100%**

Table 5: contractual status (% sector 2, % sector 1 per cluster)

cnvmtf_pra class_4	Honoraires libres	Praticien conventionné sans DP	TOTAL
Classe n° 1	6,4%	93,6%	**100%**
Classe n° 2	4,0%	96,0%	**100%**
Classe n° 3	10,9%	89,1%	**100%**
Classe n° 4	20,6%	79,4%	**100%**
TOTAL	**11,0%**	**89,0%**	**100%**

Table 6: age, seniority (years per cluster)

class_4	age	ancienn ete_lib
Classe n° 1	**46,68**	**15,99**
Classe n° 2	**47,19**	**17,48**
Classe n° 3	**47,16**	**15,95**
Classe n° 4	**46,26**	**13,48**
TOTAL	**46,79**	**15,54**

Table 7: type of location (% of each type per cluster)

POL99 class_4	Dom. rurale	Multipol arisée	Périur baine	Pôle urbain	TOTAL
Classe n° 1	37,8%	1,8%	12,5%	47,9%	**100%**
Classe n° 2	45,9%	4,4%	11,0%	38,7%	**100%**
Classe n° 3	29,0%	2,1%	8,4%	60,5%	**100%**
Classe n° 4	18,0%	1,7%	4,9%	75,3%	**100%**
TOTAL	**31,2%**	**2,2%**	**9,2%**	**57,5%**	**100%**

Table 8: economic and medical context (average values per cluster)

class_4	distmoy	IMPOT_ MOYE	REV_S AL_MO	gene_pop	txchom	denscan	densmed
Classe n° 1	13,22	7485,44	104297,39	897,76	0,09	138,27	118,31
Classe n° 2	14,75	7096,21	102883,61	951,36	0,09	126,68	117,32
Classe n° 3	10,44	8054,47	106547,65	869,80	0,09	147,62	118,67
Classe n° 4	7,09	8578,26	108626,78	751,88	0,10	172,09	119,74
TOTAL	**11,02**	**7886,36**	**105896,77**	**859,79**	**0,09**	**148,20**	**118,65**

Table 9: costs and prescriptions per patient (average values per cluster)

class_4	CTT	RA14	RA44	RA46	RA47	RA53	RA42
Classe n° 1	1833,09	90,69	175,21	2383,18	1895,91	1290,33	226,93
Classe n° 2	2336,65	92,10	185,73	2785,49	2231,32	1507,11	247,86
Classe n° 3	1266,54	90,72	177,86	2553,66	2039,60	1372,76	235,76
Classe n° 4	1051,45	81,27	183,97	1374,25	1026,49	707,36	177,99
TOTAL	**1517,40**	**88,53**	**179,29**	**2240,37**	**1770,08**	**1200,58**	**220,28**

Table 10: clientele characteristics (% of each category per cluster)

class_4	RA07	RA08	RA09	RA10	RA11	RA12
Classe n° 1	20,60	55,09	9,78	14,53	21,39	5,68
Classe n° 2	20,59	55,03	9,63	14,75	22,16	5,66
Classe n° 3	18,98	54,98	9,99	16,05	22,43	5,97
Classe n° 4	18,62	58,75	9,82	12,88	20,56	7,80
TOTAL	**19,61**	**55,91**	**9,85**	**14,67**	**21,62**	**6,30**

Table 11: Econometric results. OLS regressions with 5 dependent variables. All GPs, n=4625
Parameter estimate
t value

	Number of acts	Number of acts per patient	Percentage of home visits	Pharmacy cost per patient	Pharmacy cost per prescription order
Intercept	8343 25.19	3.24 10.08	-0.252 -7.13	105.5 1.6	96.18 13.5
Seniority	20.45 4.83	0.017 7.21	0.0011 4.33	9.88 11.6	0.354 3.27
Gender	-1588 -20.6	-0.41 -9.03	-0.075 -14.79	ns	ns
Contractual group	-505.25 -10.34	-0.11 -3.98	-0.0483 -15.31	-59.91 -5.84	-7.29 -5.6
GP density/district (“canton’)	-274109 -7.05	-179.29 -8.05	ns	-65436 -8.1	ns
GP density/country (“département”)	ns	0.015 4.49	0.00102 2.69	ns	ns
Distance to the nearest hospital	12.02 3.39	0.0094 5.25	0.00048 2.21	3.27 4.49	0.879 10.83
Number of patients		-0.00047 -17.71			
Number of acts			-18.10^{-7} -1.96	0.068 23.55	0.0019 4.82
Number of acts per patient					8.46 12.42
% 16 or younger	22.51 4.16	-0.0241 -7.6	0.00913 26.87	2.15 1.92	0.9 6.33
%70 or older	-22.62 -4.28	0.0164 4.92	0.00727 19.81	26.87 22.61	2.85 18.88
% non paying patients	ns	0.0226 8.27	0.0049 16.37	6.42 6.56	0.78 6.38
Urban/rural	ns	ns	ns	ns	ns
Unemployment rate	-3942 -2.98	-3.16 -4.11	0.467 5.47	-412.25 -1.47	-24.10 -7.03
Income tax	-0.086 -6.33	ns	$5\ 10^{-6}$ 5.5	0.0068 2.41	ns
Region	111.80 1.62	0.147 1.91	0.0385 4.39	69.44 4.9	10.12 5.8
R^2 F	0.18 99.58	0.24 121.22	0.38 239.05	0.36 231.74	0.31 211.21

Table 12: Econometric results. OLS regressions with 5 dependent variables. Rural GPs, n=1469
Parameter estimate
t value

	Number of acts	Number of acts per patient	Percentage of home visits	Pharmacy cost per patient	Pharmacy cost per prescription order
Intercept	8290 12.91	3.36 7.26	0.15 -4.28	185.97 3.01	65.84 4.15
Seniority	23.01 7.38	0.0095 2.93	0.0015 4.4	1.9 1.5	ns
Gender	-1692 -11.25	-0.427 -6.24	ns	ns	ns
Contractual group	-500.6 -4.47	ns	-0.0372 -7.13	-43.90 -2.2	-12.67 -2.34
GP density/district (“canton’)	-232112 -2.89	-122.5 -3.19	-11.46 -3.05	-64292 -4.71	ns
GP density/country (“département”)	ns	0.0082 2.02	ns	ns	ns
Distance to the nearest hospital	ns	ns	$43\ 10^{-5}$ 1.72	ns	ns
Number of patients		-00037 -9.41			
Number of acts			39.10^{-7} 3.31	0.060 13.55	ns
Number of acts per patient					9.08 6.6
% 16 or younger	ns	-0.0273 -4.10	0.0059 8.58	ns	1.37 3.82
%70 or older	-56.52 -4.47	0.0142 2.27	0.0074 11.39	31.93 15.69	4.05 12.09
% non paying patients	ns	0.0329 5.89	0.0051 8.98	17.22 7.93	1.14 3.71
Unemployment rate	ns	ns	ns	ns	-15.16 -2.34
Income tax	ns	ns	$4\ 10^{-6}$ 3.35	ns	0.00402 6.34
Region	196.19 1.61	0.35 3.70	0.0618 11.01	ns	14.89 5.08
R^2 F	0.13 30.2	0.28 56.52	0.33 66.38	0.31 211.21	0.26 65.42