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Abstract

The aim of this paper is to model a liberal profession, in this case physicians. We propose a model in which the physician acts in the same way as an agent who maximises his utility function subject to his budget constraint, while at the same time being able to affect his rate of remuneration. This model presupposes that physicians attempt to reach two target, namely income and leisure, and that the trade-off between these two target depends on their monopolistic power. Unlike existing models, our proposed model advances that some physicians may have a disutility for leisure and may adopt altruistic or strategic behaviours. To determine the relevance of our model, we estimate salaried, firm and agent versions of the model based on a sample of 317 physicians practicing in the Provence-Alpes-Côte d'Azur region (PACA). We observe that physicians do not act like a purely profit-maximising firm. Furthermore, they are able to affect their net remuneration rate through their labour supply. The model that we propose therefore is of particular importance. We estimate that around 20% of physicians experience disutility from leisure, which can be explained by their adoption of altruistic and strategic behaviours.

1 Introduction

The aim of this paper is to model a liberal profession, in this case physicians. The literature typically considers physicians in the same way as firms or self-employed individuals who supply labour and whose objectives are, for example, leisure and consumption [1]. Several authors have since integrated other elements into the physician model, such as altruism, patient welfare, and patient economic well-being[1]. However, these models cannot be applied to French family physicians. Salaried models presuppose that the

physician is a worker who cannot affect the price of his labour. However, in France, physicians are able to choose the number of patients they wish to receive on an hourly basis. Moreover, the standard models assume that physicians act as profit-maximising firms with no regard for possible additional elements in physicians' objective functions.

To model the activity of French physicians, we therefore propose a model in which the physician acts in the same way as an agent who maximises his utility function subject to his budget constraint, while at the same time being able to affect his rate of remuneration. This model presupposes that physicians attempt to reach two target, namely income and leisure, and that the trade-off between these two target depends on their monopolistic power.

Unlike existing models, our proposed model advances that some physicians may have a disutility for leisure and may adopt altruistic or strategic behaviours.

To determine the relevance of our model, we estimate salaried, firm and agent versions of the model based on a sample of 317 physicians practicing in the Provence-Alpes-Côte d'Azur region (PACA). We observe that physicians do not act like a purely profit-maximising firm. Furthermore, they are able to affect their net remuneration rate through their labour supply. The model that we propose therefore is of particular importance. We estimate that around 20% of physicians experience disutility from leisure, which can be explained by their adoption of altruistic and strategic behaviours.

2 Classical microeconomic models

2.1 Physician as price-taker salaried

In this model, we assume that a physician is a salaried individual who accepts to work according to an hourly net remuneration rate w. The physician therefore maximises his utility function $U(L, C)$ subject to the following budget constraint:

$$\begin{cases} Max\ U(L,C) = C^{\delta} L^{\varphi} \\ UC \ : \ wh + M = PC \\ h = 8640 - L \\ w = \frac{number\ of\ acts \times act\ price - expenses - taxes}{h} \end{cases}$$

where L represents leisure, h , labour supply, C , the consumptions, M others income and P the price of consumption. 8640 is the time endowment of a physician over one year. In this model, we assume that the net remuneration rate is exogenous.

When the physician optimises his utility function, the ratio between the two exponents of the Cobb-Douglas function is:

$$\frac{\delta}{\varphi} = \frac{1}{L^*}\left((8640 - L^*) + \frac{M}{w}\right) \tag{1}$$

The ratio between the exponents of the Cobb-Douglas function allows us to determine the preferences of the agent for the leisure good, L or for the consumption good, C. If the ratio is greater than 1, then the agent has a preference for consumption good, while a ratio of less than 1 indicates a preference for leisure good. This model also allows us to determine substitution and income effects.

However, this model cannot be applied to a liberal profession. The behaviour of liberal professionals cannot be modelled as a function of an exogenously set remuneration rate, as their work effort itself may influence their remuneration.

If a physician observes a reduction in their per-patient remuneration, he can decide to examine more patients per hour and thus compensate for this reduction in payment per patient. Given that physicians can effectively determine the price of their leisure, we decided to treat the physician as if they were profit-maximising firms. Two cases may arise. In the first, physicians are unable to affect their hourly rate of remuneration. In the second, they can partly influence their remuneration rate.

2.2 Physician is a firm

Several cases can be presented according to the influence which physicians can exert on market prices. In the first case, we present a model where physicians exercise their profession in a perfectly competitive market. In the second and third cases, we set out models in which physicians have some monopolistic power.

2.3 Physician is a firm in a pur and perfect market (firm as price-taker)

Here we assume that the physician acts like a firm and maximises his profit function Π :

$$\begin{cases} \Pi = h \times W - Expenses - h \times T(h, W, household\ size) \\ W = \frac{number\ of\ acts \times act\ price}{h} \end{cases}$$

where h is the labour supply, W is the hourly remuneration rate (hourly fees in the

case of physicians) and $T(h, W, household\ size)$ is the marginal taxe rate according to labour supply, hourly fees, expenses and the number of members in the physician's household.

According to classical microeconomic theory, a firm maximises its profit when its marginal cost is equal to its marginal benefit. In our case, marginal benefit and cost are given by:

$$\begin{aligned} MB =& \frac{\partial Benefit}{\partial h} = W \\ MC =& \frac{\partial Cost}{\partial h} = T(h, W, expenses, household\ size) \end{aligned}$$

As expenses are fixed costs (rental or purchase of surgery and equipment etc.), the marginal cost then merely becomes a function of taxe rate. A physician who maximises his profit observes:

$$W = T(h, W, expenses, household\ size) \tag{2}$$

In France, physicians have some monopolistic power, because they can affect their hourly remuneration rate, W. We therefore shall now consider the monopolistic power of physicians.

2.3.1 Physician as a firm in a monopolistic market (firm as price-maker)

Fixed costs

In this model, we assume that labour supply can affect the remuneration rate. Thus, the profit function Π becomes:

$$\begin{cases} \Pi = h \times W - Expenses - h \times T(h, W, expenses, household\ size) \\ W = \alpha + \beta h + \rho X + u \end{cases}$$

where W is a function of labour supply h and physician characteristics X.
The marginal benefit is now:

$$MB = \frac{\partial Benefit}{\partial h} = \alpha + 2\beta h + \rho X + u$$

The difference with the previous marginal benefit is βh.

The marginal cost remains unaffected. Thus, the physician maximises his profit when:

$$\alpha + 2\beta h + \rho X + u = T(h, W, expenses, household\ size) \quad (3)$$

$$W + \beta h = T(h, W, expenses, household\ size) \quad (4)$$

The marginal benefit depends of hourly remuneration rate and also of labour supply influence on the hourly remuneration rate βh. βh is a measure of the physician monopoly power.

Variable costs

In this model, the physician can affect the price of his expenses. The optimisation problem becomes:

$$\begin{cases} \Pi = h \times W - h \times c - h \times T(h, W, expenses, household\ size) \\ W = \alpha + \beta h + \rho X + u \\ c = \delta + \theta h + \phi X + v \end{cases}$$

where c is the hourly cost that can be written as:

$$c = \frac{Expenses}{h}$$

We assume that the physician can affect the price of his expenses for several reasons. First, he can decide to employ a secretary; the expenses levels explained by the services provided by the secretary therefore are dependent on the physician supplying his labour for these tasks or not. Second, he can determine the quantity of labour that he wants to supply. A physician who decides to increase his labour supply for a given level of expenses can increase or reduce the effective price of his expenses, c.

The marginal cost is thus affected by the labour supply:

$$Cm = \frac{\partial Expenses}{\partial h} + \frac{\partial Taxes}{\partial h} = \delta + 2\theta h + \phi X + v + T(h, W, expenses, household\ size)$$

At equilibrium, the physician observes:

$$\alpha + 2\beta h + \rho X + u = \delta + 2\theta h + \phi X + v + T(h, W, expenses, household\ size) \quad (5)$$

$$W + \beta h = c + \theta h + T(h, W, expenses, household\ size) \quad (6)$$

Marginal benefit and cost differ when we assume that physicians can affect the price of their expenses. Consequently, it becomes important to determine whether physicians can have an impact on market prices.

Monopolistic power of physicians:

A firm which has monopolistic power maximizes its profit as a function of demand elasticity, ϵ :

$$MB = MC = price\left[1 - \frac{1}{|\epsilon_D|}\right] \tag{7}$$

Hence, at the firm's optimum marginal cost equals marginal benefit. The breakdown of the hourly remuneration rate allows us to determine the elasticity of demand:

$$MB = \alpha + 2\beta h + \rho X + u = W + \beta h$$

When we replace the above equation in equation (7), we arrive at:

$$W + \beta h = W\left[1 - \frac{1}{|\epsilon_D|}\right]$$

Therefore, the elasticity of demand ϵ_D is:

$$\epsilon_D = -\frac{W}{\beta h} \tag{8}$$

According to this expression, increased labour supply reduces the physician's monopolistic power.

These models do not include the physician's utility function, hence our proposal to develop a model in which the physician is treated as an agent who maximises his utility subject to his budget constraint, while still being able to affect his hourly remuneration rate.

3 Agent model with two objectives and monopolistic power

In this model, the physician maximises his utility $U(C, L)$ subject to his budget constraint, while still being able to affect his hourly remuneration rate:

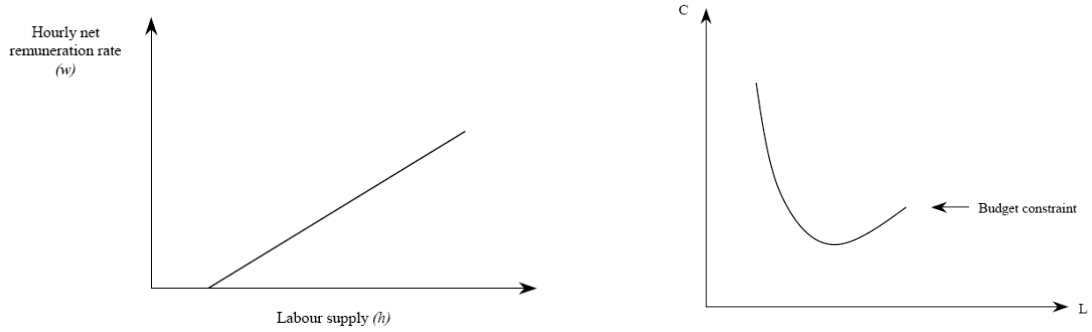
$$\begin{cases} Max\ U(C,L) = C^{\delta} L^{\varphi} \\ SC \ : \ wh + M = PC \\ w = f(h) = \alpha + \beta h + \rho X + u \\ w = \frac{number\ of\ acts \times act\ price - expenses - taxes}{h} \\ h = 8640 - L \\ L \geq L_{\min} \end{cases}$$

We assume that the hourly remuneration rate is a function of labour supply h and physician characteristics X. One part of the hourly remuneration rate is determined by the market (α,β, ρ and u) while the other part is determined by the physician h. We also assume that the physician's objective function features leisure, and that he wants consume a quantity of leisure in excess of $L_{\min}$.

A particular case can be deduced from this model. When $\beta = 0$, the physician is in effect a salaried worker because he cannot affect his hourly remuneration rate through his labour supply.

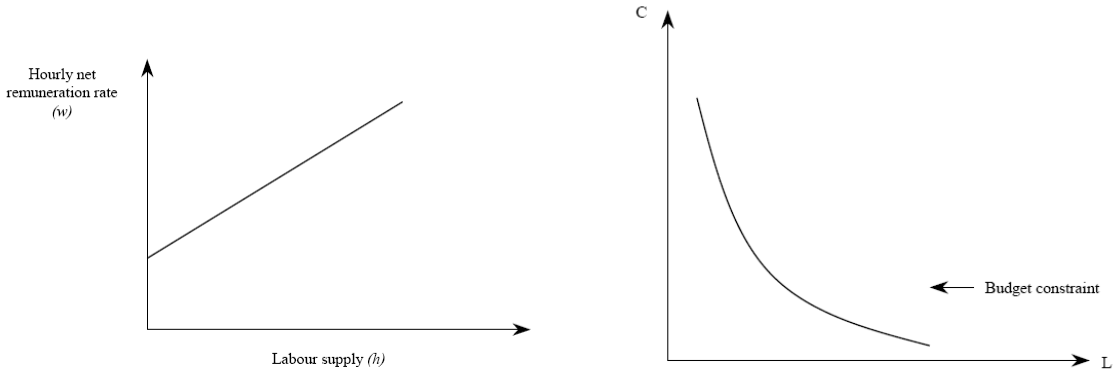
3.1 Several cases can be observed depending on the sign of α and β

This model allows us to distinguish several cases according to the sign of α and β. If $\alpha < 0$ and $\beta > 0$, the hourly remuneration rate increases with the labour supply while the budget constraint first decreases and then increases in L:



This would be the case if the physician realised economies of scale (labour supply that increases productivity), but it appears an improbable scenario. Nevertheless, if this case were to occur, then the optimisation problem would result in a corner solution.

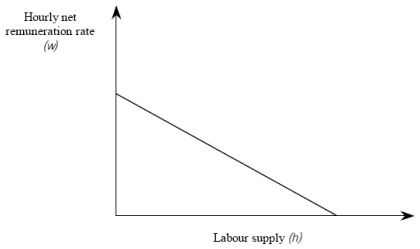
If $\alpha > 0$ and $\beta > 0$, then the hourly remuneration rate would increase with the labour supply, and the budget constraint would be convex and decreasing:



As in the previous case, this is an improbable scenario. Here too, the optimisation problem would result in a corner solution.

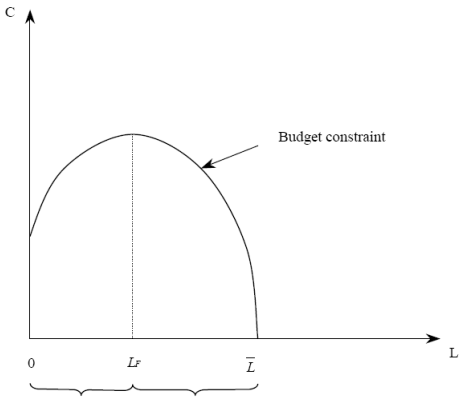
3.2 Special case: Decrease in the hourly remuneration rate

If $\alpha > 0$ and $\beta < 0$, then the hourly remuneration rate would decrease with the labour supply. The physician has monopolistic power and can affect the price of his leisure:



The negative slope of the hourly remuneration rate can be explained by two factors. The first is the reduction of the physician's productivity. The second is the loss of the physician's monopolistic power. In effect, increasing the supply of labour may lead to patients requesting longer visiting times and thus a reduction in the hourly remuneration rate. In other words, a physician who examines a given number of patients from 9am to 1pm will observe an hourly remuneration rate greater than a physician who examines the same number of patients from 9am to 6pm. When this physician supplies more labour, he reduces the monopolistic power he can exert on the market. This scenario would appear the most probable.

The budget constraint therefore increases initially, but decreases once it has crossed a certain threshold.

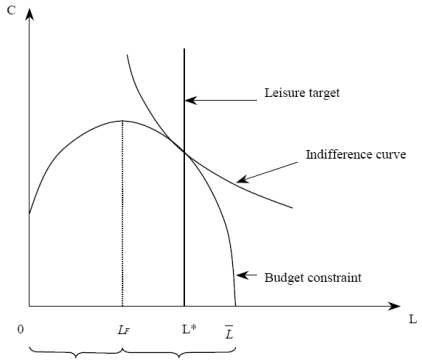


When the physician consumes L^F, then he acts like a firm and maximises his level of consumption C. When his consumption of leisure is between 0 and L^F, then his budget constraint increases. In this case, an added unit of leisure allows the physician to increase his quantity of consumption C. When his consumption of leisure is between L^F and $\overline{L}$, his budget constraint decreases. An added unit of leisure reduces the quantity of consumption C. To explain this last case, we assume that the physician is an altruistic

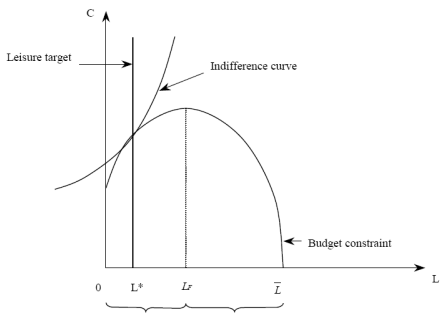
agent, because although it is in his own interest to use his monopolistic power and reduce his labour supply to increase his level of consumption, he decides against it. Instead, he prefers to act like an agent who observes a disutility for leisure.

The utility of a physician depends on his decision whether to work at a loss or not. This choice implies two cases. First, if the physician prefers not to work at a loss, then he has an utility from leisure and the exponent φ is positive. Second, if the physician decides to work at a loss, he has a disutility from leisure and the exponent φ is negative. This disutility from leisure may be explained by the altruistic behaviour adopted voluntarily by the physician, who accepts to work to satisfy the needs of his patients, although it is not in is his own material interest.

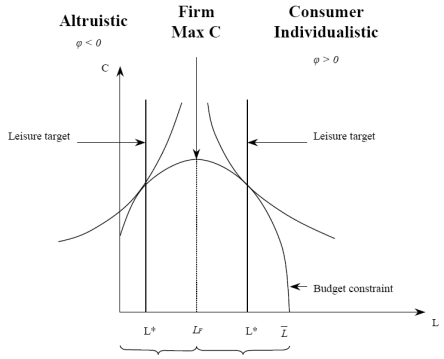
If the exponent φ is positive, then the point of tangency with the indifference curve is on the decreasing segment of the budget constraint. So, the physician consumes a quantity of leisure greater than L^F.



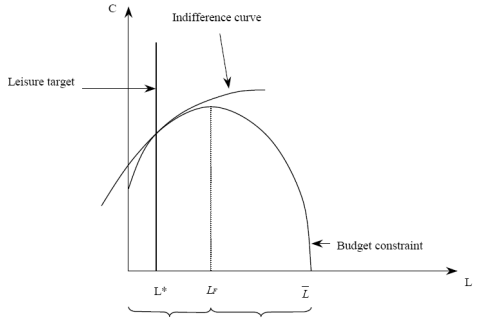
If the exponent φ is negative, then the point of tangency with the physician's indifference curve is on the increasing segment of the budget constraint. The physician consumes between 0 and L^F units of leisure.



The physician's indifference curves are therefore situated either to the right or to the left of the maximum of the budget constraint, depending on his altruism.



The indifference curve may also be concave and associated with a maximum under certain mathematical conditions.



The indifference curves are concave when $|\varphi| < \delta$. If $|\varphi| \geq \delta$, or if $\varphi > 0$ and $\delta > 0$, the indifference curves are convex and are associated with an optimum. Concave indifference curves can also be associated with an optimum under certain mathematical conditions since the budget constraint is not affine but concave.

To solve this maximisation problem, we replace labour supply by leisure. The new hourly net remuneration rate can be written as:

$$w = f(8640 - L) = \alpha + \beta(8640 - L) + \rho X + u \tag{9}$$

We introduce this hourly net remuneration rate in the budget constraint that depends on leisure L , other income M, and the price and quantities of consumption

goods P and C :

$$[\alpha + \beta(8640 - L) + \rho X + u](8640 - L) + M = PC$$

From this optimisation problem, we can deduce the quantity of leisure that optimises the budget constraint L^F, as:

$$L^F = \frac{\alpha + 2 \times 8640\beta + \rho X + u}{2\beta}$$

We can also deduce the quantity of leisure that optimises physician utility as:

$$L^* = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

where:

$$\begin{aligned} a =& 2\beta\frac{\delta}{\varphi} + \beta \\ b =& -\frac{\delta}{\varphi}\alpha - 2 \times 8640\beta\frac{\delta}{\varphi} - \frac{\delta}{\varphi}\rho X - \frac{\delta}{\varphi}u - \alpha - 2 \times 8640\beta - \rho X - u \\ c =& 8640\alpha + 8640^2\beta + 8640\rho X + 8640u + M \end{aligned}$$

When the physician does not buy any consumption goods, the quantity of leisure is:

$$L = 8460 - \left(\frac{-\alpha \pm \sqrt{\alpha^2 - 4\beta M}}{2\beta}\right)$$

When the physician does not allocate any time for leisure, but prefers to work, the quantity of consumption goods is:

$$C = \frac{8460\alpha + 8460^2\beta + M}{P}$$

We assume that the quantity of leisure cannot be negative. Thus, we retain only the solutions for which the quantity of leisure is positive. When the physician maximises his utility, the ratio between the two exponents of consumption and leisure is given by:

$$\frac{\delta}{\varphi} = -\frac{1}{L} \times \frac{[\alpha + \beta(8640 - L) + \rho X + u](8640 - L) + M}{(-\alpha - 2 \times 8640\beta + 2\beta - \rho X - u)} \tag{10}$$

This ratio enables us to determine the physician's trade-off between leisure and consumption. If $\frac{\delta}{\varphi} > 1$, then the physician has a preference for the consumption good C , whereas if $\frac{\delta}{\varphi} < 1$, the physician has a preference for the leisure good L. If $\frac{\delta}{\varphi} < 0$, the physician has a disutility for leisure.

Preference for leisure or consumption is different from setting a particular leisure or income target. Thus, a physician can prefer income over leisure without necessarily reaching his income objective. This model allows us to consider that a physician can seek to reach two objectives, leisure and income, and the trade-off between these two objectives depends on his monopolistic power. Physicians act like a firm that has a utility function to maximise and two objectives to reach.

Mathematical conditions to find an optimum

The optimisation problem can be solved using the Lagranger multiplier method:

$$L = C^{\delta} L^{\varphi} + \lambda \left[(\alpha + \beta(8640 - L) + \rho X + u)(8640 - L) + M - PC \right]$$

In our model, we assume that the solution to the optimisation problem is a maximum. Consequently, we assume that the determinant of this matrix is positive:

$$\det \begin{bmatrix} \varphi(\varphi - 1) C^{\delta} L^{\varphi - 2} + 2\beta\lambda & \varphi\delta C^{\delta - 1} L^{\varphi - 1} & -\alpha - 2 \times 8640\beta + 2\beta L \\ \varphi\delta C^{\delta - 1} L^{\varphi - 1} & \delta(\delta - 1) C^{\delta - 2} L^{\varphi} & -P \\ -\alpha - 2 \times 8640\beta + 2\beta L & -P & 0 \end{bmatrix} > 0$$

In other words, we assume that:

$$\begin{aligned} & 2 \left[\varphi\delta C^{\delta - 1} L^{\varphi - 1} \right] [-P] [-\alpha - 2 \times 8640\beta + 2\beta L] \\ & - [-\alpha - 2 \times 8640\beta + 2\beta L] \left[\delta(\delta - 1) C^{\delta - 2} L^{\varphi} \right] [-\alpha - 2 \times 8640\beta + 2\beta L] \\ & - [-P] [-P] \left[\varphi(\varphi - 1) C^{\delta} L^{\varphi - 2} + 2\beta\lambda \right] > 0 \end{aligned}$$

4 Data

4.1 Data base

The estimations are based on a representative sample of 600 physicians practicing in the PACA region (Provence-Alpes-Côte d'Azur), sampled according to age, sex and urban size. These 600 physicians were contacted by telephone. However, only 321 out of 600 answered all questions. For each physician we have personal information (sex, age, number of household members), professional information (sector 1, group practice, secretariat), the quality of their training (number of training sessions, number of reviews), the characteristics of their patients (percentage of patients that enjoy universal health insurance cover, percentage of exonerated patients), their professional environment (medical density) and their practice (number of visits, labour supply).

4.2 Endogeneous variables

The annual labour supply of physicians used in our estimation is the product of the number of weekly labour hours in liberal practice and the number of labour weeks over one year. These two variables are constructed from declarations by physicians.

The physicians' fees were determined by multiplying the number of yearly consultations and visits recorded by the CNAMTS (caisse nationale d'assurance maladie des travailleurs salariés) and the average price of consultations and home visits in the municipality where the physicians practice. These prices were estimated using data provided by URCAM for the months of January and February 2003. These enabled us to estimate the price-setting practices of physicians in 2002.

The consultation prices in sector 2 and home visit prices in sector 1 and 2 were determined from an observed average in each municipality. The price of consultations in sector 1 was 20 euro. The expenses borne by physicians were determined from their fees and the percentage of expenses in fees which they declared. The hourly net (of expenses) fees of physicians correspond to the ratio between net fees and their annual labour supply.

4.3 Physician concentration

We use the Herfindahl index H_j to measure the concentration of physician market shares in each municipality. This index takes account of each physician according to

the municipality where they practice. The Herfindahl index is:

$$H_j = \sum_{j \in J} s_{lj}^2$$

where s_{lj} represents the market shares of each physician in the given municipality. The concentration of market shares in a municipality increases the Herfindahl index.

5 Application

5.1 Description of data

Our sample is composed of 321 physicians, with an average age of 48. 19.6% are female. Physicians' households are composed of four members on average. Their other sources of income amount to around 19,000 euro. These physicians have been working in their practice for an average of 17 years. 52% practice according to a particular exercise mode (MEP), 83% have signed a work convention with the government (Sector 1), 57% are in a group practice, about 51% have a secretariat and 50% have bought their practice.

In 2003, average labour supply was around 2,635 hours per annum. The sample physicians undertook 3,495 consultations and 1,022 visits during that year. However, it should be noted that these values vary widely across the sample. Home visits on average accounted for 22% of the hours worked.

Hourly fees are about 37.8 euro, hourly expenses 17.5 euro, and hourly net fees, 20.4 euros on average.

28% of patients are exonerated. Physicians receive an average of eight medical visitors per day, attend an average of 7.5 training sessions organised by the pharmaceutical industry per year, and an average of 0.47 training sessions organised by a university. 50% of physicians participate in pharmaceutical trials.

45% of our sample physicians practice in Bouches du Rhônes, about 20% in Marseille and 34% in rural areas.

5.2 Physician preferences according to models

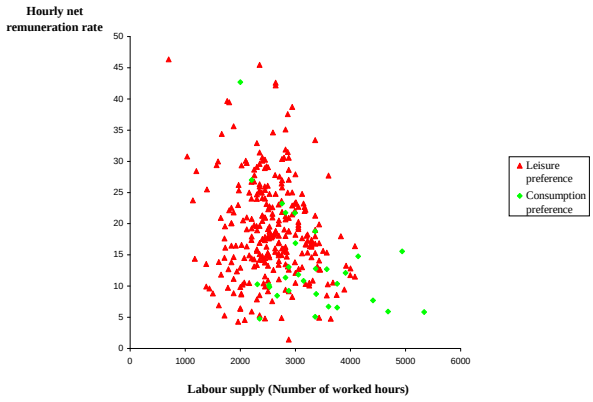
To determine the preference of physicians and the model which is best adapted to their activity, we take the models developed above and apply them to our sample data.

We first present the physician as a salaried price-taker, then the physician as a firm (price-taker and price-maker), and finally the physician as a price-making agent.

5.2.1 Physician as a price-taker salaried

To determine physician preferences for the consumption or for the leisure good, we used equation (1).

When physicians are modelled as salaried price-takers, 91% have a preference for leisure and 9% for consumption. Thus, they have a clear preference for leisure.



If we assume that physicians are salaried price-takers and if we identify their preferences, two groups emerge. The first is composed of physicians who prefer consumption. This group has high labour supply and low hourly net remuneration rates. The second is composed of physicians who prefer leisure. This group records low labour supply and high hourly net remuneration rates.

5.2.2 Physician as a firm

If physicians act like profit-maximising firms, then their marginal benefit should equal their marginal cost. But according to firm models, their marginal benefit may be either greater or less than their marginal cost. We deduce several forms of marginal benefit and marginal cost according to market competition. In effect, the marginal benefit depends on whether physicians act like price-taking firms (hourly fees W , (eq.2)) or as price-making firms (marginal benefit given by (eq.3)). Expenses also depend

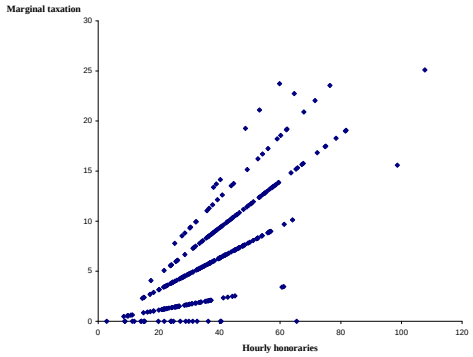
on whether physicians act like price-takers (marginal cost corresponds to taxes) or price-makers (marginal cost corresponds to (eq.5)).

The elasticity of demand (eq.8) is determined by the marginal benefits. Nevertheless, this elasticity cannot be interpreted since the marginal cost can be greater than marginal benefit.

We now present the array of possible scenarios.

5.2.3 Physician as a price-taking firm

When we assume that physicians act as price-taking firms, we observe that their hourly fees are systematically greater than marginal tax rates.



5.2.4 Physician as a price-making firm

Fixed costs

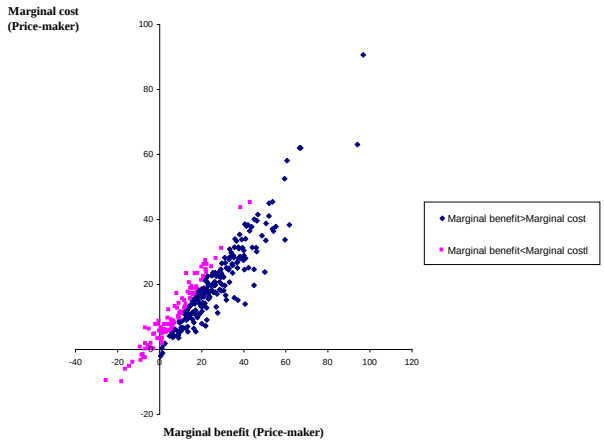
To determine whether physicians act as price-making firms, and whether they can affect the price of their labour, we estimated their hourly fees. The results of this estimation are reported in Table 3.

According to Table 3, labour supply significantly affects the hourly remuneration rate. Physicians therefore have monopolistic power in the market. In this case, the marginal benefit is not systematically greater than the marginal cost; in some cases it may even be negative.

Variable costs

To determine whether labour supply can affect hourly expenses, we estimate the impact of labour supply on hourly expenses. The results of this estimation are reported in Table 4.

We observe that labour supply significantly reduces hourly expenses. When physicians can reduce the price of expenses, they record a negative marginal cost.



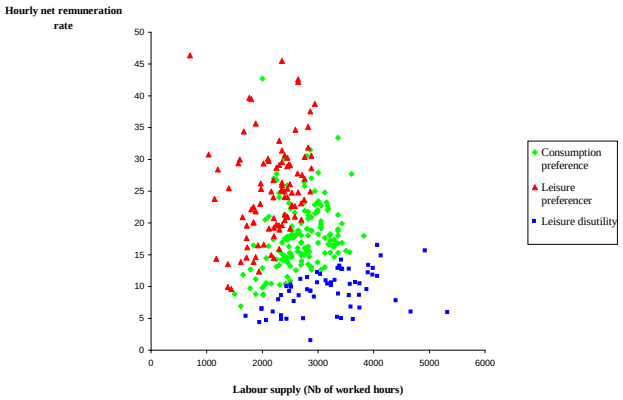
According to these results, 32% of physicians work even though their marginal cost is greater than their marginal benefit. We can conclude that physicians do not act like profit-maximising firms.

5.2.5 Physician as a price-making agent

To determine the coefficient of the ratio δ/φ (eq.10), we have estimated the hourly net remuneration rate w (eq.9) for the entire sample (Table 5).

According to these results, the physicians' labour supply significantly reduces their hourly net remuneration rate. Therefore, we can conclude that physicians have monopolistic power.

From these results, we can compute the ratio δ/φ (eq.10). When we use this ratio to determine physicians' preferences for consumption or for leisure, 49% of physicians prefer consumption good, 31% leisure good, and 20% experience a disutility from leisure.



According to these results, 20% of physicians work even though it is not in their material interest.

They work at a loss to satisfy the needs of their patients. The non-saturation hypothesis for leisure proposed by classical microeconomics is therefore irrelevant.

When we identify physician preferences as a function of this ratio, three physician groups emerge. The first group is composed of physicians who have a preference for leisure, a low labour supply and high hourly remuneration rate. The second is composed of physicians who have a preference for consumption. This group supplies more labour than the first and has a lower remuneration rate. Finally, the third group is characterised by physicians who experience a disutility from leisure. Labour supply in this group is the highest and the hourly remuneration rate is the lowest.

6 Discussion

We observe that the hourly remuneration rate is determined partly by the physician and partly by the market. Our sample physicians working in the PACA region have a monopolistic power that they can use. Our agent model therefore becomes relevant.

When we compare the results obtained from these different models, we can observe that preferences for leisure vary. According to the salaried model, physicians have a preference for leisure, whereas, according to the agent model, they have a less pronounced preference for leisure and in some cases disutility. Physicians' utility does not depend solely on leisure and consumption but also on altruism. Indirectly via leisure,

physicians assimilate altruism in their utility function.

7 Limitations

The ratio of exponents of the utility function that we use in the different models to determine the preference for consumption or leisure must be interpreted with caution. This ratio only allows us to determine if the physician experiences a disutility from leisure.

Our agent model does not allow us to determine substitution or income effects. These two effects are determined by variations in prices, which are endogenous in our setting. To determine the strategic behaviour adopted by agents after a change to their monopolistic power is difficult to evaluate. This would require further extensions of the model.

We have used an aggregated market (all physicians) to estimate the breakdown of the hourly remuneration rate, the hourly net remuneration rate and the hourly rate of expenses, whereas the optimisation problem of a physician is individual. While we are aware that the estimations are not perfect, the fact that they are based on an aggregated market allows us to observe the average impact of labour supply on these different rates.

8 Econometric application

8.1 Model

We apply a probit model to estimate the determinants of leisure disutility. The results are reported in Table 6.

8.2 Determinants of leisure disutility

According to these results, physicians who practice in municipalities where the market share is highly concentrated are more likely to observe a leisure disutility. Physicians who practice in a municipality with high medical density are more likely to observe a leisure disutility.

Two explanations can be advanced. First, physicians can adopt altruistic behaviour. Second, physicians can adopt strategic behaviour to maintain their market share. In

the case of altruistic physicians, a concentrated market can lead to health needs which cannot be satisfied. This is the reason why some physicians supply labour in these areas even though it is not in their material interest. On the other hand, physicians may exhibit what appear like a disutility from leisure because they adopt strategic behaviour. Competition in a market can lead to apparent disutility from leisure. To attract patients, physicians may take more time to satisfy patients.

9 Conclusion

According to our estimations, increased labour supply significantly reduces the remuneration rate of physicians. Consequently, they have monopolistic power that they may or may not choose to exercise. Our agent model can explain the activity of physicians in France. According to our estimations, 20% of physicians experience disutility from leisure. This disutility can be explained by the physicians' altruism aimed at serving the needs of their patients.

The agent model has some limits. In effect, we determine the impact of labour supply from an aggregated market, but this can vary as a function of the sample size. Therefore, the results may well according to the sample under investigation.

Disutility from leisure could explain the strategic behaviours adopted by physicians but also a lack of care provision in some areas. This disutility raises the question of the appropriateness of surgery location choices for the needs of patients.

The agent model that we propose could be applied to lawyers, to liberal professions, to craft professions, or to any other individual who maximises his utility subject to a budget constraint that is shaped to some extent by the presence of monopolistic power.

Reference

1. Scoot, A. "*Economics of general practice*" in "*Handbook of Health Economics Vol1.*" edited by A.J. Culyer and JP Newhouse

Appendices

Table 1: Summary statistics

Variable	Mean	Std. Dev.
GPs' activity		
Labour supply	2635.407	638.367
Number of visit	3495.334	1520.577
Number of home visit	1022.129	761.401
Fees	97805.512	40963.404
Hourly fees	37.876	15.624
Expenses	45162.862	22147.383
Hourly expenses	17.472	8.521
Net fees	52642.65	24734.038
Hourly net fees	20.404	9.44
Marginal benefit (GPs price-maker)	20.527	16.982
Marginal cost (GPs price-maker)	17.307	12.679
Part of home visit	0.221	0.122
Physicians' clientele		
Part of exonerated patients	28.444	11.545
Part of patients 0-16	18.8	6.383
Part of patients 17-58	55.605	7.157
Part of of patients 59-69	9.184	2.97
Part of patients 70 +	14.796	7.601
GPs' characteristics		
Woman	0.196	
Age	48.215	5.823
Household size	3.845	1.422
Others income	18748.862	31058.528
GPs' practice characteristics		
Age of installation	17.379	7.693
Exercise of MEP	0.524	
Sector 1	0.830	
Exercise in group	0.571	
Secretaire	0.511	
Practice purchase	0.498	
Nb of pharmaceutical prospector	8.24	5.154
Therapeutical trial	0.521	
Pharmaceutical laboratories formation hours	7.543	10.875
University formation hours	0.47	3.454
N	317	

Table 2: Summary statistics

Variable	Mean	Std. Dev.
GPs' department		
Alpes de Hautes Provence	0.028	
Hautes Alpes	0.044	
Alpes Maritimes	0.192	
Bouches du Rhône	0.451	
Var	0.174	
Vaucluse	0.11	
Marseille	0.199	
Rural area	0.344	
GPs' Competition environment		
GPs density	147.684	57.289
Specialist physician density	161.699	134.205
Herfindhal index	0.112	0.202
N	317	

Table 3: Hourly fees

Variable	Coefficient	(Std. Err.)
GPs' characteristics		
Age	-0.439*	(0.181)
Woman	-11.555**	(1.956)
Others income	0.000*	(0.000)
GPs' practice characteristics		
Age of installation	0.319*	(0.137)
Sector 1	-4.518*	(2.054)
Secretaire	6.156**	(1.476)
Pharmaceutical laboratories formation hours	0.115†	(0.067)
Therapeutical trial	4.215**	(1.511)
GPs' activity		
Labour supply	-0.007**	(0.001)
Physicians' clientele		
Part of exonerated patients	0.292**	(0.068)
Part of patients 0-16	0.696**	(0.168)
Part of of patients 59-69	0.514	(0.326)
Part of patients 70	-0.322*	(0.143)
GPs' department		
Alpes de Hautes Provence	-3.941	(4.430)
Hautes Alpes	0.237	(3.714)
Alpes Maritimes	4.528*	(2.156)
Var	7.187**	(2.162)
Vaucluse	1.723	(2.557)
Intercept	46.207**	(9.637)
N	317	
R^2	0.398	
$F_{(18,298)}$	10.942	

Significance levels : † : 10% * : 5% ** : 1%

Table 4: Hourly expenses

Variable	Coefficient	(Std. Err.)
GPs' characteristics		
Woman	-3.992**	(1.124)
GPs' practice characteristics		
Sector 1	-4.477**	(1.206)
Practice purchase	1.533†	(0.865)
Secretaire	4.160**	(0.876)
GPs' activity		
Labour supply	-0.003**	(0.001)
Physicians' clientele		
Part of exonerated patients	0.106**	(0.040)
Part of patients 0-16	0.293**	(0.098)
Part of of patients 59-69	0.363†	(0.188)
Part of patients 70 +	-0.229**	(0.084)
GPs' department		
Alpes de Hautes Provence	-3.141	(2.630)
Hautes Alpes	-1.230	(2.217)
Alpes Maritimes	2.523*	(1.274)
Var	2.888*	(1.265)
Vaucluse	0.109	(1.496)
Intercept	16.794**	(3.573)
N	317	
R^2	0.271	
$F_{(14,302)}$	8.021	

Significance levels : † : 10% * : 5% ** : 1%

Table 5: Hourly net remuneration rate

Variable	Coefficient	(Std. Err.)
GPs' characteristics		
Woman	-7.372**	(0.998)
GPs' practice characteristics		
Secretaire	2.125**	(0.760)
Pharmaceutical laboratories formation hours	0.085*	(0.035)
Pharmaceutical trial	1.913*	(0.783)
GPs' activity		
Labour supply	-0.004**	(0.001)
Physicians' clientele		
Part of exonerated patients	0.118**	(0.033)
Part of patients 0-16	0.446**	(0.082)
Part of of patients 59-69	0.248	(0.161)
Part of patients 70 +	-0.022	(0.070)
Intercept	14.336**	(3.134)
N	317	
R^2	0.339	
$F_{(9,307)}$	17.517	

Significance levels : † : 10% * : 5% ** : 1%

Table 6: Disutility of leisure

Variable	Coefficient	(Std. Err.)
GPs' characteristics		
Household size	-0.253**	(0.072)
GPs' practice characteristics		
Age of installation	-0.042**	(0.013)
Exercise in group	-0.488*	(0.207)
Secretaire	-0.349†	(0.209)
Exercise of MEP	0.486*	(0.198)
Physicians' clientele		
Part of patients 0-16	-0.056*	(0.024)
Part of of patients 59-69	0.048	(0.041)
Part of patients 70 +	-0.002	(0.017)
GPs' department		
Alpes de Hautes Provence	-0.441	(0.528)
Hautes Alpes	-0.482	(0.502)
Alpes Maritimes	-0.199	(0.254)
Var	-1.254**	(0.364)
Vaucluse	-0.060	(0.342)
GPs' Competition environment		
GPs density	0.003†	(0.002)
Herfindhal index	1.587**	(0.503)
Intercept	1.451	(0.928)

N	317
Log-likelihood	-118.57
$\chi^2_{(15)}$	76.195

Significance levels : † : 10% * : 5% ** : 1%

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