The Introduction of Pay-for-Performance : What Impact on General Practitioners' Activity in France?

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Abstract – In 2009, a system of pay-for-performance (P4P) was offered to physicians in France *via* the *Contrat d'Amélioration des Pratiques Individuelles* (CAPI). This study assesses the causal impact of CAPI on their behaviour in terms of care provision. Based on a panel of general practitioners in private practice observed before (2005 and 2008) and after (2011) its introduction, we use an instrumental variables approach, applied to a model in first-differences in order to correct the endogeneity biases linked to the fact that signing up to CAPI is a choice. We show that, unlike other practitioners, those who have signed up to CAPI have not reduced their number of consultations per patient or the amount of prescriptions per patient. They have also increased, to a greater extent than others, the proportion of their patients who they treat as the primary care doctor (i.e. the *"médecin traitant"*). Moreover, CAPI has enabled them to increase their fees per patient with, as a consequence, a higher treatment cost for the Social Security system.

JEL classification: I18, J22, C23, C26
Keywords: pay-for-performance, CAPI, care provision, general practitioners

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The way in which physicians are paid influences their behaviour in terms of care provision and the efficiency of the health system. The choice between capitation, a salary or fee-for-service, or a combination of these payment methods, influences the volume and the quality of care offered, access to care of the population and the efficiency of health expenditure (Grignon *et al.*, 2002).

In France, fee-for-service remains the dominant method. This type of payment encourages physicians to respond to demand and to meet patients' needs (Albouy & Déprez, 2009). However, there are numerous undesirable effects associated with it. In Sector 1, where rates are fixed, physicians' income mainly depends on the volume of their activity. Fee-for-service may therefore encourage the multiplication of procedures which reduces the efficiency of the health system (Delattre & Dormont, 2003). It also encourages curative care to the detriment of preventive care because it does not reward the long-term benefits of prevention (Franc & Lesur, 2004).

It is in this context that, in 2009, the *Caisse Nationale d'Assurance Maladie* (CNAM, the National health insurance) introduced a pay-for-performance (P4P) scheme, the *Contrat d'amélioration des pratiques individuelles* (CAPI, a contract between physicians and the Social Security).[1] This contract introduced a new element of remuneration for physicians associated with the achievement of targets in terms of quality and based not on the number of procedures carried out, but on the number of patients treated as the primary care doctor (the *médecin traitant*). On a voluntary basis, CAPI provided for a flat-rate remuneration to be added to fee-for-service, the amount depending on the rate of achievement of the targets set (see below).

Pay-for-performance has emerged in several OECD countries (the United States, Australia, Germany, etc.) following the example of the United Kingdom which pioneered it in 2004 with its 'Quality and Outcomes Framework' programme. With its generalisation, a large number of empirical studies have been carried out to assess its impact. All of them analyse the effect of financial incentives on achievement of the targets set under the programmes, the various incentives often being assessed separately. They conclude that pay-for-performance has a mixed effect. In France, the assessments currently available suggest a zero or limited effect. We address this question here from a different perspective, examining whether the financial incentives under CAPI, which increase the proportion of physicians' pay that is associated with the patient rather than the procedure, alter physicians' practices and the structure of their activity. This angle of analysis has not yet been adopted in France (or, as far as we are aware, in the international literature) to assess pay-for-performance.

We use a balanced panel of general practitioners (GPs) observed before (2005 and 2008) and after (2011) the introduction of CAPI. Balancing is required for our method of assessment. It means working on the basis of physicians who have been practising continually in private practice over the period from 2005 to 2011. The latter represent 84% of the procedures carried out and 82% of the patients for whom care was provided over that period. Using an instrumental variables estimation applied to a model in first-differences, we assess the causal impact of CAPI on the behaviour, in terms of care provision, of GPs who are "treated" by CAPI.

The period studied is characterised by strong growth in potential demand addressed to each physician due to changes in the medical demography, the preferences of young generations of physicians and a rise in chronic illnesses. The physicians in our sample have seen a considerable increase in patient numbers (+14.7%) which goes hand in hand with an equally large reduction in the number of consultations per patient (-14.1%). In this context, CAPI introduces a significant counterbalance to these changes: contrary to their colleagues, those physicians who opted for CAPI have not taken on more patients or reduced the number of consultations per patient; nor have they reduced the amount of prescriptions per patient. They have also increased, to a far greater extent than their colleagues, the proportion of their patients who they treat as the *médecin traitant*. By generating additional income per patient irrespective of the number of procedures carried out, CAPI has allowed physicians to increase the amount of time devoted to each patient and, as a consequence, their fees per patient. This significant effect of CAPI on physicians' practices, which may translate to an improvement in the quality of patient treatment, goes hand in hand, as far as the Social Security system is concerned, with a significant increase in the cost of care for each patient concerned.

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*1. The National Medical Council (*Conseil national de l'Ordre des médecins*) was opposed to it, seeing this contract as an attack on the independence of doctors and harming the relationship of trust between the doctor and their patient (Dormont, 2013).*

The article is structured as follows. Section 1 offers an overview of the literature on the effects of pay-for-performance, so as to put our contribution into context. Section 2 returns to the functioning of CAPI and presents the data used, the construction of the sample and some descriptive statistics. The empirical strategy is described in Section 3, the results are set out in Section 4, then we conclude.

1. Literature Review

Since the 2000s, many OECD countries have introduced a pay-for-performance system aimed at improving the quality of care provided (through better care treatment for chronic illnesses, early detection of cancers, etc.) and the efficiency of health expenditure. The emergence of this new system has given rise to a large number of studies seeking to assess its cost and its efficiency (see Cashin *et al.*, 2014 for a summary). Almost all of the studies assess the effects of these incentives on the achievement of each of the targets directly aimed at by the financial incentives (Van Herck *et al*., 2010; Flodgren *et al*., 2011; Scott *et al*., 2011; Gillam *et al.,* 2012; Eijkenaar *et al.,* 2013). These works obtain varying quality effects because, as indicated by Kantaveric *et al.* (2013), results are directly dependent on the methodology used in the assessments and on the structure of the system, and more specifically on the substance of the incentives (size of bonuses, number of targets and measure of their achievement). They are also highly dependent on the organisation of the health system in the country concerned (particularly the initial payment system, whether it is an individual or group practice). Pay-for-performance may also have an impact on the physician's other activities, those not covered by the financial incentives, but in that case too, the estimated effects are conflicting according to the studies, even where they relate to the same countries: for example in Britain, Doran *et al*. (2011) conclude that there is a deterioration in the quality of care for procedures not covered by the incentives whereas, previously, Sutton *et al*. (2010) reached the opposite conclusion.

Unlike in other countries, few econometric studies assess the effects of pay-for-performance in France. Like the international literature, these studies mainly seek to quantify the impact thereof in terms of achievement of the targets aimed at by the financial incentives, or the quality of care. Saint-Lary & Sicsic (2015) thus assess the effect of CAPI on the length of consultations, used as a proxy for the quality of care, and show that consultations by physicians who have signed up to CAPI are not significantly longer than those by others. Sicsic & Franc (2017) analyse the effect of CAPI on the number of mammographies prescribed for women between the ages of 50 and 74 but do not find any significant difference between those prescribed by physicians who have signed up to CAPI and those who have not. According to them, the amount allocated to this indicator does not generate enough of an incentive to significantly improve practices for the prevention of breast cancer. In these studies, although the authors highlight a selection of physicians in the system, the econometric specifications used do not enable this endogeneity to be controlled. On the other hand, Michel-Lepage & Ventelou (2016) consider a probit model with instrumental variables to assess the effect of CAPI on achievement of the target to reduce prescriptions of benzodiazepines in patients aged 65 or over. Their results suggest that CAPI has a significant but minor impact on the achievement of this target. However, the exogeneity of the instrument used (the number of consultations by physicians over the period studied) is disputable. Moreover, their period of study (June 2011 to December 2012) includes the period in which ROSP[2] was introduced: the control group (physicians who have not signed up to CAPI) therefore also had financial incentives to achieve this target. Rat *et al*. (2014), who look at the same indicator but in the context of ROSP and without instrumenting the amount of payments received *via* ROSP, do not observe any effect of performance-related pay.

Compared to these inconclusive results regarding the efficiency of the pay-for-performance system, our contribution to the literature is two-fold. Firstly, we examine whether CAPI, which modifies the form of payments received by physicians by giving less weight to fee-for-service, has an impact on behaviour in terms of the provision of care by physicians. Although our data do not contain any details on the pharmaceutical prescriptions (generic or original), or the tests and blood dosages prescribed, they do, on the other hand, provide a set of variables relating to behaviour in terms of the provision of care: number of consultations, procedures, number and proportion of patients treated as the *médecin traitant*, number of beneficiaries of complementary universal health insurance (CMU-C), patients in long-term illness (ALD), structure of patients by age and sex,

2. Rémunération sur Objectifs de Santé Publique, *which extended pay-for-performance to all physicians in 2012.*

prescriptions, and components of the doctor's income. As far as we are aware, no assessment of pay-for-performance from this perspective of the impact on the structure of the provision of care has yet been carried out either in the French or the international literature.

Moreover, our empirical strategy assesses the impact of these incentives taking the endogeneity of having signed up to the CAPI system into account. Our first-difference specification using an instrumental variable method allows the assessment of a local effect, measured on compliers alone, based on a balanced panel of physicians who have worked continuously in private practice from 2005 to 2011. Our results therefore have to be interpreted with caution. In any case, our approach allows for correcting biases associated with the endogeneity of having signed up to CAPI, which is not usually the case – or imperfectly – in French studies.

2. The CAPI System, Data and Descriptive Statistics

In March 2009, the UNCAM (National Union of health insurance funds) introduced pay-for-performance in France *via* CAPI (Journal officiel, 2009). The aim of the system is to encourage physicians to follow the good practice recommendations issued by the *Haute Autorité de Santé* – the National Health Authority – (more prevention, support for patients suffering chronic illnesses), whilst limiting the growth in health expenditure. The contract reduces the proportion of fee-for-service, which is known to encourage them to offer more procedures and more curative than preventive care, in physicians' pay. Any *médecin traitant* on agreement with the Social Security in private practice and having the minimum number of patients and the minimum volume of prescriptions could sign, on a voluntary basis, a three-year contract with the CNAM. Physicians were then free to leave the system if they wanted to. By signing up to CAPI, a physician undertakes to meet the targets set under public health law in return for a financial reward (see Box).

Nearly 16,000 *médecins traitants* in private practice signed up to CAPI over the period covered by this system, that is to say more than one in three eligible physicians (CCSS, 2011). The growth in the total number of signatories has been gradual: from 5,000 in June 2009, 13,000 in December 2009, 14,000 in June 2010 and 15,500 in December 2010. Most therefore signed up in 2009. In its communication, the CNAM highlighted the success of CAPI since its first year (CNAM, 2010), with objective achievement rates among those signing up to CAPI which have increased to a greater extent than among those who have not. On the other hand, achievement rates among those signing up to CAPI were initially (before they signed up) higher than the rates of those who have not.

2.1. The Data: An Exhaustive Panel of French General Practitioners in Private Practice

The study uses data from a matching process produced by INSEE on behalf of DREES from two exhaustive administrative sources relating to physicians working in private practice in France. The first, supplied by CNAM, contains information on the doctor's sociodemographic characteristics, the structure of their activity, their patients and their fees. It is matched with data from the Directorate-General of Public Finances (*Direction Générale des Finances Publiques*, DGFiP) which provide details of physicians' tax returns (personal tax returns) and detailed information on the various sources of their remuneration and the characteristics of the taxable household. The matching also contains information on the municipality in which the doctor is practising.

Box – **The CAPI System**

CAPI consists of two parts: the first relates to targets for prevention and the treating of chronic pathologies and the second, referred to as the prescription optimisation target, encourages the prescribing of generic drugs (see Appendix 1). In total, sixteen public health target indicators have been established.

When calculating whether targets have been achieved, account is taken of the physician's initial achievement rate, but also their progression. If he or she achieves at least 25% of the targets in each of the two parts of the contract, they get a bonus which is calculated as follows:

$$Bonus = Achievement\ rate \times number\ of\ patients\ as\ médecin\ traitant \times €7$$

The bonus received is an increasing function of the number of patients treated as the *médecin traitant* and the rate of achievement of the targets. To give an idea of size, a doctor who treats 800 patients as the *médecin traitant* may hope for a bonus of up to €5,600 if they achieve all of their targets.

Five years are available (2005, 2008, 2011, 2014 and 2017) but only 2005, 2008 and 2011 have been retained for analysis. This is because, in 2012, CAPI was replaced by ROSP, which extended pay-for-performance to all physicians, which may have altered their activity. The period from 2008 to 2011, which saw no reforms in outpatient care that may have had any specific effect on certain physicians, can therefore be used to identify the effect of CAPI itself.

2.2. Sample Used for the Analysis

CAPI has been offered to all physicians under agreement with the National Health Insurance working in private practice. Our data show that 99.97% of physicians who received a CAPI bonus in 2011 are GPs. For this reason, our study concentrates on the latter.

We restrict coverage to GPs working exclusively in private practice (i.e. they have no hospital work in addition to their private practice work).[3] We also disregard physicians who draw a pension over the period. Moreover, we concentrate uniquely on physicians practicing in Sector 1 (that is, who apply fees agreed with the Social Security) and thus exclude those who either are not under agreement or practice in Sector 2. These physicians have very different characteristics to those in Sector 1 and, in 2011, represent only 10.4% of GPs and only 4.4% of those who signed up to CAPI and received a bonus. The sample then consists of 50,233 GPs in private practice observed at least once in 2005, 2008 and 2011.

Our econometric strategy (see below) requires physicians to be observed before (2005 and 2008) and after (2011) CAPI was introduced. Our sample is therefore restricted solely to physicians present in these 3 years. The construction of this balanced sample reduces the initial sample by 15,980 physicians (31%) to leave 34,253 physicians.

Using a balanced sample raises the question of a selection bias. It results in excluding that three types of physicians: *(i)* physicians who left private practice in 2008 or 2011 (40% of those ruled out); *(ii)* physicians observed for the first time in 2008 or in 2011 (40%); *(iii)* physicians who have a career break and disappear from the data for one or two years (20%).[4] We do not know the reasons for any temporary or permanent departure from and return to the data. However, their characteristics (see Appendix 2) and data from the *Ordre des Médecins* – the National Medical Council – (see Le Breton-Lerouvillois & Romestaing, 2013) show that type *(i)* are physicians who left private practice for retirement reasons, for a temporary break in their careers or for a change of medical specialty and that type *(ii)* physicians started their practice that year. The remaining 20% stopped working in private practice for one or two years (sick leave, maternity or temporary departure from private practice in favour of another form of practice). They have substantially reduced their activity during the year(s) of observation, probably reflecting a departure from private practice (and therefore from the sample) during the course of the year.

Overall, the working sample is made up uniquely of physicians in a "permanent structure", that is to say physicians who have already built up their client base (so not new physicians), who are not at the end of their careers either and who have chosen to work full-time in private practice. They represent 70% of the original sample but carry out 84% of total procedures, earn 84% of total fees and treat 82% of patients. This balancing, which is needed for our econometric approach, therefore leads us to examine the main care providers.

Finally, we also excluded from this balanced sample of 34,253 physicians all of those for whom the variables of interest in 2008 or 2011, the instruments in 2005 and the control variables in 2005, 2008 or 2011 have atypical values. Our final sample then consists of 32,171 physicians from Sector 1 observed over three years, 2005, 2008 and 2011, that is to say 96,513 observations.

Of these GPs in private practice, 23.1% (7,429 physicians) received a CAPI bonus in 2011. This does not mean that 23.1% of GPs signed up to CAPI. The reason is that some physicians signed up but did not achieve the targets required for them to earn any bonus (according to CNAM, this accounts for about 25% of signatories, cf. Ulmann, 2011). In the data, we can only observe the amount paid in bonuses and not the doctor's status in terms of signing up. It is therefore impossible for us to distinguish, among the physicians not having received any CAPI bonus, those who signed up to CAPI without achieving the targets from those who did not sign up to CAPI. In this article, we are therefore seeking to measure the effect of CAPI in relation to physicians who sufficiently altered their practices to get a bonus.

3. This restriction is needed in so far as our data only provide information on work carried out in a private practice. The activity carried out in a hospital structure, a retirement home or any other structure in which the doctor would be employed is not accounted for in our data and the measurement of their activity is therefore incomplete.

4. To identify them, we also use data from 2014: if the doctor is present in 2005 but absent in 2008 and/or 2011, but present again in 2014, they have had a temporary career break.

2.3 Variables of Interest

Our analysis seeks to estimate the causal impact of CAPI, and therefore the impact of the modification of remuneration associated with each patient, on the structure of physicians' activity. Even if the bonus is a relatively small amount, it is not negligible (Figure I), and the literature on incentives shows, in many areas, a significant response by individuals to small monetary incentives. The behaviour of physicians in terms of care provision may be summarised using the following variables:

- Variables relating to overall annual activity: the number of consultations, the total number of procedures and the volume of care provided (i.e. the sum of the various procedures, valued by the standard price for these procedures). The volume of care thus valued despite being a monetary variable, allows the composition of the activity and their technicality to be measured.[5]

- Variables relating to the structure of the doctor's patients: the number of different patients seen during the year and the proportion of patients treated as the *médecin traitant* since calculating the CAPI bonus depends on the number of patients treated as the *médecin traitant* (cf. Box).

- Variables relating to the structure of the doctor's activity, measured per patient: the number of consultations, the total prescription amounts and the pharmaceutical prescription amounts. One might expect that CAPI would have a positive effect on the amount of time devoted to each patient, i.e. on the number of consultations given to each patient. The effect of the system on the amount of prescriptions is more ambiguous since the achievement of certain targets is inextricably linked to an increase in prescriptions (such as of mammographies, of dilated fundus examinations or of glycated haemoglobin tests), or in pharmaceutical prescriptions in particular (such as antihypertensives), whilst the achievement of other targets is linked to a reduction in the amount of pharmaceutical prescriptions (such as an increase in the proportion of prescribed drugs in the directory of generic medicines) (see Appendix 1).

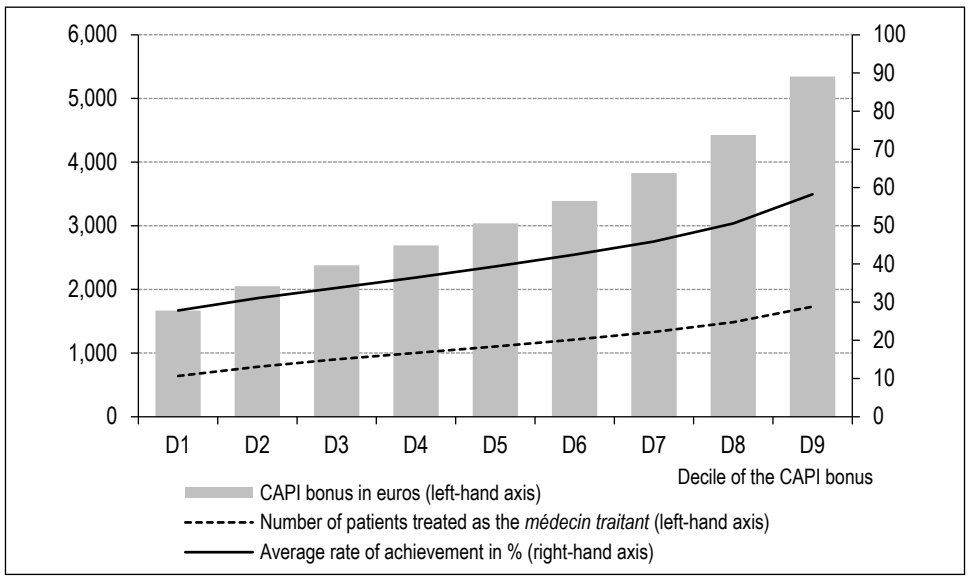
- Remuneration and cost variables: the amount of total fees and fees per patient, but also the full cost of reimbursable expenditures per patient. The latter includes physicians' fees and the value of prescriptions.

2.4. Descriptive Statistics

Our data show that, in 2011, physicians who signed up to the system received an average bonus of €3,332. This average conceals large disparities (Figure I): 10% of physicians who signed up to CAPI received a bonus of less than €1,667 and 10% received a bonus of more than

5. Indeed, where total numbers of procedures are completely identical, a physician who only gives consultations will have a lower volume of care than one who combines "conventional" consultations with technical procedures for which charges are higher (such as electrocardiograms).

Figure I – **Rate of achievement of targets, amount received in bonuses and number of patients treated by general practitioners who signed up to CAPI as the *médecin traitant* in 2011**



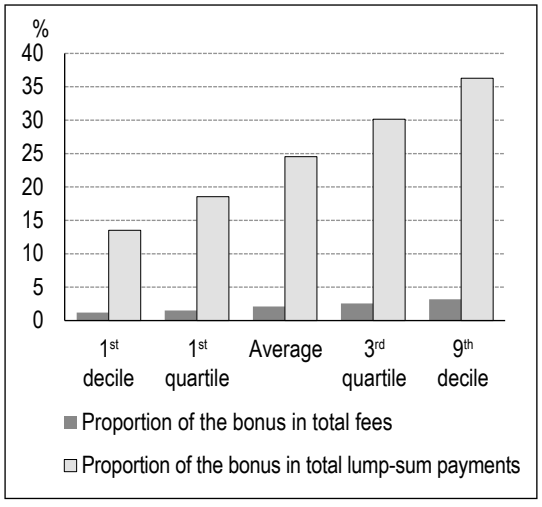
Notes: The decile of the CAPI bonus and the average number of patients treated as a *médecin traitant* are both read on the left-hand axis. The average rate of achievement is shown on the right-hand axis. The average rate of achievement is calculated by the authors.
Reading Note: In 2011, 10% of doctors who signed up to CAPI treat fewer than 641 patients as a *médecin traitant*, have a target achievement rate of less than 27.8% and receive a bonus of less than 1,667 euros.
Sources and Coverage: CNAM-DGFiP-DREES matched data, wave 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice who signed up to CAPI.

€5,342. A quick calculation shows that 59% of the variance in these bonuses between physicians is due to the variability of the number of patients treated as the *médecin traitant* and 25% is due to the variability of the rate of achievement (the remaining variability corresponding to the correlation between these two variables). The 10% of physicians receiving the lowest bonuses combine a low rate of achievement (less than 27%) and a limited number of patients treated as the *médecin traitant* (fewer than 641 patients). Conversely, the 10% of physicians receiving the highest bonuses have an average rate of achievement of more than 58% and treat more than 1,729 patients as the *médecin traitant*.

This bonus represents an average of 24.5% of the total lump-sum payments received by GPs in addition to their fee-for-service. However, this is still only a small proportion of the physicians' pay: on average, less than 2.11% of fees, a little more than 3% for the 10% of physicians earning the highest bonuses (Figure II). The extension of CAPI to ROSP, in 2012, through an increase in the number of targets giving rise to bonuses, led to an increase in the proportion of lump-sum payments in physicians' pay in subsequent years.

Table 1 shows a comparison of the characteristics (in 2008, before the introduction of CAPI) of physicians who received a CAPI bonus with those who did not receive one. Those who received a bonus have very different characteristics to other physicians: they tend to be men, to be younger and to live in a couple in a household with dependent children. They tend to practise in municipalities less densely populated with GPs, specialists and other private health professionals (dental surgeons, nurses, midwives and physiotherapists). The demand for care directed at them is therefore generally higher.

Figure II – **Proportion of the CAPI bonus in total fees and lump-sum payments of general practitioners in 2011**



Reading Note: On average, the CAPI bonus represents 24.5% of the total lump-sum payments and only 2.11% of the total fees of general practitioners in 2011.
Sources and Coverage: see Figure I. Authors' calculations.

Table 2 shows the average of the different variables of interest in 2008 and 2011. The statistics highlight a significant difference between CAPI and non-CAPI physicians in respect of all variables. Before signing up to CAPI, in 2008, physicians who are signatories carried out more procedures in total and had a significantly higher volume of activity. They treated more patients, and in a greater proportion as the *médecin traitant*, and received higher total fees. These differences grow in 2011, with the impact of CAPI and other factors of change in physicians' activity.

These statistics clearly show that physicians who signed up to CAPI are different to their colleagues. It is therefore essential to take account of the potential endogeneity of signing up to CAPI in the econometric analysis of its impact.

3. Empirical Strategy

Physicians have been able to sign up to CAPI since 2009 and we can observe, from the data for 2011, the impact of receiving a bonus on the characteristics of the doctor's overall activity. Noting $log(Y_{it})$ the logarithm of one of these characteristics, we consider a model of the form:

$$log(Y_{it}) = \alpha + \beta \text{CAPI}_{it} + X_{it}^{'}\gamma + \delta t + \theta_i + \epsilon_{it} \quad (1)$$

where t=2008 or 2011, i=1...N

CAPI_{it} is a dichotomous variable equal to 1 if the doctor has signed up to CAPI and received a bonus in 2011 and 0 if not. In the remainder of the article, we will simplify matters by saying that this variable measures the effect of "signing up to CAPI"; in fact, it measures the effect of signing up to CAPI and achieving the targets enabling the doctor to receive a bonus.

θ_i represents the individual specific effect of doctor i. This term incorporates elements of unobserved heterogeneity specific to the doctor and assumed to be constant over time: their style of practice, their ethics and the importance they give to leisure in the work and leisure trade-off.

ϵ_{it} represents the idiosyncratic error term which affect the behaviour of doctor i in terms of their care provision in year t, such as an epidemic, a variation in the demand for care, a need by the doctor to increase their income, their state of health or any other temporary shock.

Table 1 – **Sociodemographic characteristics of general practitioners in 2008, before CAPI was introcuced, according to whether or not they chose to sign up to CAPI**

	NON-CAPI % in column	CAPI % in column	p-value
Number of doctors	24,742	7,429	
Gender			
Men	73.7	77.8	
Women	26.3	22.2	***
Age			
Aged < 49	35.8	40.3	***
Aged 49-55	35.7	35.6	ns
Aged ≥ 56	28.5	24.1	***
Marital status			
Single	11.1	8.4	***
Divorced	10.5	10.1	ns
Married	76.7	79.7	***
Civil partnership	1.1	1.2	ns
Widow(er)	0.6	0.6	ns
Dependent children			
No	32.8	27.5	
Yes	67.2	72.5	***
Dependent persons in the family home			
0	32.3	26.9	***
1	21.0	19.7	**
2	26.3	28.3	***
3 or +	20.4	25.1	***
Density of GPs in private practice in the municipality where they are practising for 1,000 inhabitants			
Average (standard deviation)	1.39 (0.80)	1.36 (0.84)	***
Density of specialist doctors in private practice and other medical professions in private practice in the municipality where they are practising for 1,000 inhabitants			
Average (standard deviation)	3.68 (2.11)	3.56 (2.06)	***

Notes: The *p-value* corresponds to the test of equality of means between CAPI and non-CAPI doctors. ns stands for not significant: $p \geq 0.10$; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.
Reading Note: In 2008, 26.3% of doctors who have not signed up to CAPI are women whilst they represent 22.2% of doctors who have signed up to CAPI. This difference is significant at the 1% threshold.
Sources and Coverage: CNAM-DGFiP-DREES matched data, wave 2008. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

The variable t is a linear trend symbolising the progression between 2008 and 2011 in respect of all of the variables for the provision of care by physicians.

X'_{it} corresponds to a set of variables which explain physicians' activity. Many of them are constant between 2008 and 2011 and disappear in first differences, as well as the age of the doctor, which is collinear with the trend. On the other hand, variables relating to the number of people in the doctor's household (partner and number of children), to the density of GPs in private practice and to the density of specialists and other health professionals in private practice in the municipality where they work, are retained in the first-difference specification.

The endogeneity of the decision to sign up to CAPI partly translates to a correlation between the individual specific effect θ_i and the variable CAPI_{it}. This specific effect is eliminated by transforming the initial model through first differences. This gives:

$$\Delta log\left(Y_{it}\right) = \beta \Delta \text{CAPI}_{it} + \Delta X'_{it}\gamma + \delta + \Delta\epsilon_{it}$$

More precisely, as we will be studying the changes between 2008 and 2011, the model is expressed as follows:

$$\Delta Y_{i0811} = \beta \Delta \text{CAPI}_{i0811} + \Delta X'_{i0811}\gamma + \delta + \Delta\epsilon_{i0811} \quad (2)$$

In this context, the effect of receiving a CAPI bonus on the rate of growth of different variables is being studied: $\Delta Y_{i0811} = \left(log\, Y_{i11} - log Y_{i08}\right)$.[6]

Even if first differences allow the specific effect on the doctor to be eliminated, it is possible that

6. When this variable is a proportion (this is the case for the share of patients followed as a médecin traitant), ΔY_{i0811} corresponds only to the variation of this proportion between 2008 and 2011. For the other variables, we approximate the growth rate by the first difference of the logarithms. The choice to measure the explained variables in logarithms comes from the distribution of these variables. The values of Skewness and Kurtosis lead to a log normal distribution for the different explained variables.

Table 2 – **Comparison of variables for care provision by general practitioners, between doctors who signed up to CAPI and other doctors**

	2008			2011		
	NON-CAPI Average (standard deviation)	CAPI Average (standard deviation)	p-value	NON-CAPI Average (standard deviation)	CAPI Average (standard deviation)	p-value
Number of doctors	25,922	7,433		25,922	7,433	
Overall activities						
Number of consultations	4,696 (2,056)	5,057 (1,917)	***	4,767 (2,129)	5,134 (2,010)	***
Total number of procedures	5,413 (2,311)	5,784 (2,091)	***	5,423 (2,363)	5,806 (2,177)	***
Volume of care (1)	120,053 (51,233)	128,040 (46,453)	***	126,020 (54,844)	134,629 (50,757)	***
Patients						
Number of patients	1,538 (622)	1,643 (585)	***	1,791 (748)	1,907 (705)	***
Proportion of patients treated as the *médecin traitant*	46 (17)	51 (11)	***	56 (19)	62 (12)	***
Structure of activity per patient						
Number of consultations per patient	3.1 (0.9)	3.1 (0.7)	ns	2.7 (0.8)	2.7 (0.7)	***
Prescriptions per patient (1)	495 (244)	497 (194)	ns	434 (194)	435 (166)	ns
Pharmaceutical prescriptions per patient (1)	247 (109)	249 (94)	ns	201 (88)	201 (77)	ns
Remuneration and cost (1)						
Fees	149,806 (63,112)	159,857 (56,908)	***	150,180 (64,528)	163,784 (60,138)	***
Fees per patient	101 (34)	101 (29)	ns	87 (29)	89 (26)	***
Basis for reimbursement of the full cost per patient	597 (295)	598 (214)	ns	521 (211)	524 (183)	ns

(1) In constant euros based on 2015.
Notes: ns stands for not significant: $p \geq 0.10$; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.
Reading Note: In 2008, doctors who have not signed up to CAPI carried out an average of 4,696 consultations whilst doctors who have signed up to CAPI carried out 5,057. This difference is significant at the 1% threshold.
Sources and Coverage: CNAM-DGFiP-DREES matched data, waves 2005, 2008 and 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

temporary shocks included in $\Delta\epsilon_{i0811}$ are correlated to the adoption of CAPI. A sudden variation in demand associated, for example, with a flu or gastroenteritis epidemic may result in an increase in the doctor's activity ($\Delta Y_{i0811} > 0$) and may also lead them to sign up to CAPI if they anticipate that this increase in activity may lead patients to choose them as the *médecin traitant*. A change in family circumstances (such as a birth) may also have a negative impact on the doctor's activity ($\Delta Y_{i0811} < 0$) and at the same time encourage them to sign up to CAPI (in order to earn a bonus enabling them to offset the negative effect of less work on their income). The variables of density of GPs and family composition contained in variables X enable some of these temporary shocks to supply or demand to be controlled, but this does not catch all of the shocks. Other elements may be present in $\Delta\epsilon_{i0811}$. For example, it may be a shock in terms of the doctor's preference for the quality of care, in terms of a distaste for the multiplication of procedures, arising following the loss of patients, that is to say a shock in terms of information on the doctor's own performance. $\Delta\epsilon_{i0811}$ may also reflect the sensitivity of the doctor to the various campaigns run by the National Health insurance to promote the quality of care.

It is therefore not possible that temporary shocks figuring in the disturbance of the model influence participation in treatment, which would imply that the estimation of the model in first-differences through the ordinary least squares is not consistent. To obtain a consistent estimation, we use an instrumental variables estimator, the first stage of which being defined by:

$$\Delta \mathrm{CAPI}_{i0811} = a + bZ_{i05} + \Delta X'_{i0811} c + \Delta u_{i0811} \quad (3),$$

where $\Delta \text{CAPI}_{i0811}$ corresponds to the decision to sign up to CAPI. The instrument used, Z_{i05}, is the logarithm of the density of GPs observed in 2005 in the municipality where the doctor is practising. Its influence on ΔY_{i0811} should only be reflected in its impact on signing up to CAPI: it should be closely correlated to the probability of signing up to CAPI and not correlated to $\Delta\epsilon_{i0811}$. There are several reasons supporting the idea that this instrument observed at the level of the physician's municipality is exogenous. Firstly, this variable is observed in 2005; it is therefore implausible for it to be correlated to $\Delta\epsilon_{i0811}$ which represents temporary shocks affecting the doctor between 3 and 6 years later. It is true that this instrument may be correlated to the individual effect specific to the doctor θ_i because the latter is probably linked to their choice of location. However, θ_i is eliminated from our first-difference specification.

The correlation of the density of GPs in 2005 to signing up to CAPI may result from quality competition mechanisms or from the effects of physicians' excessive workloads. If the density of physicians is high, they may be in competition to attract patients and, in that case, improving quality may be an advantage that CAPI has conveniently been rewarding since 2009. Choosing CAPI should therefore be associated with a high density of physicians. However, there is no published information on the quality of care delivered by physicians, which limits the effect of quality on demand: if CAPI has an effect on the quality of care, this should rather occur directly through the incentive associated with pay-for-performance.

Another rationale leads to an opposite prediction: if the density of physicians is low, the doctor receives many patients and provides many procedures because the demand for their services is high. In this context, they may want to reduce their workload in favour of improving quality (see fewer patients, treat them better and, in particular, treat them as the *médecin traitant*) and earn a CAPI bonus which may offset the loss of earnings associated with the fact that they have carried out fewer procedures. In this case, choosing CAPI would be associated with a low density of physicians. It is this second interpretation which is supported by our results.

4. Estimation of the Impact of CAPI

4.1. The Context: Changes in the Practices of General Practitioners between 2008 and 2011

To understand the effect of CAPI, it is important to understand contextual elements which have affected changes in the practices of all physicians over its application period.

The period from 2008 to 2011 is characterised by the generalisation of the gatekeeping (*médecin traitant*) system, set up in 2004 and by a reduction in the numbers of GPs, which started in 2007. For the physicians in our sample, the density of GPs fell by an average of 7.4% between 2008 and 2011 and nearly 80% of them saw a reduction in density in the municipality where they practised, mainly owing to retirements. Another important change is the increase in the proportion of women in the profession, as is clearly apparent from the unbalanced data, where 47% of physicians who are established in 2008 are women whilst, that same year, 78% of the physicians who retire are men (cf. Appendix 2). This increase in the proportion of women has an impact because numerous studies have shown that female physicians in private practice work less than their male counterparts.[7] Among men, the young generations are also less active at a given age than older generations.

These changes, together with an increase in chronic illnesses, lead to changes in potential demand for the services of physicians in our sample. Since the sample is balanced, we do not observe an increase in the proportion of women who have signed up over the period from 2008 to 2011. However, these established physicians (who account for the vast majority of care provision with 84% of procedures), face movements in potential demand owing to medical demographics and the preferences of young generations. This context leads to the changes shown in Table 3.

As can be seen, there is considerable growth in the number of patients per doctor (+14.7%) and even more marked growth in the number of patients for whom the doctor is the *médecin traitant* (+34%). This reflects the increased burden on the system, which translates to a 9.7 percentage points increase in the proportion of patients treated as the *médecin traitant*. But if these physicians therefore have many more patients, they carry out virtually no more consultations: just +0.6% between 2008 and 2011. This goes hand in hand with a marked drop in the number of consultations per patient (-14.1%) and the number of prescriptions per patient (-12.8%).

7. *The difference is estimated at 35% by Dormont & Samson (2008) ; see also Dumontet & Chevillard (2020) for a summary of the results.*

Table 3 – **Changes in the different variables of interest between 2008 and 2011 over the whole sample**

Variables	Growth rate 2008-2011 (%)	Of which growth between 2008 and 2011 due to changes in density (%)
Number of consultations	0.6	0.4
Number of patients	14.7	0.4
Number of patients treated as the *médecin traitant*	34.0	0.2
Proportion of patients treated as the *médecin traitant*[1]	9.7	0.1
Number of consultations per patient	-14.1	0.0
Prescriptions per patient [2]	-12.8	0.1
Fees [2]	0.3	-0.2

[1] For this variable, it is the variation of the proportion in percentage points and not the rate of growth. [2] In constant euros basis 2015.
Notes: These average rates of growth are the average of the individual rates of growth observed between 2008 and 2011 for all doctors in the sample.
Sources and Coverage: See Table 2.

The physicians in our sample therefore provided care for far more patients over the period without carrying out far more procedures. One can see therein one effect of the *médecin traitant* system which gives an additional fee of €40, a sort of capitation, for the treatment of each patient suffering a long-term illness (*affection longue durée*, ALD), but also of the increase in potential demand. This may also be the result of changes in the density of physicians, the reduction therein necessarily implying an increase in the number of patients per doctor. However, the growth rates, which represent growth due to changes in density show that changes relating to the activity of the GPs in our sample are correlated to those relating to the density of physicians only to a very limited extent.[8] It is in this context that the CAPI system was introduced as a counterbalance, a new element of remuneration which is itself also based on patients treated as the *médecin traitant* but is associated with indicators of quality which may limit the tendency to do as little as possible per patient.

4.2. First Step: Signing Up to CAPI

The results presented in Table 4 show that the density of GPs in private practice in the municipality where they are practising in 2005 is negatively correlated to the earning of a CAPI bonus. Actually, this variable is, amongst other things, a predictor of the number of patients treated as the *médecin traitant*, a number which has a positive influence on the return on signing up to CAPI *via* the value of the bonus. In this context, a high density translating to an abundance of care provision has to have a negative impact on this number and, consequently, on the propensity to sign up to CAPI. The Fisher statistic, which corresponds to the test of significance of the instrument in the first-stage regression where there are other control variables, has a value of 14.89 which indicates that our instrument is well correlated to the CAPI bonus, in other words that the instrument is not weak.

4.3. Impact of CAPI on the Practices of General Practitioners

The results of second-stage estimations (equation (2)) are presented in Tables 5 and 6; we report the coefficients estimated in respect of the different variables ΔY_{i0811}, the name thereof being specified at the start of each line. In Table 5, the results of ordinary least squares estimations are reported in the OLS columns and those of instrumental variables estimations are reported in IV columns. Two coefficients are reported each time: the estimation of β, the effect of the treatment associated with CAPI, and that of δ,

8. Within the growth in the number of patients of 14.7%, only 0.4% is attributable to a reduction in density. The same applies to all of the variables considered apart from the number of consultations, whose growth is very slight (0.6%), but is due to a variation in density in two thirds of cases (0.4%).

Table 4 – **First-step estimation (equation (3))**

	Y = signed up to CAPI
Z = log of the density of general practitioners in the municipality where they are practising in 2005	-0.021*** (0.005)
Fisher statistic from Kleibergen-Paap	14.89
N	32,171

Notes: *** p < 0.01. The standard errors clustered at the GP level are in parenthesis. This estimation includes the control variables presented in section 3. The Fisher statistic from Kleibergen & Paap (2006) is a generalisation of the statistic from Cragg & Donald (1993) in the case where errors are not i.i.d.
Sources and Coverage: CNAM-DGFiP-DREES matched data, waves 2005, 2008 and 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

the change common to the two groups over the period, other things equal, in particular in terms of the densities of physicians in the department. δ is not a gross change in the variable of interest, but its change once changes in density have been taken into account. For example, for total fees, the IV estimation of δ is -6%: this does not mean that the fees have fallen by 6% over the period in our sample (they have increased, slightly, by 0.3%, cf. Table 3). All the following comments as regards trends have to be understood in terms of "all other things being equal in relation to changes in control variables" (to simplify things, the coefficients of the control variables are not reported in the table).

The column headed "Hausman test" gives, for each estimation, the alpha risk associated with the Hausman test of exogeneity. The tests lead to a rejection of the hypothesis of exogeneity of CAPI in respect of almost all of the variables explained, apart from the number of consultations and the total number of procedures, for which it may be considered that the ordinary least squares are consistent and efficient. The comments which follow are based on IV estimations except in the case where the OLSs are validated by the Hausman test.[9]

Table 6 summarises the main results. For physicians who signed up to CAPI, it gives an estimation of the sum of the coefficients $\beta + \delta$ (with a confidence range of 95%) and for other physicians the value of the coefficient δ. These values give the changes in the variable of interest over the period, other things equal, for each category of physicians. The third column gives an estimation of the impact β of CAPI in respect of each variable considered.

The estimations show that CAPI completely halted the current trends in the changes in the practices of GPs over the period (Table 6). Whilst GPs generally see more patients (+20.2%), with fewer consultations and fewer prescriptions for each of them (-17.5% and -21.5%), the impact of CAPI on those who signed up to it is such that these physicians are not taking on any more patients (the change is not significant) and are not significantly increasing the number of consultations they give or the value of their prescriptions per patient. Another impact of CAPI is a much greater increase in the proportion of patients treated as the *médecin traitant*: it increases by 23.7 percentage points for physicians who signed up to CAPI compared to just +5.9 points for the others. Finally, whilst total fees and fees per patient fall significantly between 2008 and 2011 for GPs (-6.3% and -26.5%), it is the opposite for those who signed up to CAPI, the effect thereof being so great that it is reversing the trend: their total fees and their fees per patient have increased by 20.8% and 25.8% respectively.

It therefore appears that CAPI has had a significant impact on physicians' practices: in the context of a considerable increase in the number of patients which translated to a consequent reduction in the number of consultations per patient, CAPI has put the brakes on a strong tendency to do little with each patient whilst giving substance to this upturn in terms of the quality of care. Although the data do not enable us to observe directly whether the targets set by the CAPI indicators have been achieved, these results show an impact that is compatible with efforts to achieve them.

For example, our estimations show that, unlike other physicians, those who have signed up to CAPI have not reduced the number of consultations per patient. It is logical that "patient time" has not been reduced thanks to CAPI because achievement of the targets may require a higher number of procedures or preventive measures per patient. For example, as diabetic patients are recommended to have 3 or 4 tests of glycated haemoglobin per year, these patients will be required to see their doctor 3 or 4 additional times per year to read the test results, whilst these consultations may have been neglected in the absence of performance indicators.

Whilst the trend over the period is for pharmaceutical prescriptions to fall, maintaining the number of meetings per patient among physicians who signed up to CAPI goes hand in hand with maintaining expenditure on prescriptions per patient. This effect was not apparent beforehand because the incentives offered by CAPI imply effects with reversed signs in relation to prescriptions: on the one hand, increasing prescriptions of preventive measures (such as mammographies or glycated haemoglobin tests),

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9. In cases where the Hausman test validates the instrumental variables estimations, it is possible to calculate, by comparison, the bias associated with the OLS estimation. The latter is positive for the majority of the variables in terms of level (volume of care, number of patients), but negative for the majority of those which are measured in terms of a ratio, per patient (consultations per patient, prescriptions per patient, cost per patient). As we explained in the section devoted to the empirical strategy, the first-difference specification means that only temporary shocks can create a bias here, personality traits or the style of practice of the doctor being eliminated by difference. The positive bias found may be explained as follows: if the physician faces a positive shock in terms of demand, associated with a flu epidemic for example (an element present in the disturbance), their activity, the number of patients they have and their prescriptions increase. At the same time, this same shock may be the time to recruit patients treated as the médecin traitant, *a factor strongly influencing decisions to sign up to CAPI. The biases observed on variables measured in terms of ratios are the result of biases on variables in terms of level at the numerator and the denominator of the variable explained.*

Table 5 – **Effects of signing up to CAPI on the provision of care by general practitioners. First-difference specifications, estimations by ordinary least squares (OLS Column) and by the instrumental variables method (IV Column)**

	OLS		IV		Hausman test
	CAPI=1	Trend	CAPI=1	Trend	
	β (standard error)	δ (standard error)	β (standard error)	δ (standard error)	p-value
Overall activity					
Number of consultations	0.001 (0.002)	0.005*** (0.001)	-0.093 (0.088)	0.027 (0.020)	H: 0.270
Total number of procedures	0.002 (0.002)	-0.006*** (0.001)	0.041 (0.081)	-0.015 (0.019)	H: 0.624
Volume of care (1)	0.002 (0.002)	0.040*** (0.001)	-0.475*** (0.147)	0.150*** (0.034)	H: 0.000
Patients					
Number of patients	-0.003* (0.002)	0.144*** (0.001)	-0.253** (0.101)	0.202*** (0.023)	H: 0.001
Proportion of patients treated as the *médecin traitant* (2)	0.326*** (0.079)	9.965*** (0.043)	17.764*** (5.726)	5.932*** (1.324)	H: 0.000
Structure of activity per patient					
Number of consultations per patient	0.004*** (0.001)	-0.139*** (0.001)	0.160** (0.077)	-0.175*** (0.018)	H: 0.016
Number of procedures per patient	0.005*** (0.001)	-0.151*** (0.001)	0.294*** (0.099)	-0.217*** (0.023)	H: 0.000
Volume of care per patient (1)	0.005*** (0.001)	-0.104*** (0.001)	-0.222** (0.086)	-0.052*** (0.020)	H: 0.000
Prescriptions per patient (1)	-0.005** (0.002)	-0.126*** (0.001)	0.377*** (0.138)	-0.215*** (0.032)	H: 0.000
Pharmaceutical prescriptions per patient (1)	-0.010*** (0.002)	-0.204*** (0.001)	0.373*** (0.132)	-0.292*** (0.031)	H: 0.000
Remuneration and cost (1)					
Fees	0.023*** (0.002)	-0.005*** (0.001)	0.271*** (0.102)	-0.063*** (0.024)	H: 0.005
Fees per patient	0.026*** (0.001)	-0.149*** (0.001)	0.523*** (0.145)	-0.265*** (0.034)	H: 0.000
Basis for reimbursement of the full cost per patient	0.000 (0.002)	-0.130*** (0.001)	0.379*** (0.129)	-0.218*** (0.030)	H: 0.000
Number of observations	32,171				

(1) In constant euros 2015. (2) This variable is not measured as the difference in the logarithms of this proportion between 2008 and 2011, but as the difference in level between 2008 and 2011.
Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. The standard errors clustered at the GP level are in parenthesis. The last column shows the p-value of the Hausman test of exogeneity of the variable "receive a CAPI bonus", where the instrument is the logarithm of the density of doctors who are general practitioners at municipality level in 2005. The estimations include the control variables presented in section 3.
Sources and Coverage: See Table 4.

or certain pharmaceutical prescriptions (such as antihypertensives) to achieve certain targets. On the other hand, an increase in the proportion of generic medicines in prescriptions is encouraged (see Appendix 1). Our estimations suggest that these two effects offset one another.

In a context where fee-for-service predominates, the pay-for-performance mechanism introduced by CAPI generates additional income per patient irrespective of the number of procedures carried out. As we are unable, with our data, to observe any effect on the length of a consultation or the quality of care, our estimations show that the CAPI bonus has allowed an increase in fees per patient for physicians who have signed up.

Finally, it is interesting to look at the impact of CAPI on the cost of treatment for each patient by the Social Security system. To this aim, we refer to the basic reimbursable amount, adding the fees and prescription expenditure per patient (second last line in Table 6). It can be observed that the cost of treatment per patient has fallen by 21.8% for physicians who have not signed up to CAPI (owing to the reduction in fees and pharmaceutical prescriptions). Conversely, the cumulative increase in total prescriptions and fees (payment for procedures + CAPI bonus)

Table 6 – **Changes in the practices of doctors who signed up or did not sign up to CAPI from 2008 to 2011. Calculations based on the estimations in Table 5**[(i)]

	NON-CAPI	CAPI	Difference = Impact of CAPI
	δ [$IC_{95\%}$]	$\beta + \delta$ [$IC_{95\%}$]	β [$IC_{95\%}$]
Overall activity			
Number of consultations	0.005*** [0.003, 0.007]	0.006*** [0.003, 0.009]	0.001 [-0.002, 0.004]
Total number of procedures	-0.006*** [-0.008, -0.004]	-0.004*** [-0.007, -0.001]	0.002 [-0.001, 0.005]
Volume of care (1)	0.150*** [0.084,0.217]	-0.324*** [-0.545, -0.103]	-0.475*** [-0.762, -0.187]
Patients			
Number of patients	0.202*** [0.156, 0.247]	-0.050 [0.202, 0.100]	-0.253** [-0.450, -0.056]
Proportion of patients treated as the *médecin traitant* (2)	5.932*** [3.337, 8.528]	23.69*** [15.06, 32.320]	17.764*** [6.541, 28.986]
Structure of activity per patient			
Number of consultations per patient	-0.175*** [-0.210, -0.140]	-0.014 [-0.131, 0.101]	0.160** [0.008, 0.312]
Number of procedures per patient	-0.217*** [-0.262, -0.173]	0.076 [-0.071, 0.225]	0.294*** [0.101, 0.487]
Volume of care per patient (1)	-0.052*** [-0.091, -0.012]	-0.273*** [-0.403, -0.143]	-0.222** [-0.391, -0.053]
Prescriptions per patient (1)	-0.215*** [-0.277, -0.152]	0.162 [-0.045, 0.370]	0.377*** [0.106, 0.648]
Pharmaceutical prescriptions per patient (1)	-0.292*** [-0.352, -0.232]	0.081 [-0.118, 0.280]	0.373*** [0.114, 0.632]
Remuneration and cost (1)			
Fees	-0.063*** [-0.109, -0.016]	0.208*** [0.053, 0.362]	0.271*** [0.070, 0.472]
Fees per patient	-0.265*** [-0.330, -0.199]	0.258** [0.040, 0.477]	0.523*** [0.239, 0.808]
Basis for reimbursement of the full cost per patient	-0.218*** [-0.276, -0.159]	0.161 [-0.033, 0.356]	0.379*** [0.126, 0.633]
Number of observations		32,171	

(i) According to the Hausman test result, use is made of the estimations by OLS ("number of consultations" and "total number of procedures" variables) or instrumental variables estimations.
(1) In constant euros 2015. (2) This variable is not measured as the difference in the logarithms of this proportion between 2008 and 2011, but as the difference in level between 2008 and 2011.
Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. The standard errors clustered at the GP level are in parenthesis. The estimations include the control variables presented in section 3.
Sources and Coverage: See Table 4.

counterbalances this bias in the cost of treatment of patients for physicians who have signed up. This system is therefore expensive for the National Health Insurance.

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Based on a balanced panel of GPs in private practice observed before and after its introduction, we have assessed the impact of CAPI on the behaviour of GPs in terms of their provision of care. Our angle of approach differs from that of other empirical studies of the influence of pay-for-performance which are centred on the effect of financial incentives on the achievement of targets set by the programmes. Our approach involves examining whether the new element of remuneration introduced by CAPI – which generates additional income per patient irrespective of the number of procedures carried out – has led to a change in the structure of physicians' activity. Our analysis is based on a panel of 32,171 French GPs in Sector 1 who have been working continuously in private practice over the course of 2005, 2008 and 2011. These physicians have carried out 84% of the procedures carried out over the period. Our method of estimation uses an instrumental variables

approach on a first-difference model in order to take account of the fact that the decision to sign up to CAPI, an optional system, is an individual decision made by the physician that is probably non-exogenous to the behaviour studied.

French studies on the impact of CAPI on quality indicators have not found any positive effect on the quality of care or found only a very slight effect (Saint-Lary & Sicsic, 2015; Michel-Lepage & Ventelou, 2016; Sicsic & Franc, 2017). However, our results show that CAPI has significantly influenced the practices of physicians who signed up to it in a way that is compatible with an improvement in the quality of care: contrary to their colleagues who have not signed up, physicians who have signed up to CAPI have not reduced "patient time" (number of consultations per patient) or the amount of prescriptions per patient. They have also increased, to a far greater extent than other physicians, the proportion of their patients who they treat as the *médecin traitant*.

Our study thus produces a different result than other studies on CAPI. It is not necessarily contradictory because we do not focus on the efficiency of the pay-for-performance mechanism as such, but examine whether the modification of the payment system implied by CAPI, which alters the proportion of fee-for-service, changes something in the structure of a physician's activity. The answer is yes. However, if CAPI has favoured improvement in the quality of care, it is not because of premiums associated to quality targets, but rather on account of a mitigation of the role of pay-for-performance in a physician's remuneration. Referring to the theoretical literature on health economics, the mechanism that would have played would be an increase in the role of capitation rather than a mechanism of financial incentive to achieve quantitative targets that are indicative of the quality of care.

Our results cannot be extrapolated without caution to the potential impact of ROSP, which extended pay-for-performance to include all physicians in 2012, because our instrumental variables estimation only enables us to identify a local effect of the treatment on the treated. This effect is obtained only on compliers, who are the physicians whose decision to sign up to CAPI was influenced by the variation of the instrument. Moreover, the database used is a balanced panel of physicians present over the period from 2005 to 2011. The external validity of the results may therefore be questioned and their generalisation to include the entire population of physicians to whom ROSP now relates has to be carried out with caution.

Our data do not allow to go further in the analysis by studying changes in the time physicians spend at work and the length of their consultations. However, CAPI has also resulted in an increase in fees per patient. As a consequence, and whilst the average cost to the Social Security system for the treatment of a patient falls over the period for all physicians, this decrease is not observed for the patients of physicians who have signed up to CAPI. This system is therefore expensive for the National Health Insurance. As a result, it is crucial to highlight its beneficial effects in the form of a better quality of care for patients or in the form of greater efficiency in care pathways which would reduce avoidable hospitalisations. In any case, we find that CAPI has a significant impact on physicians' practices, which is compatible with an improvement in the quality of care which remains to be confirmed. □

BIBLIOGRAPHY

Albouy, V. & Déprez, M. (2009). Mode de rémunération des médecins. *Économie & prévision*, 188(2), 131–139. https://doi.org/10.3917/ecop.188.0131

Caisse nationale d'Assurance Maladie. (2010). Contrat d'Amélioration des Pratiques Individuelles (CAPI) : une dynamique au bénéfice des patients. *Point d'information*, Septembre 2010. https://www.ameli.fr/fileadmin/user_upload/documents/Dp_capi_16_09_2010_vdef.pdf

Cashin, C., Chi, Y-L., Smith, P., Borowitz, M. & Thomson, S. (2014). *Paying for Performance in Health Care: Implications for Health System Performance and Accountability.* Berkshire: Open University Press. https://www.euro.who.int/__data/assets/pdf_file/0020/271073/Paying-for-Performance-in-Health-Care.pdf

Commission des Comptes de la Sécurité Sociale (2011). Les comptes de la sécurité sociale résultats 2010. Fiche éclairage maladie : Le contrat d'amélioration des pratiques individuelles (CAPI), pp. 134–137. http://www.securite-sociale.fr/IMG/pdf/fiche_eclairage_maladie_capi_sept_2011.pdf

Cragg, J. & Donald, S. (1993). Testing Identifiability and Specification in Instrumental Variable Models. *Econometric Theory*, 9(2), 222–240. https://doi.org/10.1017/S0266466600007519

Delattre, E. & Dormont, B. (2003). Fixed fees and physician-induced demand: a panel data study on French physicians. *Health Economics*, 12(9), 741–754. https://doi.org/10.1002/hec.823

Doran, T., Kontopantelis, E., Valderas, J. M., Campbell, S., Roland, M., Salisbury C. & Reeves, D. (2011). Effect of financial incentives on incentivised and non-incentivised clinical activities: longitudinal analysis of data from the UK Quality and Outcomes Framework. *British Medical Journal*, 342, d3590. https://doi.org/10.1136/bmj.d3590

Dormont, B. & Samson, A.-L. (2008). Medical demography and intergenerational inequalities in general practitioners' earnings. *Health Economics*, 17(9), 1037–1055. https://doi.org/10.1002/hec.1387

Dormont, B. (2013). Le paiement à la performance : contraire à l'éthique ou au service de la santé publique ? *Les Tribunes de la santé*, 40(3), 53–61. https://doi.org/10.3917/seve.040.0053

Dumontet, M. & Chevillard, G. (2020). *Remédier aux déserts médicaux*. Paris: Rue d'Ulm.

Eijkenaar, F., Emmert, M., Scheppach, M. & Schöffski, O. (2013). Effects of pay for performance in health care: a systematic review of systematic reviews. *Health Policy*, 110(2-3), 115–130. https://doi.org/10.1016/j.healthpol.2013.01.008

Flodgren, G., Eccles, M. P., Shepperd, S., Scott A., Parmelli, E. & Beyer, F. R. (2011). An overview of reviews evaluating the effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes. *The Cochrane database of systematic reviews*, (7), CD009255. https://doi.org/10.1002/14651858.CD009255

Franc, C. & Lesur, R. (2004). Systèmes de rémunération des médecins et incitations à la prévention. *Revue Économique*, 55(5), 901–922. https://doi.org/10.3917/reco.555.0901

Gillam, S. J., Siriwardena, A. N. & Steel, N. (2012). Pay-for-performance in the United Kingdom: impact of the quality and outcomes framework: a systematic review. *The Annals of Family Medicine*, 10(5), 461–468. https://doi.org/10.1370/afm.1377

Grignon, M., Paris, V. & Polton, D. (2002). L'influence des modes de rémunération des médecins sur l'efficience du système de soins. Rapport pour la commission Romanow, Rapport du CREDES N° 35. http://publications.gc.ca/collections/Collection/CP32-79-35-2002F.pdf

Journal Officiel (2009). Décision du 9 mars 2009 de l'Union nationale des caisses d'assurance maladie relative à la création d'un contrat type d'amélioration des pratiques à destination des médecins libéraux conventionnés. (JORF n° 0093 du 21 avril 2009). https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000020534299

Kantarevic, J. & Kralj, B. (2013). Link between pay for performance incentives and physician payment mechanisms: evidence from the diabetes management incentive in Ontario. *Health Economics*, 22(12), 1417–1439. https://doi.org/10.1002/hec.2890

Kleibergen, F. & Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, 133, 97–126. https://doi.org/10.1016/j.jeconom.2005.02.011

Le Breton-Lerouvillois, G. & Romestaing, P. (2013). *Atlas de la démographie médicale en France. Situation au 1er janvier 2013* (7e éd.). Paris: Ordre National des Médecins. https://www.conseil-national.medecin.fr/sites/default/files/external-package/analyse_etude/pjlsbo/atlas_national_2013.pdf

Michel-Lepage, A. & Ventelou, B. (2016). The true impact of the French pay-for-performance program on physicians' benzodiazepines prescription behavior. *The European Journal of Health Economics*, 17(6), 723–732. https://doi.org/10.1007/s10198-015-0717-6

Rat, C., Penhouet, G., Gaultier, A., Chaslerie, A., Pivette, J., Nguyen, J. M. & Victorri-Vigneau, C. (2014). Did the new French pay-for-performance system modify benzodiazepine prescribing practices? *BMC Health Services Research*, 14, 301. https://doi.org/10.1186/1472-6963-14-301

Saint-Lary, O. & Sicsic, J. (2015). Impact of a pay for performance programme on French GPs' consultation length. *Health policy*, 119(4), 417–426. https://doi.org/10.1016/j.healthpol.2014.10.001

Scott, A., Sivey, P., Ait Ouakrim, D., Willenberg, L., Naccarella, L., Furler, J. & Young, D. (2011). The effect of financial incentives on the quality of health care provided by primary care physicians. *The Cochrane Database of Systematic Reviews*, (9), CD008451. https://doi.org/10.1002/14651858.CD008451.pub2

Sicsic, J. & Franc, C. (2017). Impact assessment of a pay-for-performance program on breast cancer screening in France using micro data. *The European Journal of Health Economics*, 18(5), 609–621. https://doi.org/10.1007/s10198-016-0813-2

Sutton, M., Elder, R., Guthrie, B. & Watt, G. (2010). Record rewards: the effects of targeted quality incentives on the recording of risk factors by primary care providers. *Health Economics*, 19(1), 1–13. https://doi.org/10.1002/hec.1440

Ulmann, P. (2011). La rémunération des médecins sur objectifs de santé publique : premiers résultats et avancées de la convention médicale. Les modes incitatifs de rémunération des soins. L'Assurance Maladie, 29 novembre 2011. https://solidarites-sante.gouv.fr/IMG/pdf/06_Ulmann.pdf

Van Herck, P., De Smedt, D., Annemans, L., Remmen, R., Rosenthal, M. B. & Sermeus, W. (2010). Systematic review: Effects, design choices, and context of pay-for-performance in health care. *BMC Health Services Research*, 10, 247. https://doi.org/10.1186/1472-6963-10-247

APPENDIX 1

OBJECTIVES OF CAPI

Indicators [1]	Inter-mediate target (%)	Final target (%)
"Detection and prevention - Treating chronic pathologies"		
Patients over the age of 65 who have had the flu vaccine	71	≥ 75
Patients aged between 50 and 74 who have had a mammography within the last 2 years	73	≥ 80
Patients over the age of 65 treated using vasodilatators	9	≤ 7
Patients over the age of 65 treated using benzodiazepines with a long half-life	9	≤ 5
Diabetic patients who have 3 or 4 doses of HbA1c per year	54	≥ 65
Diabetic patients who have had one dilated fundus examination per year	52	≥ 65
Diabetic patients (men +50 years of age, women +60 years of age) treated using antihypertensives and statins	65	≥ 75
Diabetic patients (men +50 years of age, women +60 years of age) treated using antihypertensives and statins and low-dose aspirin (LDA)	52	≥ 65
Patients treated using antihypertensives who have normalised their blood pressure levels (declarative indicator)	40	≥ 50
"Optimisation of prescriptions"		
Antibiotics [2]	84	≥ 90
Proton pump inhibitors (PPI) [2]	70	≥ 80
Statins [2]	58	≥ 70
Antihypertensives [2]	55	≥ 65
Antidepressants [2]	70	≥ 80
Proportion of prescriptions of conversion enzyme inhibitors (CEI) out of CEI and sartan prescriptions	55	≥ 65
Number of patients treated using LDA / Number of patients treated using platelet inhibitors [1]	84	≥ 85

[1] Proportion of patients treated as the *médecin traitant*.
[2] Proportion of prescribed drugs in the directory of generic medicines (boxes).
Sources: Journal Officiel (2009).

APPENDIX 2

SOCIODEMOGRAPHIC CHARACTERISTICS OF PHYSICIANS REMOVED FROM THE INITIAL SAMPLE AND OF PHYSICIANS IN THE WORKING SAMPLE

	Leaving in 2005	Leaving in 2008	Joining in 2008	Joining in 2011	Other physicians	Analysis sample
Observed	Until 2005	Until 2008	From 2008 onwards	From 2011 onwards	With a career break	In 2005, 2008 and 2011
Number of doctors	3,057	3,493	3,376	2,999	2,755	32,171
Composition (% in column)						
Gender						
Men	77.2	78.4	52.9	52.5	59.3	77.8
Women	22.8	21.6	47.1	47.6	40.7	22.2
Age						
Aged < 49	34.8	24.2	75.6	74	44.4	40.3
Aged 49-55	22.5	19.9	15.4	15.5	27.1	35.6
Aged ≥ 56	42.7	56	9	10.4	28.5	24.1
Marital status						
Single	11.7	8.8	18.9	19.4	15.3	8.4
Divorced	14	13	9.8	9.9	14.6	10.1
Married	73	76.6	66.4	59.8	65.5	79.7
Civil partnership	0.6	0.5	4.6	10.5	3.3	1.2
Widow(er)	0.7	1.2	0.3	0.3	1.3	0.6
Dependent children						
No	50.3	55.3	26.5	29.4	37.6	27.5
Yes	49.7	44.8	73.5	70.6	62.5	72.5
Dependent persons in the family home						
0	49.8	54.8	25.3	28.6	37.9	26.9
1	18.4	18	20.2	20.2	19.8	19.7
2	17.8	15.4	32.5	31.1	24.2	28.3
3 or +	14	11.8	8	20.1	18.1	25.2

Sources and Coverage: CNAM-DGFiP-DREES matched data, waves 2005, 2008 and 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.