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GP responses to price regulation: evidence from a French nationwide reform

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Abstract

This paper uses a French reform to evaluate the impacts of overbilling restrictions on general practitioner (GP) care provision, fees, and incomes. Since 1990, this reform has introduced conditions self-employed GPs must fulfil to be permitted to bill freely. We exploit 2005 and 2008 public health insurance administrative data on GP activity and fees. We use fuzzy regression discontinuity techniques to estimate local causal impacts for GPs who established practice in 1990 and who were constrained by the new regulation to charge regulated prices (compliers). We find that those GPs react to income effects. In the regulated fee regime, GPs face prices lower by 42% and provide 50% more care than they would do in the unregulated fee regime. Male care provision increasing reaction is larger than the female one, which results in a higher male labour income in the regulated fee regime than with unregulated fees, whereas it is the opposite for women. With regulated fees, GPs limit side-salaried activities, use more lump-sum payment schemes, and occupy more often gate-keeper positions.

1 INTRODUCTION

Physician strategic responses to price regulation are of major concern for public policies, as they may have dramatic consequences for care provision - thus potentially affecting access to care in low medical density areas, and impacting national health accounts. These responses vary depending on physician preferences. For example, in response to fee cuts, the volume of care provided by physicians may increase (physicians work more to offset their decrease in income) or decrease if the Hicksian price substitution effect dominates the income effect (physicians substitute leisure for consumption as the relative price of leisure decreases). The specific French fee-for-services (FFS) system, in which both free-billing and regulated-fee general practitioners (GPs) coexist and can deliver the same services, provides an interesting setup to examine this question. In December of 1989, a reform introduced conditions that GPs must fulfil to be permitted to bill freely. This induced a discontinuity in the proportion of free-billing GPs among new GPs establishing practices. We use this change in regulation to examine the effects of price regulation, which here consists of overbilling restrictions. By applying fuzzy regression discontinuity (FRD) techniques (Hahn et al., 2001; Imbens and Lemieux, 2008; Lee and Lemieux, 2010) to 2005 and 2008 public health insurance (PHI) administrative data, we estimate local causal effects in terms of care provision, fees, incomes, and other specific dimensions of GP practice.

Neither theoretical nor empirical literature comes to a consensus on how physicians should react to price regulation. Utility-maximizer physicians (who value leisure) who can discriminate among patients by price, may provide less care than they would if they were practicing with regulated fees, (McGuire and Pauly, 1991; Rizzo and Blumenthal, 1994; Thornton and Eakin, 1997). However, they may provide the same volume of care under both regimes if they are simply profit maximizers. Less care provision may be detrimental in cases of previous rationing, but may be more efficient if, under price regulation, physicians induce demand; see (Evans, 1974) for seminal work and (Delattre and Dormont, 2000, 2003) for empirical evidence for French data. Further, discriminating both on the pricing and quality of services may generate efficiency benefits by increasing both the quality of care offered to patients who are charged extra fees

and to those who are not, as in the Medicare context (Glazer and McGuire, 1993; Kiffman and Scheuer, 2011). Nor do empirical studies offer any consensus on this issue either, probably because these studies examine countries with very different contexts of care regulation. For the U.S. case, physicians did not alter their behaviours much in response to Medicare balance-billing restrictions (McKnight, 2007). Other studies by contrast find that physicians respond to fee cuts by intensifying their activities and focusing on the most intensive procedures; regarding surgeon specialists in the U.S., see (Yip, 1998) or for Canadian GPs, (Rochaix, 1993; Nassiri and Rochaix, 2006).

In line with the latter studies, we find strong reactions to income effects: the GPs who were constrained by overbilling restrictions included in the reform to charge regulated prices (compliers) were driven to provide much more care (+51L%) when facing lower prices (-42L%) than what they would have done if they had been permitted to bill freely.[1] The increase in care provision by male GPs under the regulated fee regime (with respect to the unregulated fee scheme) exceeds the corresponding increase for female GPs. Ultimately, with regulated fees, male GPs have higher labour income than under unregulated fees, whereas it is the opposite for women. Under price regulation, GPs are more accessible to patients, as 60% of the additional activity is directed to new patients. However, regulation may also induce demand, as the remainder is attributable to more frequent visits from regular patients. Price regulation also appears to ensure ambulatory care continuity: more gate-keepers, more night or week-end shifts, and on-call duties by male GPs. Moreover, GPs increase their use of complementary remuneration schemes through capitation (lump-sum payments), but not their salaried activities. Further, price regulation results in changes among patient groups that are consistent with increased accessibility to ambulatory care.[2] A complementary analysis suggests that short-term effects (especially on activity) may be larger than those presented here based on 2005 and 2008 data.

The paper proceeds as follows. Section 2 describes the data. Section 3 examines the regulation

[1] Most of our results on relative changes (from x to y) are reported in Log percentages ($100\log(y/x)$, denoted L%) (Tornqvist et al., 1985). For infinitesimal changes, L% can be approximated by %.

[2] With a potential redistribution of patients from hospitals.

of physician fees in France. The empirical strategy is presented in section 4. Section 5 reports on the main results, and section 6 presents a final discussion.

2 DATA

Our empirical analysis relies on an exhaustive administrative *INSEE-CNAMTS-DGFiP File* on physicians. The richness of this dataset enables us to study detailed dimensions of GP practice. This dataset merges individual information on activity provided by the PHI (Caisse Nationale d'Assurance Maladie des Travailleurs Salariés, CNAMTS) and individual information on earnings based on household tax income declarations. It covers the entire GP population for 2005 and 2008. In our main analysis, we do not exploit the panel structure of the data, and instead pool the two waves.

We focus on GPs who opened their private practices between 1983 (seven years before the reform) and 1996 (six years after). We exclude those practicing overseas, those who did not sign a contract with PHI (fewer than 1% of GPs), and those who declared that they follow a particular mode of practice (such as acupuncture, homeopathy, allergy services), as their services may differ from those offered by other GPs and are not always reimbursed on the same basis. Further, we exclude GPs aged 60 or older who receive pensions or annuities. The latter engage in very limited or heterogeneous self-employed activities and are not comparable to the others. Finally, our sample consists of 45,537 pooled observations for 2005 and 2008.

3 REGULATION OF GP PAYMENTS IN FRANCE

3.1 Coexistence of regulated-fee and free-billing GPs

In the French primary care system, which mainly relies on a FFS payment system,[3] regulated-fee and free-billing GPs coexist and offer the same services. Indeed, as of 1980, physicians can

[3]Two thirds of GPs are self-employed and paid through FFS (Ecosante, 2013).

sign contracts with PHI in sectors 1 or 2. Sector 1 GPs must apply fixed grid prices, referred to as regulated or reference prices, for most of their services and for any patient. They are not permitted to bill freely. By contrast, sector 2 GPs freely set prices for any service and for any patient within 'ethical' limits - they must price with "tact and moderation" ("tact et mesure") and they are not permitted to charge extra fees to low-income patients. In exchange, PHI subsidizes a proportion of sector 1 GP social insurance contributions and pension savings, whereas it does not do so for sector 2 GPs. As an example, in 2008, a sector 2 GP office visit was priced at 34€ on average (SD=12.6€) *vs* 22€ for a sector 1 GP visit.

On the patient side, patients freely choose to consult a sector 1 or 2 GP and can change physicians at any time. The sector to which a GP belongs, and the fees she charges, are public information. Regardless of the sector of the GP, PHI will always reimburse 70% of the service reference price. The remaining 30% (co-payments) and potential supplements (extra fees) are covered by the patient himself or through private health care contracts.[4] Private health care contracts usually cover complements, though coverage levels for supplements vary considerably between contracts.

3.2 Descriptive statistics

The sector 2 contract, developed just before the Presidential elections, was adopted to increase physician incomes without affecting national health accounts (Lancry and Sandier, 1999). While practicing in sector 2 has always been financially advantageous, only 10 to 16% of GPs decided to join sector 2 from 1980 to 1989 (Ecosante, 2013). A large proportion of GPs has always been opposed to sector 2, which has been charged with creating two-tier medical care (Hassenteufel, 1997).[5] Hence, choice of sector has always been strongly endogenous, related to individual trade-offs between labour and leisure, and ethical considerations. Sector 1 and sector 2 GP preferences are likely to differ considerably. Both types of GPs also differ with respect to most observable characteristics. See Table I, which reports basic descriptive statistics for GPs who established a

[4] In 2012, only 4% of the population was not covered by any complementary healthcare scheme (Garnero and Le Palud, 2013).

[5] In 1981, GPs opposed to sector 2 formed a board that became the first union specific to GPs in 1985.

practice from 1983 to 1996 (pooled observations for 2005 and 2008). First, female GPs are over-represented in sector 2 with respect to sector 1 (29.4% *vs* 27%). Sector 1 GPs open practices at a younger age.[6] Furthermore, for medical service prices 34L% lower on average, sector 1 GP activity levels are 40L% higher than those offered by sector 2 GPs, and sector 1 GP annual fees are 8L% higher.[7] Ultimately, sector 1 GP labour incomes are 19L% higher than those of sector 2 GPs.[8] Sector 1 and sector 2 GPs also differ in terms of medical services provided. Sector 1 GPs conduct more office visits and significantly more home visits. They also meet their patients more often and prescribe more. In contrast, sector 2 GPs perform more technical procedures. More sector 1 GPs practice in rural areas (17.7% *vs* 6%). Finally, sector 1 GP patient groups contain fewer women, fewer seniors, more young patients, more low-income patients, and more patients with chronic diseases.

– INSERT HERE TABLE I –

Of course, these descriptive statistics do not provide information on causal effects of price regulation, as GPs choose to engage in a sector based on to their (unobserved) preferences. We therefore exploit the 1990 "Sector-2 freeze reform" as an exogenous change in the assignment rule to overcome this self-selection issue and identify the causal effect of price.

3.3 The "sector-2 freeze" reform

Facing a constantly rising number of sector 2 physicians (GPs and specialists) without a corresponding increase in the provision of health care, the left-wing government that came to office in 1988 initiated changes in the organization of the supply of health care. Since December of 1989, the "sector-2 freeze" reform has introduced conditions a new GP must fulfil in order to join sector 2 and therefore be able to bill freely. All physicians who established a practice in November 1989 or before could freely choose the sector in which they wished to practice, and

[6] t-tests for equal means are performed for all variables.

[7] We report log percentages (L%), *i.e.*, differences in the log of outcomes for sectors 1 and 2 (Tornqvist et al., 1985). Apart from infinitesimal changes, interpretations of results as percentage points may lead to a misinterpretation of the difference.

[8] Net incomes after social contribution subsidies.

could switch sectors subsequently. Since December of 1989, the sector 2 contract has only been offered to physicians who have run a qualifying university teaching and hospital practice for at least two years (such as ex-clinic supervisors). Further, physicians can no longer switch sectors at will during their careers, even if they hold the titles required.[9]

– INSERT HERE FIGURE 1–

With the new regulation, the proportion of new sector 2 GPs abruptly drops from 1989 to 1990, the first full year of implementation: while 11.2% of GPs who established a practice in 1989 opted for a sector 2 contract, only 0.9% chose this option in 1990; see Figure 1. This discontinuity is unrelated either to GP abilities or to ethical concerns: it depends only on the year in which GPs established their practice. As a consequence of the reform, in 2011, fewer than 7% of self-employed GPs held a sector 2 contract *vs* 16% in 1990 (Ecosante, 2013). Figure 2 intuitively illustrates the causal effects of price regulation. With overbilling restrictions from 1989 to 1990, the average price of services diminishes. The average volume of care offered increases, whereas no apparent changes in levels of fees occur. In the following, we exploit these discontinuous changes using FRD techniques to identify and estimate the magnitude of these effects.

– INSERT HERE FIGURE 2–

4 EMPIRICAL STRATEGY

4.1 FRD framework

Let W_i denote the sector (our treatment variable). $W_i = 1$ if physician i chooses sector 1 and $W_i = 0$ if she chooses sector 2. Let Y_i be an outcome of interest. In the Rubin causal model, the potential outcome of physician i in sector 1 is denoted by $Y_i(1)$, resp. $Y_i(0)$ in sector 2. The treatment effect on physician i is $\tau_i = Y_i(1) - Y_i(0)$. τ_i varies between physicians and is

[9]Sector 2 physicians can choose to enter sector 1 whenever they wish but the reverse is not possible.

unobserved as only one of the two potential outcomes is observed, $Y_i = W_i Y_i(1) + (1 - W_i) Y_i(0)$. The FRD framework enables us to identify the local average treatment effect τ on the group of GPs who established a practice in 1990 (the date of the reform), who were constrained by the reform to practice in sector 1, but who would have chosen sector 2 if that had been possible (complier group) (Hahn et al., 2001; Imbens and Lemieux, 2008; Lee and Lemieux, 2010):

$$\tau = E[Y_i(1) - Y_i(0) | X = 1990 \text{ and } i \text{ is a complier }] \tag{1}$$

where X, the running variable, denotes the year in which a physician establishes a practice. We can rewrite τ as

$$\tau = \frac{\lim\limits_{x \to 1990^+} E[Y|X = x] - \lim\limits_{x \to 1990^-} E[Y|X = x]}{\lim\limits_{x \to 1990^+} P[W = 1|X = x] - \lim\limits_{x \to 1990^-} P[W = 1|X = x]} \tag{2}$$

Changes in the average outcome immediately before and after the date of the reform are related to a strictly positive change in the proportion of new sector 1 GPs. In practice an estimate of τ can be obtained by estimating

$$Y_i = \tau W_i + h(X_i) + \epsilon_i, \quad i = 1, \ldots, n, \tag{3}$$

where W_i is instrumented by $\mathbf{1}_{X_i \geq 1990}$, n is the number of physicians who establish a practice in a local bandwidth of years preceding or following 1990, and where $h(x)$ is a very flexible function of x, which is continuous at the date of the reform.[10] For example, for a linear specification of h and a bandwidth of five years, we estimate

$$Y_i = \tau W_i + \alpha_0 + \alpha_1 (X_i - 1990) \mathbf{1}_{X_i < 1990} + \alpha_2 (X_i - 1990) \mathbf{1}_{X_i >= 1990} + \epsilon_i, \quad i | 1985 \leq X_i \leq 1994. \tag{4}$$

The FRD identification strategy holds under four validity conditions. First, the expectations of

[10] This is true if the expectations and probabilities of equation (2) are estimated using the same bandwidths and uniform kernels.

the potential outcomes conditional on X are to be continuous at the date of the reform:

$$E(Y_i(0)|X_i = x) \text{ and } E(Y_i(1)|X_i = x) \text{ are continuous in } x = 1990. \tag{5}$$

Though this condition is not directly testable, we did check that covariates related to outcomes, namely sex and family status, were continuously distributed in 1990; see the online appendix and technical report (Coudin et al., 2014).

Second, τ_i and treatment status $W_i(x)$ are assumed to be locally jointly independent of the year of practice establishment X_i (local random assignment assumption):

$$\tau_i, W_i(x) \perp\!\!\!\perp X_i \text{ close to } X_i = 1990. \tag{6}$$

Condition (6) implies that GPs do not have perfect control over the date at which they establish a practice, even if they do try deliberately to benefit from sector 2. The sector 2 freeze was unanticipated by GPs. Indeed, the agreement on the new rules for practicing medicine in sector 2 was first signed by PHI and a minority union composed largely of specialists (Fédération des médecins de France), and then applied to the population of all physicians. Moreover, if GPs had been able to perfectly manipulate the threshold and quickly establish a practice to avoid being constrained by the reform, we should expect discontinuous changes in the age of GPs at the time practices were established, and in the duration from graduation to the date of practice establishment.[11] Hence, we performed formal tests and accepted that these variables were continuously distributed before and after 1990 (see the online appendix for details). We do not find indications of manipulation.

Third, we assume that no GPs entered sector 2 after the reform was passed and would have entered sector 1 had the reform not been passed. This "no defier" assumption seems quite credible:

[11] We do not directly test the continuity of the number of GPs who opened practices each year as is usually done in FRD setups (McCrary, 2008), because this number is quasi-directly deduced from the number of students permitted to pass the first year of medical studies (*numerus clausus*) nine years prior (average studies duration). The *numerus clausus* is strongly discontinuous with no relation to potential manipulation. Moreover, the relative share of new specialists wrt to new GPs remained stable after 1990. Therefore, changes in the number of GPs are not attributable to the fact that more students chose to become specialists in order to access sector 2 after the reform was passed.

as only 0.9% of GPs signed a sector 2 contract after the reform, the number of potential defiers must be close to 0.

Finally, our running variable, X_i, the year of practice establishment, is discrete. To identify the treatment effect, we must assume that the regression function $h(.)$ is correctly specified (Lee and Card, 2008). We thus pay particular attention to model fit quality by performing goodness-of-fit (GoF) tests (Lee and Card, 2008; Lemieux and Milligan, 2008)). For inference issues, regressions are also clustered by the year of practice establishment to account for some potential specification errors.

4.2 Which effect do we estimate ?

Under these validity conditions, the FRD approach enables us to identify and estimate a local causal effect of overbilling restrictions (engaging in sector 1 rather than sector 2) on a specific group: sector 1 GPs who established a practice in 1990 and who would have chosen a sector 2 contract if possible. This complier group accounts for 10.6% of GPs who established a practice in 1990. This proportion is given by the parameter of the instrument $\mathbf{1}_{X_i \geq 1990}$ in first-stage regressions and can be read from Figure 1.[12] This complier group represents a small proportion of GPs with specific characteristics: women and unmarried GPs are over-represented, but compliers have ages similar to the full GP sample. There is no external validity *a priori* for the results, as the effect of the treatment certainly differs among physicians. The FRD method is, however, advantageous in that, being local, τ is identified regardless of structural change trends in the GP population, such as processes of feminization, as long as these structural effects were unfolding continuously at the date of the reform. Finally, overbilling restriction effects that we estimate are long-term effects, as the data we use are observed 15 to 18 years after the date of the reform.

[12] Full first-stage regression results are available upon request.

5 RESULTS

Table II reports OLS (for comparison issues), and FRD estimation results for all GPs, and for male and female GPs separately. We use a bandwidth of five years before and after the reform, and linear, polynomial, and linear spline trend specifications with different slopes before and after the date of the reform. In the interest of brevity, we only report results with the best trend specifications according to GoF tests.[13] All causal effects interpreted hereafter are local average treatment effects, which apply exclusively to the group of complying GPs.

– INSERT HERE TABLE II –

5.1 Provision of care

Our main outcome variable, the *care provision indicator*, accounts for the number of medical procedures and their intensity of care. The variable denotes numbers of medical procedures of each type weighted by their reference prices. Facing 42L% lower prices, GPs who were forced by the reform to charge regulated fees increased their volume of activity by 51L% relative to what they would have done under unregulated fees, which is significantly larger than what basic OLS suggest.[14] The large increase in the *care provision indicator* is mainly attributable to more *medical procedures*: +61L%. GPs who complied with the reform thus react strongly to income effects.[15] Male GPs react more (+69L% in activity) than female GPs (+22L%). These effect magnitudes may appear to be large when set against what is usually found in the literature. For example, a 10% rise in the relative prices of caesarean delivery with respect to normal childbirth results in a 8.4% increase in caesarean delivery rates (Gruber et al., 1999), and a 10% reduction in fees results in a 4% increase in the volume of services provided (Nguyen, 1996). The large magnitudes are due to the fact that fee cuts considered here are quite substantial, potentially resulting in drastic behaviour changes in terms of health care supply.

[13] Results are generally stable across non-rejected specifications. See the online appendix for detailed results.

[14] This results in a price elasticity of activity equal to 1.27.

[15] Under the assumption that the aggregate demand addressed to a GP under price regulation equals that addressed to her if she perfectly price-discriminates patients above the reference price, and if there are no changes in the quality of services provided.

More care provision means both an increase in accessibility with more patients seen by each GP (or a redistribution of patients from hospital to ambulatory care),[16] and in more intensive follow-up visits. The latter may reflect supply-induced demand mechanisms, a well-known drawback of FFS with regulated fees.

The number of patients seen by a GP each year is indeed 40L% higher for both men and women. Consequently, approximately 60% of the additional medical procedures are addressed to new patients, with the remaining 40% directed to patients who were already enrolled.[17] This increase in accessibility is directed not only to occasional patients but also to new regular patients, since the *share of patients for whom the GP is a gatekeeper* increases significantly (+9.7L%).

The additional care provision largely concerns visits: on average, GPs conduct 150L% more *home visits* under regulated fees and 73L% more *office visits*, whereas effects on *technical procedures*, which are often more lucrative, are null or negative. However, the trends differ between men and women. Male GPs complete more *home visits* (+255L%); women do not. In contrast, even if male GPs conduct slightly more *office visits* than women, the increase represents a more substantial share of activities for female GPs (+89L%) than for male GPs (+67L%).

5.2 Remuneration schemes

We consider the *total fees earned in a year* and the *average price of a procedure*, defined as annual fees divided by the number of medical procedures performed in a year. We also examine two other sources of remuneration that may complement FFS activities: *lump-sum payments* and side-salaried activities (*share of GPs exclusively self-employed*, $i.e.$, share of GPs not engaging in any salaried activity in addition to their self-employed practice). As a summary of GP remuneration, we consider *labour incomes*, defined as net fees ($i.e.$, total fees earned in a year minus

[16]Patients may also have redistributed themselves from sector 2 to sector 1. We thus cannot speak of causal effects, as both the treatment and the control group were affected.

[17]Assuming that errors in the log outcomes are homoskedastic among treated and non treated GPs, we can compute effects on outcome levels (Manning, 1998): under price regulation, the number of medical procedures is $[exp(0.61) - 1] \times 3,540 = 3,009$ higher, where 3,540 is the average number of medical procedures for sector 2 GPs who established a practice in 1989, immediately prior to the reform; the number of new patients is $[exp(0.42) - 1] \times 1,204 = 626$, who are seen 2.9 times on average. This concerns $2.9 \times 626 = 1,815$ procedures, $i.e.$ 60% of 3,009.

professional expenses, such as social contributions, office rents, secretarial services, etc.) and wages, if applicable.

Under price regulation, GPs focus on earning more through self-employed practice using complementary remuneration schemes based on capitation rather than through salaried activities. The *share of GPs exclusively self-employed* remains stable, whereas *lump-sum payment* levels are markedly higher (+162L%). A complementary analysis shows that GPs receive more lump-sum payments because they serve more specific cohorts of patients (children), and serve as gate keepers of patients with chronic diseases,[18] and because male GPs also cover more night and week-end shifts and on-call duties (continuity of care).

Finally, *total fees* under price regulation are higher for men (+36L%), due to combined effects on the volume of care and on lump-sum payments, but these are not significantly different from those without price regulation for female GPs, as the latter do not increase their workload levels as much as male GPs do. At the end, *GP labour incomes* are higher for male GPs (+22L%) and lower for female GPs (though estimates are not stable across specifications). This result confirms that male GPs react more to income effects than female GPs (Rizzo and Zeckhauser, 2007).

5.3 Secondary outcomes

We examine changes in GP prescribing behaviours, and patient groups. Under price regulation, male GPs prescribe more. This is not the case for female GPs.The *annual drug prescription per patient* by male GPs is 49L% higher and the *annual prescription per patient* is 22L% higher.[19] These changes in prescribing behaviours may reflect the fact that male GPs engage in shorter visits (the increase in care provision may not be entirely offset by an increase in the number of hours worked), or attempt to retain patients (if patients believe that GPs who prescribe more provide higher care quality).[20] These prescribing behaviours by contrast are not likely to reflect specific changes in patient groups. GPs do not serve patients with chronic conditions, who would

[18]Gate-keeper GPs receive 40€ per year for each patient with a chronic disease

[19]Prescriptions include drug prescriptions (50%), prescriptions for laboratory tests and diems for sick days.

[20]Though the quality of care provided is likely to change as well, we cannot study this dimension as we do not observe quality indicators.

need more prescription renewals, more often.[21] Male GPs treat *young patients* more often, which is consistent with the increase in lump-sum payments, and *low-income (CMUC) patients*. Female GPs treat *elderly patients* less often.

5.4 Sensitivity checks

Our results are not sensitive to the robustness checks that we performed: changes of bandwidth (+1/-1 year), addition of covariates in regressions (gender, experience, experience squared and marital status),[22] and falsification tests.

We now examine the possibility of threshold manipulation in greater depth. Negotiations between PHI, physicians' unions, and the government entailed a period of legal uncertainty prior to full implementation of the reform. Indeed, a convention proposing a free sector choice was signed in July of 1989 by PHI and physicians unions, but the government did not approve it by the end-of-November deadline. Hence, this convention became null and void. The government approved a new convention in March of 1990 that specified new rules for accessing sector 2. As a consequence, physicians who opened practices from July to November of 1989 freely chose their sector. Those who opened practices from December of 1989 to March of 1990 were only permitted to sign a sector 1 contract at first. These GPs were required to wait for the government to reach a decision regarding new means of accessing sector 2. After March of 1990, these GPs were given a month to switch sectors if they fulfilled the new conditions. Since then, the new rules have fully applied to GPs who have opened practices after March of 1990. Therefore, the only physicians who may have manipulated the threshold must have suspected that the government would not approve the previous convention at the end of November: we would have to look for them among those who opened practices in November. Second, treatment effects for GPs who opened practices from December to March may differ slightly from the others: they were exposed to the period of legal uncertainty just mentioned. We conducted tests using the 2008 data, in which the *month* of practice establishment is available, to determine whether our main

[21] Detailed results are available in the online appendix.

[22] Covariates enable us to eliminate bias that might result from the inclusion of periods remote from the date of the reform (Imbens and Lemieux, 2008).

results were stable with the inclusion or omission of i) GPs who opened practices in November or ii) GPs who opened practices from December of 1989 to March of 1990.[23] We found very similar results to those presented above, although effects on prescriptions were no longer significant.

Detailed results on all these sensitivity checks and the discussion below are presented in the online appendix.

6 DISCUSSION

This section relates the reform to the market structure. Sector 1 and sector 2 GPs faced similar changes in regulation from 1990, the year of reform implementation, to 2005 and 2008, the years of observation (namely increases in reference prices and extensions of new remuneration schemes for on-call duties and services for specific patients). Only some marginal changes may have affected both groups differently.[24] However, during that period, GPs who were not constrained by the reform may have strategically responded in terms of activity, and fees for free-billing GPs, to the arrival of new sector 1 GPs (compliers). The equilibrium effects induced by these strategic reactions are likely to be limited as the share of sector 2 GPs has always been small (less than 1% of never-takers and 10.6% of compliers in 1990). They also depend on the market structure and on the consequences of patients' (heterogenous) preferences on the demand function. Namely, patients may interpret the sector 2 attribute as a signal of quality or the sector 1 attribute as a signal of ethical motivation. If the demand is fully segmented (i.e. patients clearly prefer one type of GP), the new regulation affects sector 1 GPs who may face higher degrees of competition, and sector 2 GPs who may then benefit from entry barriers. If not, sector 2 GPs may also intensify their activities and decrease their prices more than they would have done had the reform not taken place.

To examine such equilibrium effects, we use another dataset, the *French self-employed GPs*

[23] We do not use the month as running variable in the main analysis, as i) we do not have enough observations per month to conduct a robust analysis; ii) this variable exhibits a high degree of seasonality; iii) we have less confidence in this variable than in the year of practice establishment, as the distribution of the number of new GPs per month differs from that found in other data-sets.

[24] See the online appendix for details.

Panel, which concerns 1/12 of GPs and which is drawn from CNAMTS administrative files, for the 1990-2008 period.[25] Results confirm that sector 2 GP activity is positively influenced by the local share of sector 1 GPs, and sector 2 GP prices are negatively influenced by this variable. Hence, demand is not likely to be fully segmented. Moreover, we performed similar FRD analyses for outcomes common to both datasets and for dates closer to the reform year, separately estimating effects for each experience group. Price regulation impacts vary according to GP experiences. The additional level of care provided by sector 1 GPs relative to what they would have supplied in sector 2 is higher at the start of GP careers, in the five years following the reform. This diminishing impact is likely to reflect equilibrium effects (sector 2 GPs adapting their behaviours to more competition from sector 1 GPs) and changing effects of experience (long-term *vs* short-term effects). For both reasons, the effects of price regulation that we measure for 2005-2008 may underestimate the short-term effects that we would likely have estimated for the earlier years. Surprisingly, we also find that the gap in prices between sector 1 and sector 2 GPs tends to increase with levels of experience, whereas it should decrease over the years if sector 2 GPs had adjusted their prices to those of the competition. In contrast, this illustrates the fact that sector 2 GPs use their prices as a signal of quality and increase extra fees with their level of experience, whereas sector 1 GPs cannot.

In responding to efficiency concerns, it might be appropriate to perform a cost-benefit analysis. This falls beyond the scope of the present paper, as the benefit side is not observed, and FRD methods only enable us to identify local treatment effects. However, we can offer some intuitive conclusions for the cost side. If GPs no longer bill freely, patients (or complementary and supplementary healthcare insurance providers) pay less for each service. There are transfers from physicians to patients. However, physicians provide more services, affecting national health accounts and, therefore, patients. Overall, total fees earned by a GP provide insight into aggregate costs. If these fees had remained stable, the reform would have been socially neutral. The decline in extra fees would have been offset by the increase in the provision of care. Our results show by contrast an increase in total levels of fees for male compliers. Hence, putting

[25] Our sample contains 2,540 GPs observed each year between 1990 and 2008.

aside equilibrium effects, the total amount paid by the collectivity is likely to be higher under overbilling restrictions.[26]

Overall, although our results have no external validity, this evaluation will be of interest for any regulator aiming to control the volume of extra fees, as is the case in most FFS healthcare systems. When GPs react strongly to income effects, complementary remuneration schemes based on capitation (such as lump-sum payments) may compensate for a part of income losses flowing from fee cuts. If these payments are high enough, they can promote changes in GP behaviours, ensuring more continuity of care and a higher accessibility, while reducing supply-induced demand.

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[26]Changes in prescription behaviours should also be taken into account in a cost-benefit analysis.

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8 TABLES

Table I: Descriptive statistics on Sector 1 and Sector 2 GPs

	Sector 1		Sector 2		Equal means
	Average	St. Dev	Average	St. Dev	test p-value
Nb of obs.	42326	-	3211	-	-
Age	48.858	4.583	51.598	3.974	0.003***
Sh. of Women	0.270	0.444	0.294	0.456	0.000***
Annual Provision of Care (in Log)					
Care Provision Indicator	11.652	0.609	11.247	0.749	0.000***
Nb. of Medical Procedures	8.471	0.633	8.053	0.751	0.000***
Nb. of Technical Procedures	2.325	1.913	2.418	2.468	0.000***
Nb. of Office Visits	8.261	0.885	7.816	1.060	0.000***
Nb. of Home Visits	5.933	1.527	4.009	2.454	0.000***
Nb. of Patients	7.249	0.577	6.981	0.765	0.000***
Nb. of Med. Proc per Patient	1.489	0.233	1.379	0.291	0.000***
Annual Fees and Incomes					
Avg. Price (in Log. €2008)	3.238	0.183	3.577	0.288	0.000***
Total fees (in Log. €2008)	11.679	0.594	11.599	0.683	0.000***
Lump-sum Payments (in Log. €2008)	8.274	1.375	6.851	2.299	0.000***
for On-Calls/Guards (2008 only)	4.378	3.919	1.713	3.200	0.000***
for Specific Patients (2008 only)	7.197	1.784	4.496	3.180	0.000***
Labour Incomes (in Log. €2008)	11.139	0.59	10.95	0.739	0.000***
Sh. of GPs Exclusively Self-Employed	0.930	0.255	0.879	0.327	0.000***
Secondary Outcomes					
Sh. of Patients for whom the GP is a Gatekeeper	0.357	0.174	0.244	0.188	0.000***
Annual Prescription per Patient (in Log. €2008)	5.923	0.719	5.342	1.079	0.000***
Annual Drug Prescription per Patient (in Log. €2008)	5.258	0.795	4.646	1.184	0.000***
Sh. of Female Patients	0.556	0.061	0.611	0.106	0.000***
Sh. of Patients aged 15 or Younger	0.217	0.072	0.157	0.100	0.000***
Sh. of Patients aged 65 or Older	0.157	0.085	0.161	0.098	0.003***
Sh. of CMUC Patients	0.094	0.089	0.048	0.049	0.000***
Sh. of Patients with Chronic Diseases	0.145	0.060	0.133	0.064	0.000***
Sh. of GPs practicing in rural areas	0.177	0.381	0.060	0.237	0.000***

*** stands for statistical significance at 1% level.

Source: INSEE-CNAMTS-DGFiP File. Self-employed GPs, who are not retired if older than 60, perceiving at least one € of fees in the observation year. Particular mode of practice excluded. Pooled observations for 2005 and 2008. The care provision indicator denotes numbers of medical procedures of each type weighted by their reference prices. The number of medical procedures is the sum of office visits, home visits and technical procedures. Average price is defined as total annual fees divided by number of medical procedures performed in a year. Total annual fees include fees earned at reference price, extra fees and lump-sum payments. Lump-sum payments for specific patients include lump-sum payments for children and for patients with chronic diseases served as gate-keeper, and some other regulated surcharges. Labour Incomes are defined as total annual fees net minus all professional expenses (such as social contributions, office rents, secretarial services, etc.) and wages, if applicable. CMUC patients are low income patients whom GPs are not permitted to charge extra fees.

Table II: FRD and OLS estimates: GPs Establishing Practice 5 Years Before and After 1990

	OLS	FRD [1]					
	All GPs	All GPs		Male GPs		Female GPs	
Annual Provision of Care (in Log)							
Care Provision Indicator	0.394***	0.510***	(LLS)	0.686***	(LLS)	0.223***	(LQ)
	(0.021)	(0.087)		(0.152)		(0.032)	
Nb. of Medical Procedures	0.409***	0.611***	(LLS)	–	–	0.472***	(LLS)
	(0.021)	(0.145)		–		(0.048)	
Nb. of Technical Proc.	-0.216***	-0.272	(LL)	-0.201	(LL)	–	–
	(0.07)	(0.251)		(0.157)		–	
Nb. of Office Visits	0.448***	0.731***	(LLS)	0.668**	(LLS)	0.891***	(LL)
	(0.030)	(0.204)		(0.332)		(0.109)	
Nb. of Home Visits	2.071***	1.509***	(LLS)	2.547***	(LLS)	-0.040	(LLS)
	(0.067)	(0.125)		(0.151)		(0.319)	
Nb. of Patients	0.249***	0.397***	(LL)	0.453**	(LL)	0.371***	(LL)
	(0.021)	(0.122)		(0.197)		(0.082)	
Nb. of Med. Proc. per Patient	0.118***	–	–	–	–	0.089*	(LLS)
	(0.009)	–		–		(0.053)	
Annual Fees and Incomes							
Average Price (in Log. €2008)	-0.346***	-0.416***	(LL)	–	–	-0.475***	(LL)
	(0.008)	(0.049)		–		(0.034)	
Total Fees (in Log. €2008)	0.063***	0.196**	(LLS)	0.36**	(LLS)	-0.046	(LQ)
	(0.019)	(0.098)		(0.151)		(0.046)	
Lump-Sum Payments	1.588***	1.621***	(LLS)	1.939***	(LLS)	0.748*	(LQ)
(in Log. €2008)	(0.061)	(0.219)		(0.386)		(0.421)	
Labour Incomes (in Log. €2008)	0.183***	0.085	(LL)	0.218**	(LL)	-0.182*	(LLS)
	(0.020)	(0.089)		(0.099)		(0.095)	
Sh. of GPs Exclusively Self-Employed	0.058***	0.031	(LLS)	-0.008	(LLS)	0.110*	(LQ)
	(0.010)	(0.022)		(0.059)		(0.063)	
Secondary Outcomes							
Sh. of Patients for whom	0.135***	0.097***	(LLS)	0.08***	(LL)	0.037	(LQ)
the GP is a Gatekeeper	(0.005)	(0.020)		(0.026)		(0.027)	
Annual Prescription per Patient	0.653***	0.249***	(LLS)	0.223***	(LL)	-0.275*	(LQ)
(in Log. €2008)	(0.031)	(0.040)		(0.084)		(0.166)	
Annual Drug Prescription per Patient	0.697***	0.403***	(LLS)	0.490***	(LLS)	-0.050	(LQ)
(in Log. €2008)	(0.034)	(0.033)		(0.115)		(0.156)	
F- First Stage of excluded instrument	–	1427	(LL)	1309	(LL)	125	(LL)
	–	957	(LQ)	1036	(LQ)	72.3	(LQ)
	–	929	(LLS)	1077	(LLS)	94.2	(LLS)
Nb of Obs.	33701	33701		24336		9365	

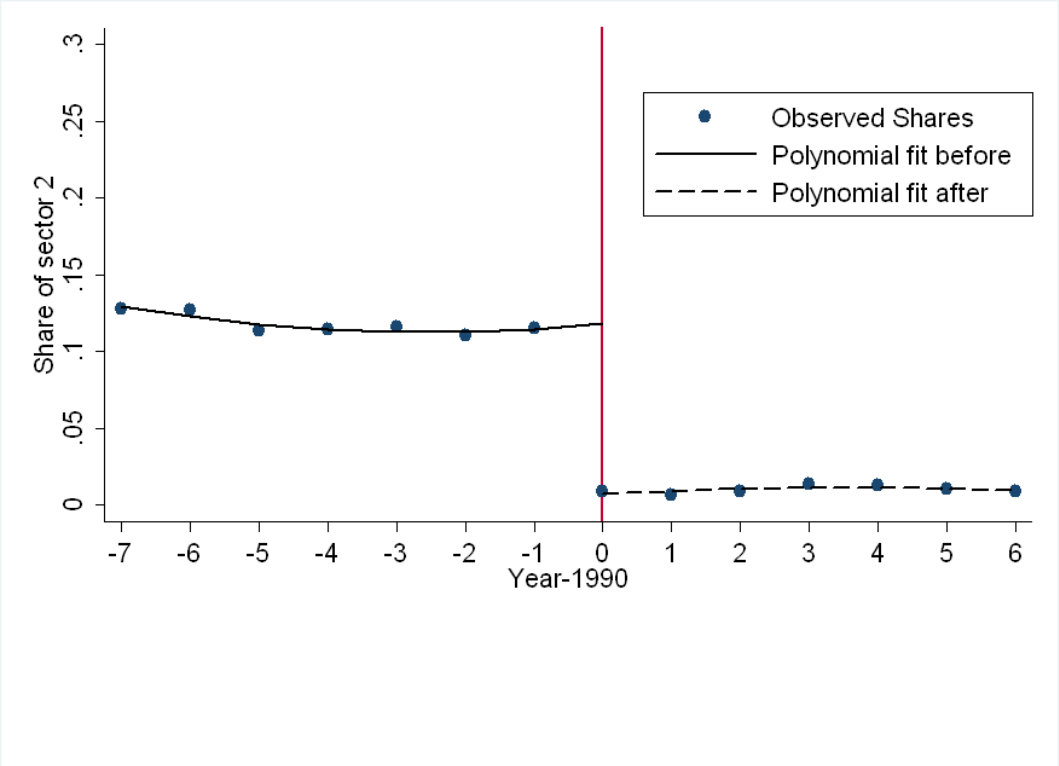
Note: This table reports OLS and fuzzy regression discontinuity (FRD) estimates of causal effects of overbilling restrictions on various outcomes, for all GPs (columns 1 and 2) and FRD estimates for male and female GPs separately (columns 3 and 4). We use a bandwidth of 5: the data restrict to GPs who opened practices between 1985 and 1994. Regressions are clustered by the year of practice establishment. OLS: outcome is regressed on a sector un-instrumented dummy and GP covariates (age, age squared, gender, year of starting practice and marital status). Standard deviations are reported in parentheses, below estimates. *** indicate statistical significance at 1%, ** at 5%, * at 10%, and ^{p} at 15% level.

Source: INSEE-CNAMTS-DGFiP File. Self-employed GPs, who are not retired if older than 60, perceiving at least one € of fees in the observation year. Particular practice mode excluded. Pooled observations for 2005 and 2008.

(1) We performed FRD with three specifications for time trends: local linear (LL), local quadratic (LQ), and local linear spline (LLS). Only results with the best fitting trend specification and that pass GoF tests are reported (Lee and Card, 2008). The chosen specification is reported in parentheses, next to estimates. See the online appendix for tables with detailed results.

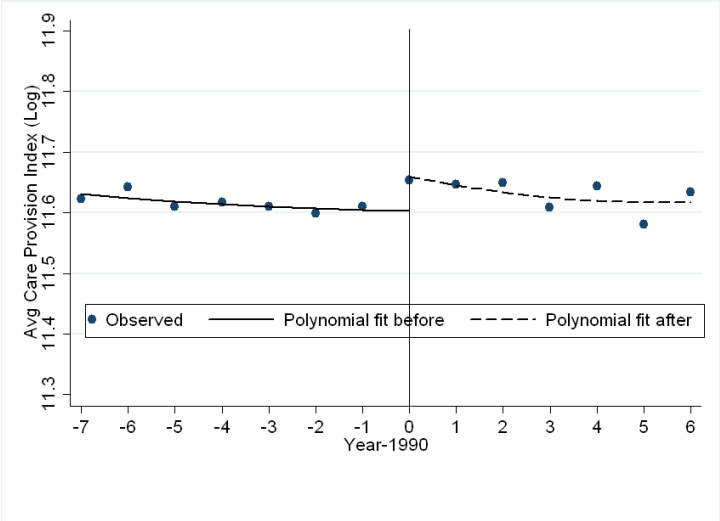
9 FIGURES

Figure 1: Share of GPs joining sector 2 by year of practice establishment

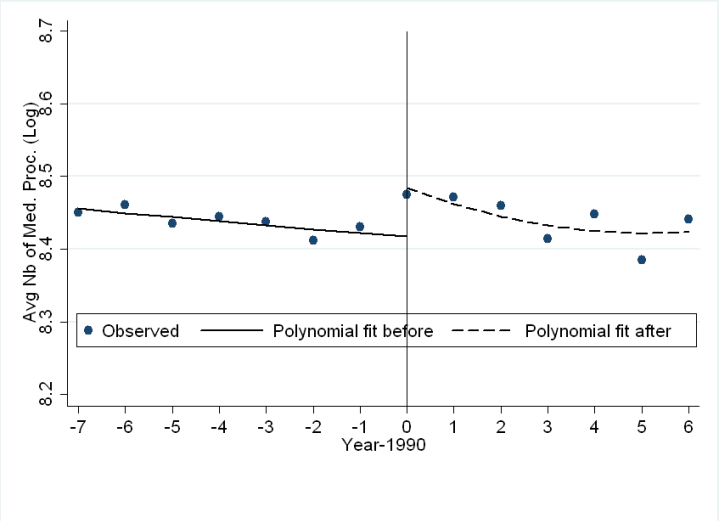


Source: INSEE-CNAMTS-DGFiP File. Self-employed GPs, who are not retired if older than 60, perceiving at least one € of fees the year of observation. Particular mode of practice excluded. Pooled observations for 2005 and 2008. Polynomial fits are obtained with quadratic specifications before and after the date of the reform.

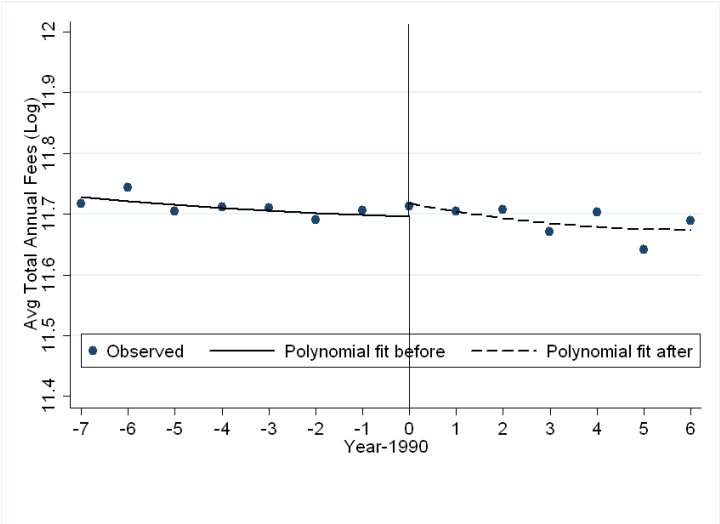
Figure 2: Main outcomes by year of practice establishment



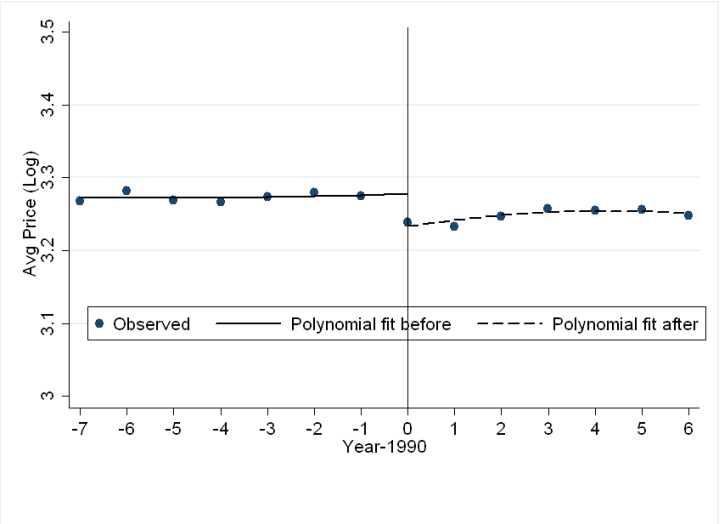
(a) Care Provision Indicator (Log)



(b) Nb of Medical Procedures (Log)



(c) Total fees (Log)



(d) Average price (Log)

Source: INSEE-CNAMTS-DGFiP File. Self-employed GPs, who are not retired if older than 60, perceiving at least one € of fees in the observation year. Particular mode of practice excluded. Pooled observations for 2005 and 2008. Polynomial fits are obtained with quadratic specifications before and after date of the reform.