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French physicians' responses to overbilling restrictions

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Abstract

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1 Introduction

In France, self-employed physicians, who are paid under a fee-for-service, can choose to practice either as sector 1 physicians (in which case, they charge their patients regulated fees) or as sector 2 physicians (and they can freely charge patients above the reference price). In 2018, 47% of specialists and 7% of general practitioners (GPs) belonged to the sector 2 (respectively 40% and 10% in 2008) (DREES, 2019). For specialists, this share is increasing every year, as newly graduated specialists mostly start their practice as sector 2 physicians. Fees earned through overbilling represented 31% of specialists' total annual fees in 2018, and 25% of GPs' ones (DREES, 2019).

In practice, overbilling does not directly impacts National Health Accounts (NHA): the extra fees are paid by the patient himself, and most of them are only partly reimbursed by their complementary health insurance. Therefore, on the demand side, overbilling may increase inequalities in access to care and lead to equity concerns. On the supply side, overbilling can lead to a decrease in physicians' activity, if they react to income effects, which may reduce the amount of services provided, especially in areas where medical density is already low. However, the literature suggests that physicians may adopt strategic behaviours when fees are regulated, that may have huge consequences on NHA as well (see for example the important literature on supply induced demand). For example, Yip (1998) shows that thoracic surgeons respond to Medicare fee cuts by increasing the volume of their services, and especially by concentrating on the most intensive procedures. Rochaix (1993) and Nassiri and Rochaix (2006) show that a tariff-freeze led to an increase in the quantity of services provided by Canadian primary care physicians as well as an adjustment to more complex and more paid procedures. In France, physicians are not allowed to overbill patients with low income: Dormont and Gayet (2021) found that self-employed physicians and dentists earnings are not impacted by this fee restriction because they increase their volume of activity. Overbilling has therefore become a major concern for public policies in France.

In France, in 1990, one reform has aimed at reducing the amount of overbilling: the "sector 2 freeze reform". More precisely, the difference between sector 1 and sector 2 had been introduced in 1980 by the French National Health Insurance. From 1980 on, physicians have been given the possibility to choose to practice in sector 2, where overbilling is allowed, or in sector 1. In exchange for charging regulated fees in sector 1, all their social contributions were reimbursed. However, given the continuous increase in the proportion of physicians choosing to practice in sector 2 and the huge inequalities in access to care it created, the government decided, in 1990, to restrict entry in sector 2 to specific physicians, who had a previous experience as teaching assistant or clinic supervisors. This reform created an exogeneous shock in the probability to start practice as a sector 2 physician: the number of physicians starting her practice in sector 2 dropped (temporarily) after 1990. Because the choice of the sector is endogeneous, decided by the physician at the end of her medical education, we use this reform to instrument the choice of the sector and evaluate how physicians react when they are constrained to practice regulated fees.

We use an exhaustive administrative data set on self-employed physicians practicing in France in 2008 and 2011, and who started their practice around the reform, ie. between 1985 and 1994. We

restrict this dataset to 5 specialties: dermatologists, otorhinolaryngologist -ORL- (2 technical specialties), pediatricians and psychiatrists (2 medical specialties) and general practitioners. We exploit the exogenous discontinuity, in 1990, in the probability that a physician (specialist or GP) starts her practice as sector 1 doctor, and use a fuzzy regression discontinuity framework to evaluate the impact of regulated fees on physicians' provision of care and total fees. More precisely, our study aims at testing whether regulated fees lead to an increase in access to care for the population and/or to strategic behaviours for physicians in their provision of care.

This reform has already been used to study the impact of fee cuts on GPs in a previous paper (Coudin et al., 2015). Price regulation was found to strongly influence physicians provision of care: GPs who were constrained to charge regulated fees increased their activity compared to what they would have done under unregulated fees, a result that is consistent with GPs reacting strongly to income effects. By focusing on specialists, our study complements this previous analysis. Indeed, in France, overbilling is mostly a concern for specialist physicians whose share in sector 2 and whose average amount of overbilling are much higher than for GPs. Moreover, a vast literature exists on GPs' behaviour, but nearly no paper analyses specialists' behaviour paid under a FFS scheme in terms of health care supply. Finally, even if we use the same fuzzy regression discontinuity design, our estimation methods are different given the huge literature that arose on regression discontinuity in the last years.

Our findings suggest that *technical specialists* constrained to charge regulated fees experience a decrease in their price, that they compensate by a strong increase in the number of acts, leading to a non significant impact on their total fees, at the expense of a larger workload. 75% of this additional activity is directed at new patients, hence showing an increase in access to care for the population, due to lower prices. However, these specialists have a wide range of available procedures in their activity: we find a huge increase in the number of technical procedures (either surgical or non surgical ones). Only 57% of these procedures are directed at their new patients, the remaining being an increase in the number of (potentially unnecessary) acts delivered to their regular patients. This may be a sign of supply induced demand from these specialists who strongly react to income effects. GPs have similar reactions: being constrained to practice in sector 1 lead to an increase in their number of acts and their number of patients, so that their total fees do not decrease with lower prices (due to regulated fees). 73% of this increased activity can be explained by the increase in their number of patients, hence a sign of a better accessibility to GPs for the population, especially because they are "gatekeepers". The remaining could be, as for technical specialists, a sign of supply induced demand. Results are different for the other medical specialists (pediatricians and psychiatrists), who have, contrary to technical specialists, an activity mainly composed of clinical acts, i.e consultations. Those constrained to charge regulated fees experience a decrease in their prices, that they did not compensate by an increase in their total level of activity. Overall, this leads to a decrease in their total fees. This result can be interpreted both on the supply side (these physicians have intrinsic characteristics that make them inelastic to prices) or on the demand side (patients who visit them do not care about the prices they charge).

The paper proceeds as follows. Section 2 describes the regulation of physicians' payments in

France and the “Sector-2 freeze” reform that we use as an instrument for practicing in sector 1. Section 3 presents the data and section 4 the empirical strategy. Section 5 then exposes the results and some robustness checks. Finally, section 6 concludes.

2 The regulation of primary care in France

2.1 Physicians’ payments

French self-employed physicians are mainly paid on a fee-for-service (FFS) basis. When they belong to the sector 1, physicians have to charge patients the regulated fee, fixed by the NHI for every procedure. In exchange, their social contributions are reimbursed. In sector 2, physicians are free to charge extra-billings in addition to the regulated price. Extra-fees should be determined with “tact and moderation” (*tact et mesure*) and exceptions are made for low income patients (beneficiaries of universal complementary health coverage (*CMU-C*)). In exchange, their social contributions are not subsidized by the NHI.

Patients are free to choose the physician they want to consult and information concerning physicians’ sector, prices and reimbursement rules are public. Since 2004, GPs are gatekeepers (*médecins traitants*). When a patient visits a specialist, the NHI reimburses 70 % of the regulated price of the consultation if she was addressed to this specialist by her *médecin traitant*. On the contrary, if a patient self-refers to a specialist (except for ophthalmologists, gynecologists and psychiatrists), she is only reimbursed up to 30% of the regulated price. In practice, data show that 50% of patients are addressed by their *médecin traitant* when they visit an ORL, 34% when they visit a dermatologist; but they mostly consult psychiatrists and pediatricians by themselves.¹ The price of a consultation also depends on the sector of the physician. For example, a price for a consult to a general practitioner belonging to sector 1 was €25 in 2008, but about €50 in sector 2. Patients have to pay the co-payments and potential supplements if the physician practices overbilling. Mostly all French citizens have a complementary health insurance that reimburses for these overbillings, but the amount of reimbursement varies greatly between contracts, so that out-of-pocket can reach very high levels.

2.2 The “Sector-2 freeze” reform and the regulation of over-billing in France

The sector 2 was created by the French Government in 1980, just before the Presidential election, as a “gift” towards the physicians. For the government, in a context of weak GDP growth, it was a way to increase physicians’ income, without increasing national health expenditures (as would have been the

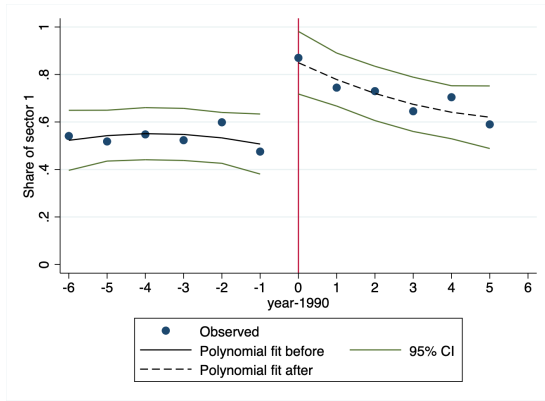
¹Computations from the authors using The health, health care and insurance survey (ESPS), wave 2010, produced by IRDES. This wave is the one that best matches with the years of the dataset used in this work.

case with an increase of the regulated fees). From 1980 on, all physicians have had the possibility to choose to practice in sector 2. However, this sector became very popular among physicians, and especially among specialists. By 1989, the share of self-employed GPs in sector 2 had reached 20% and that of specialists had reached between 20 and 60%, depending on the specialties considered (Eco-santé, 2016). Given this success, overbilling became current practice, with a growing amount of extra-fees, especially for specialists. For public policy makers, the development of overbilling became a major concern as it lead to an increase in patients' out-of-pocket expenditures and questioned equity in access to care.

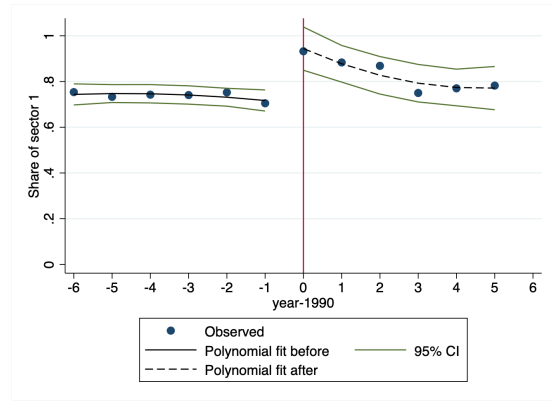
As a consequence, a reform restricted access to sector 2 in December 1989. All physicians starting their practice from the first trimester 1990 on have been constrained to choose to practice in sector 1, except for physicians who had specific experience (ex-clinic supervisors, teaching assistant in hospitals). The choice of the sector was made at the beginning of the career and was permanent, for their whole career, except that sector 2 physicians who could still switch to sector 1. However, the reverse was not possible.

This so called "Sector-2 freeze" reform created a discontinuity in the probability for physicians to start their practice as sector 1 physicians (see Figure 1). Between 1989 and 1990, there is a huge rise in the share of physicians belonging to the sector 1. Depending on the specialty considered, the gap is between 14 and 35 pp. Rapidly, the number of specialists who chose to get trained an extra 2 or 4 years in order to get the titles necessary to start practice as sector 2 increased a lot so that the freezing reform, for specialists, only concerned one specific generation of physicians.

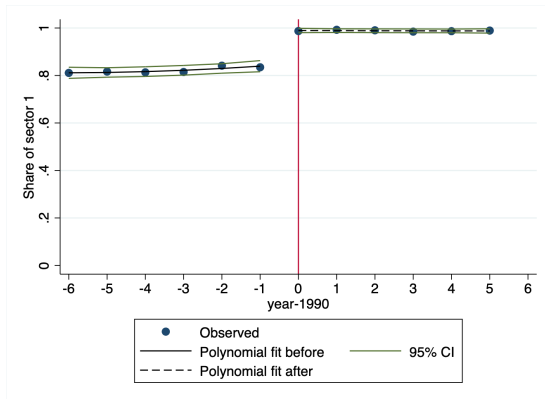
Our paper uses this reform to analyze if physicians constrained to practice regulated fees provide different levels of care to the population. Because the choice of the sector is endogeneous, this reform, which is, in France, the only attempt to regulate drastically overbilling, can be used to give insights on sector 1 physicians' provision of care .



(a) Technical specialists



(b) Medical specialists



(c) General Practitioners

Source : Insee-DGFIP-Cnam-DREES dataset ; Self-employed physicians who set up their private office between 1984 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Polynomial fit are obtained with local quadratic specifications before and after date of the reform (1990).

Figure 1: Share of physicians in sector 1 by year of practice beginning

3 Data

3.1 An exhaustive dataset on physicians in France

Our study uses an exhaustive administrative dataset “*Insee-DGFIP-Cnam-DREES*” on self-employed specialists practicing in France. This dataset merges information on physicians’ activity gathered by the National Health Insurance (“*Caisse Nationale d’Assurance Maladie*”, *CNAM*) and information on physicians’ remuneration coming from their household fiscal declarations (“*Direction Générale des Finances Publiques*”, *DGFIP*).

These data contain very detailed information on physicians’ socio-demographic characteristics (gender, age, municipality of practice, marital status, number of children), type of activity (annual number of medical procedures, decomposed into technical procedures and consultations, annual number of patients, annual amount of drug prescriptions), patients’ characteristics (in terms of age, gender, chronic condition or low-income (“*CMU-C*” status), and annual remuneration (annual fees earned at regulated prices, total amount of overbilling, annual income, spouse’s income, household income, ...).

We restrict our dataset to five specialties: dermatologists, otorhinolaryngologists (ORL), pediatricians, psychiatrists and general practitioners. The choice of those five specialties was driven by several reasons. First, this choice allows us to consider 2 specialists whose activity is divided between clinical (consultations) and technical procedures (dermatologists and ORL, we call them “technical specialists”) and 2 specialists whose activity is mostly clinical (pediatricians and psychiatrists, called “medical specialists”). We consider GPs apart from these medical specialties: while their activity is also mostly clinical, their role towards patients is very different from others, because of their “gate keeper” status. Second, on a more empirically based choice, those five specialties were the most impacted by the “Sector-2 freeze” reform (see Figure 1, and Figure A1 in appendix for the proportion of sector 1 physicians per specialty). On the contrary, some specialties were not affected by this reform (radiologists and pulmonologists - see figure A2 in appendix): the proportion of sector 1 physicians remained similar before and after the reform, around 80%. Some specialties were impacted (cardiologists, anesthesists and surgeons - see figure A3 in the appendix), but not sufficiently to use them to perform a robust econometric analysis: the F-stats from the first stage regressions (see the methodology in section 4) is always lower than 10 (4 for cardiologists, 10 for anesthesists, 5.7 for surgeons). For some other specialties (obstetrician gynecologists and ophthalmologists - see figure A4 in the appendix), the reform lead to a strategic behaviour: we observe a strong discontinuity in the number of physicians who decide to start their practice as self-employed. The reform lead them to practice more often as salaried physicians in hospitals. However, because we only observe self-employed physicians’ provision of care, we cannot study them in more details. Finally 2 other specialties were excluded (medical gynecologists and stomatologists - see figure A5 in appendix) as they are not numerous enough, especially because the training of these doctors temporarily stopped during this period. Overall, we focus on 5 specialties for which the reform had a strong impact on the probability to choose to practice in sector 1, for which the reform did not induce any strategic behaviour

(such as stopping to practice as self-employed) and which are numerous enough to perform a robust econometric analysis.

In the data, physicians are observed over a maximum of four waves (in 2005, 2008, 2011, 2014 and 2017), i.e. over a maximum of 12 years of practice. However, we only use waves 2008 and 2011. Indeed, the 2005 wave does not contain enough details on specialists' activity. Moreover, another reform to control overbilling was implemented in 2013 ("*Contrat d'accès aux soins (CAS)*"), modified in 2017 with the "*Option pratique tarifaire maîtrisée (OPTAM)*": both sector 1 and sector 2 physicians have been authorized to join these contracts, which allowed them to overbill within a certain limit fixed by the law, in exchange from the reimbursement of their social contributions. Therefore, in years 2014 and 2017, the level of activities and fees of sector 1 and sector 2 physicians who chose to join these contracts have been impacted.

Our main sample used for the econometric analysis is composed of self-employed sector 1 and sector 2 physicians belonging to the five specialties previously mentioned. Physicians who do not signed a contract with the NHI, or who are full-time private hospitals practitioners are excluded from the sample as we do not observe their activity. We also excluded physicians aged 60 or more and who receive retirement pensions. To avoid information errors, we removed physicians with annual fees, annual number of acts and annual amount of prescriptions equal to zero. More details are available in table A1 in the appendix. We end up with a sample containing 3080 dermatologists observed in 2008 and 2011 (whatever their year of beginning of practice), 2006 otorhinolaryngologists -ORL-, 2477 pediatricians, 5512 psychiatrists and 61 401 GPs. However, for the econometric analysis, we need to restrict this sample to physicians who started their practice in years around the reform. Our main analysis therefore focuses on technical specialists and GPs starting their practice six years around the reform (i.e. between 1984 and 1995) and medical specialists starting their practice three years around the reform (section 4 explains in more details the reason for this choice). Our final sample is then composed of 1577 dermatologists (2945 obs.), 964 ORL (1795 obs.), 1059 pediatricians (1501 obs.), 2660 psychiatrists (3285 obs.) and 26 829 GPs (43 529 obs.) (see table A1 in the Appendix). This sample is exhaustive on all physicians belonging to these specialties, practicing in 2008 and/or 2011 and who started their practice around the 90s.

3.2 Outcomes considered in the analysis

Our paper aims at evaluating the causal effect of price regulation on several outcomes, that can be divided into 3 categories: i) the price of a procedure²; ii) the total number of procedures (i.e. the sum of clinical (consultations) and technical (consultations including a technical procedure) acts) and the number of patients; iii) annual total fees.

Given the restriction in the possibility to overbill patients, we expect physicians forced to start their practice in sector 1 to face much lower prices. Simultaneously, we have no theoretical prediction on

²We calculate a composite price index proposed by [Choné et al. \(2019\)](#) to take into account differences in care intensity between physicians.

what will be their reaction to this decrease in prices: if the substitution dominates in their labour-leisure trade-off, the decrease in the opportunity cost of leisure could give them incentives to work identically, or even less. On the contrary, if the income effect dominates, we should observe an increase in their provision of care. Depending on which effect dominates, we will observe either a negative, positive or non significant impact on their total fees. Moreover, physicians' activity is at least partly constrained by demand: demand towards physicians who charge regulated fees may be higher than the one addressed to those who overbill, impacting their provision of care.

3.3 Descriptive statistics

Table 1 provides some descriptive statistics on the main outcomes and on the sample used for the econometric analysis (Table A2 in the appendix provides these statistics per specialty). The sample is restricted to 6 or 3 years around the reform, depending on the specialists considered).

Sector 1 physicians (1^{rst} column) are compared to sector 2 physicians (2nd column), for the three groups of specialties. The *p-value* for the test of equal means between the outcomes of both kinds of physicians is also reported in column 3. Sector 1 and sector 2 physicians strongly differ in all characteristics related to their labor supply. Sector 1 physicians always provide a significantly higher number of acts (either clinical and/or technical procedures). They also see more patients. Overall, except for GPs, sector 1 physicians' total fees are lower: their lower prices are not compensated by their larger workload.

Table 1: Descriptive statistics of care supply variables between sector 1 and sector 2 physicians

Technical specialists					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Nb. of proc.	4503	2037	3685	1824	0.000***
Nb. of technical proc.	1704	1328	1428	1585	0.000***
Nb. of non surgical proc.	1371	1519	1145	1253	0.000***
Nb. of surgical proc.	310	361	261	289	0.000***
Nb. of clinical proc.	2798	1540	2256	1321	0.000***
Nb. of patients	2822	1201	2442	1196	0.000***
Total extra-fees	3573	9063	72 580	58 629	0.000***
Overbilling rate (%)	3.02	7.43	71.32	60.52	0.000***
Total fees (including extra-fees)	161 552	83 249	202 940	111 323	0.000***
N	2865		1875		
Medical specialists					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Nb. of proc.	3363	2179	2841	1871	0.000***
Nb. of clinical proc.	2138	1095	2790	1852	0.000***
Nb. of patients	740	751	779	780	0.212
Total extra-fees	3493	10 662	68 135	47 009	0.000***
Overbilling rate (%)	4.25	11.95	84.50	48.94	0.000***
Total fees (including extra-fees)	129 193	74 028	161 814	91 349	0.000***
N	2971		732		
General Practitioners					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Nb. of proc.	5258	2397	3547	2225	0.000***
Nb. of clinical proc.	5097	2498	2996	2067	0.000***
Nb. of patients	1701	786	1347	836	0.000***
Total extra-fees	908	4008	47 083	177 890	0.000***
Overbilling rate (%)	1.20	33	63.40	318	0.000***
Total fees (including extra-fees)	150 475	66 999	145 450	145 943	0.000***
N	38 883		4646		

Note: ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Pooled observations for 2008 and 2011. Statistics are for a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists)

Source: Insee-DGFIP-Cnam-DREES dataset.

4 Empirical strategy

4.1 Fuzzy Regression Discontinuity Design

Physicians practicing in sector 1 are very different from those practicing in sector 2 in terms of activity and fees as we can see in Table 1. These differences may arise from the fact that physicians choice of the sector is endogenous, linked to their (unobserved) characteristics. They may also be a consequence of the sector to which physicians belong and therefore the price they are allowed to charge. We use a regression discontinuity in a fuzzy design (RD) to identify the causal effect of the sector on physicians' provision of care. More precisely, we exploit the discontinuity, before and after the first trimester of 1990 (date of the implementation of the "sector-2 freeze" reform), in the probability that a physician chooses to practice with a sector 1 contract (our treatment variable).

Since the access to sector 2 is still possible for physicians with specific titles, we have imperfect compliance: our RD is a fuzzy design, equivalent to a two-stage least squares setup (Lee and Lemieux, 2010). The trimester of practice beginning is the running variable and starting to practice after the first trimester 1990 is used as an instrument for practicing in sector 1. Note that while our running variable is the trimester at which physicians start their practice, all figures have been drawn using the *year* of beginning practice, in order to improve readability.

More precisely, the first stage is defined as:

$$S_i = a + b\mathbb{1}_{X \geq T_{1,1990}} + g(X_i) + \mathbb{1}_{2011} + \epsilon_i \quad (1)$$

$S_i = 1$ if the physician i chooses to practice in sector 1 and 0 otherwise; X_i represents the trimester of practice beginning, and $\mathbb{1}_{X \geq T_{1,1990}}$ is a binary variable equals to one if the physician sets up practice after the first trimester 1990. $\mathbb{1}_{2011}$ is a dummy indicating the wave 2011 (2008 is the reference year).

In the second stage, we use the exogenous variation in the probability to choose sector 1, to estimate its effect on the various outcome variables defined above:

$$Y_i = \alpha + \beta \hat{S}_i + h(X_i) + \mathbb{1}_{2011} + \mu_i \quad (2)$$

Y_i is the set of outcomes related to physicians' provision of care. $g(x)$ and $h(x)$ are very flexible functions of X , continuous at the date of the reform. This set-up allows us to estimate a local average treatment effect (β) on the complier group, ie on physicians who set up their practice in the first trimester 1990 and were constrained by the reform to practice in sector 1, but would have chosen sector 2 without the reform.

$g(x)$ and $h(x)$ are specified to be linear functions of x and equations (1) and (2) are estimated using a local-non parametric approach with a triangular kernel and first-order polynomial (Calonico et al., 2014). We also estimated β using a parametric approach (a linear function of X , continuous at the threshold). Both estimates are reported in the tables of results.

The running variable (trimester of practice beginning) is discrete and takes a moderate number

of distinct values. It has long been common practice in the empirical literature to address this concern by using standard errors clustered by the running variable (Lee and Card, 2008).³ However, Kolesár and Rothe (2018) have shown that this method does not guard against model misspecification, and those confidence intervals have poor coverage properties. They recommend against clustering by the running variable in practice. To follow this recommendation, we choose to estimate heteroskedasticity-robust standard errors clustered at the individual level (physicians are observed twice in the data).

Choosing the bandwidth used to estimate equations (1) and (2) leads to a trade-off between bias and efficiency: keeping observations closer to the cut-off produces less bias but greater uncertainty, and larger bandwidths increase the degree of precision of the estimates but also the risk of bias. We choose a bandwidth of 6 years around the reform for estimates on GPs and technical specialists and a bandwidth of 3 years for medical specialties, and show, in appendix, that our results are robust to changes in these bandwidths. The choice of the different bandwidths comes from the graphical analysis of Figure 1 (that shows the evolution of the percentage of sector 1 physicians around the cut-off), confirmed by the method proposed by Calonico et al. (2014) to determine the optimal bandwidth.

Note that our baseline regressions do not include control variables. However, as stated by Imbens and Lemieux (2008) and Lee and Card (2008), adjusting for covariates (especially covariates defined prior the reform) can help eliminate small sample biases in the specification and improve the precision of the estimates. Therefore, we also perform robustness checks that include these controls.

4.2 Validity checks

The estimation of the causal effect of price regulation on the different outcomes, using the regression discontinuity framework described above, holds under certain conditions.

First, the expectations of the potential outcomes, conditional on X , have to be continuous in the first trimester 1990:

$$E(Y_{ik}|X_i = x) \text{ is continuous in } x = T1, 1990 \text{ for } k = 0, 1$$

Because this hypothesis is not testable, we first checked that variables related to the outcomes but determined before the reform (eg. gender, age at PhD defense, thesis defense in Paris, but also variables related to the health status of the population such as men and women life expectancy at birth and mortality rate⁴) are continuously distributed in 1990. This is the case, as shown in Figures B1, B2 and B3 in the Appendix, and confirmed by regressions (table B1 in Appendix). The continuity of physicians' characteristics suggest that, even if there is an increase over time of the share of female physicians, of the age at PhD defense, or of the population health, no discontinuous change other than the probability to practice in sector 1 might affect the outcomes.

³This is what is done in Coudin et al. (2015)

⁴These last 3 variables are defined at the physician's year and region of PhD defense.

Second, β_i and treatment status $S_i(x)$ are assumed to be locally jointly independent of the year of beginning of practice X_i .

$$\beta_i, S_i(x) \perp\!\!\!\perp X_i \text{ close to } X_i = T1, 1990. \quad (3)$$

This condition implies that physicians do not have perfect control over the year and trimester at which they choose to start practice. In particular, it means that they cannot manipulate the threshold, and in that case, that they did not hurry to start their practice before access to sector 2 was restricted. This is very unlikely to be the case, as the sector 2 freezing reform had not been announced before December 1989. We perform several tests to check this hypothesis. First, we check graphically the continuity in the number of physicians who start to practice every year: there is no discontinuity in this number, and especially no increase in the year prior to the reform (Figure B5 in the Appendix). The number of physicians who start their practice every year is however not constant; as shown on Figure B5 in the Appendix, it is strongly linked to the number of medical graduates two years before, this number being the result of a "numerus clausus" imposed by the government. We implement more formally the test for manipulation when the running variable is discrete, proposed by [Frandsen \(2017\)](#) and cannot reject the continuity of the running variable for all specialties⁵. Finally, if there was manipulation, and if physicians hurried to start practice before the reform, we should observe a decrease in the age at practice set up and a decrease in the number of years between PhD defense and practice establishment around the first trimester 1990. This is not the case, as reported in Table B2 in the Appendix: for all specialties, age at practice set up did not decrease (it even increased a little for technical specialties) neither did the number of years before establishing practice. All these checks indicate that we do not find evidence of manipulation.

5 Results

5.1 Main Results

5.1.1 First stage results

First stage regression results (estimation of equation (1)) are reported in Table 2, separately for the different specialties, using a bandwidth of 6 years around the first trimester 1990 for technical specialties (ORL and dermatologists) and GPs, and 3 years for medical specialties (pediatricians and psychiatrists). For each specialty, the first columns report estimates obtained using a linear function of the trimester-year of practice establishment, while the second report estimates obtained using a local linear regression

⁵To run the test, we have to choose a parameter k for the maximal degree of nonlinearity in the probability mass function still considered to be compatible with no manipulation. Following [Frandsen \(2017\)](#), we perform the test for $k = 0$, $k = 0.01$, and $k = 0.02$. P-values are always greater than 0.10.

with a triangular kernel. As expected (see Figure 1), the reform had a strong impact on the probability to practice in sector 1: it led to a 34 to 37 pp increase in the probability that technical specialists begin their practice in sector 1, 26 to 30 pp for medical specialties and 15 pp for general practitioners. F stats are large, much above the usual threshold of 10, meaning that we do not have a weak instrument. When we split the sample per specialty (Table D1 in the Appendix), we see that, among technical specialties, dermatologists react much stronger than ORL (+36 pp versus +23 pp), and pediatricians more than psychiatrists (+31 pp versus +19 pp) but F stats are always above 10.

Regression discontinuity results (estimation of equation (2)) are reported in Table 3, again for the three grouped specialties, and using either a linear function (columns 1) or a local linear function with a triangular kernel (columns 2) of the trimester-year of practice establishment. The same previous bandwidths are used. Three types of outcomes are considered: i) the average price of procedures, decomposed into the price of clinical and technical procedures; ii) outcomes related to the annual provision of care, ie. the number of procedures decomposed into clinical and technical procedures and the number of patient; iii) annual total fees of physicians. Table 3 only reports the coefficient of the effect of the sector, for all outcomes considered (one different outcome per line). More precisely, it reports the causal impact of practicing regulated fees on the outcome, for compliers, i.e. for physicians who were constrained by the reform to establish their practice as sector 1 physicians, but would have chosen sector 2 in the absence of the reform. These compliers represent (see Table 2) 34 to 37% of technical specialists, 26 to 30% of medical specialists and 15% of GPs who started their practice in 1990.

5.1.2 Technical specialties

We first comment results for dermatologists and ORL (Table 3), grouped into "technical specialists". Contrary to medical specialists, they have the possibility to combine both clinical and technical procedures. Those technical specialists, who were constrained by the reform to practice regulated fees, face much lower prices for procedures, than they would as sector 2 physicians. Without any possibility to overbill patients, the average price of procedures is 41 to 48% lower than the one they would have faced as sector 2 physicians. This huge decrease in prices is similar between clinical procedures (-44 to -46%) and technical procedures (-44%). Physicians strongly react to this strong decrease in prices by increasing their number of acts (+33 to +41%). The increase in activity is only due to an increase in the total number of technical procedures: +67 to +76%; on the other hand, the number of clinical procedures (i.e. consultations without any technical act) is not significantly different from what they would have provided as sector 2 physicians. It is important to note that technical procedures are always performed during a consult. When a technical procedure is made by the physician, the national health insurance only charge the price of the technical procedure. Therefore, the interpretation of our result is that physicians constrained to charge regulated prices perform the same number of consultations without any technical act as they would in sector 2, but increased the number of consultations that include a technical act.

These technical procedures can be divided into two categories: non surgical procedures and

surgical ones. For dermatologists, surgical procedures include mostly biopsys and excisions of potential cancerous tumors. Non surgical procedures include skin prick tests (that test for allergic reactions), verucca removal, the use of laser to remove superficial skin lesions that do not need a full excision, and a skin cancer screening using a dermoscop to distinguish between a normal mole and a melanoma. Most surgical procedures are performed after a non surgical one (detection), in a following consult. Therefore, they have strong incentives to increase their number of non surgical procedures in order to be able to increase later their number of surgical procedures. Indeed, we observe (Table D2 in the appendix) that dermatologists constrained to charge regulated prices increased both kinds of technical procedures, but they increased the number of non surgical ones by a higher amount (96 to 108%, compared to 67-73% for non surgical ones). ORL perform only non surgical acts (for example : audiometric tonal and vocal testing, endoscopy of the nasal cavity...). They increased strongly their technical procedures (+89 to 102%). All these results are robust whatever the bandwidth (see Table E1 in the Appendix) and the use of control variables (see Table E4 in the Appendix). This greater activity could reflect a previous rationing of demand, due to financial constraints: compliers, who charge patients regulated fees, may face greater demand than the one they would have in sector 2. Calculations using results of the estimates show that 75% of the increase in total activity is due to an increase in the number of acts delivered to new patients, while 25% is due to an increase in the number of acts delivered to regular ones.⁶ Regulated fees therefore increased physicians' accessibility. However, only 53% of the increased number of technical procedures is due to the increased number of patients; 47% of these acts are therefore not justified and probably due to strategic behaviors of physicians in order to compensate for their reduced fees⁷. Table 4 investigates whether this increase in procedures and especially technical procedures could be due to changes in patients characteristics. This is not the case: the share of patients with chronic diseases, the share of low-income patients, the structure per age of the patients is not significantly different to the one they would have under unregulated fees. Moreover, Table 4 also shows that the increase in the number of patients can be due to the combined effect of i) their lower prices; ii) the fact that they choose, when they start their practice, to locate in areas where medical density is lower, hence where competition (either from sector 1 or sector 2 physicians) is lower.

Overall, dermatologists and ORL constrained to charge regulated fees because of the reform perform more acts, and among them, mostly more technical procedures. Their income is similar to the one they would have had under unregulated fees, but at the cost of a higher workload. Part of the increased activity (both in the total number of acts and in the number of technical procedures) is devoted to the follow up of new patients, which is a sign of increased availability of care. However, about 25% of the increased number of acts and 47% of the increased number of technical acts is not justified by the

⁶These calculations are performed using the estimates in Table 3. Technical specialists provide $(\exp(0.34)-1)*3399=1376$ more acts than they would in sector 2 (3399 being the average number of acts of technical specialists practicing in sector 2 in 1989); and they treat $(\exp(0.26)-1)*2301=683$ more patients. Given that they perform 1.5 act per patient, the increase in activity only due to the follow-up of new patients should be 1024 more acts, ie. 75% of their total increase in activity.

⁷Given that technical specialists perform on average 0.53 technical procedures per patient, they should provide $836*0.53=437$ more technical acts. However, the number of technical acts increased by $(\exp(0.67)-1)*1224=820$.

increased number of patients and may be the sign of supply-induced demand, with physicians reacting strongly to income effects.

5.1.3 Medical specialties

Results concerning the two medical specialties, pediatricians and psychiatrists, are also presented in Table 3. Contrary to technical specialists, their activity is only composed of clinical acts (consultations). Medical specialists constrained to charge regulated prices face a 44 to 46% decrease in their prices. At the same time, those compliers do not perform more clinical acts than they would if they had started their practice in sector 2, and do not see more patients. Overall, with a non significant variation in their level of activity combined to lower prices, physicians constrained to practice in sector 1 because of the reform earn significantly less than they would have if they had practiced in sector 2 (-38%, only significant at the 10% level). Results using larger bandwidths (see Table E2 in the Appendix) or using control variables (Table E4 in the Appendix) reinforce this result: they experience a significant decrease in fees (around -50%), when the estimation is performed using a bandwidth of 6 or 7 years around the reform.

Recall that physicians are observed in 2008 and 2011. In 2011, 29% of psychiatrists and 33% of pediatricians were practicing in sector 2. On the contrary, among technical specialities, it was the case for 57% of ORL and 45% of dermatologists (?). Medical compliers are therefore more likely to practice around sector 1 physicians in 2011, and all the more so as they chose to locate in areas where medical density and the share of sector 2 physicians is also much lower than if they had started their practice in sector 2 (see Table 4). Sector 2 medical specialists practicing in the same area as the compliers have probably modified their practice across the years, and have adapted their practice to the one of sector 1 physicians. Hence, in 2011, no difference is observed in activity for compliers who were constrained to practice regulated fees, contrary to what they would have done in sector 2.

5.1.4 General Practitioners

Results for GPs are close to results found in [Coudin et al. \(2015\)](#) who use a similar dataset, but only on year 2008, and with a slightly different methodology.⁸ We find that the decrease in prices (-29 to -33%) is compensated by a higher number of consultations (+49 to +51%)⁹ They also see more patients (+37 to +41%). Overall, their fees are similar to what they would have earned if they had not been constrained to practice regulated fees, but at the expense of a greater workload. If we perform the same kind of calculations than for technical specialties, we show that 73% of the additional activity is devoted to new

⁸First, standard errors are clustered by the year of beginning of practice, which has now been criticized by [Kolesár and Rothe, 2018](#). Second, the running variable is the year of beginning of practice and not the trimester-year. And third, $g(x)$ and $h(x)$ are linear functions of year of practice establishment, and not local linear functions using a triangular kernel.

⁹[Coudin et al. \(2015\)](#) found that GPs increase their number of clinical procedures by 61%.

patients, hence demonstrating again the greater accessibility of sector 1 physicians for the population.¹⁰ This is a strong result given the key role GPs play in the organisation of ambulatory care in France as "gatekeepers". The remaining 27% could be, as for technical specialists, a sign of supply induced demand, ie. an increase in the number of procedures - not necessarily useful in terms of health gains - devoted to regular patients. One explanation to this potential supply-demand behaviour is that, contrary to specialists, they do not locate more in areas where medical density is lower, compared to what they would have done under unregulated fees (see Table 4). Contrary to specialists, part of their reaction in terms of provision of care may be explained by the higher degree a competition they face.

5.2 Robustness checks

In order to check the validity of our results, we perform several robustness checks.

First, as already mentioned, we estimate our models using different bandwidths, and results are very stable for GPs and technical specialists; for medical specialists, significance of the coefficients increase when we increase the number of observations used in the estimates. Results can be found in Tables E1, E2 and E3 in the Appendix.

Second, we include covariates in our regressions (being a woman, being married and the number of children). Results are presented in Table E4 in the Appendix. Since covariates are continuous around the date of reform, including those variables does not change our point estimates, but those are more precise.

Third, we perform a falsification test where we arbitrarily modify the date of reform to the first trimester 1997 instead of the first trimester 1990 (see Table F1 in the Appendix). As expected, we don't observe any discontinuity in the probability to choose a sector 1 contract in 1997 nor any impact on the outcomes considered.

More importantly, the "sector 2 freeze reform" was implemented in 1990, but physicians who started practice around 1990 are, in our data, observed in 2008 and 2011, ie. about 20 years later. We are therefore far away from the reform and physicians' behaviour observed in 2008 and 2011 may be affected by the evolution of the market for health care: the increase in the share of sector 2 physicians over the years in some specialties or the decrease in medical density that may both change the competition faced by physicians. We have at our disposal an additional panel of physicians covering the 1979-1993 period, hence containing information on physicians who set up their practice around 1990 and who are observed

¹⁰GPs provide $(\exp(0.5)-1)*3330=2160$ more acts than they would in sector 2 (3330 being the average number of acts of GPs practicing in sector 2 in 1989); and they treat $(\exp(0.4)-1)*1290=634$ more patients. Given that they perform on average 2.6 acts per patient, the increase in activity only due to the follow-up of new patients should be 1586 acts, ie. 73% of their total increase in activity.

around the date of the reform.¹¹ The time period after the reform is very short, but we use this panel to analyze the short-term effects of the reform. Results are presented in Table 5. Fisher statistics show that the instrument is weak for medical specialists ($F=4$), however our estimates are valid for technical specialists and GPs. Short term effects of practicing regulated fees are higher around years of the reform, but we come to the same conclusion: these specialists increased their total number of procedures, not their clinical procedures but only the technical ones. Overall, combined to the decrease in fees, they do not earn more than they would have under unregulated fees. In the same way, compliers GPs work more, but with no significant different in fees. Overall, the estimated long-run effects are consistent with short-run effects, even if they are lower, meaning that physicians probably adapted their behaviour over the years to changes in medical density and changes in the share of sector 2 physicians.

Table 2: First stage estimates for practicing in Sector 1

	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{X \geq 1990}$	0.337*** (0.034)	0.376*** (0.036)	0.260*** (0.032)	0.302*** (0.037)	0.151*** (0.007)	0.151*** (0.007)
<i>F-stat</i>	96.71		64.18		466.40	
<i>Nb. of obs</i>	4740	4740	3703	3703	43 529	43 529

Note: $\mathbb{1}_{X \geq 1990}$ is a binary variable equals to one if the year where the physician sets up practice is not before 1990. Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists). The F-stat denotes the Fisher statistic, which corresponds to the test of significance of the instrument in the first-stage regression.

Source: Insee-CNAM-DGFIP-Drees dataset

¹¹This panel is a 10% random sample of all self-employed physicians practicing in France between 1979 and 1993, produced by the NHI. It cannot be used for the main analysis as the sample size is very small. Moreover, it only enables us to observe physicians' activity at the beginning of their career (until 1993, with a beginning of practice around 1990), while we know that physicians' activity is growing very rapidly during the first few years of the career.

Table 3: RD estimates

	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Price of procedures						
Average price of procedures	-0.412*** (0.097)	-0.478*** (0.095)	-0.444*** (0.073)	-0.462*** (0.070)	-0.331*** (0.070)	-0.284*** (0.079)
Average price of clinical procedures	-0.458*** (0.041)	-0.444*** (0.040)	-0.428*** (0.064)	-0.416*** (0.064)	-0.409*** (0.029)	-0.416*** (0.032)
Average price of technical procedures	-0.445*** (0.042)	-0.443*** (0.041)	-	-	-0.323*** (0.071)	-0.328*** (0.076)
Annual provision of care						
Nb. of procedures	0.400*** (0.127)	0.345*** (0.124)	0.091 (0.228)	0.253 (227)	0.514*** (0.103)	0.500*** (0.116)
Nb. of clinical procedures	0.237 (0.196)	0.268 (0.195)	0.065 (0.234)	0.279 (0.228)	0.539*** (0.151)	0.457*** (0.172)
Nb. of technical procedures	0.765*** (0.275)	0.669** (0.275)	-	-	-	-
Nb. of non surgical procedures	0.829** (0.357)	0.600* (0.351)	-	-	-	-
Nb. of surgical procedures	0.737** (0.304)	0.824*** (0.306)	-	-	-	-
Nb. of patients	0.278** (0.116)	0.263** (0.117)	0.023 (0.372)	-0.059 (0.382)	0.403*** (0.096)	0.401*** (0.109)
Annual fees						
Total fees	-0.049 (0.131)	-0.109 (0.129)	-0.384* (0.205)	-0.251 (0.201)	0.154 (0.097)	0.156 (0.110)
Nb. of observations (max)	4740		3703		43 529	
Nb. of observations (min)	4314		3703		43 346	

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists).

Source: Insee-DGFIP-Cnam-DREES dataset

Table 4: RD estimates - Mechanism variables

Outcomes	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Patients' characteristics						
Share of patients with chronic disease	0.249 (1.030)	-0.138 (1.050)	-4.710 (4.772)	-0.718 (4.497)	2.138* (1.119)	1.370 (1.281)
Share of CMUC-C beneficiaries	-0.097 (0.963)	-0.085 (0.969)	1.550 (1.548)	0.606 (1.488)	1.810 (1.256)	1.668 (1.394)
Share of patients (age <16)	1.752 (1.755)	1.070 (1.686)	9.026 (13.487)	-4.046 (13.329)	2.564* (1.356)	2.590* (1.522)
Share of patients (age >65)	1.911 (1.766)	0.993 (1.800)	-2.164 (2.303)	-1.030 (2.233)	1.069 (1.623)	0.116 (1.835)
Location at <i>département</i> level						
Medical density for 10K inhabitants	-0.439*** (0.092)	-0.465***	-1.425** (0.588)	-1.883***	0.210 (0.242)	0.234
Share of sector 2 physicians	-18.963*** (4.508)	-18.131*** (4.438)	-17.937*** (5.479)	-20.118*** (5.332)	-4.453*** (1.531)	-4.859*** (1.726)
Share of sector 2 physicians (with controls)	1.025 (2.606)	0.606 (2.539)	-3.219 (3.435)	-3.396 (3.487)	-0.386 (0.244)	-0.589** (0.278)
Type of activity						
Full-time self-employed	0.273*** (0.097)	0.406*** (0.095)	0.170 (0.158)	0.221 (0.159)	-0.009 (0.046)	0.041 (0.052)
Nb. of observations (max)	4740		3703		43 529	
Nb. of observations (min)	4314		3703		43 346	

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists).

Source: Insee-DGFIP-Cnam-DREES dataset

Table 5: RD estimates - physicians' behaviour around year 1990

	<i>Technical specialists</i>	<i>Medical specialists</i>	<i>General Practitioners</i>
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
First-stage estimation			
Sector 1	0.207*** (0.055)	0.107** (0.053)	0.140*** (0.022)
F-stat	14.17	4.01	40.15
Outcomes (in log)			
Annual provision of care			
Nb. of procedures	1.952** (0.720)	3.371* (1.916)	0.286 (0.364)
Nb. of clinical procedures	1.002 (0.652)	3.180* (1.830)	1.226** (0.234)
Nb. of technical procedures	3.444*** (1.215)	- -	- -
Annual fees			
Total fees	2.191*** (0.788)	3.572* (2.082)	-0.085 (0.329)
Nb. of observations	1157	775	3507

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns report estimates obtained using a first order polynomial function of year of practice set-up. Technical specialists are here composed of dermatologists, ORL, rheumatologists, cardiologists and anesthetists. Medical specialists are composed of psychiatrists and endocrinologists.

Source: Milou dataset

6 Conclusion

The “Sector-2 freeze” reform constrained some physicians who started their practice after the first trimester 1990 to charge regulated fees. These fees are much lower than those charged by physicians who are allowed to overbill. Our paper uses this reform to evaluate how physicians react to regulated fees. More precisely, using different care provision indicators, we test whether regulated fees lead to an increase in access to care for the population and/or to physicians’ strategic behaviours. Our findings suggest that *technical specialists* constrained to charge regulated fees experience a decrease in their price, that they compensate by a strong increase in the number of acts, leading to a non significant impact on their total fees, at the expense of a larger workload. 75% of this additional activity is directed at new patients, hence showing an increase in access to care for the population, due to lower prices. However, these specialists have a wide range of available procedures in their activity: we find a huge increase in the number of technical procedures (either surgical or non surgical ones). Only 57% of these procedures are directed at their new patients, the remaining being an increase in the number of (potentially unnecessary) acts delivered to their regular patients. This may be a sign of supply induced demand from these specialists who strongly react to income effects. GPs have similar reactions: being constrained to practice in sector 1 lead to an increase in their number of acts and their number of patients, so that their total fees do not decrease with lower prices (due to regulated fees). 73% of this increased activity can be explained by the increase in their number of patients, hence a sign of a better accessibility to GPs for the population, especially because they are “gatekeepers”. The remaining could be, as for technical specialists, a sign of supply induced demand. Results are different for the other medical specialists (pediatricians and psychiatrists), who have, contrary to technical specialists, an activity mainly composed of clinical acts, i.e consultations. Those constrained to charge regulated fees experience a decrease in their prices, that they did not compensate by an increase in their total level of activity. Overall, this leads to a decrease in their total fees. This result can be interpreted both on the supply side (these physicians have intrinsic characteristics that make them inelastic to prices) or on the demand side (patients who visit them do not care about the prices they charge).

Those different results could be explained by several reasons. First, pediatricians and psychiatrists have specific patients that shape the structure of their activity: pediatricians treat only children and psychiatrists can see more often and spend more time with their patients. Second, as they only do consultations, they don’t have other “tools” to compensate lower prices. Compared to them, technical specialists have an activity that allow them to combine both type of act (technical and medical) and we saw in our results that they use this flexibility in reaction to the “sector-2 freeze” reform. GPs are particular because their flexibility do not rely on the addition of technical acts in their activity but more in the treatment of additional patients, that their “gatekeeper” status might have encouraged.

By increasing the share of physicians practicing under regulated fees, this reform was implemented in order to improve financial access to care for patients. In the absence of any strategic reaction of physicians, this reform should reduce the amount paid by patients, without increasing the costs for

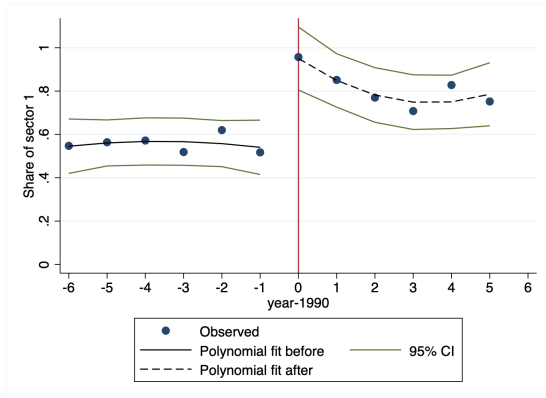
the National Health Insurance. We try to summarize the effects of this reform on the patients' welfare (total level of care provided to them), on physicians' welfare (their workload and their total fees) and on the expenditures for the national health insurance. On the demand side, this reform increased the quantity of care available at reference prices. Moreover, about 75% of physicians' increased activity was devoted to the follow-up of new patients, hence increasing availability of care. On the supply side, total fees earned by physicians constrained to practice under regulated fees are not significantly different from what they would earn in sector 2. However, this result comes at the expense of a greater workload. The national health insurance (NHI) reimburses patients for each consultation on the basis of a fixed price (the one charged by sector 1 physicians). The increased access to care lead to an increase in the number of fees reimbursed, as well as the strategic behaviors that we identified. Overall, the reform is costly for the NHI (about 40% more fees reimbursed to patients who consult a "complier" physician).

Our results have a limited external validity because they are obtained on a very specific population of physicians (only some specialties, now aged 45-50 years old) and the reform is old. Physicians who start their practice nowadays have very different characteristics and preferences than the one we studied (there are more women, young physicians have different aspirations concerning their labour-leisure trade offs, etc.). However, this analysis allows us to give intuitions on the reaction physicians have in case of fee cuts. Recently, new tools were introduced in France to encourage the reduction of overbilling: the NHI propose a contract (to sector 1 and sector 2 physicians) where physicians undertake not to exceed a amount of over-billing, and receive a financial bonus as a reward for achieving these objectives. However, first results (Kingsada, 2022) show that this type of reform is probably too soft to constrain physicians with the largest amount of over billing to join the contract and limit their overbillings.

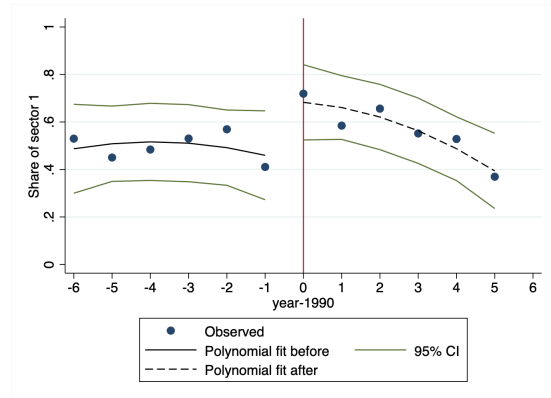
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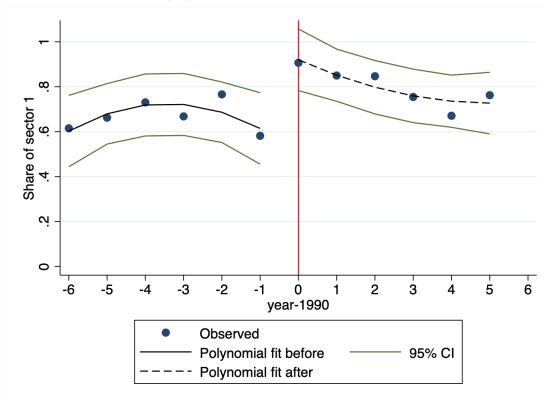
A Data: Choice of the different specialties and sample used for the estimates



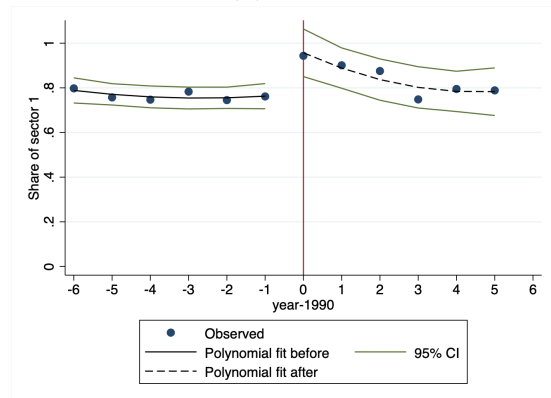
(a) Dermatologists



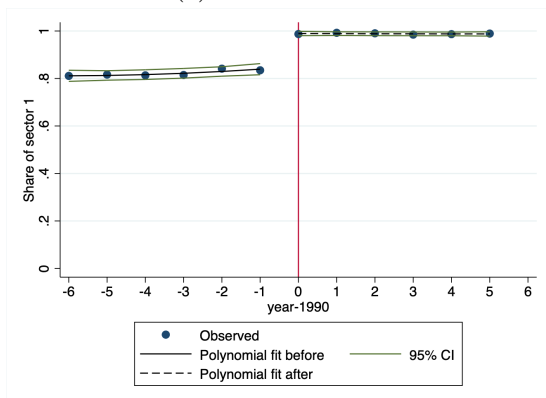
(b) ORL



(c) Pediatricians



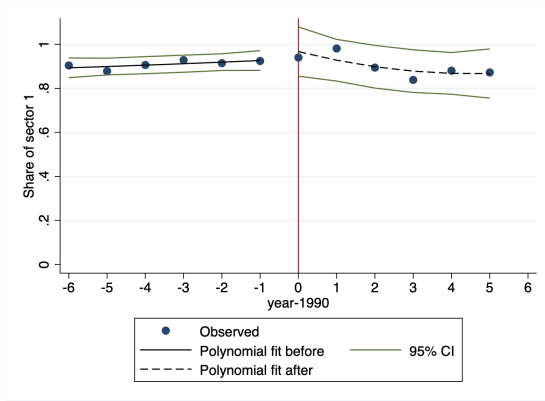
(d) Psychiatrists



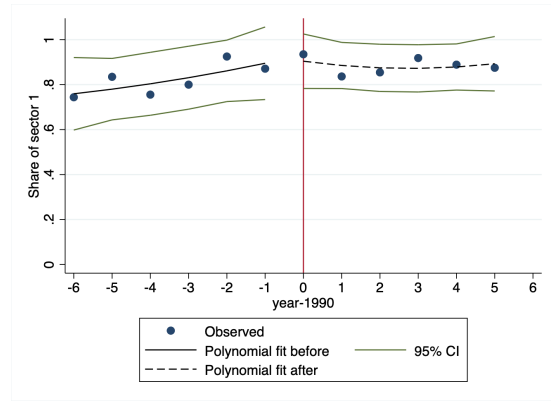
(e) General Practitioners

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Second order polynomials are obtained with functions specifications before and after date of the reform (1990).

Figure A.1: Share of physicians joining sector 1 by year of practice set-up



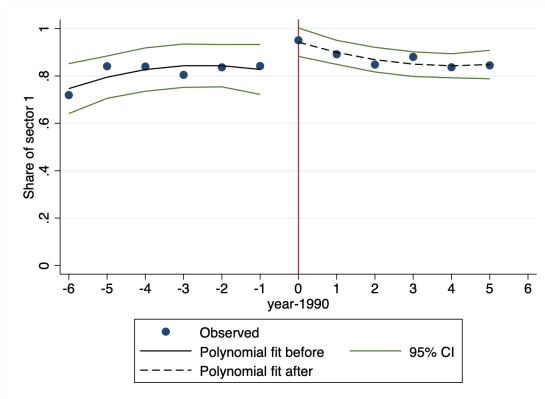
(a) Radiologists



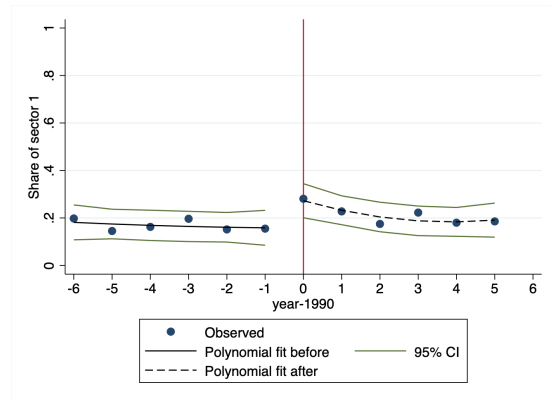
(b) Pulmonologists

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Second order polynomials are obtained with functions specifications before and after date of the reform (1990).

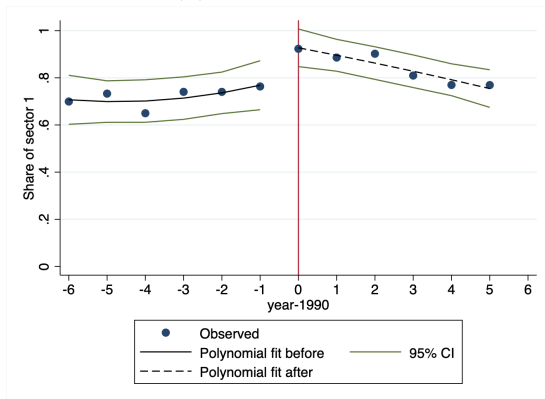
Figure A.2: Share of physicians joining sector 1 by year of practice set-up - specialties that were not impacted by the sector 2 freezing reform



(a) Cardiologists



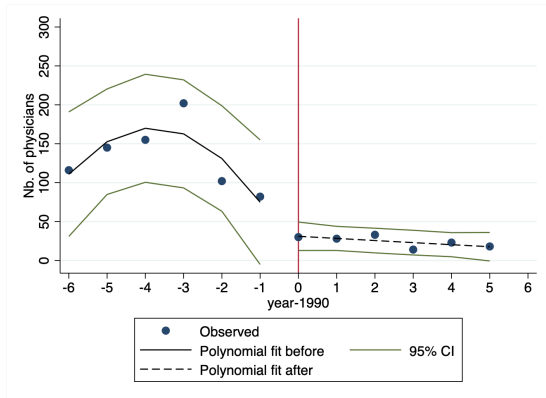
(b) Surgeons



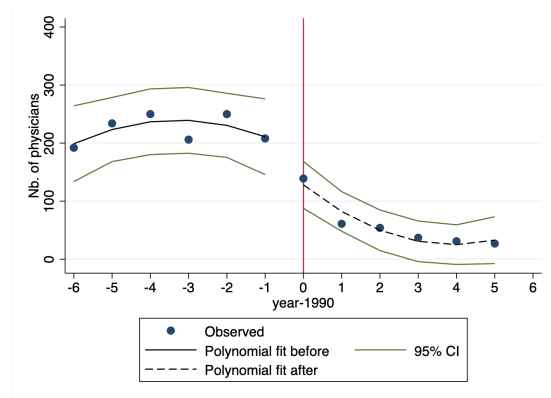
(c) Anesthetists

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Second order polynomials are obtained with functions specifications before and after date of the reform (1990).

Figure A.3: Share of physicians joining sector 1 by year of practice set-up - specialties with a small impact of the sector 2 freezing reform



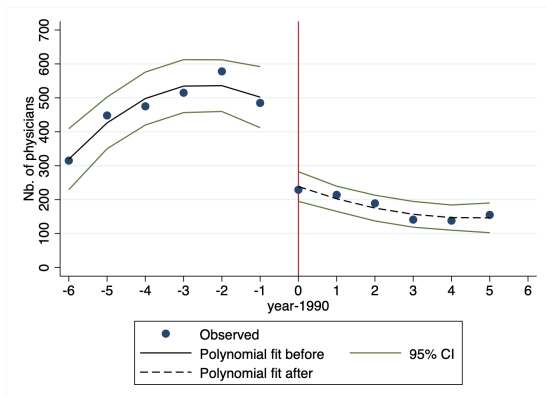
(a) Stomatologists



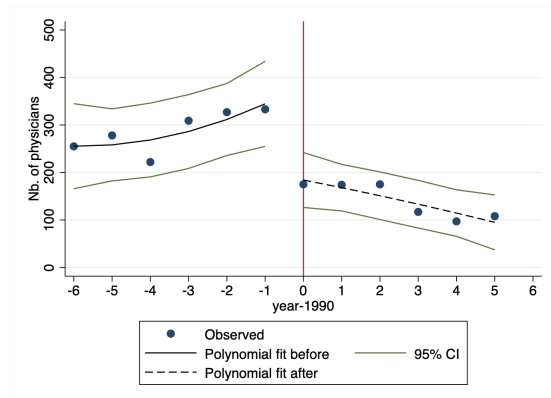
(b) Medical gynecologists

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Second order polynomials are obtained with functions specifications before and after date of the reform (1990).

Figure A.4: Number of physicians by year of practice set-up - specialities with not enough physicians



(a) Ophthalmologists



(b) Obstetricians gynecologists

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Second order polynomials are obtained with functions specifications before and after date of the reform (1990).

Figure A.5: Number of physicians by year of practice set-up - specialities who stopped practicing as self-employed

Table A1: Sample used for estimations

Self-employed specialists	Dermatologists	ORL	Pediatricians	Psychiatrists	General Practitioners
<i>General informations</i>					
Total number of physicians	3318	2309	2807	6305	61 401
Share in all physicians in 2008 (%)	2.87	1.86	2.25	4.95	56.79
Share in all physicians w/o GPs in 2008 (%)	6.63	4.32	5.22	11.74	-
Total number of observations	5988	4166	4905	11 021	113 836
<i>Exclusion criterias</i>					
No PHI contract	10	4	3	43	719
Full-time private hospital physicians	94	342	154	238	48
Retired physicians aged 60 or older	406	260	518	1378	4271
Zero fees	1	0	0	1	1
Zero acts	1	0	0	6	111
Zero prescriptions	0	0	0	32	23
Total nb. of physicians after exclusion	3080	2006	2477	5512	61 401
Total observations excluded	504	597	671	1678	5066
Total observations after exclusion	5484	3569	4234	9343	108 770
<i>Bandwidth : window of years around 1990</i>					
<i>Bandwidth 5 : [1985;1994]</i>					
<i>Number of physicians</i>	1371	827	935	2271	19 889
<i>Number of observations</i>	2555	1552	1737	4063	37 137
<i>Bandwidth 6 : [1984;1995]</i>					
<i>Number of physicians</i>	1577	964	1059	2663	23 318
<i>Number of observations</i>	2945	1795	1952	4734	43 529
<i>Bandwidth 7 : [1983;1996]</i>					
<i>Number of physicians</i>	1763	1108	1169	2980	26 829
<i>Number of observations</i>	3291	2064	2158	5281	50 076

Source: Insee-DGFIP-Cnam-DREES dataset. Pooled observations for 2008 and 2011.

Table A2: Descriptive statistics of care supply variables between sector 1 and sector 2 physicians

Dermatologists					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Average	<i>St. dev</i>	Average	<i>St. dev</i>	
Price of procedures					
Average price of procedures	33.18	2.16	51.77	18.00	0.000***
Annual provision of care					
Nb. of procedures	4418	2022	3570	1846	0.000***
Number of clinical procedures	3304	1475	2719	1370	0.000***
Nb. of technical procedures	1114	955	850	784	0.000***
Nb. of non surgical procedures	730	705	522	562	0.000***
Nb. of surgical procedures	380	393	324	333	0.000***
Nb. of patients	2868	1230	2484	1285	0.000***
Annual fees					
Total fees	140 471	64 892	168 098	82 083	0.000***
Nb. of obs	1919		1026		
ORL					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Average	<i>St. dev</i>	Average	<i>St. dev</i>	
Price of procedures					
Average price of procedures	29.92	2.97	45.11	16.68	0.000***
Annual provision of care					
Nb. of procedures	4673	2059	3823	1789	0.000***
Nb. of clinical procedures	1772	1095	1696	1008	0.129
Nb. of technical procedures	2901	1903	2126	1505	0.000***
Nb. of non surgical procedures	2671	1859	1896	1434	0.000***
Nb. of patients	2730	1133	2392	1078	0.000***
Annual fees					
Total fees	204 317	98 610	245 047	126 487	0.000***
Nb. of obs	849		946		

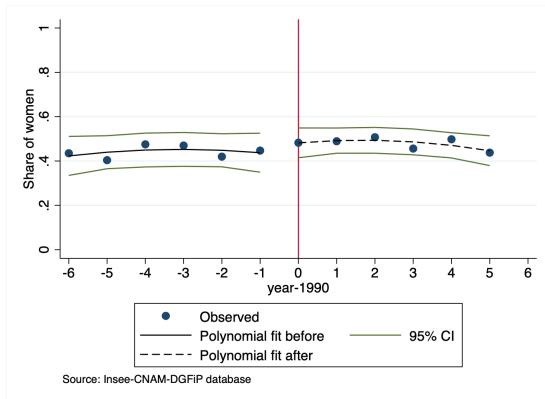
(To be continued)

Note: ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level.
Pooled observations for 2008 and 2011. Physicians installed between 1984 and 1995 (6 years around date of reform)
Source: Insee-DGFIP-Cnam-DREES dataset.

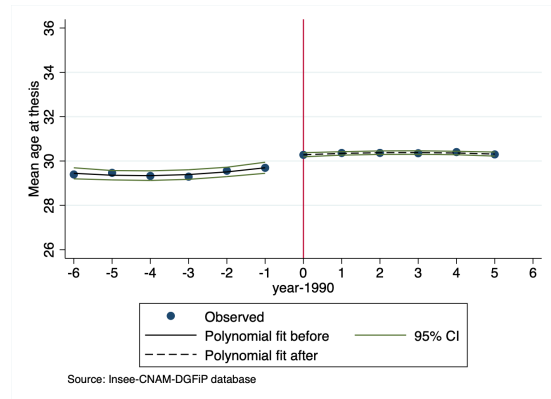
Pediatricians					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Average	<i>St. dev</i>	Average	<i>St. dev</i>	
Price of procedures					
Average price of procedures	36.69	2.45	53.87	12.69	0.000***
Annual provision of care					
Nb. of procedures	4151	1917	3806	1612	0.000***
Nb. of clinical procedures	3981	1855	3657	1616	0.000***
Nb. of patients	1596	775	1584	679	0.749
Annual fees					
Total fees	138 655	68 641	188 630	82 335	0.000***
Nb. of obs	1424		528		
Psychiatrists					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Average	<i>St. dev</i>	Average	<i>St. dev</i>	
Price of procedures					
Average price of procedures	45.07	4.35	71.51	59.50	0.000***
Annual provision of care					
Nb. of procedures	3044	2367	2239	1684	0.000***
Nb. of clinical procedures	3037	2352	2232	1679	0.000***
Nb. of patients	369	291	260	223	0.000***
Annual fees					
Total fees	125 060	80 442	149 094	94 109	0.000***
Nb. of obs	3789		945		
General Practitioners					
Outcomes	Sector 1		Sector 2		Equal means test p-value
	Average	<i>St. dev</i>	Average	<i>St. dev</i>	
Price of procedures					
Average price of procedures	34.17	121.31	48.02	89.27	0.000***
Annual provision of care					
Nb. of procedures	5258	2397	3547	2225	0.000***
Nb. of clinical procedures	5097	2498	2996	2067	0.000***
Nb. of patients	1701	786	1347	836	0.000***
Annual fees					
Total fees	150 475	145 943	145 450	66 999	0.000***
Nb. of obs	38 880		4 646		

Note: ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level.
Pooled observations for 2008 and 2011. Physicians installed between 1984 and 1995 (6 years around date of reform)
Source: Insee-DGFIP-Cnam-DREES dataset.

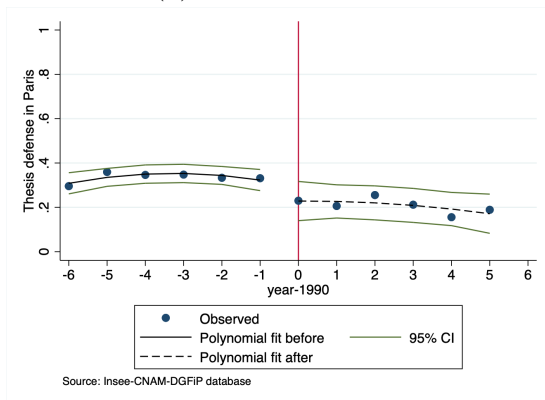
B Validity of the regression discontinuity set up



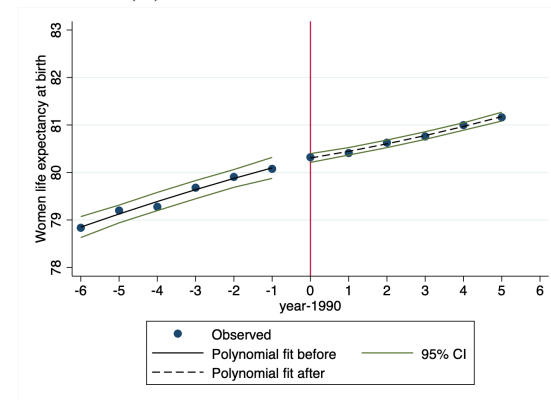
(a) Share of women



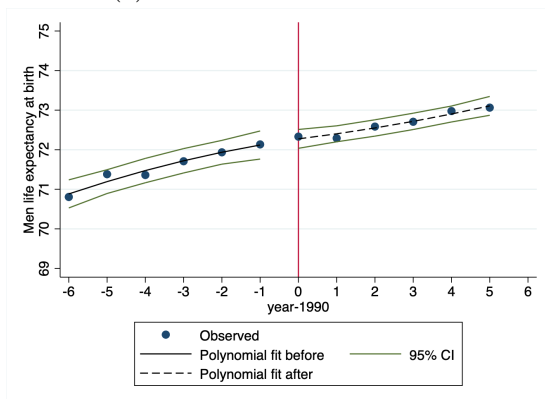
(b) Age at thesis defense



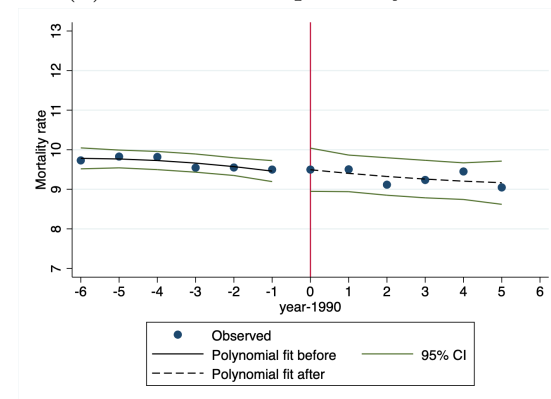
(c) Thesis defense in Paris



(d) Women life expectancy at birth



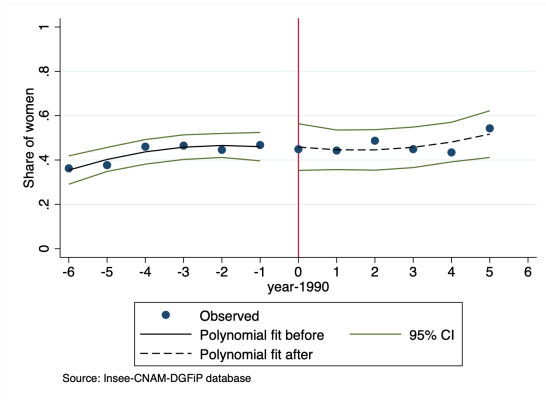
(e) Men life expectancy at birth



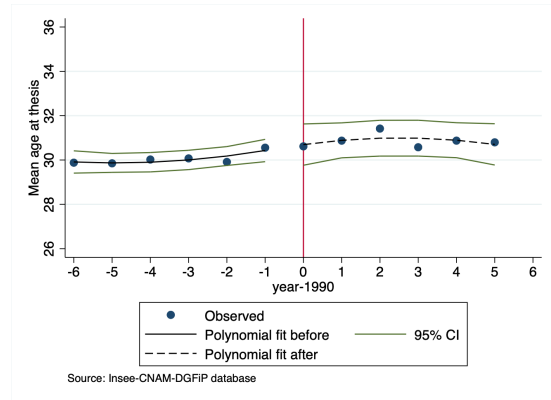
(f) Mortality rate

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Polynomial fit are obtained with local quadratic specifications before and after date of the reform(1990).

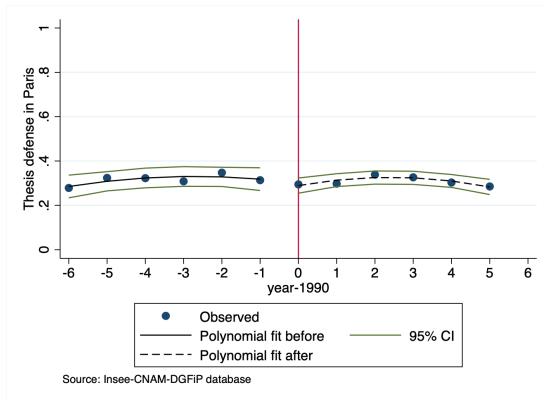
Figure B.1: Continuity in the characteristics of technical specialists



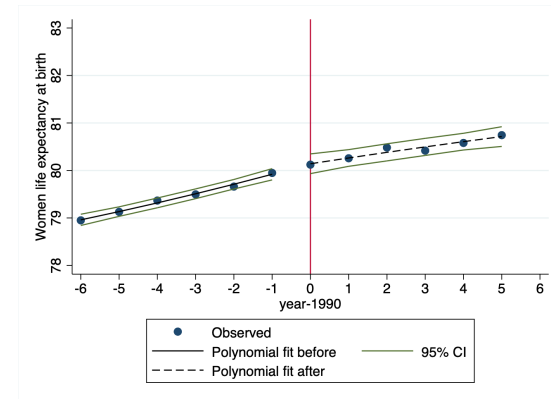
(a) Share of women



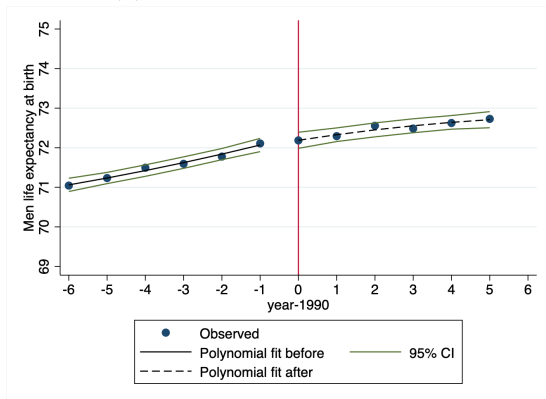
(b) Age at thesis defense



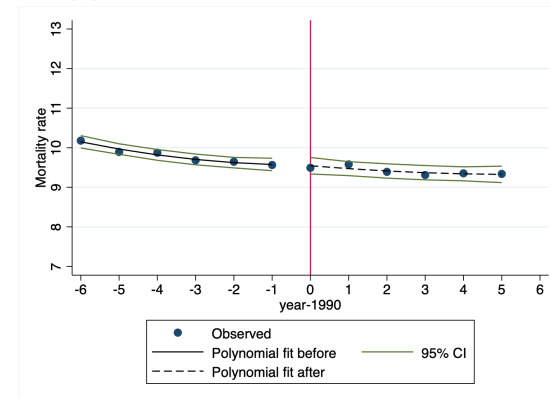
(c) Thesis defense in Paris



(d) Women life expectancy at birth



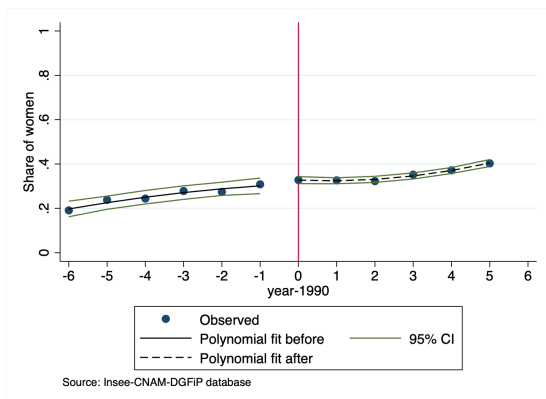
(e) Men life expectancy at birth



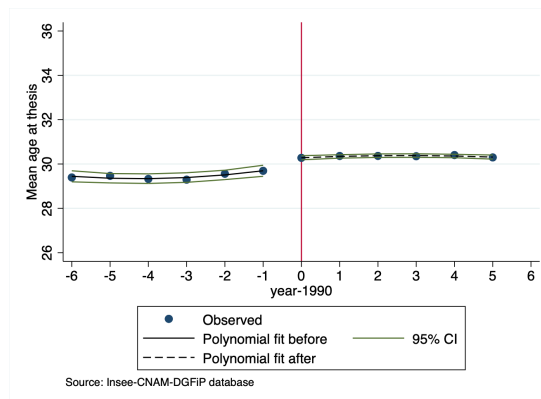
(f) Mortality rate

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Polynomial fit are obtained with local quadratic specifications before and after date of the reform(1990).

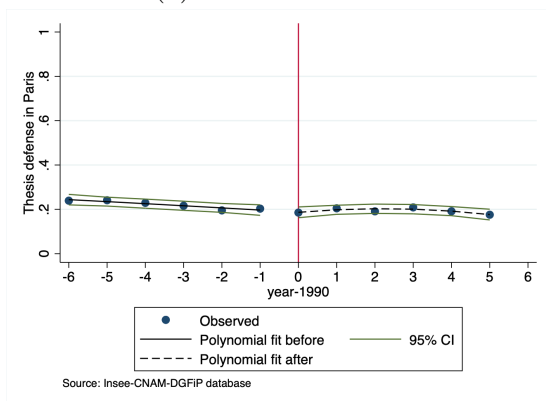
Figure B.2: Continuity in the characteristics of medical specialists



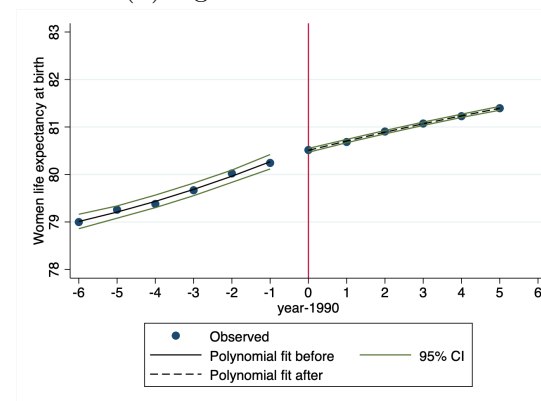
(a) Share of women



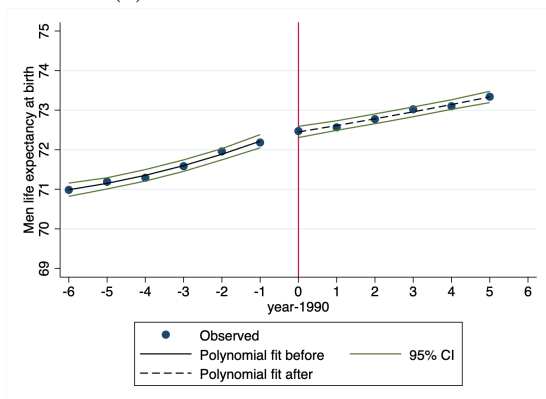
(b) Age at thesis defense



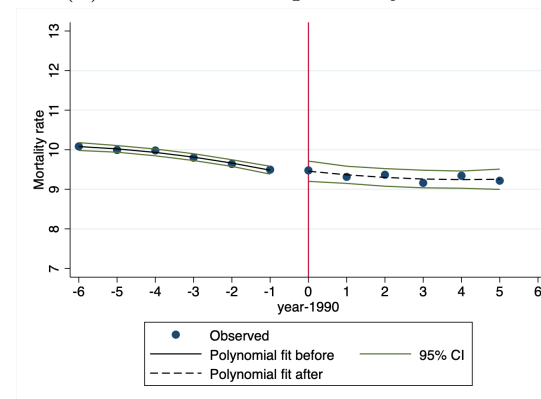
(c) Thesis defense in Paris



(d) Women life expectancy at birth



(e) Men life expectancy at birth



(f) Mortality rate

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Polynomial fit are obtained with local quadratic specifications before and after date of the reform(1990).

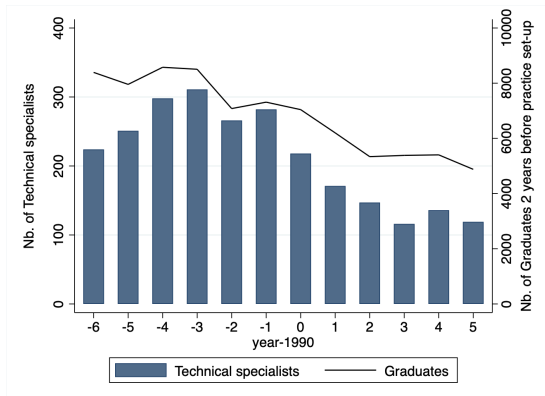
Figure B.3: Continuity in the characteristics of General Practitioners

Table B1: RD estimates of physicians' characteristics using a bandwidth of 6 years around the threshold of 1990

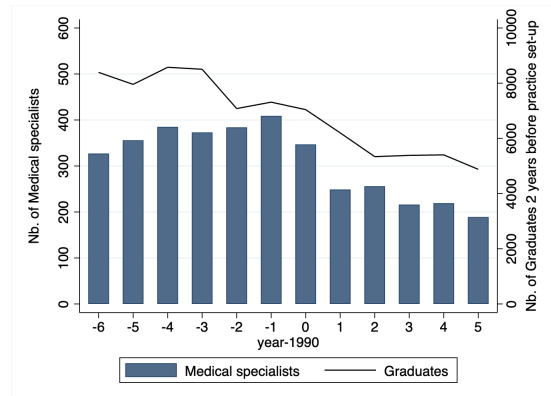
	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependant variable						
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Female (0/1)						
$\mathbb{1}_{X \geq 1990}$	0.058 (0.057)	0.046 (0.043)	-0.027 (0.065)	-0.014 (0.050)	0.014 (0.017)	0.002 (0.013)
Constant	0.428*** (0.042)		0.508*** (0.055)		0.316*** (0.013)	
Age at thesis defense						
$\mathbb{1}_{X \geq 1990}$	0.314 (0.271)	0.502** (0.208)	-0.006 (0.396)	-0.002 (0.310)	-0.088 (0.098)	-0.039 (0.075)
Constant	29.914*** (0.196)		30.628*** (0.333)		29.627*** (0.072)	
Thesis defense in Paris (0/1)						
$\mathbb{1}_{X \geq 1990}$	-0.092* (0.051)	-0.114*** (0.075)	-0.093 (0.061)	-0.086* (0.046)	-0.020 (0.015)	-0.013 (0.011)
Constant	0.313*** (0.040)		0.360*** (0.052)		0.201*** (0.012)	
Women life expectancy at birth⁽¹⁾						
$\mathbb{1}_{X \geq 1990}$	-0.048 (0.122)	-0.046 (0.095)	0.021 (0.126)	0.012 (0.100)	-0.024 (0.040)	0.031 (0.031)
Constant	80.257*** (0.090)		80.000*** (0.102)		80.464*** (0.031)	
Men life expectancy at birth⁽¹⁾						
$\mathbb{1}_{X \geq 1990}$	-0.079 (0.166)	-0.106 (0.129)	-0.118 (0.163)	-0.130 (0.131)	-0.045 (0.056)	0.031 (0.043)
Constant	72.269*** (0.121)		72.154*** (0.132)		72.442*** (0.043)	
Mortality rate⁽¹⁾						
$\mathbb{1}_{X \geq 1990}$	0.214 (0.176)	0.163 (0.138)	0.226 (0.196)	0.134 (0.157)	0.166*** (0.062)	0.098** (0.048)
Constant	9.332*** (0.128)		9.337*** (0.155)		9.330*** (0.047)	

Note: Standard errors are clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. $(X_i - 1990)\mathbb{1}_{X < 1990}$ is a binary variable indicating the physician's set up practice after the reform (1990). (1) Variables are defined at physician's year of thesis defense and département level. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Estimates are obtained using a bandwidth of 6 years (3 years) around the reform for teschnical specialists and GPs (medical specialists).

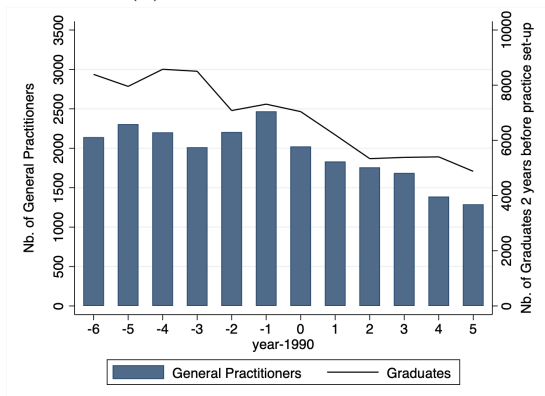
Source: Insee-DGFIP-Cnam-DREES dataset



(a) Technical specialists



(b) Medical specialists



(c) General Practitioners

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. Polynomial fit are obtained with local quadratic specifications before and after date of the reform(1990).

Figure B.4: Number of physicians per year of practice beginning and number of graduates 2 years before

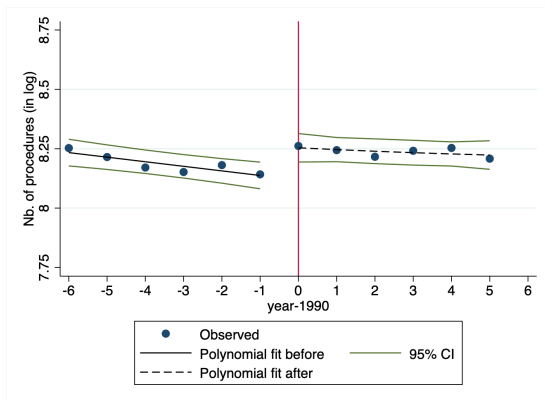
Table B2: RD estimates of physicians' characteristics - check for manipulation

	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependant variable						
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
Age at practice set-up						
$\mathbb{1}_{X \geq 1990}$	0.693** (0.319)	0.860 (0.249)	0.413 (0.424)	0.414 (0.330)	0.017 (0.117)	-0.058 (0.090)
Constant	32.572** (0.218)		34.755** (0.346)		31.521** (0.087)	
Years between thesis defense and practice set-up						
$\mathbb{1}_{X \geq 1990}$	0.375 (0.329)	0.352 (0.253)	0.419 (0.437)	0.416 (0.343)	0.097 (0.101)	-0.026 (0.077)
Constant	2.657*** (0.237)		4.127*** (0.355)		1.895*** (0.075)	

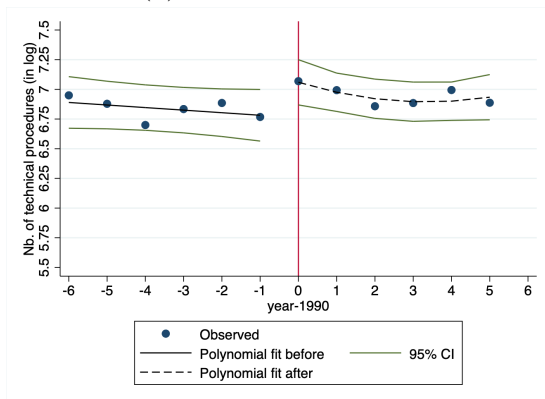
Note: Standard errors are clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. $(X_i - 1990)\mathbb{1}_{X < 1990}$ is a binary variable indicating the physician's set up practice after the reform (1990). Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Estimates are obtained using a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists).

Source: Insee-DGFIP-Cnam-DREES dataset

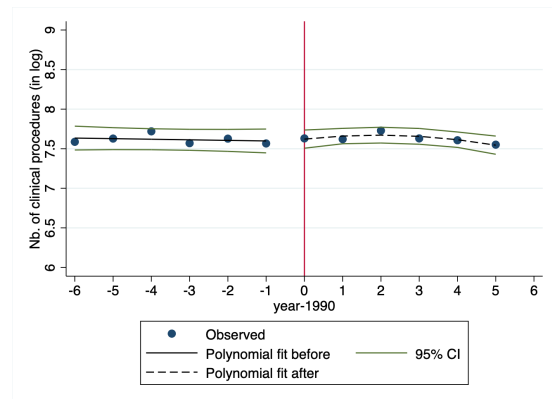
C RD estimates with 95% confidence intervals



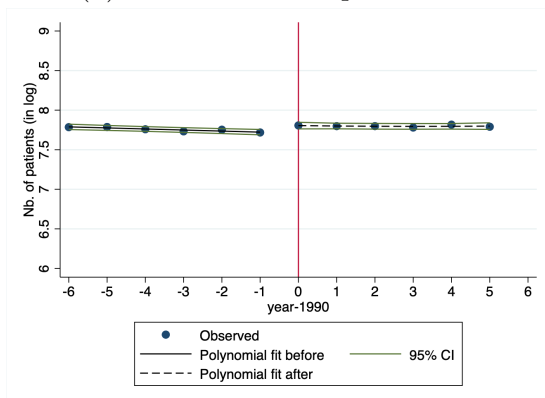
(a) Nb. of procedures



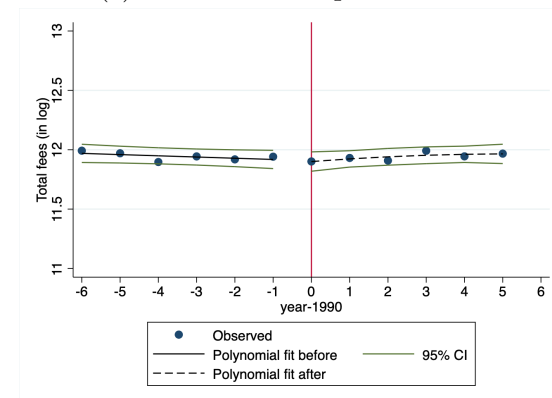
(b) Nb. of technical procedures



(c) Nb. of clinical procedures



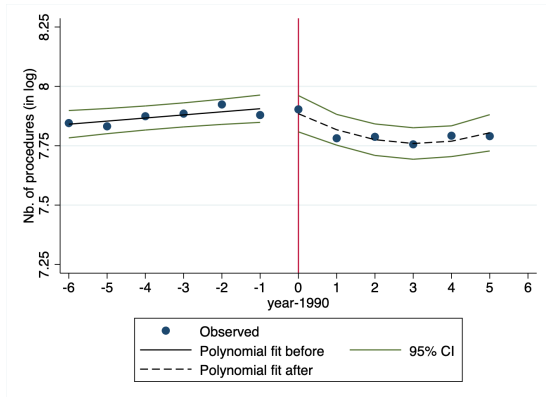
(d) Nb. of patients



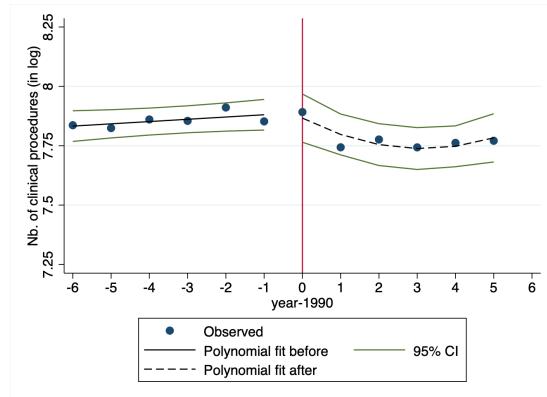
(e) Total fees

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. First order polynomials are obtained with functions specifications before and after date of the reform (1990).

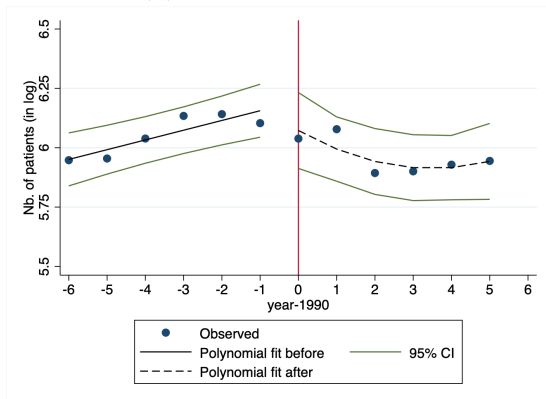
Figure C.1: Technical specialists : mean outcomes (in log) by year of practice set-up



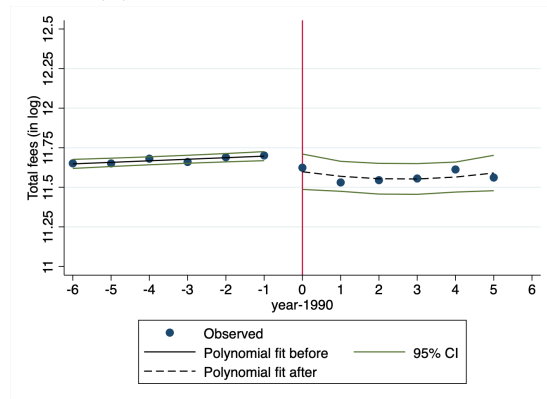
(a) Nb. of procedures



(b) Nb. of clinical procedures



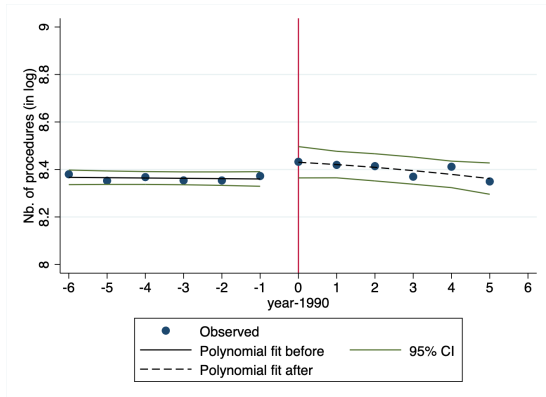
(c) Nb. of patients



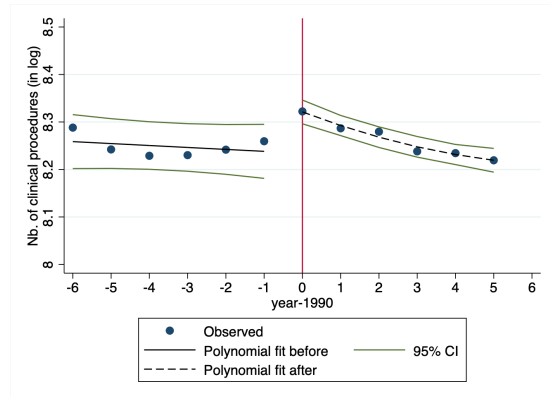
(d) Total fees

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. First order polynomials are obtained with functions specifications before and after date of the reform (1990).

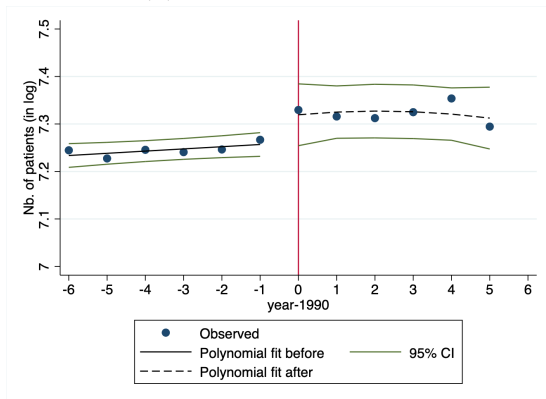
Figure C.2: Pediatricians : mean outcomes (in log) by year of practice set-up



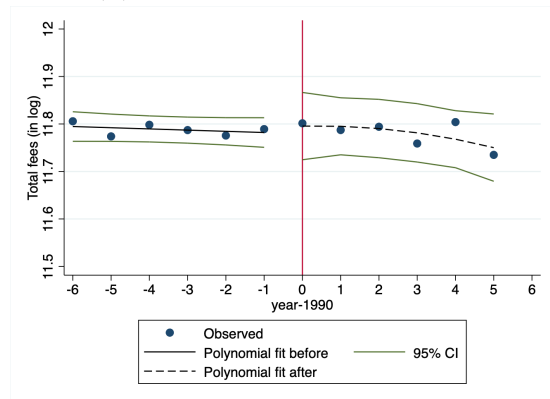
(a) Nb. of procedures



(b) Nb. of clinical procedures



(c) Nb. of patients



(d) Total fees

Source: Insee-DGFIP-Cnam-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement pensions are excluded. First order polynomials are obtained with functions specifications before and after date of the reform (1990).

Figure C.3: General Practitioners : mean outcomes (in log) by year of practice set-up

D Results for each specialty

Table D1: First stage estimates of practicing in Sector 1

	<i>Technical specialists</i>		<i>Medical specialists</i>		General Practitioners
	Dermatologists	ORL	Pediatricians	Psychiatrists	
$\mathbb{1}_{X \geq 1990}$	0.360*** (0.041)	0.228*** (0.061)	0.306*** (0.059)	0.193*** (0.026)	0.147*** (0.007)
<i>F-stat</i>	75.12	13.81	26.30	30.09	387.59
<i>Nb. of obs</i>	2945	1795	1501	3285	43 529

Note: $\mathbb{1}_{X \geq 1990}$ is a binary variable equals to one if the year where the physician sets up practice is not before 1990. Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns report estimates obtained using a bandwidth of 6 years around the reform and a first order polynomial function of year of practice set-up. The F-stat denotes the Fisher statistic, which corresponds to the test of significance of the instrument in the first-stage regression.

Source: Insee-DGFIP-Cnam-DREES dataset

Table D2: RD estimates for technical specialists

Outcomes (in log)	<i>Dermatologists</i>		<i>ORL</i>	
	(1)	(2)	(3)	(4)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Price of procedures				
Average price of procedures	-0.405*** (0.043)	-0.394*** (0.042)	-0.250 (0.248)	-0.433* (0.250)
Average price of clinical procedures	-0.405*** (0.038)	-0.398*** (0.035)	-0.607*** (0.111)	-0.590*** (0.111)
Average price of technical procedures	-0.420*** (0.042)	-0.407*** (0.041)	-0.528*** (0.103)	-0.557*** (0.109)
Annual provision of care				
Nb. of procedures	0.267* (0.142)	0.275** (0.139)	0.731** (0.290)	0.550* (0.281)
Nb. of clinical procedures	0.172 (0.138)	0.189 (0.134)	0.066 (0.484)	0.021 (0.510)
Nb. of technical procedures	0.911*** (0.310)	0.900*** (0.312)	1.024** (0.428)	0.886** (0.398)
Nb. of non surgical procedures	1.081*** (0.400)	0.964** (0.395)	1.183** (0.509)	0.934* (0.481)
Nb. of surgical procedures	0.674** (0.310)	0.734** (0.308)	0.692 (0.718)	0.658 (0.745)
Nb. of patients	0.176 (0.131)	0.221* (0.130)	0.496* (0.256)	0.375 (0.264)
Annual fees				
Total fees	-0.125 (0.135)	-0.103 (0.132)	0.290 (0.290)	0.101 (0.277)

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns 1 and 3 report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns 2 and 4 report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years around the reform.

Source: Insee-DGFIP-Cnam-DREES dataset

Table D3: RD estimates for medical specialists

Outcomes (in log)	<i>Pediatricians</i>		<i>Psychiatrists</i>	
	(1)	(2)	(3)	(4)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Price of procedures				
Average price of procedure	-0.385*** (0.112)	-0.433*** (0.084)	-0.424*** (0.048)	-0.499*** (0.052)
Average price of clinical procedure	-0.394*** (0.065)	-0.373*** (0.065)	-0.396*** (0.049)	-0.462*** (0.053)
Annual provision of care				
Nb. of procedures	-0.023 (0.249)	-0.091 (0.248)	0.073 (0.303)	0.506* (0.305)
Nb. of clinical procedures	-0.070 (0.306)	-0.029 (0.263)	0.071 (0.302)	0.506* (0.305)
Nb. of patients	-0.118 (0.241)	-0.256 (0.244)	-0.191 (0.374)	0.181 (0.376)
Annual fees				
Total fees	-0.450* (0.254)	-0.558** (0.246)	-0.382 (0.281)	-0.041 (0.283)

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without any control variables. Columns 1 and 3 report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns 2 and 4 report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 3 years around the reform.

Source: Insee-DGFIP-Cnam-DREES dataset

Table D4: RD estimates for technical specialists using a bandwidth (BW) of 5/6/7 years around the threshold of 1990

Outcomes (in log)	Dermatologists			ORL		
	BW=5	BW=6	BW=7	BW=5	BW=6	BW=7
	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)
Price of procedures						
Average price of procedures	-0.399*** (0.040)	-0.436*** (0.038)	-0.420*** (0.039)	-0.622*** (0.158)	-0.585*** (0.123)	-0.552*** (0.115)
Annual volume of care						
Total nb. of procedures	0.277* (0.152)	0.284* (0.146)	0.185 (0.153)	0.737* (0.408)	0.844** (0.351)	0.553* (0.313)
Nb of clinical procedures	0.207 (0.147)	0.191 (0.146)	0.125 (0.150)	0.233* (0.046)	0.242** (0.045)	0.254** (0.054)
Nb. of technical procedures	0.806** (0.334)	0.700** (0.322)	0.543* (0.319)	1.090* (0.611)	1.187** (0.527)	0.828* (0.483)
Nb. of non surgical procedures	0.942** (0.419)	1.103** (0.415)	0.997** (0.413)	1.139 (0.722)	1.312** (0.616)	0.857 (0.571)
Nb. of surgical procedures	0.724** (0.046)	0.574** (0.045)	0.807*** (0.054)	- -	- -	- -
Nb. of patients	0.228 (0.142)	0.204 (0.136)	0.129 (0.140)	0.548 (0.376)	0.561 (0.309)	0.355 (0.287)
Annual fees						
Total fees	-0.086 (0.144)	-0.110 (0.138)	-0.191 (0.141)	0.227 (0.397)	0.415 (0.352)	0.174 (0.321)
N	2553	2945	3289	1552	1794	2063
F-stat	68.77	75.11	76.93	9.08	13.80	14.05

Note: Standard errors clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. Regressions are performed without any control variable. Clusters at the individual level. Columns report estimates obtained using a bandwidth 5, 6 or 7 years around the reform and a first order polynomial function of year of beginning of practice.

Source: Insee-DGFIP-Cnam-DREES dataset.

Table D5: RD estimates for medical specialists using a bandwidth (BW) of 5/6/7 years around the threshold of 1990

Outcomes (in log)	Pediatricians			Psychiatrists		
	BW=5	BW=6	BW=7	BW=5	BW=6	BW=7
	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)
Price of procedures						
Average price of procedures	-0.357*** (0.052)	-0.385*** (0.056)	-0.355*** (0.060)	-0.340*** (0.055)	-0.334*** (0.050)	-0.361*** (0.047)
Annual volume of care						
Total nb. of procedures	-0.150 (0.237)	-0.092 (0.256)	-0.105 (0.267)	-0.197 (0.340)	-0.247 (0.311)	-0.370 (0.309)
Nb of clinical procedures	-0.015 (0.288)	0.034 (0.314)	0.002 (0.326)	-0.203 (0.339)	-0.249 (0.311)	-0.368 (0.308)
Nb. of patients	-0.294 (0.226)	-0.200 (0.238)	-0.193 (0.248)	-0.358 (0.412)	-0.392 (0.375)	-0.517 (0.517)
Annual fees						
Total fees	-0.595*** (0.046)	-0.545*** (0.045)	-0.512*** (0.054)	-0.547 (0.312)	-0.580** (0.286)	-0.750*** (0.286)
N	1736	1951	2157	4061	4732	5279
F-stat	26.50	22.03	20.96	34.32	43.07	45.13

Note: Standard errors clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. Regressions are performed without any control variable. Clusters at the individual level. Columns report estimates obtained using a bandwidth 5, 6 or 7 years around the reform and a first order polynomial function of year of beginning of practice.

Source: Insee-DGFIP-Cnam-DREES dataset.

E Sensitivity checks

Table E1: RD estimates for technical specialists using a bandwidth (BW) of 5/6/7 years around the threshold of 1990

Outcomes (in log)	First order polynomial function			Local linear (triangular kernel)		
	BW=5	BW=6	BW=7	BW=5	BW=6	BW=7
	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)
Price of procedures						
Average price of procedures	-0.455*** (0.104)	-0.412*** (0.097)	-0.367*** (0.096)	-0.523*** (0.096)	-0.478*** (0.095)	-0.450*** (0.093)
Average price of clinical procedures	-0.445*** (0.044)	-0.458*** (0.041)	-0.454*** (0.041)	-0.449*** (0.040)	-0.444*** (0.040)	-0.449*** (0.039)
Average price of technical procedures	-0.438*** (0.045)	-0.445*** (0.042)	-0.428*** (0.041)	-0.450*** (0.042)	-0.443*** (0.041)	-0.441*** (0.040)
Annual volume of care						
Total nb. of procedures	0.363*** (0.135)	0.400*** (0.127)	0.279** (0.128)	0.323*** (0.125)	0.346*** (0.124)	0.356*** (0.122)
Nb of clinical procedures	0.281 (0.210)	0.237 (0.196)	0.067 (0.196)	0.288 (0.197)	0.269 (0.195)	0.243 (0.191)
Nb. of technical procedures	0.683** (0.295)	0.765*** (0.276)	0.641** (0.276)	0.599** (0.278)	0.670** (0.275)	0.711*** (0.269)
Nb. of non surgical procedures	0.659* (0.378)	0.829** (0.357)	0.812** (0.361)	0.520 (0.355)	0.603* (0.351)	0.683** (0.344)
Nb. of surgical procedures	0.857*** (0.330)	0.737** (0.304)	0.630** (0.310)	0.793** (0.308)	0.824*** (0.306)	0.806*** (0.299)
Nb. of patients	0.281** (0.125)	0.278** (0.116)	0.181 (0.118)	0.260** (0.118)	0.269** (0.117)	0.267** (0.114)
Annual fees						
Total fees	-0.084 (0.139)	-0.049 (0.131)	-0.122 (0.131)	-0.145 (0.130)	-0.107 (0.129)	-0.087 (0.127)
N	4107	4740	5355	4107	4740	5355
F-stat	82.95	96.71	94.95	-	-	-

Note: Standard errors clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. Regressions are performed without any control variable. Clusters at the individual level. Columns report estimates obtained using a bandwidth 5, 6 or 7 years around the reform and a first order polynomial function of year of beginning of practice.

Source: Insee-DGFIP-Cnam-DREES dataset.

Table E2: RD estimates for medical specialists using a bandwidth (BW) of 3/4/5 years around the threshold of 1990

Outcomes (in log)	First order polynomial function			Local linear (triangular kernel)		
	BW=3	BW=4	BW=5	BW=3	BW=4	BW=5
	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)
Price of procedures						
Average price of procedures	-0.444*** (0.073)	-0.339*** (0.064)	-0.338*** (0.063)	-0.462*** (0.070)	-0.441*** (0.067)	-0.382*** (0.064)
Average price of clinical procedures	-0.428*** (0.064)	-0.315*** (0.055)	-0.294*** (0.054)	-0.416*** (0.064)	-0.409*** (0.060)	-0.353*** (0.056)
Annual volume of care						
Total nb. of procedures	0.091 (0.228)	-0.041 (0.206)	-0.183 (0.206)	0.253 (0.227)	0.162 (0.216)	0.067 (0.207)
Nb of clinical procedures	0.065 (0.234)	-0.039 (0.212)	-0.147 (0.211)	0.279 (0.228)	0.162 (0.218)	0.070 (0.211)
Nb. of patients	0.023 (0.372)	-0.225 (0.331)	-0.486 (0.327)	-0.061 (0.381)	-0.011 (0.358)	-0.152 (0.339)
Annual fees						
Total fees	-0.384* (0.205)	-0.415** (0.185)	-0.545*** (0.185)	-0.252 (0.201)	-0.316 (0.192)	-0.349* (0.185)
N	3703	4786	5800	3703	4786	5800
F-stat	64.18	81.58	85.81	-	-	-

Note: Standard errors clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. Regressions are performed without any control variable. Clusters at the individual level. Columns report estimates obtained using a bandwidth 5, 6 or 7 years around the reform and a first order polynomial function of year of beginning of practice.

Source: Insee-DGFIP-Cnam-DREES dataset.

Table E3: RD estimates for GPs using a bandwidth (BW) of 5/6/7 years around the threshold of 1990

Outcomes (in log)	First order polynomial function			Local linear (triangular kernel)		
	BW=5	BW=6	BW=7	BW=5	BW=6	BW=7
	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)	<i>Sector 1</i> Coefficient (Std. err)
Price of procedures						
Average price of procedures	-0.427*** (0.031)	-0.409*** (0.029)	-0.393*** (0.027)	-0.414*** (0.035)	-0.416*** (0.032)	-0.414*** (0.030)
Average price of clinical procedures	-0.458*** (0.041)	-0.444*** (0.040)	-0.428*** (0.064)	-0.416*** (0.064)	-0.409*** (0.029)	-0.416*** (0.032)
Annual volume of care						
Total nb. of procedures	0.451*** (0.112)	0.514*** (0.103)	0.436*** (0.097)	0.515*** (0.129)	0.500*** (0.116)	0.500*** (0.108)
Nb of clinical procedures	0.471*** (0.164)	0.539*** (0.151)	0.386*** (0.143)	0.407** (0.191)	0.457*** (0.172)	0.488*** (0.160)
Nb. of patients	0.320*** (0.104)	0.403*** (0.096)	0.347*** (0.090)	0.429*** (0.120)	0.398*** (0.108)	0.397*** (0.101)
Annual fees						
Total fees	0.078 (0.105)	0.154 (0.097)	0.093 (0.091)	0.189 (0.121)	0.156 (0.110)	0.149 (0.102)
N	37 137	43 529	50 076	37 137	43 529	50 076
F-stat	392.80	466.40	538.29	-	-	-

Note: Standard errors clustered at the individual level. ***Statistically significant at the 1% level; **significant at the 5% level; *significant at the 10% level. Regressions are performed without any control variable. Clusters at the individual level. Columns report estimates obtained using a bandwidth 5, 6 or 7 years around the reform and a first order polynomial function of year of beginning of practice.

Source: Insee-DGFIP-Cnam-DREES dataset.

Table E4: RD estimates with control variables

Outcomes (in log)	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Price of procedures						
Average price of procedures	-0.354*** (0.108)	-0.439*** (0.104)	-0.424*** (0.077)	-0.441*** (0.073)	-0.334*** (0.071)	-0.291*** (0.080)
Average price of clinical procedures	-0.414*** (0.045)	-0.414*** (0.042)	-0.410*** (0.067)	-0.394*** (0.067)	-0.409*** (0.029)	-0.415*** (0.032)
Average price of technical procedures	-0.407*** (0.046)	-0.415*** (0.045)	-	-	-	-
Annual provision of care						
Nb. of procedures	0.405*** (0.140)	0.367*** (0.132)	-0.023 (0.241)	0.168 (0.238)	0.488*** (0.101)	0.511*** (0.113)
Nb. of clinical procedures	0.231 (0.225)	0.276 (0.217)	-0.053 (0.248)	0.193 (0.238)	0.505*** (0.150)	0.469*** (0.170)
Nb. of technical procedures	0.785*** (0.292)	0.703** (0.280)	-	-	-	-
Nb. of non surgical procedures	0.818** (0.382)	0.620* (0.360)	-	-	-	-
Nb. of surgical procedures	0.743** (0.352)	0.861*** (0.341)	-	-	-	-
Nb. of patients	0.282** (0.130)	0.295** (0.127)	-0.183 (0.396)	-0.259 (0.401)	0.370*** (0.094)	0.414*** (0.106)
Annual fees						
Total fees	0.011 (0.138)	-0.044 (0.131)	-0.476** (0.216)	-0.316 (0.210)	0.127 (0.094)	0.162 (0.106)
Nb. of observations (max)	4740		3703		43 529	
Nb. of observations (min)	4314		3703		43 346	

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed with control variables (physician's gender, age at thesis defense, women/men life expectancy and mortality rate in physician's practice département at year of thesis defense. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists).

Source: Insee-DGFIP-Cnam-DREES dataset

F Falsification test

Table F1: RD estimates with a reform at 1998

Outcomes (in log)	<i>Technical specialists</i>		<i>Medical specialists</i>		<i>General Practitioners</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)
Price of procedures						
Average price of procedures	-1.080 (0.692)	3.203 (9.072)	-0.560 (0.496)	-1.233 (2.401)	-3.762 (6.308)	-2.713 (2.006)
Average price of clinical procedures	-0.265 (0.287)	-0.850 (1.482)	-0.647 (0.512)	-0.947 (1.811)	-2.601 (3.376)	-1.787* (1.017)
Average price of technical procedures	-0.581* (0.333)	-0.583 (1.021)	-	-	-	-
Annual provision of care						
Nb. of procedures	1.605 (1.507)	0.632 (2.725)	1.960 (2.527)	-6.408 (17.510)	-11.672 (14.073)	2.800 (2.515)
Nb. of clinical procedures	2.484 (2.040)	-4.094 (10.231)	1.667 (2.340)	-5.801 (16.012)	-20.897 (26.127)	3.210 (3.517)
Nb. of technical procedures	1.680 (2.373)	6.897 (17.998)	-	-	-	-
Nb. of non surgical procedures	2.700 (3.359)	2.287 (7.081)	-	-	-	-
Nb. of surgical procedures	2.214 (2.345)	-2.043 (5.572)	-	-	-	-
Nb. of patients	1.730 (1.566)	-0.300 (2.349)	0.542 (2.566)	-5.824 (16.388)	-3.556 (6.567)	3.056 (2.317)
Annual fees						
Total fees	0.567 (1.218)	3.088 (9.149)	1.108 (2.121)	-7.485 (18.990)	-13.226 (15.016)	0.910 (2.185)
Nb. of observations (max)	4740		3703		43 529	
Nb. of observations (min)	4314		3703		43 346	

Note: Standard errors are clustered at the individual level. Pooled observations in 2008 and 2011.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Nb. for number. Regressions are performed without control variables. Columns (1-3-5) report estimates obtained using a first order polynomial function of trimester-year of practice set-up. Columns (2-4-6) report estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years (3 years) around the reform for technical specialists and GPs (medical specialists).

Source: Insee-DGFIP-Cnam-DREES dataset