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Aimée Kingsada

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**THÈSE DE DOCTORAT**  
**DE L'UNIVERSITÉ PSL**

Préparée à l'Université Paris Dauphine - PSL

**RÉGULATION TARIFAIRE ET INCITATIONS FINANCIÈRES :  
QUELSEFFETS SUR L'ACTIVITÉ DES MÉDECINS LIBÉRAUX ?**

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*À Clément,*



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# Introduction générale



En 2000, l'Organisation Mondiale de la Santé (OMS) a publié pour la première fois un classement des systèmes de santé de ses 191 États membres (OMS, 2000). Elle a reconnu que la France avait le meilleur système de santé au monde pour sa performance dans la réalisation de trois objectifs : l'amélioration de la santé, la réponse aux attentes de la population concernant leur prise en charge et l'équité de la répartition de la contribution financière (quel que soit leur revenu, tous contribuent au financement de la protection sociale, équitablement distribuée). Aujourd'hui, le système de santé français connaît des mutations et des tensions inhérentes à sa structure et à son organisation (Barnay *et al.*, 2021). En 2019, les dépenses de santé en France s'élevaient à 11.1% du PIB (au 3<sup>ème</sup> rang mondial, +3.6pp par rapport à la moyenne des pays de l'OCDE). Pour ce niveau de dépenses, l'espérance de vie à la naissance des femmes est une des plus élevée des pays de l'OCDE, contrairement à celle des hommes. Les Français sont plus souvent exposés à des facteurs de risques tels que le tabagisme et l'alcoolisme qui peuvent être des causes majeures de la mortalité (OCDE, 2021). Enfin, la France fait également partie des pays d'Europe où les inégalités de santé sont les plus élevées. En outre, la France fait aujourd'hui face à de nombreux défis : le vieillissement de la population et le développement des maladies chroniques augmentent les besoins de soins et donc les dépenses de santé. L'offre de soins doit être suffisante pour répondre au mieux à cette croissance de demande de soins. Toutefois, le nombre de médecins généralistes (au centre de l'organisation de la médecine de ville) diminue et l'exercice libéral se raréfie (Anguis *et al.*, 2021). L'inégale répartition des médecins libéraux sur le territoire génère des problèmes d'accès aux soins et la pratique des dépassements d'honoraires les accentue. La rationalisation de l'offre de soins doit donc être un objectif pour améliorer le système de santé. Elle peut passer par la régulation de la rémunération des médecins, connue pour exercer une influence sur le volume et la qualité de soins prodigués.

Une présentation globale du système de soins primaires en France est proposée en partie 1. Elle décrit le rôle et les objectifs du régulateur, l'organisation du système de soins et les tensions récurrentes qu'il connaît. La partie 2 se concentre sur la structure de la rémunération des médecins libéraux français et les différentes réformes mises en place ces dernières années pour la diversifier. L'objectif de cette thèse est d'évaluer les effets des différentes réformes du système de paiement des médecins, en particulier sur leurs comportements d'offre de soins, mais également d'en évaluer l'efficacité pour la planification de l'offre de soins sur le territoire, en mettant en regard les coûts de ces différentes politiques et leurs effets en matière d'accès aux soins des populations. Plus particulièrement, cette thèse analyse les effets de l'introduction du « paiement à la performance » en complément du paiement à l'acte (chapitre 1), de l'interdiction de la pratique des dépassements d'honoraires (chapitre 2) ou de sa limitation (chapitre 3). Les méthodes microéconométriques utilisées et les principaux résultats sont présentés dans la partie 3.

## 1 Le système de soins en France

### 1.1 Les objectifs de la médecine de ville

Le système de santé français repose sur un système d'assurances sociales obligatoires. Avec la création de la Sécurité sociale en 1945, l'État se donne la mission de couvrir l'ensemble de la population dans le cadre d'un système unique. Il assure les risques sociaux liés au travail,

à la maladie, à l'invalidité et à la vieillesse. Le financement de la Sécurité sociale provient de prélèvements obligatoires. Dans ce contexte, l'État a le rôle de maîtriser les dépenses, de planifier la production de soins qui doit être distribuée de manière équitable sur l'ensemble du territoire et à l'ensemble de la population, et de garantir la qualité de soins prodigués (Grignon, 2006). Les objectifs d'efficacité productive et d'égalité à l'accès aux soins pour tous peuvent être difficiles à concilier. Il faudrait pouvoir inciter les agents (médecins et patients) à choisir un niveau optimal de soins tout en garantissant une absence d'inégalités sociales de recours aux soins (des soins selon les besoins et non en fonction du revenu). L'organisation du système français est alors opérée en prenant en compte à la fois les objectifs d'efficience, d'équité de soins, mais aussi de maîtrise des dépenses de santé (Saint-Paul, 2012).

Si la crise sanitaire liée au Covid-19 a mis en lumière le fonctionnement (et dysfonctionnements) du système hospitalier français, elle a également mis en évidence la faible implication de la médecine de ville dans la gestion de la pandémie, pourtant toute aussi essentielle à l'organisation de notre système de santé. La définition des soins primaires (de premier recours) n'a été que tardivement développée en France. Dès 1978, l'OMS définit les soins primaires comme « le premier niveau de contacts des individus avec le système national de santé » (OMS, 1978). Ce n'est qu'en 2009 que la « Loi Hôpital Patients Santé et Territoire » a défini la composition des soins primaires en France. Organisés à l'initiative des médecins libéraux, ces derniers ont pour mission la prévention, le dépistage, le diagnostic, le traitement et le suivi des patients. Ils doivent également orienter les patients selon leurs besoins vers d'autres professionnels de santé et éduquer à la santé (Journal officiel, 2009).

Les dépenses de santé consacrées aux soins ambulatoires représentent 28% du total des dépenses en 2019 (OCDE, 2021). Jusqu'en 2020, la consommation des soins de médecins généralistes et spécialistes en ville n'a cessé d'augmenter (Arnaud *et al.*, 2022). Ces coûts sont associés aux honoraires des médecins, aux rémunérations liées aux contrats type ROSP<sup>1</sup> ou OPTAM<sup>2</sup> et également au Dispositif d'indemnisation de la perte d'activité mis en place suite à la crise sanitaire du Covid-19. Pour contenir la progression des dépenses de santé, le régulateur peut mettre en place des politiques ciblant la demande de santé (en essayant de responsabiliser les patients par le biais d'incitations financières ; la réforme du « médecin traitant » de 2004 en est un exemple (Barnay *et al.*, 2007 ; Domin, 2008 ; Dumontet *et al.*, 2017)) ou l'offre de soins (en remaniant par exemple l'organisation de la médecine de ville et la rémunération des médecins pour les inciter à modifier leurs comportements). Cette thèse s'intéresse aux politiques liées à l'offre de soins délivrés par les médecins libéraux (médecins généralistes et spécialistes) et notamment aux effets de différentes réformes de leur rémunération.

## 1.2 Au cœur du système de soins : des médecins et des patients

En France, l'organisation des soins ambulatoires est largement déterminée par les principes de libre choix du professionnel de santé par le patient, de liberté thérapeutique et de prescription, et de liberté d'installation (Bourgueil *et al.*, 2009). Les soins ambulatoires sont délivrés par des

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<sup>1</sup>ROSP : Rémunération sur Objectifs de Santé Publique mise en place en 2012.

<sup>2</sup>OPTAM : Option Pratique Tarifaire Maîtrisée introduite en 2017.

médecins libéraux. Depuis 1971 (date de la signature de la première convention médicale), la majorité des médecins sont conventionnés. Cela signifie que les médecins acceptent de pratiquer des tarifs régulés, fixés à la suite de négociations entre l'assurance maladie, l'État et les syndicats de médecins. Par ailleurs, lorsque les patients visitent ces médecins conventionnés, ils sont remboursés d'une partie du tarif de la consultation. Les médecins libéraux conventionnés ont la possibilité d'exercer dans deux secteurs de conventionnement. Le secteur à tarif opposable (dit « secteur 1 ») où les tarifs sont fixés de façon exogène pour chaque acte, et identiques pour tous les médecins, et le secteur à honoraires différents (secteur 2) où les médecins sont autorisés à pratiquer des dépassements d'honoraires (la seule condition étant de fixer leurs tarifs avec « tact et mesure »), sauf lorsqu'ils soignent des patients bénéficiaires de la Complémentaire Santé Solidaire (anciennement CMU-C<sup>3</sup> et ACS<sup>4</sup>). Afin de rendre plus attractif le conventionnement en secteur 1, l'Assurance Maladie prend en charge une partie des cotisations sociales des médecins. Au 1<sup>er</sup> janvier 2021, 214 224 médecins exercent en France, dont 94 538 généralistes (44%) et 119 686 spécialistes. Plus de la moitié des médecins exercent en libéral (56%) : 65% des généralistes ont une activité libérale ou mixte contre seulement 48% des spécialistes ([Anguis et al., 2021](#)).

La politique du « médecin traitant », entrée en vigueur par la réforme de 2004, vise à rationaliser le parcours du patient dans le système de soins. Tout assuré de plus de seize ans est incité à choisir et déclarer un médecin traitant (qui est le plus souvent un médecin généraliste mais aussi, rarement, un médecin spécialiste). Cette réforme, associée à la réforme des études médicales qui a consacré la médecine générale au rang de spécialité médicale, a ainsi placé le médecin généraliste au cœur de l'organisation du système de santé. Il est le premier interlocuteur des patients et coordonne leur suivi médical tout en les orientant vers un médecin spécialiste ou un autre professionnel de santé si nécessaire. Si les patients suivent le parcours de soins et consultent leur médecin traitant avant toute consultation chez un autre professionnel de santé, l'Assurance Maladie les rembourse à hauteur de 70% du tarif conventionnel pour chaque consultation. Hors parcours de soins, le taux de remboursement est réduit ([Dourgnon et al., 2007](#)), sauf lorsqu'ils consultent des spécialistes en « accès direct » (gynécologues, ophtalmologues, stomatologues), dans le cadre d'un suivi régulier. Les patients âgés de 16 à 25 ans peuvent également consulter un psychiatre ou un neuropsychiatre sans passer par leur médecin traitant.

La mise en place d'un ticket modérateur à la charge du patient en 1945 rompt le principe d'égalité des soins. Par ailleurs, la pratique des dépassements d'honoraires par les médecins de secteur 2 constitue une deuxième barrière financière à l'accès aux soins ([Jusot et al., 2019](#)). Toutefois, le patient peut recourir à une assurance maladie complémentaire privée qui couvre ces restes à charge ([Peronnin, 2016](#)). Plus de 95% des Français souscrivent à une assurance santé complémentaire dont les taux de garanties dépendent de plusieurs paramètres : la nature du contrat (individuel ou collectif), le conventionnement du médecin et le parcours de soins du patient ([Barlet et al., 2019](#)). La présence de complémentaires privées peut générer de l'inflation sur les prix des soins et diminue les effets de toute tentative de régulation des prix.

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<sup>3</sup>Couverture Maladie Universelle Complémentaire. Elle offrait une complémentaire santé gratuite aux individus dont le revenu est inférieur à un plafond prédéfini.

<sup>4</sup>Assurance Complémentaire Santé. Elle était destinée aux personnes ayant des ressources comprises entre le plafond de la CMU complémentaire et ce plafond majoré de 35%.

### 1.3 Un système de santé en tension

En soixante-cinq ans, la part de consommation de soins et de biens médicaux (CSBM) dans la richesse nationale a été multipliée par 3.5, passant de 2.5% du PIB en 1950 à 8.9% en 2015 (Soual, 2017). En 2020, elle est estimée à 9.1% du PIB. Cette croissance des dépenses est due au développement progressif de la couverture de l'Assurance Maladie, mais aussi à l'augmentation des besoins de soins en raison du vieillissement de la population, de la prévalence des affections de longue durée (ALD), et de la diffusion des innovations technologiques. Un assuré sur trois a une pathologie chronique et cela représente deux tiers des dépenses de soins (104 milliards d'euros en 2020). D'après l'Assurance Maladie, le coût moyen par patient en ALD est de 4300 euros en 2020.

Dans le même temps, les projections de la DREES à l'horizon 2050 (Anguis *et al.*, 2021) anticipent une diminution des effectifs de médecins généralistes qui serait compensée par une augmentation des médecins spécialistes. La densité de médecins généralistes est actuellement en diminution, et près d'un tiers de ces médecins sont âgés de 60 ans et plus. L'exercice libéral a également perdu de son attractivité : entre 2012 et 2021, la proportion des médecins en exercice libéral exclusivement a diminué de 15%. Les jeunes médecins sont plus attirés par un exercice mixte (qui combine une activité libérale à une activité salariée).

Comme dans l'ensemble des pays de l'OCDE, la mauvaise répartition des médecins sur le territoire est un enjeu récurrent de l'organisation du système de soins. La mise en évidence de « déserts médicaux » remet en cause le principe d'égalité d'accès aux soins en fonction des besoins (Chevallard et Dumontet, 2020 ; Hassenteufel *et al.*, 2020). La régulation de l'offre par le seul outil du *numerus clausus*, défini au niveau national depuis 1971, et la non-prise en compte de la spécificité de chaque territoire (en matière de caractéristiques de la population résidente et des médecins y exerçant) ont fait naître ces territoires pour lesquels le manque de médecins devient problématique. Cette inégale répartition des médecins est aggravée par la libre installation des médecins sur le territoire. En outre, le problème de l'accessibilité géographique aux médecins se double d'un problème d'accessibilité financière, puisque le secteur 2, mis en place en 1980, est de plus en plus attractif, notamment pour les spécialistes. Il existe de plus en plus de zones sans offre de soins à tarifs opposables générant des comportements de renoncement aux soins (Dormont et Péron, 2016).

Outre ces éléments mettant en péril le principe d'accès aux soins pour tous, la profession de médecin évolue : elle se féminise, l'exercice en groupe (préférée par les jeunes médecins) se développe et les aspirations des jeunes médecins en matière de conciliation vie professionnelle – vie familiale se modifient. Or, les médecins généralistes femmes travaillent moins de jours par semaine, et, sur une journée de travail, réalisent moins d'actes et voient moins de patients (Grant *et al.*, 1990 ; Jakubovitch *et al.*, 2012 ; Dumontet et Franc, 2015). Elles ont également des durées de consultation plus longues (Clerc *et al.*, 2012 ; Saint-Lary et Sicsic, 2015). Au total, pour un nombre total de médecins formés, la quantité d'offre de soins fournie effectivement sur un territoire est susceptible de varier fortement en fonction de la proportion de femmes dans la population des médecins en exercice. Les jeunes médecins exercent plus fréquemment en groupe.

D'après de récentes études, ce mode d'exercice pourrait être une réponse efficace pour lutter contre les « déserts médicaux » (Chevallard et Mousquès, 2021) et améliorerait l'accès aux soins des patients tout en augmentant les revenus des médecins généralistes (Cassou *et al.*, 2020). Cependant, les structures regroupant plusieurs médecins ne sont pas encore suffisamment développées pour endiguer complètement la dégradation de l'offre de soins.

La littérature a montré que le système de paiement des médecins (paiement à l'acte, capitation ou salariat) influençait grandement l'organisation des soins primaires (des études comparées sont publiées régulièrement ; voir les plus récentes de Espinosa-González *et al.*, 2021 ; Jia *et al.*, 2021 ; Quinn *et al.*, 2020). La rémunération des médecins joue donc fortement sur la performance du système de santé du côté de l'offre de soins.

## 2 La rémunération des médecins libéraux

### 2.1 La prédominance du paiement à l'acte

En France, le mode de rémunération principal des médecins libéraux est le paiement à l'acte, qui représente 69% à 98% de la rémunération, selon les spécialités (Cour des comptes, 2022). Le paiement à l'acte est d'ailleurs l'un des sept principes de la médecine libérale énoncés dans la charte de la Confédération des syndicats médicaux français (CSMF) de 1927 (Hassenteufel, 2019). Les médecins défendent donc ardemment ce mode de paiement, dont les propriétés (garantie de soins de qualité, réponse à la demande des patients) sont bien connues (Albouy et Déprez, 2009).

Pour autant, ce système de paiement n'est pas exempt de critiques (Samson, 2009). Lorsque les prix sont libres (secteur 2) et du fait de la grande hétérogénéité des actes médicaux, le paiement à l'acte peut conduire à une multitude de prix, pas nécessairement visibles par les patients (Rochaix, 2004) qui peuvent creuser les inégalités à l'accès aux soins. Lorsque les tarifs sont fixés comme dans le secteur 1, le revenu des médecins dépend principalement du volume de leur activité. Le paiement à l'acte peut alors les conduire à des comportements stratégiques en multipliant les actes pour augmenter leurs revenus, ce qui nuit à l'efficacité (Delattre et Dormont, 2003 ; Nassiri et Rochaix, 2006). De plus, il incite à des comportements de demande induite : le médecin a un pouvoir discrétionnaire sur la fonction de demande des patients et peut l'influencer dans son intérêt (notamment, quand il fait face à une intensification de la concurrence et/ou que les tarifs diminuent). Il encourage donc à l'inflation des dépenses de santé. En outre, le paiement à l'acte n'incite pas à la prévention : il est destiné plutôt à des soins curatifs au détriment d'une approche préventive, car il ne rémunère pas les bénéfices à long terme de la prévention (Franc et Lesur, 2004).

Le paiement à l'acte, la capitation ou le salariat ont chacun des effets (positifs comme négatifs) sur les revenus des médecins, les dépenses de santé, la qualité des soins et l'accès aux soins. Une des manières de pallier ces effets négatifs est de diversifier la rémunération des médecins, dans le but d'atténuer les carences inhérentes à chaque configuration. Dès les années 2000, l'Assurance Maladie a essayé d'adopter cette stratégie en mettant en place des paiements complémentaires sous forme de forfaits et majorations qui valorisent la qualité des soins, la prévention et la



coordination des médecins. Par exemple, les médecins reçoivent une rémunération forfaitaire pour le suivi de patients en tant que médecin traitant, pour le suivi de patients en affection longue durée (ALD), ou pour les gardes et astreintes. Se sont également développés depuis 2009 des modes de paiements basés sur l'atteinte d'objectifs de santé publique (« Contrat d'Amélioration des Pratiques Individuelles » (CAPI) en 2009 – présenté dans la sous-section 2.3 et « Rémunération sur Objectifs de Santé Publique » (ROSP) en 2012). Toutes ces innovations sont mises en place dans une logique de diversification des modes de paiement des médecins.

## 2.2 La pratique des dépassements d'honoraires

Depuis 1980 et la création du secteur 2, les médecins ont la possibilité de pratiquer des dépassements d'honoraires. Cette décision a été prise dans un contexte de faible croissance du PIB, de forte croissance des dépenses de santé et de revendications croissantes des médecins pour une revalorisation de leurs revenus. Pour répondre aux revendications de médecins à la veille de l'élection présidentielle de 1981, tout en évitant de creuser les comptes de la Sécurité Sociale, le gouvernement a créé ce secteur permettant une revalorisation des tarifs non remboursés par l'Assurance Maladie et donc sans conséquence sur l'équilibre des comptes.

De nombreux arguments peuvent être trouvés dans la littérature pour justifier la pratique des dépassements. [Glazer \*et al.\* \[1993\]](#) montrent que les médecins peuvent discriminer les patients par le prix et fixer un niveau de qualité plus élevé pour tous les patients (et pas seulement ceux qui paient plus cher). Par exemple, la durée des consultations peut refléter la qualité des soins ([McGuire, 2000](#)) et cette durée augmente lorsque les dépassements sont autorisés ([Clerc \*et al.\*, 2012](#)). Certains patients ont également une disposition à payer plus élevée que les autres, de sorte que les médecins les font payer plus sans réduire le bien-être social ([Kifmann et Scheuer, 2011](#)). Le montant des honoraires demandés par les médecins est également souvent lié à la densité médicale et à la concurrence entre les producteurs de soins. [Gravelle \*et al.\* \[2016\]](#) ont constaté qu'une diminution de la concurrence entre les médecins généralistes Australiens entraînait des prix plus élevés. En France, lorsque la densité médicale locale augmente, les médecins spécialistes du secteur 2 ont tendance à réduire les dépassements d'honoraires et à maintenir leurs revenus en augmentant leur activité ([Choné \*et al.\*, 2020](#)). Les patients bénéficiant d'une bonne couverture d'assurance sont également plus susceptibles de consulter des médecins aux honoraires élevés, ce qui contribue à l'augmentation des prix médicaux ([Dormont et Péron, 2016](#)).

Toutefois, on ne peut nier les difficultés d'accès aux soins liés aux dépassements d'honoraires. Après l'intervention des organismes complémentaires, ce sont les dépassements qui constituent l'essentiel des restes à charge des patients. Plusieurs rapports administratifs dénoncent une augmentation importante des dépassements en France depuis plusieurs décennies, une augmentation des médecins spécialistes s'installant en secteur 2, une montée en charge des taux de dépassements et des disparités selon les régions et les médecins concernés ([Aballea \*et al.\*, 2007](#) ; [CNAM, 2017](#) ; [Cour des comptes, 2017](#)). Chaque institution prône la mise en place d'outils de régulation pour limiter les difficultés d'accès aux soins. Malgré l'interdiction en 2000 de pratiquer des dépassements sur les personnes bénéficiaires de la CMU-C et en 2013, sur les personnes bénéficiant de l'ACS, l'accès aux soins pour les plus précaires reste compromis du fait des montants de reste

à charge (Guthmuller et Wittwer, 2017), mais aussi de potentielles discriminations à l'égard de ces patients (Chareyron *et al.*, 2019).

La liberté tarifaire, défendue par les médecins libéraux, est encore aujourd'hui source d'inégalités d'accès aux soins. Afin de réguler la progression des dépassements, le « Contrat d'Accès aux soins » (CAS) a été introduit en 2013 et l'« Option Pratique Tarifaire Maîtrisée » (OPTAM) en 2017. Ces contrats encouragent les médecins à diminuer leurs dépassements et à augmenter leur part d'activité à tarif opposable, en contrepartie d'un gain monétaire. Ces réformes sont détaillées dans la sous partie suivante.

### 2.3 La régulation de l'offre de soins par la rémunération

L'objectif du régulateur est d'assurer des soins de qualité et une équité dans l'accès aux soins, tout en maîtrisant les dépenses de santé. Cette thèse se concentre sur deux types de réformes de la rémunération des médecins, qui ont été mises en place avec ces objectifs :

- Une réforme encourageant au suivi des patients atteints de pathologies chroniques, à la prévention, au dépistage ainsi qu'à l'efficacité des prescriptions par le biais du CAPI mis en place en 2009 (évalué dans chapitre 1) ;
- Deux réformes visant à freiner les dépassements d'honoraires et améliorer l'accès aux soins : le « gel du secteur 2 » instauré en 1990 (étudié dans le chapitre 2) puis le CAS introduit en 2013 et remplacé par l'OPTAM en 2017 (analysés dans le chapitre 3).

Le paiement à la performance s'est développé en Grande Bretagne dès 2004 avec le programme « Quality and Outcomes Framework ». La France s'en est inspiré et a introduit en 2009 le « Contrat d'Amélioration des Pratiques Individuelles » (CAPI). Le CAPI se composait de deux volets : le premier était relatif aux objectifs de prévention et au suivi des pathologies chroniques et le second, dit d'optimisation des prescriptions, encourageait la prescription de médicaments génériques. Au total, seize indicateurs de santé publique étaient établis. Basé sur le volontariat, le CAPI prévoyait une rémunération forfaitaire s'ajoutant au paiement à l'acte et dont le montant dépendait du taux d'atteinte des objectifs fixés en matière de qualité et assis non sur le nombre d'actes délivrés, mais sur le nombre de patients suivis en tant que médecin traitant. Plus d'un tiers des médecins éligibles se sont engagés dans le CAPI. Plusieurs études françaises ont cherché à quantifier l'impact du paiement à la performance en termes d'atteinte des objectifs par les incitations financières, ou de qualité des soins (Rat *et al.*, 2014; Saint-Lary et Sicsic, 2015 ; Michel-Lepage et Ventelou, 2016 ; Sicsic et Franc, 2017). À la différence de la littérature existante, le chapitre 1 aborde la question sous un angle différent, en examinant si les incitations financières du CAPI, qui augmentent la part de la rémunération des médecins liée au patient et non à l'acte, modifient les pratiques des médecins et la structure de leur activité.

La création du secteur 2 en 1980 a été un succès : en 1989, la part des généralistes en secteur 2 s'élevait à 16% et celle des spécialistes à 44% (Bras, 2015). Face à la crainte d'une augmentation incontrôlable des dépassements et une disparition de l'offre à tarifs opposables, l'accès au secteur 2 a été contraint en 1990. Aujourd'hui, seuls les médecins libéraux avec une expérience

d'anciens chefs de cliniques ou d'anciens assistants des hôpitaux, sont autorisés à s'installer en secteur 2. Cette réforme a eu un effet immédiat sur la proportion de médecins s'installant en secteur 2 (moins de 1% des généralistes se sont installés en secteur 2 en 90 et moins de 15% pour les spécialistes). Spécifique au contexte français, seule une unique étude a montré que cette réforme avait eu pour effet d'augmenter l'activité des médecins généralistes qui ont été contraints de s'installer en secteur 1 (Coudin *et al.*, 2015). Le chapitre 2 étudie l'effet du secteur de conventionnement, en utilisant la réforme du gel du secteur 2, sur l'activité et les revenus des médecins spécialistes.

L'effet du gel du secteur 2 sur la proportion de médecins s'installant en secteur 2 n'a été que temporaire : les médecins spécialistes ont eu de plus en plus accès aux titres permettant de s'installer en secteur 2. Face à la montée d'une offre où les tarifs sont libres et de dépassements pesant de plus en plus sur les revenus des ménages, l'Assurance Maladie a proposé aux médecins des contrats restreignant les dépassements, et visant, *in fine*, à améliorer l'accès aux soins. En 2014, le « Contrat d'accès aux soins » (CAS) encourageait les médecins à réduire leur taux de dépassement et à étendre leur activité à tarif opposable. L'atteinte d'objectifs définis à partir de leur activité passée était récompensée par une prise en charge partielle de leurs cotisations sociales (au même titre que les médecins du secteur 1). En 2017, le CAS est remplacé par un contrat plus souple et avantageux, l'« Option Pratique Tarifaire Maîtrisée » (OPTAM). Les objectifs d'amélioration à l'accès aux soins sont similaires, mais la contrepartie de l'atteinte de ces objectifs devient une prime monétaire versée plus rapidement aux médecins. Des études descriptives ont montré les effets de ces contrats sur l'évolution des taux de dépassements des médecins et les coûts qu'entraînait leur mise en place (CNAM, 2017 ; Cour des comptes, 2017) mais aucune étude n'a évalué empiriquement l'effet du CAS et de l'OPTAM sur les comportements de soins des médecins et leurs revenus. Le chapitre 3 propose de le faire en se concentrant sur l'activité des médecins spécialistes libéraux du secteur 2.

### 3 Objet de la thèse

Cette thèse évalue comment l'activité des médecins libéraux est modifiée à la suite d'une modification de la structure de leur rémunération. Elle se compose de trois chapitres dans lesquels des méthodes microéconométriques sont utilisées pour identifier un effet causal des réformes citées ci-dessus sur l'activité des médecins. Dans cette thèse, aucune modélisation théorique sur le comportement d'offre de soins des médecins n'est développée. Cependant, chaque étude s'appuie sur un cadre théorique dans lequel les médecins sont en concurrence monopolistique. Les médecins sont des substituts imparfaits aux yeux des patients (ils choisissent leur médecin en fonction de ses caractéristiques, par exemple en fonction de la qualité qu'il perçoit des soins). Pour définir leur niveau optimal d'activité, les médecins maximisent leur utilité avec un arbitrage travail-loisir sous la contrainte de leur fonction de production de soins et de la fonction de demande qui leur est adressée. La demande dépend des caractéristiques de la population (âge, état de santé, revenus) et de la densité médicale. Le niveau optimal d'activité va également varier si les prix sont fixes ou libres (McGuire et Pauly, 1991; McGuire, 2000).

Ces chapitres s'appuient sur une base de données administratives et exhaustives sur les médecins libéraux Français. Celle-ci contient des informations sur l'activité et les revenus des médecins, et est construite sur un rythme triennal : les médecins sont suivis tous les trois ans, de 2005 à 2017. Cette base de données fait l'objet d'une description au sein de chaque chapitre, de la même manière que les variables utilisées spécifiquement pour chaque étude. Ainsi, chaque chapitre peut être lu de manière indépendante, quand bien même constituent-ils une réflexion générale lorsqu'ils sont considérés comme un tout.

### **3.1 Chapitre 1**

Le chapitre 1 évalue l'impact causal du CAPI sur leurs comportements d'offre de soins. À partir d'un panel de médecins généralistes libéraux observés avant (2005 et 2008) et après (2011) sa mise en place, nous estimons un modèle en différences premières à variable instrumentale pour corriger des biais d'endogénéité liés au fait que l'adhésion au CAPI soit un choix. Nous montrons que le CAPI a significativement infléchi les pratiques des médecins généralistes qui y ont adhéré dans un sens compatible avec une amélioration de la qualité des soins : les adhérents au CAPI n'ont pas diminué, contrairement aux autres médecins, le nombre de consultations par patient ni le montant des prescriptions par patient. Ils ont également augmenté, plus fortement que les autres, la part de leurs patients suivis en tant que médecin traitant. Finalement, le CAPI a conduit à une augmentation des honoraires perçus par patient, avec, en conséquence, un coût de prise en charge plus élevé pour l'Assurance Maladie.

### **3.2 Chapitre 2**

Le chapitre 2 évalue les effets du secteur de conventionnement sur l'activité des médecins généralistes et spécialistes libéraux. À l'aide des régressions par discontinuité, il évalue l'effet causal de la régulation des tarifs mise en place par le biais du « gel du secteur 2 » et montre que les médecins spécialistes ayant une activité de nature plutôt « technique » augmentent fortement leur activité lorsqu'ils sont contraints d'exercer en secteur 1, et principalement leur activité technique. Les deux-tiers de ce surcroît d'activité sont associés à l'accueil de nouveaux patients, signe d'une amélioration de l'accessibilité aux soins ; le tiers restant est assimilable à des comportements stratégiques, visant à compenser la baisse de leurs tarifs par une augmentation du contenu des actes délivrés. En revanche, les spécialistes qui ont une activité principalement composée de consultations en cabinet n'ont pas de marge de manœuvre pour augmenter leur activité lorsqu'ils sont contraints d'exercer en secteur 1.

### **3.3 Chapitre 3**

Le chapitre 3 estime, à l'aide d'une approche de différence de différences, l'effet causal de deux programmes d'incitations financières à la réduction de la pratique des dépassements d'honoraires et à l'amélioration de l'accès aux soins : le CAS et l'OPTAM. Une méthode d'appariement exact (« Coarsened Exact Matching ») est également appliquée pour obtenir un échantillon de médecins comparables. Les résultats indiquent que la restriction de la pratique des dépassements a permis d'améliorer l'accès aux soins de la population ; l'OPTAM a cependant été plus efficace que le CAS. Les médecins spécialistes adhérant au CAS puis à l'OPTAM ont, parallèlement

à la baisse de leurs tarifs, augmenté leur activité (nombre de consultations, actes techniques), en raison d'une augmentation du nombre de patients suivis, et en particulier d'une hausse du nombre de patients à bas revenus (bénéficiaires de la CMU-C). Cette amélioration de l'accès aux soins génère cependant un coût important pour l'Assurance Maladie.

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## Chapter 1

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

co-written with Brigitte Dormont and Anne-Laure Samson

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# 1 Introduction

The way physicians are paid influences their behavior in terms of care provision and the efficiency of the health system. The choice between capitation, a salary or fee-for-service, or a combination of these payment methods influences the volume and the quality of care offered, access to care of the population, and the efficiency of health expenditure (Grignon et al., 2002). In France, fee-for-service remains the dominant payment method. It encourages physicians to respond to demand and meet patients' needs (Albouy and Déprez, 2009). However, there are numerous undesirable effects associated with it. In Sector 1, where rates are fixed, physicians' income mainly depends on the volume of their activity. Fee-for-service may therefore encourage the multiplication of procedures which reduces the efficiency of the health system (Delattre and Dormont, 2003). It also encourages curative care to the detriment of preventive care because it does not reward the long-term benefits of prevention (Franc and Lesur, 2004).

It is in this context that, in 2009, the National Health Insurance (NHI) introduced a pay-for-performance (P4P) scheme, the *Contrat d'amélioration des pratiques individuelles* (CAPI, a contract between physicians and the NHI)<sup>1</sup>. This contract introduced a new element of remuneration for physicians associated with the achievement of targets in terms of quality and based not on the number of procedures performed but on the number of patients treated as the primary care doctor (the *médecin traitant*). On a voluntary basis, CAPI provided for a flat-rate remuneration to be added to fee-for-service, depending on the target achievement rate (see below).

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

We use a balanced panel of General Practitioners (GPs) observed before (2005 and 2008) and after (2011) the introduction of CAPI. Balancing is required for our method of assessment. The sample is composed of self-employed GPs who have been practicing continually from 2005 to 2011. The latter represent 84% of the procedures performed and 82% of the patients for whom care was provided over that period. Using an instrumental variable estimation applied to a first-difference model, we assess the causal impact of CAPI on the behavior, in terms of care

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

provision, of GPs who are “treated” by the CAPI.

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

The article is structured as follows. Section 2 offers an overview of the literature on the effects of pay-for-performance to put our contribution into context. Section 3 returns to the functioning of CAPI and presents the data used, the construction of the sample, and some descriptive statistics. The empirical strategy is described in Section 4, the results are set out in Section 5, then we conclude.

## 2 Literature Review

Since the 2000s, many OECD countries have introduced a pay-for-performance system aimed at improving the quality of care provided (through better care treatment for chronic illnesses, early detection of cancers, etc.) and the efficiency of health expenditure. The emergence of this new system has given rise to many studies seeking to assess its cost and efficiency (see [Cashin \[2014\]](#) for a summary). Almost all of the studies assess the effects of these incentives on the achievement of each of the targets directly aimed at by the financial incentives ([Van Herck et al., 2010](#); [Flodgren et al., 2011](#); [Scott et al., 2011](#); [Gillam et al., 2012](#); [Eijkenaar et al., 2013](#)). These papers obtain varying quality effects because, as indicated by [Kantarevic and Kralj \[2013\]](#), results are directly dependent on the methodology used in the assessments and on the structure of the system, and more specifically on the substance of the incentives (size of bonuses, number of targets and measure of their achievement). They are also highly dependent on the health system organization in the country concerned (particularly the initial payment system, whether it is an individual or group practice). Pay-for-performance may also have an impact on the physician’s other activities, those not covered by the financial incentives, but in that case too, the estimated effects are conflicting according to the studies, even where they relate to the same countries: for example in Britain, [Doran et al. \[2011\]](#) conclude that there is a deterioration in the quality of care for procedures not covered by the incentives whereas, previously, [Sutton et al. \[2009\]](#) reached

the opposite conclusion.

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

Compared to these inconclusive results regarding the efficiency of the pay-for-performance system, our contribution to the literature is two-fold. Firstly, we examine whether CAPI, which modifies the form of payments received by physicians by giving less weight to fee-for-service, impacts behavior regarding the provision of care by physicians. Although our data do not contain any details on the pharmaceutical prescriptions (generic or original), or the tests and blood dosages prescribed, they do, on the other hand, provide a set of variables relating to behavior in terms of the provision of care: number of consultations, procedures, number and proportion of patients treated as the *médecin traitant*, number of beneficiaries of complementary universal health insurance (CMU-C<sup>3</sup>), patients in long-term illness (ALD<sup>4</sup>), the structure of patients by age and sex, prescriptions, and components of the doctor's income. As far as we know, no assessment of pay-for-performance from this perspective of the impact on the structure of the provision of care has been carried out either in the French or the international literature.

Moreover, our empirical strategy assesses the impact of these incentives, taking into account the endogeneity of having signed up for the CAPI system. Our first-difference specification using an instrumental variable method allows the assessment of a local effect, measured on compliers

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

<sup>3</sup>*Couverture Maladie Universelle Complémentaire*.

<sup>4</sup>*Affection Longue Durée*.

alone, based on a balanced panel of physicians who have worked continuously in private practice from 2005 to 2011. Our results, therefore, have to be interpreted with caution. In any case, our approach allows for correcting biases associated with the endogeneity of having signed up to CAPI, which is not usually the case – or imperfectly – in French studies.

### 3 The CAPI system, Data and Descriptive statistics

In March 2009, the *UNCAM* (National Union of health insurance funds) introduced pay-for-performance in France via the CAPI ([Journal officiel, 2009](#)). The system aims to encourage physicians to follow the good practice recommendations issued by the *Haute Autorité de Santé* – the National Health Authority – (more prevention, support for patients suffering chronic illnesses) while limiting the growth in health expenditures. The contract reduces the proportion of fee-for-service, which is known to encourage them to offer more procedures and curative than preventive care in physicians’ pay. Any *médecin traitant* in agreement with the NHI in private practice and having the minimum number of patients and the minimum volume of prescriptions could voluntarily sign a three-year contract with the NHI. Physicians were then free to leave the system if they wanted to. By signing up for CAPI, a physician undertakes to meet the targets set under the public health law in return for a financial reward (see Box below). Nearly 16,000 *médecins traitants*, self-employed physicians, signed up to CAPI over the period covered by this system, that is to say, more than one in three eligible physicians [[Cour des comptes, 2011](#)]. The growth in the total number of CAPI members has been gradual: from 5,000 in June 2009, 13,000 in December 2009, 14,000 in June 2010, and 15,500 in December 2010. Most, therefore, signed up in 2009. In its communication, the NHI highlighted the success of CAPI since its first year [[CNAM, 2010](#)], with objective achievement rates among those signing up for CAPI, which have increased to a greater extent than among those who have not. On the other hand, achievement rates among those signing up for CAPI were initially (before they signed up) higher than the rates of those who have not.

#### 3.1 The Data: an exhaustive panel of French self-employed General Practitioners

The study uses data from a matching process produced by *INSEE*<sup>5</sup> on behalf of *DREES*<sup>6</sup> from two exhaustive administrative sources relating to self-employed physicians in France. The first, supplied by the NHI, contains information on the doctor’s sociodemographic characteristics, the structure of their activity, their patients, and their fees. It is matched with data from the DGFIP<sup>7</sup>, which provide details of physicians’ tax returns (personal tax returns) and detailed information on the various sources of their remuneration and the characteristics of the taxable household. The matched data also contain information on the municipality in which the doctor is practicing. Five years are available (2005, 2008, 2011, 2014, and 2017), but only 2005, 2008, and 2011 have been retained for analysis. This choice was made because, in 2012, CAPI was replaced by ROSP, which extended pay-for-performance to include all physicians and may have

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<sup>5</sup> *Institut National de la Statistique et des Études Économiques.*

<sup>6</sup> *Direction de la Recherche, des Études, de l’Évaluation et des Statistiques.*

<sup>7</sup> *Direction Générale des Finances Publiques.*

altered their activity. The period from 2008 to 2011, which saw no reforms in outpatient care that may have had any specific effect on certain physicians, can be used to identify the impact of CAPI itself.

### 3.2 Sample used for the analysis

CAPI has been offered to all physicians under agreement with the NHI working in private practice. Our data show that 99.97% of physicians who received a CAPI bonus in 2011 are GPs. For this reason, our study concentrates on the latter. We restrict coverage to GPs working exclusively in private practice (i.e. they have no hospital work in addition to their private practice work)<sup>8</sup>. We also disregard physicians who draw a pension over the period. Moreover, we concentrate uniquely on physicians practicing in Sector 1 (that is, who apply fees agreed with the Social Security) and thus exclude those who either are not under agreement or practice in Sector 2. These physicians have very different characteristics to those in Sector 1 and, in 2011, represented only 10.4% of GPs and only 4.4% of those who signed up to CAPI and received a bonus. The sample then consists of 50,233 GPs in private practice observed at least once in 2005, 2008, and 2011.

Our econometric strategy (see below) requires physicians to be observed before (2005 and 2008) and after (2011) CAPI was introduced. Our sample is therefore restricted solely to physicians present in these three years. The construction of this balanced sample reduces the initial sample by 15,980 physicians (31%) to leave 34,253 physicians. Using a balanced sample raises the question of selection bias. It results in excluding three types of physicians: (i) physicians who left private practice in 2008 or 2011 (40% of those ruled out); (ii) physicians observed for the first time in 2008 or 2011 (40%); (iii) physicians who have a career break and disappear from the data for one or two years (20%)<sup>9</sup>. We do not know the reasons for any temporary or permanent departure from and return to the data. However, their characteristics (see Table 1.B.1) and data from the “*Ordre des Médecins*” – the National Medical Council – (see [Le Breton-Lerouillois and Romestaing, 2013](#)) show that type (i) are physicians who left private practice for retirement reasons, for a temporary break in their careers or a change of medical specialty and that type (ii) physicians started their practice that year. The remaining 20% stopped working in private practice for one or two years (sick leave, maternity, or temporary departure from private practice in favor of another form of practice). They have substantially reduced their activity during the year(s) of observation, probably reflecting a retirement (and therefore from the sample) during the year. Overall, the working sample is made up uniquely of physicians in a “permanent structure,” that is to say, physicians who have already built up their client base (so not new physicians), who are not at the end of their careers either and who have chosen to work full-time in private practice. They represent 70% of the original sample but carry out 84% of total procedures, earn 84% of total fees and treat 82% of patients. This balancing, which is needed for our econometric

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<sup>8</sup>This restriction is needed in so far as our data only provide information on work carried out in a private practice. The activity carried out in a hospital structure, a retirement home or any other structure in which the doctor would be employed is not accounted for in our data and the measurement of their activity is therefore incomplete.

<sup>9</sup>To identify them, we also use data from 2014: if the doctor is present in 2005 but absent in 2008 and/or 2011, but present again in 2014, they have had a temporary career break.



approach, therefore leads us to examine the main care providers.

Finally, we also excluded from this balanced sample of 34,253 physicians all of those for whom the variables of interest in 2008 or 2011, the instruments in 2005 and the control variables in 2005, 2008 or 2011 have atypical values. Our final sample consists of 32,171 physicians from Sector 1 observed over three years, 2005, 2008 and 2011, that is to say, 96,513 observations. Of these self-employed GPs, 23.1% (7,429 physicians) received a CAPI bonus in 2011. This does not mean that 23.1% of GPs signed up for CAPI. The reason is that some physicians signed up but still need to achieve the targets required to earn any bonus (according to the NHI, this accounts for about 25% of signatories, cf. [Ulmann \[2011\]](#)). In the data, we can only observe the amount paid in bonuses and not the doctor's status in terms of signing up. Therefore, we cannot distinguish among the physicians not receiving any CAPI bonus who signed up to CAPI without achieving the targets from those who did not sign up for it. In this article, we seek to measure CAPI's effect in relation to physicians who sufficiently altered their practices to get a bonus.

### 3.3 Variables of interest

Our analysis seeks to estimate the causal impact of CAPI, and therefore the impact of the modification of remuneration associated with each patient, on the structure of physicians' activity. The literature on incentives shows, in many areas, a significant response by individuals to small monetary incentives. Even if the bonus is a relatively small amount, it is not negligible (Figure 1.1). The behavior of physicians in terms of care provision may be summarised using the following variables:

- Variables relating to overall annual activity: the number of consultations, the total number of procedures and the volume of care provided (i.e. the sum of the various procedures, valued by the standard price for these procedures). The volume of care, thus valued despite being a monetary variable, allows the composition of the activity and their technicality to be measured<sup>10</sup>;
- Variables relating to the structure of the doctor's patient file: the number of different patients seen during the year and the proportion of patients treated as the *médecin traitant* since calculating the CAPI bonus depends on the number of patients treated as the *médecin traitant* (cf. Box);
- Variables relating to the structure of the doctor's activity, measured per patient: the number of consultations, the total prescription amounts and the pharmaceutical prescription amounts. One might expect that CAPI would have a positive effect on the amount of time devoted to each patient, i.e. on the number of consultations given to each patient. The effect of the system on the amount of prescriptions is more ambiguous since the achievement of certain targets is inextricably linked to an increase in prescriptions (such as of mammographies, of dilated fundus examinations or of glycated haemoglobin

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<sup>10</sup>Indeed, where total numbers of procedures are completely identical, a physician who only gives consultations will have a lower volume of care than one who combines "conventional" consultations with technical procedures for which charges are higher (such as electrocardiograms).

tests), or in pharmaceutical prescriptions in particular (such as antihypertensives), whilst the achievement of other targets is linked to a reduction in the amount of pharmaceutical prescriptions (such as an increase in the proportion of prescribed drugs in the directory of generic medicines) (see Table 1.A.1);

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

#### Box - The CAPI system

CAPI consists of two parts: the first relates to targets for prevention and the treatment of chronic diseases and the second, referred to as the prescription optimization target, encourages the prescribing of generic drugs (see Table 1.A.1). In total, sixteen public health target indicators have been established. When calculating whether targets have been achieved, the account is taken of the physician's initial achievement rate, but also their progression. If a physician achieves at least 25% of the targets in each of the two parts of the contract, her bonus is calculated as follows:

$$\text{Bonus} = \text{Achievement rate} \times \text{number of patients as } \textit{m\acute{e}decin traitant} \times \text{€}7$$

The bonus received is an increasing function of the number of patients treated as the *m\acute{e}decin traitant* and the rate of achievement of the targets. To give an idea of size, a physician who treats 800 patients as their *m\acute{e}decin traitant* may hope for a bonus of up to €5,600 if she achieves all her targets.

Source : [Journal officiel](#) [2009]

### 3.4 Descriptive statistics

Our data show that, in 2011, physicians who signed up for P4P received an average bonus of €3,332. This average conceals significant disparities (Figure 1.1): 10% of physicians who joined the CAPI received a bonus of less than €1,667 and 10% received a bonus of more than €5,342. A quick calculation shows that 59% of the variance in these bonuses between physicians is due to the variability of the number of patients treated as the *m\acute{e}decin traitant* and 25% is due to the variability of the rate of achievement (the remaining variability corresponding to the correlation between these two variables). The 10% of physicians receiving the lowest bonuses combine a low rate of achievement (less than 27%) and a limited number of patients treated as the *m\acute{e}decin traitant* (fewer than 641 patients). Conversely, the 10% of physicians receiving the highest bonuses have an average rate of achievement of more than 58% and treat more than 1,729 patients as the *m\acute{e}decin traitant*.

This bonus represents an average of 24.5% of the total lump-sum payments received by GPs in addition to their fee-for-service. However, this is still only a small proportion of the physicians' pay: on average, less than 2.11% of fees, a little more than 3% for the 10% of physicians earning

the highest bonuses (Figure 1.2). The extension of CAPI to ROSP, in 2012, through an increase in the number of targets giving rise to bonuses, led to an increase in the proportion of lump-sum payments in physicians' remuneration in subsequent years.

Table 1.1 compares the characteristics (in 2008, before the introduction of CAPI) of physicians who received a CAPI bonus with those who did not. Those who received a bonus have very different characteristics to other physicians: they tend to be men, to be younger, and to live in a couple in a household with dependent children. In addition, they tend to practice in municipalities less densely populated with GPs, specialists, and other private health professionals (dental surgeons, nurses, midwives, and physiotherapists). The demand for care directed at them is, therefore, generally higher.

Table 1.2 shows the average of the different variables of interest in 2008 and 2011. The statistics highlight a significant difference between CAPI and non-CAPI physicians regarding all variables. Before joining the CAPI in 2008, physicians who are signatories performed more procedures in total and had a significantly higher volume of activity. They treated more patients, and in a greater proportion as the *médecin traitant*, and received higher total fees. These differences grew in 2011, with the impact of CAPI and other factors of change in physicians' activity.

These statistics clearly show that physicians who signed up to CAPI are different from their colleagues. Therefore, it is essential to consider the potential endogeneity of signing up for CAPI in the econometric analysis of its impact.

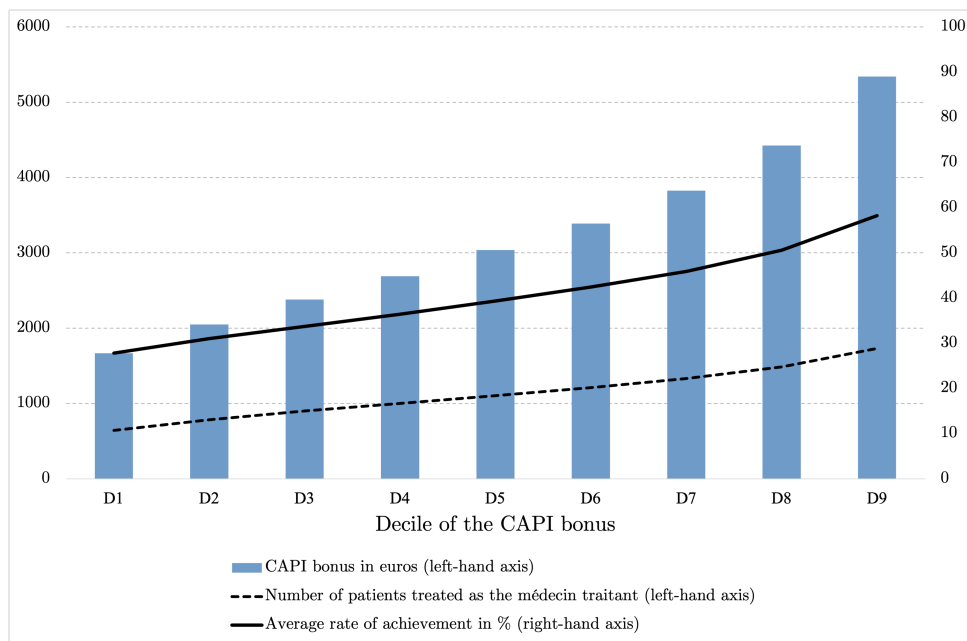


Figure 1.1: Rate of achievement of targets, amount received in bonuses and number of patients treated by general practitioners who signed up to CAPI as the *médecin traitant* in 2011

*Notes:* The decile of the CAPI bonus and the average number of patients treated as a *médecin traitant* are both read on the left-hand axis. The average rate of achievement is shown on the right-hand axis. The average rate of achievement is calculated by the authors.

*Reading Note:* In 2011, 10% of doctors who signed up to CAPI treat fewer than 641 patients as a *médecin traitant*, have a target achievement rate of less than 27.8% and receive a bonus of less than 1,667 euros.

*Source and Coverage:* Insee-CNAM-DGFiP-DREES matched data, wave 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice who signed up to CAPI.

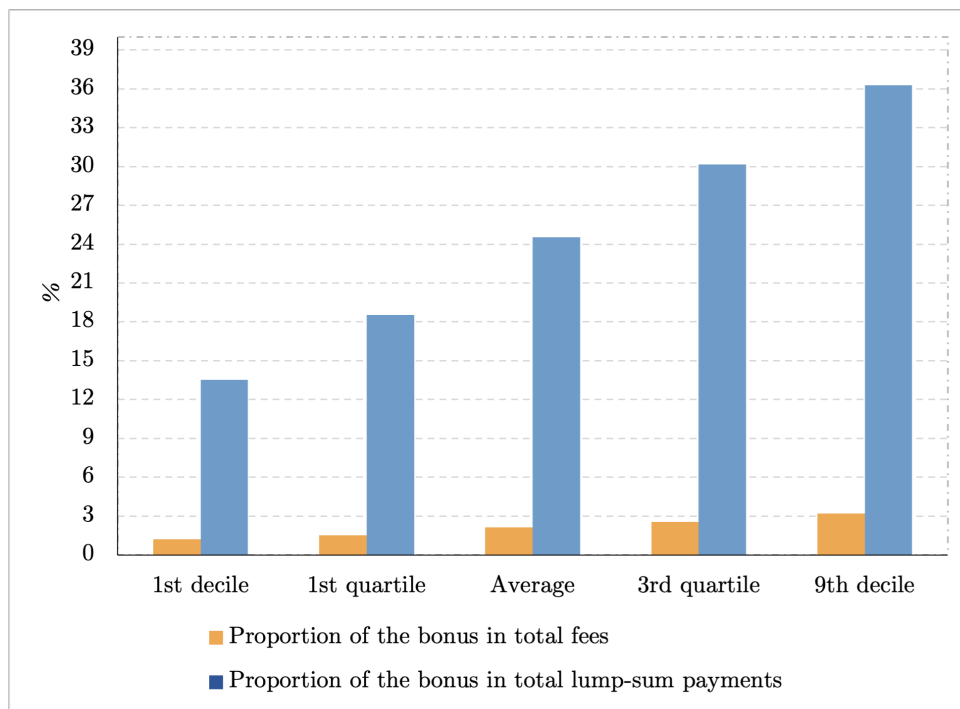


Figure 1.2: Proportion of the CAPI bonus in total fees and lump-sum payments of general practitioners in 2011

*Reading Note:* On average, the CAPI bonus represents 24.5% of the total lump-sum payments and only 2.11% of the total fees of general practitioners in 2011.

*Source and Coverage:* Insee-CNAM-DGFIP-DREES matched data, wave 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice who signed up to CAPI.

Table 1.1: Sociodemographic characteristics of general practitioners in 2008, before CAPI was introduced, according to whether or not they chose to sign up to CAPI

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

*Notes:* The p-value corresponds to the test of equality of means between CAPI and non-CAPI doctors. ns stands for not significant:  $p \geq 0.10$ ; \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

*Reading Note:* In 2008, 26.3% of doctors who have not signed up to CAPI are women whilst they represent 22.2% of doctors who have signed up to CAPI. This difference is significant at the 1% threshold.

*Source and Coverage:* Insee-CNAM-DGFIP-DREES matched data, wave 2008. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

Table 1.2: Comparison of variables for care provision by general practitioners, between doctors who signed up to CAPI and other

	2008			2011		
	NON CAPI	CAPI		NON CAPI	CAPI	
	Average (s.d)	Average (s.d)	p-value	Average (s.d)	Average (s.d)	p-value
Number of doctors	25,922	7,433		25,922	7,433	
<i>Overall activities</i>						
Number of consultations	4,696 (2,056)	5,057 (1,917)	***	4,767 (2,129)	5,134 (2,01)	***
Total number of procedures	5,413 (2,311)	5,784 (2,091)	***	5,423 (2,363)	5,806 (2,177)	***
Volume of care (FWEFC) <sup>(1)(2)</sup>	120,053 (51,233)	128,04 (46,453)	***	126,02 (54,844)	134,629 (50,757)	***
<i>Patient list</i>						
Number of patients	1,538 (622)	1,643 (585)	***	1,791 (748)	1,907 (705)	***
Proportion of patients treated as the <i>médecin traitant</i>	46 (17)	51 (11)	***	56 (19)	62 (12)	***
<i>Structure of activities per patient</i>						
Number of consultations per patient	3.1 (0.9)	3.1 (0.7)	ns	2.7 (0.8)	2.7 (0.7)	***
Prescriptions per patient <sup>(1)</sup>	495 (244)	497 (194)	ns	434 (194)	435 (166)	ns
Pharmaceutical prescriptions per patient <sup>(1)</sup>	247 (109)	249 (94)	ns	201 (88)	201 (77)	ns
<i>Remuneration and cost <sup>(1)</sup></i>						
Fees	149,806 (63,112)	159,857 (56,908)	***	150,18 (64,528)	163,784 (60,138)	***
Fees per patient	101 (34)	101 (29)	ns	87 (29)	89 (26)	***
Basis for reimbursement of the full cost per patient	597 (295)	598 (214)	ns	521 (211)	524 (183)	ns

<sup>(1)</sup> In constant euros based on 2015. <sup>(2)</sup> FWEFC stands for Fees without extra fees or flat charges.

Notes: ns stands for not significant:  $p \geq 0.10$ ; \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

Reading Note: In 2008, doctors who have not signed up to CAPI performed an average of 4,696 consultations whilst doctors who have signed up to CAPI performed 5,057. This difference is significant at the 1% threshold.

Source and Coverage: Insee-CNAM-DGFIP-DREES matched data, wave 2008. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

## 4 Empirical Strategy

Physicians have been able to sign up to CAPI since 2009 and we can observe, from the data for 2011, the impact of receiving a bonus on the characteristics of the GP's overall activity.

Noting  $\log(Y_{it})$  the logarithm of one of these characteristics, we consider a model of the form:

$$\log(Y_{it}) = \alpha + \beta CAPI_{it} + X'_{it}\gamma + \delta_t + \phi_i + \epsilon_{it} \quad (1.1)$$

where  $t=2008$  or  $2011$ ,  $i=1 \dots N$

$CAPI_{it}$  is a dichotomous variable equal to 1 if the physician has signed up to CAPI and received a bonus in 2011 and 0 if not. In the remainder of the article, we will simplify matters by saying that this variable measures the effect of "signing up to CAPI"; in fact, it measures the effect of signing up to CAPI and achieving the targets enabling the physician to receive a bonus.  $\phi_i$  represents the specific effect on physician  $i$ . This term incorporates elements of unobserved heterogeneity specific to the physician and assumed to be constant over time: their style of practice, their ethics, and the importance they give to leisure in the work and leisure trade-off.  $\epsilon_{it}$  represents the idiosyncratic error term that affects the behavior of physician  $i$  in terms of their care provision in year  $t$ , such as an epidemic, a variation in the demand for care, a need by the physician to increase their income, their state of health or any other temporary shock. The variable  $t$  is a linear trend symbolizing the progression between 2008 and 2011 in respect of all of the variables for the provision of care by physicians.  $X'_{it}$  corresponds to a set of variables that explain physicians' activity. Many of them are constant between 2008 and 2011 and disappear in first-differences, as well as the physician's age, which is collinear with the trend. On the other hand, variables relating to the number of people in the physician's household (partner and number of children), the density of GPs in private practice, and to the density of specialists and other health professionals in private practice in the municipality where they work, are retained in the first-difference specification.

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

$$\Delta \log(Y_{it}) = \beta \Delta CAPI_{it} + \Delta X'_{it}\gamma + \delta + \Delta \epsilon_{it} \quad (1.2)$$

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

$$\Delta Y_{i0811} = \beta \Delta CAPI_{i0811} + \Delta X'_{i0811}\gamma + \delta + \Delta \epsilon_{i0811} \quad (1.3)$$

In this context, the effect of receiving a CAPI bonus on the rate of growth of different variables



is being studied:  $\Delta Y_{i0811} = (\log Y_{i11} - \log Y_{i08})^{11}$ .

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

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

$$\Delta CAPI_{i0811} = a + bZ_{i05} + \Delta X'_{i0811}c + \Delta u_{i0811} \quad (1.4)$$

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

The correlation between the density of GPs in 2005 to signing up for CAPI may result from quality competition mechanisms or the effects of physicians' excessive workloads. If the density

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<sup>11</sup>When this variable is a proportion (this is the case for the share of patients followed as a *médecin traitant*),  $\Delta Y_{i0811}$  corresponds only to the variation of this proportion between 2008 and 2011. For the other variables, we approximate the growth rate by the first-difference of the logarithms. The choice to measure the explained variables in logarithms comes from the distribution of these variables. The values of Skewness and Kurtosis lead to a log-normal distribution for the different explained variables.

of physicians is high, they may compete to attract patients, and, in that case, improving quality may be an advantage that CAPI has conveniently been rewarding since 2009. Choosing CAPI should therefore be associated with a high density of physicians. However, there is no published information on the quality of care delivered by physicians, which limits the effect of quality on demand. If CAPI affects the quality of care, this should instead occur directly through the incentive associated with pay-for-performance.

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

## 5 Estimation of the Impact of CAPI

### 5.1 The context: changes in the practices of General Practitioners between 2008 and 2011

To understand the effect of CAPI, it is essential to understand contextual elements which have affected changes in the practices of all physicians over its application period. The period from 2008 to 2011 is characterized by the generalization of the gatekeeping (*médecin traitant*) system, set up in 2004, and by a reduction in the numbers of GPs, which started in 2007. For the physicians in our sample, the density of GPs fell by an average of 7.4% between 2008 and 2011 and nearly 80% of them saw a reduction in density in the municipality where they practiced, mainly owing to retirements. Another significant change is the increase in the proportion of women in the profession, as is clearly apparent from the unbalanced data, where 47% of physicians who were established in 2008 are women while, that same year, 78% of the physicians who retire are men (cf. Table 1.B.1). This increase in the proportion of women has an impact because numerous studies have shown that female physicians in private practice work less than their male counterparts<sup>12</sup>. Among men, the young generations are also less active at a given age than older generations.

These changes and an increase in chronic illnesses lead to changes in the potential demand for physicians' services in our sample. Since the sample is balanced, we do not observe an increase in the proportion of women who signed up from 2008 to 2011. However, these established physicians (who account for the vast majority of care provision with 84% of procedures) face movements in potential demand owing to medical demographics and the preferences of young generations. This context leads to the changes shown in Table 1.3.

As can be seen, there is considerable growth in the number of patients per physician (+14.7%)

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<sup>12</sup>The difference is estimated at 35% by [Dormont and Samson \[2008\]](#); see also [Dumontet and Chevillard \[2020\]](#) for a summary of the results.

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

Table 1.3: Changes in the different variables of interest between 2008 and 2011 over the whole sample

Variables	Growth rate 2008-2011 (%)	Of which growth between 2008 and 2011 due to changes in density (%)
Number of consultations	0.6	0.4
Number of patients	14.7	0.4
Number of patients treated as the <i>médecin traitant</i>	34.0	0.2
Proportion of patients treated <sup>(1)</sup> as the <i>médecin traitant</i>	9.7	0.1
Number of consultations per patient	-14.1	0.0
Prescriptions per patient <sup>(2)</sup>	-12.8	0.1
Fees <sup>(2)</sup>	0.3	-0.2
Observations	32,171	

<sup>(1)</sup> For this variable, it is the variation of the proportion in percentage points and not the rate of growth. <sup>(2)</sup> In constant euros basis 2015.

*Notes:* These average rates of growth are the average of the individual rates of growth observed between 2008 and 2011 for all doctors in the sample.

*Source and Coverage:* Insee-CNAM-DGFIP-DREES matched data, waves 2008 and 2011. Metropolitan France. General practitioners in Sector 1 and working exclusively in private practice.

The physicians in our sample therefore provided care for far more patients over the period without carrying out far more procedures. One can see one effect of the *médecin traitant* system, which gives an additional fee of €40, a sort of capitation, for the treatment of each patient suffering a long-term illness (ALD), but also of the increase in potential demand. This may also be the result of changes in the density of physicians, the reduction therein necessarily implying an increase in the number of patients per doctor. However, the growth rates, which represent growth due to changes in density, show that changes relating to the activity of the GPs in our sample are correlated to those relating to the density of physicians only to a very limited extent<sup>13</sup>. It

<sup>13</sup>Within the growth in the number of patients of 14.7%, only 0.4% is attributable to a reduction in density. The same applies to all of the variables considered apart from the number of consultations, whose growth is very slight (0.6%) but is due to a variation in density in two-thirds of cases (0.4%).

is in this context that the CAPI system was introduced as a counterbalance, a new element of remuneration which is itself also based on patients treated as the *médecin traitant* but is associated with indicators of quality which may limit the tendency to do as little as possible per patient.

## 5.2 First Stage: signing up to CAPI

The results presented in Table 1.4 show that the density of GPs in private practice in the municipality where they were practicing in 2005 is negatively correlated to the earning of a CAPI bonus. This variable is, amongst other things, a predictor of the number of patients treated as the *médecin traitant*, a number which positively influences the return on signing up to CAPI via the value of the bonus. In this context, a high density translating to an abundance of care provision has to have a negative impact on this number and, consequently, on the propensity to sign up for CAPI. The Fisher statistic, which corresponds to the test of significance of the instrument in the first stage regression where there are other control variables, has a value of 14.89, which indicates that our instrument is well correlated to the CAPI bonus; in other words, that the instrument is not weak.

Table 1.4: First stage estimation - equation (1.4)

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

Notes: \*\*\*  $p < 0.01$ . The standard deviations clustered at the GP level are in parenthesis. This estimation includes the control variables presented in section 3. The Fisher statistic from Kleibergen and Paap [2006] is a generalisation of the statistic from Cragg and Donald [1993] in the case where errors are not i.i.d..

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

## 5.3 Impact of CAPI on the practices of General Practitioners

The results of second-stage estimations (equation 1.3) are presented in Tables 1.5 and 1.6; we report the coefficients estimated in respect of the different variables  $\Delta Y_{i0811}$ , the name thereof is specified at the start of each line. In Table 1.5, the results of ordinary least squares estimations are reported in the OLS columns, and those of instrumental variables estimates are reported in IV columns. Two coefficients are reported each time: the estimation of  $\beta$ , the effect of the treatment associated with CAPI, and that of  $\delta$ , the change common to the two groups over the period, other things equal, in particular in terms of the densities of physicians in the department.  $\delta$  is not the raw evolution of the variable of interest, but its growth, once those of the densities are taken into account. For example, for total fees, the IV estimation of  $\delta$  is -6%: this does not mean that the fees have fallen by 6% over the period in our sample (they have increased, slightly, by 0.3%, cf. Table 1.3). All the following comments regarding trends have to be understood in

terms of “all else being equal in terms of changes in the control variables ” (to simplify things, the coefficients of the control variables are not reported in the table).

The column headed “Hausman test” gives, for each estimation, the alpha risk associated with the Hausman test of exogeneity. The tests lead to the rejection of the CAPI exogeneity hypothesis for almost all the variables explained, except for the number of consultations and the number of total procedures, for which the ordinary least squares can be considered convergent and efficient. The following comments are based on the instrumental variable estimates, except in the case where OLS is validated by the Hausman test<sup>14</sup>.

Table 1.6 summarises the main results. For physicians who signed up for CAPI, it gives an estimation of the sum of the coefficients  $\beta + \delta$  (with a confidence range of 95%) and for other physicians the value of the coefficient  $\delta$ . These values give the changes in the variable of interest over the period, other things equal, for each category of physicians. The third column gives an estimation of the impact  $\beta$  of CAPI in respect of each variable considered.

The estimations show that CAPI completely halted the current trends in the changes in the practices of GPs over the period (Table 1.6). Whilst GPs generally see more patients (+20.2%), with fewer consultations and fewer prescriptions for each of them (-17.5% and -21.5%), the impact of CAPI on those who signed up to it is such that these physicians are not taking on any more patients (the change is not significant) and are not significantly increasing the number of consultations they give or the value of their prescriptions per patient. Another impact of CAPI is a much greater increase in the proportion of patients treated as the *médecin traitant*: it increases by 23.7 percentage points for physicians who signed up to CAPI compared to just +5.9 points for the others. Finally, whilst total fees and fees per patient fall significantly between 2008 and 2011 for GPs (-6.3% and -26.5%), it is the opposite for those who signed up to CAPI, the effect thereof being so great that it is reversing the trend: their total fees and their fees per patient have increased by 20.8% and 25.8% respectively.

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

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<sup>14</sup>In the case where the Hausman test validates the instrumental variable estimates, the bias related to the use of OLS can be calculated by comparison. This is positive for most of the level variables (volume of care, number of patients) but negative for most of those measured in ratio per patient (consultations per patient, prescriptions per patient, cost per patient). As we explained in the section devoted to the empirical strategy, the first-difference specification means that only temporary shocks can create a bias here, personality traits or the style of practice of the doctor being eliminated by difference. The positive bias found may be explained as follows: if the physician faces a positive shock in terms of demand associated with a flu epidemic for example (an element present in the disturbance), their activity, the number of patients they have, and their prescriptions increase. At the same time, this same shock may be the time to recruit patients treated as the *médecin traitant*, a factor strongly influencing decisions to sign up to CAPI. The biases observed on variables measured in ratios are the result of biases on variables in terms of level at the numerator and the denominator of the variable explained.

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

While the trend over the period is for pharmaceutical prescriptions to fall, maintaining the number of meetings per patient among physicians who signed up for CAPI goes hand in hand with maintaining expenditure on prescriptions per patient. This effect was not apparent beforehand because the incentives offered by CAPI imply effects with reversed signs concerning prescriptions: on the one hand, increasing prescriptions of preventive measures (such as mammographies or glycated hemoglobin tests), unable, with our data, to observe any effect on the length of a consultation or the quality of care, our estimations show that the CAPI bonus has allowed an increase in fees per patient for physicians who have signed up.

Finally, it is interesting to look at the impact of CAPI on the cost of treatment for each patient by the Social Security system. To this aim, we refer to the basic reimbursable amount, adding the fees and prescription expenditure per patient (second last line in Table 1.6). We observe that the cost of treatment per patient has fallen by 21.8% for physicians who have not signed up to CAPI (owing to the reduction in fees and pharmaceutical prescriptions). Conversely, the cumulative increase in total prescriptions and fees (payment for procedures + CAPI bonus) counterbalances this bias in the cost of treatment of patients for physicians who have signed up. This system is, therefore, expensive for the National Health Insurance.

Table 1.5: Effects of signing up for CAPI on the provision of care by General Practitioners

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

<sup>(1)</sup> In constant euros 2015 <sup>(2)</sup> This variable is not measured as the difference in the logarithms of this proportion between 2008 and 2011, but as the difference in level between 2008 and 2011.

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . The standard deviations clustered at the GP level are in parenthesis. The last column shows the  $p$ -value of the Hausman test of exogeneity of the variable “receive a CAPI bonus”, where the instrument is the logarithm of the density of doctors who are general practitioners at municipality level in 2005. The estimations include the control variables presented in section 4.

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

Table 1.6: Changes in the practices of doctors who signed up or did not sign up for CAPI from 2008 to 2011. Calculations based on the estimations in Table 5 <sup>(i)</sup>

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

<sup>(i)</sup> Depending on the result of the Hausman test, OLS estimates (variables "number of consultations" and "number of total procedures") or instrumental variable estimates are used.

<sup>(1)</sup> In constant euros 2015 <sup>(2)</sup> This variable is not measured as the difference in the logarithms of this proportion between 2008 and 2011, but as the difference in level between 2008 and 2011.

Notes: \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01. The standard deviations clustered at the GP level are in parenthesis. The estimations include the control variables presented in section 4.

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



## 6 Discussion and Conclusion

Based on a balanced panel of self-employed GPs observed before and after its introduction, we have assessed the impact of CAPI on the behavior of GPs in terms of their provision of care. Our approach differs from other empirical studies of the influence of pay-for-performance, which are centered on the effect of financial incentives on the achievement of targets set by the programs. Instead, our approach examines whether the new remuneration element introduced by CAPI – which generates additional income per patient irrespective of the number of procedures carried out – has led to a change in the structure of physicians’ activity. Our analysis is based on a panel of 32,171 French GPs in Sector 1 who have worked continuously in private practice throughout 2005, 2008, and 2011. These physicians have performed 84% of the procedures over the period. Our estimation method uses an instrumental variables approach on a first-difference model to account for the decision to sign up for CAPI, which is an individual decision made by the physician that is probably non-exogenous to the behavior studied. French studies on the impact of CAPI on quality indicators have not found any positive effect on the quality of care or found only a very slight impact (Saint-Lary and Sicsic, 2015; Michel-Lepage and Ventelou, 2016; Sicsic and Franc, 2017). However, our results show that CAPI has significantly influenced the practices of physicians who signed up for it in a way that is compatible with an improvement in the quality of care: contrary to their colleagues who have not signed up, physicians who have signed up to CAPI have not reduced “patient time” (number of consultations per patient) or the amount of prescriptions per patient. They have also increased, to a far greater extent than other physicians, the proportion of their patients whom they treat as *thémédecin traitant*.

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

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

Our data do not allow to go further in the analysis by studying changes in the time physicians

spend at work and the length of their consultations. However, CAPI has also increased fees per patient. As a consequence, and whilst the average cost to the Social Security system for the treatment of a patient falls over the period for all physicians, this decrease is not observed for the patients of physicians who have signed up to CAPI. This system is, therefore, expensive for the National Health Insurance. As a result, it is crucial to highlight its beneficial effects in the form of a better quality of care for patients or greater efficiency in care pathways that would reduce avoidable hospitalizations. In any case, we find that CAPI significantly impacts physicians' practices, which is compatible with an improvement in the quality of care that remains to be confirmed.

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## A. Objectives of CAPI

Table 1.A.1: Objectives of CAPI

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

<sup>(1)</sup> Proportion of patients treated as the *médecin traitant*.

<sup>(2)</sup> Proportion of prescribed drugs in the directory of generic medicines (boxes).

Source: Journal officiel [2009]

## B. Sampling frame

Table 1.B.1: Sociodemographic characteristics of physicians removed from the initial sample and of physicians in the sample

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

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

## Chapter 2

# French physicians' responses to overbilling restrictions

co-written with Anne-Laure Samson

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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). This share is increasing yearly for specialists, 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 impact National Health Accounts (NHA): the extra fees are paid by the patient, and most 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 income effects are higher than substitution effects (which is often the case for physicians), 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 behaviors when fees are regulated, which may also have enormous consequences on NHA (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 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 number 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 this fee restriction does not impact self-employed physicians' and dentists' earnings because they increase their volume of activity. Overbilling has therefore become a significant concern for public policies in France.

In 1990, one reform aimed at reducing the amount of overbilling in France: the "sector 2 freeze reform". More precisely, the difference between sector 1 and sector 2 was 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, an important part of their social contributions was reimbursed. However, given the continuous increase in the proportion of physicians choosing to practice in sector 2 and the vast inequalities in access to care it created, the government decided, in 1990, to restrict entry into sector 2 to specific physicians who had previous experience as teaching assistants or clinic supervisors. This reform created an exogenous shock in the probability of starting practice as a sector 2 physician: the number of physicians beginning their practice in sector 2 dropped (temporarily) after 1990. The difference in physicians' provision of care between sector 1 and sector 2 physicians (and especially general practitioners) has been studied theoretically by [Clerc et al. \[2012\]](#) who show how physicians from both sectors adjust their labor supply (either by making their care provision vary (in sector 1), or their fees vary (in sector 2)). Empirically, because the choice of the sector is endogenous, 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 in France in 2008 and 2011 who started their practice around the reform, i.e., between 1985 and 1994. We restrict this dataset to 5 specialties: dermatologists, otorhinolaryngologists (ENT<sup>1</sup>) physicians (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 to test whether regulated fees lead to better access to care for the population and strategic behaviors for physicians in their care provision.

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 primarily a concern for specialist physicians whose share in sector 2 and whose average amount of overbilling is much higher than for GPs. Moreover, a vast amount of literature exists on GPs' behavior, but nearly no paper analyses specialists' behavior paid under a FFS scheme regarding health care supply. Finally, even if we use the same fuzzy regression discontinuity design, our estimation methods are different given the huge literature that has arisen 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 more significant 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 and probably the previous rationing. However, these specialists have a wide range of available procedures in their activity: we find a considerable increase in the number of technical procedures (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 leads to an increase in their number of acts and 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 better accessibility to GPs for the population, mainly because they are "gatekeepers". As for technical specialists, the remaining could be 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 for by an increase in their total activity level. Overall, this leads to a reduction in

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<sup>1</sup>ENT for Ear-Nose-Throat physicians.

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 values that make them insensitive to the level of income they earn) or on the demand side (patients who visit them to 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 ambulatory 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 National Health Insurance (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 can choose the physician they want to consult, and information concerning the 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 if the specialist is an ophthalmologist, gynecologist, or psychiatrist, or if the patient has a long-term disease), 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 ENT physician, 34% when they visit a dermatologist. Still, they mostly consult psychiatrists and pediatricians by themselves.<sup>2</sup> The price of consultation also depends on the sector of the physician. For example, the price of a general practitioner’s consultation belonging to sector 1 was € 25 in 2008, but about € 43 in sector 2.<sup>3</sup> Patients must pay for co-payments and potential supplements if the physician practices overbilling. Mostly all French citizens have complementary health insurance that reimburses for this overbilling. Still, reimbursement varies greatly between contracts, so out-of-pocket can reach very high levels.

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<sup>2</sup>Computations 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 the years of the dataset used in this work.

<sup>3</sup>This does not correspond to the total fees earned by a physician during a consultation. Indeed, some expenses must be deduced from these fees (equipment rental, for example, and social contributions.). Furthermore, some additional payments are added to these fees (e.g., they get lump-sum payments when treating a patient with a chronic disease, a child, etc.). Therefore, sector 1 GPs earn €30 per consultation without deducing expenses and €45 in sector 2. When social contributions are deduced, the price remains similar for sector 1 GPs but falls to €40 for sector 2 GPs. The same pattern is observed for technical and medical specialists: in sector 1, the average price of a consult to a technical specialist (resp. medical specialist) is €37 (resp. €41). In sector 2, the average price is €62 (resp. €64), but after deducting the social contributions, physicians earn €52 (resp. €58).

## 2.2 The "Sector-2 freeze" reform and the regulation of overbilling in France

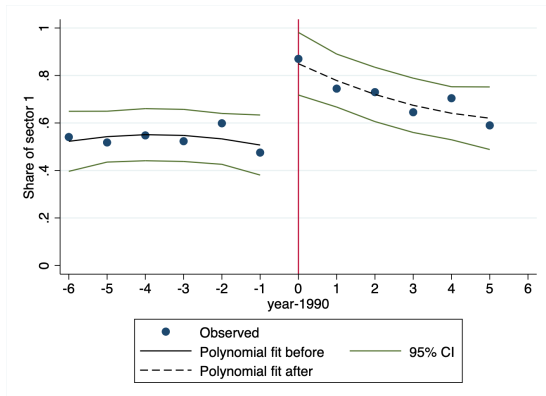
The sector 2 was created by the French Government in 1980, just before the Presidential election, as a “gift” towards the physicians. For the government, in a context of weak GDP growth, it was a way to increase physicians’ income, without increasing national health expenditures (as would have been the case with an increase of the regulated fees). From 1980 on, all physicians could 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 (Score Santé, 2022). Given this success, overbilling became a current practice, with a growing amount of extra fees, especially for specialists. For public policymakers, the development of overbilling became a major concern as it increased patients’ out-of-pocket expenditures and questioned equity in access to care.

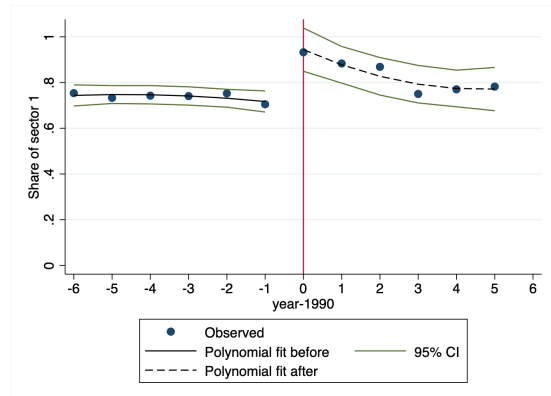
As a consequence, a reform restricted access to sector 2 in December 1989. As a result, all physicians starting their practice from the first trimester of 1990 have been constrained to choose to practice in sector 1, except for physicians with specific experience (ex-clinic supervisors, teaching assistants 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 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 2.1). Between 1989 and 1990, there was a considerable rise in the share of physicians belonging to 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 to get the titles necessary to start practicing as sector 2 increased significantly. But, then, the freezing reform for specialists only concerned one specific generation of physicians.

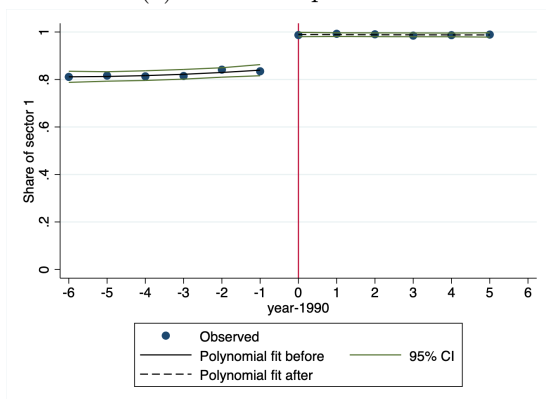
Our paper uses this reform to analyze if physicians constrained to practice regulated fees provide different levels of care to the population. Moreover, because the choice of the sector is endogenous, this reform, which is in France, the only attempt to regulate drastically overbilling, can be used to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



(a) Technical specialists



(b) Medical specialists



(c) General Practitioners

Source : Insee-CNAM-DGFIP-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 NHI, 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 2.1: 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-CNAM-DGFiP-DREES*” on self-employed specialists practicing in France. This dataset merges information on physicians’ activity gathered by the NHI 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. Several reasons drove the choice of those five specialties. First, this choice allows us to consider two specialists whose activity is divided between clinical (consultations) and technical procedures (dermatologists and ORL, we call them “technical specialists”) and two 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 differs significantly from others because of their “gatekeeper” status. Second, on a more empirically based choice, those five specialties were the most impacted by the “Sector-2 freeze” reform (see Figure 2.1, and Figure 2.A.1 in appendix A for the proportion of sector 1 physicians per specialty). On the contrary, this reform did not affect some specialties (radiologists and pulmonologists - see Figure 2.A.2): the proportion of sector 1 physicians remained similar before and after the reform, around 80%. Some specialties were impacted (cardiologists, anesthetists, and surgeons - see Figure 2.A.3), 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 anesthetists, 5.7 for surgeons). For some other specialties (obstetrician-gynecologists and ophthalmologists - see Figure 2.A.4), the reform led to a strategic behavior: we observe a strong discontinuity in the number of physicians who decide to start their practice as self-employed. The reform led them to practice more often as salaried physicians in hospitals<sup>4</sup>. However, we cannot study them in more detail because we only observe self-employed physicians’ care provision. Finally, two other specialties were excluded (medical gynecologists and stomatologists - see Figure 2.A.5) as they are not numerous enough, especially because the training of these doctors temporarily stopped during this period. Overall, we focus on five specialties for which the reform had a strong impact on the probability of choosing to practice in sector 1, for which the reform did not induce any strategic behavior (such as stopping to practice as self-employed)

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<sup>4</sup>This discontinuity is very surprising, and observed whatever the gender and location of practice of the physician.

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 needs more 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 2014 and 2017, the level of activity and fees of sector 1 and sector 2 physicians who chose to join these contracts were impacted (see Chapter 3).

Our main sample used for the econometric analysis is composed of self-employed sector 1 and sector 2 physicians belonging to the five previously mentioned specialties. We excluded physicians older than 60 and who receive retirement pensions. In addition, to avoid information errors, we removed physicians with annual fees, annual number of acts and annual amount of prescriptions equal to zero. We ended up with a sample containing 3,080 dermatologists observed in 2008 and 2011 (whatever their year of the beginning of practice), 2,006 ENT physicians, 2,477 pediatricians, 5,512 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 principal analysis, therefore, focuses on technical specialists, medical specialists, and GPs starting their practice six years around the reform, i.e., between 1984 and 1995 (section 4 explains the reason for this choice). Our final sample is then composed of 1,577 dermatologists (2,945 obs.), 964 ENT physicians (1,795 obs.), 1,059 pediatricians (1,501 obs.), 2,660 psychiatrists (3,285 obs.) and 26,829 GPs (43,529 obs.) (see Table 2.A.1 in appendix A). This sample is exhaustive on all physicians in these specialties, practicing in 2008 and/or 2011 and who started their practice around the 90s<sup>5</sup>. Overall, these physicians represent 50% of all physicians from these specialties who practiced in 2008 and 2011.

### 3.2 Outcomes considered in the analysis

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

Given the restriction in the possibility of overbilling patients, we expect physicians forced to start their practice in sector 1 to face much lower prices. Simultaneously, we have no theoretical prediction of their reaction to this price decrease. The decrease in the opportunity cost of leisure could give them incentives to work identically or even less. On the contrary, we could observe an increase in their care provision if they have a "target income" to reach. Overall, we could observe either a negative, positive or non-significant impact on their total fees<sup>6</sup>.

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<sup>5</sup>Most physicians are observed both in 2008 and 2011: 5% are observed in 2008 only and 1% in 2011 only.

<sup>6</sup>We cannot formalize our predictions using a standard labor-leisure trade-off, and refer to substitution or income effects, as the main variables of these models - the total work duration, or the consultation length - are



### 3.3 Descriptive statistics

Table 2.1 provides some descriptive statistics on the main outcomes and on the sample used for the econometric analysis, i.e. the sample is restricted to physicians who started their practice 6 years around the reform (Tables 2.A.2 and 2.A.3 provides these statistics per specialty).

Sector 1 physicians (1<sup>st</sup> column) are compared to sector 2 physicians (2<sup>nd</sup> 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<sup>7</sup>.

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unobserved in our data.

<sup>7</sup>Note that *fees* refer to total fees earned by the physician during the year. These are not physicians' *income*, defined as total fees net of expenses (rent for the office, payment of the secretary, etc.). These expenses account for about 50% of physicians' fees; hence their annual disposable income (before income tax) is usually about twice lower than their annual fees.

Table 2.1: Descriptive statistics of care supply variables between sector 1 and sector 2 physicians

TECHNICAL SPECIALISTS					
Outcome variables	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Price of procedures (€)	36.21	8.72	59.42	32.05	0.000***
Price of clinical procedures (€)	29.21	5.20	49.85	14.61	0.000***
Price of technical procedures (€)	36.86	15.66	70.74	68.11	0.000***
Nb. of procedures	4,518	2,030	3,697	1,807	0.000***
Nb. of clinical procedures	2,815	1,542	2,264	1,316	0.000***
Nb. of technical procedures	1,702	1,579	1,433	1,302	0.000***
Nb. of non surgical procedures	1,368	1,515	1,149	1,226	0.000***
Nb. of surgical procedures	311	361	261	287	0.000***
Nb. of patients	2,838	1,203	2,453	1,188	0.000***
Total prescriptions (€)	117,187	79,957	117,989	89,182	0.748
Total extra-fees (€)	3,535	8,341	73,147	59,061	0.000***
Overbilling rate (%)	2.93	6.77	70.49	60.02	0.000***
Total fees (€)	163,634	83,955	205,240	111,827	0.000***
Labor income (€)	87,551	54,573	98,913	71,014	0.000***
Charges (€)	76,083	52,004	106,326	69,959	0.000***
Total NHI reimbursements (€)	277,286	149,154	250,082	151,578	0.000***
Nb. of observations	2,844		1,841		
MEDICAL SPECIALISTS					
Outcome variables	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Price of procedures (€)	41.31	8.16	63.91	19.28	0.000***
Price of clinical procedures (€)	34.48	7.58	61.93	20.09	0.000***
Nb. of procedures	3,374	2,309	2,844	1,831	0.000***
Nb. of clinical procedures	3,314	2,265	2,784	1,802	0.000***
Nb. of patients	713	731	755	782	0.060**
Total prescriptions (€)	139,973	168,359	140,107	118,660	0.000***
Total extra-fees (€)	3,336	10,241	70,270	49,001	0.000***
Overbilling rate (%)	4.05	11.22	87.03	118.86	0.000***
Total fees (€)	131,265	79,302	167,049	93,736	0.000***
Labor income (€)	73,624	53,537	83,203	61,319	0.000***
Charges (€)	57,640	43,226	83,846	53,053	0.000***
Total NHI reimbursements (€)	267,901	227,069	215,439	182,640	0.000***
Nb. of observations	5,100		1,406		

*Continued on next page*

Notes: \*\*\*Statistically significant at the 1% level; \*\*significant at the 5% level; \*significant at the 10% level. Total extra-fees are included in total fees.

Pooled observations for 2008 and 2011. Statistics are for a bandwidth of 6 years around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset.

**Table 2.1 – continued from previous page**

GENERAL PRACTITIONERS					
Outcome variables	Sector 1		Sector 2		Equal means test p-value
	Mean	St. dev.	Mean	St. dev.	
Price of procedures (€)	30.39	24.70	44.62	24.89	0.000***
Price of clinical procedures (€)	24.49	3.38	39.07	13.82	0.000***
Nb. of procedures	5,267	2,399	3,560	2,212	0.000***
Nb. of clinical procedures	5,107	2,500	3,013	2,070	0.000***
Nb. of patients	1,705	786	1,358	838	0.000***
Total prescriptions (€)	708,144	415,810	332,563	351,846	0.000***
Total extra-fees (€)	923	4,119	47,517	180,957	0.000***
Overbilling rate (%)	0.66	112.07	62.64	320.55	0.000***
Total fees (€)	152,309	67,802	147,504	148,067	0.000***
Labor income (€)	82,614	45,815	68,529	48,991	0.000***
Charges (€)	69,695	39,521	78,974	127,687	0.000***
Total NHI reimbursements (€)	859,531	463,628	432,550	408,218	0.000***
Nb. of observations	38,747		4,576		

Notes: \*\*\*Statistically significant at the 1% level; \*\*significant at the 5% level; \*significant at the 10% level. Total extra-fees are included in total fees.

Pooled observations for 2008 and 2011. Statistics are for a bandwidth of 6 years around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset.

## 4 Empirical strategy

### 4.1 Fuzzy Regression Discontinuity Design

Physicians practicing in sector 1 are very different from those in sector 2 in terms of activity and fees, as we can see in Table 2.1. These differences may arise from the fact that the choice of the sector is endogenous, linked to physicians’ (unobserved) characteristics. On the other hand, 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 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 of 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 to improve readability.

More precisely, the first stage is defined as:

$$S_i = a + b\mathbb{1}_{X \geq T_{1,1990}} + g(X_i) + \mathbb{1}_{2011} + \epsilon_i \quad (2.1)$$

$S_i = 1$  if the physician  $i$  chooses to practice in sector 1 and 0 otherwise;  $X_i$ , the running variable, 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:

$$Y_{it} = \alpha + \beta \hat{S}_i + h(X_i) + \mathbb{1}_{2011} + \mu_i \quad (2.2)$$

$Y_{it}$  is the set of outcomes related to physicians' provision of care (all variables are in logarithms).  $g(x)$  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 ( $\beta$ ) 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 (2.1) and (2.2) are estimated using a local-non parametric approach with a triangular kernel and first-order polynomial (Calonico et al., 2014). We also estimated  $\beta$  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<sup>8</sup> (Lee and Card, 2008). However, Kolesár and Rothe [2018] have shown that this method does not guard against model misspecification and that confidence intervals have poor coverage properties. They recommend against clustering by the running variable in practice. To follow this recommendation, we estimate heteroskedasticity-robust standard errors clustered at the individual level (physicians are observed twice in the data).

Choosing the bandwidth used to estimate equations (2.1) and (2.2) 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 all specialties and show, in the appendix, that our results are robust to changes in these bandwidths. The choice of the bandwidths comes from the graphical analysis of Figure 2.1 (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<sup>9</sup>.

<sup>8</sup>This is what is done in Coudin et al. [2015].

<sup>9</sup>This method leads to an optimal bandwidth for each specific outcome considered. To harmonize the results, we chose a similar bandwidth of 6 years for all outcomes and all specialties, which corresponds to the most frequent

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 before 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  $X$ , must be continuous in the first trimester of 1990. Because this hypothesis is not testable, we first checked that variables related to the outcomes but determined before the reform (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’s life expectancy at birth and mortality rate<sup>10</sup>) were continuously distributed in 1990. This is the case, as shown in [Figures 2.B.1, 2.B.2 and 2.B.3](#) in [appendix B](#), and confirmed by regressions ([Table 2.B.1](#)). The continuity of physicians’ characteristics suggests that, even if there is an increase over time in the share of female physicians, of the age at PhD defense, or of the population health, there is no discontinuous change other than the probability to practice in sector 1 occurred in 1990 and might affect the outcomes.

Second,  $\beta_i$  and treatment status  $S_i(x)$  are assumed to be locally jointly independent of the year of the beginning of practice  $X_i$ . This condition implies that physicians do not have perfect control over the year and trimester they choose to start practice. In particular, it means that they cannot manipulate the threshold, and in that case, 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 before the reform ([Figure 2.B.4](#)). The number of physicians who start their practice every year is, however, not constant; as shown in [Figure 2.B.4](#), it is strongly linked to the number of medical graduates two years before, this number being the result of the “numerus clausus” imposed by the government at the end of the first year of medical education. We implement more formally the manipulation test when the running variable is discrete, proposed by [Frandsen \[2017\]](#) and cannot reject the continuity of the running variable for all specialties<sup>11</sup>. 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 of 1990. This is not the case, as reported in [Table 2.B.2](#). For all specialties, the age at practice set up did not decrease (it even

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bandwidth selected by the methodology of [Calonico et al. \[2014\]](#).

<sup>10</sup>These last three variables are defined at the physician’s year and region of PhD defense.

<sup>11</sup>To 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.

increased a little for technical specialties), and neither did the number of years before establishing a practice. Figure 2.B.5 also shows graphically that there is continuity around the threshold for these variables. All these checks confirm that we do not have evidence of manipulation.

## 5 Results

### 5.1 Main Results

#### 5.1.1 First stage results

First stage regression results (estimation of equation (2.1)) are reported in Table 2.2, separately for the different specialties, using a bandwidth of 6 years around the first trimester 1990 for all specialties. For each specialty, the first columns ((1), (3) and (5)) report estimates obtained using a linear function of the trimester-year of practice establishment, while the second ((2), (4) and (6)) report estimates obtained using a local linear regression with a triangular kernel. As expected (see Figure 2.1), 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 likelihood 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 we do not have a weak instrument. When we split the sample per specialty (Table 2.D.1 in appendix D), we see that, among technical specialties, dermatologists react much stronger than ENT physicians (+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 (2.2)) are reported in Table 2.3, again for the three grouped specialties, using either a linear function (columns (1), (3) and (5)) or a local linear function with a triangular kernel (columns (2), (4) and (6)) of the trimester-year of practice establishment and a bandwidth of 6 years around the threshold. 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, i.e., the number of procedures decomposed into clinical and technical procedures and the number of patients; iii) total annual fees of physicians. All these variables are taken in logarithms<sup>12</sup>. Table 2.3 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 2.2) 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 on results for dermatologists and ENT physicians (Table 2.3), grouped into “technical specialists”. Contrary to medical specialists, they have the possibility to combine

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<sup>12</sup>This choice results from comparing the skewness and kurtosis values of all these variables, taken in logarithms or not.

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 of overbilling patients, the average price of procedures is 46% lower than the one they would face as sector 2 physicians. This huge price decrease is higher for technical procedures (-64% to -66%) than for clinical ones (-50%). Physicians strongly react to this price decrease by increasing their number of acts (+36 to +42%). This increase in activity is only due to the rise in the total number of technical procedures: +66 to +77%; 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 the physician makes a technical procedure, the NHI only charges the price of the technical procedure. Therefore, the interpretation of our result is that physicians constrained to set regulated prices perform the same number of consultations without any technical act as they would in sector 2, but increase the number of consultations that include a technical act.

These technical procedures can be divided into two categories: non-surgical and surgical procedures. 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), verruca removal, the use of a laser to remove superficial skin lesions that do not need a complete excision, and a skin cancer screening using a dermoscopy to distinguish between a normal mole and a melanoma. In addition, most surgical procedures are performed after a non-surgical one (detection) in a following consult. Therefore, physicians have strong incentives to increase their number of non-surgical procedures to raise their number of surgical procedures later. Indeed, we observe (Table 2.D.2) that dermatologists constrained to charge regulated prices increased both kinds of technical procedures. Still, they increased the number of non-surgical ones by a higher amount (89 to 105%, compared to 66-71% for non-surgical ones). ENT physicians only perform non-surgical acts (for example, audiometric tonal and vocal testing and endoscopy of the nasal cavity...). However, they strongly increased their technical procedures (+89 to 122%). All these results are robust whatever the bandwidth (see Tables 2.E.1, 2.E.4 and 2.E.5 in appendix E) and the use of control variables (see Table 2.E.8).

This greater activity could reflect a previous rationing of demand, due to financial constraints: because they charge patients lower fees, compliers may face greater demand than the one they would have in sector 2. Using the estimates presented in Table 2.3, additional calculations show that 75% of the increase in total activity is due to the rise 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<sup>13</sup>. Regulated fees, therefore, increased physicians' accessibility. However, only 48% of the increased number of technical procedures is due to the increased number of patients; 52% of these acts are therefore not justified and probably due to strategic behaviors of physicians to compensate for their reduced fees<sup>14</sup>.

<sup>13</sup>Technical specialists provide 1,473 more acts  $[(\exp(0.36)-1)*3,399=1,473]$  than they would in sector 2 (3,399 being the average number of acts of technical specialists practicing in sector 2 in 1989). They also treat 743 more patients  $[(\exp(0.28)-1)*2,301=743]$ . Given that they perform 1.5 act per patient, the increase in activity only due to the follow-up of new patients should be 1,114 more acts, i.e., 75% of their total increase in activity.

<sup>14</sup>Given that technical specialists perform on average 0.53 technical procedures per patient, they should provide

Table 2.4 investigates whether this increase in procedures, especially in technical procedures, could be due to changes in patients' characteristics. This is not the case: the share of patients with chronic diseases, the percentage of low-income patients, and the structure per age of the patients are not significantly different from the one they would have under unregulated fees. However, Table 2.4 also shows that the increase in the number of patients can be due to the combined effect of i) their lower prices; ii) their choice of location in areas where medical density, hence competition (either from sector 1 or sector 2 physicians) is lower.

Overall, dermatologists and ENT physicians constrained to charge regulated fees because of the reform perform more acts, primarily 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 52% of the increased number of technical acts are not justified by the increased number of patients. It may be a sign of supply-induced demand, with physicians reacting strongly to income effects. Note that the duration of consultations or the total work duration of the physicians is not available in our administrative data. Therefore, technical specialists who increased their number of acts either increased their total work duration (keeping constant the time of each consultation) or maintained it (by decreasing the length of each consultation). This distinction does not matter for our analysis. What matters more is the total number of acts that can be delivered to the population (i.e., the amount of care provided by more sector 1 instead of sector 2 physicians) and not the total number of hours they work.

### 5.1.3 Medical specialties

Results concerning the two medical specialties, pediatricians and psychiatrists, are presented in Table 2.3. Contrary to technical specialists, their activity is only composed of clinical acts (consultations): they have less latitude in the composition of their activity. Medical specialists constrained to charge regulated prices face a 33 to 38% decrease in their prices, i.e., a smaller drop than technical specialists. 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 they do not see more patients. Overall, this non-significant variation in their level of activity, combined with lower prices, led physicians constrained to practice in sector 1 because of the reform to earn significantly less than if they had practiced in sector 2 (fees are 38% to 54% lower). Results using different bandwidths (see Tables 2.E.2, 2.E.6 and 2.E.7) or using control variables (Table 2.E.8) confirm these results.

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 specialties, it was the case for 57% of ENT physicians and 45% of dermatologists (DREES, 2019). Medical specialists compliers are, therefore, more likely than technical specialists compliers 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 2.4). Sector 2 medical specialists practicing in the same

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743\*0.53=394 more technical acts. However, the number of technical acts increased by  $(\exp(0.67)-1)*1224=820$ .



area as the compliers may have adapted their practice to the ones of sector 1 physicians over the years. Hence, in 2011, no difference was observed in the compliers' care provision, contrary to what they would have done in sector 2. This long-term effect needs to be investigated in more detail; this will be done in the next section. Another interpretation could be that pediatricians and psychiatrists have specific intrinsic characteristics that make them choose these specialties, which are among the lowest-paid ones. Given that the characteristics of all specialties (especially the level of income) are standard information for students in medicine when they choose their specialty, they made a fully informed choice. This means that, on average, they have less interest in monetary considerations than other doctors, hence their absence of any strategic response to price regulation.

#### 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 for the year 2008, and with a slightly different methodology<sup>15</sup>. We find that the decrease in prices (-36%) is compensated by a higher number of consultations (+47 to +55%)<sup>16</sup>. They also see more patients (+36 to +38%). 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. Suppose we perform the same kind of calculations as for technical specialties. In that case, we show that 67% of the additional activity is devoted to new patients, hence demonstrating the greater accessibility of sector 1 physicians for the population again<sup>17</sup>. This is a strong result given the key role of GPs - as "gatekeepers" - for the organization of ambulatory care in France. The remaining 27% of this increased activity could reflect, as for technical specialists, some supply-induced demand, i.e., an increase in the number of procedures devoted to regular patients, not necessarily justified in terms of health gains.

One potential explanation for the supply-demand behavior of GPs 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 2.4](#)). In addition, contrary to specialists, part of their reaction regarding the provision of care may be explained by the higher degree of competition they face. As they are paid under a FFS scheme, their fees are strongly related to the number of acts they perform and, therefore, to the degree of competition they are exposed to.

## 5.2 Robustness checks

We perform several robustness checks in order to test the validity of our results.

First, as already mentioned, we estimate our models using larger and smaller bandwidths, and

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<sup>15</sup>First, standard errors are clustered by the year of the beginning of practice, which has now been criticized by [Kolesár and Rothe \[2018\]](#). Second, the running variable is the year of the beginning of practice, not the trimester year as we use it. And third,  $g(x)$  and  $h(x)$  are only linear functions of the year of practice establishment and not local linear functions using a triangular kernel.

<sup>16</sup>[Coudin et al. \[2015\]](#) found that GPs increase their number of clinical procedures by 61%.

<sup>17</sup>GPs 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). They treat  $(\exp(0.36)-1)*1290=558$  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 1453 acts, i.e., 67% of their total increase in activity.

point estimates and standard errors are very stable. Results can be found in appendix E (Tables 2.E.1 to 2.E.7).

Second, we include control variables defined prior to the reform in our regressions (being a woman, being married and the number of children). Results are presented in Table 2.E.8 in the appendix. Since covariates are continuous around the date of reform, including those variables does not change our point estimates, but they are more precise.

Third, we run the estimates using only wave 2008 or wave 2011<sup>18</sup>. For GPs, this test using wave 2008 only is essential in order to check whether the CAPI influences our estimates. Indeed, the CAPI was implemented in 2009 for sector 1 and sector 2 GPs. Therefore, their provision of care, observed in 2011, may be influenced by the introduction of this payment for performance. However, our results are very stable when they are obtained in one year instead of two - apart from being sometimes less significant due to the small sample size (especially for specialists).

Fourth, we perform a falsification test where we arbitrarily modify the reform date: instead of the first trimester of 1990, we consider several hypothetical dates for the reform: the first trimester of 1986, 1988, 1992 and 1994. Results are presented in appendix F (Tables 2.F.1, 2.F.2 and 2.F.3). As expected, we do not observe any discontinuity in the probability to choose a sector 1 contract at these years nor any impact of the sector on the different outcomes. This confirms that the effects we obtain can be attributed to the sole effect of price regulation for physicians who started their practice around the 90s.

Finally, and more importantly, the “sector 2 freeze reform” was implemented in 1990, but physicians who started their practice around 1990 are, in our data, observed in 2008 and 2011, i.e., about 20 years later. We are, therefore, far away from the reform and physicians’ behavior followed in 2008 and 2011 may be affected by the evolution of the market for health care: the increase in the share of sector 2 specialists and the decrease in share of sector 2 GPs over the years, or the reduction in medical density may change the competition faced by physicians. But, in return, they have gradually modified their provision of care so that the effects we measure for 2008-2011 are very different from those we could obtain if we observed physicians around the years of the reform.

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 around the date of the reform<sup>19</sup>. The 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 2.5. 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 the years of the reform. Still, we come to the same conclusion: these specialists

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<sup>18</sup>Results are not presented but are available upon request.

<sup>19</sup>This panel is a 10% random sample of all self-employed physicians practicing in France between 1979 and 1993, produced by the NHI. It can not be used for the principal 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 their career.

increased their total number of procedures but only the technical ones. Overall, combined with the decrease in fees, they do not earn more than they would have under unregulated fees. In the same way, compliers GPs work more, with no significant differences in fees.

The estimated long-run effects are consistent with short-run effects, even if they are lower, meaning that physicians probably adapted their behavior over the years to changes in medical density and the share of sector 2 physicians.

Table 2.2: First stage estimates for practicing in Sector 1

	TECHNICAL SPECIALISTS		MEDICAL SPECIALISTS		GENERAL PRACTITIONERS	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{X \geq 1990}$	0.337*** (0.034)	0.375*** (0.037)	0.220*** (0.024)	0.244*** (0.026)	0.151*** (0.007)	0.151*** (0.007)
<i>F-stat</i>	93.80		80.49		454.29	
<i>Nb. of obs</i>	4,685		6,506		43,323	

*Notes:*  $\mathbb{1}_{X \geq 1990}$  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 around the reform. 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

Table 2.3: RD estimates

Outcomes (in log)	TECHNICAL SPECIALISTS		MEDICAL SPECIALISTS		GENERAL PRACTITIONERS	
	(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.)
<b>Price of procedures</b>						
Average price of procedures (€)	-0.459*** (0.059)	-0.462*** (0.059)	-0.335*** (0.062)	-0.383*** (0.061)	-0.369*** (0.036)	-0.357*** (0.041)
<i>Mean outcome for non treated</i>		58.20		64.21		44.61
Average price of clinical procedures (€)	-0.504*** (0.045)	-0.495*** (0.046)	-0.462*** (0.072)	-0.532*** (0.071)	-0.432*** (0.019)	-0.440*** (0.021)
<i>Mean outcome for non treated</i>		50.17		62.20		39.02
Average price of technical procedures (€)	-0.641*** (0.094)	-0.663*** (0.094)	-	-	-	-
<i>Mean outcome for non treated</i>		67.35		-		-
<b>Annual provision of care</b>						
Nb. of procedures	0.419*** (0.125)	0.362*** (0.122)	-0.229 (0.220)	-0.009 (0.212)	0.483*** (0.105)	0.464*** (0.118)
<i>Mean outcome for non treated</i>		3600		2897		3561
Nb. of clinical procedures	0.277 (0.195)	0.337* (0.194)	-0.203 (0.225)	0.004 (0.217)	0.553*** (0.153)	0.476*** (0.174)
<i>Mean outcome for non treated</i>		2291		2848		3023
Nb. of technical procedures	0.771*** (0.276)	0.663** (0.274)	-	-	-	-
<i>Mean outcome for non treated</i>		1308				
Nb. of non surgical procedures	0.793** (0.359)	0.507 (0.353)	-	-	-	-
<i>Mean outcome for non treated</i>		1035				
Nb. of surgical procedures	0.721** (0.307)	0.812*** (0.310)	-	-	-	-
<i>Mean outcome for non treated</i>		251				
Nb. of patients	0.286** (0.114)	0.279** (0.114)	-0.539 (0.338)	-0.181 (0.336)	0.377*** (0.097)	0.358*** (0.109)
<i>Mean outcome for non treated</i>		2419		767		1353
<b>Annual fees</b>						
Total fees (€)	-0.040 (0.131)	-0.100 (0.128)	-0.564*** (0.197)	-0.392** (0.190)	0.114 (0.098)	0.108 (0.111)
<i>Mean outcome for non treated</i>		196 350		171 038		147 622
Nb. of observations (max)	4,685		6,506		43,323	
Nb. of observations (min)	4,274		6,232		41,922	

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 around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset

Table 2.4: 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.)
<b>Patients' characteristics</b>						
Share of patients with chronic disease	0.240 (1.046)	-0.140 (1.069)	1.276 (4.260)	-1.727 (4.248)	1.824 (1.124)	1.102 (1.281)
<i>Mean outcome for non treated</i>	13.01		12.00		14.34	
Share of CMUC-C beneficiaries	-0.003 (0.976)	0.004 (0.980)	-0.526 (1.429)	0.025 (1.392)	1.596 (1.268)	1.491 (1.403)
<i>Mean outcome for non treated</i>	4.58		3.86		3.56	
Share of patients (age <16)	1.692 (1.789)	1.342 (1.735)	-17.684 (12.071)	-9.037 (12.230)	2.631* (1.374)	2.636* (1.536)
<i>Mean outcome for non treated</i>	16.70		37.32		13.92	
Share of patients (age >65)	1.622 (1.805)	0.608 (1.851)	0.313 (2.170)	-0.467 (2.153)	0.943 (1.643)	-0.053 (1.850)
<i>Mean outcome for non treated</i>	19.34		4.93		18.78	
<b>Location at <i>département</i> level</b>						
Medical density for 10K inhabitants	-0.439*** (0.093)	-0.467*** (0.093)	-0.948* (0.543)	-1.211** (0.543)	0.232 (0.246)	0.264 (0.278)
<i>Mean outcome for non treated</i>	1.09		3.11		8.74	
Share of sector 2 physicians	-18.258*** (4.611)	-16.910*** (4.561)	-14.888*** (5.133)	-16.658*** (5.045)	-4.314*** (1.552)	-4.897*** (1.744)
<i>Mean outcome for non treated</i>	61.68		44.28		18.72	
Share of sector 2 physicians (controlling for medical density)	0.918 (2.637)	0.612 (2.580)	-4.301 (3.044)	-3.420 (3.508)	-0.378 (0.247)	-0.559** (0.281)
<b>Type of activity</b>						
Full-time self-employed	27.080*** (9.956)	39.248*** (9.755)	1.985 (14.813)	15.389 (14.706)	-1.334 (4.707)	3.934 (5.302)
<i>Mean outcome for non treated</i>	53.25		41.48		85.58	
Nb. of observations (max)	4,685		6,506		43,323	
Nb. of observations (min)	4,602		6,385		42,676	

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. For one outcome (share of sector 2 physicians), regressions are performed with control variables (medical density in sector 1 and 2 at the *département* level). For others, no control variables were added in the regressions. 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 around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset

Table 2.5: RD estimates - physicians' behavior around year 1990

	<i>Technical specialists</i>	<i>Medical specialists</i>	<i>General Practitioners</i>
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
<b>First-stage estimation</b>			
$\mathbb{1}_{X \geq 1990}$	0.207*** (0.055)	0.107** (0.053)	0.140*** (0.022)
F-stat	14.17	4.01	40.15
<b>Outcomes (in log)</b>			
<b>Annual provision of care</b>			
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)	- -	- -
<b>Annual fees (in log)</b>			
Total fees (€)	2.191*** (0.788)	3.572* (2.082)	-0.085 (0.329)
Nb. of observations	1,157	775	3,507

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 Discussion and Conclusion

The “Sector-2 freeze” reform constrained some physicians who started their practice after the first trimester of 1990 to charge regulated fees. These fees are much lower than those set 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 increased access to care for the population and/or to physicians’ strategic behaviors.

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, increasing 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 48% 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 signify supply-induced demand from these specialists who strongly react to income effects. *GPs* have similar reactions: being constrained to practice in sector 1 leads to an increase in their number of acts and patients so that their total fees do not decrease with lower prices (due to regulated fees). 67% of this increased activity can be explained by the increase in their number of patients, hence a sign of better accessibility to GPs for the population, mainly because they are “gatekeepers”. As for technical specialists, the remaining could be 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).

Several reasons could explain those different results. 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. There are also two specialties for whom GPs are (imperfect) substitutes: GPs often treat children in areas with a shortage of pediatricians, and GPs are often the first prescribers of psychotropic treatments instead of psychiatrists. Second, as they only perform consultations, they don’t have other “tools” to compensate lower prices. Compared to them, technical specialists have an activity that allows them to combine both types of acts (technical and medical). We saw in our results that they use this flexibility in reaction to the “sector-2 freeze” reform. Finally, GPs are particular because their flexibility does not rely on adding technical acts in their activity but more on treating additional patients that their “gatekeeper” status might have encouraged.

This reform was implemented by increasing the share of physicians practicing under regulated

fees to improve financial access to care for patients. Therefore, without any strategic reaction from physicians, this reform should reduce the amount patients pay without increasing the costs for the NHI. 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 the expenditures for the NHI. 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 the availability of care. On the supply side, total fees earned by physicians constrained to practice under regulated fees are similar to what they would earn in sector 2. However, this result comes at the expense of a greater workload. The NHI reimburses patients for each consultation based on a fixed price (the one charged by sector 1 physicians). The increased access to care leads to an increase in the number of fees reimbursed, as well as 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).

The regulator has two tools to ensure access to care to the population while meeting the high-income requirements of doctors: i) increase or decrease the number of physicians trained; ii) modify the prices of the different acts and relax/constrain the possibilities of overbilling. In our case, solution i), increasing the number of doctors trained to improve access to healthcare for the population, is not a solution. As shown by [Dormont and Samson \[2008\]](#), when the number of physicians increases, i.e., when competition among physicians increases, they adopt strategic behaviors to maintain their income levels (e.g., they induce demand). Solution ii) would consist in constraining the practice of overbilling. Unfortunately, the 1990 reform that banned the practice of overbilling can no longer be implemented nowadays. But the generalization of "OPTAM" (overbilling would be permitted to all doctors, with a maximum rate of overbilling not to be exceeded, and a fixed part of their activity performed at regulated prices), made compulsory (and not voluntary anymore) to all doctors, could be a middle way to avoid these strategic behaviors.

Our results have limited external validity because they are obtained on a particular population of physicians (only some specialties, now aged 45-50), and the reform is old. Moreover, physicians starting their careers today have very different characteristics and preferences than the ones we studied (they are more often women, young physicians have different aspirations concerning their labor-leisure trade-offs, etc.). Moreover, we evaluate the causal effect of the 1990 reform using data from 2008 and 2011: physicians' behavior 20 years after the reform has probably changed compared to what we would have evaluated in the near post-reform years. In particular, since the 90s, the share of sector 2 doctors has increased continuously, so that sector 1 physicians have probably adapted their practices to the local competition from more and more sector 2 physicians. Looking at data closer to the year of the reform, as is done in the robustness checks, is, therefore, necessary to better evaluate the amount of bias that affects our estimates.

However, this analysis allows us to give intuitions on physicians' (strategic) reactions in case of fee cuts. Another interesting approach would be to evaluate, symmetrically, the impact of the creation of sector 2 (in 1980): compliers (physicians who started their practice in sector 2 because of the reform but would have chosen sector 1 instead) could be analyzed to observe whether there

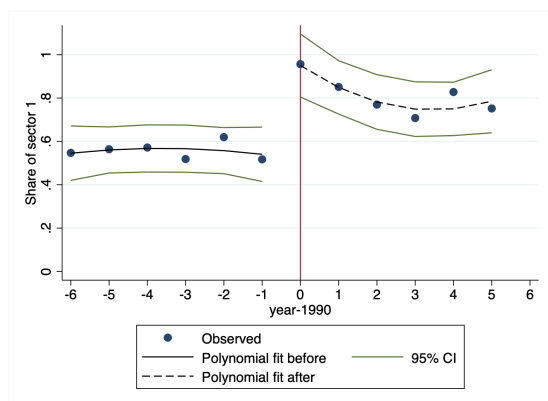


is any strategic behavior following the permission to overbill. Recently, new tools were introduced in France to encourage the reduction of overbilling: the NHI proposed a contract (to sector 1 and sector 2 physicians) where physicians agree not to exceed a specific rate of overbilling and receive a financial bonus as a reward for achieving these objectives. The purpose of chapter 3 is the evaluation of these new contracts.

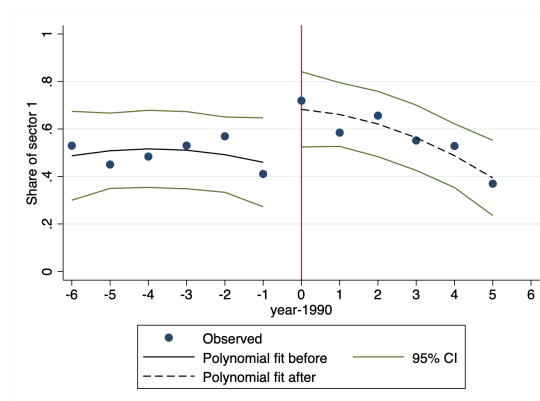
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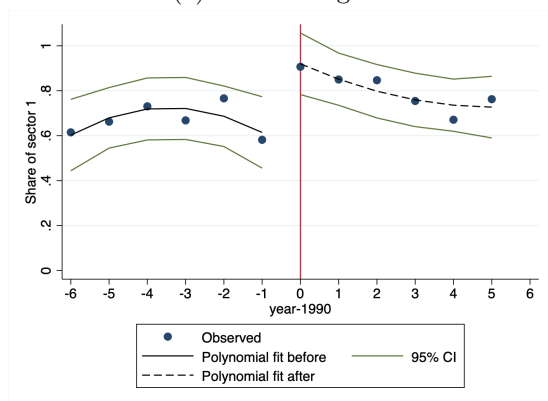
## A. Data: Choice of the different specialties and sample used for the estimates



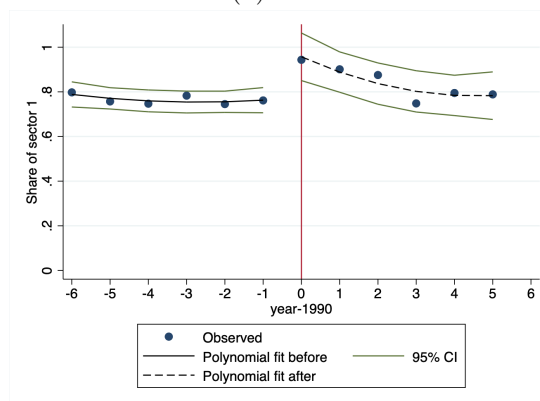
(a) Dermatologists



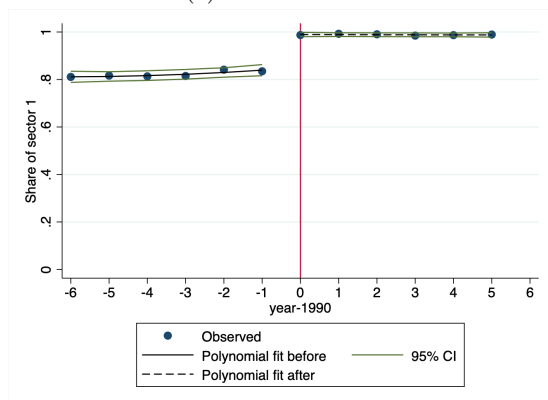
(b) ORL



(c) Pediatricians



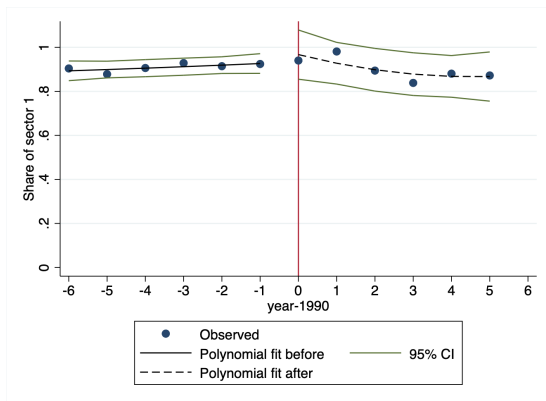
(d) Psychiatrists



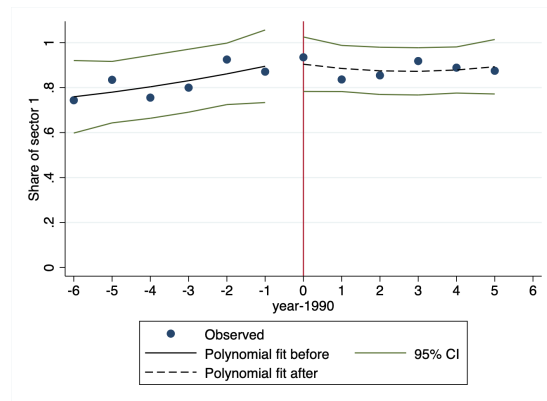
(e) General Practitioners

Source: Insee-CNAM-DGFIP-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 2.A.1: Share of physicians joining sector 1 by year of practice set-up



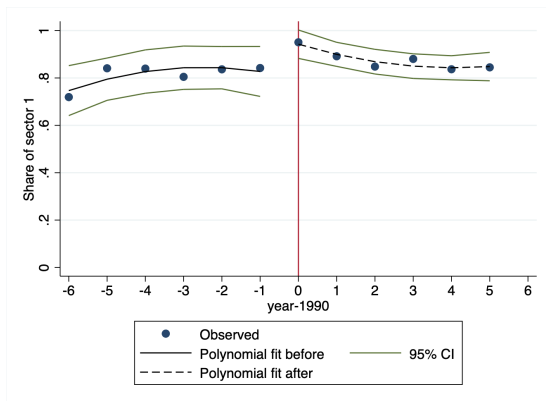
(a) Radiologists



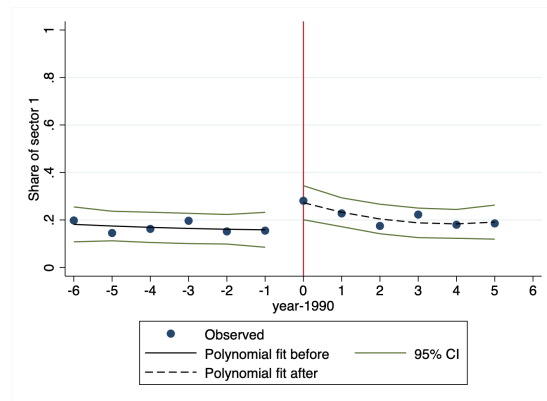
(b) Pulmonologists

Source: Insee-CNAM-DGFIP-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).

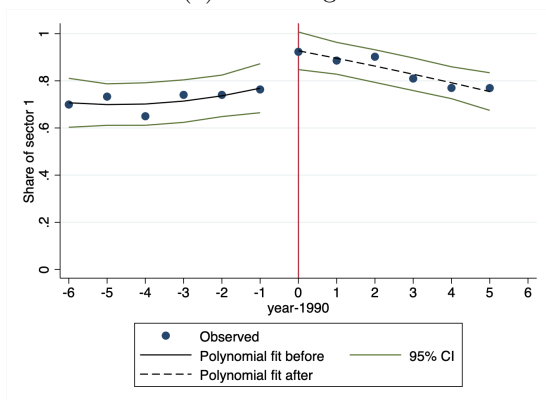
Figure 2.A.2: Share of physicians joining sector 1 by year of practice set-up - specialities that were not impacted by the sector 2 freezing reform



(a) Cardiologists



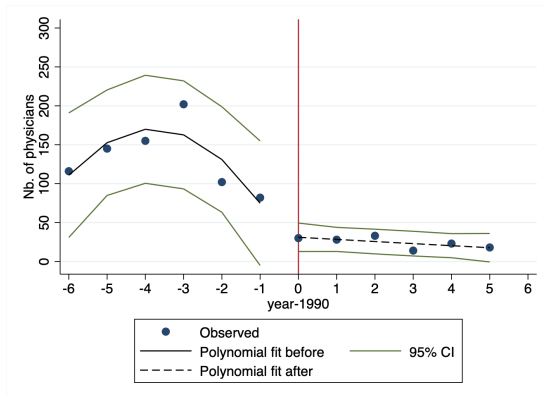
(b) Surgeons



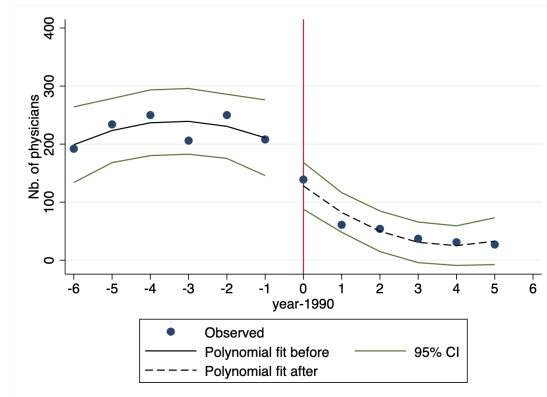
(c) Anesthetists

Source: Insee-CNAM-DGFIP-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 2.A.3: Share of physicians joining sector 1 by year of practice set-up - specialities with a small impact of the sector 2 freezing reform



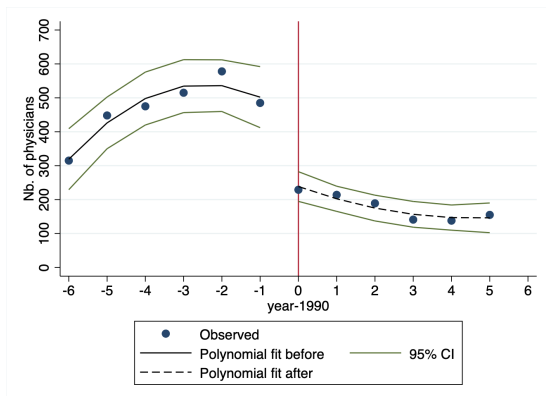
(a) Stomatologists



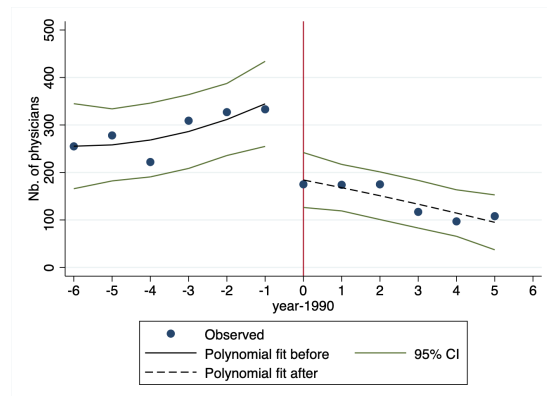
(b) Medical gynecologists

Source: Insee-CNAM-DGFIP-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 2.A.4: Number of physicians by year of practice set-up - specialities with not enough physicians



(a) Ophthalmologists



(b) Obstetricians gynecologists

Source: Insee-CNAM-DGFIP-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 2.A.5: Number of physicians by year of practice set-up - specialities who stopped practicing as self-employed

Table 2.A.1: Sample used for estimations

	DERMATOLOGISTS	ENTs	PEDIATRICIANS	PSYCHIATRISTS	GPs
<i>General informations</i>					
Total nb. of physicians	3,457	2,453	2,995	7,010	66,422
Share observed all period (%)	94	92	89	91	92
Total nb. of observations	6,484	4,457	5,379	12,774	121,643
<i>Sample after exclusion</i>					
Total nb. of physicians	2,822	1,852	2,254	4,946	58,437
Share oh physicians kept	82	76	75	71	88
Total nb. of observations	5,319	3,453	4,075	9,016	107,316
<i>Bandwidth : window of years around 1990</i>					
Bandwidth 6 : [1984;1995]					
Total nb. of physicians	1,532	910	988	2,404	22,475
Share observed only in 2011 (%)	0.9	2.1	2.0	2.0	1.9
Share of physicians in all observed	54.29	49.14	43.83	48.60	38.46

Source: Insee-CNAM-DGFIP-DREES dataset. Pooled observations for 2008 and 2011. We exclude physicians who were not matched with DGFIP dataset, who had not a contract with the NHI, who worked full-time in a private sector or in a hospital, who was 60 years old or older and retired, who had zero fees, zero prescriptions and zero acts performed.

Table 2.A.2: Descriptive statistics of care supply variables for Dermatologists and ENT physicians

DERMATOLOGISTS					
Outcome variables	Sector 1		Sector 2		T-test
	Mean	St. dev.	Mean	St. dev.	p-value
Price of procedures (€)	32.30	4.06	51.02	16.78	0.000***
Price of clinical procedures (€)	27.91	3.55	49.66	14.48	0.000***
Price of technical procedures (€)	30.06	10.20	51.63	27.18	0.000***
Nb. of procedures	4,429	2,013	3,589	1,840	0.000***
Nb. of clinical procedures	3,316	1,477	2,727	1362	0.000***
Nb. of technical procedures	1,113	952	862	785	0.000***
Nb. of non surgical procedures	730	705	534	568	0.000***
Nb. of surgical procedures	381	393	325	330	0.000***
Nb. of patients	2,881	1,230	2,496	1,271	0.000***
Total prescriptions (€)	99,868	60,686	93,109	82,506	0.011**
Overbilling rate (%)	3.45	7.13	79.50	59.92	0.000***
Total extra-fees (€)	3,687	6,337	66,755	42,932	0.000***
Total fees (€)	142,320	65,255	169,893	81,901	0.000***
Labor income (€)	80,450	49,930	84,046	54,965	0.074*
Charges (€)	61,870	43,434	85,848	63,935	0.000***
Total NHI reimbursements (€)	238,501	114,405	196,247	122,969	0.000***
Nb. of observations	1,916		1,008		
ENT PHYSICIANS					
Outcome variables	Sector 1		Sector 2		T-test
	Mean	St. dev.	Mean	St. dev.	p-value
Price of procedures (€)	44.29	10.12	69.61	41.75	0.000***
Price of clinical procedures (€)	31.90	6.82	50.09	14.78	0.000***
Price of technical procedures (€)	50.73	15.73	93.60	91.39	0.000***
Nb. of procedures	4,702	2,055	3,829	1,760	0.000***
Nb. of clinical procedures	1,784	1,099	1,705	1,008	0.118
Nb. of technical procedures	2,918	1,894	2,124	1,460	0.000***
Nb. of non surgical procedures	2,686	1,853	1,894	1,387	0.000***
Nb. of surgical procedures	170	228	185	203	0.145
Nb. of patients	2752	1,140	2,402	1,079	0.000***
Total prescriptions (€)	152,945	100,495	148,096	87,710	0.283
Overbilling rate (%)	1.85	5.85	59.60	58.35	0.000***
Total extra-fees (€)	3,322	11,415	80,882	73,309	0.000***
Total fees (€)	207,641	99,713	248,013	127,249	0.000***
Labor income (€)	102,213	60,536	116,906	83,092	0.000***
Charges (€)	105,428	55,834	131,107	68,947	0.000***
Total NHI reimbursements (€)	357,364	177,938	315,227	157,323	0.000***
Nb. of observations	928		833		

Notes: \*\*\*Statistically significant at the 1% level; \*\*significant at the 5% level; \*significant at the 10% level. Total extra-fees are included in total fees.

Pooled observations for 2008 and 2011. Statistics are for a bandwidth of 6 years around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset.

Table 2.A.3: Descriptive statistics of care supply variables for Pediatricians and Psychiatrists

PEDIATRICIANS					
Outcome variables	Sector 1		Sector 2		T-test
	Mean	St. dev.	Mean	St. dev.	p-value
Price of procedures (€)	34.01	7.88	51.52	14.58	0.000***
Price of clinical procedures (€)	25.72	3.16	46.87	13.21	0.000***
Nb. of procedures	4,166	1,923	3,811	1,617	0.000***
Nb. of clinical procedures	3,990	1,865	3,658	1,620	0.000***
Nb. of patients	,1606	786	1,602	682	0.917
Total prescriptions (€)	171,683	106,174	178,350	131,408	0.255
Overbilling rate (%)	2.26	8.26	78.44	47.99	0.000***
Total extra-fees (€)	2,352	9,819	74,776	46,757	0.000***
Total fees (€)	14,0943	69,765	190,901	84,447	0.000***
Labor income (€)	73,978	49,746	88,710	54,585	0.000***
Charges (€)	66,965	34,861	102,191	55,437	0.000***
Total NHI reimbursements (€)	310,274	157,974	294,475	158,769	0.053*
Nb. of observations	1,916		1,008		
PSYCHIATRISTS					
Outcome variables	Sector 1		Sector 2		T-test
	Mean	St. dev.	Mean	St. dev.	p-value
Price of procedures (€)	44.08	6.36	70.99	18.04	0.000***
Price of clinical procedures (€)	27.91	3.55	49.66	14.48	0.000***
Nb. of procedures	3,074	2,372	2,292	1,714	0.000***
Nb. of clinical procedures	3,059	2,350	2,285	1,710	0.000***
Nb. of patients	376	300	273	234	0.000***
Total prescriptions (€)	127,976	185,162	84,580	133,417	0.000***
Overbilling rate (%)	4.73	12.10	91.94	144.31	0.000***
Total extra-fees (€)	3,710	10,374	67,698	50,082	0.000***
Total fees (€)	127,603	82,337	153,432	96,072	0.000***
Labor income (€)	73,491	54,910	80,059	64,671	0.002***
Charges (€)	54,112	45,506	73,373	48,664	0.000***
Total NHI reimbursements (€)	251,869	246,373	170,314	180,097	0.000***
Nb. of observations	3,700		895		

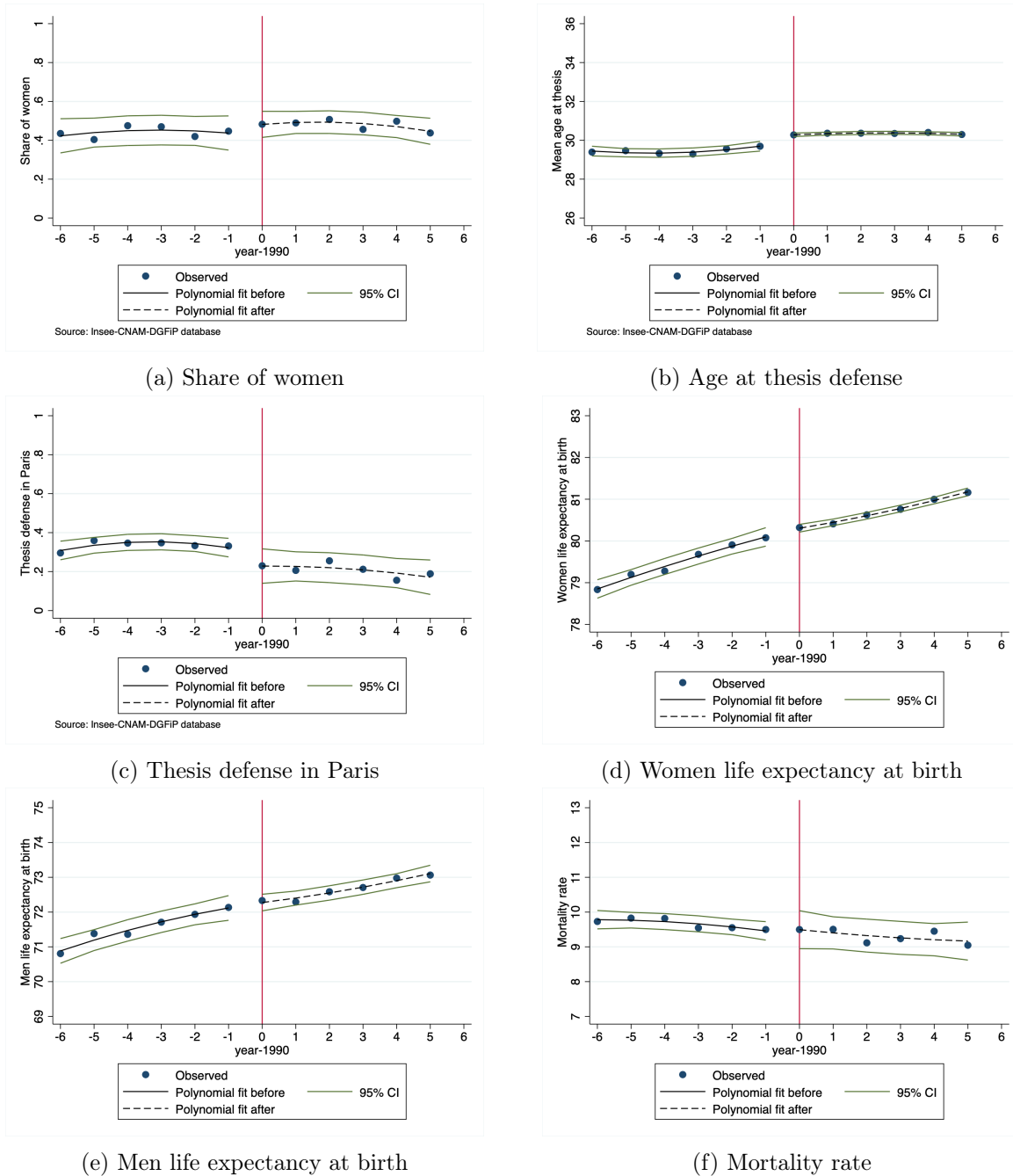
Notes: \*\*\*Statistically significant at the 1% level; \*\*significant at the 5% level; \*significant at the 10% level. Total extra-fees are included in total fees.

Pooled observations for 2008 and 2011. Statistics are for a bandwidth of 6 years around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset.

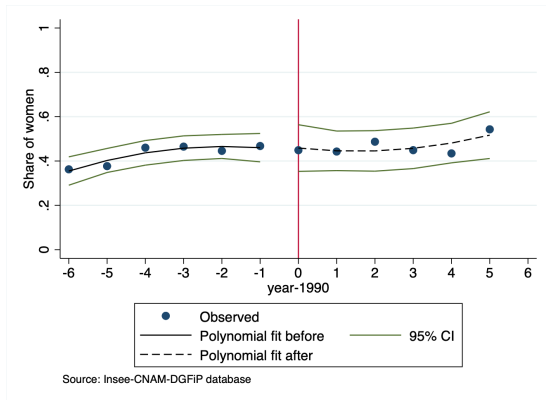


## B. Validity of the regression discontinuity set up

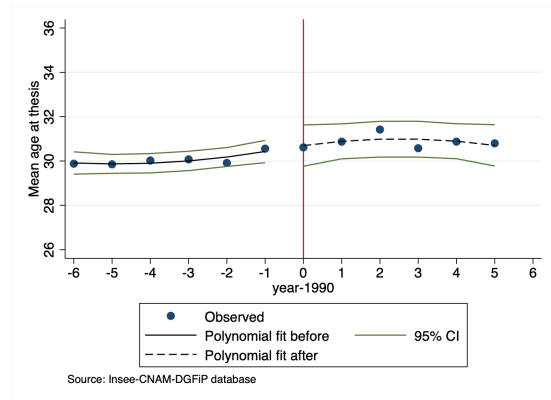


Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement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

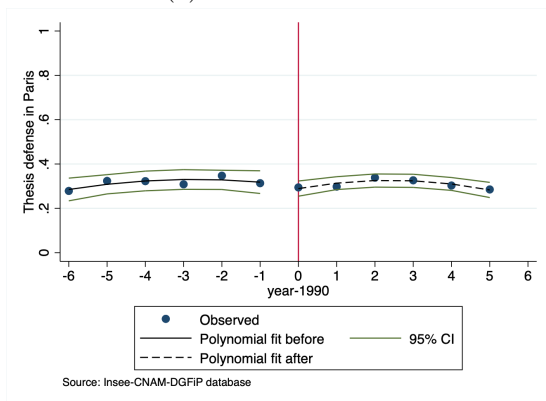
Figure 2.B.1: Continuity in the characteristics of technical specialists



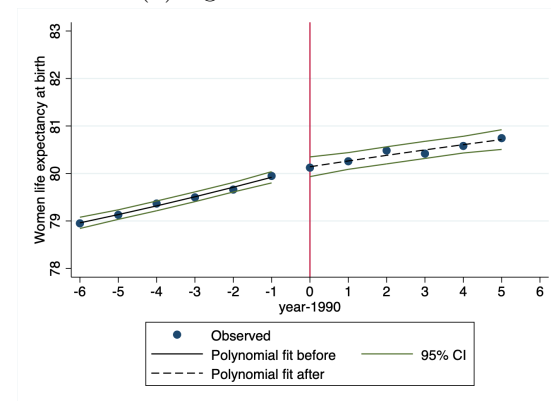
(a) Share of women



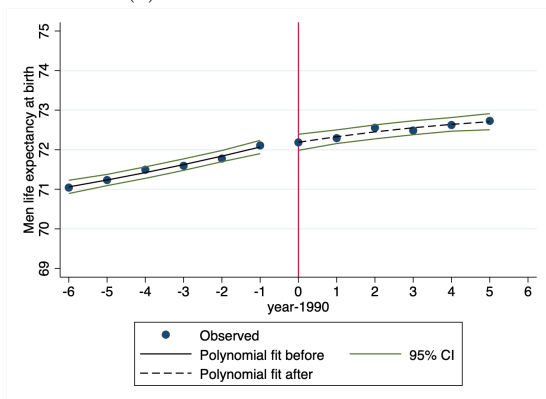
(b) Age at thesis defense



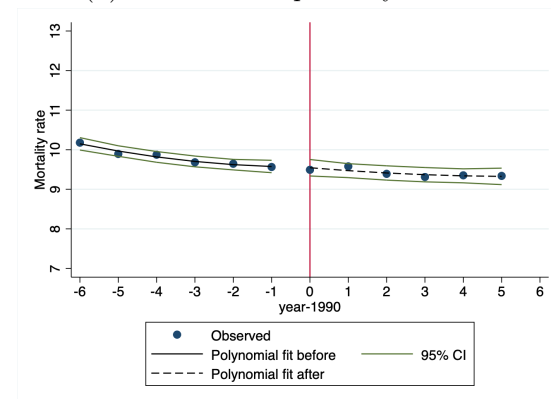
(c) Thesis defense in Paris



(d) Women life expectancy at birth



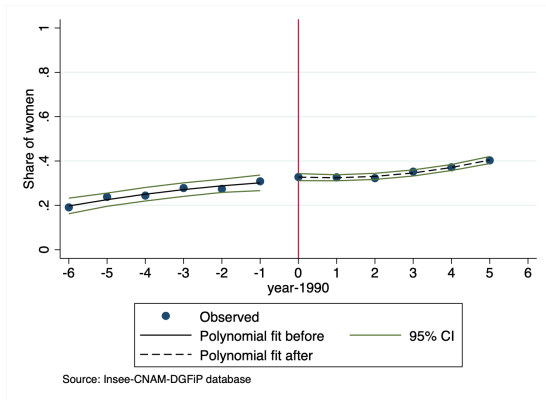
(e) Men life expectancy at birth



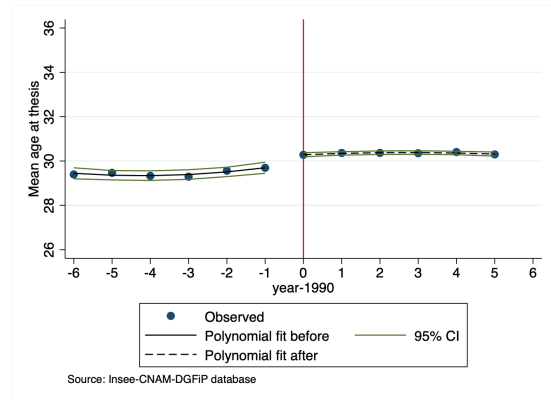
(f) Mortality rate

Source: Insee-CNAM-DGFIP-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).

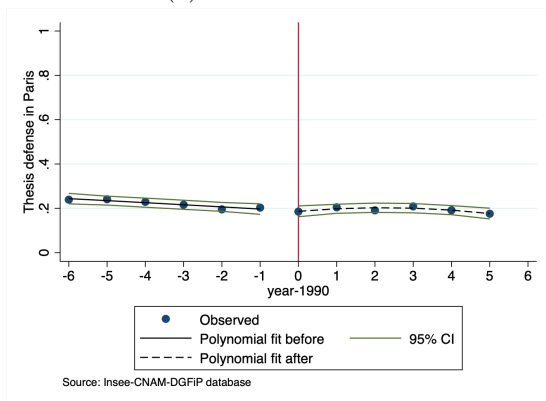
Figure 2.B.2: Continuity in the characteristics of medical specialists



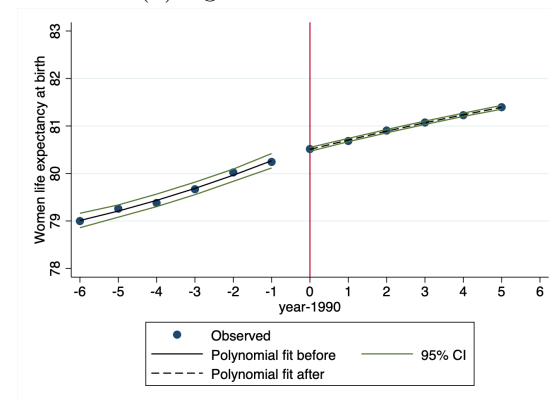
(a) Share of women



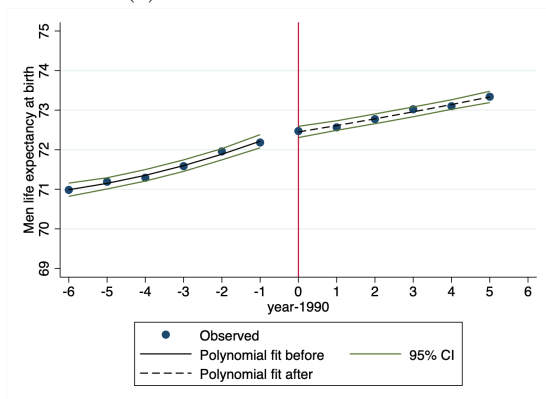
(b) Age at thesis defense



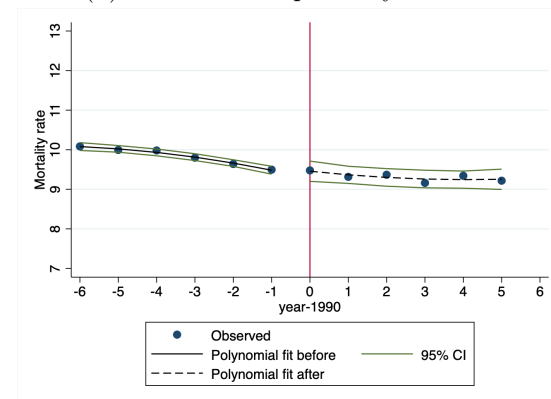
(c) Thesis defense in Paris



(d) Women life expectancy at birth



(e) Men life expectancy at birth



(f) Mortality rate

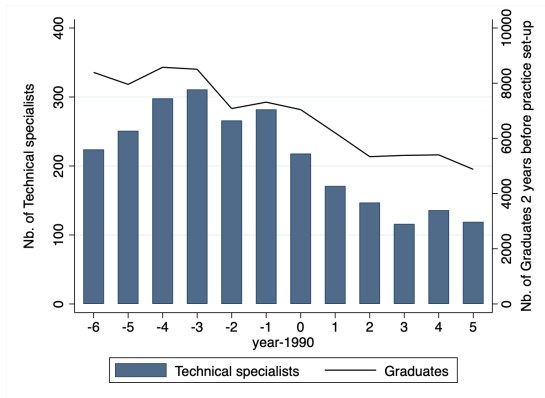
Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement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

Figure 2.B.3: Continuity in the characteristics of General Practitioners

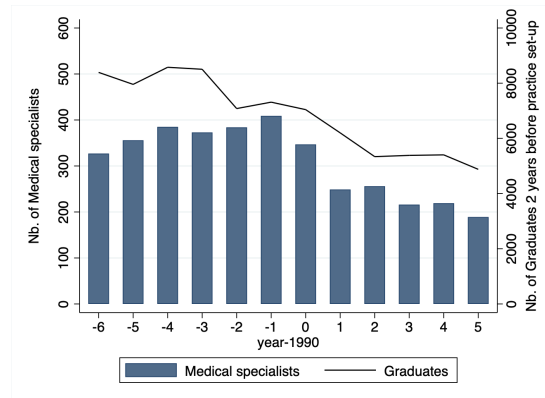
Table 2.B.1: RD estimates of physicians' characteristics

	TECHNICAL SPECIALISTS		MEDICAL SPECIALISTS		GENERAL PRACTITIONERS	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Female (0/1)</b>						
$\mathbb{1}_{X \geq 1990}$	0.043 (0.058)	0.039 (0.045)	0.008 (0.047)	-0.025 (0.037)	0.016 (0.018)	0.003 (0.014)
Constant	0.438*** (0.043)		0.461*** (0.036)		0.314*** (0.013)	
<b>Age at thesis defense</b>						
$\mathbb{1}_{X \geq 1990}$	0.338 (0.275)	0.517** (0.211)	0.026 (0.291)	0.202 (0.226)	-0.092 (0.099)	-0.039 (0.076)
Constant	29.917*** (0.200)		30.603*** (0.217)		29.589*** (0.073)	
<b>Thesis defense in Paris (0/1)</b>						
$\mathbb{1}_{X \geq 1990}$	-0.078 (0.052)	-0.104*** (0.039)	-0.053 (0.043)	-0.059* (0.033)	-0.019 (0.015)	-0.012 (0.012)
Constant	0.293*** (0.041)		0.308*** (0.034)		0.197*** (0.012)	
<b>Women life expectancy at birth<sup>(1)</sup></b>						
$\mathbb{1}_{X \geq 1990}$	-0.016 (0.124)	-0.024 (0.096)	0.059 (0.097)	0.071 (0.077)	-0.027 (0.041)	0.029 (0.031)
Constant	80.263*** (0.092)		80.071*** (0.072)		80.474*** (0.031)	
<b>Men life expectancy at birth<sup>(1)</sup></b>						
$\mathbb{1}_{X \geq 1990}$	-0.031 (0.168)	-0.072 (0.130)	-0.080 (0.125)	-0.040 (0.098)	-0.055 (0.057)	0.025 (0.044)
Constant	72.260*** (0.123)		72.243*** (0.093)		72.455*** (0.044)	
<b>Mortality rate<sup>(1)</sup></b>						
$\mathbb{1}_{X \geq 1990}$	0.168 (0.179)	0.128 (0.140)	0.100 (0.149)	0.117 (0.117)	0.171*** (0.063)	0.099** (0.048)
Constant	9.363*** (0.131)		9.462*** (0.107)		9.331*** (0.048)	
Nb. of observations	4,685		6,506		43,323	

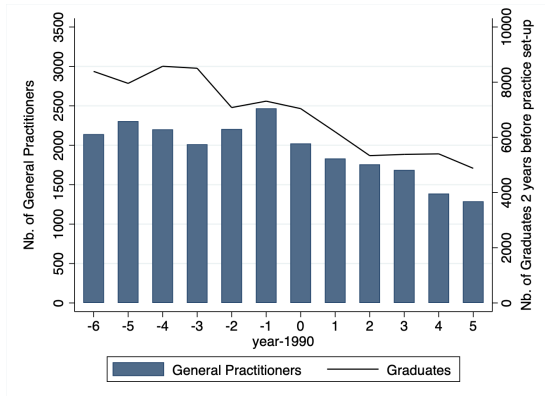
Note: Standard errors are clustered at the individual level. \*\*\*Statistically significant at the 1% level; \*\*significant at the 5% level; \*significant at the 10% level.  $(X_i - 1990)\mathbb{1}_{X < 1990}$  is a binary variable indicating the physician's set up practice after the reform (1990). (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 around the reform for technical specialists, medical specialists and GPs  
Source: Insee-CNAM-DGFIP-DREES dataset



(a) Technical specialists



(b) Medical specialists



(c) General Practitioners

Source: Insee-CNAM-DGFIP-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).

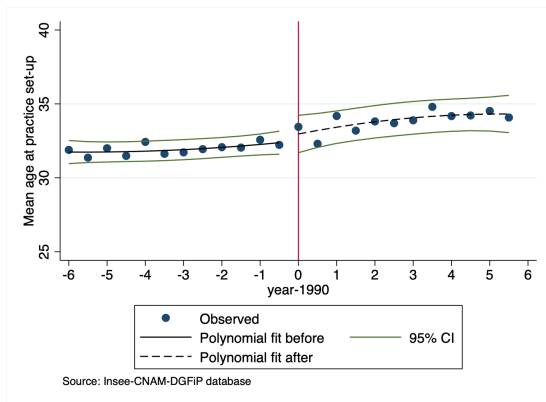
Figure 2.B.4: Number of physicians per year of practice beginning and number of graduates 2 years before

Table 2.B.2: RD estimates of physicians' characteristics - check for manipulation

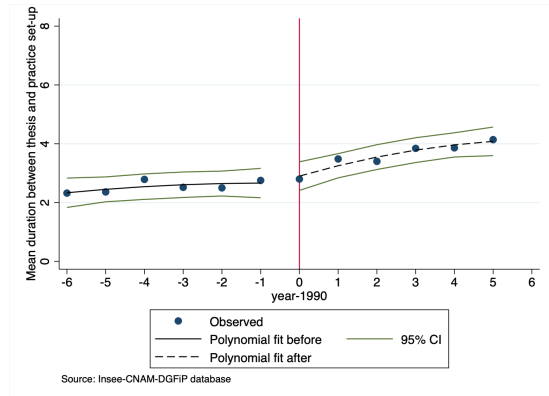
	TECHNICAL SPECIALISTS		MEDICAL SPECIALISTS		GENERAL PRACTITIONERS	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Dependant variable</b>						
	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)	Coefficient (Std. Err.)
<b>Age at practice set-up</b>						
$\mathbb{1}_{X \geq 1990}$	0.567* (0.315)	0.773*** (0.245)	0.081 (0.302)	0.310 (0.236)	0.027 (0.117)	-0.044 (0.090)
Constant	32.475*** (0.217)		34.482*** (0.212)		31.413*** (0.087)	
<b>Years between thesis defense and practice set-up</b>						
$\mathbb{1}_{X \geq 1990}$	0.226 (0.322)	0.250 (0.246)	0.054 (0.317)	0.108 (0.247)	0.110 (0.101)	-0.012 (0.078)
Constant	2.558*** (0.235)		3.879*** (0.220)		1.826*** (0.075)	
Nb. of observations	4,685		6,506		43,323	

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 around the reform for Technical specialists, Medical specialists and GPs.

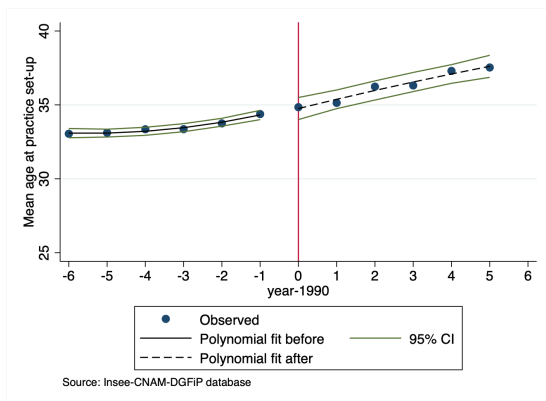
Source: Insee-CNAM-DGFIP-DREES dataset



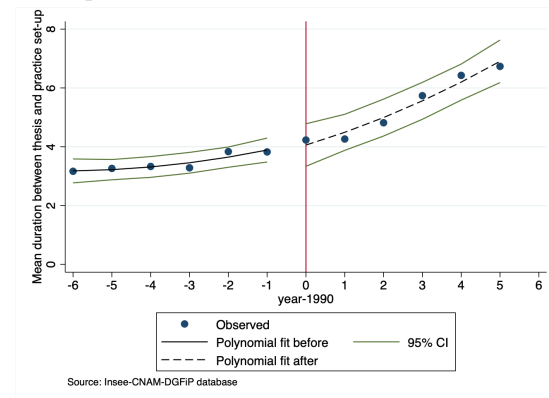
(a) Technical: age at practice set up



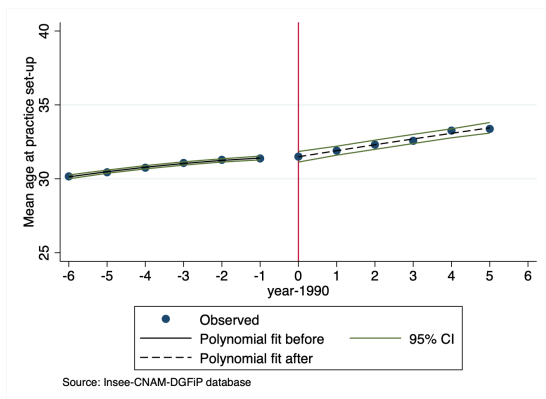
(b) Technical: years between thesis defense and practice set-up



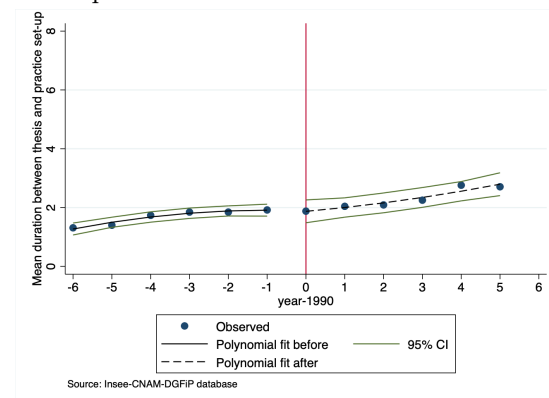
(c) Medical: age at practice set up



(d) Medical: years between thesis defense and practice set-up



(e) GPs: age at practice set up

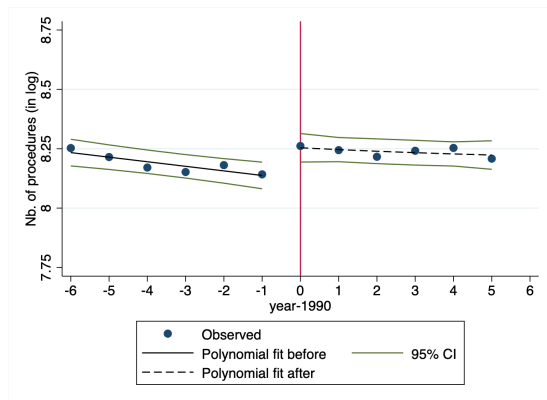


(f) GPs: years between thesis defense and practice set-up

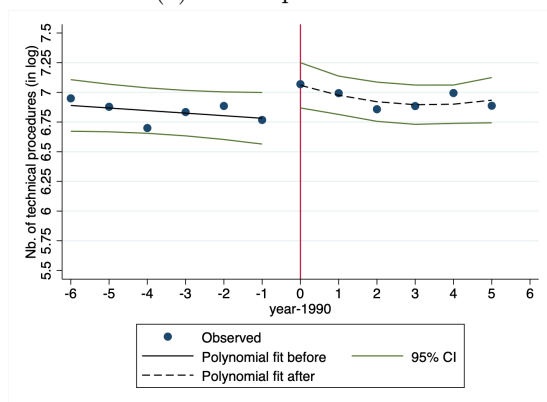
Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1995. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement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

Figure 2.B.5: Continuity in the characteristics - check for manipulation

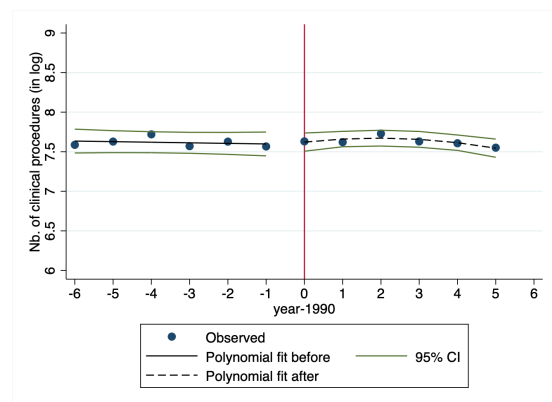
## C. RD estimates with 95% confidence intervals



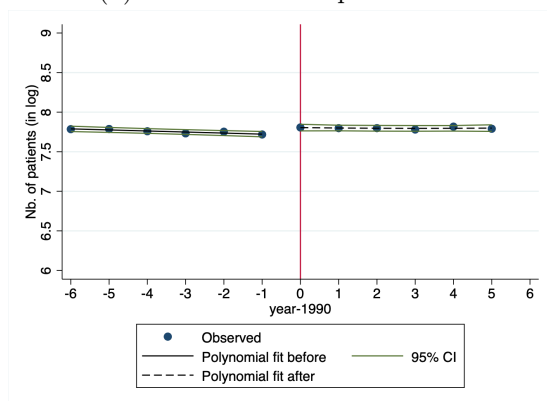
(a) Nb. of procedures



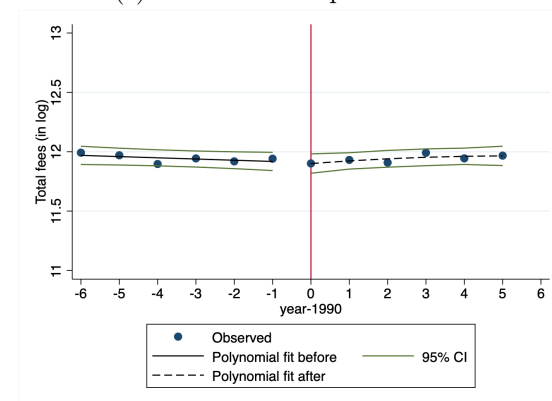
(b) Nb. of technical procedures



(c) Nb. of clinical procedures



(d) Nb. of patients

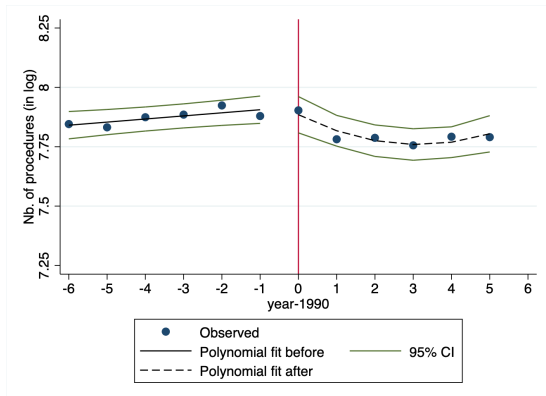


(e) Total fees

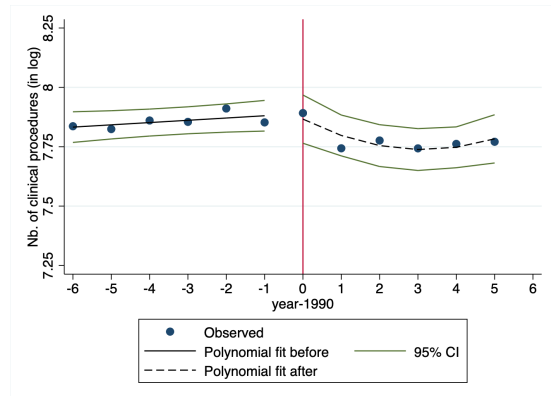
Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians who set up their private office between 1983 and 1996. Pooled observations for 2008 and 2011. Physicians with no contract with the national health insurance, full time private hospital practitioners and aged 60 or more receiving retirement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

Figure 2.C.1: Technical specialists : mean outcomes (in log) by year of practice set-up

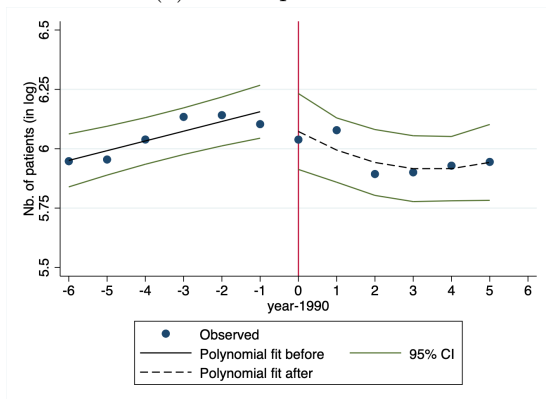




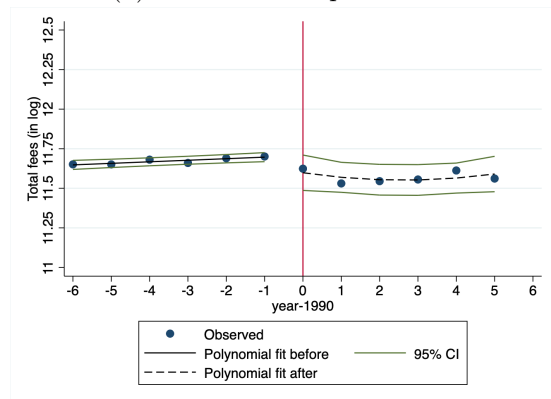
(a) Nb. of procedures



(b) Nb. of clinical procedures



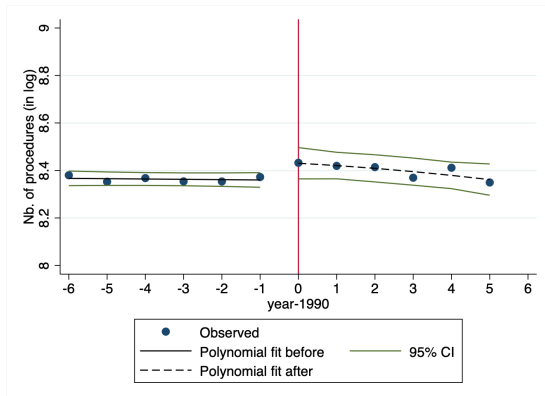
(c) Nb. of patients



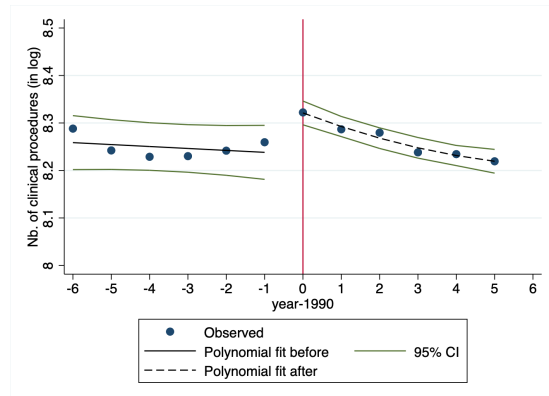
(d) Total fees

Source: Insee-CNAM-DGFIP-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).

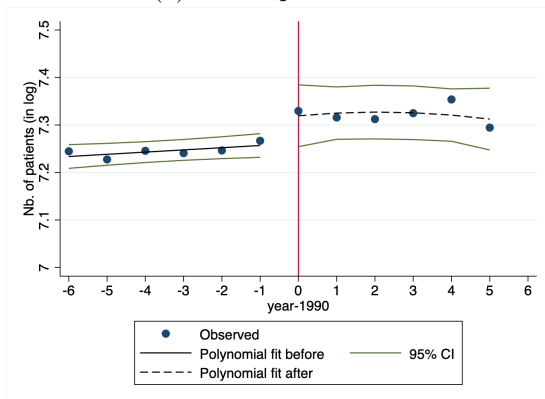
Figure 2.C.2: Pediatricians : mean outcomes (in log) by year of practice set-up



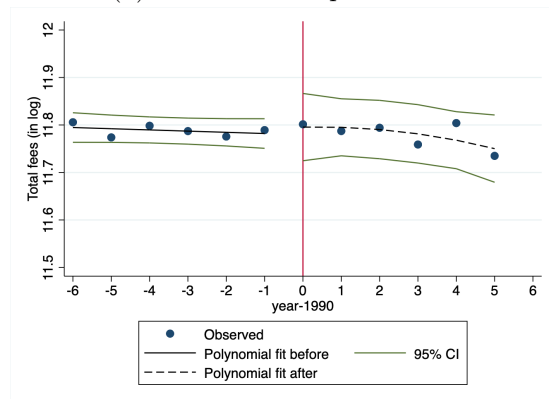
(a) Nb. of procedures



(b) Nb. of clinical procedures



(c) Nb. of patients



(d) Total fees

Source: Insee-CNAM-DGFIP-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 2.C.3: General Practitioners : mean outcomes (in log) by year of practice set-up

## D. Results for each specialty

Table 2.D.1: First stage estimates for practicing in Sector 1

	<i>Dermatologists</i>		<i>ENTs</i>		<i>Pediatricians</i>		<i>Psychiatrists</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{1}_{X \geq 1990}$	0.362*** (0.040)	0.410*** (0.043)	0.277*** (0.061)	0.292*** (0.066)	0.230*** (0.048)	0.275*** (0.052)	0.209*** (0.028)	0.228*** (0.029)
<i>F-stat</i>	80.59		20.47		22.88		55.66	
<i>Nb. of obs</i>	2,924		1,761		1,911		4,595	

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 around the reform. 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

Table 2.D.2: RD estimates for Dermatologists and ENT doctors

Outcomes (in log)	<i>Dermatologists</i>		<i>ENTs</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.)
<b>Price of procedures</b>				
Average price of procedures	-0.384*** (0.044)	-0.372*** (0.042)	-0.471*** (0.122)	-0.471*** (0.131)
<i>Mean outcome for non treated</i>		49.75		69.21
Average price of clinical procedures	-0.486*** (0.046)	-0.462*** (0.046)	-0.499*** (0.102)	-0.507*** (0.109)
<i>Mean outcome for non treated</i>		49.39		50.83
Average price of technical procedures	-0.471*** (0.072)	-0.464*** (0.071)	-0.745*** (0.193)	-0.786*** (0.212)
<i>Mean outcome for non treated</i>		50.28		92.49
<b>Annual provision of care</b>				
Nb. of procedures	0.301** (0.140)	0.318** (0.134)	0.714** (0.285)	0.509* (0.281)
<i>Mean outcome for non treated</i>		3563		3572
Nb. of clinical procedures	0.205 (0.136)	0.244* (0.129)	0.080 (0.477)	0.078 (0.511)
<i>Mean outcome for non treated</i>		2704		1654
Nb. of technical procedures	0.944*** (0.312)	0.935*** (0.312)	1.028** (0.424)	0.842** (0.400)
<i>Mean outcome for non treated</i>		859		1917
Nb. of non surgical procedures	1.052*** (0.407)	0.889** (0.402)	1.222** (0.506)	0.888* (0.485)
<i>Mean outcome for non treated</i>		484		1713
Nb. of surgical procedures	0.659** (0.316)	0.710** (0.314)	0.618 (0.706)	0.645 (0.763)
<i>Mean outcome for non treated</i>		371		154
Nb. of patients	0.201 (0.128)	0.257** (0.125)	0.464* (0.251)	0.323 (0.264)
<i>Mean outcome for non treated</i>		2260		2077
<b>Annual fees</b>				
Total fees	-0.083 (0.134)	-0.053 (0.130)	0.243 (0.283)	0.039 (0.277)
<i>Mean outcome for non treated</i>		165,004		232,141
Labor income	0.067 (0.171)	0.171 (0.171)	0.295 (0.360)	0.107 (0.370)
<i>Mean outcome for non treated</i>		79,016		105,895
Nb. of observations (max)		2,924		1,761
Nb. of observations (min)		1,030		1,068

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 around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset

Table 2.D.3: RD estimates for Pediatricians and Psychiatrists

	<i>Pediatricians</i>		<i>Psychiatrists</i>	
	(1)	(2)	(3)	(4)
<b>Outcomes (in log)</b>	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	<i>Sector 1</i> Coefficient (Std. Err.)	Coefficient (Std. Err.)
<b>Price of procedures</b>				
Average price of procedures	-0.445*** (0.085)	-0.393*** (0.080)	-0.362*** (0.060)	-0.401*** (0.059)
<i>Mean outcome for non treated</i>		51.51		72.07
Average price of clinical procedures	-0.597*** (0.071)	-0.563*** (0.070)	-0.498*** (0.061)	-0.545*** (0.060)
<i>Mean outcome for non treated</i>		46.65		71.58
<b>Annual provision of care</b>				
Nb. of procedures	-0.044 (0.259)	-0.066 (0.244)	-0.213 (0.291)	0.046 (0.282)
<i>Mean outcome for non treated</i>		3807		2327
Nb. of clinical procedures	-0.036 (0.324)	-0.078 (0.293)	-0.187 (0.290)	0.070 (0.281)
<i>Mean outcome for non treated</i>		3703		2320
Nb. of patients	-0.179 (0.242)	-0.148 (0.231)	-0.288 (0.334)	-0.079 (0.331)
<i>Mean outcome for non treated</i>		1381		250
<b>Annual fees</b>				
Total fees	-0.489* (0.262)	-0.459* (0.244)	-0.574** (0.267)	-0.355 (0.261)
<i>Mean outcome for non treated</i>		190,007		159,973
Labor income	-0.218 (0.327)	-0.194 (0.315)	-0.396 (0.335)	-0.233 (0.345)
<i>Mean outcome for non treated</i>		86,408		83,740
Nb. of observations (max)		1911		4595
Nb. of observations (min)		1098		2291

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 around the reform.

Source: Insee-CNAM-DGFIP-DREES dataset

## E. Sensitivity checks

Table 2.E.1: RD estimates for Technical Specialists using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.455*** (0.063)	-0.459*** (0.059)	-0.414*** (0.059)	-0.477*** (0.060)	-0.462*** (0.059)	-0.451*** (0.057)
Average price of clinical procedures	-0.499*** (0.049)	-0.504*** (0.045)	-0.511*** (0.045)	-0.497*** (0.046)	-0.495*** (0.046)	-0.496*** (0.044)
Average price of technical procedures	-0.636*** (0.100)	-0.641*** (0.094)	-0.544*** (0.094)	-0.696*** (0.096)	-0.663*** (0.094)	-0.638*** (0.091)
<b>Annual provision of care</b>						
Nb. of procedures	0.382*** (0.133)	0.419*** (0.125)	0.312** (0.126)	0.336*** (0.123)	0.362*** (0.122)	0.373*** (0.120)
Nb. of clinical procedures	0.346* (0.209)	0.277 (0.195)	0.118 (0.194)	0.358* (0.195)	0.337* (0.194)	0.302 (0.189)
Nb. of technical procedures	0.675** (0.294)	0.771*** (0.276)	0.651** (0.275)	0.589** (0.277)	0.663** (0.274)	0.710*** (0.268)
Nb. of non surgical procedures	0.593 (0.379)	0.793** (0.359)	0.785** (0.361)	0.404 (0.357)	0.507 (0.353)	0.610* (0.346)
Nb. of surgical procedures	0.858*** (0.333)	0.721** (0.307)	0.631** (0.313)	0.771** (0.313)	0.812*** (0.310)	0.793*** (0.302)
Nb. of patients	0.293** (0.123)	0.286** (0.114)	0.207* (0.116)	0.269** (0.116)	0.279** (0.114)	0.277** (0.111)
<b>Annual fees (€)</b>						
Total fees	-0.073 (0.138)	-0.040 (0.131)	-0.102 (0.130)	-0.140 (0.129)	-0.100 (0.128)	-0.078 (0.125)
Nb. of observations	4,059	4,685	5,277	4,059	4,685	5,277

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-CNAM-DGFIP-DREES dataset.

Table 2.E.2: RD estimates for Medical Specialists using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.363*** (0.061)	-0.335*** (0.062)	-0.352*** (0.063)	-0.410*** (0.064)	-0.383*** (0.061)	-0.374*** (0.059)
Average price of clinical procedures	-0.497*** (0.071)	-0.462*** (0.072)	-0.476*** (0.073)	-0.565*** (0.075)	-0.532*** (0.071)	-0.517*** (0.069)
<b>Annual provision of care</b>						
Nb. of procedures	-0.170 (0.216)	-0.229 (0.220)	-0.339 (0.227)	0.104 (0.220)	-0.009 (0.212)	-0.079 (0.206)
Nb. of clinical procedures	-0.133 (0.221)	-0.203 (0.225)	-0.312 (0.232)	0.108 (0.224)	0.004 (0.217)	-0.061 (0.212)
Nb. of patients	-0.428 (0.334)	-0.539 (0.338)	-0.612* (0.346)	-0.057 (0.354)	-0.181 (0.336)	-0.279 (0.324)
<b>Annual fees (€)</b>						
Total fees	-0.533*** (0.194)	-0.564*** (0.197)	-0.691*** (0.205)	-0.306 (0.197)	-0.392** (0.190)	-0.453** (0.185)
Nb. of observations	5,645	6,506	7,219	5,645	6,506	7,219

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-CNAM-DGFIP-DREES dataset.

Table 2.E.3: RD estimates for General Practitioners using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.386*** (0.039)	-0.369*** (0.036)	-0.351*** (0.034)	-0.338*** (0.045)	-0.357*** (0.041)	-0.363*** (0.038)
Average price of clinical procedures	-0.440*** (0.021)	-0.432*** (0.019)	-0.419*** (0.018)	-0.443*** (0.024)	-0.440*** (0.021)	-0.437*** (0.020)
<b>Annual provision of care</b>						
Nb. of procedures	0.410*** (0.113)	0.483*** (0.105)	0.412*** (0.098)	0.480*** (0.130)	0.464*** (0.118)	0.467*** (0.110)
Nb. of clinical procedures	0.483*** (0.166)	0.553*** (0.153)	0.397*** (0.144)	0.436** (0.192)	0.476*** (0.174)	0.506*** (0.162)
Nb. of patients	0.279*** (0.105)	0.377*** (0.097)	0.321*** (0.090)	0.389*** (0.120)	0.358*** (0.109)	0.362*** (0.101)
<b>Annual fees (€)</b>						
Total fees	0.024 (0.106)	0.114 (0.098)	0.061 (0.092)	0.143 (0.122)	0.108 (0.111)	0.104 (0.103)
Nb. of observations	36,987	43,323	49,805	36,987	43,323	49,805

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-CNAM-DGFIP-DREES dataset.



Table 2.E.4: RD estimates for Dermatologists using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.359*** (0.046)	-0.384*** (0.044)	-0.373*** (0.047)	-0.380*** (0.044)	-0.372*** (0.042)	-0.373*** (0.041)
Average price of clinical procedures	-0.464*** (0.049)	-0.486*** (0.046)	-0.498*** (0.045)	-0.461*** (0.048)	-0.462*** (0.046)	-0.469*** (0.044)
Average price of technical procedures	-0.421*** (0.075)	-0.471*** (0.072)	-0.437*** (0.074)	-0.495*** (0.074)	-0.464*** (0.071)	-0.457*** (0.069)
<b>Annual provision of care</b>						
Nb. of procedures	0.333** (0.145)	0.301** (0.140)	0.238 (0.145)	0.301** (0.139)	0.318** (0.134)	0.312** (0.132)
Nb. of clinical procedures	0.256* (0.141)	0.205 (0.136)	0.175 (0.143)	0.236* (0.133)	0.244* (0.129)	0.230* (0.127)
Nb. of technical procedures	0.919*** (0.324)	0.944*** (0.312)	0.718** (0.308)	0.899*** (0.325)	0.935*** (0.312)	0.945*** (0.302)
Nb. of non surgical procedures	0.949** (0.412)	1.052*** (0.407)	0.952** (0.403)	0.836** (0.422)	0.889** (0.402)	0.945** (0.390)
Nb. of surgical procedures	0.817** (0.330)	0.659** (0.316)	0.544* (0.312)	0.638* (0.327)	0.710** (0.314)	0.702** (0.305)
Nb. of patients	0.254* (0.134)	0.201 (0.128)	0.165 (0.132)	0.254* (0.130)	0.257** (0.125)	0.238* (0.122)
<b>Annual fees (€)</b>						
Total fees	-0.026 (0.139)	-0.083 (0.134)	-0.135 (0.136)	-0.078 (0.134)	-0.053 (0.130)	-0.060 (0.128)
Nb. of observations	2,528	2,924	3,254	2,528	2,924	3,254

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-CNAM-DGFIP-DREES dataset.

Table 2.E.5: RD estimates for ENT physicians using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.499*** (0.150)	-0.471*** (0.122)	-0.427*** (0.123)	-0.475*** (0.127)	-0.471*** (0.131)	-0.459*** (0.125)
Average price of clinical procedures	-0.524*** (0.124)	-0.499*** (0.102)	-0.511*** (0.106)	-0.509*** (0.105)	-0.507*** (0.109)	-0.502*** (0.104)
Average price of technical procedures	-0.831*** (0.244)	-0.745*** (0.193)	-0.657*** (0.194)	-0.774*** (0.203)	-0.786*** (0.212)	-0.758*** (0.202)
<b>Annual provision of care</b>						
Nb. of procedures	0.554* (0.318)	0.714** (0.285)	0.509* (0.275)	0.457* (0.268)	0.509* (0.281)	0.557** (0.276)
Nb. of clinical procedures	0.119 (0.568)	0.080 (0.477)	-0.155 (0.482)	0.116 (0.494)	0.078 (0.511)	0.065 (0.490)
Nb. of technical procedures	0.850* (0.473)	1.028** (0.424)	0.782* (0.421)	0.772** (0.371)	0.842** (0.400)	0.877** (0.398)
Nb. of non surgical procedures	0.926 (0.567)	1.222** (0.506)	0.893* (0.502)	0.792* (0.451)	0.888* (0.485)	0.961** (0.481)
Nb. of patients	0.384 (0.293)	0.464* (0.251)	0.312 (0.250)	0.288 (0.254)	0.323 (0.264)	0.364 (0.256)
<b>Annual fees (€)</b>						
Total fees	0.055 (0.313)	0.243 (0.283)	0.082 (0.279)	-0.018 (0.264)	0.039 (0.277)	0.098 (0.272)
Nb. of observations	1,531	1,761	2,023	1,531	1,761	2,023

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-CNAM-DGFIP-DREES dataset.

Table 2.E.6: RD estimates for Pediatricians using different bandwidths

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)
<b>Price of procedures (€)</b>						
Average price of procedures	-0.439*** (0.078)	-0.445*** (0.085)	-0.403*** (0.088)	-0.383*** (0.081)	-0.393*** (0.080)	-0.411*** (0.077)
Average price of clinical procedures	-0.588*** (0.068)	-0.597*** (0.071)	-0.560*** (0.076)	-0.556*** (0.073)	-0.563*** (0.070)	-0.574*** (0.066)
<b>Annual provision of care</b>						
Nb. of procedures	-0.099 (0.234)	-0.044 (0.259)	-0.072 (0.276)	-0.074 (0.246)	-0.066 (0.244)	-0.065 (0.237)
Nb. of clinical procedures	-0.055 (0.291)	-0.036 (0.324)	-0.070 (0.344)	-0.105 (0.289)	-0.078 (0.293)	-0.067 (0.288)
Nb. of patients	-0.255 (0.222)	-0.179 (0.242)	-0.196 (0.258)	-0.144 (0.234)	-0.148 (0.231)	-0.166 (0.223)
<b>Annual fees (€)</b>						
Total fees	-0.538** (0.237)	-0.489* (0.262)	-0.475* (0.278)	-0.456* (0.244)	-0.459* (0.244)	-0.476** (0.238)
Nb. of observations (max)	1,696	1,911	2,113	1,696	1,911	2,113

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-CNAM-DGFIP-DREES dataset.

Table 2.E.7: RD estimates for Psychiatrists using different bandwidths

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)
<b>Price of procedures</b>						
Average price of procedures	-0.374*** (0.062)	-0.362*** (0.060)	-0.401*** (0.059)	-0.436*** (0.062)	-0.401*** (0.059)	-0.392*** (0.057)
Average price of clinical procedures	-0.511*** (0.063)	-0.498*** (0.061)	-0.530*** (0.060)	-0.583*** (0.062)	-0.545*** (0.060)	-0.532*** (0.058)
<b>Annual provision of care</b>						
Nb. of procedures	-0.149 (0.296)	-0.213 (0.291)	-0.365 (0.297)	0.215 (0.295)	0.046 (0.282)	-0.043 (0.276)
Nb. of clinical procedures	-0.119 (0.295)	-0.187 (0.290)	-0.337 (0.295)	0.239 (0.294)	0.070 (0.281)	-0.019 (0.275)
Nb. of patients	-0.267 (0.344)	-0.288 (0.334)	-0.414 (0.338)	0.049 (0.350)	-0.079 (0.331)	-0.156 (0.321)
<b>Annual fees</b>						
Total fees	-0.524* (0.272)	-0.574** (0.267)	-0.766*** (0.275)	-0.220 (0.274)	-0.355 (0.261)	-0.435* (0.255)
Nb. of observations	3,949	4,595	5,106	3,949	4,595	5,106

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-CNAM-DGFIP-DREES dataset.

Table 2.E.8: 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.)
<b>Price of procedures</b>						
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)	-	-	-	-
<b>Annual provision of care</b>						
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)
<b>Annual fees</b>						
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)	4,685		6,506		43,323	
Nb. of observations (min)	4,274		6,232		41,922	

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. reports estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years around the reform for technical specialists, medical specialists and GPs.

Source: Insee-CNAM-DGFIP-DREES dataset

## F. Falsification test

Table 2.F.1: Technical specialists - RD estimates with a reform at different dates around 1990

<i>Reform in ...</i>	TECHNICAL SPECIALISTS				
	1986	1988	1990	1992	1994
<b>Outcomes (in log)</b>	<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.)
<b>Annual provision of care</b>					
Nb. of procedures	-35.538 (549.029)	-6.102 (13.181)	0.406** (0.159)	1.299 (0.847)	0.684 (1.447)
Nb. of clinical procedures	18.757 (292.349)	-6.799 (15.246)	0.266 (0.216)	-0.154 (0.891)	1.895 (2.372)
Nb. of technical procedures	-116.737 (2339.178)	-3.397 (6.235)	0.837*** (0.285)	2.250* (1.216)	-2.045 (3.838)
Nb. of non surgical procedures	-55.335 (402.415)	0.049 (2.804)	0.787** (0.368)	2.652* (1.482)	-1.294 (3.964)
Nb. of surgical procedures	-0.776 (12.787)	-6.268 (9.319)	0.829*** (0.308)	-0.070 (0.893)	2.277 (4.747)
Nb. of patients	-20.186 (239.425)	-6.616 (14.177)	0.359*** (0.139)	0.896 (0.657)	0.523 (1.206)
<b>Annual fees</b>					
Total fees	-30.657 (357.908)	-4.289 (8.861)	-0.108 (0.152)	0.843 (0.817)	0.361 (1.452)
Nb. of observations	4,685	4,685	4,685	4,685	4,685

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. Table reports estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years around the date reform for technical specialists.

Source: Insee-CNAM-DGFIP-DREES dataset

Table 2.F.2: Medical specialists - RD estimates with a reform at different dates around 1990

<i>Reform in ...</i>	MEDICAL SPECIALISTS				
	1986	1988	1990	1992	1994
<b>Outcomes (in log)</b>	<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.)
<b>Annual provision of care</b>					
Nb. of procedures	3.832 (10.078)	4.524 (21.549)	-0.012 (0.215)	1.614 (1.249)	-3.966 (9.624)
Nb. of clinical procedures	2.786 (7.712)	4.535 (21.639)	0.007 (0.219)	1.329 (1.203)	-3.263 (8.037)
Nb. of patients	12.549 (33.620)	11.799 (52.146)	-0.336 (0.326)	3.502 (2.148)	-5.133 (11.914)
<b>Annual fees</b>					
Total fees	2.023 (7.043)	2.512 (14.347)	-0.368* (0.195)	1.926 (1.420)	-5.445 (11.291)
Nb. of observations	4,685	4,685	4,685	4,685	4,685

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. Table reports estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years around the date reform for technical specialists.

Source: Insee-CNAM-DGFIP-DREES dataset

Table 2.F.3: General practitioners - RD estimates with a reform at different dates around 1990

<i>Reform in ...</i>	GENERAL PRACTITIONERS				
	1986	1988	1990	1992	1994
<b>Outcomes (in log)</b>	<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.)
<b>Annual provision of care</b>					
Nb. of procedures	-2.014 (3.808)	15.755 (199.332)	0.529*** (0.133)	1.045** (0.521)	-0.332 (0.766)
Nb. of clinical procedures	0.315 (3.067)	-9.373 (108.805)	0.534*** (0.185)	1.555** (0.746)	0.653 (1.106)
Nb. of patients	0.637 (2.071)	31.359 (578.030)	0.388*** (0.124)	0.879* (0.490)	-0.044 (0.678)
<b>Annual fees</b>					
Total fees	-0.095 (0.233)	-0.086 (0.203)	0.114 (0.098)	-0.144 (0.289)	0.226 (0.329)
Nb. of observations	47,373	46,151	43,323	40,379	37,509

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. Table reports estimates obtained using a local linear regression with a triangular kernel. Regressions are estimating with a bandwidth of 6 years around the date reform for technical specialists.

Source: Insee-CNAM-DGFIP-DREES dataset

## Chapter 3

# Do conditional financial incentives improve access to care? Evidence from a French experiment on specialist physicians

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# 1 Introduction

In France, physicians are mainly paid on a fee-for-service (FFS) basis. When they first set up practice as self-employed doctors, they have to choose between two contracts with the National Health Insurance (NHI): they either choose to practice in sector 1 where they agree to charge their medical services at regulated prices (negotiated and fixed by the NHI) in exchange of fiscal benefits (subsidy of social contributions and pension savings) or they choose to renounce to those advantages and practice in sector 2 where they are allowed to overbill patients (“with tact and moderation”). The choice of practicing in sector 1 is definitive, but it is always possible for sector 2 physicians to change their contract to sector 1.

Since the establishment of sector 2, the amount of extra fees charged to patients has kept increasing, and it has become a barrier to access to care. In order to limit those inequalities, the regulator (NHI) chose to implement a contract called “*Contrat d’accès aux soins*” (CAS) in 2014. It was a voluntary contract proposed to sector 2 physicians, based on financial incentives to increase their activity charged at regulated prices and to decrease their overbilling rate. This contract aimed to improve access to care by decreasing patients’ out-of-pocket expenditures. Objectives in terms of overbilling rate and care provided at the regulated price were set for physicians. If they respected their commitments, the NHI partially subsidized their social contributions and pension savings (in the same way as sector 1 physicians). However, the CAS only lasted three years: physicians negotiated a more flexible and advantageous contract in terms of payments, and the CAS became in 2017 the “*Option Pratique Tarifaire Maîtrisée*” (OPTAM). This new contract imposed similar objectives, yet the criteria to reach them were slightly modified (see section 3.1 for more details). Further, the nature of payment has been modified: the subsidy of social contributions by the NHI was replaced by the payment of a bonus calculated on the physician’s activity charged at regulated prices.

Many payment schemes can be combined to contribute to the objectives of a healthcare system, one of which is to enable access to care to the whole population, according to their need (WHO et al., 2019; Fainman and Kucukyazici, 2020). Based on a theoretical model where the physician is a utility-maximizer (McGuire and Pauly, 1991; McGuire, 2000), fee-for-service payment is known to encourage physicians to treat all patients, but can sometimes lead to an unnecessary increase in the volume of care (Evans, 1974). Empirical evidence is predominantly derived from primary care settings, but a recent systematic review on specialist physicians shows that the payment model also affects the utilization of specialty care (Quinn et al., 2020). Furthermore, physicians are known to react to financial incentives (Folland et al., 2013), even small ones (see Chapter 1). Financial incentives can increase the volume of care provided (Clemens and Gottlieb, 2014). They are also commonly used to improve the quality of care through a pay-for-performance scheme: several systematic reviews show evidence of it (Mendelson et al., 2017, Cattel and Eijkenaar, 2020, Zaresani and Scott, 2021). However, financial incentives can have unintended consequences: they can motivate physicians to prioritize more profitable patients (Feng and Gravelle, 2019) or only remunerated tasks (Minchin et al., 2018).

In this paper, I empirically evaluate how financial incentives through the CAS and the OPTAM change specialist physicians' behavior. I use a panel dataset on all self-employed specialists followed every three years from 2005 to 2017. Data come from administrative sources: information about physicians' annual activity, income, and sociodemographic characteristics are available. I divided specialties into two groups according to a standard definition: Surgical and Medical specialists. I use a difference-in-differences estimation to assess the causal impact of the CAS and the OPTAM on several outcomes relative to physicians' activity. Using the panel dimension of my dataset, I take into account the potential endogeneity to the membership to both programs by estimating a two way fixed effect model which controls for all time-invariant individual-specific factors and for constant average differences between physicians in any observable or unobservable variables that could be correlated to the program's membership. This paper is the first to evaluate those contracts empirically, and I contribute to the little existing literature on specialist physicians' behavior in reaction to overbilling regulation through financial incentives.

My main results are the following. The CAS membership did not affect Surgical specialists' activity or fees, but the OPTAM had a strong impact. Treated Surgical physicians saw more patients (including those with low income) and performed more procedures (office visits and technical procedures). Their fees increased due to this higher workload, but also because of their monetary reward. For Medical specialists, both the CAS and the OPTAM impacted their activity: they also performed more office visits because of a higher number of patients seen. However, this increase in access to care was associated with a rise in total expenditures for the NHI.

The paper proceeds as follows. Section 2 describes overbilling regulation in France. Section 3 presents the empirical strategy, and section 4 the data. Section 5 exposes the results and section 6 several robustness analyses. Finally, section 7 discusses the results and concludes.

## 2 The regulation of overbilling in France

### 2.1 The practice of overbilling in France

In France, the existence of public health insurance (which reimburses a part of the price of medical services for patients) generates a constant debate between physicians and public authorities to define the price of the different acts (Bras, 2015). High prices would assure a high income for physicians, but it will also increase national health expenditures which could be unsustainable. On the contrary, if public authorities do regulate prices, it can encourage doctors to multiply procedures since they are paid on a fee-for-service basis.

Price regulation involves agreements between physicians and the NHI: when they first set up practice as self-employed physicians, they can choose between two sectors. The first one, called sector 1, engaged them to charge regulated prices fixed by the NHI, and in exchange, they receive non-negligible fiscal advantages (subsidy of social contributions and pension savings). If they choose to practice in sector 2, they are not reimbursed of their social insurance contributions, but they are allowed to practice overbilling.

The creation of sector 2 in 1980 has been a success. However, the large proportion of physicians who started charging extra fees has jeopardized the principle of access to care for all. In 1989, 16% of GPs and 44% of specialists were in sector 2. Access to sector 2 was then constrained in 1990 to limit inequalities in access to care (see Chapter 2 for an evaluation of this reform on specialists' activity). Only physicians with specific previous positions (e.g., former heads of clinics, former hospital assistants) obtained after several years of experience were allowed to practice in sector 2. The share of General Practitioners practicing in sector 2 dropped after this reform (in 2017, less than 1% of General Practitioners (GPs) started their practice as sector 2 physicians). However, it is more attainable for specialist physicians, so the reform only had a short-term effect: the proportion of specialists settling in sector 2 remains high and continues to increase. This proportion varies within specialties: 83% of surgeons settled practice in sector 2, while only 45% of pediatricians did it in 2017. An increase in the amount of extra fees also accompanies this attraction for sector 2. In 2009, the amount of overbilling was €1.9 billion, and almost €2.4 billion in 2015 (+26% in 6 years). Recently, a new record was beaten with nearly 3.5 billion euros in extra fees in 2021. The average overbilling rate practiced by physicians in sector 2 exceeded 50% of regulated prices from 2006, whereas it was only 36.6% in 2000 ([Cour des comptes, 2017](#)). Total extra fees represent, on average, a third of sector 2 physicians' fees.

Overbilling contributes to the increase in physicians' incomes without weighing on public expenditures, but this monetary burden is then transferred to the patient. They represent a significant part of the patient's out-of-pocket expenditures: on an annual average, they represent around €200, in addition to the average co-payments of €220 ([Jusot et al., 2019](#)). The extra fees are not reimbursed by the NHI or are partially reimbursed if the patient subscribes to supplementary health insurance. More than 95% of French people benefit from complementary health insurance, individual or collective, to finance expenses not covered by the NHI ([DREES, 2019](#)). However, the level of coverage depends on many parameters: the nature of the supplementary health insurance (individual or collective), the physician's specialty, and the patient's health care pathways. Moreover, half of the beneficiaries of individual contracts have no coverage for extra fees charged by self-employed specialists. Therefore, those financial barriers increase inequalities in access to care ([Perronnin, 2016](#)). Overall, on the demand side, overbilling increases inequalities in access to care and leads to equity concerns. On the supply side, overbilling could contribute to the poor distribution of physicians on the territory. Indeed, physicians can freely choose their practice location, and sector 2 specialist physicians mainly set up practice in urban areas, where there is also fewer sector 1 physicians ([Chevallard and Dumontet, 2020](#); [Dormont and Péron, 2016](#)). In addition, overbilling creates inequalities in income between sector 1 and sector 2 physicians. However, to my knowledge, there is no evidence of differences in the quality of care provided by physicians from the two sectors, so there is no objective reason for those income inequalities. Overbilling has thus become a significant concern for public policies in France.

In France, recent and few empirical studies exist on the practice of overbilling. The choice to make higher or lower extra fees depends on the doctor's environment: practicing in an urban center with a wealthy economic patient base positively influences the amount of extra fees ([Bellamy and Samson, 2011](#)). Local medical density also determines extra fees and the volume of care provided: when competition increases, physicians make fewer extra fees but provide more care

(Choné et al., 2019). Coudin et al. [2015] analyze the consequences of the sector 2 freeze reform in 1990: it resulted in an intensification of activity for GPs forced to practice in sector 1, which is reflected in an increase in the patient population and the number of procedures performed. The creation of a complementary universal health coverage (“*Couverture maladie universelle complémentaire*”) has also played a role in controlling overbilling: physicians are forbidden to charge extra fees to CMU-C beneficiaries. This regulation has decreased the average amount of extra fees per procedure performed without leading to a decrease in total fees for self-employed specialists in sector 2. However, an increase in activity partly offset this price drop (Dormont and Gayet, 2021).

## 2.2 Decreasing overbilling to improve access to care through financial incentives

In order to promote patient access to care at regulated prices and to reduce their out-of-pocket costs, the NHI proposed a contract called “*Contrat d'accès aux soins*” (CAS) in 2014, essentially to physicians practicing in sector 2 but also to sector 1 physicians who had the titles to enter in sector 2 but preferred to set up practice in sector 1<sup>1</sup>. It is a three-year contract based on financial incentives. In exchange for their commitment to decrease their average overbilling rate and to maintain the share of their activity at regulated prices (compared to what they did in 2012), members of the CAS received a subsidy from the NHI for their social contributions proportional to their activity charged at regulated prices (only if they reach 100% of their objectives). In March 2014, 10 700 physicians accepted to join the program (36.1% of all physicians) (Cour des comptes, 2014). However, the CAS was then criticized for failing to attract the targeted doctors: physicians with the highest overbilling rate did not enroll in the CAS, and nearly a third of CAS members were sector 1 physicians (Cour des comptes, 2017).

To make the CAS more attractive, it was repealed and replaced by another contract in 2017 called “*Option Pratique Tarifaire Maîtrisée*” (OPTAM). This contract was negotiated with physicians to be more flexible (it became a one-year contract with the possibility to leave anytime) and advantageous in terms of payments (the NHI’s subsidy of social contributions became a bonus based on the activity charged at regulated prices, paid more rapidly than the load reduction of social contributions). Objectives to reduce the overbilling rate and increase the share of activity at regulated prices were similar to the CAS but based on their practice over the previous three years (2013 to 2015) instead of 2012 only. Moreover, there were fewer constraints to obtaining benefits from the program: the OPTAM bonus was degressive according to the achievement of the objectives. Overbilling rate and the share of activity charged at regulated prices were defined in percentage. They could earn a bonus if they did not deviate more than 5 percentage points from their objectives. Table 3.1 summarizes the CAS and the OPTAM criteria.

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<sup>1</sup>Eligible sector 1 physicians had to set up their practice before 2013.

Table 3.1: Description of the CAS and the OPTAM

	CAS	OPTAM
<b>Date of introduction</b>	December 2013	January 2017
<b>Eligible physicians</b>	Physicians practicing in sector 2 Physicians practicing in sector 1 (before 2013) but could have chosen to practice in sector 2	
<b>Duration of contract</b>	3 years	1 year renewable
<b>Commitments</b>	<ul style="list-style-type: none"> <li>- Respect an overbilling rate based on their activity in 2012</li> <li>- Maintain or increase the share of activity charged at regulated prices (compared to 2012)</li> </ul>	<ul style="list-style-type: none"> <li>- Respect an overbilling rate based on their activity from 2013 to 2015</li> <li>- Maintain or increase the share of activity charged at regulated prices (compared to 2013-2015)</li> </ul>
<b>Physicians' benefits (€)</b>	<ul style="list-style-type: none"> <li>- Coverage by the NHI of social contributions in the same way as sector 1 physicians on their activity charged at regulated prices</li> </ul>	<ul style="list-style-type: none"> <li>- Bonus calculated in proportion to the activity charged at regulated prices: <math>Bonus = Fees\ charged\ at\ regulated\ prices \times rate^1\ by\ specialty</math></li> <li>Introduction of a sliding scale of remuneration according to the level of compliance with commitments</li> <li>Strict respect of commitments : 100% of bonus difference of 1 pp to 2 pp: 90% of bonus difference of 2 pp to 3 pp: 70% of bonus difference of 3 pp to 4 pp: 50% of bonus difference of 4 pp to 5 pp: 30% of bonus difference higher to 5pp: no bonus</li> </ul>
<b>Patients' benefits</b>	<ul style="list-style-type: none"> <li>- Same reimbursement rates than sector 1 physicians</li> <li>- Better reimbursement of extra fees by specific supplementary health insurance since 2015</li> <li>- Public information to find a CAS/OPTAM physician on the national NHI website<sup>(2)</sup> or common medical appointment website (ex: doctolib)</li> </ul>	

<sup>(1)</sup> There is a specific rate for each specialty that corresponds to to the average social contribution within the specialty.

<sup>(2)</sup> <http://annuaiesante.ameli.fr/>

Sources: Journal officiel [2012], Journal officiel [2016]

Suppose physicians respect their commitments regarding the overbilling rate and share of activity at regulated prices. In that case, the NHI subsidizes a part of their social insurance contributions and pension savings, proportional to their activity charged at regulated prices. Before the CAS, only sector 1 physicians benefited from this subsidy. Given that the amount of subsidies is not observed in my data, I simulated in Table 3.2 the average amount of social contributions between non-CAS physicians and CAS physicians in 2014, both for Surgical and Medical physicians. The NHI subsidizes 60 to 70% of CAS physicians' social contributions and pension savings. On average, Surgical specialists (Medical specialists) benefited from a reduction in their social contributions equal to €14,952 (€15,054). Those amounts represented 4.3% of Surgical physicians' and 4.7% of Medical specialists' total fees. In addition, I simulated what could earn physicians in 2017 with the OPTAM at several levels of commitment achievement. If OPTAM physicians all strictly reached their goals, the average bonus equals €19,343 for Surgical specialists and €18,582 for Medical specialists. Those bonuses represent 5% of their total fees. Therefore, the OPTAM is more attractive than the CAS in absolute value.

Table 3.2: Simulations of physicians' benefits from the CAS and the OPTAM

	SURGICAL SPECIALISTS	MEDICAL SPECIALISTS
<i>NHI's subsidy for CAS physicians (2014)</i>	14,952	15,054
Observations	1,006	1,323
<i>Bonus for OPTAM physicians (2017)</i>		
100%	19,343	18,582
90%	17,408	16,724
70%	13,540	13,007
50%	9,671	9,291
30%	5,802	5,574
Observations	2,441	2,001

*Source:* Author's calculations using Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old and observed in 2014 and 2017.

The existing literature on the evaluation of the CAS and the OPTAM is only composed of descriptive studies made by the NHI or by the “*Cour des comptes*” (CC), a public institution whose principal mission is to ensure the proper use of public resources and to inform the citizens. For the NHI, at the initiative of both programs, this regulation tool has been a success: 45% of eligible sector 2 physicians joined the OPTAM, 32.8% the CAS (which proves that the OPTAM is more attractive), and the overbilling rate for all sector 2 specialists decreased (54.1% to 52.5%) as well for sector 2 members of the CAS (22.4% to 21.7%) between 2015 and 2016 (CNAM, 2017a). However, the CC affirmed that the CAS had only a limited effect, given its high cost. In 2015, the cost of financial incentives was €183 million, and only €18 million of extra fees were avoided. In other words, to prevent €1 of extra fees, the NHI spent €10 (Cour des comptes, 2017). The NHI responded to CC with a press release and ensured that in the absence of the CAS, given the trends in physicians' overbilling rates observed over the previous five years, €100 million invested by the NHI that had prevented nearly €300 million in extra fees. The NHI concluded that €1 spent had prevented about €3 in extra fees (CNAM, 2017b). Nevertheless, neither the CC nor the NHI provided explicit calculations of their statements. Overall, there is no empirical study of the CAS or the OPTAM, so it is essential to correctly evaluate the programs using econometrics methods to find a causal impact on physicians' activity and fees.

### 3 Empirical Strategy

#### 3.1 Difference-in-Differences framework

In this paper, I estimate the effect of the CAS and the OPTAM membership on specialist physicians' activity and fees. The assignment in both programs is not random: physicians could join the programs voluntarily. Therefore, some unobservable characteristics may affect the physician's decision to sign in. Estimating the effect of both programs with a naive comparison

of outcomes between treated physicians (having at least chosen a contract) and non-treated physicians (those who never signed in) before and after the program’s implementation would lead to biased estimates. Therefore, I use a difference-in-differences design with a two-way fixed effect model (TWFE) to limit the selection bias. In addition, I used the “Coarsened Exact Matching” (CEM) method (Iacus et al., 2012) (detailed in subsection 3.2) to estimate the effect of both programs on the most comparable treated and non-treated physicians in terms of observed characteristics.

Using the panel dimension of my dataset, I estimate the average effect of both programs using the following equation:

$$Y_{it} = \alpha CAS_{it} + \beta OPTAM_{it} + X'_{it}\mu + \delta_i + \delta_t + u_{it} \quad (3.1)$$

where  $i = 1 \dots N$  and  $t = 2005, 2008, 2011, 2014, 2017$ .

$Y_{it}$  is the logarithm of the outcome of interest for physician  $i$  at year  $t$ . Outcome variables are related to the physician’s activity and fees, and are presented in section 4. The first variable of interest is  $CAS_{it}$  that indicates the CAS treatment for physician  $i$  at year  $t$  i.e., equals zero for all physicians before 2014 and 1 after 2014<sup>2</sup> for those who joined the CAS. The second variable of interest,  $OPTAM_{it}$ , corresponds to the OPTAM treatment for physician  $i$  at year  $t$ : it equals zero for all physicians before 2017 and equals one in 2017 for the ones who joined it.  $X_{it}$  is a set of time varying control variables: defined at the individual level (doctor’s age, marital status, family status (being a parent)) or at the *département* level (General Practitioner’s density, medical density of the specialty considered, both being measured for 100K inhabitants, share of physicians in sector 2, overbilling rate, share of activity charged at regulated prices). I also control for part of local demand at the *département* level using the share of low-income individuals (CMU-C beneficiaries), the structure of the population by age, and the unemployment rate.  $\delta_i$  denotes individual fixed effects, which consider all physicians’ characteristics (observable and unobservable) constant over time. It allows the control for individual time-invariant heterogeneity that affects the decision of the CAS or the OPTAM membership.  $\delta_t$  are time fixed effects that control for macroeconomic shocks common to all individuals in a given time period. Robust standard errors are clustered at the physician level.

Since physicians chose the CAS and the OPTAM, one can wonder if there is an additional effect of joining both programs. Therefore, the equation 3.1 is also estimated with the interaction term of the CAS and OPTAM:

$$Y_{it} = aCAS_{it} + bOPTAM_{it} + g(CAS_{it} \times OPTAM_{it}) + X'_{it}m + d_i + d_t + v_{it} \quad (3.2)$$

where  $i = 1 \dots N$  and  $t = 2005, 2008, 2011, 2014, 2017$ .

If the coefficient  $g$  is statically different from zero, joining the CAS before OPTAM has an

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<sup>2</sup>An assumption on the CAS treatment is made here: once a physician is treated, he stays treated for the post-treatment period (including the year 2017, when CAS no longer exists). Indeed, the CAS treatment variable indicates the membership until December 31, 2016: the CAS’s effect could remain a little after its removal



additional effect on the outcome of interest. Therefore,  $a$  represents the average effect of the CAS on  $Y_{it}$  for physicians who only joined the CAS and  $(a + g)$  is the average effect of the CAS on  $y_{it}$  for the *always treated* (physicians who joined the CAS and the OPTAM) compared to the never treated (physicians who did not join neither CAS nor OPTAM). The coefficient  $b$  is the average effect of OPTAM for physicians who did not join the CAS before, and  $(b + g)$  corresponds to the average effect of OPTAM for the *always treated*. All other variables are defined as in equation 3.1.

The difference-in-differences (DiD) estimation strategy to identify the causal impact of programs on the outcomes of interest relies on a key identifying assumption known as the common trends assumption. It means that in the absence of the CAS or OPTAM, both treated groups (physicians signing the CAS and/or the OPTAM) and control group (never treated by either the CAS or the OPTAM) would have experienced the same trends in outcomes (Rubin, 1974; Angrist and Pischke 2009). Unfortunately, this identifying assumption cannot be tested since it is impossible to observe the potential outcomes in both situations (treated and non-treated cases) for a physician  $i$  at year  $t$ . However, we can check pre-treatment trends in outcomes between treated and non-treated physicians. If trends are parallel in pre-treatment periods, one might expect trends to be the same in post-treatment periods if CAS and OPTAM had not been implemented. We expect similar trends in outcomes for CAS physicians and the control group before 2014. Moreover, physicians who only chose the OPTAM should have similar trends with the control group before 2017 for the assumption to hold. I check graphically for the validity of the hypothesis of parallel pre-treatment trends in outcomes for each group of treated physicians by the CAS and/or the OPTAM (the CAS physicians were divided into two groups: those who chose to join the OPTAM or not and the physicians who only opted for the OPTAM) with the control group (never treated) (appendix C, Figures 3.C.1 to 3.C.6). The figures show parallel trends for all outcomes, except those related to the contract objectives (extra fees, overbilling rate, and the share of activity charged at regulated price). It could mean that the adhesion of the programs is specific to a particular type of physician.

I describe in subsection 4.2 who chose the CAS and the OPTAM. In addition to graphical evidence, I performed a placebo test: I changed the CAS and OPTAM implementation date for 2011 and restricted the sample to non-treated physicians between 2005 and 2011. I run DiD regressions for each outcome and each group of treated physicians. If the parallel assumption holds, coefficient estimates should not be statistically different from zero, which is the case for most outcomes. Results are reported in Table 3.C.1. As suspected, treated and non-treated physicians have different slopes for outcomes related to the contract. Also, the indicator of office visits is sometimes statistically different from zero at the 1% threshold for specialists only treated by the OPTAM, so we should be careful in interpreting results for those physicians.

### 3.2 Construction of a comparison group

As shown in Table 3.3, the CAS and the OPTAM are not randomly assigned; the treatment group and the control group differ in some (observable) characteristics, especially in terms of the location of the practice. In order to limit the selection bias, I constructed a control group by using the ‘‘Coarsened Exact Matching’’ (CEM) method (Iacus et al., 2012). Recent literature

showed that it is no longer recommended to use a propensity score for matching (King and Nielsen, 2019) and that CEM matching is preferable as it reduces imbalances, model dependence, estimate error, and bias. The idea of matching is to find, for each treated unit, at least one control unit that is "similar" on the covariates. CEM matching step procedure is the following: first, it temporarily coarsens each observable covariate into substantively meaningful groups (for example, I coarsened the overbilling rate measured at the *département* level, a continuous variable, of treated physicians into four subgroups where the threshold for each subgroup was the quartile of the distribution). Second, it applies the method of exact matching to those coarsened data and sorts observations into strata, each with unique values of the coarsened data. Then, it prunes any stratum that does not have at least one treated and one control unit. Finally, it only retains the matched data's original (uncoarsened) values (except those pruned). Then, weights for the control group are calculated in each stratum to equal the treated group that will be used in the estimations.

Model 3.1 estimates the effect of the CAS and the OPTAM for four groups of physicians: the three treated groups and the control group. Since I could not match each group to the control group, I had to choose a unique treatment variable (a dummy for the ones treated by the CAS and/or the OPTAM). Thus, the CEM algorithm matched physicians who joined the CAS and/or the OPTAM with physicians who never chose to join either program. In particular, I matched the "global" treatment group and the control group on observable characteristics in 2011 (before any treatment): gender, age, marital status, having children, and covariates defined at the *département* level (the overbilling rate, the share of activity charged at regulated price, the share of sector 2 physicians). Table 3.3 shows descriptive statistics before and after matching for the treated and non-treated physicians by distinguishing Surgical and Medical specialists. Before the matching, treated and non-treated physicians had similar individual characteristics. There was no difference in the proportion of women and age structure between the two groups. Moreover, marital status or being a parent did not play a role in the treatment. However, treated and non-treated specialists practiced in different locations: treated physicians were less likely to practice in a *département* where the share of sector 2 physicians was high. For example, 37.13% of Medical specialists practiced in a *département* where less than 30% of Medical specialists were in sector 2. Said differently, treated physicians practiced more often near sector 1 physicians, i.e., in locations where the share of activity charged at regulated prices is higher than the control group.

After the matching, those differences are statistically insignificant (detailed statistics, depending on the definition of the treated group, are available in Tables 3.B.1 and 3.B.2, appendix B). Results of the econometric analysis will be presented only with matched physicians.

Table 3.3: Treated and non treated physicians' socio-demographic characteristics in 2011 before and after matching

Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	Treated (1)	Non Treated (2)	Non Treated (3)	(1-2)	(1-3)	Treated (4)	Non Treated (5)	Non Treated (6)	(4-5)	(4-6)
Female	13.72	13.75	13.72	0.979	1.000	31.05	32.11	31.05	0.541	1.000
Age < 45 years old	28.65	31.36	28.65	0.080	1.000	33.79	32.00	33.79	0.304	1.000
Age between 45 and 54 years old	39.73	37.56	39.73	0.186	1.000	29.85	30.97	29.85	0.514	1.000
Age ≥ 55 years old	31.62	31.08	31.62	0.729	1.000	36.36	37.03	36.36	0.707	1.000
<i>Marital status</i>										
Single	4.80	4.46	4.80	0.633	1.000	8.38	10.36	9.72	0.071	0.212
Divorced	8.04	7.49	8.04	0.544	1.000	11.46	11.60	11.54	0.908	0.949
Married	84.86	86.16	84.86	0.273	1.000	73.65	71.47	72.65	0.187	0.543
Civil partnership	2.23	1.84	2.23	0.407	1.000	4.96	5.85	5.25	0.293	0.723
Widow	0.07	0.05	0.07	0.784	1.000	1.54	0.73	0.84	0.030	0.070
Having children	79.73	79.36	79.73	0.784	1.000	74.68	72.04	74.68	0.108	1.000
<i>Practice location (at département level)</i>										
Share of sector 2 physicians (%)										
X ≤ 57.14 (30.00)	25.88	25.29	25.88	0.688	1.000	37.13	19.83	37.13	0.000	1.000
X ∈ ]57.14,72.41] ( <i>]30.00,42.33[</i> )	22.50	22.99	22.50	0.730	1.000	26.35	24.96	26.35	0.391	1.000
X ∈ ]72.41,83.91] ( <i>]42.33,58.00[</i> )	29.66	24.05	29.66	0.000	1.000	21.64	28.95	21.64	0.000	1.000
X > 83.91 (58.00)	21.96	27.68	21.96	0.000	1.000	14.88	26.26	14.88	0.000	1.000
Share of activity at regulated prices (%)										
X ≤ 79.10 (71.72)	18.85	27.45	18.85	0.000	1.000	13.52	33.76	13.52	0.000	1.000
X ∈ ]79.10,82.43] ( <i>]71.72,80.96[</i> )	29.73	28.92	29.73	0.597	1.000	24.12	25.22	24.12	0.493	1.000
X ∈ ]82.43,84.51] ( <i>]80.96,83.45[</i> )	24.73	19.49	24.73	0.000	1.000	30.71	18.75	30.71	0.000	1.000
X > 84.51 (83.45)	26.69	24.14	26.69	0.081	1.000	31.65	22.27	31.65	0.000	1.000
Overbilling rate (%)										
X ≤ 36.84 (45.80)	28.24	23.54	28.24	0.001	1.000	34.39	22.48	34.39	0.000	1.000
X ∈ ]36.84,54.07] ( <i>]45.80,69.37[</i> )	26.62	23.17	26.62	0.017	1.000	25.83	23.56	25.83	0.154	1.000
X ∈ ]54.07,101.40] ( <i>]69.37,161.56[</i> )	24.26	25.52	24.26	0.388	1.000	27.72	25.17	27.72	0.118	1.000
X > 101.40 (161.56)	20.88	27.77	20.88	0.000	1.000	12.06	28.79	12.06	0.000	1.000
Number of observations	1,480	2,175	2,175			1,169	1,931	1,931		

Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

## 4 Data

### 4.1 Administrative data on all French self-employed physicians

This study uses an exhaustive administrative dataset “*Insee-CNAM-DGFiP-DREES*” on self-employed physicians practicing in France. This dataset, collected by the National Institute of Statistics and Economic Studies (*Insee*), merges information on physicians’ activity gathered by the NHI and information on physicians’ remuneration coming from their household fiscal declarations (*Direction Générale des Finances Publiques, DGFiP*).

From 2005 to 2017, this dataset is renewed every three years and can be used as a panel, i.e., physicians are observed over a maximum of twelve years of practice (2005, 2008, 2011, 2014 and 2017). All self-employed physicians practicing on the 31<sup>st</sup> of December of a given year and who received at least one euro of fees during the year are included.

The data contain, for each physician, several variables that describe their annual provision of care and annual fees. I use the following variables as outcomes:

- Indicators of provision of care, decomposed into office visits and technical procedures. They are continuous and monetary variables. They combine the quantity and price of procedures: each procedure is valued by its regulated price fixed by the NHI, and the indicator is calculated annually as the sum of those various procedures. They have the advantage of taking into account the complexity (represented by the price) of each procedure performed by the physician.
- Number of patients and number of CMU-C beneficiaries (patients with low income) in the patient list.
- Amount of extra fees, amount of fees (including extra fees and lump-sum payments), and fees less simulated social contributions, plus NHI’s subsidy (for CAS physicians) and OPTAM bonus (for OPTAM physicians). I simulated social contributions using physicians’ income declared in the DGFiP dataset (calculations details are in Table 3.A.1). OPTAM bonuses are calculated by assuming two levels of rewards depending on the achievement of their objectives (100% and 30%). All those variables are in euros.
- Overbilling rate (the amount of extra fees compared to the amount of fees earned at regulated price) and the share of activity charged at regulated prices.
- Costs for the NHI composed of physicians’ fees without extra fees in addition to NHI’s subsidy (if physicians were CAS members in 2014) and OPTAM bonuses (if physicians were OPTAM members in 2017). The NHI’s cost of programs was simulated while assuming that all physicians reached 100% of their objectives. In other words, it is the maximal cost for the NHI.

All these variables provide an overview of physicians’ activity and income. Furthermore, I use the information on their sociodemographic characteristics (gender, age, department of practice, family, and marital status). Finally, I add variables provided by *Insee* concerning their *départe-*

ment of practice: unemployment rate, the population’s age structure, and the share of CMU-C beneficiaries.

In this study, I focus on self-employed physicians who can overbill patients (sector 2 physicians) because they are the main target of the CAS and the OPTAM: 65% of Surgical specialists and 30% of Medical specialists practice in sector 2<sup>3</sup>. Furthermore, I make several restrictions on the sample. Physicians who did not sign a contract with the NHI are excluded from the sample. I only keep physicians working full time as self-employed physicians (i.e., they have no hospital work or any activity in addition to their private office work) because, in the data, I only observe their activity in their private office. I also excluded physicians under 70 years old who are more likely to have an atypical activity than others (fewer patients seen in the year, fewer procedures performed ...). According to a standard definition of grouping physicians’ specialties, my principal analysis focuses on two groups: surgical specialists and medical specialists (outside General Practitioners). Surgical specialists are composed of surgeons, ophthalmologists, obstetricians gynecologists (OG) and otorhinolaryngologists (ENT<sup>4</sup> doctors.). Medical specialists are anesthetists, cardiologists, dermatologists, radiologists, gastroenterologists, pediatricians, rheumatologists, and psychiatrists. Overall, there are 9,891 sector 2 Surgical specialists (30,972 observations) and 6,926 sector 2 Medical specialists (21,650 observations) observed between 2005 and 2017 in the dataset<sup>5</sup>.

## 4.2 Who chose the CAS and the OPTAM?

The CAS was introduced in December 2013. The identification of physicians joining the CAS is only available in wave 2017 of our dataset: a dummy variable equal to one if the physician is a member of the CAS program on December 31, 2016. I report this information for wave 2014 for physicians already present in the panel dataset (66% of Surgical and Medical specialists remain in the sample<sup>6</sup>). The date of signing the CAS is unobserved. However, by comparing physician adhesion figures given by the “*Cour des Comptes*” and those of our dataset, I can hypothesize that most CAS physicians signed the contract at its implementation. Indeed, by March 2014, 10,700 physicians signed the contract (representing more than a third of eligible physicians; *Cour des comptes*, 2014). In my data, I observed 10,056 CAS physicians (who were still in the program by 31<sup>st</sup> December 2016). The NHI has also reported that there were 10,914 in late June 2014 and 11,103 in late December 2014<sup>7</sup>. This difference in figures could be explained by the fact that physicians may have signed the contract but ended it between 2014 and 2016, which I do not observe. One explanation for leaving the program is that they did not respect their commitments and found it too hard to do so. Therefore, if unsatisfied physicians (who signed the CAS in 2014

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<sup>3</sup>I excluded sector 1 physicians for several reasons: first, they have different incentives from the program (the programs allowed them to overbill whereas before, they could not) so this population of physicians are atypical and difficult to understand at first sight. Second, the ones who chose to join the programs represent less than 10% of sector 1 physicians. Third, they have specific (observed and unobserved) characteristics, and finding a proper control group will be more complex.

<sup>4</sup>Ear-nose-throat

<sup>5</sup>Depending on the year and the analysis, samples can be modified.

<sup>6</sup>Physicians excluded are physicians who are not observed in 2017: 13.63% are only observed for one year, 20.77% for two years, 29.98% for three years, and 35.61 for four years between 2005 and 2014. The median age of those excluded physicians is 59 years old; they are likely to have retired before 2017.

<sup>7</sup>These are cumulative figures.

and left the program after 2014) are considered in my control group, my estimation of the CAS effect on physicians' activity and income would only be underestimated.

In 2017, the OPTAM replaced the CAS. The NHI identified 14,781 physicians by November 2017, including 11,621 sector 2 physicians and 3160 sector 1 physicians. In my dataset, 12,995 physicians opted for the OPTAM, including 10,186 sector 2 physicians and 2,809 sector 1 physicians. As for the CAS, our figures are similar to the NHI's.

Table 3.4 shows the number of physicians according to their choice of CAS or OPTAM. In 2017, there were 7,077 Surgical specialists and 5,632 Medical specialists. The CAS was chosen by 15.85% of Surgical specialists and 27.59% of Medical specialists; the OPTAM by, respectively, 34.5% and 35.5% of these specialties. Mostly all CAS physicians renewed the experience with the OPTAM: 92.42% for Surgical specialists and 92.99% for Medical specialists. Those who did not join the CAS but changed their mind about the OPTAM represent 19.83% of Surgical specialists and 9.80% of Medical specialists in 2017. Overall, more than a third of each group of specialists opted for the CAS or the OPTAM, and nearly no physician chose to join the CAS without choosing to join OPTAM afterward.

Table 3.4: Physicians' status according to CAS and OPTAM in 2017

OPTAM	CAS		Total	OPTAM	CAS		Total
	0	1			0	1	
0	<b>4,551</b>	<b>85</b>	<b>4,636</b>	0	<b>3,522</b>	<b>109</b>	<b>3,631</b>
	<i>98.17</i>	<i>1.83</i>	<i>100.00</i>		<i>97.00</i>	<i>3.00</i>	<i>100.00</i>
	76.42	7.58	65.51		86.37	7.01	64.47
1	<b>1,404</b>	<b>1,037</b>	<b>2,441</b>	1	<b>556</b>	<b>1,445</b>	<b>2,001</b>
	<i>57.52</i>	<i>42.48</i>	<i>100.00</i>		<i>27.79</i>	<i>72.21</i>	<i>100.00</i>
	23.58	92.42	34.49		13.63	92.99	35.53
Total	<b>5,955</b>	<b>1,122</b>	<b>7,077</b>	Total	<b>4,078</b>	<b>1,554</b>	<b>5,632</b>
	<i>84.15</i>	<i>15.85</i>	<i>100.00</i>		<i>72.41</i>	<i>27.59</i>	<i>100.00</i>
	100.00	100.00	100.00		100.00	100.00	100.00

(a) Surgical specialists

(b) Medical specialists

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, wave 2017.

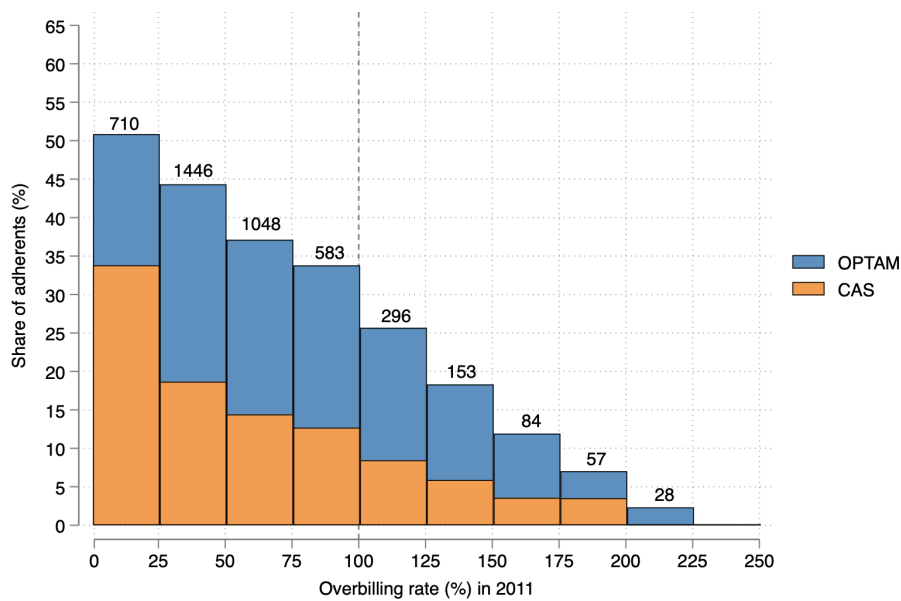
Notes: Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70. Physicians with no contract with the NHI are excluded. In bold, the number of physicians; in italic, the proportion in rows; in regular, the proportion in columns.

Figure 3.1 represents the share of treated physicians according to overbilling rate in 2011, calculated at the individual level. Nearly 35% of Surgical specialists and more than 45% of Medical specialists, who had an overbilling rate between 0 and 25% in 2011, chose to join the CAS. Those proportions are even higher with the OPTAM, which means that new members of the program (physicians who did not chose the CAS but only the OPTAM) are also the ones who overbill the less. For both groups of specialists, the higher the overbilling rate, the lower the proportion of

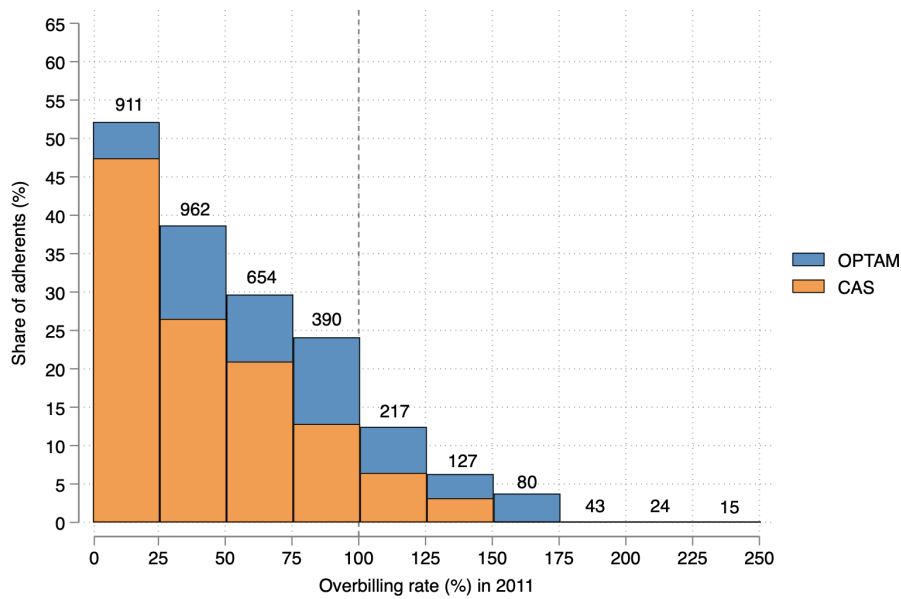
physicians who chose to sign in to the program. Nevertheless, the matching procedure limits the selection bias and as the location is constant over time, individual fixed effects controls for it in the estimation of the programs' effect.

Table 3.5 highlights a significant difference between CAS and non-CAS physicians regarding variables relative to activity and income before CAS implementation in 2011. On average, Surgical specialists members of the CAS saw fewer patients than the non-CAS specialists. On the contrary, CAS Medical specialists had more patients compared to others. Both groups of treated specialists had a higher share of CMU-C patients. Since it is forbidden to charge extra fees for the CMU-C beneficiaries, the overbilling rate performed by treated specialists is lower than the control group, as the average total extra fees earned. In 2011, the difference in extra fees for CAS Surgical specialists compared to non-CAS specialists equaled €42,000 and €30,000 for Medical specialists. Those differences with the control group increased in 2014 and are statistically significant. With the implementation of the CAS contract in 2014, CAS physicians decreased their overbilling rate. They also increased their share of activity charged at regulated prices. Surgical specialists' social contributions were the same for CAS and non-CAS physicians in 2011 but dropped in 2014 for CAS physicians. The same drop is observed for medical specialists. Regarding total fees, CAS Surgical specialists always had lower fees than non-CAS physicians, despite a similar workload (number of office visits and technical procedures). On the contrary, there is no difference between CAS and non-CAS Medical specialists in terms of fees: they compensate their lower extra fees with a higher workload than non-CAS physicians.

Tables 3.6 and 3.7 show the difference between OPTAM and non-OPTAM physicians, respectively, for Surgical and Medical specialists in 2014 and 2017. The CAS was implemented in 2014, so I distinguished for each specialty OPTAM physicians who were also members of the CAS. For Surgical specialists, the differences between physicians who were always treated (by the CAS and the OPTAM) and the control group were still the same, as cited above. The "only" OPTAM physicians tended to have fewer patients but a more significant number of CMU-C patients than the control group. Their overbilling rate was also lower, and they had a more significant number of office visits. However, their total fees were not statistically different compared to the control group. Generally, physicians only treated by the OPTAM are more similar to the control group than the "always treated" group. This statement is more striking for Medical specialists. Compared to the control group, physicians only treated by the OPTAM had a similar workload, number of patients, and social contributions. However, they had more CMU-C patients, a lower overbilling rate, and fewer extra fees.



(a) Surgical specialists



(b) Medical specialists

*Reading note:* 710 Surgical specialists in 2011 had an overbilling rate between 0 and 25%. On average, 34% of them were CAS members in December 2016. For the OPTAM, this proportion raised to 50%.

*Source:* Author's calculation from Insee-CNAM-DGFIP-DREES dataset, wave 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Figure 3.1: Adhesion rate of the CAS and the OPTAM according to overbilling rate



Table 3.5: Mean outcomes difference between CAS and non CAS physicians before and after treatment (2011-2014)

Variables	SURGICAL SPECIALISTS						MEDICAL SPECIALISTS					
	CAS	2011 Non CAS	T-test p-value	CAS	2014 Non CAS	T-test p-value	CAS	2011 Non CAS	T-test p-value	CAS	2014 Non CAS	T-test p-value
<i>Indicator of provision of care (€)</i>												
All procedures	234,997	231,518	0.584	264,345	251,828	0.068	239,339	196,097	0.000	265,262	212,249	0.000
Office visits	63,990	64,658	0.710	63,893	64,521	0.716	62,263	61,388	0.637	67,129	63,212	0.042
Technical procedures	170,480	166,545	0.497	185,698	179,720	0.345	180,018	135,805	0.000	184,342	142,778	0.000
<i>Patients (€)</i>												
Number of patients	2,476	2,728	0.010	2,629	2,950	0.002	2,583	2,392	0.036	2,800	2,582	0.031
Share of CMU-C patients	6.26	4.56	0.000	6.91	4.83	0.000	4.95	3.85	0.000	5.49	4.26	0.000
<i>Income (€)</i>												
Extra-fees	87,530	129,531	0.000	86,610	143,624	0.000	52,015	82,909	0.000	51,205	94,028	0.000
Fees	331,751	367,488	0.000	350,955	395,452	0.000	298,021	283,823	0.102	316,468	306,277	0.272
Contributions	20,628	20,831	0.697	8,953	23,735	0.000	18,711	17,529	0.005	6,939	20,298	0.000
Fees + contributions	312,122	348,738	0.000	342,075	373,719	0.001	280,845	267,433	0.111	311,211	286,724	0.007
Overbilling rate (%)	42.91	69.54	0.000	37.72	67.16	0.000	31.14	54.82	0.000	24.40	54.89	0.000
Activity at regulated prices (%)	70.62	62.96	0.000	75.39	63.90	0.000	76.70	67.30	0.000	82.45	68.00	0.000
Nb. of observations	634	3,021		615	2,924		843	2,257		798	2,147	

Notes: The p-value corresponds to the test of equality of means between CAS and non CAS physicians. Standard deviation are in parentheses.

Source: Author's calculations from Insee-CNAM-DGFiP-DREES dataset, waves 2011 and 2014. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.6: Mean outcomes difference between OPTAM and non-OPTAM Surgical physicians before and after treatment (2014-2017)

Variables	SURGICAL SPECIALISTS									
	OPTAM		2014 Non OPTAM	T-test p-value	T-test p-value	OPTAM		2017 Non OPTAM	T-test p-value	T-test p-value
	CAS (1)	Non CAS (2)	(3)	(1)-(3)	(2)-(3)	CAS (1)	Non CAS (2)	(3)	(1)-(3)	(2)-(3)
<i>Indicator of provision of care (€)</i>										
All procedures	265,289	261,499	248,146	0.026	0.034	294,986	279,007	256,223	0.000	0.000
Office visits	64,135	68,899	62,757	0.487	0.000	64,370	68,889	60,161	0.038	0.000
Technical procedures	186,281	181,257	179,113	0.321	0.715	205,377	195,416	189,332	0.030	0.266
<i>Patients (€)</i>										
Number of patients	2,592	2,437	3,150	0.000	0.000	2,500	2,316	2,996	0.000	0.000
Share of CMU-C patients	6.87	5.28	4.71	0.000	0.000	6.89	5.27	4.64	0.000	0.000
<i>Income (€)</i>										
Extra-fees	85,569	136,612	145,273	0.000	0.029	80,635	134,946	154,353	0.000	0.000
Fees	350,858	398,111	393,419	0.000	0.697	375,622	413,953	410,576	0.005	0.726
Contributions	9,033	23,957	23,285	0.000	0.562	24,919	23,027	21,587	0.000	0.010
Fees + contributions (a)	341,987	374,617	372,658	0.004	0.892	362,010	400,717	406,267	0.001	0.639
(a) + OPTAM bonus										
100 %	341,987	374,617	372,658	0.004	0.892	383,305	420,722	406,267	0.081	0.150
30 %	341,987	374,617	372,658	0.004	0.892	368,399	406,718	406,267	0.003	0.915
Overbilling rate (%)	36.88	55.28	71.28	0.000	0.000	30.46	51.59	73.70	0.000	0.000
Activity at regulated prices (%)	75.50	66.59	63.10	0.000	0.000	78.60	67.98	62.39	0.000	0.000
Nb. of observations	565	829	2145			541	819	2054		

Notes: The p-value corresponds to the test of equality of means between CAS and non CAS physicians. Standard deviation are in parentheses.

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2014 and 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.7: Mean outcomes difference between OPTAM and non-OPTAM Medical physicians before and after treatment (2014-2017)

Variables	MEDICAL SPECIALISTS									
	OPTAM		2014 Non OPTAM	T-test p-value	T-test p-value	OPTAM		2017 Non OPTAM	T-test p-value	T-test p-value
	CAS (1)	Non CAS (2)	(3)	(1)-(3)	(2)-(3)	CAS (1)	Non CAS (2)	(3)	(1)-(3)	(2)-(3)
<i>Indicator of provision of care (€)</i>										
All procedures	269,532	211,177	212,537	0.000	0.900	295,363	226,947	218,314	0.000	0.502
Office visits	67,453	61,741	63,465	0.054	0.503	68,365	63,492	62,614	0.007	0.706
Technical procedures	188,112	141,535	142,906	0.000	0.893	202,781	153,535	150,080	0.000	0.863
<i>Patients (€)</i>										
Number of patients	2,835	2,393	2,607	0.045	0.127	2,880	2,448	2,601	0.027	0.273
Share of CMU-C patients	5.58	4.78	4.18	0.000	0.003	5.56	4.80	4.10	0.000	0.001
<i>Income (€)</i>										
Extra-fees	50,652	89,602	93,555	0.000	0.29	48,876	85,547	100,107	0.000	0.002
Fees	320,184	300,779	306,092	0.193	0.620	344,239	312,494	318,421	0.037	0.581
Contributions	6,956	19,832	19,927	0.000	0.432	22,700	19,772	19,510	0.000	0.789
Fees + contributions (a)	315,782	277,373	287,313	0.005	0.383	336,914	312,882	315,483	0.110	0.756
(a) + OPTAM bonus										
100 %	315,782	277,373	287,313	0.005	0.383	357,106	329,742	315,483	0.001	0.454
30 %	315,782	277,373	287,313	0.005	0.383	342,971	317,940	315,483	0.036	0.993
Overbiling rates (%)	23.89	49.12	55.05	0.000	0.005	20.98	44.13	57.83	0.000	0.000
Activity at regulated price (%)	82.70	69.39	68.15	0.000	0.058	84.41	71.31	66.85	0.000	0.000
Nb. of observations	735	317	1,893			696	308	1,776		

Notes: The p-value corresponds to the test of equality of means between CAS and non CAS physicians. Standard deviation are in parentheses.

Source: Author's calculation from Insee-CNAM-DGFIP-DREES dataset, waves 2014 and 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

## 5 Results

### *Effects on physicians' activity*

Table 3.8 reports the average effect of the CAS and the OPTAM on physicians' activity without (Model 3.1) and with (Model 3.2) the interaction term between the two programs. Since the estimated coefficients are quite similar<sup>8</sup> between the two models, I mainly comment results from equation 3.1. The results indicate no effect of the CAS for Surgical specialists on indicators of provision of care compared to the never treated. However, joining the OPTAM has a more substantial effect on physicians' activity: on average, they increased all procedures by 12.3%, office visits by 19.4%, and technical procedures by 6%. The general increment in activity is driven by a higher number of patients seen (+4.3%), especially from a higher number of CMU-C beneficiaries (+5.8%). Overall, the OPTAM membership impacted more Surgical specialists' activity than the CAS. The OPTAM, through its flexibility and advantageous payment, in contrast with the CAS, provides more incentives to Surgical physicians to improve access to care by increasing their workload. As a reminder, the CAS's enrolment rate was 15.85%, and the OPTAM's was 34.49 %: those figures also confirmed OPTAM's attractiveness (Table 3.4).

Medical specialists were sensitive to both programs: more Medical Specialists enrolled in the CAS (27.59%) compared to Surgical Specialists, and many enrolled in the OPTAM (35.53%). On average, CAS physicians increased the number of office visits (+8.4%). In addition, they saw more patients (+4.6%) and more CMU-C beneficiaries (+6.9%) compared to the never treated physicians. As for Surgical specialists, the effect of the OPTAM is stronger than the CAS on physicians' activity. The number of procedures rose by 12.3% (+7.8% of office visits) for OPTAM physicians. They started to perform more technical procedures than others (+7.1%). This higher workload can be explained by more patients seen (+5.8%) and CMU-C beneficiaries (+5.9%). Finally, both the CAS and the OPTAM affected Medical specialists' activity, but the OPTAM provided more incentives.

### *Effects on physicians' income*<sup>9</sup>

Table 3.9 reports the average effect of the CAS and the OPTAM on physicians' income. The results suggest that joining the CAS had a slightly negative impact on Surgical specialists' total fees (-4.5%): the decrease is statistically significant at the 10% threshold. When taking into account the reduction of social contributions<sup>10</sup> paid by the CAS physicians, fees between CAS physicians and the control group are similar: subsidies from the NHI compensated for the decrease in extra fees. However, under the assumption that all CAS physicians benefited from the NHI's subsidies, this increased NHI's expenditures by 6%. The OPTAM membership positively influenced their total fees (+7.8%). The effect on total fees is slightly smaller (+7.6%) when I included their social contributions (which decrease their fees) and a simulated 100% of OPTAM

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<sup>8</sup>The interaction term is rarely statistically significant in Model 3.2.

<sup>9</sup>I only comment on estimations of outcome variables for which the parallel trend assumption seemed to be confirmed. The effect of the CAS and the OPTAM on extra fees, overbilling rates, and the share of activity are as expected, but we must be cautious about interpreting them as they are.

<sup>10</sup>Social contributions are simulated using physicians' labor income and activity charged at regulated prices.

bonus: the increase in social contributions (due to a higher activity) in 2017<sup>11</sup> is compensated by the OPTAM bonus. The positive effect of OPTAM on total fees decreased with a lower OPTAM bonus. This increase in fees cost the NHI 17% more than the control group.

For the Medical specialists, the CAS did not impact their total fees. The increase in activity only compensated for the decrease in fees. However, when removing their social contributions (reduced by the NHI's subsidy for CAS physicians) to their fees, they increased by +5.9% compared to others. The NHI's expenditures rose by +14.7%. The OPTAM influenced Medical specialists' fees (+5.9%): they increased their activity more than decreased their extra fees. When removing social contributions and adding the OPTAM bonus, the effect is slightly smaller (+5.7%). As for Surgical specialists, 100% of the OPTAM bonus compensated for the increase in social contributions. However, if OPTAM physicians deviated too much from their objectives, they only compensated for the decrease in fees with an increase in activity (the effect is statistically insignificant when adding 30% of the OPTAM bonus to their fees). On average, the costs for the NHI were higher than the control group by 13.6%.

Finally, the CAS and the OPTAM encouraged physicians to see more patients (including the poorest). Consequently, *treated* specialists had a higher workload and fees than the control group. Our results show that financial incentives, even “small” ones (5% of physicians' fees), encourage specialist physicians to improve access to care. However, physicians who chose the CAS and OPTAM were not the ones who charged the highest extra fees. Table 3.10 shows changes over the years of the sum of fees, extra fees, and NHI's costs for each subgroup. We see that the sum of fees for Surgical specialists increased over the period. On the whole, the sum of extra fees decreased by only €1 million. As expected, the *always treated* group decreased their fees from 2014, and the *only OPTAM* did the same in 2017, but the increase in extra fees of the control group counterbalanced those decreases. The rise in fees and (simulated) programs' rewards generated high costs for the NHI. The cost of each treated group increased on the year they enrolled in the programs. The programs cost €56,942,133 million to avoid €9,683,171<sup>12</sup> of extra fees from Surgical specialists: in other words, the NHI spent €5.88 to avoid €1 of extra fees. For the Medical specialists, the total sum of fees increased for the treated physicians, and as Surgical specialists, I observed a drop in the sum of extra fees during the year they joined the program. In addition, the total sum of the NHI's costs increased with fees and rewards from the programs. For Medical specialists, the NHI spent €4 to avoid €1 of extra fees. Surgical and Medical specialists together, treated physicians drop their extra fees by €17,936,698 million, and it cost €90,869,587 million for the NHI: on average, the NHI spent €5 to avoid €1 of extra fees. Those results are closer to the CC's conclusion than the NHI's: both the CAS and the OPTAM were costly for the NHI. However, the cost I found is half the size of theirs.

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<sup>11</sup>The NHI no longer subsidy physicians' social contributions.

<sup>12</sup>The cost and the avoided extra fees are calculated for each treated group: I calculated the difference between the year before and the last year of treatment. Then, I summed up all the differences. Identical calculations are made for Medical specialists.

Table 3.8: Average effect of the CAS and OPTAM adherence on matched physicians' activity

Outcomes in logarithm	INDICATORS OF PROVISION OF CARE (€)			NUMBER	
	All procedures	Office visits	Technical procedures	All Patients	CMU-C patients
<i>Panel A: Surgical specialists</i>					
<b>CAS</b>	0.027 (0.026)	0.010 (0.031)	0.008 (0.026)	-0.018 (0.018)	0.025 (0.023)
<b>OPTAM</b>	0.123*** (0.021)	0.194*** (0.030)	0.060*** (0.023)	0.043*** (0.016)	0.058*** (0.019)
<b>CAS</b> ( $\alpha$ )	0.015 (0.029)	0.027 (0.032)	-0.003 (0.026)	-0.017 (0.019)	0.025 (0.024)
<b>OPTAM</b> ( $\beta$ )	0.112*** (0.022)	0.209*** (0.033)	0.051** (0.025)	0.043** (0.017)	0.059*** (0.021)
<b>CAS</b> × <b>OPTAM</b> ( $\gamma$ )	0.036 (0.023)	-0.049* (0.028)	0.032 (0.025)	-0.002 (0.017)	-0.002 (0.022)
P-value ( $\alpha + \gamma$ )	0.061	0.555	0.389	0.397	0.412
P-value ( $\beta + \gamma$ )	0.000	0.000	0.002	0.019	0.013
Number of observations	15,222	13,033	12,998	15,222	15,222
<i>Panel B: Medical specialists</i>					
<b>CAS</b>	0.084*** (0.026)	0.084*** (0.029)	0.037 (0.039)	0.046** (0.021)	0.069** (0.025)
<b>OPTAM</b>	0.123*** (0.019)	0.078*** (0.026)	0.071** (0.030)	0.058*** (0.016)	0.059** (0.025)
<b>CAS</b> ( $\alpha$ )	0.083*** (0.025)	0.087*** (0.028)	0.033 (0.039)	0.049** (0.021)	0.061** (0.025)
<b>OPTAM</b> ( $\beta$ )	0.122*** (0.028)	0.087** (0.036)	0.062 (0.044)	0.065*** (0.024)	0.038 (0.035)
<b>CAS</b> × <b>OPTAM</b> ( $\gamma$ )	0.003 (0.026)	-0.015 (0.038)	0.015 (0.049)	-0.012 (0.024)	0.035 (0.035)
P-value ( $\alpha + \gamma$ )	0.014	0.111	0.398	0.227	0.014
P-value ( $\beta + \gamma$ )	0.000	0.012	0.027	0.002	0.005
Number of observations	12,499	10,187	8,659	12,499	12,499

Notes: \*p < 0.10 ; \*\* p < 0.05 ; \*\*\* p < 0.01

Robust standard errors are clustered at the physician level and reported in parentheses. Table reports estimates from Models 3.1 and 3.2. Regressions control for a set of covariates described in section 3 and include physicians and time fixed effects.

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.9: Average effect of the CAS and OPTAM adhesion on matched physicians' fees

Outcomes in logarithm <sup>1</sup>			INCOME (€)		(% )		NHI's COSTS (€)
	All Extra-fees	All Fees	All Fees – contributions +100% bonus	All Fees – contributions +30% bonus	Overbilling rate	Activity at regulated price	All costs
<i>Panel A: Surgical specialists</i>							
<b>CAS</b>	-0.251*** (0.027)	-0.045* (0.026)	-0.004 (0.022)	-0.006 (0.022)	-9.494*** (0.688)	5.322*** (0.274)	0.060** (0.026)
<b>OPTAM</b>	-0.034 (0.027)	0.078*** (0.022)	0.076*** (0.017)	0.039** (0.017)	-7.521*** (0.809)	2.849*** (0.246)	0.170*** (0.022)
Number of observations	15,222	15,222	14,765	14,765	15,222	15,222	15,222
<b>CAS</b> ( $\alpha$ )	-0.211*** (0.026)	-0.034* (0.021)	0.014 (0.022)	0.014 (0.022)	-8.827*** (0.730)	4.808*** (0.287)	0.089*** (0.020)
<b>OPTAM</b> ( $\beta$ )	0.011 (0.029)	0.067*** (0.022)	0.080*** (0.018)	0.045** (0.018)	-6.600*** (0.896)	2.354*** (0.277)	0.169*** (0.021)
<b>CAS</b> × <b>OPTAM</b> ( $\gamma$ )	-0.139*** (0.029)	0.003 (0.017)	-0.029* (0.017)	-0.035** (0.017)	-2.945*** (0.764)	1.627*** (0.303)	-0.036** (0.017)
P-value ( $\alpha + \gamma$ )	0.000	0.253	0.547	0.411	0.000	0.000	0.051
P-value ( $\beta + \gamma$ )	0.000	0.000	0.003	0.550	0.000	0.000	0.000
Number of observations	15,222	15,222	14,765	14,765	15,222	15,222	15,222
<i>Panel B: Medical specialists</i>							
<b>CAS</b>	-0.272*** (0.043)	0.033 (0.025)	0.059*** (0.021)	0.058*** (0.021)	-9.126*** (0.593)	5.362*** (0.361)	0.147*** (0.025)
<b>OPTAM</b>	-0.189*** (0.029)	0.059*** (0.018)	0.057*** (0.018)	0.015 (0.018)	-6.916*** (0.524)	3.163*** (0.235)	0.136*** (0.018)
Number of observations	12,499	12,499	12,241	12,241	12,499	12,499	12,499
<b>CAS</b> ( $\alpha$ )	-0.233*** (0.044)	0.008 (0.024)	0.046** (0.022)	0.046** (0.022)	-9.267*** (0.584)	5.266*** (0.344)	0.135*** (0.025)
<b>OPTAM</b> ( $\beta$ )	-0.071** (0.034)	0.072*** (0.027)	0.088*** (0.025)	0.049** (0.025)	-7.809*** (0.846)	3.194*** (0.375)	0.193*** (0.027)
<b>CAS</b> × <b>OPTAM</b> ( $\gamma$ )	-0.193*** (0.045)	0.007 (0.025)	-0.027 (0.024)	-0.033 (0.024)	1.449* (0.821)	-0.024 (0.376)	-0.063** (0.026)
P-value ( $\alpha + \gamma$ )	0.000	0.656	0.528	0.664	0.000	0.000	0.039
P-value ( $\beta + \gamma$ )	0.000	0.000	0.003	0.428	0.000	0.000	0.000
Number of observations	12,499	12,499	12,241	12,241	12,499	12,499	12,499

Notes: \*p < 0.10 ; \*\*p < 0.05 ; \*\*\*p < 0.01

Robust standard errors are clustered at the physician level and reported in parentheses. Table reports estimates from Models 3.1 and 3.2. Regressions control for a set of covariates described in section 3 and include physicians and time fixed effects.

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.10: Sum of fees, extra fees and NHI's costs by subgroups

Variables (€)	2005	2008	2011	2014	2017
SURGICAL SPECIALISTS					
<b>Total fees</b>					
<i>Control group</i>					
CAS=0 OPTAM=0	434,999,552	614,936,704	826,114,752	865,284,032	869,939,520
<i>Treated group</i>					
CAS=1 OPTAM=1	120,448,896	152,977,088	193,389,696	198,234,720	203,211,344
CAS=1 OPTAM=0	8,228,263	11,403,722	16,940,196	17,602,406	17,254,274
CAS=0 OPTAM=1	166,894,944	235,609,232	312,609,824	330,034,016	339,027,424
Total	730,571,655	1,014,926,746	1,349,054,468	1,411,155,174	1,429,432,562
<b>Total extra fees</b>					
CAS=0 OPTAM=0	142,116,416	217,920,032	311,175,712	332,657,792	339,167,104
<i>Treated group</i>					
CAS=1 OPTAM=1	28,316,468	39,105,040	51,108,256	48,346,680	43,623,752
CAS=1 OPTAM=0	2,014,630	3,005,267	4,385,957	4,918,274	4,718,295
CAS=0 OPTAM=1	45,121,708	70,817,736	102,198,240	113,251,744	110,520,760
Total	217,569,222	330,848,075	468,868,165	499,174,490	498,029,911
<b>Total costs of NHI</b>					
CAS=0 OPTAM=0	292,883,136	397,016,704	514,939,072	532,626,208	530,772,384
<i>Treated group</i>					
CAS=1 OPTAM=1	92,132,432	113,872,048	142,281,440	158,712,016	170,707,936
CAS=1 OPTAM=0	6,213,633	8,398,455	12,554,238	13,356,147	12,535,979
CAS=0 OPTAM=1	121,773,240	164,791,488	210,411,584	216,782,256	244,495,984
Total	513,002,441	684,078,695	880,186,334	921,476,627	958,512,283
MEDICAL SPECIALISTS					
<b>Total fees</b>					
<i>Control group</i>					
CAS=0 OPTAM=0	314,542,624	461,347,168	603,720,704	618,367,040	604,637,120
<i>Treated group</i>					
CAS=1 OPTAM=1	123,023,160	169,623,920	233,837,536	235,335,552	239,590,224
CAS=1 OPTAM=0	12,779,897	15,010,754	17,394,052	17,205,656	12,051,691
CAS=0 OPTAM=1	46,339,368	69,119,864	90,810,272	95,346,912	96,248,168
Total	496,685,049	715,101,706	945,762,564	966,255,160	952,527,203
<b>Total extra fees</b>					
<i>Control group</i>					
CAS=0 OPTAM=0	90,745,264	146,878,144	208,855,968	221,935,488	218,020,848
<i>Treated group</i>					
CAS=1 OPTAM=1	21,083,234	29,408,218	40,219,712	37,229,316	34,017,912
CAS=1 OPTAM=0	2,333,141	2,955,428	3,628,757	3,632,590	2,725,756
CAS=0 OPTAM=1	11,503,545	18,425,362	25,466,954	28,403,932	26,348,372
Total	125,665,184	197,667,152	278,171,391	291,201,326	281,112,888
<b>Total costs of NHI</b>					
<i>Control group</i>					
CAS=0 OPTAM=0	223,797,376	314,469,024	394,864,736	396,431,520	386,616,288
<i>Treated group</i>					
CAS=1 OPTAM=1	101,939,928	140,215,696	193,617,824	209,317,072	219,086,256
CAS=1 OPTAM=0	10,446,756	12,055,326	13,765,295	14,385,289	9,325,934
CAS=0 OPTAM=1	34,835,824	50,694,504	65,343,320	66,942,980	74,782,008
Total	371,019,884	517,434,550	667,591,175	687,076,861	689,810,486

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.



## 6 Additional robustness analyses

### 6.1 Average treatment effects on subgroups

The baseline model (equation 3.1) estimates the effect of the CAS and the OPTAM on specialists' activity and income for four groups of physicians (three treated groups and a control group). Since the matching procedure used a unique treatment variable (a dummy for the ones treated by the CAS and/or the OPTAM), it could be imperfect if we consider that CAS physicians differ from OPTAM physicians. I then check with three additional models if the effects of the programs are different depending on the group compared to the never treated:

- *CAS physicians (whether they chose OPTAM or not) versus the control group.*

The following equation estimates the effect of the CAS whatever the OPTAM status afterwards:

$$Y_{it} = \sigma CAS_{it} + X'_{it}\omega + \eta_i + \eta_t + v_{it} \quad (3.3)$$

with  $i = 1...N$  and  $t = 2005, 2008, 2011, 2014$

$CAS_{it}$  is a dummy variable equals to 1 in 2014 if the physician  $i$  joined the CAS, zero otherwise.

- *CAS and OPTAM physicians versus the control group.*

The following equation estimates the CAS and the OPTAM for physicians who were the most responsive to financial incentives:

$$Y_{it} = \lambda CAS_{it} + \theta OPTAM_{it} + X'_{it}\rho + \zeta_i + \zeta_t + \nu_{it} \quad (3.4)$$

with  $i = 1...N$  and  $t = 2005, 2008, 2011, 2014, 2017$

$CAS_{it}$  is a dummy variable equals to 1 in 2014 and in 2017 if the physician  $i$  joined the CAS, zero otherwise.

$OPTAM_{it}$  is a dummy variable equals to 1 in 2017 if the physician  $i$  joined the OPTAM, zero otherwise.

- *Only OPTAM physician (no CAS chosen before) versus the control group.*

The following equation estimates the effect of OPTAM for physicians who did not chose the CAS:

$$Y_{it} = \phi OPTAM_{it} + X'_{it}\tau + \psi_i + \psi_t + \xi_{it} \quad (3.5)$$

with  $i = 1...N$  and  $t = 2005, 2008, 2011, 2014, 2017$

$OPTAM_{it}$  is a dummy variable equals to 1 in 2017 if the physician  $i$  joined the OPTAM, zero otherwise.

For each equation,  $Y_{it}$  and  $X'_{it}$  denote the same outcome variables and set of control variables than those used in Model 3.1. All regressions include physician and time fixed effects, and robust standard errors are clustered at the physician level.

## Results of the estimation of average treatment effects on subgroups

### *The average effect of the CAS*

Results for the three additional analyses (equations 3.3, 3.4 and 3.5) are reported in Table 3.11. In equation 3.3, I estimate the average effect of the CAS before the OPTAM's implementation, i.e., I restrict my sample to years 2005-2014 and ignore the future OPTAM status. Being a Surgical specialist who joined the CAS led to a small rise in office visits, and the number of patients and total fees are not significantly different from the control group. However, the CAS (if we make the hypothesis that all physicians reached their goals) rose for the NHI expenditures by 11.7%. While the CAS has little effect on Surgical specialists' activity, it led to a rise in all outcomes related to Medical specialists' activity: they saw more patients (including CMU-C patients) and increased their workload (mainly office visits). Their fees increased with the reduction of social contributions, leading to 17.5% in NHI expenditures. The effect of the CAS is quite similar to what we found in the main analysis: it failed to motivate Surgical specialists. It was costly for the NHI, but it effectively increased the number of patients seen and the total activity of Medical specialists.

### *The average effect of the CAS and the OPTAM for the always treated*

In equation 3.4, I restrict the sample to *always treated* and to *never treated* physicians. For Surgical specialists, we have the same results for the effect of the CAS as in equation 3.3. It means that the effect of the CAS (observed in equation 3.3) is only driven by the *always treated*, who are more sensitive to the programs than the others. The OPTAM significantly influenced physicians' activity: *always treated* physicians increased all their procedures, and the number of CMU-C patients rose by 8%. Their fees increased with the OPTAM bonus by also 8%. However, it is still costly for the NHI (+23% compared to the *never treated* group). Both the CAS and the OPTAM impacted Medical specialists' activity and income: the whole activity increased (the more extensive patient lists led to increased procedures). Hence, their fees increased with both the programs' benefits and even more with the OPTAM bonus (even if the rewards were the lowest they could get). As a result, both programs were costly for the NHI (+18% with the CAS and +28% with the OPTAM). Those results confirmed that the CAS was inefficient for Surgical specialists and that the OPTAM was a better option for them. Furthermore, Surgical and Medical specialists reacted more with the OPTAM, which proves its efficiency compared to the CAS. However, the increased access to care goes hand in hand with higher costs for the NHI.

### *The average effect of the OPTAM for the newly treated*

The average effect of the OPTAM for the *only OPTAM* physicians is estimated using equation 3.5. Treated Surgical specialists in 2017 saw 5.9% more CMU-C patients than the *never treated* group. Consequently, they increased all procedures by 9.4% compared to others. It led to a rise in fees with the OPTAM bonus up to 7.3% and a 16% increase in costs for the NHI. For Medical Specialists, we can see an increase in all procedures (+9.3%) and a little increase in the number of patients seen (+4.2%). With the total OPTAM bonus, their fees would increase by 5.2%, and consequently, the NHI's costs by 16.4%. Those results show a significant impact of the OPTAM on physicians' activity and income.

## 6.2 Estimations with Callaway and Sant’Anna [2021] method

The CAS and the OPTAM are two contracts with considerable similarities. They have the exact nature of incentives: to improve access to care by increasing the supply of care charged at regulated prices (by decreasing extra fees paid by the patient). Therefore, we could consider them as one instead of two treatments. For instance, physicians who opted for the CAS and the OPTAM are just physicians who were treated longer than the others. Therefore, the CAS and the OPTAM are one policy but with physicians’ enrollment at different dates. Callaway and Sant’Anna [2021] proposed an innovative framework for average treatment effects in Difference-in-Differences setups with multiple periods, variation in treatment timing, and when the parallel trends assumption holds potentially only after conditioning on observed covariates. One of the assumptions is the staggered treatment adoption: once a physician is treated, she will remain treated in the next period. Each group  $g$  of treated is identified by the first date of entry in the program: for the CAS, it is in 2014 and for the OPTAM, it is 2017. The authors used a propensity score matching procedure to find good controls for the treated groups. The propensity score could be calculated based on the “not yet treated” group (physicians who did not choose the CAS but enrolled in the OPTAM) and on the never treated group. I used the same covariates for the propensity score matching and the CEM matching used for the previous analyses. Finally, a "group-time average treatment effect" can be estimated for each group  $g$  at a particular time  $t$ :  $ATT(g, t) = E[Y_t(g) - Y_t(0)|Gg = 1]$  where  $g = 2014, 2017$  and  $t = 2005, 2008, 2011, 2014, 2017$ .  $Y_t(0)$  denotes physician  $i$ ’s untreated potential outcome at time  $t$  if they remain untreated through the time period and  $G$  is the time period when a physician first becomes treated. In addition, the authors constructed aggregated parameters: the average effect of the treatment across each group and for both groups over the period considered. They also provided a test for pre-trends parallel assumption where the null hypothesis is “all pre-treatment are equal to 0”. To validate pre-trend parallel assumption with this test at the 5% threshold, the p-value should not be under 0.050.

### Results with Callaway and Sant’Anna [2021] estimation method

Table 3.12 reports group-time average treatment effects, average group specific effect, and a generalized average treatment effect for Surgical and Medical specialists. The pre-trends tests confirm the violation of the parallel trend assumption for the following outcomes: extra fees, overbilling rate and the share of the activity charged a regulated prices. For Surgical specialists, pre-trends are not parallel for office visits and the number of CMU-C patients so we must be cautious with results on those outcomes. For Medical specialists, all other outcomes passed the pre-treatment test. On average, treated Surgical specialists increased all procedures (+8.9%), which could be explained by a rise in technical procedures (+4.5%). The number of patients is slightly higher (+2%) compared to the never treated. However, this effect is stronger in 2017 for physicians first treated in 2014 (which corresponds to the OPTAM effect on CAS physicians’ number of patients seen). Their fees increased, in particular with the programs’ rewards. When looking at the group-specific effect, we can see that physicians who first enrolled with the CAS had, on average, fees that increased more than those first treated in 2017 (*only OPTAM*). As for Surgical specialists, treated Medical specialists increased their activity by 13.5% compared to the never treated physicians. Moreover, they saw more patients and more CMU-C beneficiaries

(+6.4%). Consequently, their fees increased by 8.8% with a bonus; on average, both programs cost the NHI 10% more than the control group. The OPTAM still had a more substantial effect than the CAS on physicians' activity and income. On average, the *always treated* group is more sensitive to the programs than others, only treated by the OPTAM.

Table 3.11: Additional estimations on subgroups of treated versus the never treated group

Outcomes in logarithm	INDICATORS OF PROVISION OF CARE (€)			NUMBER		INCOME (€)				(% )		(NHI's costs (€))
	All procedures	Office visits	Technical procedures	All Patients	CMU-C patients	All Extra-fees	All Fees	Fees + contributions +100% bonus	Fees + contributions +30% bonus	Overbilling rate	Activity at regulated prices	All costs
AVERAGE EFFECT OF CAS (2005-2014) - TREATED GROUP: CAS=1												
<i>Panel A: Surgical specialists</i>												
CAS	0.066*** (0.023)	0.081** (0.036)	0.014 (0.028)	-0.004 (0.018)	0.035 (0.026)	-0.167*** (0.028)	0.001 (0.023)	0.037 (0.023)	0.037 (0.023)	-7.123*** (1.185)	4.881*** (0.327)	0.117*** (0.022)
Number of observations	8059	6582	6559	8060	8005	8054	8060	8008	8008	8059	8060	8060
<i>Panel B: Medical specialists</i>												
CAS	0.120*** (0.026)	0.115*** (0.029)	0.074* (0.039)	0.074*** (0.021)	0.072*** (0.025)	-0.207*** (0.046)	0.047* (0.025)	0.076*** (0.022)	0.076*** (0.022)	-8.921*** (0.605)	5.146*** (0.388)	0.175*** (0.025)
Number of observations	8395	6532	5479	8396	8233	8370	8396	8359	8359	8396	8396	8396
AVERAGE EFFECT OF CAS AND OPTAM (2005-2017) - TREATED GROUP: CAS=1 OPTAM=1												
<i>Panel A: Surgical specialists</i>												
CAS	0.055** (0.021)	0.083** (0.036)	0.002 (0.028)	-0.011 (0.018)	0.030 (0.026)	-0.177*** (0.028)	-0.011 (0.022)	0.032 (0.023)	0.032 (0.023)	-7.509*** (1.063)	4.894*** (0.331)	0.106*** (0.021)
OPTAM	0.176*** (0.029)	0.242*** (0.051)	0.095** (0.037)	0.025 (0.024)	0.080** (0.031)	-0.319*** (0.044)	0.050 (0.031)	0.081*** (0.027)	0.041 (0.027)	-17.409*** (1.387)	8.868*** (0.429)	0.233*** (0.030)
Number of observations	9886	8452	8421	9887	9826	9879	9887	9716	9716	9886	9887	9887
<i>Panel B: Medical specialists</i>												
CAS	0.128*** (0.026)	0.109*** (0.030)	0.077* (0.041)	0.079*** (0.021)	0.070*** (0.025)	-0.209*** (0.046)	0.052** (0.025)	0.082*** (0.022)	0.081*** (0.022)	-9.570*** (0.643)	5.264*** (0.462)	0.183*** (0.025)
OPTAM	0.225*** (0.032)	0.169*** (0.038)	0.129*** (0.048)	0.115*** (0.027)	0.140*** (0.035)	-0.483*** (0.056)	0.106*** (0.032)	0.127*** (0.030)	0.082*** (0.030)	-15.898*** (0.760)	8.480*** (0.461)	0.284*** (0.032)
Number of observations	10233	8304	7084	10234	10046	10204	10234	10034	10034	10234	10234	10234
AVERAGE EFFECT OF OPTAM (2005-2017) - TREATED GROUP: CAS=0 OPTAM=1												
<i>Panel A: Surgical specialists</i>												
OPTAM	0.094*** (0.022)	0.172*** (0.033)	0.040 (0.025)	0.040** (0.019)	0.059*** (0.023)	-0.005 (0.029)	0.055** (0.023)	0.073*** (0.020)	0.038* (0.020)	-7.083*** (0.927)	2.390*** (0.288)	0.160*** (0.022)
Number of observations	11594	9947	9924	11594	11525	11586	11595	11385	11385	11594	11595	11595
<i>Panel B: Medical specialists</i>												
OPTAM	0.093*** (0.029)	0.082* (0.046)	0.042 (0.052)	0.042* (0.025)	0.022 (0.036)	-0.106*** (0.036)	0.043 (0.028)	0.052** (0.024)	0.013 (0.024)	-8.064*** (0.952)	3.091*** (0.403)	0.164*** (0.029)
Number of observations	6964	5765	4822	6965	6816	6955	6965	6814	6814	6965	6965	6965

Notes: \*p < 0.10 ; \*\*p < 0.05 ; \*\*\*p < 0.01

Robust standard errors are clustered at the physician level and reported in parentheses. Table reports estimates from Models 3.3, 3.4 and 3.3. Regressions control for a set of covariates described in section 3 and include physicians and time fixed effects.

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.12: Estimations with Callaway and Sant'Anna [2021] method

Outcomes in logarithm	INDICATORS OF PROVISION OF CARE (€)			NUMBER		All Extra-fees	All Fees	INCOME (€)		(%)		NHI's costs (€)
	All procedures	Office visits	Technical procedures	All Patients	CMU-C patients			Fees + contributions +100% bonus	Fees + contributions +30% bonus	Overbilling rate	Activity at regulated prices	
<i>Panel A: Surgical specialists</i>												
TREATED IN 2014: g=2014												
t=2014	0.063** (0.021)	0.076** (0.030)	0.024 (0.024)	0.003 (0.016)	0.020 (0.020)	-0.154*** (0.026)	0.010 (0.021)	0.053*** (0.019)	0.053*** (0.019)	-50.596*** (0.812)	40.393*** (0.282)	0.118*** (0.021)
t=2017	0.178*** (0.026)	0.220*** (0.036)	0.097*** (0.031)	0.041** (0.020)	0.078*** (0.025)	-0.304*** (0.035)	0.068*** (0.026)	0.093*** (0.024)	0.053** (0.024)	-14.42*** (1.023)	8.363*** (0.356)	0.242*** (0.026)
TREATED IN 2017: g=2017												
t=2017	0.058** (0.019)	0.123*** (0.022)	0.030 (0.021)	0.018 (0.015)	0.015 (0.017)	-0.073*** (0.021)	0.017 (0.020)	0.032** (0.016)	-0.002 (0.016)	-7.156*** (0.611)	2.449*** (0.173)	0.126*** (0.020)
PARTIALLY AGGREGATED: GROUP SPECIFIC EFFECT												
g=2014	0.119*** (0.022)	0.146*** (0.031)	0.060 (0.026)	0.022 (0.017)	0.048** (0.021)	-0.227*** (0.028)	0.038* (0.022)	0.072** (0.020)	.053** (0.020)	-9.917*** (0.837)	6.335*** (0.297)	0.179*** (0.022)
g=2017	0.058** (0.019)	0.123*** (0.022)	0.030 (0.021)	0.018 (0.015)	0.015 (0.017)	-0.073*** (0.021)	0.017 (0.020)	0.032** (0.016)	-0.002 (0.016)	-7.156*** (0.611)	2.449*** (0.173)	0.126*** (0.020)
AVERAGE TREATMENT EFFECT												
ATT	0.089*** (0.015)	0.135 (0.020)	0.045*** (0.017)	0.020* (0.012)	0.032 (0.014)	-0.153*** (0.018)	0.028* (0.015)	0.053*** (0.013)	0.027** (0.013)	-8.592*** (0.563)	4.470*** (0.189)	0.153*** (0.015)
P-value pre-trends test	0.850	0.000	0.958	0.123	0.001	0.029	0.704	0.750	0.750	0.000	0.000	0.954
Number of observations	22,274	19,209	19,148	22,275	22,092	22,250	22,276	20,651	20,651	22,274	22,276	22,100
<i>Panel B: Medical specialists</i>												
TREATED IN 2014: g=2014												
t=2014	0.108*** (0.025)	0.091** (0.028)	0.036 (0.032)	0.057*** (0.020)	0.047** (0.022)	-0.172*** (0.045)	0.043* (0.024)	0.076*** (0.020)	0.076*** (0.020)	-6.65*** (0.553)	5.108*** (0.314)	0.159*** (0.025)
t=2017	0.207*** (0.029)	0.151*** (0.035)	0.076** (0.038)	0.092*** (0.024)	0.103*** (0.029)	-0.403*** (0.055)	0.100 (0.028)	0.113*** (0.026)	0.069*** (0.026)	-12.60*** (0.698)	8.056*** (0.381)	0.262*** (0.028)
TREATED IN 2017: g=2017												
t=2017	0.063** (0.021)	0.025 (0.024)	0.051 (0.038)	0.029 (0.019)	0.029 (0.027)	-0.075*** (0.027)	0.024 (0.021)	0.068*** (0.023)	0.030 (0.023)	-6.34*** (0.618)	2.500*** (0.252)	0.136* (0.021)
PARTIALLY AGGREGATED: GROUP SPECIFIC EFFECT												
g=2014	0.156*** (0.026)	0.120*** (0.029)	0.056* (0.032)	0.074*** (0.021)	0.074*** (0.023)	-0.284*** (0.047)	0.071*** (0.025)	0.093*** (0.021)	0.073*** (0.021)	-9.553*** (0.594)	6.544*** (0.334)	0.209*** (0.026)
g=2017	0.063** (0.021)	0.025 (0.024)	0.051 (0.038)	0.029 (0.019)	0.029 (0.027)	-0.075*** (0.027)	0.024 (0.021)	0.068*** (0.023)	0.030 (0.023)	-6.34*** (0.618)	2.500*** (0.252)	0.136* (0.021)
AVERAGE TREATMENT EFFECT												
ATT	0.135*** (0.020)	0.097*** (0.023)	0.055** (0.026)	0.064*** (0.017)	0.064*** (0.019)	-0.235*** (0.037)	0.060*** (0.020)	0.088*** (0.017)	0.064*** (0.017)	-8.807*** (0.489)	5.605*** (0.269)	0.192*** (0.020)
P-value pre-trends test	0.317	0.925	0.491	0.347	0.822	0.020	0.681	0.974	0.974	0.000	0.000	0.215
Number of observations	16,319	13,213	11,211	16,319	15,881	16,319	14,898	14,898	16,319	16,319	16,319	16,122

Notes: \*p < 0.10 ; \*\*p < 0.05 ; \*\*\*p < 0.01

Robust standard errors are clustered at the physician level and reported in parentheses. Regressions control for a set of covariates described in section 3 and include physicians and time fixed effects.

Source: Author's calculations from Insee-CNAM-DGFiP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

## 7 Discussion and Conclusion

This paper evaluates the causal impact of two programs of overbilling regulation, called the "*Contrat d'accès aux soins*" (CAS) introduced in 2014 and the "*Option Pratique Tarifaire Maîtrisée*" (OPTAM) which replaced the CAS in 2017, on French specialists' activity and income.

The main objective of those programs was to improve access to care through financial incentives, which encourage physicians to charge fewer extra fees and increase their activity charged at regulated prices. If they reached some objectives regarding overbilling rates and share of activity set at regulated prices, the NHI subsidized their social insurance contributions (with the CAS) or gave monetary bonuses (with the OPTAM).

This study focuses on two groups of self-employed physicians: Surgical specialists (composed of surgeons, ophthalmologists, obstetricians gynecologists and ENT doctors) and Medical specialists (anesthetists, cardiologists, dermatologists, rheumatologists, pediatricians, psychiatrists and radiologists). I use a panel administrative dataset on all self-employed specialists, which gives information on physicians' annual activity, income and sociodemographic characteristics. Using difference-in-differences estimations, I assess the impact of the CAS and the OPTAM on several outcomes relative to physicians' activity and income. Using the panel dimension of my dataset, I take into account the potential endogeneity to the membership to both programs by estimating a two-way fixed effect model which controls for all time-invariant individual-specific factors and for constant average differences between physicians in any observable or unobservable variables that could be correlated to the program's membership. Additional robustness analyses on subgroups and estimations with [Callaway and Sant'Anna \[2021\]](#) method are made. Our results are consistent with those additional models.

My results show that the CAS did not impact surgical specialists' activity or fees. However, they were influenced by the OPTAM: they saw more patients (including those with low income) and performed more procedures (office visits and technical procedures). As a result, their fees increased due to this higher workload and also because of their monetary reward. For Medical specialists, both the CAS and the OPTAM impacted their activity: they also performed more office visits because of a higher number of patients seen. However, this increase in access to care was associated with a rise in total expenditures for the NHI.

The OPTAM had a more substantial effect than the CAS on physicians' activity. Its flexibility and payment changes give physicians better incentives to improve access to care. Even if financial incentives represented, on average, 5% of physicians' fees, they were enough to change specialist physicians' behavior by working more and treating more patients. Nevertheless, the CAS and the OPTAM missed their main target (physicians who charge high extra fees): physicians who joined the programs already had a low level of extra fees, so their constraints were lower than expected. Consequently, the decrease in extra fees was costly for the NHI, who had to pay both the fee increase and the programs' rewards.

To sum up, the CAS and the OPTAM improved access to care. Indeed, physicians treated more patients, especially those with low income, who were most likely to not seek care because of extra

fees. However, the increased number of patients led to an increased workload for physicians. In addition, the increase in fees is smaller than the rise in activity. Suppose all physicians reached all their objectives imposed by the contracts, the improvement in access to care is costly for the NHI. Regarding benefits and costs, the balance is negative: the NHI spent more than on average €5 to avoid €1 of extra fees. Therefore, introducing financial incentives has generated a transfer of the payment of extra fees from the patients to the community (the NHI).

This paper estimates a short-term effect of the CAS and the OPTAM on physicians' activity. One of the main assumptions is that physicians directly react once they decide to join the programs. However, the NHI gave them information about their activity during the registration (and also to convince them to join it), informed them every trimester about their progression, and advised them on how to reach their goals in terms of overbilling rates especially. Therefore, seeing them try to achieve their objectives would not be surprising. Furthermore, I only estimate the effect of the programs on the volume of care rather than on the quality. Indeed, I need the information on consultation length and waiting time to do so: if the supply side was already constrained, increasing their workload could decrease the quality of care (more office visits performed in a given time). Finally, The CAS and the OPTAM also had unintended effects: a non-negligible number of eligible sector 1 physicians chose to join the programs and can now overbill: the total share of activity proposed to the population at regulated prices has therefore decreased. Further investigations on sector 1 physicians' adhesion to these programs and the consequences on access to care at regulated prices for the population is, therefore, necessary and left for future research.



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## A. Social contributions calculations

All self-employed physicians must pay social insurance contributions and pension savings each year. The National Health Insurance (NHI) subsidizes most sector 1 physicians' social contributions, and sector 2 physicians have to pay for their own. With the CAS implemented, the NHI proposes a subsidy of social contributions to physicians who sign the contract.

Those social contributions are divided in three categories and the total amount is the sum of those categories:

- general health insurance contributions
- familial contributions
- pension savings

The NHI subsidizes 9.70% of net fees for their Health insurance contributions, 5% of net fees for their familial contributions and 2/3 of the annual lump sum for pension savings.

I calculate CAS and non CAS physicians social insurance contributions based on their activity observed each year of the data set (from 2005 to 2017). To see what CAS physicians would earned in terms of subsidy, I also estimate the average NHI's subsidy proportionnal to their activity at regulated price. The following table shows formulas to calculate contributions and subsidy:

Table 3.A.1: Social contributions and NHI's subsidy

	Contributions Sector 2 physicians (CAS and non-CAS)	NHI's subsidy
(1) Health Insurance contributions	$9.81\% \times \text{net fees}$	$9.7\% \times \text{net fees}$
(2) Familial contributions	$5.4\% \times \text{net fees}$	$5\% \times \text{net fees}$ if net fees $\leq X$ $(5\% \times X) + 2.9\% \times (\text{net fees} - X)$
(3) Pensions savings	$Y + 0.015 \times \text{net fees}$ if net fees $\leq 5X$ $4500 + 0.015 \times 5X$ if net fees $> 5X$	$2/3 (4500 + 0.015 \times 5X)$ if net fees $\leq 5X$ $2/3 (4500 + 0.015 \times 5X)$ if net fees $> 5X$
Total	$(4) = (1) + (2) + (3)$	$(5) = [(1) + (2) + (3)] \times \text{fees at regulated price}$

Notes:  $X$  is the annual social security limit (€) ;

$X_{2005} = 30,192$ ,  $X_{2008} = 33,276$ ,  $X_{2011} = 35,352$ ,  $X_{2014} = 37,548$ ,  $X_{2017} = 43,151$ .

$Y$  is a lump sum amount (€) ;

$Y_{2005} = 3,600$ ,  $Y_{2008} = 3,960$ ,  $Y_{2011} = 4,140$ ,  $Y_{2014} = 4,500$ ,  $Y_{2017} = 4,929$ .

Source: Urssaf

Finally, total social insurance contributions and pension savings paid by the CAS physician is the difference between initial contributions and NHI's subsidy [(4)-(5)].

Table 3.A.2: OPTAM rate applied to activity charged at regulated price

Specialities	Rate
Anesthetists	7,0%
Cardiologists	7,0%
Surgeons	7,2%
Dermatologists	8,3%
Gastro-enterogolists	7,1%
Obstetrician gynecologists	7,1%
ENT doctors	7,4%
Ophthalmologists	5,7%
Psychiatrists	8,6%
Pediatricians	8,7%
Radiologists	4,6%
Rheumatologists	7,5%

Source: Journal officiel [2016]

Table 3.A.3: CAS and OPTAM adhesion rates by specialty (2017)

	CAS		OPTAM		CAS among OPTAM		Total nb. of physicians
	Nb. of physicians	Adhesion rate (%)	Nb. of physicians	Adhesion rate (%)	Nb. of physicians	Share (%)	
<b>Surgical specialists</b>	<b>1,122</b>	<b>15.85</b>	2,441	<b>34.50</b>	<b>1,037</b>	<b>42.48</b>	<b>7,077</b>
Surgeons	501	15.42	1,253	38.58	462	36.87	3,248
Ophthalmologists	144	8.39	255	14.86	124	48.63	1,716
Obstetricians gynecologists	339	23.77	704	49.36	325	46.16	1,426
ENR doctors	138	20.09	229	33.33	126	55.02	687
<b>Medical specialists</b>	<b>1,554</b>	<b>27.59</b>	<b>2,001</b>	<b>35.53</b>	<b>1,445</b>	<b>71.85</b>	<b>5,632</b>
Anesthetists	226	15.74	349	24.30	212	60.74	1,436
Cardiologists	212	42.23	238	47.41	198	56.73	502
Dermatologists	116	17.55	185	27.99	108	30.93	661
Radiologists	268	38.95	296	43.02	253	72.49	688
Gastroenterologists	178	37.95	228	48.61	165	47.28	469
Pediatricians	197	38.40	263	51.27	186	53.30	513
Rheumatologists	115	27.32	163	38.72	104	29.80	421
Psychiatrists	240	25.67	276	29.52	217	62.18	935

Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

## **B. Sociodemographic characteristics of CAS and OPTAM physicians**

Table 3.B.1: CAS and non CAS physicians' socio-demographic characteristics in 2011 before and after matching

Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	CAS	Non CAS	Non CAS	(1-2)	(1-3)	CAS	Non CAS	Non CAS	(4-5)	(4-6)
	(1)	(2)	(3)			(4)	(5)	(6)		
Female	14.04	13.67	13.65	0.807	0.796	27.76	33.19	32.28	0.004	0.015
Age < 45 years old	25.08	31.35	29.40	0.002	0.029	32.50	32.74	34.27	0.899	0.355
Age between 45 and 54 years old	36.28	38.89	40.45	0.218	0.051	28.35	31.37	30.42	0.105	0.264
Age ≥ 55 years old	38.64	29.76	30.15	0.000	0.000	39.15	35.89	35.31	0.094	0.048
<i>Marital status</i>										
Single	3.79	4.77	5.01	0.284	0.190	7.59	10.37	9.82	0.020	0.056
Divorced	85.17	85.73	84.80	0.715	0.812	75.09	71.25	72.26	0.033	0.114
Married	8.68	7.51	7.91	0.319	0.518	10.79	11.83	11.78	0.423	0.446
Civil partnership	2.21	1.95	2.23	0.676	0.968	4.98	5.72	5.20	0.426	0.805
Widow	0.16	0.03	0.05	0.223	0.337	1.54	0.84	0.94	0.086	0.152
Having children	76.66	80.11	80.37	0.050	0.034	73.78	72.75	75.01	0.564	0.484
<i>Practice location (at department level)</i>										
Share of sector 2 physicians (%)										
X ≤ 57.14 (30.00)	29.65	24.66	25.09	0.009	0.017	42.94	20.16	34.95	0.000	0.000
X ∈ [57.14,72.41] ( <i>[30.00,42.33]</i> )	23.97	22.54	22.19	0.434	0.328	24.44	25.88	27.06	0.414	0.140
X ∈ [72.41,83.91] ( <i>[42.33,58.00]</i> )	26.50	26.28	30.33	0.911	0.055	20.05	28.49	22.24	0.000	0.188
X > 83.91 (58.00)	19.87	26.51	22.40	0.000	0.163	12.57	25.48	15.75	0.000	0.027
Share of activity at regulated prices (%)										
X ≤ 79.10 (71.72)	19.87	24.83	18.64	0.008	0.469	11.86	31.46	14.13	0.000	0.100
X ∈ [79.10,82.43] ( <i>[71.72,80.96]</i> )	26.97	29.73	30.31	0.166	0.095	22.54	25.65	24.72	0.074	0.208
X ∈ [82.43,84.51] ( <i>[80.96,83.45]</i> )	24.13	21.09	24.86	0.090	0.702	32.74	19.72	29.95	0.000	0.134
X > 84.51 (83.45)	29.02	24.36	26.20	0.014	0.144	32.86	23.17	31.20	0.000	0.377
Overbilling rate (%)										
X ≤ 36.84 (45.80)	26.18	25.29	28.68	0.639	0.205	36.54	23.39	33.59	0.000	0.124
X ∈ [36.84,54.07] ( <i>[45.80,69.37]</i> )	27.44	23.97	26.45	0.064	0.606	25.74	23.93	25.87	0.295	0.943
X ∈ [54.07,101.40] ( <i>[69.37,161.56]</i> )	25.55	24.89	23.98	0.727	0.403	28.00	25.43	27.61	0.148	0.832
X >101.40 (161.56)	20.82	25.85	20.89	0.008	0.968	9.73	27.25	12.93	0.000	0.015
Number of observations	634	3021	3021			843	2257	2257		

Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.B.2: OPTAM and non OPTAM physicians' sociodemographic characteristics in 2011 before and after matching

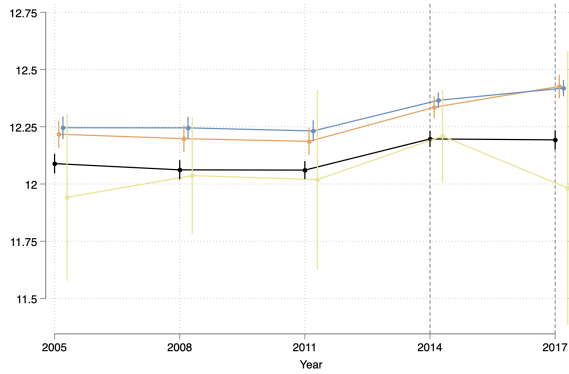
Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	OPTAM	Non OPTAM	Non OPTAM	(1-2)	(1-3)	OPTAM	Non OPTAM	Non OPTAM	(4-5)	(4-6)
	(1)	(2)	(3)			(4)	(5)	(6)		
Female	13.86	13.66	13.63	0.865	0.844	31.28	31.95	30.92	0.705	0.836
Age < 45 years old	29.11	31.00	28.35	0.226	0.620	34.90	31.44	33.17	0.049	0.330
Age between 45 and 54 years old	39.68	37.65	39.76	0.218	0.959	29.48	31.14	30.06	0.334	0.731
Age ≥ 55 years old	31.21	31.36	31.89	0.926	0.669	35.62	37.41	36.76	0.323	0.528
<i>Marital status</i>										
Single	4.83	4.45	4.78	0.591	0.944	8.41	10.28	9.66	0.090	0.247
Divorced	84.81	86.16	84.90	0.257	0.946	73.51	71.61	72.76	0.259	0.654
Married	7.98	7.55	8.08	0.634	0.911	11.48	11.58	11.52	0.932	0.972
Civil partnership	2.31	1.80	2.18	0.280	0.794	5.06	5.77	5.19	0.411	0.882
Widow	0.07	0.04	0.07	0.752	0.964	1.54	0.75	0.86	0.038	0.084
Having children	79.78	79.34	79.70	0.747	0.955	75.23	71.82	74.38	0.040	0.602
<i>Practice location (at department level)</i>										
Share of sector 2 physicians (%)										
X ≤ 57.14 (30.00)	25.96	25.25	25.82	0.629	0.926	36.89	20.51	37.26	0.000	0.840
X ∈ ]57.14,72.41] (30.00,42.33)	22.11	23.23	22.75	0.434	0.654	26.40	24.97	26.32	0.383	0.959
X ∈ ]72.41,83.91] (42.33,58.00)	29.81	24.08	29.57	0.000	0.875	21.70	28.69	21.61	0.000	0.954
X > 83.91 (58.00)	22.11	27.45	21.86	0.000	0.857	15.01	25.83	14.82	0.000	0.885
Share of activity at regulated prices (%)										
X ≤ 79.10 (71.72)	18.61	27.40	19.00	0.000	0.769	13.47	33.15	13.54	0.000	0.958
X ∈ ]79.10,82.43] (71.72,80.96)	30.16	28.66	29.45	0.331	0.648	24.32	25.08	24.01	0.642	0.847
X ∈ ]82.43,84.51] (80.96,83.45)	24.77	19.59	24.70	0.000	0.962	30.29	19.36	30.94	0.000	0.705
X > 84.51 (83.45)	18.61	27.40	19.00	0.153	0.795	31.92	22.42	31.50	0.000	0.813
Overbilling rate (%)										
X ≤ 36.84 (45.80)	28.48	23.50	28.09	0.001	0.798	34.09	23.02	34.56	0.000	0.792
X ∈ ]36.84,54.07] (45.80,69.37)	26.73	23.18	26.55	0.015	0.904	26.04	23.52	25.72	0.118	0.846
X ∈ ]54.07,101.40] (69.37,161.56)	24.00	25.65	24.42	0.262	0.774	27.67	25.28	27.74	0.147	0.964
X > 101.40 (161.56)	20.78	27.67	20.94	0.000	0.910	12.21	28.18	11.98	0.000	0.854
Number of observations	1429	2226	2226			843	2257	2257		

Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

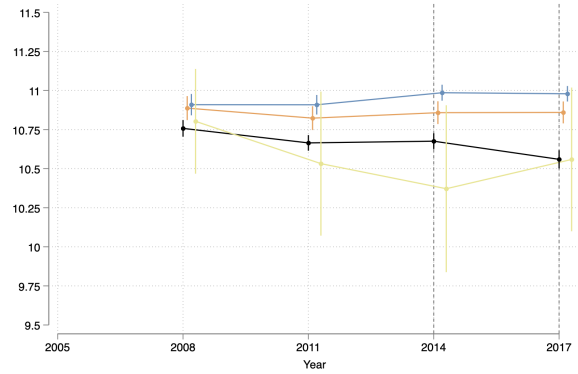
Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.



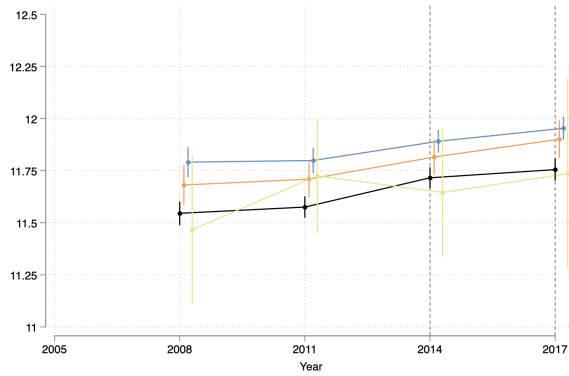
## C. Trends in outcomes of interest



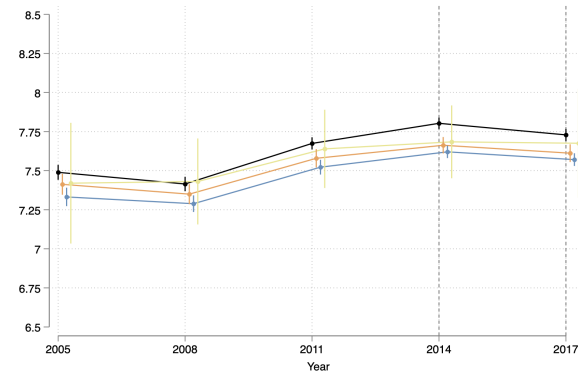
(a) All procedures (€)



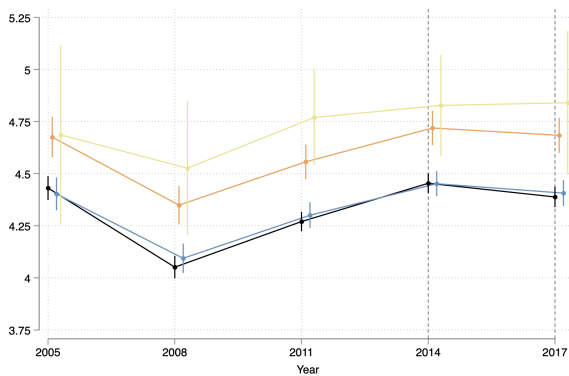
(b) Office visits (€)



(c) Technical procedures (€)



(d) Number of patients

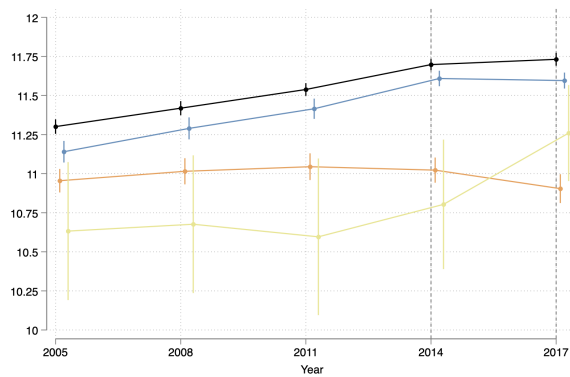


(e) Number of CMU-C patients

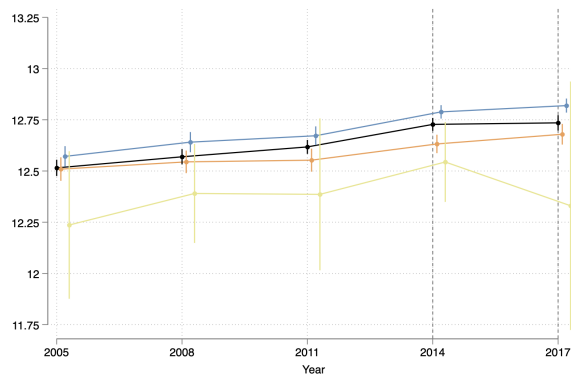
— Control group    — CAS=1 OPTAM=1    — CAS=0 OPTAM=1    — CAS=1 OPTAM=0

Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

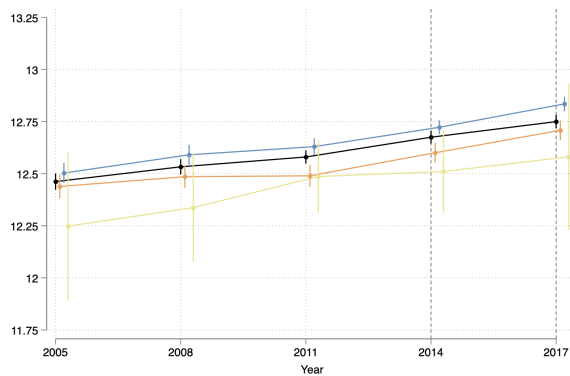
Figure 3.C.1: Surgical specialists - trends in the volume of care



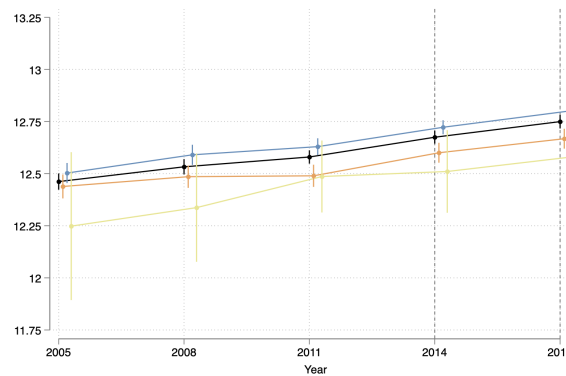
(a) Extra-fees (€)



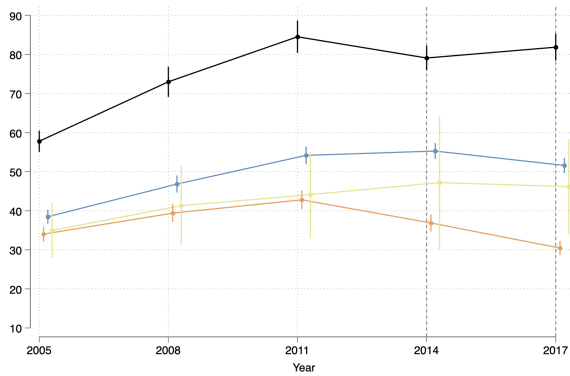
(b) Total fees (€)



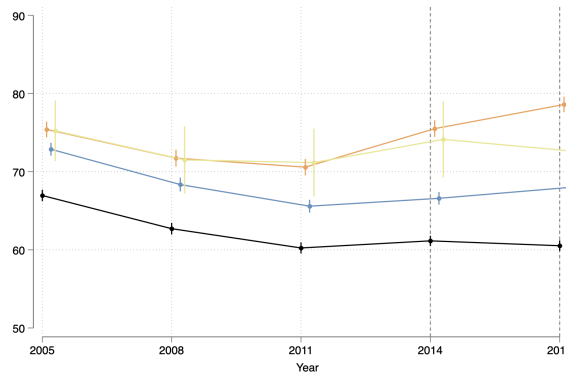
(c) Fees + contributions + bonus (100%) (€)



(d) Fees + contributions + bonus (30%) (€)



(e) Overbilling rate (%)

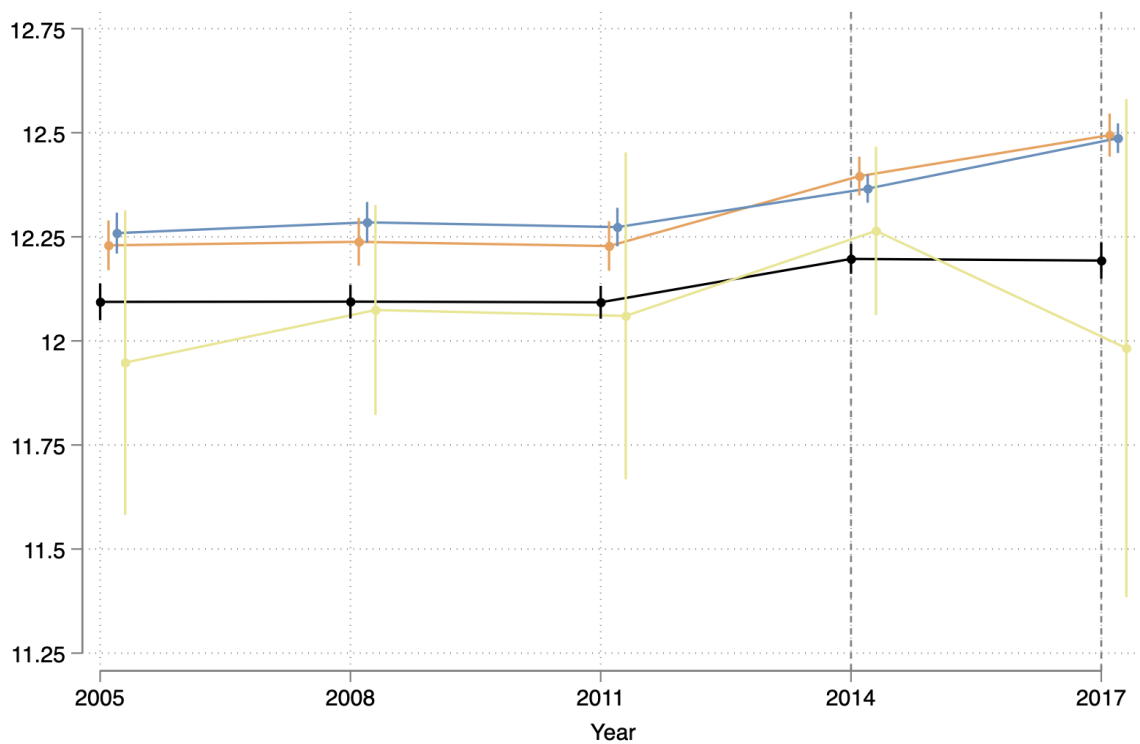


(f) Activity at regulated price (%)

— Control group    — CAS=1 OPTAM=1    — CAS=0 OPTAM=1    — CAS=1 OPTAM=0

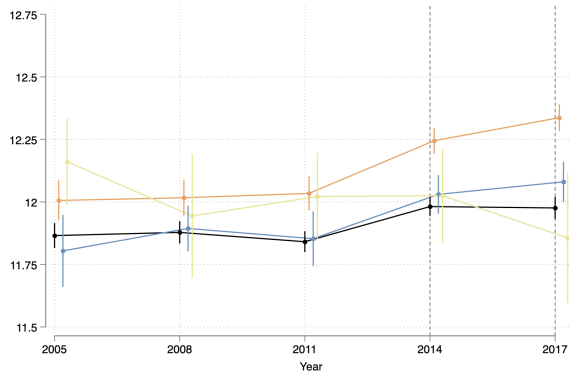
Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

Figure 3.C.2: Surgical specialists - trends in income

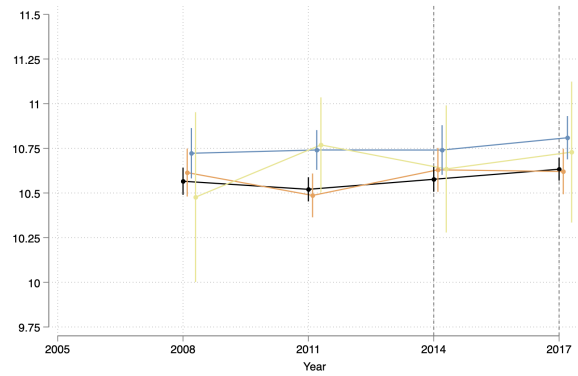


— Control group    — CAS=1 OPTAM=1    — CAS=0 OPTAM=1    — CAS=1 OPTAM=0

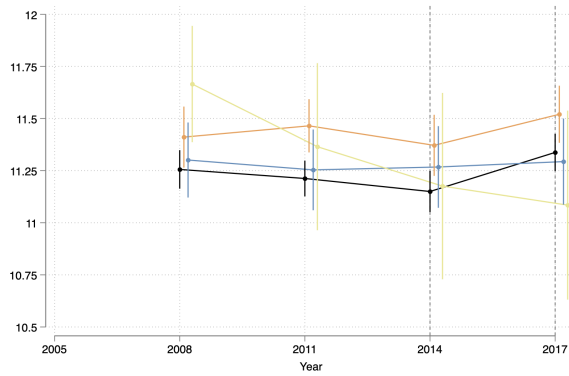
Figure 3.C.3: NHI's costs (€) for Surgical specialists



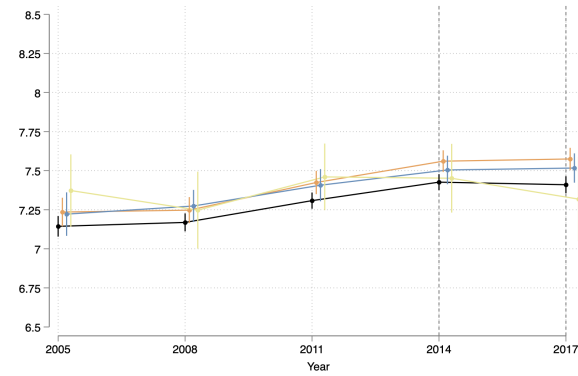
(a) All procedures (€)



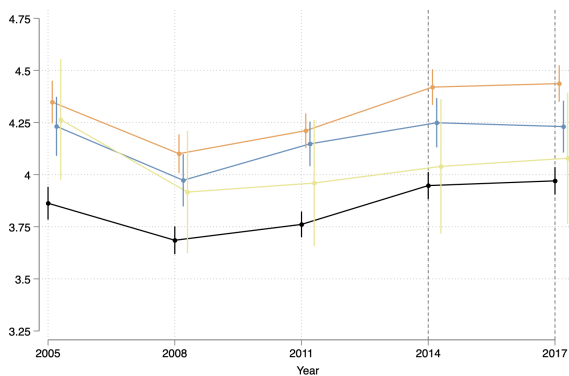
(b) Office visits (€)



(c) Technical procedures (€)



(d) Number of patients

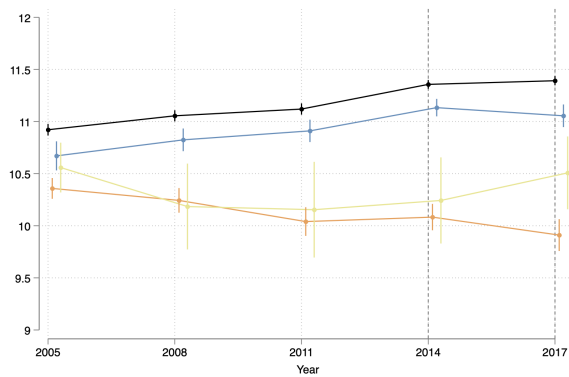


(e) Number of CMU-C patients

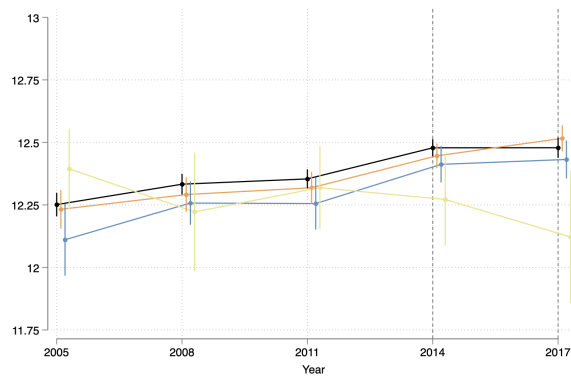
— Control group    — CAS=1 OPTAM=1    — CAS=0 OPTAM=1    — CAS=1 OPTAM=0

Source: Insee-CNAM-DGFiP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

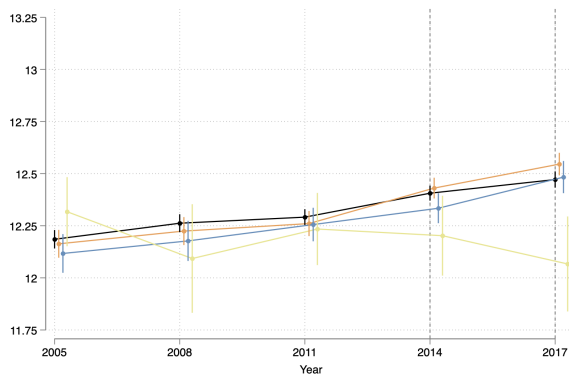
Figure 3.C.4: Medical specialists - trends in the volume of care



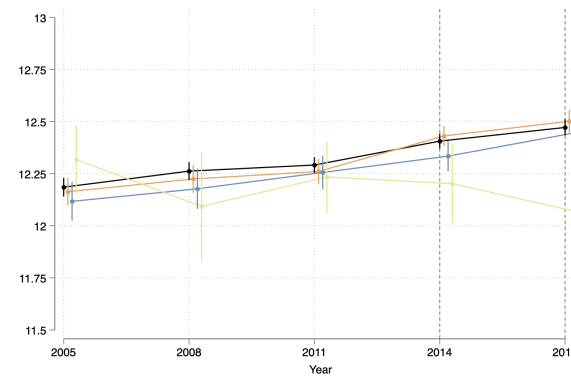
(a) Extra-fees (€)



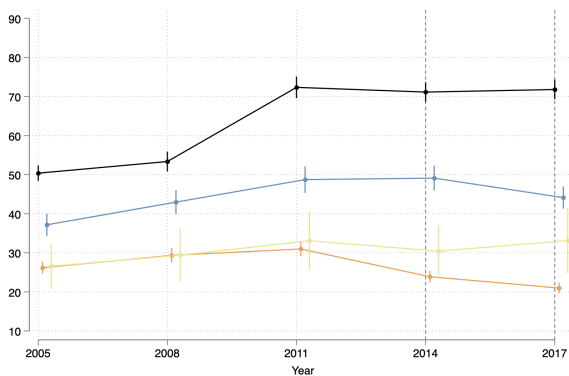
(b) Total fees (€)



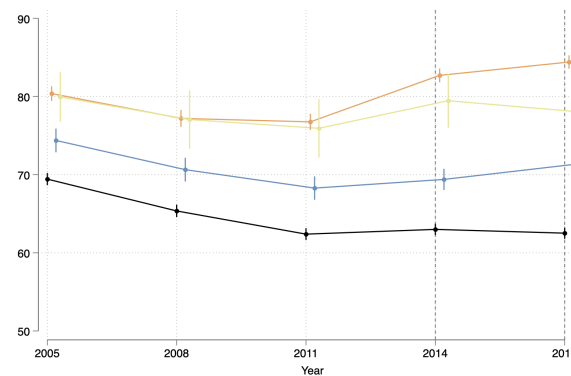
(c) Fees + contributions + bonus (100%) (€)



(d) Fees + contributions + bonus (30%) (€)



(e) Overbilling rate (%)



(f) Activity at regulated price (%)

— Control group    — CAS=1 OPTAM=1    — CAS=0 OPTAM=1    — CAS=1 OPTAM=0

Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

Figure 3.C.5: Medical specialists - trends in income

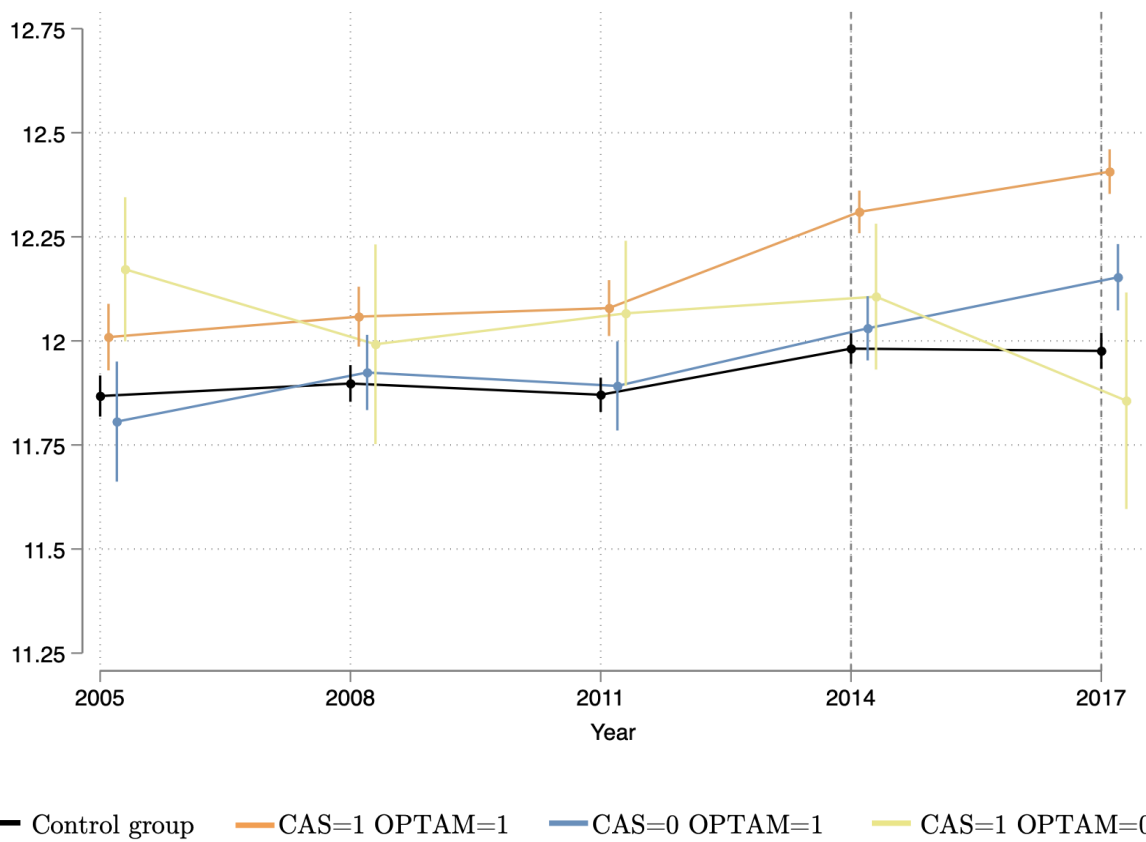


Figure 3.C.6: NHI's costs (€) for Medical specialists

Table 3.C.1: Placebo test: Treatment in 2011

Outcomes in logarithm	INDICATOR OF PROVISION OF CARE (€)			NUMBER		All Extra-fees	All Fees	INCOME (€)		Overbilling (%)		NHI's costs (€)
	All procedures	Office visits	Technical procedures	All Patients	CMU-C patients			Fees + contributions +100% bonus	Fees + contributions +30% bonus	Overbilling rate	Activity at regulated price	
<i>Panel A: Surgical specialists</i>												
<b>CAS</b>	-0.017 (0.030)	0.006 (0.034)	-0.010 (0.030)	-0.017 (0.019)	0.038 (0.025)	-0.091*** (0.029)	-0.052* (0.023)	-0.038* (0.025)	-0.038* (0.023)	-8.508*** (0.946)	1.480*** (0.289)	-0.019 (0.030)
<b>OPTAM</b>	0.028 (0.020)	0.065*** (0.025)	0.003 (0.026)	-0.017 (0.016)	0.025 (0.021)	-0.012 (0.024)	-0.002 (0.019)	-0.011 (0.019)	-0.011 (0.019)	-8.468*** (1.086)	0.819*** (0.252)	0.024 (0.019)
Number of observations	7667	5488	5466	7667	7630	7667	7667	7667	7667	7667	7667	7667
<b>CAS=1 OPTAM=1</b>	-0.000 (0.023)	0.026 (0.029)	-0.016 (0.029)	-0.018 (0.018)	0.031 (0.026)	-0.060** (0.028)	-0.036* (0.022)	-0.043* (0.023)	-0.043* (0.023)	-9.041*** (1.015)	1.416*** (0.298)	-0.003 (0.022)
Number of observations	7141	5488	5466	7141	7103	7141	7141	7141	7141	7141	7141	7141
<b>CAS=0 OPTAM=1</b>	0.038* (0.022)	0.076*** (0.027)	0.014 (0.030)	-0.013 (0.018)	0.025 (0.024)	0.016 (0.028)	0.017 (0.021)	0.012 (0.022)	0.012 (0.022)	-7.062*** (1.220)	0.306 (0.282)	0.034 (0.022)
Number of observations	6290	4518	4500	6290	6255	6290	6290	6290	6290	6290	6290	6290
<b>CAS=1 OPTAM=0</b>	-0.158 (0.272)	-0.180 (0.248)	0.059 (0.139)	-0.009 (0.116)	0.143 (0.104)	-0.313 (0.271)	-0.180 (0.115)	0.036 (0.115)	0.036 (0.115)	-6.583* (3.424)	1.053 (1.277)	-0.156 (0.272)
Number of observations	4624	3322	3296	4624	4590	4624	4624	4624	4624	4624	4624	4624
<i>Panel B: Medical specialists</i>												
<b>CAS</b>	0.032 (0.027)	0.008 (0.030)	0.044 (0.050)	0.031 (0.022)	0.042 (0.028)	-0.131*** (0.038)	0.005 (0.026)	-0.014 (0.024)	-0.014 (0.024)	-6.126*** (0.801)	0.762 (0.563)	0.032 (0.027)
<b>OPTAM</b>	0.029 (0.023)	-0.008 (0.026)	0.037 (0.041)	0.029 (0.019)	0.038 (0.027)	-0.096*** (0.033)	0.006 (0.022)	-0.011 (0.021)	-0.011 (0.021)	-5.569*** (0.741)	0.699 (0.433)	0.030 (0.023)
Number of observations	6245	4260	3512	6245	6115	6245	6245	6245	6245	6245	6245	6245
<b>CAS=1 OPTAM=1</b>	0.026 (0.028)	-0.020 (0.031)	0.053 (0.052)	0.025 (0.023)	0.033 (0.029)	-0.125*** (0.039)	0.001 (0.027)	-0.024 (0.024)	-0.024 (0.024)	-6.191*** (0.815)	0.678 (0.566)	0.027 (0.027)
Number of observations	6016	4260	3512	6016	5885	6016	6016	6016	6016	6016	6016	6016
<b>CAS=0 OPTAM=1</b>	0.035 (0.033)	0.023 (0.034)	0.019 (0.039)	0.035 (0.027)	0.042 (0.033)	-0.035 (0.033)	0.018 (0.031)	0.014 (0.031)	0.014 (0.031)	-3.804*** (0.974)	0.842* (0.458)	0.035 (0.033)
Number of observations	4547	3098	2550	4547	4426	4547	4547	4547	4547	4547	4547	4547
<b>CAS=1 OPTAM=0</b>	0.074 (0.082)	0.235* (0.121)	-0.080 (0.099)	0.082 (0.067)	0.101 (0.099)	-0.176 (0.146)	0.032 (0.080)	0.051 (0.089)	0.051 (0.089)	-7.308*** (2.097)	2.098** (1.030)	0.064 (0.080)
Number of observations	4,022	2,728	2,230	4,022	3,904	4,022	4,022	4,022	4,022	4,022	4,022	4,022

Notes: \*p < 0.10 ; \*\*p < 0.05 ; \*\*\*p < 0.01

Robust standard errors are clustered at the physician level and reported in parentheses. Regressions control for a set of covariates described in section 3 and include physicians and time fixed effects.

Source: Author's calculations from Insee-CNAM-DGFIP-DREES dataset, waves 2005 to 2017. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

## D. Additional analyses trends



Table 3.D.1: Model 3.3 - CAS and non CAS physicians' socio-demographic characteristics in 2011 before and after matching

Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	CAS	Non CAS	Non CAS	(1-2)	(1-3)	CAS	Non CAS	Non CAS	(4-5)	(4-6)
	(1)	(2)	(3)			(4)	(5)	(6)		
Female	14.04	10.87	14.04	0.032	1.000	27.76	30.35	27.76	0.173	1.000
Age < 45 years old	25.08	29.75	25.08	0.025	1.000	32.50	31.35	32.50	0.551	1.000
Age between 45 and 54 years old	36.28	38.25	36.28	0.377	1.000	28.35	30.96	28.35	0.173	1.000
Age ≥ 55 years old	38.64	32.00	38.64	0.002	1.000	39.15	37.69	39.15	0.473	1.000
<i>Marital status</i>										
Single	3.79	3.13	3.79	0.425	1.000	7.59	9.49	9.15	0.109	0.183
Divorced	8.68	5.43	8.68	0.004	1.000	10.79	11.81	11.74	0.445	0.477
Married	85.17	90.40	85.17	0.000	1.000	75.09	72.02	73.00	0.097	0.256
Civil partnership	2.21	0.99	2.21	0.020	1.000	4.98	5.91	5.15	0.336	0.856
Widow	0.16	0.05	0.16	0.434	1.000	1.54	0.77	0.96	0.066	0.187
Having children	76.66	81.45	76.66	0.009	1.000	73.78	72.19	73.78	0.390	1.000
<i>Practice location (at département level)</i>										
Share of sector 2 physicians (%)										
X ≤ 55.55 (28.97)	29.65	25.47	29.65	0.040	1.000	42.94	21.08	42.94	0.000	1.000
X ∈ [55.55,73.01] ([28.97,42.30])	23.97	22.01	23.97	0.308	1.000	24.44	24.83	24.44	0.825	1.000
X ∈ [73.01,86.20] ([42.30,57.75])	26.50	22.61	26.50	0.047	1.000	20.05	28.20	20.05	0.000	1.000
X > 86.20 (57.75)	19.87	29.91	19.87	0.000	1.000	12.57	25.88	12.57	0.000	1.000
Share of activity at regulated prices (%)										
X ≤ 77.98 (71.72)	19.87	28.98	19.87	0.000	1.000	11.86	35.10	11.86	0.000	1.000
X ∈ [77.98,82.43] ([71.72,80.96])	24.13	19.81	24.13	0.580	1.000	22.54	24.12	22.54	0.373	1.000
X ∈ [82.43,84.61] ([80.96,83.45])	26.97	25.85	26.97	0.021	1.000	32.74	18.71	32.74	0.000	1.000
X > 84.61 (83.45)	29.02	25.36	29.02	0.071	1.000	32.86	22.08	32.86	0.000	1.000
Overbilling rate (%)										
X ≤ 41.57 (45.80)	26.18	23.44	26.18	0.164	1.000	36.54	21.91	36.54	0.000	1.000
X ∈ [41.57,56.07] ([45.80,69.37])	27.44	21.73	27.44	0.003	1.000	25.74	23.29	25.74	0.169	1.000
X ∈ [56.07,102.86] ([69.37, 161.56])	25.55	25.63	25.55	0.969	1.000	28.00	25.28	28.00	0.138	1.000
X >102.86 (161.56)	20.82	29.20	20.82	0.000	1.000	9.73	29.53	9.73	0.000	1.000
Number of observations	634	1,822	1,822			843	1,812	1,812		

Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

Table 3.D.2: Modele 3.4 - CAS and non CAS physicians' socio-demographic characteristics in 2011 before and after matching

Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	CAS	Non CAS	Non CAS	(1-2)	(1-3)	CAS	Non CAS	Non CAS	(4-5)	(4-6)
	(1)	(2)	(3)			(4)	(5)	(6)		
Female	14.41	10.61	14.41	0.013	1.000	27.82	30.06	27.82	0.253	1.000
Age < 45 years old	25.90	30.00	25.90	0.058	1.000	33.97	31.74	33.97	0.267	1.000
Age between 45 and 54 years old	35.85	38.16	35.85	0.318	1.000	27.69	30.84	27.69	0.109	1.000
Age ≥ 55 years old	38.25	31.84	38.25	0.004	1.000	38.33	37.42	38.33	0.659	1.000
<i>Marital status</i>										
Single	3.77	2.68	3.77	0.176	1.000	7.56	9.38	8.95	0.136	0.249
Divorced	8.58	5.42	8.58	0.006	1.000	10.77	11.69	11.68	0.502	0.504
Married	85.08	90.84	85.08	0.000	1.000	75.00	72.25	72.97	0.148	0.283
Civil partnership	2.40	1.01	2.40	0.011	1.000	5.13	5.96	5.49	0.407	0.709
Widow	0.17	0.06	0.17	0.403	1.000	1.54	0.73	0.92	0.056	0.165
Having children	76.50	81.96	76.50	0.004	1.000	74.49	73.03	74.49	0.443	1.000
<i>Practice location (at département level)</i>										
Share of sector 2 physicians (%)										
X ≤ 55.31 (29.00)	30.19	25.81	30.19	0.038	1.000	43.08	21.12	43.08	0.000	1.000
X ∈ [55.31,73.15] ([29.00,42.33])	23.16	21.45	23.16	0.388	1.000	24.36	24.49	24.36	0.942	1.000
X ∈ [73.15,86.33] ([42.33,58.00])	26.59	22.79	26.59	0.062	1.000	20.00	28.09	20.00	0.000	1.000
X > 86.33 (58.00)	20.07	29.94	20.07	0.000	1.000	12.56	26.29	12.56	0.000	1.000
Share of activity at regulated prices (%)										
X ≤ 78.76 (71.72)	19.38	28.16	19.38	0.000	1.000	11.67	35.73	11.67	0.000	1.000
X ∈ [78.76,82.43] ([71.72,80.96])	27.79	26.31	27.79	0.485	1.000	22.69	23.48	22.69	0.000	1.000
X ∈ [82.43,84.61] ([80.96,83.45])	24.19	20.17	24.19	0.039	1.000	32.31	18.48	32.31	0.663	1.000
X > 84.61 (83.45)	28.64	25.36	28.64	0.118	1.000	33.33	22.30	33.33	0.000	1.000
Overbilling rate (%)										
X ≤ 41.57 (45.80)	26.59	23.52	26.59	0.134	1.000	36.28	22.08	36.28	0.000	1.000
X ∈ [36.84,56.07] ([45.80,69.37])	27.79	22.12	27.79	0.005	1.000	26.03	22.58	26.03	0.059	1.000
X ∈ [56.07,102.86] ([69.37,161.56])	25.04	25.75	25.04	0.000	1.000	27.95	25.39	27.95	0.176	1.000
X >102.86 (161.56)	20.58	28.60	20.58	0.000	1.000	9.74	29.94	9.74	0.000	1.000
Number of observations	583	1,790	1,790			780	1,780	1,780		

Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

Source: Author's calculations using Insee-CNAM-DGFIP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

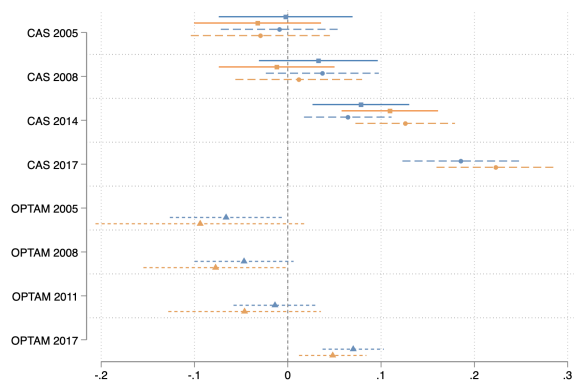
Table 3.D.3: Modele 3.5 - OPTAM and non OPTAM physicians' socio-demographic characteristics in 2011 before and after matching

Variables	SURGICAL SPECIALISTS					MEDICAL SPECIALISTS				
	Non matched		Matched	T-test p-value		Non matched		Matched	T-test p-value	
	OPTAM (1)	Non OPTAM (2)	Non OPTAM (3)	(1-2)	(1-3)	OPTAM (4)	Non OPTAM (5)	Non OPTAM (6)	(4-5)	(4-6)
Female	13.48	12.88	13.48	0.668	1.000	39.57	33.26	39.57	0.031	1.000
Age < 45 years old	31.32	30.14	31.32	0.532	1.000	37.12	33.40	37.12	0.203	1.000
Age between 45 and 54 years old	42.32	40.19	42.32	0.293	1.000	33.74	31.55	33.74	0.444	1.000
Age ≥ 55 years old	26.36	29.68	26.36	0.075	1.000	29.14	35.05	29.14	0.042	1.000
<i>Marital status</i>										
Single	5.56	4.02	5.56	0.072	1.000	10.43	9.51	11.19	0.615	0.695
Divorced	7.57	6.44	7.57	0.278	1.000	13.19	11.73	11.02	0.466	0.268
Married	84.63	88.00	84.63	0.015	1.000	69.94	72.75	71.74	0.308	0.516
Civil partnership	2.25	1.55	2.25	0.196	1.000	4.91	5.36	5.52	0.740	0.659
Widow	0.00	0.00	0.00	-	-	1.53	0.64	0.53	0.107	0.053
Having children	82.03	81.50	82.03	0.740	1.000	76.99	74.18	76.99	0.292	1.000
<i>Practice location (at département level)</i>										
Share of sector 2 physicians (%)										
X < 58.69 (33.48)	23.05	24.88	23.05	0.300	1.000	22.09	19.60	22.09	0.313	1.000
X ∈ [58.69,73.45] (33.48,48.17)	21.39	22.82	21.39	0.406	1.000	31.29	24.03	31.29	0.007	1.000
X ∈ [73.45,85.93] (48.17,61.28)	32.03	23.85	32.03	0.000	1.000	25.77	29.18	25.77	0.219	1.000
X > 85.93 (61.28)	23.52	28.44	23.52	0.007	1.000	20.86	27.18	20.86	0.019	1.000
Share of activity at regulated prices (%)										
X < 79.12 (71.72)	18.09	27.98	18.09	0.000	1.000	17.79	34.41	17.79	0.000	1.000
X ∈ [79.12,82.43] (71.72,80.20)	31.80	27.67	31.80	0.027	1.000	28.22	23.96	28.22	0.109	1.000
X ∈ [82.43,84.57] (80.20,83.41)	25.18	18.70	25.18	0.000	1.000	25.46	17.38	25.46	0.001	1.000
X > 84.57 (83.41)	24.94	25.66	24.94	0.690	1.000	28.53	24.25	28.53	0.000	1.000
Overbilling rate (%)										
X < 36.60 (47.25)	29.79	24.88	29.79	0.007	1.000	28.83	21.60	28.83	0.005	1.000
X ∈ [36.60,54.07] (47.25,70.22)	26.00	22.87	26.00	0.075	1.000	26.07	25.54	26.07	0.842	1.000
X ∈ [54.07,102.86] (70.22,250.72)	23.29	24.47	23.29	0.501	1.000	26.99	20.74	26.99	0.014	1.000
X > 102.86 (250.72)	20.92	27.77	20.92	0.000	1.000	18.10	32.12	18.10	0.000	1.000
Number of observations	846	1,941	1,941			326	1,398	1,398		

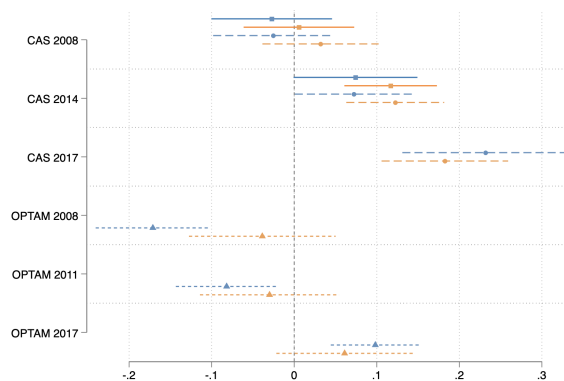
Notes: For the outcomes of practice location, quartiles in regular refer to Surgical specialists, and in italic font refers to Medical specialists.

Source: Author's calculations using Insee-CNAM-DGFiP-DREES dataset, wave 2011. Self-employed physicians practicing in sector 2, working full time as self-employed, under 70 years old.

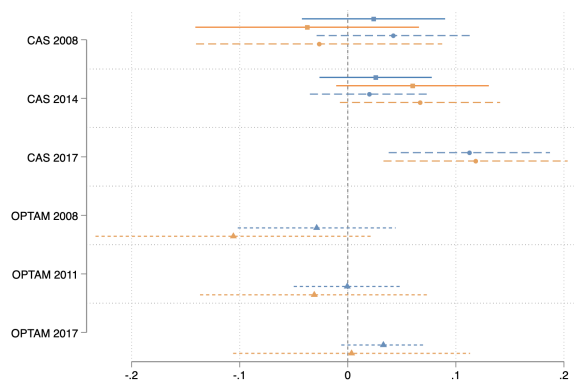




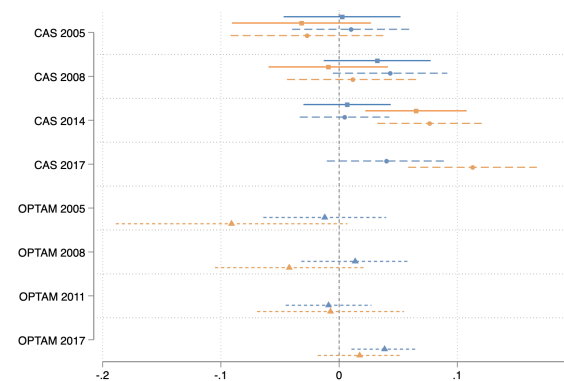
(a) All procedures (€)



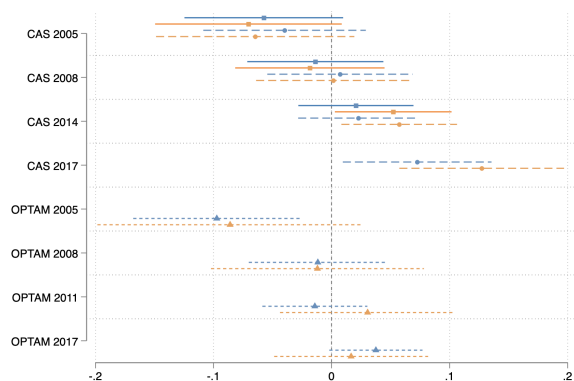
(b) Office visits (€)



(c) Technical procedures (€)



(d) Number of patients

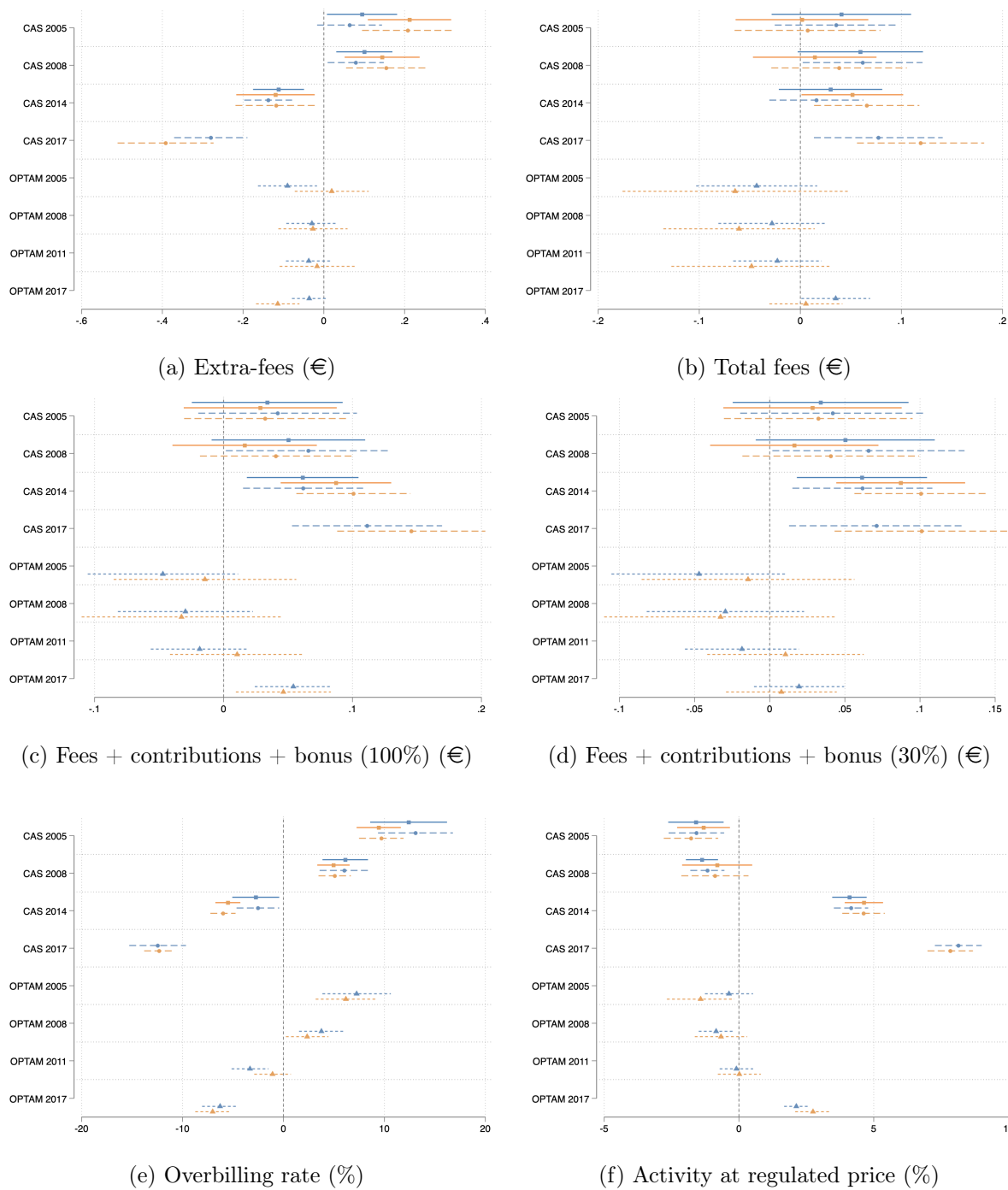


(e) Number of CMU-C patients

■ Surgical specialists - CAS    
 ● Surgical specialists - CAS OPTAM    
 ▲ Surgical specialists - OPTAM  
■ Medical specialists - CAS    
 ● Medical specialists - CAS OPTAM    
 ▲ Medical specialists - OPTAM

Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

Figure 3.D.1: Event study - volume of care outcomes



Source: Insee-CNAM-DGFIP-DREES dataset. Self-employed physicians practicing in sector 2, working full time as self-employed, aged less than 70 years old. Physicians with no contract with PHI are also excluded.

Figure 3.D.2: Event study - income outcomes

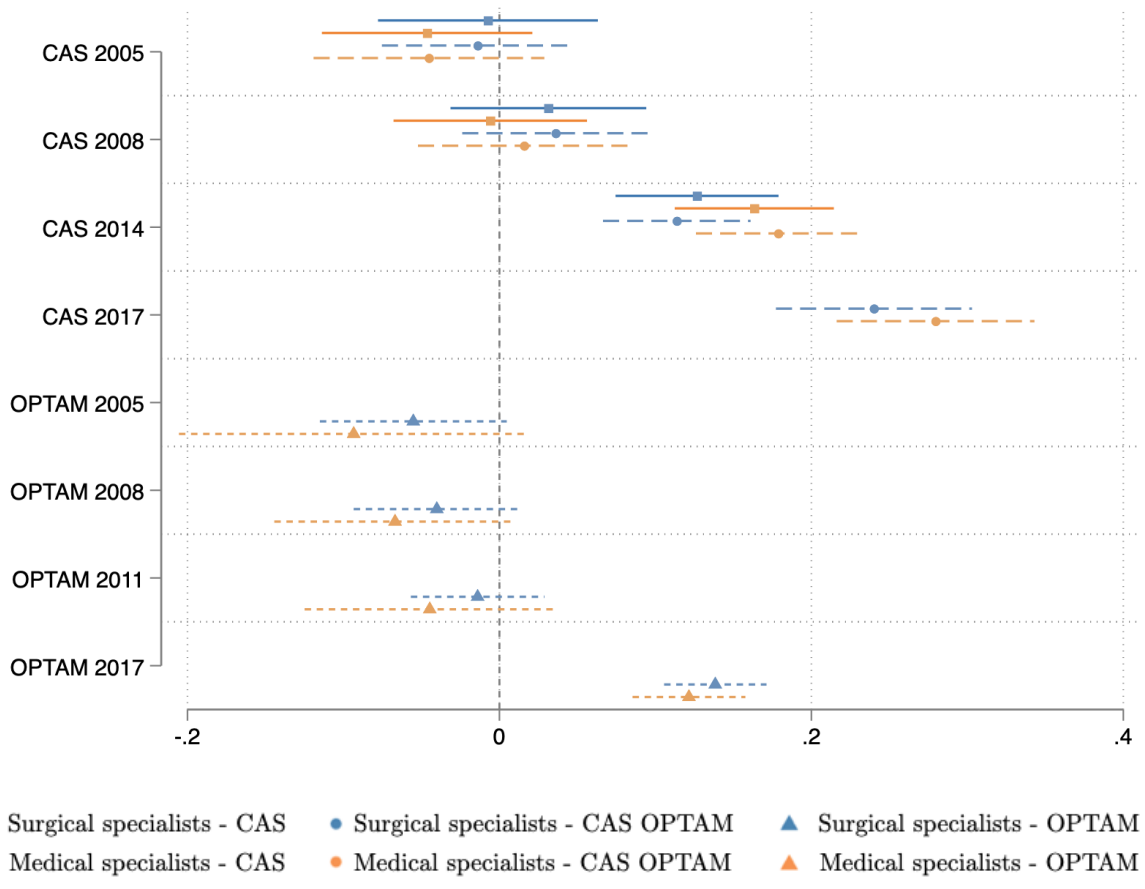


Figure 3.D.3: NHI's costs (€) - robustness analyses

# Conclusion générale





L'objet de cette thèse est d'évaluer les effets de réformes touchant à la rémunération des médecins, au travers d'une restriction tarifaire ou par le biais d'incitations financières, sur l'activité des médecins généralistes et spécialistes libéraux. La thèse se compose de trois chapitres indépendants. À partir de données longitudinales, chaque chapitre emploie des méthodes d'estimations microéconométriques servant à identifier un effet causal d'un changement de rémunération sur l'activité des médecins libéraux. Plus particulièrement, le chapitre 1 estime l'effet d'un paiement à la performance sur l'activité des médecins généralistes. Le chapitre 2 estime l'effet du secteur de conventionnement sur l'activité à la fois des généralistes, mais aussi des spécialistes. Enfin, le chapitre 3 estime l'effet d'incitations financières à la baisse des dépassements sur l'activité d'un ensemble de spécialistes. Dans chaque étude, les effets de chaque réforme sont discutés du côté de chaque acteur du système de santé (médecins, patients et régulateur).

## 1 Résultats et contributions

L'étude du chapitre 1 est la première à estimer l'effet du « Contrat d'Amélioration des Pratiques Individuelles » (CAPI), non pas sur l'efficacité du mécanisme de paiement à la performance en tant que tel, mais sur les pratiques des médecins généralistes libéraux. Elle tient également compte de l'endogénéité de l'adhésion au CAPI en appliquant un modèle d'estimation à variable instrumentale sur un modèle en différences premières. Les résultats montrent que l'introduction d'un paiement à la performance, relativisant la part de paiement à l'acte dans la rémunération, modifie la structure de l'activité des médecins généralistes libéraux. Le « Contrat d'Amélioration des Pratiques Individuelles » (CAPI) a eu un impact significatif sur les pratiques des médecins : dans un contexte de forte augmentation du nombre de patients qui se traduisait par une importante diminution du nombre de consultations par patient, le dispositif a freiné une tendance forte à en faire peu avec chaque patient, tout en donnant un contenu en termes de qualité des soins à cette inflexion. Les médecins adhérant au CAPI n'ont pas diminué, contrairement aux autres, le « temps patient » (nombre de consultations par patient) ni le montant des prescriptions par patient. Ils ont également augmenté, beaucoup plus fortement que les autres médecins, la proportion de leurs patients suivis en tant que médecin traitant. Toutefois, le CAPI a aussi conduit à augmenter les honoraires par patient et est donc coûteux pour l'Assurance Maladie.

Le chapitre 2 étudie l'effet du secteur de conventionnement sur l'activité des médecins généralistes et spécialistes. L'estimation de l'effet du secteur sur les comportements de soins peut être difficile puisque le secteur est un choix du médecin qui peut s'appuyer sur des caractéristiques inobservables. Cependant, la mise en place du « gel du secteur 2 » en 1990, correspondant à un choc exogène sur le choix du secteur, donne un cadre analytique propice à l'évaluation des différences de secteur sur les pratiques des médecins. La restriction à l'accès au secteur 2 a contraint certains médecins à s'installer en secteur 1. Cette analyse donne des résultats de long terme sur une réforme coercitive. À l'aide de régressions par discontinuité, les estimations mettent en évidence que les médecins spécialistes ayant une activité de nature plutôt « technique » augmentent fortement leur activité lorsqu'ils sont contraints d'exercer en secteur 1 et principalement leur activité technique. Les deux-tiers de ce surcroît d'activité sont associés à l'accueil de nouveaux patients, signe d'une amélioration de l'accessibilité aux soins ; le tiers restant est assimilable à des

comportements stratégiques, visant à compenser la baisse de leurs tarifs par une augmentation du contenu des actes délivrés. En revanche, les spécialistes qui ont une activité principalement composée de consultations en cabinet n'ont pas de marge de manœuvre pour augmenter leur activité lorsqu'ils sont contraints d'exercer en secteur 1. Finalement, le surcroît d'activité à tarif opposable augmente les dépenses de santé dues aux remboursements des patients, mais aussi à la hausse des revenus des médecins.

Le chapitre 3 analyse comment les médecins spécialistes du secteur 2 réagissent à des incitations financières qui les encouragent à diminuer leurs dépassements d'honoraires. Cette étude est la première à estimer empiriquement l'effet du « Contrat d'Accès aux soins » (CAS) mis en place en 2014 et de son substitut l'« Option Pratique Tarifaire Maîtrisée » (OPTAM) en 2017. Les résultats montrent que les médecins spécialistes réagissent à des incitations financières, même si elles ne sont quantitativement pas très importantes. Le CAS et l'OPTAM ont permis de réduire les dépassements d'honoraires et d'améliorer l'accès aux soins de la population ; l'OPTAM a cependant été plus efficace que le CAS. Les médecins spécialistes adhérant au CAS puis à l'OPTAM ont, parallèlement à la baisse de leurs tarifs, augmenté leur activité (nombre de consultations, actes techniques), en raison d'une augmentation du nombre de patients suivis, et en particulier d'une hausse du nombre de patients à bas revenus (bénéficiaires de la CMU-C). Cette amélioration à l'accès aux soins génère cependant un coût important pour l'Assurance Maladie.

## 2 Pistes de recherche

Le chapitre 1 se focalise sur le CAPI. Une autre approche serait d'étudier la « Rémunération sur Objectifs de Santé Publique » qui généralise le CAPI à l'ensemble des médecins libéraux en 2012. Au moment de l'élaboration de l'étude et d'après les données disponibles, il était difficile de concevoir une étude sur l'effet successif de ces politiques. La généralisation de la ROSP à tous les médecins libéraux élimine tout groupe de contrôle. Pour estimer un effet causal de la ROSP sur l'activité des médecins, il faudrait contrôler des effets du CAPI pour les médecins qui l'ont pris auparavant. Le nombre d'années disponibles dans la base de données doit donc être aussi suffisant avant la mise en place des incitations financières pour pouvoir comparer des situations avant/après ces programmes (ce qui ne semble pas être faisable en l'état). De plus, il serait également intéressant de non plus s'intéresser uniquement à la marge extensive du CAPI ou de la ROSP, mais de se concentrer sur la marge intensive (mettre en évidence une relation entre le montant des primes et le changement de comportements d'offre). Ces montants par volet de la ROSP sont disponibles dans la base de données en 2017.

Le chapitre 2 montre des effets de long terme du secteur de conventionnement sur l'activité des médecins. Pour développer l'étude, il aurait été intéressant d'avoir des données (plus détaillées que celles utilisées dans l'étude dans les tests de robustesse) sur l'activité des médecins au moment de la réforme du gel du secteur 2. De la même manière, le manque d'informations sur la demande de soins et sur les durées de consultations limite l'interprétation de nos résultats. Il serait également bénéfique, au regard de la croissance des jeunes médecins en secteur 2, d'étudier les déterminants du secteur de conventionnement sur ces jeunes générations.

Le chapitre 3 s'intéresse exclusivement aux médecins du secteur 2. Toutefois, les incitations financières sont également destinées aux médecins du secteur 1 qui auraient pu s'installer en secteur 2. Alors qu'ils étaient contraints à tarifier au prix conventionnel, les médecins du secteur 1 adhérant au CAS ou/puis à l'OPTAM ont désormais le droit de faire des dépassements d'honoraires. L'étude de ce paradoxe compléterait l'analyse sur les médecins en secteur 2 et donnerait une vision d'ensemble sur l'effet de ces incitations financières sur l'offre de soins globale. En outre, les données disponibles ne permettaient que d'estimer des effets de court terme. L'exploitation des prochaines années du panel serait également un atout pour comprendre si les effets d'amélioration à l'accès aux soins persistent ou s'atténuent.

### **3 Recommandations de politiques publiques**

Les résultats de cette thèse démontrent qu'en général, les médecins réagissent aux outils de régulation tarifaire et aux incitations financières. Ces modifications dans la structure d'activité des médecins indiquent une amélioration dans l'accès aux soins, même si on peut soupçonner chez certains médecins des comportements stratégiques visant à contrebalancer la perte de revenus. Les critiques visant le mode de paiement à l'acte sont donc légitimes. Les incitations financières participent à réduire la part de paiement à l'acte dans la rémunération, tout en poursuivant des objectifs bien définis. Au regard de la littérature et de nos résultats, la diversification de la rémunération des médecins est donc un outil efficace pour améliorer le système de santé.

L'organisation du système de santé primaire est déterminée par les médecins libéraux. Appliquer des réformes coercitives comme le gel du secteur 2 est nécessaire pour obtenir des effets rapides et directs. Cependant, la diminution de la proportion de médecins spécialistes s'installant en secteur 2 n'a été que temporaire et les problèmes d'accès aux soins liés aux dépassements d'honoraires sont toujours d'actualité. Des politiques basées sur le volontariat sont des alternatives pouvant être efficaces, comme l'a montré le CAS et surtout l'OPTAM. Cependant, pour cibler les médecins qui font le plus de dépassements, il faudrait réfléchir à des actions concomitantes à la mise en place d'incitations financières.

Enfin, nos études sont souvent contraintes par un manque de données disponibles. Les analyses de cette thèse se sont focalisées sur l'offre de soins des médecins, mesurée que tous les trois ans. La disponibilité de données de la demande de soins adressée à ces médecins serait nécessaire à l'approfondissement de nos recherches. De plus, la question de la qualité des soins n'est pas abordée dans cette thèse, les données administratives disponibles rendant impossible une telle analyse. Il faudrait mener des études qualitatives pour mieux saisir les préférences des médecins quant à l'allocation de leur temps de travail. Finalement, le manque d'études empiriques sur des réformes menées par des autorités publiques de santé souligne également la nécessité de penser en amont aux outils d'évaluations de ces réformes.





## RÉSUMÉ

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En France, les médecins libéraux sont principalement payés à l'acte avec des tarifs fixés (pour les médecins de secteur 1) ou des dépassements d'honoraires (médecins de secteur 2). Ce mode de rémunération, qui, par définition, incite les médecins à multiplier les actes pour augmenter leurs revenus, impacte leurs comportements d'offre de soins. Il influence donc plus généralement l'organisation et l'efficacité du système de santé. À partir de bases de données administratives et exhaustives de l'ensemble des médecins libéraux exerçant en France, cette thèse a pour objet de mieux comprendre comment les médecins réagissent lorsqu'ils font face à des modifications de leur rémunération. Plus particulièrement, lorsqu'un système de « paiement à la performance » est introduit en complément du paiement à l'acte (chapitre 1), ou lorsque la pratique des dépassements d'honoraires est interdite (chapitre 2) ou limitée (chapitre 3). Le paiement à la performance a été introduit en 2009 par le biais du « Contrat d'Amélioration des Pratiques Individuelles » (CAPI). Le premier chapitre montre que le CAPI a significativement infléchi les pratiques des médecins généralistes qui y ont adhéré dans un sens compatible avec une amélioration de la qualité des soins : contrairement à l'ensemble de leurs collègues, les adhérents du CAPI n'ont pas diminué le nombre de consultations par patient ni le montant des prescriptions par patient. Ils ont également augmenté, plus fortement que les autres, la proportion de leurs patients suivis en tant que médecin traitant. Finalement, le CAPI a conduit à une augmentation des honoraires perçus par patient, avec, en conséquence, un coût de prise en charge plus élevé pour la Sécurité sociale. Le deuxième axe de recherche s'intéresse principalement aux médecins spécialistes, qui sont souvent conventionnés en secteur 2 et peuvent ainsi pratiquer des dépassements d'honoraires. Ces dépassements, élevés et à la charge des patients, peuvent générer des inégalités dans l'accès aux soins. La première tentative de régulation de la pratique des dépassements d'honoraires est la réforme du « gel du secteur 2 », en 1990. À l'aide de régressions par discontinuité, le chapitre 2 évalue l'effet causal de cette régulation des tarifs. Il montre que les médecins spécialistes ayant une activité de nature plutôt « technique » augmentent fortement leur activité lorsqu'ils sont contraints d'exercer en secteur 1 et principalement leur activité technique. Les deux-tiers de ce surcroît d'activité sont associés à l'accueil de nouveaux patients, signe d'une amélioration de l'accessibilité aux soins ; le tiers restant est assimilable à des comportements stratégiques, visant à compenser la baisse de leurs tarifs par une augmentation du contenu des actes délivrés. En revanche, les spécialistes qui ont une activité principalement composée de consultations en cabinet n'ont pas de marge de manœuvre pour augmenter leur activité lorsqu'ils sont contraints d'exercer en secteur 1. Le chapitre 3 estime, à l'aide de différences de différences, l'effet causal de deux programmes d'incitations financières à la réduction de la pratique des dépassements d'honoraires et à l'amélioration de l'accès aux soins : le « Contrat d'accès aux soins » (CAS) introduit en 2013, remplacé par l'« Option Pratique Tarifaire Maîtrisée » (OPTAM) en 2017. Les résultats indiquent que la restriction de la pratique des dépassements a permis d'améliorer l'accès aux soins de la population ; l'OPTAM a cependant été plus efficace que le CAS. Les médecins spécialistes adhérant au CAS puis à l'OPTAM ont, parallèlement à la baisse de leurs tarifs, augmenté leur activité (nombre de consultations, actes techniques), en raison d'une augmentation du nombre de patients suivis, et en particulier d'une hausse du nombre de patients à bas revenus (bénéficiaires de la CMU-C). Cette amélioration à l'accès aux soins génère cependant un coût important pour la Sécurité sociale.

## MOTS CLÉS

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Médecins libéraux, Offre de soins, Régulation tarifaire, Incitations financières, Accès aux soins, Microéconomie

## ABSTRACT

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In France, self-employed physicians are mainly paid on a fee-for-service basis with regulated prices (for sector 1 physicians) or extra fees (sector 2 physicians). This remuneration scheme, which, by definition, encourages physicians to perform more procedures to increase their income, impacts the way they provide care. More generally, it influences the organization and efficiency of the healthcare system. Based on administrative and exhaustive databases of all French self-employed physicians, this thesis aims to understand better how physicians react when faced with changes in their remuneration. In particular, when a "pay-for-performance" (P4P) scheme is introduced in addition to fee-for-service payment (chapter 1), or when the practice of overbilling is prohibited (chapter 2) or limited (chapter 3). P4P was introduced in 2009 through the "Contrat d'Amélioration des Pratiques Individuelles" (CAPI). The first chapter shows that the CAPI has significantly influenced the GPs' activity who have joined it in a way that is compatible with an improvement in the quality of care. Unlike other GPs, CAPI members did not reduce their number of consultations per patient or the amount of prescriptions per patient. They have also increased, to a greater extent than others, the proportion of their patients whom they treat as the primary care doctor (i.e. the "médecin traitant"). Finally, CAPI led to an increase in the fees per patient, with, as a consequence, a higher cost for the National Health Insurance. The second line of research focuses mainly on specialists, who often practice in sector 2 and can therefore charge higher fees. Extra fees, which are high and charged to patients, can generate inequalities in access to care. The first attempt to regulate the practice of extra fees was the "sector 2 freeze" reform in 1990. Using discontinuity regressions, Chapter 2 evaluates the causal effect of this regulation of fees. It shows that specialists whose activity is more "technical" in nature increase their activity significantly when constrained to practice in sector 1, mainly their technical activity. Two-thirds of this increase in activity is associated with the arrival of new patients, a sign of improved accessibility to care; the remaining third can be assimilated to strategic behavior, aiming to compensate for the fall in their tariffs by an increase in the content of the procedures provided. On the other hand, specialists whose activity is mainly composed of office visits have no room for maneuver to increase their activity when they are forced to practice in sector 1. Chapter 3 estimates, using difference-in-differences, the causal effect of two financial incentive programs to reduce the practice of overbilling and improve access to care: the "Contrat d'accès aux soins" (CAS) introduced in 2014, replaced by the "Option Pratique Tarifaire Maîtrisée" (OPTAM) in 2017. The results indicate that restricting the practice of overbilling has improved access to care for the population; however, the OPTAM has been more effective than the CAS. Specialists joining the CAS and then the OPTAM have, in parallel with the reduction in their fees, increased their activity (number of consultations, technical acts) due to an increase in the number of patients followed, and in particular, an increase in the number of low-income patients (CMU-C beneficiaries). However, this improvement in access to care generates a high cost for the National Health Insurance.

## KEYWORDS

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Self-employed physicians, Healthcare supply, Price regulation, Financial incentives, Access to care, Microeconomics