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Formal and informal care arrangements for the disabled elderly in France

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UNIVERSITÉ PARIS 1 PANTHÉON SORBONNE
PARIS SCHOOL OF ECONOMICS

T H È S E

pour l'obtention du titre de Docteur en Sciences Économiques

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**Formal and informal care arrangements
for the disabled elderly in France**

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Table of contents

Reading note / Note de lecture	11
Funding information / Financements	13
Summary in French / Présentation de la thèse en français	15
General introduction	39
1 Informal care arrangements and interactions	63
2 The price elasticity of home care	105
3 Decentralized policies and formal care use	171
4 Importance and variations of travel costs in home care provision	219
General conclusion	251
Bibliography	257
<i>Glossary</i>	275
<i>List of tables</i>	278
<i>List of figures</i>	280
Abstract / Résumé	283



Reading note / Note de lecture

This thesis has been written entirely in English in order to ease the discussion and the diffusion of its results. For French readers, a substantial summary in French is proposed at the beginning of the manuscript. The thesis is made of four independent chapters, each one contributing to the analysis of home care arrangements for the disabled elderly in France. In order to make each chapter readable independently from the others, some elements are to be found in several chapters, especially those relating to the economic literature and the institutional context. As much as possible, though, redundancies have been avoided. The general conclusion holds the results together in order to bring to light the main contributions of the thesis.

Cette thèse a été rédigée intégralement en anglais pour faciliter la discussion et la diffusion de ses résultats. Un résumé substantiel en français est toutefois proposé au lecteur au début du manuscrit. La thèse se compose de quatre chapitres autonomes, qui visent chacun à éclairer une question spécifique en lien avec l'étude des configurations d'aide autour des personnes âgées en incapacité. Pour permettre la lecture de chaque chapitre indépendamment des autres, certains éléments sont mentionnés dans plusieurs chapitres, notamment parmi ceux ayant trait à la littérature économique ou à la compréhension du contexte institutionnel français. Les redondances ont été évitées tant que possible. La conclusion générale met en relation les résultats de chaque chapitre pour souligner les principales contributions de la thèse.



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Summary in French / Présentation de la thèse en français

Le 17 mai 2018, le Comité Consultatif National d’Ethique pour les sciences de la vie et de la santé rendait public son avis sur les enjeux éthiques du vieillissement, visant à contribuer au “soubassement éthique d’une politique d’accompagnement du vieillissement” ([Comité Consultatif National d’Ethique, 2018](#)). Il interrogeait en particulier les logiques et les conditions d’institutionnalisation des personnes âgées, en présentant l’institutionnalisation comme une forme potentielle d’exclusion, qui découlerait d’une dénégation collective de la vieillesse et de la fin de vie. Ce rapport mettait ainsi en exergue deux réalités françaises, l’une démographique et l’autre politique.

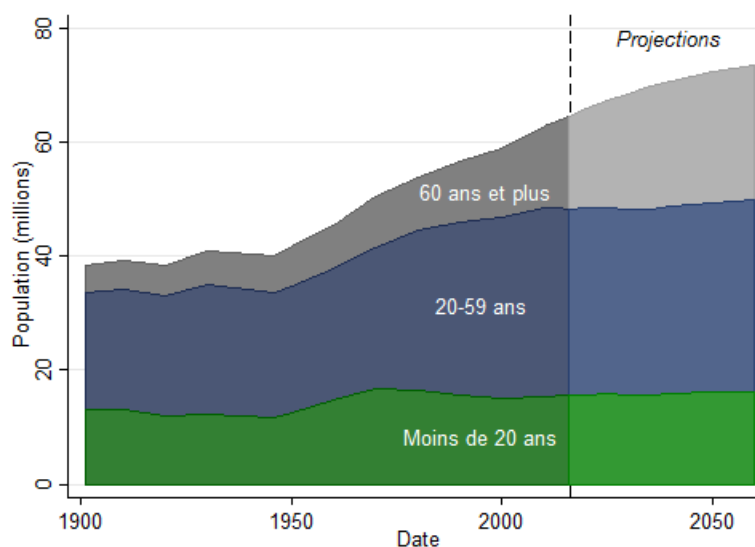
Comme la plupart des pays membres de l’OCDE, la France fait face au vieillissement rapide de sa population ([Gaymu, 2017](#)). La part des personnes âgées de soixante ans et plus représente aujourd’hui quasiment un quart de la population, contre un cinquième il y a 50 ans (Graphique 1). Renforcée par la relative stabilité des taux de fertilité, cette modification de la pyramide des âges tend à se confirmer pour les prochaines décennies, notamment avec l’arrivée massive des “baby-boomers” au grand âge pour la période allant de 2025 à 2060 ([Monnier, 2007](#)). Les personnes âgées d’au moins 60 ans devraient ainsi représenter quasiment un tiers de la population en 2060. Le vieillissement démographique s’accompagne d’une forte prévalence des incapacités, que l’on peut comprendre, selon la définition de l’Organisation Mondiale de la Santé, comme l’ensemble des déficiences et des limitations d’activités auxquels font face les individus, ainsi que les limites à leur implication dans les situations concrètes vécues (restrictions de participation). L’évolution des comportements de santé et les avancées technologiques pourraient permettre la stabilisation de la prévalence des incapacités à âge donné ([Cutler, 2001](#)), mais cette stabilisation ne permettra pas de compenser l’augmentation en nombre des personnes âgées. On s’attend ainsi à une augmentation massive du nombre de personnes en situation de perte d’autonomie dans les décennies à venir ([Marbot and Roy, 2015](#)).

Face à ce défi démographique, la volonté des politiques publiques françaises s’est historiquement affirmée vers le “maintien à domicile”. En 1960, le rapport Laroque, souvent présenté comme une étape importante de la construction des politiques publiques françaises en matière d’accompagnement de la dépendance, affirmait que l’entrée en institution devait demeurer une situation exceptionnelle, expliquée par l’absence de famille ou un état de santé trop dégradé pour permettre de vivre à domicile ([Ennuyer, 2007](#)). Les politiques tournées vers les personnes âgées dépendantes dans la deuxième moitié du vingtième siècle ont ainsi proposé un ensemble de mesures visant à rendre possible la vie à domicile des

personnes âgées dépendantes, notamment en encourageant le recours à l'aide à domicile professionnelle. S'il semble moins coûteux qu'un accompagnement en institution, le maintien à domicile demande toutefois une organisation spécifique du quotidien des personnes âgées, mobilisant généralement, pour la production d'aide, l'entourage et éventuellement des aidants professionnels.

C'est dans ce contexte démographique et politique que s'inscrit cette thèse, en étudiant les déterminants des configurations d'aides familiales et professionnelles autour des personnes âgées dépendantes résidant à domicile. Elle se rattache ainsi aux travaux économiques qui ont cherché à comprendre les mécanismes de décision des individus en perte d'autonomie et de leurs proches. Le présent résumé propose un aperçu de la littérature économique sur les configurations d'aides autour des personnes âgées en perte d'autonomie, afin de mettre en évidence les contributions de cette thèse à la littérature. Il propose ensuite une présentation des politiques publiques françaises tournées vers les personnes âgées dépendantes, qui constituent à la fois le cadre et l'objet d'étude de la thèse, avant de présenter de manière détaillée les chapitres de la thèse et leurs résultats.

FIGURE 1 – Volume et structure de la population française entre 1900 et 2060



SOURCE : INSEE, Estimations et projections de population (2007-2016 ; 2020-2060).

NOTES : scénario central de projection de population 2007-2060.

Approches économiques de l'aide formelle et informelle auprès des personnes âgées en perte d'autonomie

La littérature économique s'est d'abord intéressée à l'aide informelle, définie comme l'aide non rémunérée apportée par les proches. L'aide reçue par les personnes âgées dépendantes provient en effet encore majoritairement de leurs proches. Avec la mise en place des politiques publiques visant à subventionner le recours à l'aide professionnelle, la littérature s'est penchée sur la relation entre ces deux types d'aide, ainsi que sur les déterminants et les effets de la consommation d'aide professionnelle. Ces analyses sont centrées sur les personnes âgées résidant à domicile : un troisième pan de la littérature centrée sur les déterminants de l'entrée en institution permet de voir en quoi en quoi cette population se distingue de celle résidant en institution.

L'importance et l'organisation de l'aide informelle

La littérature économique s'est tout d'abord intéressée à l'aide familiale, qui constitue la forme historique et encore prépondérante de l'accompagnement des personnes âgées dépendantes. Désignée comme aide informelle pour souligner son caractère le plus souvent peu qualifié et non rémunéré, cette aide est à la fois plus importante en volume et en fréquence que l'aide dite formelle (professionnelle et rémunérée). D'après l'enquête *Handicap Santé Ménages* de 2008, parmi les 3,6 millions de personnes âgées bénéficiant régulièrement d'une aide, 80 % déclarent être aidés par un proche, éventuellement en consommant également de l'aide professionnelle (48 %) (Soullier and Weber, 2011). Le temps d'aide médian apporté par les aidants informels atteint 1h40 par jour contre 0h35 pour les aidants professionnels. Cette aide est également plus variée : les aidants informels interviennent en moyenne dans quatre activités de la vie quotidienne, contre deux pour les aidants professionnels (Fontaine, 2011).

On peut distinguer trois courants d'analyse de l'aide informelle dans la littérature économique. Le premier courant s'est intéressé à la relation entre l'aide informelle et l'aide formelle. Il s'agissait notamment d'anticiper l'effet d'une subvention publique encourageant la consommation d'aide professionnelle sur l'aide des proches. La majorité des études concluent à une forme d'éviction de l'aide informelle par l'aide formelle (Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Viitanen, 2007; Rapp *et al.*, 2011; Fontaine, 2012; Arnault, 2015). Considérant la relation inverse, d'autres travaux ont montré que la présence d'aide informelle conduit à une faible demande d'aide professionnelle (Van Houtven and Norton, 2004; Pezzin and Schone, 1999; Bolin *et al.*, 2008a; Bonsang, 2009), bien que cet effet de substitution disparaisse pour les niveaux de dépendance les plus sévères

(Bonsang, 2009).

Un autre pan de littérature s'est concentré sur l'effet de l'aide informelle sur les aidants, notamment sur leur offre de travail (Ettner, 1995, 1996; Pezzin and Schone, 1999; Bolin *et al.*, 2008*b*; Fontaine, 2009; Van Houtven *et al.*, 2013), leur santé physique et mentale (Savage and Bailey, 2004; Coe and Van Houtven, 2009; Do *et al.*, 2015) ou leurs relations sociales (Miller and Montgomery, 1990).

Le troisième courant de la littérature met enfin l'accent sur la genèse des configurations d'aide et cherche à expliquer les processus de désignation des aidants (Stern, 1994; Sloan *et al.*, 1997; Pezzin and Schone, 1999; Hiedemann and Stern, 1999; Engers and Stern, 2002). Ces travaux visent à étudier l'effet des caractéristiques individuelles et parentales sur les configurations d'aide, et, plus récemment, l'effet des interactions endogènes au sens de Manski (2000), c'est-à-dire la manière dont le comportement d'aide d'un aidant influence celui des autres (Fontaine *et al.*, 2009). Le premier chapitre de la thèse s'inscrit essentiellement dans ce troisième courant, en proposant une analyse de la genèse des configurations d'aide dans les familles d'un parent âgé dépendant dans le contexte français.

Comprendre la demande et les effets de l'aide formelle

La littérature économique s'est également penchée sur les comportements de consommation d'aide formelle, comme forme d'accompagnement le plus souvent valorisée et encouragée par les politiques publiques (Muir, 2017).

Un premier champ de la littérature s'est ainsi intéressé à la relation entre la consommation d'aide professionnelle à domicile et l'entrée en institution. Ces travaux montrent que la consommation d'aide professionnelle à domicile permet de retarder l'entrée en maison de retraite (Ettner, 1994; Pezzin *et al.*, 1996; Guo *et al.*, 2015). Ce caractère "protecteur" de l'aide formelle par rapport à l'institution semble avoir un effet ambigu sur les coûts privés et publics liés à l'accompagnement de la dépendance : la baisse des coûts liés à l'institution ne compense pas les coûts additionnels liés à l'aide formelle (Guo *et al.*, 2015), ou bien ne les compense qu'à condition de mobiliser largement l'aide informelle (Wübker *et al.*, 2015). L'effet préventif de la consommation d'aide formelle s'observe en outre directement sur les indicateurs de santé des personnes âgées : la consommation d'aide formelle à domicile est associée à une amélioration de la santé mentale (Barnay and Juin, 2016), ainsi qu'à une diminution des hospitalisations et du recours aux urgences (Rapp *et al.*, 2015; Costa-Font *et al.*, 2018).

Les déterminants du recours à l'aide formelle et de l'importance de la consommation ont également fait l'objet de travaux, qui visaient notamment à analyser l'effet des politiques publiques subventionnant le recours à l'aide formelle. Outre les limitations d'activités et la disponibilité de l'aide informelle qui sont, de manière récurrente, des déterminants

de la consommation d'aide formelle (voir [Bakx, Meijer, Schut and Doorslaer \(2015\)](#) pour une revue de littérature), le prix de l'aide apparaît comme un facteur expliquant les comportements de consommation d'aide formelle. Plusieurs travaux ont ainsi montré que la probabilité de recourir à l'aide formelle et le volume consommé sont plus importants en présence de dispositifs publics diminuant le prix de l'aide ([Coughlin *et al.*, 1992](#); [Ettner, 1994](#); [Pezzin *et al.*, 1996](#); [Stabile *et al.*, 2006](#); [Rapp *et al.*, 2011](#); [Fontaine, 2012](#)). Toutefois, faute de données appropriées, ces travaux n'ont pas pu quantifier l'élasticité-prix de la demande d'aide professionnelle pour les personnes âgées dépendantes. C'est à cette lacune que tente de répondre le Chapitre 2 de la thèse, réalisé dans le cadre du projet Modapa étudiant la demande d'aide à domicile des personnes âgées, en estimant l'effet d'une variation du prix sur la quantité d'aide formelle consommée.

Le domicile ou l'institution

De nombreux travaux économiques se sont enfin intéressés aux déterminants de l'entrée en institution, opposée aux solutions de maintien à domicile, et ce d'autant plus que les institutions ont longtemps été considérées comme le lieu exclusif de l'accompagnement professionnel des personnes âgées ([Norton, 2016](#)). Ils ont montré que l'entrée en institution s'explique le plus souvent par un état de santé (physique ou cognitif) particulièrement dégradé et par la moindre disponibilité de l'aide informelle, en particulier de la part du conjoint ou des enfants ([Freedman, 1996](#); [Lo Sasso and Johnson, 2002](#); [Van Houtven and Norton, 2004](#); [Charles and Sevak, 2005](#); [Gaugler *et al.*, 2007](#); [Arnault, 2015](#)). Des travaux récents se sont en outre penchés sur la question de la sensibilité au prix des institutions. [Grabowski and Gruber \(2007\)](#) ont montré que la demande était relativement inélastique, tandis que [Mommaerts \(2018\)](#) a confirmé ce résultat en le nuancant : les personnes âgées seules ont une plus grande probabilité d'entrer en institution lorsque le prix associé est faible plutôt que de co-résider.

Cette thèse est centrée sur les personnes âgées résidant à domicile, et ne traite pas des personnes résidant en institution. La population étudiée dans la thèse présente donc, en moyenne, un meilleur état de santé et de plus grandes ressources en aide informelle comparé à l'ensemble des personnes âgées.

Le financement et la régulation de l'aide à domicile en France

La thèse s'inscrit dans le contexte français : cette section propose donc de décrire l'organisation décentralisée et les caractéristiques des politiques publiques visant à ac-

compagner la perte d'autonomie, du point de vue du financement de la demande d'aide professionnelle et de la régulation du secteur de l'aide à domicile.

La décentralisation au niveau des conseils départementaux

L'une des caractéristiques du système d'accompagnement de la perte d'autonomie français est la décentralisation des politiques de financement et de régulation de l'aide à domicile au niveau des conseils départementaux. Reconnus comme "chefs de file de l'action sociale" en 2004, ce sont eux qui sont en charge de la mise en oeuvre de l'Allocation personnalisée d'autonomie (APA), principal programme destiné aux personnes âgées dépendantes. Ils sont également chargés de la régulation des producteurs d'aide à domicile professionnels intervenant auprès de publics fragiles. Si le cadre légal est apparemment contraignant sur ces deux volets — financement de la demande et régulation de l'offre —, l'observation des pratiques départementales montre qu'il existe une marge de manoeuvre considérable dont se saisissent les départements et qui résulte en une réelle disparité des pratiques d'un département à un autre.

La décentralisation de l'APA et la variété des pratiques départementales dans sa mise en oeuvre sont structurantes pour cette thèse. En effet, d'une part, elles expliquent qu'il soit nécessaire de travailler au niveau d'un département donné pour récolter des données précises permettant le calcul du reste-à-charge exact et du volume d'aide consommé dans le cadre de la politique : l'un des chapitres visant à l'estimation de l'élasticité-prix s'appuie sur les données administratives de l'APA récoltées auprès d'un conseil départemental (Chapitre 2). D'autre part, elles constituent également un objet d'étude en soi : le Chapitre 3 s'intéresse à l'effet des différentes pratiques départementales sur le recours à l'aide professionnelle.

L'Allocation personnalisée d'autonomie

Mise en place en 2002, l'Allocation personnalisée d'autonomie (APA) vise principalement à aider au financement de l'aide professionnelle pour les bénéficiaires résidant à domicile¹. L'APA est ouverte à toute personne âgée d'au moins 60 ans, résidant en France de manière stable et régulière, et en situation de perte d'autonomie². Il s'agit donc d'une allocation universelle, puisque l'éligibilité ne dépend pas du niveau de revenu des per-

¹L'APA est également versée aux personnes en établissement et couvre alors une partie du tarif "dépendance" facturé aux usagers. Ce volet de la politique n'est pas considéré dans la thèse, centrée sur les personnes résidant à domicile.

²" Toute personne âgée résidant en France qui se trouve dans l'incapacité d'assumer les conséquences du manque ou de la perte d'autonomie liés à son état physique ou mental a droit à une allocation personnalisée d'autonomie permettant une prise en charge adaptée à ses besoins." Article L232-1 du Code de l'Action Sociale et des Familles (CASF).

sonnes. Elle se distingue par là des formes antérieures du financement public de l'aide à domicile professionnelle, notamment l'Allocation compensatrice pour tierce personne (ACTP), mise en place en 1975, et la Prestation Spécifique Dépendance (PSD) qui l'a remplacée en 1997, toutes deux sous condition de ressources.

L'évaluation du niveau de dépendance se fait au domicile du demandeur par une équipe médico-sociale du conseil départemental, qui évalue les limitations d'activités et restrictions fonctionnelles de l'individu au moyen de la grille "Autonomie, Gérontologie, Groupes Iso-Ressources" (AGGIR). Basée sur le système de "case-mix classification system", qui vise à regrouper au sein d'une catégorie homogène les individus qui nécessitent les mêmes ressources ou génèrent des coûts similaires (Fries, 1990; Coutton, 2001), cette grille permet de déterminer les groupes iso-ressources (GIR) de l'individu parmi les six groupes qu'elle délimite. Seuls les individus évalués entre le GIR 1 (correspondant au niveau de perte d'autonomie le plus élevé) et le GIR 4 (niveau intermédiaire) sont éligibles à l'APA³. Lorsque l'individu est jugé éligible, l'équipe médico-sociale établit le nombre d'heures d'aide qui pourront être subventionnées pour ce bénéficiaire, que l'on appelle le plan d'aide individualisé. L'équivalent monétaire du plan d'aide doit être inférieur à un plafond national, spécifique à chaque GIR et actualisé chaque année. Le bénéficiaire de l'APA est ensuite libre du nombre d'heures d'aide qu'il consomme effectivement; tant qu'il n'a pas consommé l'intégralité de son plan d'aide, il reçoit une subvention horaire diminuant le prix de l'aide. Le montant de cette subvention dépend de son taux de participation, fonction croissante de son revenu. Le bénéficiaire de l'APA peut consommer des heures d'aide au-delà du plan d'aide, mais en assumant alors l'intégralité du coût. La loi relative à l'adaptation de la société au vieillissement de 2015 a augmenté la générosité de la politique de l'APA, en modifiant la formule de calcul du taux de participation pour le rendre plus faible, à revenu donné, pour les individus les plus dépendants. Elle a également relevé les plafonds nationaux sur lesquels butaient potentiellement les plans d'aide.

Explicitement, les conseils départementaux ne sont chargés que des procédures d'information et d'attribution de l'allocation. Mais l'observation de leurs pratiques montre que cette mise en œuvre dépasse la simple application d'une politique nationale au niveau local. La diversité des pratiques porte ainsi d'abord sur la manière de gérer les missions qui leur sont explicitement confiées (mise en œuvre de l'évaluation par l'équipe médico-sociale, décisions d'éligibilité, prescription de l'aide). Elle est également visible sur la gestion des "zones d'incertitude" que crée le cadre légal sur certains paramètres essentiels au calcul de l'APA. La mise en œuvre du dispositif implique en effet que les conseils départementaux tranchent sur un certain nombre de paramètres déterminants dans le calcul de l'allocation.

³Le lecteur pourra se référer, entre autres, à [Eghbal-Téhérani and Makdessi \(2011\)](#) pour une présentation détaillée du contenu de chaque GIR (page 8).

Ils choisissent en particulier le mode de valorisation des heures du plan d'aide, c'est-à-dire la manière dont est calculé l'équivalent monétaire du plan d'aide pour s'assurer qu'il est inférieur au plafond national, paramètre qui influence la générosité de la politique. Ils fixent également la formule de calcul de la subvention horaire, c'est-à-dire la manière dont le taux de participation interagit avec le prix pour former le reste-à-charge horaire effectif. Ce sont les variations de pratiques d'un département à l'autre sur ce dernier point qu'étudie le Chapitre 3 de la thèse.

La régulation des producteurs d'aide à domicile

Les conseils départementaux sont également chargés de la régulation de l'offre dans le secteur de l'aide à domicile. Définir "le" secteur de l'aide à domicile est délicat dans la mesure où les producteurs de l'aide à domicile professionnelle sont variés, en termes d'ancienneté, de statuts juridiques et de modes de régulation. Cette section récapitule la construction des différents modes de régulation des producteurs intervenant auprès des personnes âgées dépendantes.

L'emploi direct (ou gré-à-gré) est un premier mode d'intervention en matière d'aide à domicile. Forme historique de l'intervenant à domicile, l'employé est embauché directement par la personne qui reçoit le service. Le niveau de régulation, dans ce cas, est très faible : ce sont uniquement les dispositions du Code du travail qui s'appliquent. Avec ce mode d'intervention, les niveaux des prix et de qualification des intervenants sont généralement très faibles. Une forme alternative à l'emploi direct, toutefois équivalente en matière de régulation, est le recours à une structure mandataire, qui assiste l'employeur dans les procédures de recrutement.

On trouve par ailleurs sur le marché des structures prestataires d'aide à domicile, employant directement des aidants professionnels qui interviennent au domicile des personnes aidées au nom de la structure. La majorité des services prestataires qui interviennent auprès des bénéficiaires de l'APA à domicile sont des structures "autorisées" par le conseil départemental. Ce mode de régulation, instauré en 2002, est associé à plusieurs niveaux de contrôle par le Conseil départemental. L'entrée sur le marché, la transformation et l'extension de ces services sont d'abord conditionnées à l'obtention d'une autorisation par le président du conseil départemental. Les structures autorisées doivent répondre aux exigences de certification et d'évaluation externes, visant à garantir un certain niveau de qualité. En outre, la zone géographique au sein de laquelle chaque service autorisé intervient fait l'objet d'un accord avec le conseil départemental. Enfin, chaque service autorisé est tarifé par le conseil départemental : un tarif unique est fixé au niveau de la structure, théoriquement en fonction du coût de revient moyen précédemment observé, mais aussi selon des considérations administratives et politiques ([Gramain and Xing, 2012](#)).

L'autre mode de régulation des services prestataires existant sur le secteur, mis en place dans le cadre du plan Borloo en 2005, relâche les contraintes de régulation associées à l'autorisation. Il permet ainsi aux services d'aide à domicile d'intervenir auprès des publics fragiles avec l'obtention d'un "agrément qualité" dont les exigences sont moindres comparées à celles de l'autorisation. Les "services agréés" sont ainsi libres d'entrer sur le marché sans autorisation et de fixer leurs prix, sous réserve de respecter un taux d'évolution annuel maximal. La création de ce statut visait à ouvrir le secteur aux entreprises pour stimuler l'emploi par l'accroissement et la diversification de l'offre de service.

Entre 2005 et 2015, en dépit de la stabilité législative du secteur, et malgré l'augmentation de la demande, de nombreux rapports publics font état des difficultés réelles et croissantes du secteur (Aube-Martin *et al.*, 2010; Poletti, 2012; Cour des Comptes, 2014; Branchu *et al.*, 2015). Ces rapports soulignent notamment les contraintes que représentent les coûts de transports et leur poids inégal selon l'importance et les caractéristiques des zones desservies (Aube-Martin *et al.*, 2010; Blondel *et al.*, 2013; Garabige *et al.*, 2015; Branchu *et al.*, 2015). Cette question est considérée spécifiquement dans le Chapitre 4 de cette thèse. De plus, outre le manque d'attractivité des professions de l'aide à domicile et l'insuffisance des niveaux de tarification, ces rapports ont déploré la complexité de la superposition des cadres réglementaires, question qu'adresse partiellement la loi relative à l'adaptation de la société au vieillissement de 2015.

L'article 47 de la loi met en effet en place les conditions d'un régime unique pour les services prestataires d'aide à domicile intervenant auprès des personnes âgées à domicile. Il prévoit d'unifier les cadres réglementaires des services en faisant prévaloir celui de l'autorisation, pour tous les services intervenants auprès de publics fragiles. Ceci implique donc que l'ensemble des services seront soumis aux dispositions du droit commun liées au régime de l'autorisation. La loi prévoit en outre un cahier des charges national qui soumet tous les services (autorisés) à des règles organisationnelles et fonctionnelles. Ce nouveau régime oriente donc explicitement la régulation du secteur vers la simplification et vers la logique de protection des publics fragiles (Labazée, 2017). L'homogénéité du secteur ainsi régulé rencontre toutefois un obstacle majeur dans le fait que toutes les structures prestataires ne seront pas tarifées. En effet, la tarification administrée n'est pas présentée comme une obligation pour tous les services, étant données les réticences des services anciennement agréés et la charge additionnelle que cette obligation représenterait pour les conseils départementaux (Direction générale de la cohésion sociale, 2016). Le secteur reste ainsi marqué par la dichotomie entre les services tarifés d'une part et les services non tarifés de l'autre, qui implique des différences majeures dans la gestion des services et la solvabilisation des bénéficiaires de l'aide sociale⁴.

⁴Concernant le mode de financement des services déjà tarifés avant la loi et dont le prix reste admi-

Présentation de la thèse

Cette thèse porte sur les déterminants des configurations d'aide autour des personnes âgées dépendantes résidant à domicile. La majeure partie de la thèse analyse les déterminants de l'aide formelle, en particulier ceux qui dépendent des décisions de politiques publiques. Sous quelles conditions les individus ont-ils recours à l'aide professionnelle, et comment se détermine leur niveau de consommation? Comment les producteurs d'aide familiale et professionnelle s'adaptent-ils aux contraintes de production qui leur sont propres? La thèse se propose, d'une part, d'étudier les déterminants de la demande d'aide formelle. Elle s'intéresse à ces déterminants à la marge extensive de l'aide (la décision de consommer de l'aide professionnelle, ou non) et à sa marge intensive (le volume consommé, parmi les individus consommant de l'aide professionnelle). La thèse contribue également à l'analyse de l'organisation de la production d'aide, formelle et informelle. Elle étudie, d'une part, les déterminants des configurations d'aide familiale, en particulier les interactions entre les décisions d'aide des enfants au sein d'une fratrie. De l'autre, elle s'intéresse aux coûts de transport comme contrainte de production pour les services d'aide à domicile professionnels.

Chapitre 1

Le premier Chapitre, écrit avec Roméo Fontaine et Agnès Gramain, porte sur les configurations d'aide familiale autour d'un parent âgé dépendant. Il étudie les déterminants de l'aide informelle apportée par les enfants d'un parent âgé dépendant : comment l'implication des enfants s'ajuste-t-elle aux caractéristiques individuelles et familiales? Comment s'articulent les décisions de chacun? Existe-t-il des logiques d'implication différentes selon le rang des enfants dans la fratrie, et selon le type d'aide considéré? Pour prendre en compte la potentielle interdépendance des comportements d'aide au sein des fratries, plusieurs travaux ont déjà proposé des modèles inspirés de la théorie des jeux, qui incluent les anticipations que forment les agents sur les décisions d'aide des autres enfants (Hiedemann and Stern, 1999; Checkovich and Stern, 2002; Engers and Stern, 2002; Pezzin *et al.*, 2007; Byrne *et al.*, 2009). A partir des données européennes de l'enquête *Survey, Health, Aging and Retirement in Europe* (SHARE), Fontaine *et al.* (2009) a cherché à étudier directement les "interactions endogènes" au sens de Manski (Manski, 2000), c'est-à-dire l'effet de la décision d'un membre d'un groupe sur la décision des autres. L'identification de ces interactions est délicate, puisqu'elles peuvent se confondre avec les "effets contextuels", peu de modifications sont apportées. L'article 47 prévoit un travail sur des tarifs nationaux de référence non opposables prenant en compte la nature des activités, la qualification du personnel et la couverture territoriale.

tuels”, désignant l’effet des caractéristiques d’un membre sur la décision des autres, et les “effets corrélés”, renvoyant à l’existence d’un contexte commun aux individus d’un même groupe. Fontaine *et al.* (2009) développent une modélisation semi-structurale, reprise dans ce chapitre, qui permet de distinguer ces différents effets.

Le Chapitre se propose ainsi d’étudier les configurations d’aide familiale, et plus spécifiquement les interactions endogènes, dans le contexte français. Il s’appuie sur les données françaises de l’enquête *Handicap Santé Ménages* (DREES and INSEE, 2008). Cette enquête représentative de la population française porte spécifiquement sur l’état de santé et les restrictions d’activités des enquêtés. On sélectionne un échantillon de personnes âgées de soixante ans ou plus, qui déclarent avoir besoin d’aide humaine pour la réalisation des activités de la vie quotidienne. L’intégralité de l’information disponible dépend de la déclaration de l’enquêté, notamment pour le repérage des limitations d’activité et des aidants. Ceci implique donc des biais de déclaration potentiellement liées aux caractéristiques de l’individu et à son environnement (Merrill *et al.*, 1997; Brink *et al.*, 2003).

Une première étape descriptive montre que l’aide apportée par les enfants — toutes tailles de fratrie confondues — est affectée par le statut conjugal du parent, la taille de la fratrie et le rang dans la fratrie. L’analyse se tourne ensuite vers les interactions, définies comme la réaction de la décision d’aide d’un enfant à la décision d’aide des autres enfants. Elle se concentre sur les familles de deux enfants. Si ce choix restreint la portée de l’analyse, il permet non seulement d’étudier les familles les plus fréquentes dans notre échantillon et en population générale, mais aussi d’adopter une modélisation relativement simple, sans hypothèses fortes sur le mode d’agrégation des comportements des enfants. La modélisation reprise de Fontaine *et al.* (2009) fait l’hypothèse que les décisions des enfants au sein d’une fratrie sont non-coopératives et simultanées. Outre les interactions, les déterminants étudiés relèvent des caractéristiques individuelles des enfants (âge, statut familial, statut d’emploi), des variables de famille, incluant à la fois les caractéristiques du parent (sexe, âge, niveau de dépendance, ressources, éducation) et celles de la fratrie (composition sexuée, écart d’âge). Ces déterminants sont étudiés pour deux définitions différentes de l’aide. La première, définition large de l’aide, considère comme aidants tous les enfants qui apportent une aide aux tâches de la vie quotidienne, de l’aide matérielle ou du soutien moral. La seconde définition restreint le statut d’aidant aux enfants déclarés aidants pour les tâches de la vie quotidienne, ce type d’aide étant potentiellement plus contraignant que l’aide matérielle ou le soutien moral.

Avec la définition large de l’aide, les écarts de mobilisation observés selon le rang dans la fratrie découlent de trois sources : les caractéristiques individuelles de chaque enfant, l’effet de ces caractéristiques sur la décision d’aide, et l’ajustement de l’un au comportement de l’autre (interactions endogènes). Comparé à celui de l’aîné, le comportement du

cadet est plus sensible à ses contraintes personnelles, faisant apparaître un arbitrage entre coûts et utilité de l'aide. Les caractéristiques familiales ont un effet relativement similaire quelque soit le rang, en particulier la forte assignation au rôle d'aidant des femmes ayant un frère. On observe en outre une asymétrie dans les interactions des décisions d'aide : l'aîné a une plus forte probabilité d'être aidant lorsque le cadet est déclaré aidant, tandis que le cadet ne semble pas réagir significativement à l'implication de son aîné. Lorsqu'on étudie les déterminants de la définition restreinte de l'aide, centrée sur les tâches de la vie quotidienne, une seule explication majeure des différences demeure : l'asymétrie, entre aînés et cadets, dans l'ajustement au comportement de l'autre enfant, à caractéristiques individuelles et familiales données.

Les limites de ce travail tiennent d'abord aux hypothèses fortes mobilisées pour la modélisation des configurations d'aide. Discutée dans le Chapitre, les hypothèses de non coopération et de simultanéité des décisions imposent en effet un cadre relativement rigide aux décisions d'aide. Elles ne prennent pas en compte les possibilités d'un ajustement coopératif entre les enfants, ni la potentielle séquentialité des décisions, où un enfant prendrait sa décision avant l'autre. Ce chapitre se restreint également à la marge extensive de l'aide (être aidant ou ne pas être aidant). Être déclaré aidant peut cependant renvoyer à une large variété de situations, quant aux volumes apportés ou aux types de tâches accomplies. Enfin, étudier uniquement les fratries de deux enfants restreint la portée de l'analyse par rapport à l'ambition initiale. Des développements futurs sont ainsi nécessaires pour modéliser les interactions dans un cadre plus large. Ce travail constitue toutefois la première étude des interactions au sein des fratries autour d'un parent âgé dépendant dans un contexte français. Il confirme les résultats obtenus sur les données européennes, notamment concernant l'effet d'une fratrie mixte et l'asymétrie des interactions.

Chapitre 2

Le second Chapitre est centré sur la sensibilité au prix de la demande d'aide professionnelle : dans quelle mesure le volume d'aide professionnelle consommé par les personnes âgées dépendantes dépend-il du prix qu'ils payent pour cette aide ? Malgré l'importance des politiques publiques subventionnant le recours à l'aide à domicile professionnelle, la question de la sensibilité au prix de la demande d'aide professionnelle a encore été relativement peu étudiée dans la littérature économique. Plusieurs travaux, mentionnés ci-dessus, ont montré que la demande était effectivement sensible au coût de l'aide professionnelle, sans pouvoir toutefois, faute de données adéquates, quantifier l'élasticité-prix de cette demande. C'est ce que vise à faire ce chapitre, coécrit avec Marianne Tenand et réalisé dans le cadre du projet Modapa⁵, dont l'objectif est justement d'estimer la sensibilité de

⁵Pour plus d'information, voir www.modapa.cnrs.fr.

la demande d'aide au reste-à-charge et ses implications pour les politiques publiques.

Etudier cette question demande de disposer de données permettant d'observer précisément à la fois le reste-à-charge et la consommation des personnes âgées dépendantes. Or, dans le contexte français, il n'existe pas, à ce jour, de données vérifiant une telle condition parmi les enquêtes et fichiers administratifs nationales. Nous avons donc récolté, auprès d'un Conseil départemental français, les données administratives du programme de l'APA dans le département entre 2012 et 2014. Ces données permettent de connaître le taux de participation et la consommation d'aide professionnelle des bénéficiaires de l'APA. La consommation observée est toutefois limitée aux heures subventionnées dans le cadre de la politique (le plan d'aide) et, pour les individus qui consomment l'intégralité de leur plan d'aide, on ignore si la consommation totale est supérieure ou égale à ce plan d'aide (censure à droite). Nous estimons donc un modèle de censure, expliquant le volume consommé par le reste-à-charge et un ensemble de caractéristiques individuelles. L'échantillon sélectionné comprend les individus consommant auprès d'un service d'aide autorisé, pour lesquels le prix facturé est observable puisqu'il est fixé par le Conseil départemental. A revenu donné, le reste-à-charge supporté par les individus dépend en effet directement du prix du producteur qui leur fournit l'aide. Nous exploitons principalement les variations dans le prix des producteurs d'un individu à l'autre pour identifier l'élasticité-prix. Une stratégie de variable instrumentale est mobilisée pour s'assurer de l'exogénéité de ce prix, qui s'appuie sur les différences de couverture territoriale entre les producteurs : le prix est instrumenté par le nombre de communes servies par le producteur.

Nos résultats font apparaître une élasticité-prix de -0.4, significativement différente de 0 et de -1. Les tests d'hétérogénéité montrent que l'élasticité-prix n'est pas significativement différente lorsqu'on distingue les individus par leur niveau de dépendance ou leur statut matrimonial. En revanche, la sensibilité au prix est plus importante pour les individus aux revenus les plus élevés. Ces résultats confirment les premières estimations obtenues dans le cadre du projet Modapa. En utilisant les données nationales de l'enquête *Handicap Santé Ménages* et en faisant des hypothèses sur les restes-à-charge espérés, [Hege \(2016\)](#) estime une élasticité-prix de -0.1, significativement différente de 0. Utilisant des fichiers administratifs de l'APA provenant d'un autre département que celui étudié dans ce chapitre et une stratégie d'identification alternative, [Bourreau-Dubois et al. \(2014\)](#) trouvent une élasticité-prix de -0.55.

Deux limites de ce travail tiennent aux données utilisées. D'une part, ces données administratives ne présentent qu'une information limitée sur les caractéristiques sociodémographiques de l'individu et sur son entourage. On ignore notamment si les bénéficiaires étudiés reçoivent de l'aide de la part d'un proche, ce qui serait susceptible de diminuer leur demande d'aide informelle. Outre le fait que cette lacune limite le pouvoir explicatif

de notre modèle, elle pourrait également biaiser notre estimation de l'élasticité-prix si le recours à l'aide informelle s'avère être corrélé au prix du producteur. Plusieurs tests sont menés dans le chapitre. Ils suggèrent que l'élasticité-prix n'est pas affectée par la présence d'un conjoint, ni par la consommation durant le week-end dimanche, caractéristique potentiellement liée à de moindres ressources en aide informelle. Nos estimations semblent donc robustes à la prise en compte de l'aide informelle.

La seconde limite porte sur la possible généralisation de l'élasticité-prix obtenue. Nous travaillons sur un échantillon sélectionné à plusieurs niveaux : d'une part, des personnes âgées dépendantes sélectionnées par rapport à l'ensemble des personnes dépendantes, de l'autre, des personnes résidant dans un département français particulier. Le premier point renvoie au fait que l'élasticité-prix est estimée sur une population résidant à domicile, ayant fait une demande d'APA et servie par un producteur prestataire. Cette population est donc en meilleure santé et en relation fréquente avec leur entourage, par rapport aux personnes résidant en institutions. Dans la mesure où le non-recours à l'APA est souvent observé chez les individus disposant des plus hauts revenus, ces individus ont également un revenu plus faible que la moyenne des personnes âgées dépendantes résidant à domicile. Enfin, la comparaison des individus servis par un producteur prestataire et ceux consommant auprès d'un producteur agréé ou en gré-à-gré montre que les revenus et le niveau de dépendance des premiers sont légèrement moins élevés en moyenne. La deuxième source de sélection tient au fait que nous travaillons sur les données d'un département français en particulier. Si la plupart des indicateurs socio-démographiques y sont proches des moyennes nationales, le niveau de richesse du département est toutefois légèrement plus élevé qu'en moyenne.

Nos estimations confirment les résultats déjà obtenus à partir de données ou de stratégies d'identification alternatives, à savoir une élasticité-prix non nulle mais faible (significativement inférieure à 1 en valeur absolue). Une élasticité-prix non nulle implique que les paramètres des politiques publiques influençant le prix de l'aide à domicile ont des effets sur l'efficacité allocative de ces programmes. Étant donnée la faible sensibilité de la demande, ces paramètres ont en outre des propriétés redistributives et modulent l'importance de la redistribution des contribuables vers les personnes âgées dépendantes.

Chapitre 3

Le troisième chapitre, coécrit avec Rémi Kaboré et Jérôme Wittwer, porte sur les déterminants du recours à l'aide professionnelle des personnes âgées, en particulier ceux qui dépendent des politiques départementales. L'organisation des politiques sociales françaises confiant aux conseils départementaux la mise en œuvre de l'APA et la régulation du secteur de l'aide à domicile, on se demande dans quelle mesure les décisions départemen-

tales sont susceptibles d'influencer le recours à l'aide professionnelle sur le territoire du département. Deux dimensions de la décision départementale sont étudiées : d'une part, le choix de la règle de calcul pour la subvention de l'APA, donnant lieu à différents niveaux de générosité pour les départements (indicateur de demande); de l'autre, l'importance des producteurs autorisés dans le secteur départemental, impliquant un accès différencié à une qualité et un prix régulé (indicateur d'offre). La question de l'effet de la générosité des politiques de subvention de l'aide formelle a déjà été étudiée en mobilisant, à l'instar de notre démarche, les variations territoriales. *Stabile et al. (2006)* montrent que la générosité des provinces au Canada, mesurée par le niveau de dépenses locales, influence le recours à l'aide formelle et informelle, tandis qu'*Arrighi et al. (2015)* montrent que la probabilité de faire une demande d'APA augmente avec la générosité des départements à la marge extensive (part des bénéficiaires APA dans la population de 60 ans et plus) et à la marge intensive (montant moyen de la subvention).

Nous exploitons une enquête départementale originale, l'enquête *Territoire (LEDa-LEGOS and CES, 2012)*. Menée en 2012, cette enquête visait à comprendre et documenter la variété des pratiques départementales en matière d'accompagnement des personnes âgées. Elle s'est déroulée en deux temps. Dans une première partie, des enquêtes de terrain ont été menées dans huit conseils départementaux afin de comprendre l'organisation et les paramètres d'intérêt pour la politique. Puis, un questionnaire standardisé a été diffusé auprès de l'ensemble des conseils départementaux métropolitains, questionnaire retourné par 71 conseils départementaux⁶. Ces informations départementales sont appariées, sur la base du département de résidence, avec un échantillon de personnes âgées qui déclarent des restrictions dans la réalisation des activités de la vie quotidienne, issu de l'enquête *Handicap santé Ménages*.

Une première partie documente la variété des pratiques départementales reflétées par les indicateurs d'offre et de demande, et les met en lien avec les caractéristiques socio-démographiques des départements. Il apparaît ainsi que le choix d'une règle généreuse pour la subvention APA n'est pas corrélé aux caractéristiques démographiques ou sociales des populations départementales, alors qu'un plus faible niveau de régulation est observé dans des départements peu vieillissants et avec un plus faible taux de bénéficiaires de l'APA parmi les personnes âgées. Les deux indicateurs d'offre et de demande sont ensuite intégrés dans un modèle de choix discret expliquant le recours à l'aide à domicile professionnelle. Ce recours est expliqué à la fois par des variables individuelles et des variables départementales. Outre les indicateurs d'offre et de demande, ces dernières incluent des contrôles pour les caractéristiques sociodémographiques des départements. L'estimation de ce modèle montre qu'une règle de calcul généreuse pour la subvention APA n'est pas

⁶Le questionnaire est disponible ici : <http://modapa.cnrs.fr/questionnaire.pdf>.

associée à un recours à l'aide à domicile plus systématique que dans les autres départements. En revanche, les individus résidant dans un département pour lesquels le niveau de régulation est faible ont une plus faible probabilité de consommer de l'aide à domicile professionnelle. Ce plus faible recours à l'aide professionnelle dans les départements où la régulation est faible pourrait s'expliquer par un effet prix (effet désincitatif des prix non régulés) ou un effet qualité (effet désincitatif de la qualité non régulée). Un faible niveau de régulation pourrait en outre signaler une politique départementale peu orientée sur le maintien à domicile par le recours à l'aide professionnelle (peu de diffusion de l'information, procédures d'accès complexes), entraînant une plus faible demande. La comparaison de différents modèles de choix discrets — sans variables départementales, avec effets fixes ou avec les indicateurs d'offre et de demande — montre que l'usage des indicateurs d'offre et de demande permet d'augmenter le pouvoir explicatif des modèles.

Ce chapitre ne permet pas de conclure quant à l'effet causal du niveau de régulation sur le recours à l'aide professionnelle, dans la mesure où une causalité inverse (où le niveau de la demande locale détermine les politiques de régulation) ou un biais de variable omise (influençant à la fois la demande et la politique de régulation) sont possibles. Il permet toutefois d'éclairer des dimensions peu connues et étudiées de la décentralisation des politiques tournées vers les personnes en perte d'autonomie en France. Il permet également de discuter des effets attendus de la réforme de 2016 modifiant à la fois la règle de calcul du taux de participation et le mode de régulation du secteur.

Chapitre 4

Le dernier chapitre s'intéresse plus spécifiquement à la production de l'aide professionnelle et aux contraintes qui lui sont associées, notamment celle du déplacement à domicile. De nombreux rapports publics ont fait le constat que les coûts de transport, comprenant à la fois les indemnités pour les frais liés aux déplacements des aidants professionnels et le temps improductif qu'ils passent dans les transports, représentent une contrainte non négligeable pour les services d'aide à domicile. Cette contrainte pèse inégalement sur les services, selon le type de zones qu'ils desservent, et affecte potentiellement leur prix (Chevreul, 2009; Aube-Martin *et al.*, 2010; Garabige *et al.*, 2015). En outre, l'organisation de la régulation du secteur par un tarif unique propre à chaque structure d'aide engendre de fait une péréquation territoriale entre les résidents des zones coûteuses à desservir et ceux résidant en zones peu coûteuses. Ce chapitre propose donc d'étudier empiriquement l'importance, les sources de variation et l'effet des coûts de transport dans le secteur de l'aide à domicile. Dans quelle mesure les coûts de transport supportés par les services d'aide à domicile dépendent-ils des caractéristiques des zones desservies? Sont-ils susceptibles d'affecter la consommation d'aide professionnelle des personnes résidant dans les

zones les plus coûteuses ?

Ce chapitre mobilise des données originales récoltées auprès d'un producteur d'aide à domicile, autorisé et associatif, desservant plus de 10 000 consommateurs dans un département français. Ces consommateurs peuvent être des bénéficiaires de l'APA ou des individus non subventionnés par l'aide publique, consommant des services de confort. Ces données permettent d'observer les tournées des aidants professionnels pendant le mois d'octobre 2015. Grâce aux informations géographiques contenues dans les données, il est possible, en mobilisant des outils dédiés, de reconstruire les temps et distances de trajet pour chaque tournée. Ces informations permettent de quantifier les coûts de transport associés aux tournées journalières de chaque intervenant et de les comparer au nombre d'interventions ou au temps d'intervention dans la journée. Grâce aux fichiers de facturation et de paye disponibles par ailleurs, il est possible d'associer ces coûts aux caractéristiques du client et de l'aidant professionnel.

On montre que ces coûts sont plus élevés pour les tournées servant les zones rurales ou les petites unités urbaines, du fait des contraintes géographiques associées à ces espaces : les temps et distances de trajet pour aller d'une intervention à une autre sont plus importants dans ces zones. Mais l'importance des coûts de transport observés dans ces zones tient aussi aux caractéristiques de la demande qui réside dans ces espaces. En effet, les bénéficiaires de l'APA, et parmi eux, les individus les plus dépendants, sont sur-représentés dans les zones rurales ou petites zones urbaines. Or, leur profil de consommation est fragmenté : ces bénéficiaires reçoivent des interventions plus courtes, mais plus souvent, ce qui génère mécaniquement des temps et distances de transport plus importants. En outre, ces bénéficiaires reçoivent plus souvent de l'aide de la part d'aidants professionnels très qualifiés, dont le taux de salaire horaire est plus élevé : le coût du temps passé en transport est donc plus élevé pour ces aidants. Ainsi, les contraintes physiques des territoires mais également la structure de la demande qui y réside expliquent la variation des coûts de transport d'une zone à l'autre.

Ce chapitre constitue un cas d'étude permettant l'approche des coûts de transport d'une manière particulièrement précise. L'intérêt des données du point de vue géographique a toutefois un coût quant à l'information disponible sur les consommateurs : on dispose de très peu d'éléments sur les caractéristiques sociodémographiques des consommateurs ainsi que l'aide informelle qu'ils reçoivent. En outre, dans la mesure où l'analyse est centrée sur un producteur particulier dans un département donné, il est nécessaire d'être prudent dans la généralisation des résultats, qui sont observés conditionnellement à l'organisation des tournées dans ce territoire. Ces résultats permettent toutefois de mettre en évidence, outre la dimension géographique de la distribution de la demande dans les différents types de zones (rurale, petite zone urbaine, grande zone urbaine...) l'effet de la

structure de la demande sur les coûts de transport. Cet effet est potentiellement généralisable, dans la mesure où la fragmentation des interventions pour les plus hauts niveaux de dépendance est susceptible de ne pas être spécifique au mode d'organisation du service étudié. D'autres travaux ont ainsi montré que l'augmentation du niveau de dépendance est associée à une fragmentation des interventions (Chevreul, 2009).

Contributions

Ces quatre chapitres se proposent d'éclairer les mécanismes expliquant les configurations d'aide fournie aux personnes âgées en incapacité vivant à domicile. Leurs contributions portent à la fois sur les déterminants de la demande d'aide formelle et sur les modes d'organisation de la production d'aide formelle et informelle. La mise en perspective des résultats permet de dégager trois principales contributions de la thèse. Tout d'abord, cette thèse permet de documenter les sources de variation des coûts que supportent les producteurs d'aide formelle et informelle. Elle permet en outre de montrer que la demande d'aide formelle est relativement peu sensible au prix, à la marge intensive et extensive. Enfin, elle permet d'analyser les effets notables, pour les consommateurs, de la régulation du secteur de l'aide à domicile. Ces contributions permettent finalement de discuter des effets de la récente loi relative à l'adaptation de la société au vieillissement.

Source de variation des coûts des producteurs d'aide formelle et informelle

Le premier et le dernier chapitre contribuent à la compréhension de l'organisation des aidants formels et informels. Le premier chapitre s'attache à décrire les déterminants de l'aide pour les enfants d'une personne âgée lorsqu'elle a déclaré avoir besoin d'aide humaine pour la réalisation des activités de la vie quotidienne. On peut ainsi identifier les variables augmentant le bénéfice de l'aide et celles la diminuant, selon le rang de l'individu et avec deux définitions de l'aide. Les résultats font apparaître qu'avec une définition large de l'aide, les cadets sont significativement plus sensibles aux coûts de l'aide que leurs aînés. On observe en outre, quelle que soit la définition de l'aide mobilisée, une plus forte assignation à l'aide des femmes avec un frère. Les interactions des décisions d'aide sont enfin systématiquement asymétriques, ce qui implique un effet différencié de l'aide fournie par un membre de la fratrie sur les coûts et bénéfices de l'aide fournie par l'autre.

Le Chapitre 4 analyse les coûts de transport d'un producteur d'aide formelle, dimension encore peu étudiée de leur fonction de coût. Il montre que ces coûts varient selon le type de zone géographique où résident les consommateurs, avec des plus forts coûts

de transport en zone rurale et dans les petites unités urbaines. L'importance des coûts de transport dans ces zones s'explique par les contraintes géographiques qui leurs sont associées (distances de transport), mais aussi par les caractéristiques de la demande : on trouve plus fréquemment dans ces zones des bénéficiaires lourdement dépendants dont la consommation est fragmentée.

Ces deux chapitres contribuent ainsi à documenter les sources de variation dans les coûts des producteurs d'aide, en étudiant plus spécifiquement un aspect peu documenté de l'organisation de la production : les interactions endogènes pour l'aide informelle, et les coûts de transport pour l'aide formelle. Dans les deux cas, de manière attendue, les caractéristiques de l'aidé pèsent notablement sur la décision d'aide des enfants d'une part et sur l'organisation des tournées d'autre part.

La demande d'aide formelle relativement peu sensible au prix

Les deux autres chapitres s'intéressent à la demande d'aide formelle, à la marge intensive (Chapitre 2) ou extensive (Chapitre 3). A la marge extensive, le recours à l'aide formelle semble peu affecté par la générosité publique, mesurée par la formule de calcul pour la subvention APA utilisée par le conseil départemental. A la marge intensive, on trouve une élasticité-prix de la demande d'aide non nulle, ce qui interroge l'efficacité des programmes finançant la consommation d'aide formelle. Cette élasticité-prix est toutefois significativement inférieure à 1 en valeur absolue : il s'agit donc d'une élasticité-prix relativement faible selon la théorie micro-économique standard.

On peut ainsi conclure que la sensibilité au prix de la demande d'aide formelle, à la marge intensive et extensive, est relativement limitée. Dans les deux chapitres, cette demande semble en revanche largement influencée par la gravité des limitations fonctionnelles et la présence d'aidants informels potentiels. Ceci suggère que les déterminants majeurs dans la genèse des configurations d'aide sont l'état de santé et la disponibilité de l'aide informelle. Les variations du prix de l'aide formelle, quant à elles, entraîneraient des ajustements essentiellement à la marge. Un tel résultat fait écho à la littérature sur l'entrée en institution, présentée précédemment : cette littérature a montré l'importance de l'état de santé et des ressources en aide informelle comme déterminants de l'entrée en institution, tout en mettant en évidence la faible sensibilité de la demande au prix des établissements.

Les effets notables de la régulation du secteur de l'aide à domicile pour les consommateurs

Les résultats de la thèse contribuent également à éclairer les implications de la régulation du secteur de l'aide à domicile pour les consommateurs. Cette régulation implique tout d'abord une dimension d'équité géographique. La régulation des zones d'intervention des services autorisés permet de garantir la couverture territoriale du département en matière d'aide à domicile. En présence de coûts de transport, étudiés dans le Chapitre 4, une moindre régulation des zones de desserte pourrait conduire les services d'aide à domicile à négliger les zones pour lesquels le gain attendu est inférieur au coût de desserte. Le Chapitre 4 montre en outre que ces zones potentiellement rationnées en l'absence de régulation correspondent aux zones rurales et petites unités urbaines, où sont sur-représentés les bénéficiaires de l'APA et parmi eux, les plus dépendants. En outre, l'existence d'un tarif unique pour tous les bénéficiaires d'un même service organise de fait une redistribution, en provenance des consommateurs pour lesquels le coût de production horaire est faible vers ceux pour lesquels il est plus élevé. Selon le Chapitre 4, cette redistribution tend en moyenne à bénéficier aux individus les plus dépendants. Cette redistribution, en revanche, n'est effective que parmi les usagers d'un même service d'aide. En effet, la tarification au prix unique pour chaque service génère potentiellement une forte disparité des prix entre les services selon le type et l'importance de la zone géographique qu'ils desservent. Cette variation est documentée et utilisée comme source d'identification dans le Chapitre 2.

La deuxième dimension de régulation discutée dans la thèse a trait au caractère mixte du marché, entre structures régulées et structures ou travailleurs non régulés. Le Chapitre 3 fait apparaître une corrélation entre le faible poids des structures régulées sur le marché et un moindre recours des personnes âgées à l'aide formelle. Si cette corrélation est interprétée comme causale, cela signifierait qu'un moindre niveau de régulation diminuerait les incitations à la consommation de l'aide formelle, potentiellement via un effet prix ou qualité. Si, à l'inverse, une faible régulation s'explique par le faible niveau de la demande départementale, alors les départements où la demande d'aide formelle est faible investiraient moins dans la régulation du secteur que les autres. Dans cette configuration, les personnes âgées dépendantes en demande d'aide formelle vivant dans un département où la demande est faible dans l'ensemble auraient un moindre accès aux services dont le prix et la qualité sont régulés.

Quels effets de la loi relative à l'adaptation de la société au vieillissement ?

Ces résultats peuvent enfin être mobilisés pour discuter des effets attendus de la loi relative à l'adaptation de la société au vieillissement. Du côté de la demande d'aide formelle, cette réforme a entraîné la modification de la formule de calcul du taux de participation des bénéficiaires de l'APA, de manière à augmenter la générosité du programme pour les individus les plus dépendants. Etant donné la faible sensibilité au prix de la demande, cette modification devrait avoir un effet volume limité. Elle devrait en revanche renforcer la redistribution opérée par la subvention APA des contribuables vers les personnes âgées dépendantes.

Concernant la régulation de l'offre, la réforme a organisé le passage de tous les prestataires sous le régime de l'autorisation. Une telle mesure pourrait encourager le recours à l'aide formelle dans les départements où les prestataires non régulés dominent le marché. L'effet dépendra toutefois des mécanismes expliquant l'association entre faible niveau de régulation et non-recours à l'aide formelle (effet prix ou effet qualité), et à l'importance des prestataires face à l'emploi en gré-à-gré.

Cette thèse éclaire ainsi les mécanismes expliquant la formation des configurations d'aides formelles et informelles autour des personnes âgées en incapacité en France. Cette analyse appelle évidemment des extensions. La première a trait à l'exploitation de nouvelles sources de données pour actualiser et approfondir les analyses. Ainsi, l'enquête *Capacités, aides et ressources des seniors* (CARE), récoltée en 2015 et représentative de la population française âgée d'au moins 60 ans, présente un intérêt certain à plusieurs titres. D'une part, grâce aux informations précises récoltées sur le reste-à-charge et le volume d'aide professionnelle consommé, il sera possible d'estimer une élasticité-prix en prenant en compte l'aide informelle et sans problèmes relatifs à la censure. D'un point de vue méthodologique, il sera utile de comparer le résultat obtenu sur ces données très précises, mais coûteuses à produire, et les estimations alternatives sur des données moins appropriées, mais plus facilement disponibles. En outre, grâce à l'enquête départementale *SolvAPA* récoltée en parallèle, dont le questionnaire rejoint partiellement celui de l'enquête *Territoire*, il sera possible d'actualiser l'analyse de l'effet des pratiques départementales sur le recours à l'aide formelle.

Les futures analyses pourraient en outre se pencher sur le caractère dynamique des configurations d'aide. Comment les configurations d'aide évoluent-elles avec le temps, notamment selon le niveau d'ancienneté et de sévérité de la perte d'autonomie d'un individu ? Puisqu'elles s'appuient essentiellement sur des données en coupe, les contributions proposées par la thèse apportent peu d'éléments sur cette question. Seul le deuxième chapitre

mobilise des données longitudinales, dont l'usage permet essentiellement l'amélioration de la précision des estimations et non la mise en évidence de mécanismes dynamiques. L'usage de données longitudinales sur les personnes âgées, à l'instar de l'enquête SHARE, pourrait permettre de mettre en évidence les dynamiques d'évolution des configurations d'aide.



General introduction

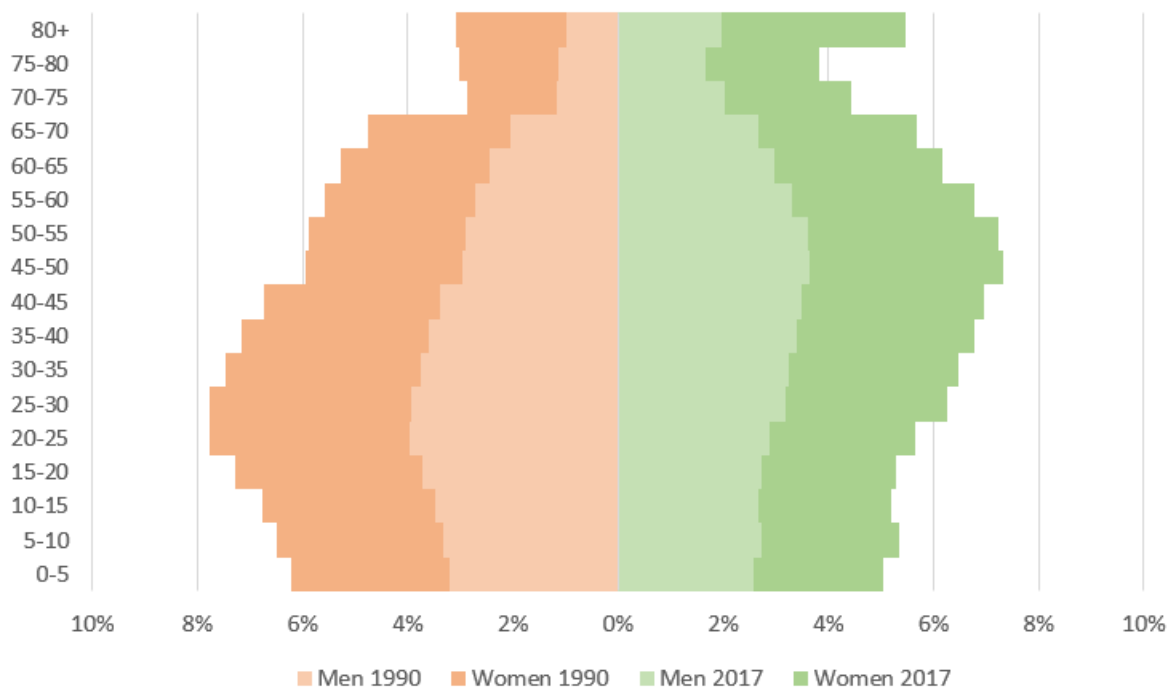
1 An increasing demand for long-term care

1.1 Aging populations

For the past 50 years, the OECD countries have been experiencing the ageing of their population. Due to structural declines in fertility levels and in mortality rates in old-age, the number of the elderly in the population is increasing; for the period between 2025 and 2060, this trend will be additionally stimulated by the advance in age of baby-boomers (Monnier, 2007). The population pyramids, presenting the share of the population in each age group, illustrate this phenomenon. Figure 2 compares the population pyramids of the European population in 1990 (left-hand side of the Figure) and in 2017 (right-hand side). With the rise of life expectancy, the number of older people is increasing: individuals aged 80 or more represented 3% of the population in 1990 while this figure increased to 5.5% in 2017. The top of the age pyramid is thus becoming broader: this is what is called “aging at the top” (European Commission *et al.*, 2015). Simultaneously, the mechanical decrease in the proportion of young people is reinforced by the decline in fertility rates: the share of the European population aged 30 or less has decreased by 9 percentage points during the period (42% to 33%), leading to a narrower base for the 2017 population pyramid (“aging at the bottom”).

Whatever the hypothesis made in demographic projections, populations are expected to continue aging in the coming decades (Gaymu, 2017). From 1% in 1950 to 4% in 2010, individuals aged 80 are expected to represent more than 9% of the OECD population in 2050 (Colombo *et al.*, 2011). According to the 2015-based population projections of Eurostat, the share of this age group in the European population will more than double between 2016 and 2070 (6% to 13%), with an equivalent trend in France (6% to 11 %) (European Commission *et al.*, 2017). These projections rest on the following conjectures regarding the key demographic determinants: fertility rates and life expectancy are assumed to rise and converge across European countries, while the expected migration flows in each country depend on past trends, latest empirical evidence and long-term partial convergence. Though it has long been regarded as a policy issue specific to the industrialized countries of Europe and North America, aging is also becoming a major issue in developing countries, whose older populations are growing more rapidly than those of industrialized countries (Shrestha, 2000).

Figure 2 – Population pyramids in European countries - 1990 and 2017



SOURCE: Eurostat (1990-2017).

NOTES: European Union before the entry of Croatia.

1.2 Disability in old-age: definitions and measures

Population ageing is associated with the higher prevalence of disabilities. According to the International Classification of Functioning, Disability and Health of the World Health Organization (WHO), the term “disability” refers to “impairments, activity limitations, and participation restrictions” that are met by individuals. As is underlined by the WHO, the notion of disability does not only identify an individual health problem but it also results from the characteristics of the environment the person lives in.

Measuring the life expectancy is not enough to take the limitations associated with old-age into account. The disability-free life expectancy has thus been proposed as a complementary measure. While life expectancy focuses on the expected years of life, the disability-free life expectancy measures the average number of years an individual is expected to live free of disability, provided that current patterns of mortality and disability keep on being relevant. The corresponding indicator of “healthy life years” has been included in the European Community Health Indicators (ECHI) and is monitored every year. It is computed on the basis of the Global Activity Limitation Indicator (GALI) present in the European statistics on income and living conditions. Individuals

declare if they have encountered limitations for more than six months, because of a health problem, in daily living activities defined as “activities people usually do”. This indicator is generally analyzed separately for men and women, because of noticeable differences in health and survival rates according to sex (Oksuzyan *et al.*, 2010).⁷ In Europe, in 2014, the life expectancy of a woman aged 50 was around 35 years; 51% of these years (17.8 years) were healthy life years (Cambois and Robine, 2017). The life expectancy of men at 50 was of 30 years, among which 58% (17.4) are free of disabilities. These mean values at the European level cover a substantial heterogeneity across countries. The French values in 2014 were slightly higher than the European means, with a life expectancy for women and men aged 50 of respectively 37.5 years and 31.7 years, among which 55% and 68% (20.6 and 19.7 years) are healthy years.

The GALI has been shown to be consistent with other measures of functional limitations, in particular with the subjective declaration of activity daily living scores (Jagger *et al.*, 2010). The classification of activities of daily living has been proposed in the epidemiological literature as a tool to help to the assessment of functional limitations for the elderly (Lawton and Brody, 1969). It distinguishes between two types of activities of daily living, the (essential) Activities of daily living (ADL) and the Instrumental activities of daily living (IADL). In the first group, activities related to personal care (bathing and showering, personal hygiene and grooming, dressing, toilet hygiene, self-feeding) or functional mobility (transferring) are to be found. They are highly correlated with physical self-maintenance. In the second group, activities are more demanding in terms of cognitive capacities. They are related to housework (cleaning and maintaining the house), basic logistics (managing budget, shopping for groceries and necessities, preparing meals, taking prescribed medications, using the telephone or other form of communication) or extended mobility (going out of the house). The Katz Index builds on this classification to differentiate disability levels according to the number and the type of activity restrictions (Katz *et al.*, 1970; Katz, 1983). This index proposes eight categories. Group A refers to the fully independent individuals. Activity limitations increase in other groups, up to Group G that gathers together individuals requiring assistance for six activities of daily living (personal hygiene, dressing, toileting, transferring, eating and drinking, and continence). Finally, Group H corresponds to persons requiring assistance for at least two activities but not falling into previous categories.

The indicators of functional limitations — ADL and IADL in particular — have been frequently used to construct the administrative tools that aim at assessing individuals’

⁷The so-called “male-female health-survival paradox” refers to the existing discrepancy between men and women, with these last experiencing greater longevity but higher rates of disability and poor health. It is likely to be due to biological, behavioral, and social differences between men and women, as well as methodological points — relative to health problem reporting especially — (Oksuzyan *et al.*, 2008).

disability level in long-term care policies. Administrative measures of disability levels often builds on the principle of case-mix classification systems (Coutton, 2001): they aim at regrouping in the same group individuals with similar relative needs for resources, called “resource utilization group” (Fries and Cooney, 1985; Fries, 1990). In France, a specific grid, the grid *Autonomie, Gérontologie, Groupes Iso-Ressources* (AGGIR), was proposed in 1994 and has become the main tool for the evaluation of the disability levels of the elderly in the French long-term care policy. It combines variables on physical autonomy and mental health to establish six disability groups, the *Groupes iso-ressources* (GIR) (Eghbal-Téhérani and Makdessi, 2011). GIR 1, corresponding to the most severe disability level, gathers invalid individuals (bedridden persons) with important cognitive troubles, who need to be constantly taken care of. Individuals in GIR 2 either are invalid but have their cognitive functions less deteriorated than individuals in GIR 1, or are not invalid but have important cognitive troubles. In GIR 3, individuals need every-day help for personal care but they do not have any important mental troubles. In GIR 4 are individuals who need some help, either for getting out of bed, or for meal preparation, dressing or undressing. In GIR 5, there are individuals who sometimes need help for activities of daily living but not on a regular basis. Finally, in GIR 6, the individuals have no daily activity limitations.

The rate of prevalence of disabilities in the elderly population is expected to decline with technological medical improvements and behavioral changes (Cutler, 2001). According to the first results of the national survey *Capacités, Aide et Ressources des seniors* (CARE), 3% of French individuals aged 60 or more in 2015 were disabled in the sens of the Katz Index, while 4% were in GIR 1 to 4⁸ (Brunel and Carrère, 2017). It is slightly lower than the prevalence that was computed in 2008 with the *Handicap Santé Ménages* (HSM) survey. The decrease in activity limitations at a given age, however, will not compensate for the increase in the number of elderly people. Marbot and Roy (2015) estimate that the number of old disabled individuals will increase by 71%⁹ between 2010 and 2040. It is similar to the trend expected in other European countries (Scherbov and Weber, 2017).

Finally, not directly referring to disabilities, the concept of frailty borrowed from me-

⁸The rate reported here is obtained by reconstructing the estimated GIR of individuals on the basis of the declaration of their activity limitations. It builds on a restricted definition of the GIR, not taking into account individuals having *some* difficulties in the accomplishment of activities. With the broad definition, which includes them, 10% of the elderly are regarded as disabled.

⁹This rate corresponds to the intermediate scenario proposed by Marbot and Roy (2015), which rests on the hypothesis that the share of healthy years in the life expectancy at 65 will remain stable. Marbot and Roy (2015) also compute demographic projections based either on an optimistic prevision (the increase in the life expectancy is entirely due to the increasing number of healthy years) or a pessimistic assumption (the prevalence of disabilities remains stable at each age). The number of disabled elderly is expected to increase by less than 50% in the optimistic scenario while with the pessimistic scenario, the increase would almost reach 90%.

dical sciences is increasingly used in the economic literature. In the widely used definition proposed by [Fried *et al.* \(2001\)](#), “frailty” refers to the state in which individuals are not disabled but have a low physiologic reserve and high vulnerability, characterized by weight loss, poor endurance and energy, slowness and low physical activity level.¹⁰ This concept makes it possible to refine the analysis of old-age limitations and the way individuals turn disabled.

1.3 Demand for long-term care

The increase in the number of disabled elderly results in a growing demand for long-term care. Long-term care covers the relatively large range of services provided to individuals with functional limitations. Needed in the long-run, it differs from acute medical care and is more related to chronic illness ([Norton, 2000](#)). Long-term care first includes personal care, which is defined as a “range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living” ([OECD and European Commission, 2013](#)). Personal care typically refers to bathing, dressing, grooming, using the toilet or eating. Long-term care also includes domestic help, which relates to housekeeping tasks (cleaning, shopping), or help with the IADL. Finally, long-term care also includes to the nursing care, including pain management, health monitoring or medication.

Being in need for long-term care because of functional, physical and cognitive limitation is a risk whose realization generates a considerable and potentially costly reorganization of the way of living. Studying nine European countries,¹¹ [Juin \(2016\)](#) shows that 57% of individuals aged 65 or more will experience at least one period of disability, suffering from at least two ADL limitations. The probability is higher for low-income individuals and poorly educated people. In OECD countries, the cost of long-term care is systematically high compared to typical incomes ([Muir, 2017](#)) and few individuals would be able to cover the costs of long-term care on the sole basis of their own resources.

Additional sources of long-term care financing or provision are thus needed. The economic analysis usually distinguishes between three sources of risk coverage ([Genier, 1996](#)): family, social protection and market-based solutions. According to the opinion barameter of the *Direction de la recherche, des études, de l'évaluation et des statistiques* (DREES) ([Leroux, 2017](#)), 61% of the French population in 2015 declare that the State should be the main source of financial support for the disabled elderly, while 27% believe it should be handed to children or relatives, and 12% declare that it should rest on the

¹⁰See [Sirven and Rapp \(2017\)](#) for a discussion of other concepts of frailty.

¹¹Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark and Belgium.

individual responsibility (savings or private insurance).

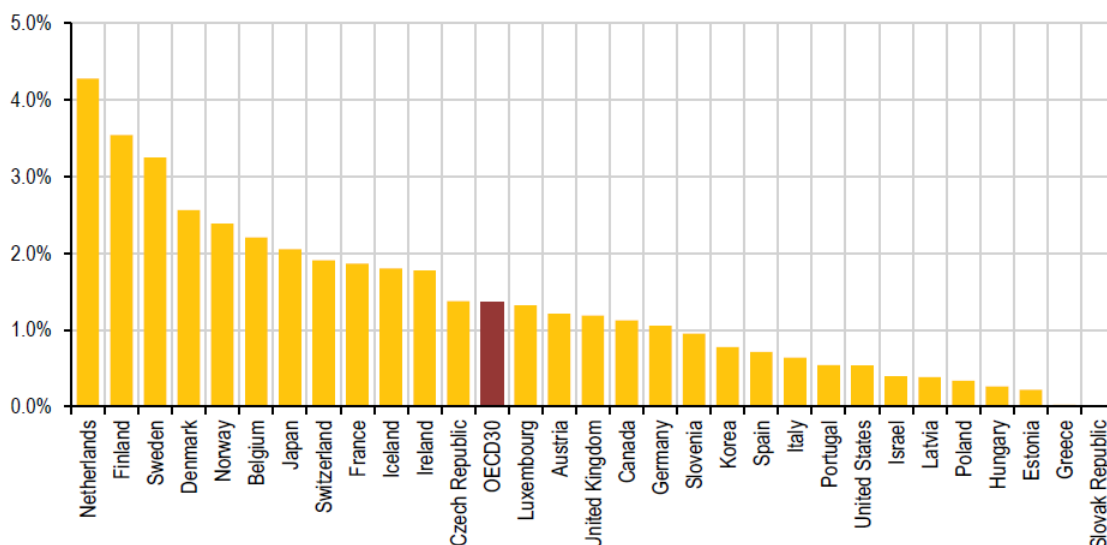
Family (or more broadly, relatives) is an historical actor of the care provision and is still nowadays the major provider of care to the elderly. The entourage, mostly the family, most often directly provides personal care or domestic help, the so-called “informal care”, corresponding to the unpaid care provided by relatives. In France, 80% of the elderly received care from their relatives in 2008, either together with professional care (48%) or as the exclusive source of human care (32%) (Soullier and Weber, 2011). The care provided by relatives is thus more frequent, but also more intensive than professional care. The median daily volume of informal care received by these disabled elderly was three times higher than the volume of professional care received and informal caregivers performed four activities on average, whereas formal caregivers executed two activities (Fontaine, 2011). Other types of care can be provided by relatives. Relatives may provide financial support, to help financing professional care or covering the cost of a nursing home. It is, though, fairly rare in European countries (Bonsang, 2007). A third dimension of the support provided by relatives is the moral support. 84% of caregiver children of their disabled parent are providing moral support in the HSM survey (Chapitre 1, below). The future evolution of informal care provision is uncertain. Ongoing changes in the demographic structures of the population, such as declining family size, increased geographic mobility and female participation to the labour market, could diminish the direct provision of care by relatives.

Social protection is playing an increasing role in the long-term care. It generally takes the form of financial support to long-term care and commonly fosters formal care utilization (Muir, 2017). There is a large variety of existing policies in OECD and European countries. Public schemes can be compared through several points:¹² eligibility criteria (universal or means-tested), targeted population (all disabled individuals or older people), types of benefits provided (in-kind and/or cash) and the source(s) of financing (taxation, social security contributions). Muir (2017) provides a classification distinguishing between (i) universal, tax-funded social care systems (found in Nordic countries), (ii) dedicated social insurance schemes (Netherlands, Japan, Korea, Germany), (iii) systems based on cash benefits (Austria, Czech Republic, Italy) and (iv) means-tested, safety net programs (United-Kingdom, United-States). These different systems, together with national variations in the characteristics of the elderly population and in the cost of long-term care, result in substantial differences in the long-term care expenditures across countries, as shown in Figure 3.

Finally, market-based solutions refer mainly to the private long-term care insurance.

¹²See Colombo *et al.* (2011), p.216, for an overview of public long-term care scheme in the OECD countries.

Figure 3 – Public expenditure on long-term care as a share of GDP



SOURCE: OECD Health data 2016, in [Muir \(2017\)](#) (p.12).

NOTES: Refers to total expenditure reported as either “health” or “social” long-term care expenditures under the System of Health Accounts definitions used by by OECD, WHO and the European Commission. Includes spending on LTC for people of all ages. Data for the United States and Israel refer to institutional care only. GDP from 2014 or nearest year.

Such a scheme provides an annuity or ensures the reimbursement of long-term care expenses to insured individuals when they turn disabled. This market is fairly little developed. It is partly due from supply shortcomings ([Fontaine *et al.*, 2014](#)): adverse selection is likely, transaction costs are high while competition is low, overall leading to high prices ([Brown and Finkelstein, 2009](#)). Moreover, there is a strong uncertainty on future disability prevalence. This argument additionally explains the low demand for the insurance coverage, along with the limited available information on the market, the orientation of time preferences towards present and the potential taste for informal care.

Overall, social protection and market-based solutions essentially support the care provision of formal or insitutional care, while relatives are bringing substantial in-kind support. The financing and the provision of long-term care by these actors participate to elaborate the care arrangements, defined as the way individuals and their environnement get organized for long-term care provision when they face activity limitations and functional restrictions.

2 The economic approach of care arrangements

2.1 Institutional care

Institutional care, referring to the care provided in nursing homes, has long been regarded as the main potential provider of professional care for disabled elderly (Norton, 2016). The economic literature has first been interested in the determinants of nursing home entry. It has identified recurrent predictors, in particular health status and potential informal care provision.¹³ A deteriorated health status (functional or cognitive) is a strong predictor of admission to a nursing home, as many elderly enter a nursing home when they are no longer able to live independently because of activity limitations (Gaugler *et al.*, 2007; Laferrère *et al.*, 2013; Arnault, 2015). Potential informal care also has a strong predictive power: the probability to enter a nursing home is higher for individuals living alone, and it decreases with the number of children (Freedman, 1996; Lo Sasso and Johnson, 2002; Van Houtven and Norton, 2004; Charles and Sevak, 2005; Gaugler *et al.*, 2007; Laferrère *et al.*, 2013; Arnault, 2015). Yet, the protective effect of the spouse has been found to vanish in the presence of cognitive impairments (Arnault, 2015).

Some papers have dealt with in the price elasticity of the demand for institutional care. Grabowski and Gruber (2007) finds that the demand for nursing homes is relatively inelastic, not reacting much to the variations in Medicaid reimbursement rules for institutional care. More recently, Mommaerts (2018) has confirmed these broad results, but has also provided evidence of the heterogeneity of the sensitivity according to the marital status. Single individuals are more likely to enter a nursing home, and less likely to co-reside with relatives, when the cost of nursing homes is lower. A form of price sensitivity is however observed in the choice of a nursing home. Stroka and Schmitz (2015) point out that the probability to choose a nursing home decreases with price and distance,¹⁴ while it is not sensitive to its quality, as measured by quality report cards.

2.2 Aging in place: the importance of informal care

In OECD countries, most elderly keep on living in the community: 70% of long-term care users receive services at home (Colombo *et al.*, 2011).¹⁵ In France, in 2016, 58% of beneficiaries of the long-term care policy, the *Allocation Personnalisée d'autonomie* (APA)

¹³See Arnault (2015) for a detailed literature review.

¹⁴Regarding the effect of distance, Ramos-Gorand (2013) has shown that migrations for institutionalization are rare in France: 15% of nursing residents have moved from their previous department of residence to enter a nursing home. Migrations are mainly explained by individual determinants (previous place of living, family status, legal protection status).

¹⁵In a selected sample of 23 countries for which data were available

program presented below, were living in the community rather than in institutions.¹⁶ The economic literature has been prolific on the relationship existing between formal care and informal care for community-dweller elderly.¹⁷ This literature has to cope with the endogeneity existing in a model studying the relationship between both types of care. Indeed, consumption decisions can be jointly determined or affected by unobserved characteristics such as health status or preferences. Once this endogeneity bias is dealt with, this literature finds strong evidence of informal care resources affecting the decision to consume formal care: when elderly are provided with informal care, they have a lower probability to consume formal care (Van Houtven and Norton, 2004; Pezzin and Schone, 1999; Bolin *et al.*, 2008a; Bonsang, 2009). This substitution effect is more relevant for unskilled formal care (domestic help) than for skilled care (nursing or personal care) and tends to vanish when the disability level increases (Bonsang, 2009). On the reverse side, the effect of formal care use on informal care consumption seems more ambiguous. Most studies have analyzed the effect of a public scheme financing formal care use on privately and publicly funded formal care use as well as informal care consumption. Many of them point out that the increase of formal care partially crowds out informal care (Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Viitanen, 2007; Rapp *et al.*, 2011; Fontaine, 2012; Arnault, 2015). But still, others find no evidence of a significant relationship (Christianson, 1988; Motel-Klingebiel *et al.*, 2005). Beyond the volumes provided, using publicly financed home care affects the organization of informal care, with a lower number of tasks performed by caregivers (Fontaine, 2012). The relationship between formal and informal care has finally been shown to depend on countries through cultural and institutional differences (Motel-Klingebiel *et al.*, 2005; Bolin *et al.*, 2008a; Bakx, Meijer, Schut and Doorslaer, 2015).

Another strand of the literature on informal care has focused on the consequences of care provision on careers. Informal care provision has been found to negatively affect the labor supply of caregivers, both at the intensive and extensive margins (Ettner, 1995, 1996; Pezzin and Schone, 1999; Bolin *et al.*, 2008b; Van Houtven *et al.*, 2013). This effect is stronger only in countries where long-term care public support is more limited (Fontaine, 2009). Care provision also affects the physical and mental health of relatives (Savage and Bailey, 2004; Coe and Van Houtven, 2009; Do *et al.*, 2015). These effects, however, fade out in the medium-run, after care provision has ended (Schmitz and Westphal, 2015). The magnitude of such effects has also been found to depend on the geographical area

¹⁶Source: DREES (2016).

¹⁷Informal care usually refers to the care provided for elderly individuals living in the community. Still, families usually remain involved when an elderly enters a nursing home. This aspect of informal care has been little investigated in the economic literature. Gaugler (2005) provides a synthesis of the existing literature.

when comparing different countries in Europe (Novi *et al.*, 2015). Finally, the social life of caregiving relatives is also affected (Miller and Montgomery, 1990), though this field has been under-investigated (Bauer and Sousa-Poza, 2015). Most studies in this literature distinguish between the effect of care provision on men and women. They study women exclusively (daughters or daughters-in-law), or they provide subgroup analyses that generally reveal larger effects for women.

Drawing near to the economics of the family, the literature has also examined the organization of care arrangements and the determinants of care decisions of the family. When they have a (non-disabled) spouse, individuals are primarily provided care by their partner; then, children are the principal source of informal care (Weber, 2011; Soullier and Weber, 2011). The literature has first highlighted the effects of parent and children characteristics on the care decisions. It shows that care decisions relate to the opportunity cost of care (i.e. job status and family situation). Moreover, care provision is unequally distributed according to the sex of the children, with women being systematically more involved into care provision. Within sibling, the decision of one child is also likely to be affected by the characteristics of other children and their own care decision. It raises the question of potential interactions existing among family members (Fontaine *et al.*, 2009), thus relating to the economic analysis of social interactions (Manski, 1993, 2000).

2.3 Formal care use

In a context of public policies fostering home care, the determinants of formal care use have received an increasing attention in the economic literature. Need-related characteristics and availability of informal care have been shown to be strong predictors of formal care use (see Bakx, Meijer, Schut and Doorslaer (2015) for a review). Regarding public policy parameters, the demand for formal care has been shown to be price-sensitive: existing studies have tested the effect of benefiting from subsidies on the utilization of paid home care (Coughlin *et al.*, 1992; Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Rapp *et al.*, 2011; Fontaine, 2012).

Formal care has been found to have a beneficial effect for the elderly and their informal caregivers. Formal care has a preventive effect on the health for the elderly: it positively affects mental health (Barnay and Juin, 2016) and decreases hospitalization (Costa-Font *et al.*, 2018) as well as emergency care use (Rapp *et al.*, 2015). It also diminishes the indirect costs of informal care, by limiting the negative effect of informal care on perceived health (Juin, 2016). More broadly, consuming formal home care has been shown to help postponing the entry in institutions (Ettner, 1994; Pezzin *et al.*, 1996; Guo *et al.*, 2015).¹⁸ With the aging population and existing pressure on public spending, there is

¹⁸See Guo *et al.* (2015) for a detailed literature review.

thus a growing interest in quantifying how much providing home-based formal care saves money compared to institutional care. The distribution of disability levels between the community and nursing homes is substantially different (Bozio *et al.*, 2016), such that it is hard to directly compare the price of a nursing home and the cost of living in the community.¹⁹ For severe disability levels, living in institutions might theoretically be more cost effective through economies of scale.²⁰ Evidence on this point is limited and mixed. Wübker *et al.* (2015) compare individuals suffering from dementia receiving professional home care, and being at risk of institutionalization, with individuals recently admitted to institutional nursing care, in eight European countries. They include the monetary valuation of informal care and find that overall costs in the home formal care setting are much lower than those of institutional care. Guo *et al.* (2015) points out that increasing Medicaid home care expenditure reduces the use of nursing home facilities, but the gain in costs is not sufficient to fully offset home care expenditures. Beyond monetary costs and valuation of informal care, the comparison of home-based formal care and institutional care could additionally evaluate the preferences of individuals for home-based care. The quality of life in institutions is indeed perceived to be poor, such that institutionalization is often regarded as a non-desirable alternative solution to aging in place. Mattimore *et al.* (2015) report that 30% of the 9105 patients they study “would rather die” than living permanently in a nursing home, while 26% were “very unwilling”. The preference for living at home is relatively common in OECD countries and it has shaped the old-age policies in France.

3 Old-age policies in France

3.1 Construction of policies supporting home care

The French long-term policies have historically been constructed around a clear division between institutionalization and aging in place. In the aftermath of the French Revolution, a draft order presented institutionalization as a second-best option, when individuals are not taken care of by their families or when their health status requires specific care (Ennuyer, 2007). The idea that institutionalization should be implemented only because of a shortcoming in family resources or extreme health disabilities remained important in the first part of the 20th century. Hospices represent the typical figure of the institution devoted to the elderly during this period: Feller (2005), quoted by En-

¹⁹In France, the median price in nursing homes (public benefits not taken into account) was of €1,949 in 2016 (Caisse Nationale de Solidarité pour l’Autonomie, 2017).

²⁰Following this idea, many long-term systems limit the number of care hours that can be covered at home to ensure that institutional care is used when it is the cheaper option Muir (2017).

nuyer (2007), analyses how they have been associated with a very low quality of life and a symbol of social relegation.²¹

The report *Politiques de la vieillesse* (“Old-age policies”) directed by Pierre Laroque in 1962, mainly known as the “Laroque Report”, is usually regarded as a cornerstone in the construction of the French old-age policies and its strong stay-at-home orientation. This report kept on affirming that “institutionalization must remain an exception” (Haut Comité Consultatif de la population et de la famille (1962), quoted by Ennuyer (2007)) and it encouraged the use of home care services to promote the integration of the elderly in the society.²² Public support for home care was reaffirmed a few years later, through the reform of the assistance laws (1953, 1954),²³ implementing an allowance to finance home care for deprived elderly. The means-tested property was preserved in the following forms of the home-care support policy. The *Allocation compensatrice pour tierce personne* (ACTP) was created in 1975 and was open to any disabled adult, whatever her age: old-age disabilities were then regarded as a sub-category in the larger field of disabilities (Capuano and Weber, 2015). A specific allowance devoted to the disabled elderly was created in 1997, the *Prestation spécifique dépendance* (PSD). It changed the legal approach to disabilities and created an age barrier: all disabled individuals aged 60 and more were eligible for the old-age allowance, whatever the cause of their disability and they were explicitly distinguished from the handicap policies (Capuano and Weber, 2015). This distinction according to age, which is close to be a French exception in the European landscape,²⁴ has been widely debated (Tenand, 2016) but it has remained the basis of the French long-term care system up to now.

The creation, in 2002, of the APA program, which is still in force nowadays, represented a shift in the French long-term care policies as it is a universal (not means-tested) benefit.²⁵ Any individual aged 60 or more, who has been living in France for more than three months, can apply to the program. When she lives in the community, she receives an evaluation of her needs performed by a socio-medical team at home. It aims at defining her disability

²¹See Cribier (2008) for an overview of Feller (2005)’s contribution.

²²“Cette solution doit demeurer exceptionnelle. L’accent doit être mis, par priorité, sur la nécessité d’intégrer les personnes âgées dans la société, tout en leur fournissant les moyens de continuer le plus longtemps possible à mener une vie indépendante par la construction de logements adaptés, par la généralisation de l’aide ménagère à domicile, par la création de services sociaux de toute nature qui leur sont nécessaires (...) Ainsi tout en évitant de faire naître chez les vieillards un sentiment de dépendance, pourra-t-on respecter le besoin qu’ils éprouvent de conserver leur place dans une société normale, d’être constamment mêlés à des adultes et à des enfants ” Haut Comité Consultatif de la population et de la famille (1962), quoted by Ennuyer (2007).

²³Décret 53-1186 du 29 novembre 1953, décret 54-611 du 11 juin 1954.

²⁴Greece and the United-Kingdom also have an age-barrier in the definition of their long-term care policies.

²⁵In addition, and contrary to the PSD, the funds received by an individual in the APA program cannot be recovered on her inheritance.

level using the GIR classification. Individuals whose disability level is evaluated from GIR 4 to GIR 1 are eligible for the APA program. The evaluation team sets up a personalized care plan, corresponding to the maximum number of hours of professional care²⁶ that will be open to subsidies, given the activity limitations encountered by the applicant. The monetary equivalent of the care plan volume should be below national thresholds that are specific to each disability group and yearly reevaluated. Once the care plan volume is set, the APA beneficiary is free to consume the number of hours she wants; for each hour consumed within the care plan volume, her out-of-pocket (OOP) price is reduced by the APA subsidy. The OOP price depends on the participation rate of the individual, which is an increasing function of her income. In 2015, the APA program counted 748,000 community-dwelling beneficiaries and amounted to an overall public spending of €3,2 billions (0.15% of GDP).²⁷ The APA benefit is also open to individuals living in nursing homes: in this case, it pays for the part of the price covering expenses for care provision.²⁸

As is the case for all social policies in France,²⁹ the implementation of the APA program is decentralized to local authorities, the departmental councils (*Conseils départementaux*). These sub-regional authorities have been recognized to be the “leaders of social action” (*Chefs de file de l’action sociale*) in 2004,³⁰ thus confirming the decentralization process initiated in 1982-1983 (Lafore, 2004). Departmental councils manage the eligibility procedure in the APA program as well as the computation and payment of the allowance. They have been shown to have a considerable latitude in the implementation of the program (Billaud *et al.*, 2012). In addition, they play a major role in the regulation of the home care sector. Overall, the practices of each departmental council substantially participate to define the long-term policy at the local level.

3.2 The French home care sector

Studying “the” home care sector in France, as one consistent unit, is a thorny point, as the professional care provision has actually been developed and structured by a large variety of operators. It is often regarded as an heterogeneous group of providers, with different motives, regulatory frameworks and juridical status, such that the home care

²⁶The APA program can alternatively be used to finance informal care provided by relatives (except the spouse). This solution is relatively limited (8% of APA beneficiaries in 2003) (Petite and Weber, 2006).

²⁷Source: DREES (2015b).

²⁸The price paid in nursing homes comprises three components: one part is related to the medical care, one is related to care provided for the activities of daily living and the last is devoted to accommodation fees. The APA subsidy in institutions lowers the second part of the price.

²⁹Up to now, the long-term care policy in France has remained explicitly regarded as a social policy, definitively independent from the health policies. Recent reforms, though, have tried to encourage integrated forms of care.

³⁰*Loi du 13 août 2004 relative aux libertés et responsabilités locales.*

sector would be hard to approach globally and would finally be “statistically indefinable” (Aldeghi and Loones, 2010). I will consider here the home care providers that have been involved in the care of the elderly individuals, and, as such, have been submitted to some public regulation.

The home care services to the elderly population have historically been developed by benevolent initiatives to provide assistance to deprived individuals. On the eve of the 20th century the juridical status of the non-profit organization was defined, thus offering an institutionalized form for the charitable operators. According to Lafore (2010), this status has allowed the central government to regulate the private operators of social action. It created a clear delimitation between these private operators and the public regulation; the first being the key actors of social action, while the second was intervening mainly at the administrative level and as a regulatory entity.³¹ This delimitation between private operate and public regulation remained stable in the first half of the 20th century. It also remained globally unchanged after the Second World War, despite the increasing involvement of the central government in social action. In 1953, the reform of assistance laws stated that municipalities could create their own operators of social action and thus opened the sector to public actors. In 1975, all private or public organizations operating in home care were designated as social or medico-social institutions (*Institutions sociales ou médico-sociales*).³²

With the creation of the APA program and the widening of the policy financing home care, the regulation of home care was increased with the so-called law renovating the social and medico-social action of 2002;³³ it created a specific status of regulation for the home care structures, the “regulated status” (*autorisation*), which still exists today. Under this status, home care structures have to be granted an authorization from the departmental council to enter the market. The departmental councils manage the provision of home care by regulated providers through several channels. Firstly, regulated structures have to meet quality standards, including certification processes and external evaluations. Secondly, the geographical area they serve is negotiated with the Departmental council. Thirdly, the price of each regulated structure is fixed by the Departmental council. This regulated price is supposedly based on the average production cost of the structure of two years earlier; it actually largely depends on administrative and political considerations. It can therefore be regarded as an additional tool in the hands of departmental councils to regulate the home care provision (Gramain and Xing, 2012). Regulated prices substantially vary both within one department and among departments, due to different provision characteristics

³¹It strongly differs from what was happening at the same period regarding the education policy, where the republican government was becoming itself a provider.

³²*Loi 75-535 du 30 juin 1975 relative aux institutions sociales et médico-sociale.*

³³*Loi 2002-2 du 2 janvier 2002 rénovant l'action sociale et médico-sociale.*

and pricing practices (Hege *et al.*, 2014; Labazée, 2017).

This regulation orientation was challenged by the 2005 plan for social cohesion, also referred to as the “Borloo law”. It aimed at encouraging for-profit enterprises to enter the market in order to foster job creations.³⁴ To do so, it loosened the constraints established in 2002 and created a new status (*agrément qualité*), associated with a lower level of regulation. Under this status, non-regulated structures could enter the home care sector with a quality certification whose requirements were lower than those needed for the authorization. Non-regulated structures were free to choose their geographical area of intervention and to set their price provided they respected restrictions on yearly price evolution that were enacted at the national level.

With for-profit enterprises being increasingly present on the home care sector, three juridical status are distinguished among structures providing home care: non-profit organizations, public structures and for-profit enterprises. In 2016, non-profit organizations represented the majority of the home care operators. Among hours provided by structures in 2016, 54.3% were from non-profit organizations, and only 35.2% and 9.5% from for-profit enterprises and public structures (Dares, 2016). The importance of for-profit enterprises is growing: they provided 8.5% more hours in 2016 than in 2015. Differences in juridical status partially correspond to differences in the regulatory status: for-profit enterprises are generally non-regulated while public and non-profit organizations are more frequently regulated. A differentiation in the activities performed is also observed: non-profit and public organizations are more oriented towards the assistance to the disabled elderly (60% of the hours they provide in 2016) and housekeeping (25%), while hours provided by for-profit enterprises are more diversified: they more frequently provide child care or gardening.

In parallel to the development of structures devoted to the provision of home care, the model of the housekeeper directly employed by individuals consuming professional care (over-the-counter workers, *emploi gré-à-gré*) has been another key figure of the home care provision in the 20th century and remains important nowadays. According to Lefebvre (2012), over-the-counter workers strongly differ from the caregivers employed in structures regarding the construction and the recognition of the profession. The status of over-the-counter worker is inherited from the historical form of the domestic servant. Remaining mostly at the margins of the labor market legislation in the first half of the 20th, the domestic workers were considered in the labor law for the first time in 1973, though the definition of such workers remained unclear. Since 1991, consumers of care services have also been able to employ a professional worker but with the intermediate of an agent

³⁴According to Cour des Comptes (2014), the effect of this measure on job creations has however been limited.

company (*service mandataire*), which assists her in the recruitment and administrative procedure. Table 1 recapitulates the different types of providers. According to the data *Remontées individuelles* (DREES, 2011), which consisted in APA administrative files extracted from 66 departments, two thirds of APA beneficiaries in respondent departments were served by a structure (either regulated or non regulated) in 2011, while one quarter were provided care by over-the-counter workers (7% with the help of an agent company).³⁵

Despite the increasing demand and the relative stability in the regulatory framework in the home care sector between 2005 and 2016, numerous public reports have underlined the difficulties encountered by home care providers (Aube-Martin *et al.*, 2010; Poletti, 2012; Cour des Comptes, 2014; Branchu *et al.*, 2015). Along with the low attractiveness of home care professions and the insufficient level of the departmental pricings, they have recurrently underlined the complexity of the regulation scheme in the home care sector. It has been partly addressed in the 2016 law on adapting society to the aging of the population.

Table 1 – Home care providers in France

Intervention mode	Employer of the caregiver	Regulatory framework	Creation	Juridical status
Over-the-counter	the consumer	Labor law	Historical form	–
Agent company			1991	
Structures	the structure	Regulated	2002	Non-profit/public/for-profit
		Non-regulated	2005	

3.3 The 2016 reform: adapting society to the aging of the population

The law on the adaptation of society to the aging of the population, which came into effect on the 1st of January, 2016,³⁶ has reformed the French old-age policy in several respects. It has first modified several parameters of the APA program. The national thresholds binding the care plan volumes have been reevaluated upwards. The formula determining the copayment of APA beneficiaries has also been substantially reformed. Before 2015, the copayment rate only depended on the income of the individual. With the reform, it now depends on both the income and the disability level, taking into account the value of the care plan volume. At a given income level, the copayment rate decreases with the disability level.

³⁵For the remaining 9%, the source of home care provision is not filled in.

³⁶*Loi 2015-1776 du 28 décembre 2015 relative à l'adaptation de la société au vieillissement.* In the thesis, I will refer to this law as the 2016 reform.

On the supply side, this reform has tended to gather home care structures under the regulated status. Home care structures serving APA beneficiaries have to be regulated.³⁷ The underlying orientation of such a reform is to protect the fragile population by strengthening the public control over home care structures (Labazée, 2017). The pricing of these structures by departmental councils, however, was not presented as compulsory, due to the opposition of previously non-regulated structures and the additional workload it would generate for departmental councils (Direction générale de la cohésion sociale, 2016). Thus, if the reform has organized the conditions of an harmonization regarding quality certifications and evaluations, it has not addressed the dichotomy existing in the pricing of structures.

The reform has also addressed issues regarding informal care and institutional care. Regarding informal care, the reform has created the legal status of the caregiving relative (*proche aidant*), defined as someone, non-professional, who is regularly providing care to a disabled elderly for some activities of daily living. Caregiving relatives are said to have a right to respite, which can be publicly financed. The law has finally planned the increase in the transparency regarding the price of institutional care and it had encouraged the creation of intermediate solutions, between home and institutions, through the so-called “autonomy-residences”.

4 Research questions and overview of chapters

This thesis aims at improving the understanding of home care arrangements for the disabled elderly in the context of France. What are the determinants of formal care consumption, at both the extensive and intensive margins? How do formal and informal care providers adjust to their provision constraints? The thesis focuses on personal care and domestic help, which can be provided either by professional caregivers or informally. I investigate several determinants of formal care use that have little been studied in the literature. I particularly focus on the effect of the price of formal care and its regulation: how do individuals adjust the volume they consume to the price they pay for professional home care? Is their demand affected by the local regulation regarding the APA program and the regulation of providers? The thesis additionally analyzes the organization of the care provision, from both informal and formal providers. Regarding informal care, I analyze the way families are organized for home care provision, with a specific focus on the interactions of the care decisions among siblings. How do families get organized to take care of an elderly parent? Is the decision of other siblings likely to affect the decision

³⁷The transition for previously non-regulated structures has been organized as follows: from the beginning of 2016, all non-regulated structures were to be regarded as regulated and they were to apply to get the authorization at the end of their current agreement.

of others? With respect to formal care provision, I focus on the costs borne by home care providers and study the travel costs generated by their rounds. What are the sources of their variations? What are the implications of varying travel costs for the consumers?

4.1 Chapter 1

The first chapter³⁸ deals specifically with the genesis of informal care. It studies the determinants of the care provided by children to their disabled elderly parent. It is particularly centered on endogenous interactions, corresponding to the way children take the care behavior of others into account for their own decision. We use a French national survey implemented in 2008, the HSM survey — presented below —, to provide general descriptive statistics on the family care arrangements. They are found to be sensitive to the size of the family, the rank in the sibling and the parent's matrimonial status. The analysis of the determinants of care behavior is then centered on two-child families. We implement a semi-structural model explaining the decision to provide care, in a non-cooperative framework. Determinants are children characteristics as well as family (including parent and sibling) variables. They are estimated with two alternative definitions of caregiving.

With a broad definition of care including domestic care, financial help and moral support, we find that the elder child reacts mainly to family variables while the younger child is additionally sensitive to her personal characteristics. When restricting the definition to domestic care, sibling behaviors are more similar. In both cases, we observe asymmetric interactions coefficients and a systematic assignment to care for daughters with a brother. Even though the scope of this work is limited to the two-child families and only highlights the extensive margin of care provision (being caregiver or not), this is the first contribution on the interactions among siblings for informal care in the French context. Results confirm the previous findings obtained on European data regarding interactions and the systematic assignment to care provision of daughters with a brother (Fontaine *et al.*, 2009).

4.2 Chapter 2

The second chapter³⁹ focuses on the price elasticity of formal home care for the disabled elderly. Previous works have shown that the consumption of formal care is price-sensitive, but, because of data limitations, they have not been able to quantify the magnitude of this effect. We estimate how the volume consumed by individuals depends on the OOP

³⁸Co-authored with Roméo Fontaine and Agnès Gramain.

³⁹Co-authored with Marianne Tenand.

price they pay, while controlling for a set of individual characteristics. To get appropriate data, we have collected administrative files of the APA program from one Departmental Council. They makes it possible to observed both the consumption and the OOP price of the APA beneficiaries. The consumption observed in these data, however, is limited to the hours subsidized within the APA framework (at the care plan volume), such that our data are right-censored. At a given income level, the main source of variations in the OOP price is the inter-individual variations in prices. We make sure that provider price variations are exogenous by exploiting the unequal spatial coverage by providers in the department: the provider price is instrumented by the number of municipalities served by the provider.

Our results indicate a negative price elasticity of -0.4 , with point estimates ranging from -0.5 to -0.1 , significantly different from 0 and -1 . This research was carried out within a research project, the Modapa project,⁴⁰ whose objective is to quantify the sensitivity of the demand for care among the disabled elderly living at home. Our results are in line with the alternative estimations of the price-elasticity obtained in the research team (Bourreau-Dubois *et al.*, 2014; Hege, 2016). With the disabled elderly being sensitive to the price of care, the copayment rates in home care subsidy programs thus entail allocative and dynamic efficiency issues. Given the low value of the price elasticity, however, the generosity of home care subsidies also has substantial redistributive effects, from taxpayers to the disabled elderly.

4.3 Chapter 3

Chapter 3⁴¹ focuses on the extensive margin of formal care and the decision to consume formal care. It studies how formal care use is affected by the decisions of departmental councils, regarding of the APA policy and the regulation of home care providers. We use an original survey on departmental practices, the *Territoire* survey, to describe the departmental variations.. We focus on the generosity of the APA allowance, measured by the way the department council computes the hourly subsidy, and the market share of regulated providers compared to the non-regulated ones. We discuss the exogeneity of these practices and study how they relate to departmental socioeconomic characteristics. These departmental data are matched with a sample of disabled elderly from the HSM survey. A discrete choice model is estimated to show how departmental variations contribute to explain the use of formal home care.

Our results show that departmental generosity in the APA policy, measured by the formula used to compute the APA subsidy, does not correlate to formal care use. On the

⁴⁰More details on the Modapa project can be found at www.modapa.cnrs.fr

⁴¹Co-authored with Rémi Kaboré and Jérôme Wittwer.

supply side, the dominance of non-regulated providers — whose quality is uncertain and price is little regulated — decreases the probability to consume formal care, potentially due to a price effect or a quality effect. Such an interpretation needs to be cautious, however, since we additionally observe that the absence of any regulated providers does not correlate with low use. These results can be used to discuss both the questions raised by the decentralization of a national program and the recent reform of the home care sector.

4.4 Chapter 4

The last Chapter turns to the examination of the supply of professional care. It sheds light on one specific provision constraints for home care services, namely the travel costs borne to reach consumers. The provider indeed bears the costs generated by the travels of caregivers to the consumers' location. Many public reports have underlined that this feature of care provision is likely to influence the costs and the organization of home care providers. It might be unequally binding to providers, depending on the spatial distribution of their consumers. Moreover, the regulation of the sector is such that the unique price per structure organizes a redistribution from non costly to serve consumers to the others. This work aims at documenting the importance and the variations of travel costs for home care providers, and their effect on home care provision. Are travel costs negligible? How do they vary? How do they influence the organization of the home care provision? I use a very detailed database collected from one home care provider serving thousands of consumers spread over a French department. Using information on consumers' location and caregiver rounds and building upon a micro-costing approach, I compute the travels costs borne by the provider and study the sources of their variations.

Travel costs are shown to be higher in rural municipalities and decreases with the size of urban units. It first comes from geographical constraints associated with these areas, namely longer travel distances. But it also relates to the characteristics of the elderly residing in these areas. Indeed, severely disabled individuals are over-represented in these areas and they generate more costly rounds, due to fragmentation of the interventions they receive and the higher wage rate of caregivers they receive care from. In this context, severely disabled individuals — and especially those living in rural areas or small urban units — benefits from the redistribution organized by the uniform price. I finally test if travel costs affect the length of interventions and find no evidence of such an effect.

5 Methodological guidelines

5.1 Sample selections

This thesis focuses on the disabled elderly living in the community. Compared to the whole population of the disabled elderly, community-dwellers are less severely disabled level, on average, and are potentially provided with more informal care than those entering in institutions. These characteristics are expected to influence the parameters of interest of the thesis, especially the price sensitivity of the demand for care. Results are then essentially relevant for this (major) subgroup of the population of disabled elderly. Additional sample selections are performed in some Chapters. Chapter 2 and 4 study consumers of formal care and Chapter 2 additionally focuses, among them, on the APA beneficiaries served by a regulated provider. The reasons and implications of such selections are discussed in the Chapters.

5.2 Data

The HSM survey is used in the first and last chapter.⁴² This national survey is the most recent French one focusing on health, though the CARE survey, conducted in 2015, will be available soon. Collected in 2008, this representative national survey focuses on the disabilities and health limitations encountered by the French population. It has three sections: one is focused on individuals living in the community, one focuses on individual living in institutions and the third section concentrated on caregivers. We use the part on individuals living in the community, which counts almost 30,000 individuals. In both Chapters, it is used for the precise information it offers on elderly individuals, their activity restrictions and their socioeconomic characteristics. Chapter 1 additionally exploits the information obtained on the care provided by children and the detailed data on all children, whatever their caregiver status. Chapter 4 focuses on the available information on the formal care received by the elderly. In both cases, an important issue lies in the fact that available information is self-reported. It implies risks of bias in the identification of disabilities and caregivers that are discussed in the next subsection. The information obtained could also have been influenced by the choices made by the person in charge of filling the questionnaire (Beliard *et al.*, 2013).⁴³

⁴²Data have been obtained through the *Réseau Quetelet*. References: Handicap-Santé, volet ménages - 2008 - (2008), INSEE, Centre Maurice Halbwachs (CMH).

⁴³Individuals filling the questionnaire have to understand the situation of the disabled individuals so as to make sure it appropriately respond to the questionnaire. For instance, she has to make sure that caregivers declared as such by the individual fit with the definition of caregiving established in the questionnaire. The perception of these individuals has been shown to be influenced by their social characteristics.

In Chapter 4, a sample of disabled elderly from HSM is matched with an original departmental survey, the survey *Territoire* (LEDa-LEGOS and CES, 2012).⁴⁴ This survey has been implemented by a team of researchers in social sciences, with the aim of documenting variations existing in the implementation of the long-term care policies by the departmental councils. It provides original information on the departmental practices, though it is available only for voluntary respondents (71 departmental councils over the 96 metropolitan survey).

The second type of data used are datasets collected from one departmental council or one home care provider, in order to study questions that could not have been addressed through available survey or administrative data. In Chapter 2, administrative files extracted from the APA program in one Departmental Council make it possible to get precise information on both the volume of formal care consumed by the APA beneficiaries and the OOP payments they pay. In Chapter 3, original data from a professional home care provider have been collected to study the travel costs generated by the care provision. It offers a very rich set of information on the rounds of caregivers as well as details on caregivers and consumers characteristics. This type of data, though, suffers from several limitations. First, they offer poor sociodemographic information, compared to survey data. They are centered on the consumption in a restricted framework, either the consumption subsidized in the APA program (Chapter 2) or the consumption served the provider (Chapter 3). We have no information on potential other care or medical provision; in particular, these data do not offer any information on the care provided by relatives. Finally, they cannot be publicly released and imply anonymity constraints. But still, these data provide original highlights on fairly little explored questions.

5.3 Disability measures

Centered on the disabled elderly, the thesis makes use of several definitions of disability, which depend on the data used. A first indicator of disability help delimiting the sample studied. A second one distinguishes, within the sample, between different degrees of severity. With survey data (Chapter 1 and Chapter 4), I use definitions based on the self-declared restrictions encountered by individuals in the accomplishment of daily living activities, either essential or instrumental. As they are self-reported, they are likely to be influenced by the characteristics of individuals and their environment (Merrill *et al.*, 1997; Brink *et al.*, 2003). Chapter 1 is centered on the provision of informal care: the sample definition is specifically based on the declared need for *human* care for the accomplishment of the activities of daily living. Among the individuals identified as disabled with this definition, I distinguish in my study two different disability levels: individuals who declare

⁴⁴The questionnaire is available (in French) here: <http://modapa.cnrs.fr/questionnaire.pdf>.

they need human help for the ADL on the one hand, and those declaring they need such a help exclusively for the IADL on the other hand. In Chapter 4, the sample is larger and comprises all elderly declaring they have restrictions in the accomplishment of ADL or IADL.

When administrative or management data are used (Chapter 2 and 3), I do not select samples on the basis of disability. I directly observe a sample of APA beneficiaries or formal care consumers. Within samples, indicators of disabilities considered are those administratively used (GIR). The relevance of these measures is highly dependent on the practices of the socio-medical team establishing the disability level. It might be threatened if the evaluation process is not frequently actualized: in this case, observed disability levels would tend to be lower than actual disability levels.

Chapter 1

My baby just cares for me

Informal care arrangements and interactions in France

This chapter was co-authored with
Roméo Fontaine and **Agnès Gramain**.

Summary of the chapter

Despite increasing professional home care utilization, the dependent elderly are still predominantly provided care by their relatives. Our paper studies the determinants of the family care arrangements in the French context. How do care provided by children depend on child or family characteristics? Among siblings, do the care decisions of each child depend on the decision of others? Do the effects of these determinants vary with the rank? Using the HSM survey (2008), we describe care arrangements and show that they are sensitive to the parent's marital status and the size of the siblings. Focusing on two-child families, we then identify the determinants of care arrangements according to the rank. Determinants are child or family variables, and the model also highlights potential interaction effects among siblings, namely the way a child reacts to the care decision of her sibling. With a broad definition of care including domestic care, financial help and moral support, we find that the elder child reacts mainly to family variables while the younger child is additionally sensitive to her personal characteristics. When restricting the definition to domestic care, sibling behaviors are more similar. In both cases, we observe asymmetric interactions coefficients and a systematic assignment to care for daughters with a brother.

Classification

JEL Classification: D13, J14

Keywords: disabled elderly, informal care, social interactions

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Contents of the Chapter

1	Introduction	66
2	Modeling interactions among siblings	67
3	Informal care in the HSM survey	68
3.1	Sample of disabled elderly living in the community	68
3.2	Definition of caregiver children	69
4	What are the observed care arrangements?	72
5	Determinants of care decision in two-child families	78
5.1	Micro-econometric model	78
5.2	Child and family determinants	81
6	Results	83
6.1	From differentiation to convergent behaviors	83
7	Additional estimations	87
8	Discussion and potential extensions	91
9	Conclusion	93
10	Appendices	95
10.1	Details on the econometric specification	95
10.2	Descriptive statistics on the sample	100
10.3	Additional results	102

1 Introduction

With the ageing of the population and the advance in age of baby-boomers, there is an increasing demand for provision of home care to the disabled elderly. Although the utilization of professional home care is increasing, the dependent elderly are still predominantly provided care by their relatives: in France, in 2008, 50% of the disabled elderly received care from their relatives only, while 32 % were provided care both by their relatives and professionals (Soullier and Weber, 2011). Informal care — defined as the unpaid home care provided to the disabled elderly by their relatives, mainly family members — is thus a key issue for long-term public policies. Despite the importance of informal care provision, little is known about the mechanisms explaining care arrangements. The literature on informal care has mainly focused on the relationship between formal and informal care (Ettner, 1994; Hoerger *et al.*, 1996; Pezzin *et al.*, 1996; Byrne *et al.*, 2009). Other studies have been interested in the effect of informal care on caregivers' health, labor supply or social life (Miller and Montgomery, 1990; Ettner, 1995; Pezzin and Schone, 1999; Coe and Van Houtven, 2009). In a third axis, papers have addressed the genesis of care arrangements. It first focused on the determinants of care provision, first assuming there is only one caregiver child (Stern, 1994; Sloan *et al.*, 1997; Pezzin and Schone, 1999; Hiedemann and Stern, 1999), before taking into account shared care provision that is empirically more frequent (Hiedemann and Stern, 1999; Checkovich and Stern, 2002; Engers and Stern, 2002; Pezzin *et al.*, 2007; Byrne *et al.*, 2009; Fontaine *et al.*, 2009).

Our paper analyzes the determinants of the family care arrangements in the French context. We shed light on several issues: how do care arrangements depend on child or family characteristics? Among siblings, are the care decisions independent one from the others? Do the effects of determinants vary with the rank among siblings? We use the HSM survey (DREES and INSEE, 2008) and focus on the decision to be — or not to be — a caregiver (extensive margin of informal care). In a first step, we describe care arrangements and show that they are sensitive to the marital status of the parent and the size of the siblings. In the second step, we focus on two-child families; we implement a semi-structural model that makes it possible to identify separately the determinants of care arrangements. We study the effects of the child characteristics as well as those of the parent and sibling (family variables). Interestingly, our model also identifies potential interaction effects among siblings, that is to say the way a child reacts to the care decision of her sibling. The effects of determinants are estimated separately according to the rank in the sibling, with two definitions of care. With a broad definition including several types of care, we find that the elder child reacts mainly to family determinants while the younger child is additionally sensitive to her individual characteristics. When restricting

the definition to domestic care, children behaviors are more similar. In both cases, we observe asymmetric interactions and a systematic assignment to care for daughters with a brother. This work has several limitations. In particular, it studies exclusively the extensive margin and the analysis of interactions is centered on two-child families. Though, it draws interesting results with strong policy implications. Care provided by children is found to be sensitive to family characteristics, and asymmetrically distributed within sibling. In this context, a public policy that would encourage informal care as a major source of care provision could potentially generate inequalities within sibling, especially with respect to the sex and the rank.

2 Modeling interactions among siblings

The economic literature on informal care arrangements has first assumed that a single child was found to be caregiver. It aimed at understanding the effect of child and parent variables on the decision to provide care (Stern, 1994; Sloan *et al.*, 1997; Pezzin and Schone, 1999; Hiedemann and Stern, 1999). However, this approach is questioned by empirical evidence, as informal care is frequently provided by several children simultaneously. In Europe, in 2004, one over five disabled elderly living alone and having two children did receive care from several children at the same time (Fontaine *et al.*, 2009). The same proportion is found in 2008 in France according to the HSM Survey (see *infra*). The genesis of care arrangements is thus more complex than one single care decision.

Are care decisions independent one from each other when care provision is shared? Addressing this question, many studies have used game theory models to take into account the anticipations of agents in the care decision of others (Hiedemann and Stern, 1999; Checkovich and Stern, 2002; Engers and Stern, 2002; Pezzin *et al.*, 2007; Byrne *et al.*, 2009). The potential link between care decisions raises two issues: is the care provided by one child a complement or a substitute to the care provided by other children? According to qualitative studies, shared care provision are observed but withdrawals of sibling when one child is caregiver are also likely (Pennec, 2007). Secondly, are children reacting the same way to the care decision of others, whatever their rank in the sibling? Fontaine *et al.* (2009) use a model allowing asymmetric interactions: children can react differently to the care decision of siblings according to their rank. Making use of the Survey of Health, Ageing and Retirement in Europe (SHARE) and focusing on two-child families with a disabled parent living alone, they find that the elder child is more likely to be caregiver when her sibling is caregiver, while it is the reverse for the younger child.

To identify these interactions, one needs to isolate their effect from other mechanisms that might explain the correlation of care behaviors. According to Manski (2000), the

behaviors of group members can be correlated for three reasons. The first corresponds to “endogenous interactions” and refers to the direct interdependence of behaviors within the group. It corresponds to the interactions we want to study within the family: how is the care decision of one child affected when the other is caregiver ? But correlation of behaviors can also be observed because of “contextual interactions”, referring to the effect of one group member’s characteristics to the behavior of others. Within a family, if one child is unemployed, her siblings could consider she has to be caregiver for the parent. They might not be involved in the care provision for this reason, even if the unemployed child is not actually providing care. The third mechanism corresponds to the “correlated effects” and refers to the existence of a shared context for the group members. In a family, the care provision of children can be simultaneously influenced by the marital status of the parent, her disability level or by unobserved family norms.

Isolating endogenous interactions is needed to analyze the mechanisms of shared care provision. With endogenous interactions, modifying the care provided by one child will affect the care provision of all children. It should be taken into account when forecasting the effect of long-term care policies. For instance, a policy targeting children providing informal care while being employed could also have effects for retired children through endogenous interactions. Identifying the effect of endogenous interactions is also needed to predict the evolution of informal care resources. Within a family, the lower care provision of some children could be compensated by an increase in the provision by others. Overall, it would leave the amount of provided care unchanged, modifying the quasi-consensus on the forthcoming decrease of informal care.

3 Informal care in the HSM survey

3.1 Sample of disabled elderly living in the community

Implemented in France in 2008-2009, the HSM survey is centered on the disability and health limitations encountered by the French population. We use the household section of the survey. For each person, we know her individual sociodemographic characteristics and have information on the formal and informal care she receives. The survey also provides information on the family of the person: for each of her children, we get a set of sociodemographic characteristics (sex, age, employment situation, cohabitation with the parent, geographical proximity to the parent). Having such information for each child, whether a caregiver or not, is essential to study the determinants of the observed care behavior.

Our analysis considers care arrangements for the disabled elderly living in the com-

munity and having one child at least. Focusing on the disabled elderly living in the community creates a selection compared to the whole population of the disabled elderly. Even though they represent the majority of the disabled elderly, individuals living in the community are more frequently women, moderately disabled, and have more relationships with their relatives than individuals living in institutions (Désesquelles and Brouard, 2003; Duée and Rebillard, 2006). Our analysis is thus conditional on the residence in the community. We focus on the elderly, considering individuals aged 60 and more. This threshold has been chosen in reference to the French legislation. In France, any individual aged 60 or more can be eligible for long-term care benefits if she is disabled (Tenand, 2016).¹ We define as “disabled” an individual if she declares she needs help from someone else to perform at least one ADL (bathing and showering, personal hygiene and grooming, dressing, toilet hygiene, functional mobility and self-feeding) or one IADL (cleaning and maintaining the house, managing money, moving within the community, preparing meals, shopping for groceries and necessities, taking prescribed medications, using the telephone or other form of communication). With this relatively broad definition, 10.6% of the elderly (2,226 individuals) are disabled in the HSM survey in 2008.²

Table 1.1 presents the distribution of disabled elderly according to their marital status and their number of children. The description of care arrangements is based on the 1,883 disabled elderly having one child at least. Then, the analysis of care determinants rests on a restricted sample of 479 disabled elderly having two children, excluding twins.³

3.2 Definition of caregiver children

In the HSM survey, informal care corresponds to a regular care provided by relatives in response to the individual’s limitations. Individuals answer the following question: “Are there persons (family, friends), non professional, who help you on a regular basis to perform some tasks of daily living, or who help you financially or materially, or who provide you with moral support, because of a health problem or a disability, including persons living with you?”. If it is the case, the individual is invited to list ten informal

¹This threshold implies to differentiate between the disabled elderly and the disabled adults getting old. In the last case, care arrangements are probably older and might be specific to the characteristics of the disabilities (not old-age related). Using information of the benefits received by individuals, we identified and suppressed from our sample 13 individuals aged 60 or more whose disabilities are not (only) old-age related.

²23.8% of them declare needing help from someone to perform one ADL at least. Among other disabled elderly, 79.1% have at least two IADL limitations.

³492 disabled elderly parents have two children (Tables 1.1, 1.2, 1.3). When analyzing children care behaviors according to the rank, we exclude the 13 disabled elderly having twins and end up with a sample of 479 parents (Tables 1.8, 1.9, 1.5, 1.4). We are not able to use twins in our estimation strategy as they are not numerous enough in our sample (13 disabled elderly parents have only twins).

Table 1.1 – Disabled elderly according to their marital status and the number of children

	Whole sample		Single		With a spouse	
	Observations	Frequency	Observations	Frequency	Observations	Frequency
No children	307	14.9	218	19.1	89	9.3
One child	425	20.0	237	21.5	188	18.1
Two children	492	24.8	241	22.5	251	27.6
Three children	351	16.1	173	14.9	178	17.8
Four children	238	9.7	129	9.7	109	9.8
Five and more	377	14.5	198	12.3	179	17.4
Total	2190	100.0	1196	100.0	994	100.0

SAMPLE: 2,190 disabled elderly living in the community. Every child is over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: weighted frequencies.

caregivers. We regard a child as caregiver if she is included in this list.⁴ This definition of care thus rests on the declaration of the parent. It implies risks of missing some children, or considering wrongly a child as caregiver, depending on the declaration of the parent. It is also potentially affected by the use of a proxy to answer the questionnaire⁵. It could even be influenced by the choices made by the person in charge of filling the questionnaire (Beliard *et al.*, 2013).⁶ Moreover, this measure does not give any information on potential constraints explaining the care decision (requests from the parent for instance) nor on the volume or the type of care provided.

With this definition, some children living with their parent are not regarded as caregivers. We assume that the cohabitation leads *de facto* to care provision, even indirectly, through the accomplishment of tasks of daily living. We thus consider as caregiver a child living with her parent.⁷ Due to this choice, we suppressed from our sample families where one of the children is still under the age of legal majority (18 years old in France),⁸ since the cohabitation status is ambiguous in their case.

⁴In three cases, some of the individual's children are not included in the list of ten caregivers and the individual declares she has more than ten caregivers. There is then a concern for missing caregiver children. We suppress from our sample these observations.

⁵In our sample, 64% persons answered the survey themselves, 20% were helped by someone. For the remaining 16%, somebody else answered the survey (proxy).

⁶It is a problem for our estimations if the declaration bias are correlated with some of our variables of interest (care arrangements, parent's or children's sexes), which is likely to be the case.

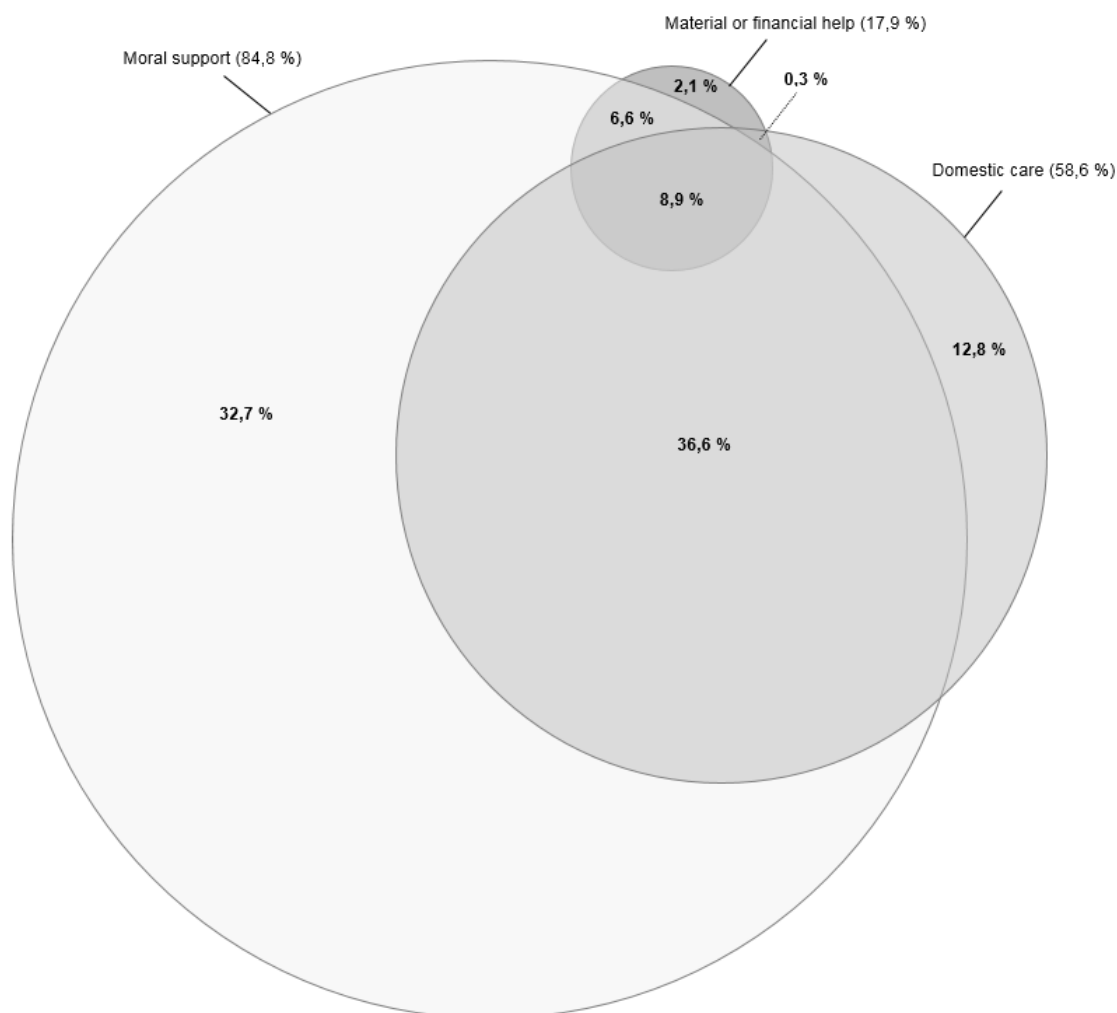
⁷7% of children of a disabled elderly parent live with their parent and 4% children of a disabled elderly parent live with their parent without being declared as caregiver. Among two-child families (with a disabled elderly parent), 10% of children live with their parent and 3% children live with their parent without being declared as caregiver (with same frequencies for elder and younger children).

⁸They represent 1.6% of families with a disabled elderly parent and 1.2% of two-child families with a disabled elderly parent.

The definition of care in the survey gathers several types of care together. It includes not only the care provided to perform the tasks of daily living (hygiene, dressing, household maintaining) but also the financial or material help and the moral support. This diversity echoes the broad definition of disability we retained. The survey makes it possible to distinguish between these types of care. Among children declared caregivers, around 85% provide at least moral support, 59% provide care for the tasks of daily living and 18% provide a financial or material help (Figure 1.1). Financial or material help is thus rarely provided without any other type of care.⁹ Including it in the definition does not markedly change the identification of caregiver children. Including moral support, however, is more problematic, as over one third of children are declared caregiver for this type of care only. Our results will rest on the broad definition of care. Since the coordination issues are probably more important for the help provided for the tasks of daily living, our analysis of endogenous interactions is additionally run with the definition of care restricted to domestic help.

⁹Financial support to parents is rare in Western countries; [Bonsang \(2007\)](#) shows that only 2.6% of adult children in European countries provide financial assistance to their parents.

Figure 1.1 – Types of care provided by caregiver children of a disabled elderly parent



SAMPLE: 1,341 children over the age of legal majority declared caregivers by a disabled elderly parent living in the community.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: weighted frequencies. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided). Children cohabiting with her parent but not declared as caregiver are not included.

READING: 12.8% of children of a disabled elderly exclusively provide domestic care. Overall, 58.6% (12.8% + 36.5% + 0.3% + 8.9%) of children provide care for domestic care at least.

4 What are the observed care arrangements?

Care arrangements can be observed either at the child level (how many children are providing care? — Table 1.2) or at the parent level (how many parents are provided with care? — Table 1.3). Comparing these frequencies according to the marital status of the parent and the size of the sibling gives interesting results on the care arrangements

in France. As expected, involvement of children is more frequent when the parent lives alone, both at the parent and child level. The involvement rate of children is up to twice lower when the parent is in couple, whatever the size of the sibling (Table 1.2); among only children of a single disabled parent, one over two is declared caregiver while it is only one over four when the parent lives with a spouse. Parents declares being provided care by children in only 27.6% of the case when they live in couple while the proportion is of 53.4% when they live without children (Table 1.3). However, the relatively more important care provided for single parents is not associated with an increase in shared care provision. On average, 44.8% of caregiver children are providing care alone when the parent is single (Table 1.2), or about the same proportion than when the parent lives in couple (43.4%). The similarity of frequencies is also observed at the parent level. The marital status also affects the link between the children involvement and the size of the sibling. When the parent lives alone, the proportion of caregiver children tends to decrease with the size of the sibling. When she lives in couple, the involvement rate for children with sibling is lower than the involvement rate of only children, but it is remarkably constant across sibling sizes (around one child over six).

When the parent has several children, interactions are likely. Indeed, the proportion of parents provided with care is systematically lower than what we would observe if the care decisions of children in one family were independent. When the parent lives with a spouse, the stability of children involvement rates results in an increase in the proportion of parents provided with care only from siblings with three children. When the parent lives alone, no simple mechanisms can be identified.

Taking the rank into account provides an another insight. According to Figure 1.2, there are significant variations in the probability to be caregiver according to the rank and the sibling size.¹⁰ In families with more than two children, involvement rates according to the rank seem to follow a U-shaped trend, with younger and elder children having higher probabilities to be caregiver; this trend is unbalanced, as younger children have a higher probability to be caregiver than elder children. This U-shaped trend is not observed, though, in families with seven children. In all sibling size, the provision of care as a single caregiver is rather erratic.

In two-child families, younger children are more frequently caregiver than elder children. How is it possible to explain this difference? Is it related to a difference in the distribution of individual characteristic according to the rank? We do observe that the younger and elder children differ in terms of sociodemographic characteristics (Table 1.4).

¹⁰Independence tests accounting for the survey structure (weights and family as sampling unit) shows that the differences observed in the probability to be caregiver according to the rank are significant at the 10%, except for families with three, five and seven children (P-values respectively at 0.31, 0.14 and 0.80).

Is the gap rather due to differences in the reaction to individual characteristics? Alternatively, can it be explained by asymmetric interactions? We propose to explore these three sources of variations, studying the effects of child or family determinants and interactions and allowing them to vary with the rank.

Table 1.2 – Caregiver children of disabled elderly individuals

		Observations (child)	Caregiver or cohabiting children	Involvement rate (%)	If caregiver, share of children providing care alone (%)
Single	One child	237	148	56.0	100.0
	Two children	482	208	38.5	42.0
	Three children	519	162	21.1	38.4
	Four children	516	153	28.9	33.4
	Five or more	1328	298	24.8	22.8
	Total	3082	969	30.4	44.8
With a spouse	One child	188	49	26.4	100
	Two children	502	104	15.0	48.9
	Three children	534	106	17.9	31.9
	Four children	436	72	17.8	29.2
	Five or more	1198	198	14.3	36.6
	Total	2858	529	16.4	43.4

SAMPLE: 5,940 children over the age of legal majority having a disabled elderly parent living in the community.

SOURCE: HSM (DREES and INSEE, 2008)

NOTES: weighted frequencies. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided) or cohabiting with her parent.

READING: in two-child families with a disabled elderly single parent, 38.5% of children are caregiver. 42% are the only caregiver child.

Table 1.3 – Share of disabled elderly parents provided with care by their children

		Observations (parent)	Share of parents provided with care by a least one child (%)	Among parents provided with care, share of parents provided with care by only one child (%)
Single	One child	237	56.2	100.0
	Two children	241	51.2	63.4
	Three children	173	37.8	58.9
	Four children	129	64.1	57.9
	Five or more	198	69.3	54.7
	Total	978	53.4	69.9
With a spouse	One child	188	24.7	100.0
	Two children	251	19.1	62.9
	Three children	178	22.7	42.7
	Four children	109	32.5	55.0
	Five or more	179	46.6	71.9
	Total	905	27.6	68.2

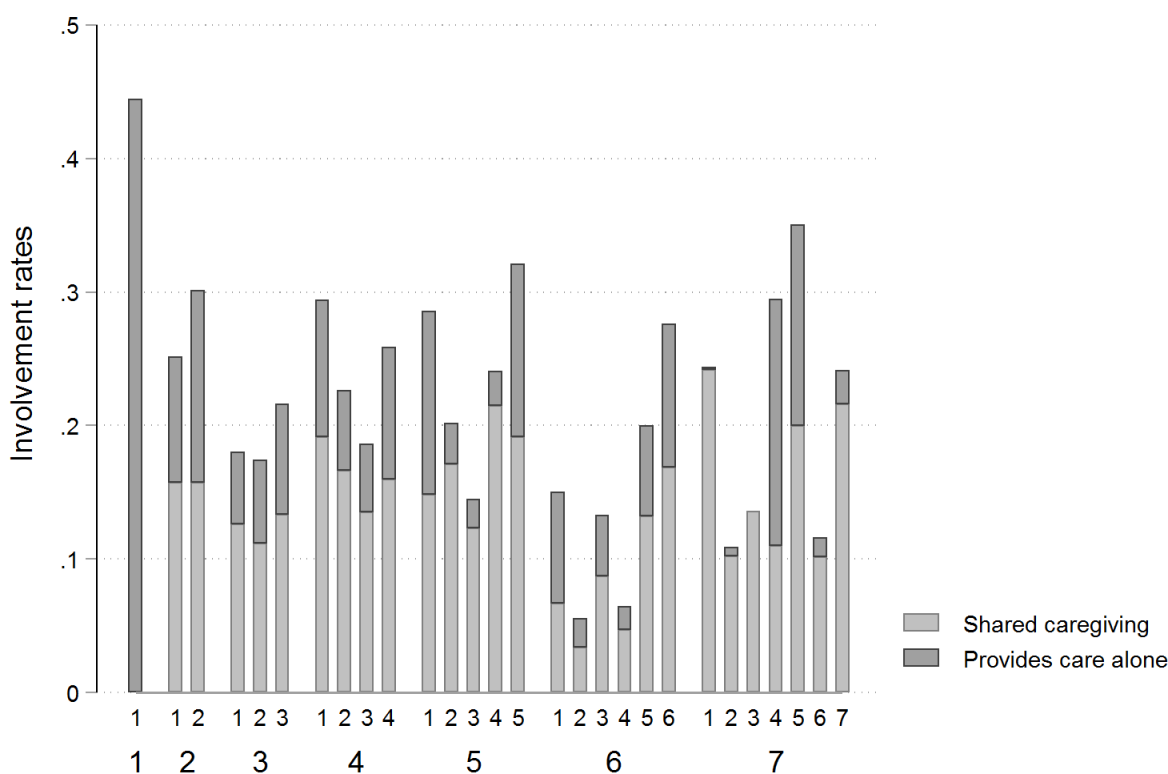
SAMPLE: 1,883 disabled elderly living in the community and having at least one child. Every child is over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: weighted frequencies. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided) or cohabiting with her parent.

READING: 51.2% of the disabled elderly living without a spouse and having two children receive care from at least one child. 63.4% of them receive care from only one child.

Figure 1.2 – Involvement rates of children according to rank and sibling size



SAMPLE: 4,349 children over the age of legal majority with a disabled elderly parent living in the community, whose sibling size is not higher than 6 children.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: weighted frequencies. On the x-axis, the first line of numbers is the rank and the second line of numbers is the size of the siblings. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided). Children cohabiting with her parent but not declared as caregiver are regarded as caregiver.

READING: In families with three children, 25% of the elder children provide care (17% provides care with one other child at least, 8% provides care alone).

Table 1.4 – Sociodemographic characteristics of children (two-child families)

	Elder child	Younger child	Difference (p-value)
Age (years) ^(a)	51.6	46.7	0.00
Women (%)	52.2	53.4	0.70
Having a spouse (%)	71.8	68.7	0.29
Having children (%)	80.4	75.2	0.05
Number of children ^(b)	02.2	02.0	0.01
Active of the job market (%)	67.4	75.8	0.00
Cohabiting with the parent (%)	09.4	10.0	0.74
Living in the parent's municipality (%)	20.9	24.4	0.19
Living in the parent's department (%)	29.0	32.0	0.33
Living in the parent's region (%)	11.3	10.6	0.75
Living outside of the parent's region (%)	28.0	22.1	0.04

SAMPLE: 958 children from two-child families, over the age of legal majority, having a disabled elderly parent living in the community.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: Unweighted frequencies. P-value from a Student test.

(a) The average age is computed on children for whom the parent was able to respond (469 elder children, 474 younger children).

(b) Among those having children (385 elder children, 360 younger children).

5 Determinants of care decision in two-child families

In order to isolate the effect of endogenous interactions, our analysis focuses on two-child families. We work at a given sibling size, instead of aggregating families with different sibling sizes. Indeed, care behaviors vary with both the rank and the sibling sizes. Two-child siblings present important differences in care behavior according to the rank. Technically, two-child families makes it possible to avoid restrictive hypothesis that would be needed to formalize interactions among larger siblings: with two children, the care behavior of siblings is mechanically reduced to the other child. Moreover, two-child families tend to be the more frequently observed size of siblings in France: 34% of men and 31% of women born between 1931 and 1935 with children have two children. For generations born 30 years later, these proportions equal 46% and 45% (Masson, 2013). If we compare the frequency of each sibling size in Table 1.1, two-child families are the most frequent case (1/4 of siblings).

5.1 Micro-econometric model

To analyze if the care decision of a child depends on the care behavior of her sibling, we need a statistical model considering simultaneously the care behavior of both children. In a two-child family j , the care behavior of a child i is represented by a binary variable a_{ij} ($i = 1$ for the elder child, $i = 2$ for the younger), with $a_{ij} = 1$ if the child is providing care to the parent, $a_{ij} = 0$ otherwise.

Depending on the care decision of each child, four care arrangements k_j are observed:

- no child is caregiver ($a_{1j} = 0, a_{2j} = 0$) : $k_j = 0$;
- the elder child only is caregiver ($a_{1j} = 1, a_{2j} = 0$) : $k_j = 1$;
- the younger child only is caregiver ($a_{1j} = 0, a_{2j} = 1$) : $k_j = 2$;
- both children are caregiver ($a_{1j} = 1, a_{2j} = 1$) : $k_j = 3$.

The utility function of each child depends not only on her own involvement but also on the care behavior of her sibling.

$$\begin{aligned} U_{1j} &= U_{1j}(a_{1j}, a_{2j}) \\ U_{2j} &= U_{2j}(a_{2j}, a_{1j}) \end{aligned} \tag{1.1}$$

The care behavior of a child depends on her net utility of caregiving, ΔU_{ij} which corresponds to the utility gap between the situation when the child provides care ($a_{ij} = 1$)

and where she does not ($a_{ij} = 0$). The utility gap for the elder child is thus defined as follows:

$$\Delta U_{1j}(a_{2j}) = U_{1j}(1, a_{2j}) - U_{1j}(0, a_{2j}) \quad (1.2)$$

while the utility gap for the younger child is:

$$\Delta U_{2j}(a_{1j}) = U_{2j}(1, a_{1j}) - U_{2j}(0, a_{1j}) \quad (1.3)$$

Utility gaps can be either positive or negative. If it is positive, the child is a caregiver while she does not provide care if the utility gap is negative. Following the model implemented by [Fontaine *et al.* \(2009\)](#), we assume that the net benefit of caregiving depends on individual and family characteristics and on the care behavior of the sibling. It is decomposed as follows:

$$\begin{aligned} \Delta U_{1j}(a_{2j}) &= \alpha_1 \cdot X_{1j} + \beta_1 \cdot a_{2j} + \epsilon_{1j} \\ \Delta U_{2j}(a_{1j}) &= \alpha_2 \cdot X_{2j} + \beta_2 \cdot a_{1j} + \epsilon_{2j} \end{aligned} \quad (1.4)$$

$\alpha_1 \cdot X_{1j}$ (resp. $\alpha_2 \cdot X_{2j}$) captures the effect of the characteristics X_{ij} on the net benefit of caregiving. It includes child characteristics, parent and sibling characteristics. The choice of the variables is detailed in the next subsection.

$\beta_1 \cdot a_{2j}$ (resp. $\beta_2 \cdot a_{1j}$) is the interaction component: it measures the way the net utility to provide care is affected by care behavior of the sibling.

Note that both the α and the β are specific to the elder child and the younger child: the model allows the effects of the child and family characteristics to affect differently the care behavior of each child, and the interactions can be asymmetric.

Care behaviors of children might depend on unobserved characteristics that are likely to correlate within a family. To cope with this potential bias, we allow the error terms to be correlated within a family. We assume that the residuals are distributed according to a bi-variate normal density function: $(\epsilon_{1j}, \epsilon_{2j}) \sim N[0, 0, 1, 1, \rho]$, where ρ is the correlation coefficient between ϵ_{1j} and ϵ_{2j} .

We assume that an observed care arrangement is stable and corresponds to a pure Nash equilibrium: within a family, given the behavior of the sibling, no child wants to change her care behavior. We choose to model decisions as a non-cooperative game: children independently decide on their own behavior. Such a modeling is consistent with what has been done in the literature on intrafamily allocations regarding care to an elderly parent ([Hiedemann and Stern, 1999](#); [Pezzin and Schone, 1999](#); [Byrne *et al.*, 2009](#); [Fontaine *et al.*, 2009](#); [Antman, 2012](#)). It is argued to be relevant as adult siblings are independent and

might have conflicting interest (Antman, 2012). It also has the interest to be self-enforcing and then to avoid the need of binding agreements (Chen and Woolley, 2001). Alternative modeling would either consider the family as the unit of decision (unitary model) or allow for some cooperation within the family (cooperative bargaining model). Assuming a unique joint utility function for the whole family, the unitary model can be regarded as non-relevant for modeling decisions of adult individuals living separately (Antman, 2012). The cooperative bargaining model presents more interest for the investigation of children care decisions. Indeed, it could be the case that children behaviors depend on intra-sibling bargaining and adjustments. As underlined by Antman (2012), siblings might consider the joint maximization of their utilities relative to a threat point, that could be determined in comparison to utilities in the non-cooperative framework. Such a framework is appealing but is hard to implement empirically. To empirically cope with the possibility of cooperation, Engers and Stern (2002) decomposes the care decision in two steps. First, each child independently (non-cooperatively) chooses whether she will join the parental care decision; then, the involved children decide together what the care arrangement will be. It echoes the more general family bargaining model proposed by Konrad and Lommerud (2003), where human capital investment decisions are made non-cooperatively in a first stage and day-to-day allocation of time is determined later through Nash bargaining, with non-cooperative behaviour as a threat point. Sloan *et al.* (1997), focusing on the care decision of only one child, discusses two potential frameworks. In the first, either the child or the parent unilaterally makes the decision on the quantity of formal and informal care. In the second case, decisions about informal care are made jointly. In this case, the outcome of the joint decision depends on the bargaining power of both individuals, whose explaining factors are empirically captured. Knoef and Kooreman (2011) directly address the issue of the choice between a cooperative and non-cooperative framework when modeling the care decision of siblings. They compare the empirical estimations of two models, one non-cooperative (both siblings maximize their utility given the choice of the other and their own characteristics), the other cooperative (siblings maximize the sum of their utilities subject to their own constraint). They find that in most siblings, the non-cooperative framework has a better fit than the cooperative model.

Finally, decisions are assumed to be simultaneous. As formulated by Stöhr (2015), it is equivalent to assume that decisions are only infinitesimally spaced in time and repeated until an equilibrium is reached. This is a strong assumption however, preventing one child to choose first and to have a first mover advantage. This assumption is further discussed in Section 7.

A care arrangement (a_{1j}, a_{2j}) is a pure Nash equilibrium if:

$$\begin{cases} U_{1j}(a_{1j}, a_{2j}) \geq U_{1j}(a_{1j} - 1, a_{2j}) \\ U_{2j}(a_{2j}, a_{1j}) \geq U_{2j}(a_{2j} - 1, a_{1j}) \end{cases} \quad (1.5)$$

With N_j the set of Nash equilibria for a family j , the probability of each care arrangement to be a Nash equilibrium of N_j is:

$$\begin{cases} P(0 \in N_j) = P(\Delta U_{1j}(0) < 0 \cap \Delta U_{2j}(0) < 0) \\ P(1 \in N_j) = P(\Delta U_{1j}(0) > 0 \cap \Delta U_{2j}(1) < 0) \\ P(3 \in N_j) = P(\Delta U_{1j}(1) < 0 \cap \Delta U_{2j}(0) > 0) \\ P(4 \in N_j) = P(\Delta U_{1j}(1) > 0 \cap \Delta U_{2j}(1) > 0) \end{cases} \quad (1.6)$$

With the specification of the net utility described in Equation 1.4, the probability for each care arrangement to be a Nash equilibrium can be written:

$$\begin{aligned} P(0 \in N_j) &= F(-\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j}, \rho) \\ P(1 \in N_j) &= F(\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j} - \beta_2, -\rho) \\ P(2 \in N_j) &= F(-\alpha_1 \cdot X_{1j} - \beta_1, \alpha_2 \cdot X_{2j}, -\rho) \\ P(3 \in N_j) &= F(\alpha_1 \cdot X_{1j} + \beta_1, \alpha_2 \cdot X_{2j} + \beta_2, \rho) \end{aligned} \quad (1.7)$$

where F is the joint cumulative distribution of the bivariate normal.

As it often happens to be the case in models with multiple agents making discrete choice, this model is “incomplete” (Tamer, 2003): it can lead to multiple equilibria or no equilibrium. We overpass this difficulty with a selection rule applying to situations of multiple equilibria or absence of equilibrium.¹¹ With the selection rule, the probability of observing each care arrangement are estimated as a function of the exogenous variables and the model is estimated by maximum likelihood.¹²

5.2 Child and family determinants

We detail here the choices made to select the child and family determinants included in the estimation of the model (X_{ij} variables).¹³ Along with the child age, we study the effect of the family and professional status of each child. These characteristics affect the availability of the child (Le Bihan-Youinou and Martin, 2006; Peyrache and Ogg, 2017). Family status includes the marital status (living with a spouse or not) and the

¹¹See Appendix 10.1.A for details on the selection rule.

¹²The equations that are finally estimated are presented in Appendix 10.1.A (System 4.5).

¹³Appendix 10.2 provides the descriptive statistics on these variables.

parental situation (having children or not). Child care is likely to be a competing demand to parental care (negatively affecting the probability to provide care), but it could also increase contacts with the parent due to their grand-parenting role. Living in couple can reduce the availability of the child or make it possible to report the care on the spouse (expected negative effect), but it also makes it possible to share household chores and give the child more time for the parent (expected positive effect). The variable related to the professional status distinguishes between children who are active in the labour market (employed or seeking work) and inactive children (retired, students, homemakers or others)¹⁴. The opportunity costs of care is likely to be higher for active individuals; previous works have shown that the willingness to pay for diminishing the care provision by an hour is higher for caregivers active on the job market (Davin *et al.*, 2015). Additionally, we isolate the case when the parent was not able to answer the question on the job status, as it is likely to be correlated to her health status and the provision of informal care (Davin *et al.*, 2009). Overall, controlling for these variables is essential, especially because the definitions of care include the children cohabiting with their parent, who have specific family and professional status (Ogg *et al.*, 2015).

Regarding parental characteristics, we include, along with her age, the effect of her sex. It can affect both the volume and the nature of care. Indeed, women more frequently declare receiving regular care (Bonnet *et al.*, 2013) and the help they receive is more frequently material or financial. Conversely, men more frequently declare being provided care for the tasks of daily living (Soullier and Weber, 2011; Soullier, 2012). All parents are disabled but we distinguish between two disability levels: most disabled individuals are those who declare they need help to perform one of the ADL. Others encounter limitations for the IADL. We control for the marital status of the parent, as the literature has shown the importance of the spouse in the care provision, likely to substitute for care provided by children (Fontaine *et al.*, 2007; Weber, 2011) and it is confirmed in our description of care arrangements. We additionally test for the effect of the education level of the parent, isolating individuals who have the French *baccalauréat*. We also control for the income, isolating individuals whose income is below the last quartile of our sample (monthly income at least equal to €1,800). These variables, correlated with the social position of individuals, are assumed to affect the care provided by children through differences in the utilization of professional home care and specific social norms (Weber *et al.*, 2014).

The last type of variables included in the estimation relates to the sibling characteristics. These variables aims at capturing the contextual effects identified by Manski. For each child, the professional status of her sibling is controlled for, distinguishing the sibling

¹⁴As is explicitly stated in the questionnaire of the survey, the “other” category might refer to a case where the child is declared disabled and can not be active. This situation is rare in our sample (3.5% of children).

who is active in the labour market from other situations. Instead of including directly the sex of each child, we control for the sex composition of the sibling. Rarely used in the literature, this variable makes it possible to test for contextual interactions depending on the sex of children. It is a well-known fact that women are more systematically assigned to the role of caregiver (Bonnet *et al.*, 2013; Membrado, 2013). We would like to go further by studying if the effect of being a woman is different when the sibling is a man or when she is a woman. Finally, we include a dummy equal to one when the age difference between the children is superior to ten years.

Our estimation makes use of the quasi-totality of the available information on children. Two variables have not been directly included. The first is the socioprofessional category of the child, highly correlated with the professional status of the child and the education level of the parent. The second is the geographical proximity of children to their parent. This variable is potentially highly endogenous. Instead of determining the care behavior, the distance to the parent's location can be explained by the care behavior (reverse causality). It could also be a source of collinearity: living outside of the region of the parent is correlated to the family and professional status of children, as well as to the marital status and education level of the parent. Including this variable is thus likely to bias estimates and to lower their precision. In the robustness checks, we discuss the inclusion of these variables.

6 Results

6.1 From differentiation to convergent behaviors

Table 1.5 presents the estimation results, with the two definitions of care. In the first estimation, the effect of the determinants of care provision are estimated for the elder child (Column 1) and the younger child (Column 2), regarding as caregiver all the children cohabiting with their parent or declared caregiver, whatever the type of care provided (broad definition). In the second estimation (Columns 4 and 5), the definition of care is restricted to children cohabiting or declared caregiver for the performance of the tasks of daily living (restricted definition). In the estimation procedure, some coefficients have been forced to be equal for the elder and younger child: it is indicated in Column 3 (resp. 6) for the first (resp. second) estimation.

With the broad definition, important differences are observed when comparing the care behavior of the elder and the younger child. The involvement of the younger child appears to be more sensitive to her individual characteristics than the elder's involvement: her probability to be caregiver is lower when she lives in couple, she has children or she

is active in the labour market.¹⁵ Conversely, the elder child's behavior is only affected by her marital status. When restricting the definition of care to the help provided in the tasks of daily living, behaviors are more similar in terms of individual characteristics' effect: the elder child has a lower probability to provide care if she has children or if she is active. Situations when the parent was not able to respond to the question on the child's professional status are associated with a lower probability for the child to be caregiver. In both cases, children age is controlled for, such that the effects tied to differences in the life cycle should be limited.

The effect of parent characteristics according to the rank are more homogeneous. Whatever the definitions and the rank, children are more likely to be caregiver when the parent is older, lives alone or has a lower level of education. Both children are also more likely to be caregiver if the parent is their mother. This effect, however, is significant only for the broad definition of care; it suggests that the parent's sex mainly affects the material, financial care or the moral support. In addition, rank-related divergences are observed when we focus on the broad definition. A lower level of income and a higher level of disability increases the probability of the younger child to be caregiver. The effect of parent's income, however, disappears with the restricted definition. It suggests the effect observed was due to financial support from the younger child when the parent have a relatively lower income. The elder child's behavior is remarkably not affected by these two variables.

Regarding family variables, several regularities are observed. First, whatever the definition and the rank, a child has a higher probability to be caregiver when she is a woman whose sibling is a man. This results echoes previous findings on the systematic assignment of woman to the role of caregiver. But it also originally underlines the relative dimension of this effect: being a woman is significantly associated with a higher probability of being caregiver if, and only if, the sibling is a man. The only exception is observed the younger child, with the broad definition: in this case, it can only be said that being a man with a brother decreases the probability to be caregiver, compared to all other sex compositions. In both definitions, children do not react to the job status of their sibling. In addition, an important age gap decreases the probability to be caregiver for the younger child. An important age gap could correspond to situations when the elder child has earlier played a role of caregiver (helping the parent and caring for the younger child) and keeps on playing this role. In two-child families, a elder child much older than her sibling could also behave as if he was the only child; it would mechanically designate her as the caregiver (Weber, 2011).

¹⁵As we control for children age, the status on the labour market is not expected to reflect life cycle effects.

With respect to endogenous interactions, we finally observe asymmetric behaviors, whatever the definition of care that is used. *Ceteris paribus*, the elder child has a higher probability to be caregiver if the younger child is providing care; conversely, the younger child tends to be less frequently caregiver when the elder child is providing care, or does not react to the care behavior of their sibling (coefficient not significantly different from zero at conventional thresholds).

Table 1.5 – Determinants of care behaviors in two-child families

	Broad definition			Restricted definition		
	Elder	Younger	Coeff.	Elder	Younger	Coeff.
Constant	-0.364 (0.563)	-0.364 (0.563)	Yes	-0.464 (0.605)	-0.464 (0.605)	Yes
<i>Child characteristics</i>						
Age	-0.036*** (0.011)	-0.010 (0.010)	No	-0.032*** (0.011)	-0.016 (0.010)	No
Has a spouse <i>Ref: lives without a spouse</i>	-0.490*** (0.124)	-0.490*** (0.124)	Yes	-0.733*** (0.126)	-0.733*** (0.126)	Yes
Has children <i>Ref: has no children</i>	-0.174 (0.188)	-0.550*** (0.174)	No	-0.347** (0.140)	-0.347** (0.140)	Yes
Active in the labour market	-0.177 (0.158)	-0.641*** (0.158)	No	-0.308* (0.160)	-0.823*** (0.159)	No
The parent does not know the job status <i>Ref: retired, student, homemaker, other</i>	-1.434*** (0.376)	-1.434*** (0.376)	Yes	-2.027*** (0.469)	-2.027*** (0.469)	Yes
<i>Parent characteristics</i>						
Age	0.026*** (0.010)	0.026*** (0.010)	Yes	0.026** (0.011)	0.026** (0.011)	Yes
Woman	0.225** (0.116)	0.225** (0.116)	Yes	0.159 (0.128)	0.159 (0.128)	Yes
Has no spouse <i>Ref: lives with a spouse</i>	0.394*** (0.125)	0.394*** (0.125)	Yes	0.298** (0.121)	0.298** (0.121)	Yes
Has the <i>baccalauréat</i> <i>Ref: does not have the baccalauréat</i>	-0.519*** (0.191)	-0.519*** (0.191)	Yes	-0.707*** (0.219)	-0.707*** (0.219)	Yes
Monthly income \geq €1,800 <i>Ref: monthly income < €1,800</i>	-0.116 (0.159)	-0.1551*** (0.149)	No	-0.123 (0.114)	-0.123 (0.114)	Yes
One ADL limitation at least <i>Ref: IADL limitation(s)</i>	-0.073 (0.165)	0.368** (0.151)	No	0.104 (0.178)	0.468*** (0.157)	Yes
<i>Sibling characteristics</i>						
The other child is active	-0.132	-0.132	Yes	-0.076	-0.076	Yes

Continued on next page

Table 1.5 – Continued from previous page

	Broad definition			Restricted definition		
	Elder	Younger	Coeff.	Elder	Younger	Coeff.
<i>Ref: the other child retired, student, homemaker, other or the parent does not know</i>	(0.129)	(0.129)		(0.138)	(0.138)	
Ego = woman, alter = woman	-0.399** (0.175)	-0.215 (0.176)	Yes	-0.244* (0.138)	-0.244* (0.138)	Yes
Ego = man, alter = man	-0.459*** (0.144)	-0.459*** (0.144)	No	-0.481*** (0.161)	0.481*** (0.161)	Yes
Ego = man, alter = woman	-0.700*** (0.190)	-0.122 (0.199)	Yes	-0.402*** (0.145)	-0.402*** (0.145)	Yes
<i>Ego = woman, alter = man</i>						
Age gap ≥ 10 years	0.377 (0.236)	-0.720*** (0.265)	No	0.433* (0.242)	-0.514* (0.280)	No
<i>Ref: age gap < 10 years</i>						
<i>Interactions</i>						
The other child is caregiver	1.197*** (0.360)	-0.476 (0.524)	No	1.004*** (0.367)	-0.373 (0.428)	No
Correlation coefficient	-0.090 (0.361)			-0.015 (0.322)		
Log-likelihood	-486.795			-403.442		
Observations	479			479		

SAMPLE: 479 disabled elderly living in the community and having two children over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$. Columns “Coeff.” indicate if the coefficients were constrained to be equal.

7 Additional estimations

In this section, the results of several additional estimations are presented. Table 1.6 presents the coefficients obtained for the additional variables and the interaction terms in these robustness checks. We first focus on the broad definition for which care behaviors are more likely to be differentiated. We add to the control variables the geographical proximity of the child’s location to the parent’s home.¹⁶ We include a dummy indicating if the child lives in the parent’s region.¹⁷ Following the literature (see, for instance, Mulder and van der Meer (2009)), the geographical proximity is strongly correlated to the care behavior: living outside of the region decreases significantly the probability to

¹⁶This dimension is further explored in Appendix 10.3.A.

¹⁷We tried to use more precise indicators (living in the same municipality, or in the same department) but we encountered convergence issues.

be caregiver, for both children. Moreover, in this estimation, the implication of the elder child decreases the probability for the younger child to be caregiver (significant negative coefficient). Despite our concerns regarding collinearity, our results on the other determinants are robust to the inclusion of this dummy.

The model is estimated including as controls the socioprofessional category of the children. We use the classification of socioprofessional categories done by the *Institut nationale de la statistique et des études économiques* (INSEE). In this classification, six different categories are found: 1) farmers, 2) craftspersons, shopkeepers, company heads, 3) executives, intellectual professions, 4) intermediate professions, 5) employees, 6) workers. Higher socioprofessional categories are expected to have a lower probability to be caregiver, because of time constraints and higher opportunity costs. With executives and intellectual professions as a reference, being a worker or having an intermediate profession for the elder child, being farmer for the younger child, is associated with an increased probability to be caregiver. To ease the interpretation, we test the effect of a difference in the socioprofessional categories of the two children. We consider there is a difference when one of the children belongs to the first three categories while the other belongs to the last three categories. When the elder child belongs to the first categories and not the younger child, the probability to be caregiver is higher for the elder child and lower for the younger. In the reverse case, there is no effect on children care provision. We also interact the difference in the socioprofessional categories with the sex of each child.¹⁸ In this model, we control for the sex of each child rather than the sibling composition. It shows that when the elder child belongs to a higher socioprofessional category, if she is a woman, she has a higher probability to be caregiver, compared to a elder son or a sibling with no socioprofessional differences. When the younger child belongs to a higher socioprofessional category and is a women, she does not have a higher probability to be caregiver than a man. Thus, for the younger child, higher opportunity costs compensate the effect of being a woman on the probability to provide care, while it is not the case for the elder child.

At the parent's level, the model is also estimated with a control for the location of the parent: we include a dummy for residence in rural areas. No significant effect is observed for parent's rural residence and the results on other determinants are unchanged. We additionally control for the status of the respondent of the questionnaire (the individual, the individual helped by someone, or someone else). When someone else was involved in the survey (responded to the questionnaire or helped the individual), the probability for the younger child to be caregiver is higher; it is the case for the elder child only if someone helped the individual to respond. This inclusion does not affect the other variables, except

¹⁸For the sake of conciseness, these results are not presented in Table 1.6 but are available upon request.

a loss of significance for the effect of parent disability level and age for the younger child.

Other parental variables are included, which do not affect the results. When the parent is single, a sharing effect would possibly be observed if the parent is actually separated or divorced. We distinguish in the initial model separated or divorced parent on the one hand, and widowed or never-married parent on the other hand. There is no significant effect of this variable. When the disabled parent lives with a spouse, the spouse is more than likely to be caregiver. We include a dummy indicating if the spouse was declared as caregiver in the list of informal caregiver. This dummy negatively affects the probability to be caregiver only for the younger child. To take into account formal care and informal care provided by other relatives (broader family, friends, neighbours), we estimate the model including successively a dummy indicating if the parent is provided with formal care and a dummy indicating when the parent receives care from other relatives.¹⁹ According to these estimations, the children care behaviors are not affected by formal care nor by informal care from other relatives. The absence of a (negative) correlation between formal care consumption and informal care is surprising, as the literature has shown evidence of a substitution effect between formal care and informal care (Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Viitanen, 2007; Rapp *et al.*, 2011; Fontaine, 2012; Arnault, 2015). However, we are here focusing on care provision by children, at the extensive margin, instead of the overall volume of informal care. Moreover, for severely disabled individuals, the substitution effect is less likely to be observed (Bonsang, 2009). Results on other determinants are robust to the inclusion of these dummies.

We also restrict our sample to individuals aged 75 at least (64% of our initial sample). Probably due to a loss of precision, some variables that were previously significant from zero are not anymore, while the coefficient estimates do not change importantly. It is the case for the age variables, the parental sex for both children, the sex composition and the age gap for the younger child. The income of the parent, however, turns to negatively affect the probability of the elder child to be caregiver. Regarding interactions, they are still asymmetric with a positive coefficient for the elder child and a negative for the younger child, but only the younger child coefficient is significantly different from zero while the other is not.

With the definition of care restricted to the activities of daily living, we have tested the existence of a relationship between the provision of this type of care and other types of care. We include in the control variables the fact that the child is providing moral

¹⁹Formal care corresponds to individuals who have declare they receive help from a professional caregiver for the activities of daily living, either essential or instrumental; it is the case for 51.3% of parents in our sample. Informal care from other relatives corresponds to the care provided by the broader family (siblings of the parent for instance) or non-family members (neighbours, friends). One quarter of parents in our sample declares they receive informal care from other relatives.

support or material help.²⁰ The provision of care for the activities of daily living could increase the provision of moral support (or material help): in that case, we expect a positive relationship. If providing moral support or material help is a way to substitute to the care provided for daily living, we conversely expect a negative coefficient. Results shows that moral support or financial help are substitutes to the care for activities of daily living only for the younger children, while there is no significant relationship for the elder children. The sign and magnitude of interaction terms are robust to these inclusions.

²⁰The provision of material help only is scarce in our sample (0.5% of children). Thus, the results on this variable are likely to be driven by the provision of moral support.

Table 1.6 – Synthesis of additional results

	Variable coefficient		Interaction coefficients	
	Elder	Younger	Elder	Younger
BROAD DEFINITION				
<i>Baseline estimation</i>			1.197***	-0.476
<i>Children variables</i>				
Outside parent's region	-1.413***	-1.413***	0.852**	-0.531*
<i>Parent variables</i>				
Parent in rural area	-0.165	-0.165	1.172***	-0.501
Spouse as caregiver	0.053	-0.346*	1.300***	-0.668
Divorced or separated	-0.074	0.213	1.257***	-0.638
Other informal care	0.142	-0.131	1.205***	-0.440
Formal care	0.088	0.088	1.196***	-0.475
Respondent:				
Parent, with someone else	0.329**	0.329**		
Someone else	-0.147	0.560***	0.924**	-0.054
<i>Ref: parent alone</i>				
<i>Sibling variables</i>				
Difference in socioprofessional categories (SPC) :				
Elder: SPC+	-0.233*	-0.233*	1.144***	-0.499
Younger: SPC+	-0.044	-0.044		
<i>Ref: no difference in SCP</i>				
<i>Sample restriction</i>				
75+ only			0.385	-1.090***
RESTRICTED DEFINITION				
<i>Baseline estimation</i>			1.004***	-0.373
<i>Children variables</i>				
Provides material or moral support	-0.176	-1.077***	1.184***	-0.417

SAMPLES: 479 disabled elderly living in the community and having two children over the age of legal majority. Among them, 308 individuals are aged 75 or more (restricted sample).

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: * $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$. Estimations of the baseline model with additional variables or sample restrictions. Individual and family variables are controlled for.

8 Discussion and potential extensions

Our results show that care behaviors are relatively differentiated with a broad definition of care, while they are more similar when the definition of care is restricted to the care provided for the tasks of daily living. They confirm the importance of children family and professional situation as well as parent's marital status and education level. They informatively provide evidence for a relative gender effect : daughters are more frequently declared caregivers, especially when they have a brother rather than a sister. Finally, they

confirm the existence of asymmetric endogenous interactions.

Our results are relevant for a quite specific definition of disabled parents: we focus here on individuals who declare they need human help to perform some activities of daily living. We have tried to enlarge our sample by including all parents declaring they have at least one activity restriction.²¹ In this case, there are much less differences in child and family determinants according to the rank and the type of care provided, and we are not able to identify endogenous interactions. It is possibly due to the higher heterogeneity of our enlarged sample in terms of care needs compared to our baseline sample.

The data we use present several limitations. First, our results rests on the parent's declaration regarding the identification of disability, of caregiver children and with respect to the characteristics of the children. Moreover, reconstituted families are plausibly not taken into account.²² Moreover, we do not observe some determinants of care. Are children caregivers because of their preferences, or because of more systematic requests from the parent? Data on the demand or the frequency of contacts would be needed to take this point into account. Additionally, we could have tried to control for unobserved family norms using information on the birth country or the nationality of individuals, but there are few variations in our sample on these dimensions.²³

Our work focuses on the extensive margin of care, without saying anything on the volume of care provided by children. It thus only provides the first step in the analysis of care arrangement by understanding the decision to be caregiver. Along with the type of care provided, we do observe in the survey the volume of care provided by children.²⁴ Thus, it might be possible to estimate the determinants of the volume of care provided. This study would need to be carried out separately, as it raises specific technical issues. Focusing on families where the two children are caregiver would further restrict our sample size. Moreover, the utilization of a linear model would raise the "reflection problem" identified by Manski (Manski, 1993, 2000). A simple way to bypass this issue would be to transform linear variables (i.e. volume of care provided) into discrete variables (i.e. brackets of hours) (Brock and Durlauf, 2001).

We assume the simultaneity of care decisions. To comprehensively understand the genesis arrangements, a model with several decision moments would be useful (see for instance Hiedemann and Stern (1999); Engers and Stern (2002); Pezzin *et al.* (2007)). However, while being very demanding in terms of data, such structural models have

²¹See Appendix 10.3.B for details.

²²The questionnaire mentioned the children of the individual but it does not specify if it might include (or not) stepchildren. However, the document giving instructions to the persons in charge of filling the questionnaire makes it clear that the aim of this part is to know better on the legal descendants ("obligés alimentaires").

²³85% were born in France. 89% of individual are French by birth.

²⁴See Appendix 10.2 for descriptive statistics on the volume provided by children.

exclusively been developed for a single caregiver and have not yet considered multiple care arrangements. Assuming that the elder child move first, Appendix 10.1.B presents a simple estimation taking the elder child's behavior as exogenous to the behavior of the younger children. It is a limited empirical contribution on this question, which is open for future research.

Another field of extension is related to the size of the sibling we consider. We are focusing on two-child families, taking one step further compared to the literature focused on one only caregiver. However, mechanisms operating in larger families are still unknown and models making it possible to study them would be needed. Such models would require to specify assumptions on the aggregation of care behavior of others. For instance, the care decision of one child could depend on the fact that at least one other child is providing care. The literature on intra-household selection could offer interesting methods to study such a question. [Chort and Senne \(2013\)](#) builds on a model explaining the selection of migrant(s) among an household. This type of model could be useful to study the effect of children and family determinants, but might not be sufficient to study interactions. [Stöhr \(2015\)](#) studies the migration and care decisions in Moldova, with an explicit insight on the interactions of decisions within siblings. Working at the children level, he aggregates decisions of family members as the share of migrants among siblings. Although such approach also has its own limitations, it offers an interesting way of broading the analysis to larger families.

9 Conclusion

Our results shed light on the genesis of children care arrangement for a disabled elderly parent in France. The description of care arrangements confirm that the presence of a spouse for the disabled parent decreases the involvement rate of children. It also affects the impact of the sibling size on child involvement. In two-child families, behaviors are differentiated when considering several types of care, while they are more convergent when focusing on the care provided for the tasks of daily living. Endogenous interactions are asymmetric whatever the type of care: the elder child is more likely to be caregiver when the younger child is providing care, while the provision of care from the younger child is not affected by the elder's child behavior.

Results obtained at the European level with SHARE are akin to ours regarding the asymmetry of interactions and the effect of mixed siblings ([Fontaine *et al.*, 2009](#)). Nonetheless, differences are observed; in particular, parent variables mainly affect the behavior of the younger children. These differences could be due to the differences in the sample: [Fontaine *et al.* \(2009\)](#) focus on single parents, while we are including both single parents

and those living with a spouse. It could also come from differences in the scale of the study: Fontaine *et al.* (2009) work on several European countries, potentially heterogeneous, while we are focusing on France. Finally, it might result from differences in the definition of care used. Indeed, in SHARE, caregivers are not necessarily providing care regularly, in response to a disability problem.

Determinants of care behavior, interactions in particular, are thus asymmetric depending on the rank in the sibling. Results also provide additional and original evidence on the existing imbalance in care provision between men and women. In this context, a public policy that would encourage informal care as a major source of care provision could potentially increase the inequalities within sibling, especially with respect to the sex and the rank.

10 Appendices

10.1 Details on the econometric specification

10.1.A Selection rule

The equations provided in the subsection 5.1 describe a well-defined economic model ; this model, however, can not be directly estimated econometrically. Indeed, for some vectors of exogenous variables, the economic model can predict several equilibria or no equilibrium.

The absence of equilibrium ($N_j = \{\emptyset\}$) is likely when interactions are asymmetric (β_1 and β_2 do not have the same sign: $\beta_1 \cdot \beta_2 < 0$). In this case, one child tends to behave like her sibling, while the other chooses the care decision opposite to the one of her sibling. This coordination issue will lead to an unstable care arrangement, with the children successively changing their care behavior following the other's decision.

Multiple equilibria are likely when the care behaviors of children interact symmetrically (β_1 and β_2 do have the same sign). If both children want to provide care alone ($\beta_1 < 0$, $\beta_2 < 0$), it can result in either the elder or the younger child providing care alone ($N_j = \{1, 2\}$). Conversely, if the two children want to adopt the same care behavior, none or both can be caregivers ($N_j = \{0, 3\}$).

This indetermination can be dealt with by imposing a selection rule in the region of non-uniqueness (Krauth, 2006). The selection rule is a function $S(K_j, N_j)$ which assigns a probability to each Nash equilibrium in the regions of non-uniqueness or no equilibrium.

To describe a probability distribution, the selection rule must obey the following constraints:

$$sel(k_j, N_j) \geq 0 \tag{1.8}$$

$$\sum_{k_j} sel(K_j, N_j) = 1 \tag{1.9}$$

In addition, there is the constraint that only existing Nash equilibrium can be attributed a positive probability.

$$\forall k_j \notin N_j, sel(k_j, N_j) = 0 \tag{1.10}$$

When the economic model predicts no equilibrium, each equilibrium k_0 , k_1 , k_2 and k_3 will be chosen with a probability $S(k_0, \{\emptyset\})$, $S(k_1, \{\emptyset\})$, $S(k_2, \{\emptyset\})$ and $S(k_3, \{\emptyset\})$. When the economic model predict multiple equilibria, each equilibrium included in the set of multiple equilibria will be assigned a probability. In each case, the sum of the probability

assigned to each case will sum to 1.

$$\begin{aligned}
 \sum_{j=0}^3 sel(k_j, \{\emptyset\}) &= 1 \\
 sel(1, \{1, 2\}) + sel(2, \{1, 2\}) &= 1 \\
 sel(0, \{0, 3\}) + sel(3, \{0, 3\}) &= 1
 \end{aligned} \tag{1.11}$$

With the selection rule, the probability of observing each care arrangements according to the different sets of Nash equilibrium can be written:

$$\begin{aligned}
 P(k_j = 0) &= P(N_j = \{0\}) + sel(0, \{0, 3\}).P(N_j = \{0, 3\}) + sel(0, \{\emptyset\}).P(N_j = \{\emptyset\}) \\
 P(k_j = 1) &= P(N_j = \{1\}) + sel(1, \{1, 2\}).P(N_j = \{1, 2\}) + sel(1, \{\emptyset\}).P(N_j = \{\emptyset\}) \\
 P(k_j = 2) &= P(N_j = \{2\}) + sel(2, \{1, 2\}).P(N_j = \{1, 2\}) + sel(2, \{\emptyset\}).P(N_j = \{\emptyset\}) \\
 P(k_j = 3) &= P(N_j = \{3\}) + sel(3, \{0, 3\}).P(N_j = \{0, 3\}) + sel(3, \{\emptyset\}).P(N_j = \{\emptyset\})
 \end{aligned} \tag{1.12}$$

To be able to implement the model econometrically, we finally need to write each probability of observing a given care arrangements as a function of the exogenous variables. To do so, we express the probability of each care arrangement to be a unique Nash equilibrium given its probability to be a Nash equilibrium, from which we subtract the probability that it belongs to a set of multiple equilibrium.

$$\begin{aligned}
 P(N_j = \{0\}) &= P(0 \in N_j) - P(N_j = \{0; 3\}) \\
 P(N_j = \{1\}) &= P(1 \in N_j) - P(N_j = \{1; 2\}) \\
 P(N_j = \{2\}) &= P(2 \in N_j) - P(N_j = \{1; 2\}) \\
 P(N_j = \{3\}) &= P(3 \in N_j) - P(N_j = \{0; 3\})
 \end{aligned} \tag{1.13}$$

We express the probability of having a set of multiple equilibrium with respect to the probability of each care arrangement to be a Nash equilibrium.

$$\begin{aligned}
 P(N_j = \{1; 2\}) &= \mathbb{1}_{\beta_1 < 0, \beta_2 < 0} \cdot [P(0 \in N_j) + P(1 \in N_j) + P(2 \in N_j) + P(3 \in N_j) - 1] \\
 P(N_j = \{0; 3\}) &= \mathbb{1}_{\beta_1 > 0, \beta_2 > 0} \cdot [P(0 \in N_j) + P(1 \in N_j) + P(2 \in N_j) + P(3 \in N_j) - 1] \\
 P(N_j = \{\emptyset\}) &= \mathbb{1}_{\beta_1, \beta_2 < 0} \cdot [1 - P(0 \in N_j) - P(1 \in N_j) - P(2 \in N_j) - P(3 \in N_j)]
 \end{aligned} \tag{1.14}$$

Dummies $\mathbb{1}_{\beta_1 < 0, \beta_2 < 0}$, $\mathbb{1}_{\beta_1 > 0, \beta_2 > 0}$ and $\mathbb{1}_{\beta_1, \beta_2 < 0}$ respectively refer to situations when in-

teractions are symmetric and negative, symmetric and positive, and asymmetric. The presence of these dummies indicates that the likelihood function will not be differentiable at the points $\beta_1 = 0$ and $\beta_2 = 0$.

We replace in Equation 1.12 the expressions given in Equations 1.7 and 1.13: we can thus express the probability of each outcome as a function of the exogenous variables, the selection rule parameters and the parameters α , β , ρ .

$$\begin{aligned}
 P(k_j = 0) &= F(-\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j}, \rho) + sel(0, \{0, 3\}) \cdot \mathbb{1}_{\beta_1 > 0, \beta_2 > 0} \cdot [A - 1] \\
 &\quad + sel(0, \{\emptyset\}) \cdot \mathbb{1}_{\beta_1, \beta_2 < 0} \cdot [1 - A] \\
 P(k_j = 1) &= F(\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j} - \beta_2, -\rho) + sel(1, \{1, 2\}) \cdot \mathbb{1}_{\beta_1 < 0, \beta_2 < 0} \cdot [A - 1] \\
 &\quad + sel(1, \{\emptyset\}) \cdot \mathbb{1}_{\beta_1, \beta_2 < 0} \cdot [1 - A] \\
 P(k_j = 2) &= F(-\alpha_1 \cdot X_{1j} - \beta_1, \alpha_2 \cdot X_{2j}, -\rho) + sel(2, \{1, 2\}) \cdot \mathbb{1}_{\beta_1 < 0, \beta_2 < 0} \cdot [A - 1] \\
 &\quad + sel(2, \{\emptyset\}) \cdot \mathbb{1}_{\beta_1, \beta_2 < 0} \cdot [1 - A] \\
 P(k_j = 3) &= F(\alpha_1 \cdot X_{1j} + \beta_1, \alpha_2 \cdot X_{2j} + \beta_2, \rho) + sel(3, \{0, 3\}) \cdot \mathbb{1}_{\beta_1 > 0, \beta_2 > 0} \cdot [A - 1] \\
 &\quad + sel(3, \{\emptyset\}) \cdot \mathbb{1}_{\beta_1, \beta_2 < 0} \cdot [1 - A]
 \end{aligned} \tag{1.15}$$

With:

$$\begin{aligned}
 A &= P(0 \in N_j) + P(1 \in N_j) + P(2 \in N_j) + P(3 \in N_j) \\
 &= F(-\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j}, \rho) + F(\alpha_1 \cdot X_{1j}, -\alpha_2 \cdot X_{2j} - \beta_2, -\rho) \\
 &\quad + F(-\alpha_1 \cdot X_{1j} - \beta_1, \alpha_2 \cdot X_{2j}, -\rho) + F(\alpha_1 \cdot X_{1j} + \beta_1, \alpha_2 \cdot X_{2j} + \beta_2, \rho)
 \end{aligned} \tag{1.16}$$

We are able to estimate our parameters α , β , ρ once the selection rule is specified. Our selection rule is the following : in the absence of equilibrium, we attribute to each Nash equilibrium a probability to be selected equal to the frequency observed for this care arrangement in the sample. For multiple equilibria, we attribute to each of the two possible equilibria a probability of 1/2 to be selected (random equilibrium).

10.1.B Considering sequentiality

To take into account the potential non-simultaneity of decisions, we provide here an alternative estimation where the decision of the younger child depends on the decision of the decision (and the characteristics) of the elder child, which is regarded as given. Table 1.7 presents the results of a Probit estimation at the younger child level in two-child families. It shows that the care behavior of the younger and the elder children are positively correlated: with both definitions of care, when the elder child is caregiver, the probability of the younger child to be caregiver is higher. The coefficient, however, only reflects a correlation and illustrates the fact that both children are more frequently providing care together than alone. In our baseline estimations, we are estimating the probability to observe a given care arrangement given children and family variables and interactions. Studying the care arrangements rather than the individual behaviors as dependent variable makes it possible to disentangle between the effect of the elder child behavior on the behavior of the younger, and the reverse effect.

Table 1.7 – Determinants of care provision by younger children

	Younger child is caregiver	
	Broad definition	Restricted definition
<i>Younger child characteristics</i>		
Age	-0.000 (0.001)	-0.002 (0.002)
Woman	0.283** (0.138)	0.405*** (0.154)
Has a spouse	-0.283* (0.164)	-0.482*** (0.182)
Has children	-0.510*** (0.185)	-0.081 (0.208)
Active on the labour market	-0.521*** (0.162)	-0.595*** (0.168)
Lives outside of the parent's region	-1.241*** (0.226)	-1.148*** (0.294)
<i>Elder child characteristics</i>		
Is caregiver (broad)	0.691*** (0.167)	
Is caregiver (restricted)		0.506*** (0.191)
Woman	-0.076 (0.141)	0.005 (0.153)
Age	-0.000 (0.001)	0.000 (0.001)
Has a spouse	0.477*** (0.183)	0.654*** (0.211)
Has children	0.007 (0.195)	-0.235 (0.217)
Lives outside of the parent's region	0.342** (0.174)	-0.098 (0.199)
Parental controls	Yes	Yes
Observations	479	479
Log-likelihood	-234.617	-192.560

SAMPLE: 479 younger children in two-child families having a disabled elderly living in the community.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

10.2 Descriptive statistics on the sample

We first provide in Table 1.8 and Table 1.9 the descriptive statistics on the variables exploited in our estimations.

Table 1.8 – Children characteristics

		Caregiver(s):			Total	
		None	Elder child	Younger child		Both children
Age (years) ^(a)	Elder	49.73	53.02	55.04	52.63	51.63
	Younger	45.19	45.49	50.42	47.99	46.68
Has a spouse (%)	Elder	76.40	46.67	80.65	65.79	71.82
	Younger	77.20	61.67	56.99	60.53	68.68
Has children (%)	Elder	81.60	70.00	81.72	82.89	80.38
	Younger	82.40	70.00	73.12	64.47	76.20
Active on the labour market (%)	Elder	76.80	51.67	56.99	61.84	67.43
	Younger	86.00	71.67	59.14	65.79	75.78
The parent does not know the job status (%)	Elder	2.80	6.67	5.38	0.00	3.34
	Younger	2.80	3.33	1.08	0.00	2.09

SAMPLE: 479 disabled elderly living in the community and having two children over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: unweighted frequencies. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided) or cohabiting with her parent.

(a) computed for children whose parent answered the question (469 elder, 474 younger children).

Figure 1.3 presents the number of care hours provided by caregiver children for the activities of daily living. Following the correction made by the Ministry of Health, we are only able to exploit the volume of care for informal caregivers providing care for the activities of daily living. This volume of care, though, is not available for all the children that have been declared caregivers. It is observable only for caregivers whose parent has been able to declare both the frequency and the number of hours provided at the frequency. Consequently, there are numerous missing values (61 missing values / 185 caregivers for the activities of daily living). It should be taken into account when reading the Figure. Figure 1.3 shows that, among children with observed volume of care, younger children provide on average 20 hours per week while the average volume provided by elder children is lower (16 hours per week). The heterogeneity in the volume is more important for younger children, with the first quartile at 5 hours per week (3 for elder children), the third quartile is at 28 (21 for elder children). More extreme values, however, are observed among elder children. This short and incomplete description shows that being caregiver covers a large variety of situations.

Table 1.9 – Parent and family characteristics

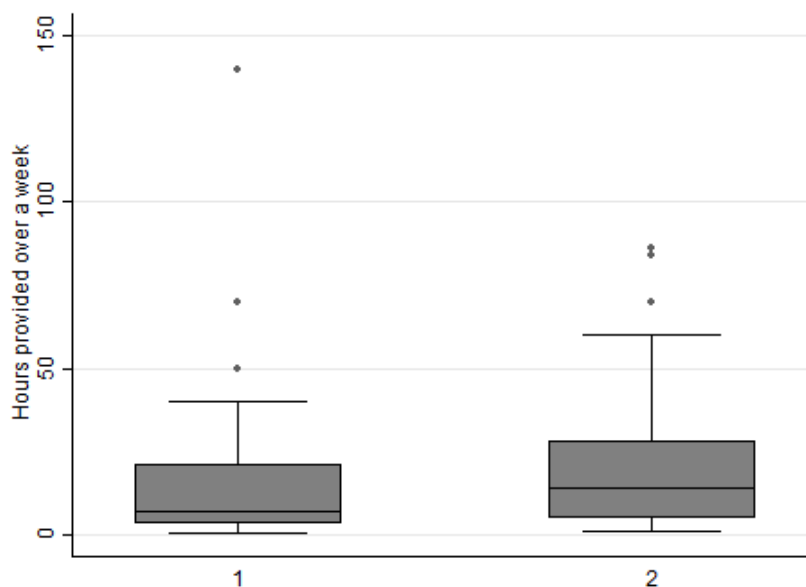
	None	Caregiver(s):			Total
		Elder child	Younger child	Both children	
<i>Parent characteristics</i>					
Age	75.11	80.17	80.47	78.67	77.35
Woman (%)	62.80	70.00	74.19	82.89	69.10
One ADL limitation at least (%)	23.20	21.67	33.33	36.84	27.14
Has the <i>baccalauréat</i> (%)	16.00	3.33	7.53	6.58	11.27
Monthly income \geq € 1800 (%)	45.20	43.33	33.33	17.11	38.20
<i>Sibling characteristics</i>					
Elder = woman, younger = man (%)	20.40	46.67	22.58	31.58	25.89
Elder = man, younger = woman (%)	27.20	15.00	37.63	23.68	27.14
Elder = woman, younger = woman (%)	26.80	23.33	24.73	28.95	26.30
Age gap > 10 years (%)	7.20	21.67	8.60	7.89	9.39

SAMPLE: 479 disabled elderly living in the community and having two children over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: unweighted frequencies. A caregiver child is a child declared as caregiver by the parent (whatever the type of care provided) or cohabiting with her parent.

Figure 1.3 – Volume of care provided by children for the activities of daily living



SAMPLE: 124 children over the age of legal majority declared caregivers for the activities of daily living by a disabled elderly parent living in the community. Only children whose parent has been able to quantify the volume of care provided are included.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: “1” refers to the group of elder children and “2” refers to the group of younger children.

10.3 Additional results

10.3.A Child proximity and care decisions

In this section, we further explore the effect of the proximity of the child on the decision to be caregiver, differentiating according to the type of care provided (Table 1.10). As we are mainly interested in the effect of the inclusion of proximity, we do not differentiate children according to their rank. Consequently, we do not include the sex composition of the siblings, the age gap, the job status of the other child nor the interactions.

Living outside of the parent's region could decrease the probability to be caregiver for domestic help but could be associated with provision of moral support or material help. Indeed, moral support and material help do not require the child to be physical present. A child living far from her parent is likely to compensate the distance with other types of care (Bonsang, 2007). Moreover, a higher distance between the caregiver and the individual she is taking care of has been found to increase her willingness to pay for being replaced by a formal caregiver (Davin *et al.*, 2015).

Table 1.10 shows that living outside of the parent's region systematically implies a lower probability to be caregiver, whatever the type of care (though the magnitude of the effect is lower for material help). Including this variable also cancels the significance of the effect of the parent's education level for moral support and material help.

Table 1.10 – Individual and parental determinants of care provision

	Broad definition of care		Moral support		Domestic help		Material help	
<i>Child characteristics</i>								
Age	-0.001 (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.001 (0.000)	-0.001** (0.000)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Woman	0.346*** (0.093)	0.399*** (0.097)	0.288*** (0.095)	0.320*** (0.098)	0.426*** (0.106)	0.507*** (0.113)	0.061 (0.145)	0.062 (0.147)
Has a spouse	-0.304*** (0.112)	-0.216* (0.118)	-0.367*** (0.114)	-0.303** (0.119)	-0.449*** (0.123)	-0.397*** (0.133)	-0.469*** (0.164)	-0.442*** (0.167)
Has children	-0.025 (0.127)	-0.038 (0.134)	0.023 (0.131)	0.018 (0.136)	0.034 (0.145)	0.036 (0.157)	-0.223 (0.182)	-0.221 (0.185)
Active on the labour market	-0.207* (0.108)	-0.208* (0.111)	-0.108 (0.111)	-0.104 (0.113)	-0.403*** (0.116)	-0.446*** (0.122)	-0.033 (0.167)	-0.024 (0.167)
Lives outside of the parent's region		-1.162*** (0.143)		-0.929*** (0.142)		-1.573*** (0.235)		-0.462** (0.215)
<i>Parent characteristics</i>								
One ADL limitation at least	0.192* (0.104)	0.210* (0.108)	0.108 (0.107)	0.117 (0.110)	0.397*** (0.113)	0.429*** (0.120)	-0.123 (0.167)	-0.132 (0.169)
Has the <i>baccalauréat</i>	-0.412** (0.168)	-0.261 (0.177)	-0.396** (0.174)	-0.266 (0.181)	-0.506** (0.205)	-0.398* (0.222)	-0.470* (0.284)	-0.383 (0.285)
Woman	0.252** (0.109)	0.300*** (0.112)	0.224** (0.112)	0.258** (0.115)	0.288** (0.127)	0.367*** (0.135)	0.013 (0.175)	0.044 (0.177)
Age	0.017*** (0.006)	0.019*** (0.006)	0.016*** (0.006)	0.018*** (0.006)	0.019*** (0.007)	0.023*** (0.007)	0.024*** (0.009)	0.026*** (0.009)
Monthly income \geq € 1800	-0.385*** (0.102)	-0.337*** (0.106)	-0.354*** (0.105)	-0.312*** (0.108)	-0.134 (0.113)	-0.076 (0.120)	0.065 (0.157)	0.084 (0.158)
Lives without a spouse	0.397*** (0.104)	0.397*** (0.108)	0.350*** (0.107)	0.342*** (0.110)	0.255** (0.118)	0.212* (0.125)	0.431** (0.174)	0.403** (0.176)
Observations	958	958	958	958	958	958	958	958

SAMPLE: 958 children from two-child families, over the age of legal majority, having a disabled elderly parent living in the community.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

10.3.B Change in the definition of disability in the sample

In our baseline sample, individuals are regarded as disabled if they declare they need to be provided with care by someone else to perform at least one ADL or IADL. We test here the effects of enlarging our sample to individuals who declare they have restrictions in the activities of daily living (essential or instrumental). This sample counts 1,550 disabled elderly having two children. The heterogeneity in the demand for informal care is likely to be more important in this sample than in our baseline sample. The estimation of our model on this sample induces a gain of precision in all control variables (child and family variables), with signs consistent with our baseline findings on control variables. It is the case for both types of care. Thus, the differentiation of behaviors according to the rank and the definition of caregiving is much less important than in our baseline estimations. Regarding interaction coefficients (reported in Table 1.11), they are not significant, in both definitions. Our baseline results are relevant for the specific case when activity restrictions generate a demand for human care, but not for the broader case of activity restrictions in general.

Table 1.11 – Interactions in care provision with an enlarged sample

	Broad definition		Restricted definition	
	Elder	Younger	Elder	Younger
<i>Interactions</i>				
The other child is caregiver	-0.187 (0.213)	0.002 (0.225)	0.292 (0.269)	-0.314 (0.269)
Controls	Yes		Yes	
Correlation coefficient	0.497** (0.206)		0.315 (0.228)	
Log-likelihood	-1168.155		-969.845	
Observations	1150		1150	

SAMPLE: 1,150 disabled elderly living in the community and having two children over the age of legal majority.

SOURCE: HSM survey (DREES and INSEE, 2008)

NOTES: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Compared to the baseline estimations, these individuals are “disabled” in the sense that they have activity restrictions (ADL or IADL).

Chapter 2

Pay less, consume more?

The price elasticity of home care for the disabled elderly in France

This chapter was co-authored
with **Marianne Tenand**.

Summary of the chapter

Little is known about the price sensitivity of demand for home care of the disabled elderly. We partially fill this knowledge gap by using administrative data on the beneficiaries of the main French home care subsidy program in a department and exploiting inter-individual variation in provider prices. We address the potential endogeneity of prices by taking advantage of the unequal spatial coverage of providers and instrumenting price by the number of municipalities served by a provider. We estimate a price elasticity of around -0.4 that is significantly different from both 0 and -1. This less than proportionate response of consumption to price has implications for the efficiency and redistributive impact of variations in copayments in home care subsidy schemes.

Classification

JEL Classification: C24; D12; I18; J14.

Keywords: Long-term care, home care, disabled elderly, price elasticity, censored regression.

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Contents of the Chapter

1	Introduction	108
2	Institutional context and demand for home care	110
2.1	The APA program	110
2.2	Computation rules of APA subsidies	111
2.3	Modeling demand for home care with APA	111
3	Data	113
3.1	Administrative data from a Departmental Council	113
3.2	Sample selection	113
3.3	Descriptive statistics	114
4	Empirical strategy	116
4.1	A censored measure of home care consumption	116
4.2	Econometric specification	116
4.3	Identification using cross-sectional variations in prices	117
4.4	An instrumental variable strategy	118
5	Results and discussion	120
5.1	Main results	120
5.2	Further results and robustness checks	121
5.3	Discussion	122
6	Conclusion	127
7	Appendices	128
7.1	Additional information on the data	128
7.2	Specifications	134
7.3	Maximum likelihood estimation	138
7.4	Determinants of the care plan volume and censoring	142
7.5	The home care sector in France	144
7.6	Explaining variations in provider prices	146
7.7	Robustness checks	152

1 Introduction

Like most developed countries, France is facing the ageing of its population: due to the increase in life expectancy and the advance in age of baby-boomers, the share of the population above 75 is predicted to grow from 9.0% in 2013 to 17.2% in 2060 (Blanchpain and Buisson, 2016). As healthy years fall short of the life expectancy (Cambois and Robine, 2017), the number of the elderly needing assistance to perform the activities of daily living is expected to grow substantially. Most disabled elderly keep on living in the community rather than entering specialized institutions (Colombo *et al.*, 2011). Besides medical and nursing care, they are often provided with domestic help and personal care. Assistance may be provided by relatives (informal care) and also by professional services (formal care), whose utilization is increasing. In most countries, public policies foster the utilization of formal home care by subsidizing its consumption. These programs, however, only partially cover the cost of professional home care and the disabled elderly often bear non-negligible OOP costs. In France, the average monthly OOP payment for home care was estimated to be €300 in 2011 (Fizzala, 2016), or over one fifth of the average pension (Solard, 2015).

We address the following question: how sensitive to price are the disabled elderly when consuming professional home care? Besides concerns regarding the financial accessibility of long-term care services, OOP payments raise efficiency issues. As in the health care context, generous home care subsidies may induce over-consumption and a welfare loss, while insufficient coverage could have adverse health effects (Stabile *et al.*, 2006; Rapp *et al.*, 2015; Barnay and Juin, 2016) or induce beneficiaries to substitute home care for more expensive institutional care (Ettner, 1994; Guo *et al.*, 2015). Uncovering the impact of OOP price on home care consumption is crucial to design an optimal subsidy policy that would achieve *ex ante* insurance of uncertain LTC costs while limiting *ex post* demand-side moral hazard (Zeckhauser, 1970; Cutler and Zeckhauser, 2000; Bakx, Chernichovsky, Paolucci, Schokkaert, Trottmann, Wasem and Schut, 2015). Our paper brings evidence on this empirical question by estimating the price elasticity of the demand for non-medical home care services of the disabled elderly, at the intensive margin.

We focus on the French home care scheme targeted to the disabled elderly, the APA policy. Administrative records of the scheme provide detailed information on home care consumption and OOP payments of APA beneficiaries, but they are available only at the local level. We use an original dataset made of the individual records we collected for the beneficiaries of a given Departmental Council (*Conseil départemental*). We exploit inter-individual variations in provider prices to identify consumer price elasticity. Price endogeneity may arise if APA beneficiaries non-randomly choose their home care provider.

To address this issue, we exploit the unequal spatial coverage by providers in the department. We fit a censored regression model to deal with observational issues and control for disposable income and other individual characteristics likely to affect the consumption of home care. Our results indicate a negative price elasticity, with point estimates ranging from -0.5 to -0.1 . According to our favoured estimation, an increase of 10% of the hourly OOP price would reduce total hours consumed by 4% on average, or 70 minutes per month for a beneficiary consuming the median monthly volume of 18 hours. Although confidence intervals are relatively large, we statistically reject a price elasticity of both 0 and -1 in most specifications. We thus conclude to a significant but limited volume effect of an OOP price variation.

Our paper provides one of the very first estimates of the price elasticity of the demand for home care services of the disabled elderly. Despite the growing concern about the financing of long-term care, the impact of OOP payments on the consumption of home care has been little investigated in the economic literature. A few papers tested for the effect of benefiting from subsidies on the utilization of paid home care (Coughlin *et al.*, 1992; Ettner, 1994; Pezzin *et al.*, 1996; Stabile *et al.*, 2006; Rapp *et al.*, 2011; Fontaine, 2012); because of data limitations, they were not able to quantify the price sensitivity. To our knowledge, the only existing studies addressing this gap in the literature exploit French data. Using national survey data, Hege (2016) makes assumptions on unobserved OOP prices and estimates a price elasticity of -0.16 . Bourreau-Dubois *et al.* (2014) use APA records from a department to observe exact home care prices, as we do, and estimate an elasticity of -0.55 . We use a different, original dataset and propose an instrumental variable strategy to deal with potential price endogeneity.

Our results entail important policy implications, as home care subsidy schemes are expanding with population ageing. Home care consumption is found to be price sensitive, meaning that home care support programs have efficiency implications. Moreover, since consumption of home care reacts less than proportionately to a price change, home care subsidies should be regarded as a tool to achieve redistribution from taxpayers to the disabled elderly and reduce OOP spending on long-term care.

2 Institutional context and demand for home care

2.1 The APA program

The French APA program aims at fostering the utilization of professional care services by the elderly requiring assistance in the activities of daily living (household chores, meal preparation or personal hygiene). The APA policy is established at the national level and implemented at the departmental level.¹ To be eligible, an individual must be at least 60 years-old and recognized as disabled. If she applies to the program,² she receives at home a specific assessment from a team managed by the Departmental Council, called the evaluation team, made of medical professionals (nurses, doctors) and/or social workers. The evaluation team visits each APA applicant to evaluate her needs of assistance using a national standardized scale. The applicant is thus assigned a disability group (*Groupe Iso-Ressources*, or GIR). Individuals found to be moderately (GIR-4) to extremely disabled (GIR-1) are eligible for APA, while the least severely disabled (GIR-5 or -6) are not.

The evaluation team then establishes a “personalized care plan”. This document lists the activities for which the individual needs assistance and sets the number of hours necessary to their realization. It gives the maximum number of hours eligible for APA subsidies of each beneficiary, called the care plan volume.³ Up to the care plan volume, the OOP price of each hour of care is lowered by the APA subsidy. The beneficiary is free to consume hours beyond the care plan volume but there are no more subsidies.

When setting the care plan volume, the evaluation team supposedly takes into account the needs of the beneficiary in terms of assistance with the activities of daily living. By law, the care plan volume should depend on the administrative disability group. Gender and age may influence the care plan volume, as they correlate with unobserved health problems and housekeeping skills. Additionally, even though matrimonial status and family structure are not supposed to influence the care plan volume, anecdotal evidence suggests that the evaluation team takes into account the possible assistance regularly provided by relatives when establishing the care plan; it appears to depend on departmental orientations (Billaud *et al.*, 2012). Appendix 7.4 provides additional elements on the set up of the care plan volume.

¹Metropolitan France is divided into 95 departments.

²See the introduction of the thesis for more information on the application process and potential non take-up.

³The monetary valuation of the care plan volume must not exceed a legal ceiling, which depends on the disability level. At the end of 2014, the ceiling was €1,313 (resp. €563) per month for GIR -1 (resp. GIR -4).

2.2 Computation rules of APA subsidies

For subsidized hours, the APA beneficiary is charged an hourly OOP price that depends on both the provider price for one hour of care, and a copayment rate, increasing with disposable income. For low-income individuals (below €739 per month at the end of 2014) the copayment rate is zero, while it reaches 90% for the richest beneficiaries (monthly income above €2,945). In between the two, the copayment rate is an increasing linear function of disposable income.⁴

If the provider chosen by the beneficiary is regulated, then the hourly OOP price is given by applying the copayment rate to the regulated price charged by the provider.⁵ For “non-regulated” providers,⁶ the copayment rate is applied to a lump-sum price to get the OOP price. This distinction has important implications for what can be known of beneficiaries’ OOP payments, since Departmental Councils usually keep track only of the prices of regulated providers.

2.3 Modeling demand for home care with APA

We write the Marshallian demand for professional home care assuming a heterogeneity-only model (Moffitt, 1986):

$$h_i^* = g(CP_i, \hat{I}_i; X_i) + \nu_i \quad (2.1)$$

where h_i^* is the number of hours of home care consumed by individual i and $g(\cdot)$ denotes the demand function. Care consumption depends on the consumer (or OOP) price for one hour of home care, CP_i , on the total disposable income available for consumption \hat{I}_i , and on individual sociodemographic characteristics, X_i . ν_i is an individual preference shifter.

With APA, up to the care plan volume denoted \bar{h}_i , the hours consumed are subsidized. The consumer price is $CP_i = c(I_i)p_i$, where p_i is the hourly provider price for individual i and the copayment rate c_i is a function of individual i ’s monetary disposable income: $c_i = c(I_i)$, with $c(\cdot)$ a linear function.

Beyond the care plan volume \bar{h}_i , the consumer price equals the full provider price as

⁴The schedule of APA copayments was substantially reformed in 2016. We describe the pre-reform schedule.

⁵49 metropolitan Departmental Councils out of the 73 that answered a national survey conducted in 2012 applied this computation rule (LEDa-LEGOS and CES, 2012; Bourreau-Dubois *et al.*, 2015). Regulated providers are generally priced by the Departmental Councils.

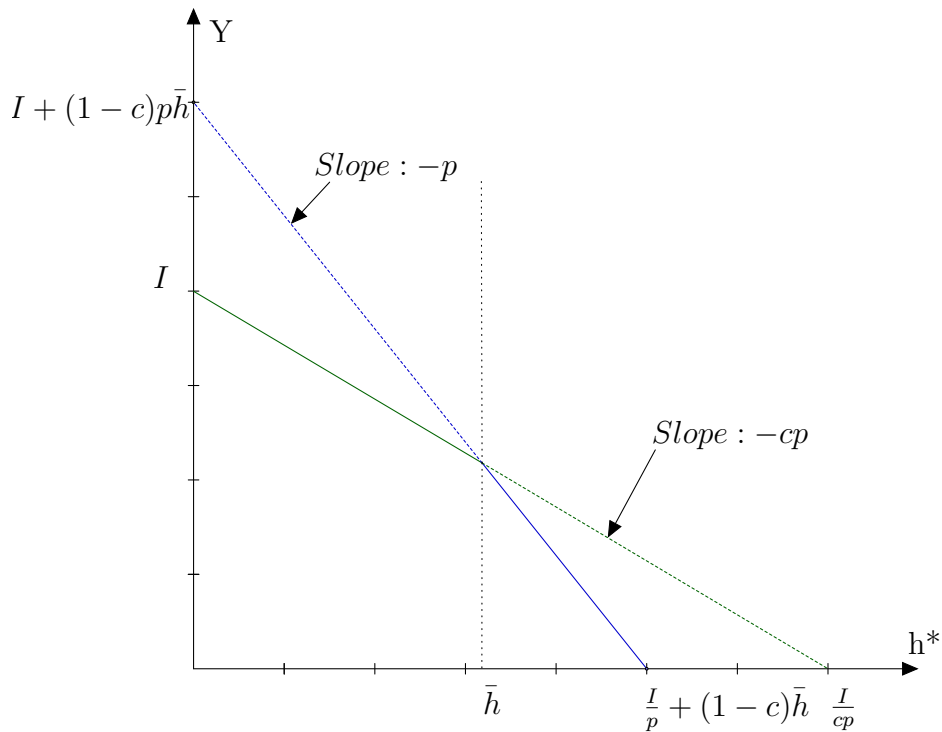
⁶It can be either a non-regulated structure (*service agréé non-autorisé*) or an over-the-counter worker (*gré-à-gré* or *mandataire*). See Appendix 7.5 for more details on the French home care sector.

there is no APA subsidy any more. The budget constraint is:

$$\begin{cases} I_i = c_i p_i h_i^* + Y_i & \text{if } h_i^* \leq \bar{h}_i \\ I_i = c_i p_i \bar{h}_i + p_i (h_i^* - \bar{h}_i) + Y_i & \iff I_i + (1 - c_i) p_i \bar{h}_i = p_i h_i^* + Y_i \text{ if } h_i^* > \bar{h}_i \end{cases}$$

where Y denotes the composite good, with price set to 1. The APA program creates a kink in the budget constraint of the beneficiary (Figure 2.1).⁷

Figure 2.1 – Budget constraint for home care under the APA program



As shown by the previous system, when deciding upon an increase in home care consumption beyond \bar{h}_i , the individual should take into account not only her monetary disposable income I_i but also the subsidies received on the first \bar{h}_i hours of care she has consumed. Denoting $\tilde{I}_i = I_i + (1 - c_i) p_i \bar{h}_i$ the “virtual” income of individual i (Moffitt,

⁷The budget constraint is classically supposed to be saturated. Potential transfers from children to parents could generate an empirical problem, as we do not observe them. These transfers, however, are scarce in France and in Europe (see Chapter 1). Another point of discussion is that individuals might save money in the perspective of inheritance constitution. We could argue that saving money enters the decision to allocate income in a similar way than the consumption of the composite good.

1986, 1990), we rewrite the demand function specified in Equation (2.1) as follows:

$$\begin{cases} h_i^* = g(c_i p_i, I_i; X_i) + \nu_i & \text{if } h_i^* < \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i \leq \bar{h}_i \leq g(c_i p_i, I_i; X_i) + \nu_i & \text{if } h_i^* = \bar{h}_i \\ h_i^* = g(p_i, \tilde{I}_i; X_i) + \nu_i & \text{if } h_i^* > \bar{h}_i \end{cases}$$

The objective of the paper is to obtain an empirical estimate of the following quantity, which is the point price elasticity:

$$\frac{dg(CP, \hat{I}; X)}{dCP} \frac{CP}{g(CP, \hat{I}; X)}$$

3 Data

3.1 Administrative data from a Departmental Council

In France, there is no national survey or administrative data set that provides precise information on both the OOP payments and the formal home care use of the disabled elderly. We collected data from one Departmental Council that uses the most frequent APA subsidy computation rule. We selected a department with demographic characteristics close to the national averages, although its population has higher than average incomes (Appendix 7.1.A).

Data were collected for every month in 2012-2014. Since within year variation in provider prices is negligible, we only use data for the month of October,⁸ when home care consumption is less likely to be affected by seasonal variations (like public holidays and visits from children).

3.2 Sample selection

To ensure clean identification, we focus on APA beneficiaries served by a regulated home care provider for which the provider price is observed: we exclude 23% of beneficiaries of the initial sample as they receive care from other providers. We also exclude beneficiaries with missing information on subsidized consumption around the month of interest, so as to limit the risk that unobserved shocks (temporary absences or hospitalizations) could bias the estimates.

In addition, we exclude beneficiaries whose copayment rate is zero: their OOP price on subsidized hours is zero. We also exclude beneficiaries whose copayment is strictly equal

⁸Averaging consumption and OOP prices on an annual basis would hamper identification by blurring the true empirical relationship between price and consumption.

to 90%: the relationship between their disposable income and their copayment rate is not linear. Indeed, their income being equal or higher than the higher income threshold, their copayment is capped at 90%. This makes identification more complex. We end up with 8,190 individuals, or about 2,700 per year, representing 51% of the initial sample.⁹

3.3 Descriptive statistics

Columns [3] and [4] of Table 2.1 describe our estimation sample for October 2014.¹⁰ The typical individual is a woman, in her mid-80s and living alone.

Six APA beneficiaries out of ten do not consume their full care plan volume;¹¹ price sensitivity is one possible candidate to explain part of this high figure. The beneficiaries that consume their entire care plan volume are supposedly privately financing their additional consumption. No public source, at either the departmental or the national level, provides information on home care consumption beyond the care plan volume. However, data collected on a large provider operating in a French department show that 17% of its customers receiving APA consume strictly more than their care plan volume, with a median “over-consumption” of 1.5 hour per month (Fontaine and Gramain, 2017).

Columns [1] and [2] present the same statistics for two larger populations we selected our final sample from (all APA beneficiaries / all beneficiaries with a regulated provider). The last two columns indicate whether our sample and the larger samples differ in statistical terms when they can be compared.¹² Differences are significant in terms of income and disability level, translating into differences in copayment rate and both care plan volume and value. Implications for the external validity of the analysis will be discussed in Section 4.

⁹Appendix 7.1.B provides more details.

¹⁰We present the data of October 2014 to draw a better picture of the population of interest. Appendix 7.1.D replicates these statistics for the pooled sample.

¹¹In our data, care plan volume are generally revised every two years; they are thus unlikely to be driven by actual consumption.

¹²Information on care plan volume, effective consumption and provider price is not available when the beneficiary receives care from a non-regulated provider.

Table 2.1 – Descriptive statistics on the estimation sample and APA beneficiaries (Oct. 2014)

Variable	<i>All</i>	<i>With an authorized provider</i>	<i>Estimation sample</i>		<i>Differences between samples</i>	
	Mean [1]	Mean [2]	Mean [3]	Std-dev. [4]	P-value [1] – [3]	P-value [2] – [3]
Care plan volume [a]	<i>n.a.</i>	21.9	20.5	10.7	<i>n.c.</i>	0.00
Care plan monetary value [b]	<i>n.a.</i>	€471.7	€455.5	€238.3	<i>n.c.</i>	0.00
Hours effectively subsidized [c]	<i>n.a.</i>	<i>n.a.</i>	17.7	10.9	<i>n.c.</i>	<i>n.c.</i>
Amount of effective subsidies [d]	<i>n.a.</i>	<i>n.a.</i>	€300.8	€201.4	<i>n.c.</i>	<i>n.c.</i>
[c] inferior to [a]	<i>n.a.</i>	<i>n.a.</i>	59.8%	-	<i>n.c.</i>	<i>n.c.</i>
Ratio [c]/[a]	<i>n.c.</i>	<i>n.c.</i>	85.0%	20.7 pp.	<i>n.c.</i>	<i>n.c.</i>
Ratio [d]/[b]	<i>n.c.</i>	<i>n.c.</i>	65.1%	22.2 pp.	<i>n.c.</i>	<i>n.c.</i>
Individualized income	€1,324.5	€1,264.6	€1,315.8	€422.5	0.00	0.00
Co-payment rate	24.4%	22.3%	23.7%	17.3pp.	0.01	0.00
Regulated provider price	<i>n.a.</i>	€22.2	€22.2	€1.3	<i>n.c.</i>	0.04
Hourly OOP price	<i>n.a.</i>	€4.9	€5.2	€3.8	<i>n.c.</i>	0.00
Total OOP payments on subsidized hours	<i>n.a.</i>	€84.5	€91.3	€98.6	<i>n.c.</i>	0.00
Age	<i>n.a.</i>	84.1	84.2	7.4	<i>n.c.</i>	0.29
Women	76.7%	73.8%	74.0%	-	0.03	0.76
Disability group 1 (most severe)	1.5%	1.3%	1.2%	-		
Disability group 2	14.5%	13.8%	12.5%	-		
Disability group 3	21.2%	21.0%	19.6%	-	0.00	0.00
Disability group 4 (moderate)	62.8%	63.9%	66.7%	-		
	100%	100%	100%			
Living with a spouse	32.1%	31.0%	33.8%	-		
Living alone	66.6%	67.5%	65.6%	-	0.00	0.00
Spouse in institution	1.3%	1.6%	0.6%	-		
	100%	100%	100%			
Number of individuals	5486	4199	2862		-	-
Number of households	<i>n.a.</i>	<i>n.a.</i>	2785		-	-

SAMPLES: [1]: sample of community-dweller APA beneficiaries in the department; [2]: sample of beneficiaries who receive care, but not necessarily exclusively, from a regulated provider; [3] and [4]: estimation sample.

NOTES: “pp.” stands for percentage points, “*n.a.*” for “not available”, “*n.c.*” for “not computable” (available information is insufficient). Care plan volume, effective home care consumption, income, subsidies and total OOP payments are expressed per month.

TESTS: P-values from a Student (resp. Pearson χ^2) test if variable is binary or continuous (resp. categorical). The comparison of the estimation sample with the reference sample ([1] - [2]) excludes the estimation sample in [1].

4 Empirical strategy

4.1 A censored measure of home care consumption

APA files register the individual number of home care hours that are charged by the provider to the Departmental Council or, equivalently, the *subsidized* hours of home care. However, we do not observe the *total* volume of home care consumed by each APA beneficiary. For the beneficiaries whose recorded consumption equals their care plan volume (40% of our sample), our measure of home care consumption is then right-censored.

Denote h_i the number of home care hours billed to the Departmental Council for beneficiary i . We observe:

$$\begin{cases} h_i = g(c_i p_i, I_i; X_i) + \nu_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i < \bar{h}_i \\ h_i = \bar{h}_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i \end{cases} \quad (2.2)$$

Hence, the parameters of the demand function $g(\cdot)$ can only be identified from information relating to the first segment of the budget constraint. For individuals with the maximum number of billed hours \bar{h}_i , the only information we can use is that their demand is at least as high as this number.¹³

4.2 Econometric specification

Since the distribution of (observed) home care consumption is slightly skewed, we assume a log-linear specification of $g(\cdot)$, as follows:

$$\ln(h_{it}^*) = \beta_0 + \beta_1 \cdot \ln(c_{it} p_{it}^j) + \beta_2 \cdot \ln(I_{it}) + X_{it}' \cdot \theta + \lambda_t + \epsilon_{it} \quad (2.3)$$

where p_{it}^j denotes the hourly price charged by provider j chosen by individual i in year t ¹⁴ and λ_t are year fixed effects. Both price and income are included in log so that β_1 represents the consumer price elasticity and β_2 captures the income elasticity of the demand for home care services. As $c(\cdot)$ is fully linear in income in the sample,¹⁵ Equation 2.3 can be rewritten as:

$$\ln(h_{it}^*) = \gamma_0 + \beta_1 \cdot \ln(p_{it}^j) + (\beta_1 + \beta_2) \cdot \ln(I_{it}) + X_{it}' \cdot \theta + \lambda_t + \epsilon_{it} \quad (2.4)$$

¹³Appendix 7.3 provides more details.

¹⁴All beneficiaries with the same provider are charged the same provider price, before APA copayment rate applies.

¹⁵The relationship between c_{it} and I_{it} depends on the year the copayment rate was set. We control for this source of inter- and intra-individual variation in our estimations. Appendix 7.2.A provides more details.

Equation (2.4) makes it clear that the income variations identify the *empirical* income effect within the APA framework. With APA, any marginal increase in the disposable income has two effects. First, it increases home care consumption, provided home care is a normal good (standard income effect). Then, it induces the reassessment of the copayment rate, which may further affect home care consumption through an increased OOP price (price effect).

As System (2.2) corresponds to the typical observational scheme underlying censored regression model, β_1 and β_2 can be estimated by Maximum Likelihood after making a parametric assumption on ϵ (Tobit model).¹⁶ Our favoured specification though, is a more flexible version of Equation (2.4). In Equation (2.5), we take as dependent variable the log-share of the care plan volume consumed by the individual, h_{it}^*/\bar{h}_{it} (call it “relative consumption”) and include the care plan volume \bar{h}_{it} as a control. Equation (2.4) is nested in Equation (2.5) and $\tilde{\beta}_1$ can still be interpreted as a price elasticity.¹⁷

$$\ln(h_{it}^*/\bar{h}_{it}) = \tilde{\gamma}_0 + \tilde{\beta}_1 \ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_{it}) + \tilde{\beta}_3 \ln(\bar{h}_{it}) + X'_{it} \tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \quad (2.5)$$

This specification comes with several advantages. First, it includes \bar{h}_{it} as a control, which might be a proxy of the unobserved determinants of consumption.¹⁸ Technically, relative home care consumption has a better-behaved distribution than absolute consumption, making parametric estimates more likely to be consistent.¹⁹ Its censoring point is unique (equal to 0), which eases the implementation of the estimation.

Our baseline estimates are obtained fitting a population-average²⁰ censored regression estimation of Equation (2.5) assuming that:

$$\tilde{\epsilon} \mid p, I, \bar{h}, X, \tilde{\lambda} \sim \mathcal{N}(0, \tilde{\sigma}^2). \quad (2.6)$$

4.3 Identification using cross-sectional variations in prices

As suggested by Equations (2.4) and (2.5), the *consumer price* elasticity of demand is identified by the cross-sectional variation in *provider prices*. In the department, there are 28 regulated providers. Each provider price is reassessed every year. In the panel, provider prices range from €19.35 to €23.50, with an average of €21.8 and a standard-deviation

¹⁶Appendix 7.3 derives the maximum likelihood function.

¹⁷Appendix 7.2.A provides more details.

¹⁸The care plan volume is supposedly based only on the specific activity restrictions of the beneficiary; but qualitative studies have shown that the evaluation team is likely to take into account additional characteristics of the individual, such as the informal care she receives (Billaud *et al.*, 2012).

¹⁹See Figures 2.3 and 2.4 in Appendix 7.2.B.

²⁰We use the unbalanced sample: selecting individuals staying in the APA programme for three years would raise additional selection issues.

of €1.3. As yearly variation in prices was small between 2012 and 2014, most of the price variation is cross-sectional.²¹

To get unbiased estimates, the provider price charged to individual i must be uncorrelated with the unobserved factors affecting her home care consumption, ϵ_i . Supply-demand simultaneity may violate this condition (Zhen *et al.*, 2014), but it should be negligible in our context. Indeed, although each provider is priced by the Departmental Council on the basis of its average production cost of two years earlier, the pricing process largely depends on administrative and political considerations (Gramain and Xing, 2012).

The risk of omitted variable biases is more difficult to dismiss. Beneficiaries may non-randomly select their provider (price) on the basis of some unobservable individual characteristics such as quality expectations, unobserved health condition or informal care provision (Billaud *et al.*, 2012). Some sources of price variations can be documented and are unlikely to be correlated with unobserved determinants of home care consumption (Appendix 7.6), but it is insufficient to rule out any price endogeneity induced by non-random provider choice. To address this potential bias, we exploit the unequal spatial coverage by regulated providers in the department.

4.4 An instrumental variable strategy

We propose to instrument the provider price by the number of municipalities in which the provider serves APA beneficiaries and estimate an IV-Tobit. To be valid, our instrument must first correlate with the price, conditional on the control variables. Second, it must be uncorrelated with the unobserved determinants of professional home care consumption.

From a practical standpoint, serving more municipalities translates into higher transportation and coordination costs for a provider.²² Exploiting the service files of a large French home care provider, Chapter 4 of this thesis gives an estimate for the travel costs supported by a given provider, for one hour of intervention. The average value is between 6% and 8% of the provider price and is found to vary considerably according to the type of areas served by the provider. For regulated providers, such costs are partially incorporated in the price set by the Departmental Council (Gramain and Xing, 2012). Several public and research reports on the French home care sector have insisted on the heterogeneity in transportation costs borne by providers and the differences in prices it induces (Aube-Martin *et al.*, 2010; Vanlerenberghe and Watrin, 2014; Branchu *et al.*, 2015;

²¹On average, provider prices increased by 1.9% between October 2012 and 2013 and by 1.3% between 2013 and 2014.

²²Transportation costs here refers to the costs that are paid by the structure and incorporated into the provider price. It does not take into account potential additional costs paid by professional caregivers but not reimbursed by the structure (i.e, fees for going away from/back to the caregiver's own home).

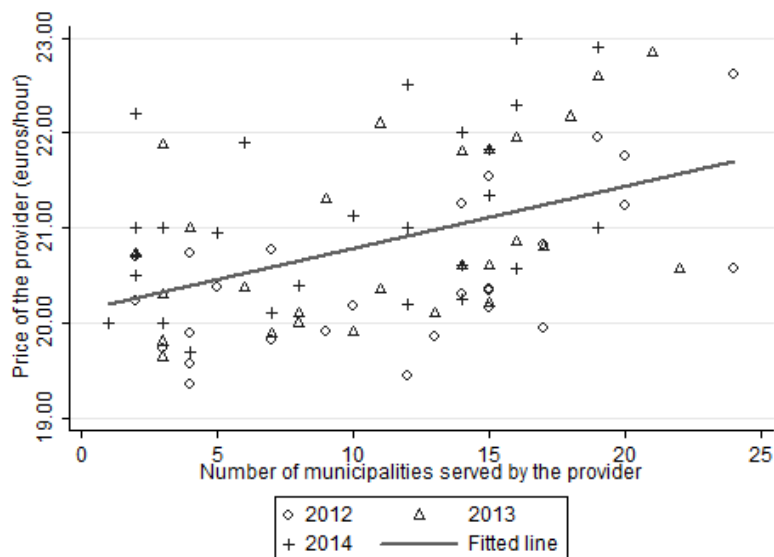
Garabige *et al.*, 2015).

In our data, as is evidenced by Figure 2.2, the price charged by a given provider and the number of municipalities in which it operates are positively correlated. The coefficient correlation is 0.45, significant at the 1% level.²³ The IV-Tobit first stage (Table 2.2) shows that a one standard-deviation increase in the number of municipalities served by the provider is associated with a 4.9% increase in its price. The F-statistic associated with this estimate exceeds 143 - a figure far higher than the conventional threshold used to assess the risk that the instrument is weak (Staiger and Stock, 1997).

A potential threat to the exclusion restriction is that the instrument may correlate with individual consumption through another channel than the price charged by the provider. In particular, it would be the case if the number of hours provided by a service systematically increases its provision costs due to decreasing returns to scale. Apart from transportation and coordination costs though, the care provision process may be assumed to exhibit roughly constant returns to scale, as most of the provision costs is made of caregivers' wages. The strong association between the price charged by a provider and its geographical area of operation is thus unlikely to be driven by the volume of care it delivers.

²³When excluding the biggest provider, as is done in Figure 2.2 When it is included, the coefficient correlation is 0.50, significant at the 1% level.

Figure 2.2 – Correlation between provider price and number of municipalities served by the provider



NOTES: The number of municipalities served by each provider is constructed using information on all APA beneficiaries receiving home care from a regulated provider in October 2012, 2013 and 2014. The line is fitted using all three years of observation. To make the graphical representation more readable, we excluded the largest provider. With 199 municipalities served in October 2014, it charged the highest price over the 3 years of observation (€23.5 in 2014). The positive correlation displayed by the graph is preserved when we include the largest provider.

5 Results and discussion

5.1 Main results

Table 2.2 presents our main results, obtained on the panel data. The coefficients displayed give the predicted impact of a marginal (or 0/1) change in a given explanatory variable on the total, uncensored relative home care consumption. First stage (Panel B) regresses the log-provider price on the standardized number of municipalities served by the provider. Column (1) presents Tobit estimates of Equation (2.5). Column (2) presents the estimates we obtain when the price is instrumented by the number of municipalities served by the provider.²⁴ We cluster the standard errors at the provider level since our “treatment” variable, p_{it}^j , essentially varies at the provider level (Moulton, 1990; Cameron and Miller, 2015).

When the provider price is considered as exogenous, the consumer price elasticity

²⁴We use the parametric version of Stata command `ivtobit`. We thus assume the error terms of the first-stage and second-stage equations are jointly normally distributed.

estimate is about -0.45 . When using our instrument, the coefficient is slightly lower in absolute value. The difference between the two is not statistically significant, suggesting that the potential bias due to non-random provider selection may be limited.²⁵ Overall, price elasticity estimates are negative, statistically significant, confirming that the disabled elderly are sensitive to the price of professional home care. Our favoured estimation (Column (2)), which instruments the price, gives a point estimate of -0.387 , or about -0.4 .

The income effect in the APA framework appears negative, but negligible and statistically not different from zero. Richer APA beneficiaries do not tend to consume more formal care, all other things being equal. With $\hat{\beta}_1 + \hat{\beta}_2$ close to zero, our estimations suggest that the increase in the copayment rate, induced by an increase in income, compensates for the standard income effect. We also derive an estimate of the standard income elasticity $\tilde{\beta}_2$. Both the Tobit and the IV-Tobit give a value of about 0.4, statistically different from zero. Although this income effect is imprecisely estimated,²⁶ we are able to conclude that home care is a necessity good for the disabled elderly.

Individuals with a higher care plan volume tend to consume a larger share of their care plan. For a given disability level, a higher care plan volume could be explained by a lower provision of informal care. Alternatively, a higher care plan may also have a stronger prescriptive effect.

As expected, the severely disabled individuals consume relatively more than the beneficiaries with mild to moderate disability, all other factors being equal. Even when controlling for the disability level, age retains a significant effect on the consumption on home care services. Being a woman increases the consumption of professional home care relative to the care plan volume, by a small but statistically significant amount. Living alone (spouse in institution or no spouse) increases the amount of professional assistance received, consistently with previous works showing the importance of the co-residing spouse in providing informal care substituting partly for formal home care services.

5.2 Further results and robustness checks

We replicate the estimations on each year separately (Appendix 7.7.A); price elasticity estimates are found to range from -0.54 to -0.13 . Precision is low but we can reject that the price elasticity is zero (except for 2014)²⁷ or unity. We check our results are robust

²⁵We implement a cluster Bootstrap Hausman test. We cannot reject that the provider price is exogenous ($p = 0.88$).

²⁶ $\tilde{\beta}_2$ corresponds to the difference between the empirical income elasticity with APA and the price elasticity estimates; the associated standard error is high (around 0.19), due to the relatively large standard error of the price elasticity estimate.

²⁷Precision in 2014 is lower, as a provider closed down.

to the fact that inference relies on a small number of clusters by implementing a cluster percentile-t bootstrap (Appendix 7.7.B). Statistical significance of the price elasticity is preserved at the 5% level on the pooled sample.

To investigate the potential heterogeneity in price sensitivity, we estimate the model interacting the price with the disability level, the income level or the marital status (Table 2.3). A credible IV strategy would require to find an additional instrument for each interaction term. As Table 2.2 suggests that the bias due to potential price endogeneity is limited, we fit a simple Tobit model when adding the interaction terms. We expected more severely disabled individuals to be less price sensitive, but we are not able to detect such an effect. Price sensitivity is higher for individuals whose income is above the sample median income. This result echoes Duarte (2012), who finds that higher income individuals are more price elastic in their medical care consumption. Richer individuals may be more able to understand the health care system and cost-sharing schedules due to a higher financial literacy, or they have more outside options. Finally, the price elasticity tend to be lower (in absolute value) but is not significantly different for individuals living alone compared to those living with a spouse. Thus, the potential provision of informal care — by a spouse — does not affect the price elasticity estimate.

As a robustness check, we implement an alternative identification strategy (Appendix 7.7.C). We estimate our equation of interest (without instrumenting the price) on the subsample of APA beneficiaries who live in a municipality where a single regulated provider is found to operate. In a context in which price selection is arguably limited, we find a price elasticity estimate around -0.5, not statistically different from our main result.

5.3 Discussion

Our results confirm that the consumption of home care of the disabled elderly is sensitive to the price they pay. Decisions relating to formal home care consumption are influenced by a trade-off between the OOP price of an extra hour and its marginal value. Such a pecuniary trade-off has been documented at the extensive margin, as the take-up of APA benefits is affected by the average subsidy rate in the department (Arrighi *et al.*, 2015). We find original evidence that the price elasticity of the demand for home care is seemingly lower than unity at the intensive margin: the adjustment of consumption is proportionally lower than a given change in price. This implies a positive price elasticity of OOP expenditures: a *decrease* in the OOP price should lead to a *decrease* in total OOP payments.

The price sensitivity we obtain is of an order of magnitude similar to the estimates found for health care demand. Although the magnitude of the -0.2 estimate derived from the Rand Health Insurance Experiment (Manning *et al.*, 1987; Keeler and Rolph,

1988) is subject to discussion (Aron-Dine *et al.*, 2013), a large literature has confirmed that medical spending is price-elastic, with price sensitivity varying with the type of care (Duarte, 2012; Fukushima *et al.*, 2016). Our paper provides interesting evidence that, at the intensive margin, home care consumption is closer to acute care than to elective care in terms of price sensitivity.

Our OOP price measure does not take into account possible tax reductions on home care services, unobserved in the APA records. Without sufficient information to simulate them, we implicitly assume APA beneficiaries to be sensitive to the “spot” price (Geoffard, 2000). We also assume that APA recipients react in the same way to variations in the copayment rate and in the provider price. If salience differs (Chetty *et al.*, 2009), implications for the design of the copayment schedule are less straightforward.

In our administrative data, information on family characteristics is poor. Receiving more informal care has been found to decrease formal care use, both at the extensive and intensive margins (Van Houtven and Norton, 2004; Bonsang, 2009). Omitting informal care provision could bias the estimates of our entire set of coefficients. This is all the more of a concern as the share of (self-declared) APA beneficiaries who declare receiving some informal help is higher in the department than in the rest of France.²⁸ The existence and the importance of the bias depend on the relationship existing between the provider price and the informal care consumed. This relationship is unclear and little documented. There might be a negative correlation if the provision of informal care leads individuals to choose a low-price provider; in this case, the more individuals are provided with informal care, the less they consume formal care and the lower the price they choose. It would thus lead to underestimate the price-elasticity. On the reverse, the consumption of informal care could be positively correlated with the price, if individuals delegate to relatives the low-qualified care (i.e. domestic help) while choosing to be provided with professional care for tasks requiring more qualification (i.e. personal care). In this case, consumption of informal care would be associated with a lower formal care use and a higher provider price, leading to overestimate the price elasticity. As a robustness check, we include as a control whether the individual receives formal home care during the weekend and public holidays (Appendix 7.7.D). We hypothesize that individuals not receiving professional home care over the weekend are more likely to receive assistance from their relatives.²⁹ Receiving formal care during the weekend is associated with more hours consumed during working days; reassuringly though, it does not significantly affect the price elasticity estimate.

²⁸Over four-fifths in the department, against 75% in metropolitan France (INSEE-DREES, 2014).

²⁹It is a strong assumption, as (non) consumption during the week-end could be due to other unobserved variables. For instance, some consumers might not consume during the week-end if the provider is not available to provide care. Comparing areas with one single provider operating and those with several providers, though, shows that there is no significant differences in the probability to consume during the week-end (Table 2.13).

Finally, external validity of our results should be qualified, as our sample is selected. First, we focus on individuals living at home; they are expected to have a lower disability level and more informal care than those living in institutions. Moreover, they have applied to the APA program and consume formal care, thus being different from community-dweller individuals that do not apply to the program. From the existing evidence on the APA take-up, we know that individuals who do not apply tend not to be strongly disabled, to have preferences for informal care or to have a high income such that the expected gain from the APA subsidy is low (Chauveaud and Warin, 2005; Ramos-Gorand, 2016). In addition, we focus on a department which is slightly richer than France as a whole. Overall, with price sensitivity being greater for richer beneficiaries, our estimates may be an upper bound (in absolute value). Yet the department is reasonably close to “average France” in terms of other sociodemographic characteristics and most APA beneficiaries in France receive care from regulated providers (Hege *et al.*, 2014). Finally, our results are in line with the two available estimates (Bourreau-Dubois *et al.*, 2014; Hege, 2016), which rely on different estimation strategies and data.

Table 2.2 – Censored regression estimates of demand for home care hours

	<i>Tobit</i> (1)	<i>IV-Tobit</i> (2)
<i>Panel A: Second stage</i>		
	Dependent variable: relative consumption h^*/\bar{h} (log)	
Price (log)	-0.450** (0.181)	-0.387** (0.192)
Disposable income (log)	-0.010 (0.008)	-0.010 (0.008)
Care plan volume (log)	0.040* (0.023)	0.040* (0.023)
Woman	0.029** (0.014)	0.030** (0.014)
Age: 60–69	-0.124*** (0.047)	-0.123*** (0.047)
Age: 70–79	-0.042** (0.017)	-0.042** (0.017)
<i>Ref: age: 80-89</i>		
Age: 90 or older	0.051*** (0.015)	0.052*** (0.015)
Disability group: 1 (most severe)	0.154*** (0.057)	0.153*** (0.057)
Disability group: 2	0.027 (0.022)	0.027 (0.022)
<i>Ref: disability group: 3</i>		
Disability group: 4 (moderate)	0.008 (0.012)	0.009 (0.012)
Living with no spouse	0.107*** (0.013)	0.107*** (0.013)
Spouse receives APA	0.036 (0.034)	0.037 (0.034)
Spouse in institution	0.170* (0.095)	0.170* (0.094)
<i>Ref: living with non-APA spouse</i>		
Constant	1.225** (0.556)	1.032* (0.592)
<i>Panel B: First stage</i>		
	Dependent variable: provider price p (log)	
Number of municipalities (std.)		0.049*** (0.004)
F statistic		143.98
Observations	8190	8190
Censored observations	39.6%	39.6%
Number of clusters	28	28
<i>AIC</i>	11454	-22049
<i>BIC</i>	11644	-21860

SAMPLE: Pooled samples of APA beneficiaries in October 2012, 2013 and 2014.

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include year fixed effects, dummies for the year in which the copayment rate was computed as well as dummies for the year the latest plan was decided upon.

Table 2.3 – Price elasticity of home care by disability level, income and marital status

	Dependent variable: relative consumption h^*/h (log)			
	(1)	(2)	(3)	(4)
Price (log)	-0.450** (0.181)	-0.323 (0.236)	-0.446** (0.178)	-0.507*** (0.194)
Price (log) \times disability group 4 (moderate)		-0.190 (0.270)		
Price (log) \times income above median			-0.019*** (0.006)	
Price (log) \times lives alone				0.090 (0.186)
Disposable income (log)	-0.010 (0.008)	-0.010 (0.008)	0.011 (0.010)	-0.010 (0.008)
Observations	8190	8190	8190	8190
Censored observations	39.6%	39.6%	39.6%	39.6%
Number of clusters	28	28	28	28
<i>AIC</i>	11454	11453	11439	11454
<i>BIC</i>	11643	11642	11629	11643

SAMPLE: Pooled samples of APA beneficiaries in October 2012, 2013 and 2014.

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of Tobit model by Maximum Likelihood. All specifications include as controls the care plan volume, sociodemographic characteristics, year fixed effects, dummies for the year in which the copayment rate was computed as well as dummies for the year the latest plan was decided upon.

6 Conclusion

This paper estimates the consumer price elasticity of the demand for professional home care services of the disabled elderly benefiting from the French APA program. Our results suggest this parameter is about -0.4 , with point estimates statistically different from zero and unity in absolute value.

Our findings pave the way for several policy implications. As the disabled elderly are sensitive to the price of care, the copayment rates in home care subsidy programs entail allocative and dynamic efficiency issues. Given the low value of the price elasticity, the generosity of home care subsidies also has substantial redistributive effects from taxpayers to the disabled elderly.

While remaining cautious regarding the external validity of the results, our estimates can be used to discuss the effects of potential reforms of home care subsidies. The decrease of copayment rates enacted by the 2016 APA reform, higher for low-income recipients, should reduce overall OOP expenses on professional home care of current APA recipients, while having a limited volume effect.

7 Appendices

7.1 Additional information on the data

7.1.A Comparison of the department with metropolitan France

Table 2.4 compares the department studied to metropolitan France. We use either administrative sources ([A]: INSEE *et al.* (2013); [B]: INSEE (2014); [D]: DREES (2013)) or survey data ([C]: INSEE-DREES (2014)).

Column [1] gives descriptive statistics on metropolitan France while Column [2] focuses on the department studied. Column [2] reports intervals around the true department value to preserve its anonymity. Bounds are computed so that 20% of the French departments closest to the department of interest (weighting by the size of the departmental population aged 60 or more) have a value lying in the interval.³⁰ If the department is located in the bottom quintile, we report as a lower bound the minimum value observed across French departments for the variable; similarly, when the department ranks in the top quintile, the upper bound we report is the maximum value observed in metropolitan France.

The third column tests the significance of the differences between the first two columns. For statistics computed using exhaustive administrative sources ([A], [B] and [D]), we test whether the department *population* can be considered as a random draw from the French metropolitan population. When using survey data ([C]), the tests of difference compare the *sample* of the respondents of the department with the respondents of the rest of France.

Although differences are quasi-systematic in statistical terms, the selected department has sociodemographic characteristics close to that of France overall. Our selected department is however richer than the rest of France: it has a higher share of households subject to the income tax and a lower poverty rate in the 75+ population, although the median taxable income in the department is only slightly higher than in France. Albeit the prevalence of functional limitations in the 60+ population is similar in the department and in the rest of France, the rate of APA beneficiaries is slightly higher in our department. This possibly reflects local variations in the way the APA policy is implemented (Billaud *et al.*, 2012; Arrighi *et al.*, 2015).

³⁰INSEE *et al.* (2013) directly provides the deciles of the taxable income distribution in the metropolitan French population aged 75 or more. The department is found to be richer than the 40% least wealthy departments, but poorer than the 40% richest departments. We use the 4th and 6th deciles of the national distribution to bound the median taxable income observed in the department studied.

Table 2.4 – Descriptive statistics for department studied and metropolitan France

	<i>Metropolitan France</i> [1]	<i>Department</i> [2]	<i>Difference (p. value)</i> [1] – [2]	<i>Source</i>
General population				
Households subject to income tax	58.2%	[61.9%–75.1%]	0.00	[A]
60+ population/total population	24.4%	[23.8%–26.3%]	0.00	[B]
Elderly population (60+)				
Average age	71.8	[71.3–71.7]	0.00	
<i>Health status (functional limitations)</i>				
Level 1 (least severe)	64.9%	[63.9%–66.2%]		
Level 2	21.4%	[20.1%–21.0%]	0.48	[C]
Level 3	7.7%	[7.2%–7.8%]		
Level 4 (most severe)	6.0%	[6.3%–7.0%]		
	100%	100%		
Poverty rate in 75+ population	8.9%	[6.9%–7.9%]	0.00	[A]
Median taxable income (75+ households)	€19,536	[€17,380– €22,050]	<i>n.c.</i>	
Rate of APA beneficiaries	7.8%	[8.1%–9.1%]	0.00	
At-home recipients/all APA beneficiaries	58.7%	[56.1%–60.6%]	0.00	[D]
At-home APA beneficiaries				
Woman	73.7%	[71.7%–72.8%]	0.00	
<i>Age groups</i>				
Age 60-74	12.7%	[11.2%–12.7%]		
Age 75-79	13.6%	[13.8%–14.6%]	<i>n.c.</i>	[D]
Age 80-84	23.9%	[23.5%–24.4%]		
Age 85+	49.7%	[49.2%–51.0%]		
	100%	100%		
<i>Living arrangements</i>				
Living alone	55.3%	[54.7%–56.9%]		
Living with her spouse	30.4%	[27.7%–32.7%]	0.88	[C]
Living with a relative other than her spouse	14.3%	[9.5%–12.5%]		
	100%	100%		
<i>Disability group</i>				
Disability group 1 (most severe)	2.4%	[1.7%–2.1%]		
Disability group 2	16.8%	[14.1%–15.6%]	<i>n.c.</i>	[D]
Disability group 3	22.1%	[20.0%–21.7%]		
Disability group 4 (moderate)	58.8%	[60.5%–64.5%]		
	100%	100%		
Amount of effective subsidies	€361.1	[€329.1–€350.5]	<i>n.c.</i>	

SOURCES: [A]: INSEE *et al.* (2013); [B]: INSEE (2014); [C]: INSEE-DREES (2014) - APA benefit is self-declared. Rate of spousal co-residence may be underestimated; [D]: DREES (2013)- Administrative files on APA beneficiaries in 2013, all French departments. Decomposition by sex and age (resp. by disability level) not available in 21 (resp. in 5) departments.

NOTES: Column [2] reports intervals around the true department value to preserve its anonymity. Bounds are computed so that 20% of the French departments closest to the department of interest (weighting by the size of the departmental population aged 60 or more) have a value lying in the interval.

TESTS: *n.c.* stands for “not computable”. P-value from a Student (resp. Pearson χ^2) test for binary (resp. categorical) variables.

7.1.B Sample selection

This Appendix aims at documenting the selection steps the data from October 2014 have gone through. We follow the same steps to construct the samples of October 2012 and 2013. The percentages of individuals selected at each step are very similar to what is found for 2014 and are available upon request.

The initial number of beneficiaries is considered to be 5,486.³¹ Table 2.5 sums up the selection steps.

Table 2.5 – Sample selection steps

	Recipients with a regulated provider <i>at least</i>					
	All	Recipients effectively consuming care in the month				
		All	“Stable” recipients			
	All		All	Recipients consuming <i>only from one</i> regulated provider		
		All		Recipients with $0 < c_i < 90\%$		
	(1)	(2)	(3)	(4)	(5)	(6)
Number	5,486	4,475	4,199	3,527	3,327	2,862
% of previous step	-	81.6%	93.8%	84.0%	94.3%	86.1 %
% of initial sample	100%	81.6%	76.5%	64.3%	60.6%	52.2%

NOTES: “Stable” APA recipients in October 2014 are defined as those for which information is available also for the months of September and November 2014. For additional 63 individuals (not in the numbers here above), the administrative files contain no information on the copayment rate or on the consumption of home care hours, or are inconsistent with national APA legislation.

To observe precisely both the OOP price and the number of hours that are effectively consumed and subsidized, we retain the beneficiaries receiving care from a regulated provider. They represent the majority of APA recipients in the department (more than 4/5).

Among them, about 6% have no actual consumption of home care recorded in the files. This might be explained by temporary absences (like hospitalizations) or disruptions (e.g. visits from relatives, who replace temporarily professional home care services by providing informal care). As the outcome of interest is missing, we drop these observations. Another 15% of APA recipients with a regulated provider have missing information on subsidized care consumption for the preceding or the following month. We choose to drop them

³¹For October 2014, administrative records indicate that 5,549 beneficiaries were receiving APA; but for 61 individuals, essential information on subsidized hours, copayment rate or on matrimonial status was missing or inconsistent. These individuals are presumably former APA recipients not yet erased from the files. For 2 additional individuals, the monetary value of the care plan was beyond the national legal ceiling, signaling a probable error in the records. We dropped these 63 observations from our sample.

to avoid potential unobservable shocks likely to bias our estimations. The remaining individuals can be regarded as “stable”.

Among beneficiaries actually receiving care from a regulated provider at least, less than 6% receive care from a secondary provider.³² As we generally do not observe care consumption from the secondary provider nor its price,³³ we drop multiple-provider individuals.

Beneficiaries with income below a certain threshold have a 0% copayment rate: their OOP price is zero. Our log-log specification cannot be estimated on these observations. In addition, so as to make the relationship between the consumer price and the provider price fully linear in disposable income (see Appendix 7.2.A), we retain only those individuals with a copayment rate strictly below 90%. These two income groups represent respectively 12.7% and 1.3% of the remaining 3,327 beneficiaries.

We end up with a sample that represents 52% of total at-home APA recipients of the department.

A Heckman-type model would allow to take into account the selection of our sample on both observable and unobservable factors affecting the demand for home care. But we do not have any good instrument at hand to construct an estimator that would not entirely rely on a parametric assumption. We choose to estimate our parameters of interest directly on the selected sample. Such a choice imposes to remain cautious about the external validity of our estimates, as discussed in Section 5.3 of the paper.

³²The majority of these beneficiaries receive additional care from an over-the-counter worker (see Section 7.5 for more details on the different types of home care providers). Over-the-counter workers are generally cheaper and more flexible than home care structures. 7 individuals receive home care from a second regulated provider. Theoretically, there might be a third case: beneficiaries could also complement the care provided by a regulated structure with care provided by a non-regulated structure. Our files do not allow us to identify such cases; we believe they are marginal, as care provision by non-regulated structures is rare (only 6% of beneficiaries with no regulated provider receive home care from a non-regulated structure).

³³Even if we had all necessary information, dealing with the simultaneity of consumption decisions would have made our empirical strategy considerably more complex.

7.1.C Imputation of couples of APA beneficiaries

The data we collected indicate when a beneficiary lives with a partner, but we do not directly know whether the partner also receives APA. Having an APA-recipient spouse may correlate with one's own home care consumption; failing to control for such a characteristic may bias our estimates.

To identify potential couples in our sample, we checked whether each individual could be matched with another recipient of the opposite sex, recorded as living with a spouse, with exactly the same income³⁴ and residing in the same municipality. If two individuals match, we assume they belong to the same household: our estimations will control for the fact of having a spouse receiving APA.

The matching procedure may fail for individuals whose copayment rate is 0%. The reported disposable income is the same for all such individuals, be they actual spouses or not. The same pitfall applies for individuals whose copayment rate is 90%. In these cases, the Departmental Council simply records the lower or upper income threshold of the APA copayment schedule. In October 2014, only 16 individuals were not matched for this reason. But all our estimations rely on the sample of individuals with a copayment rate strictly between 0 and 90%, for whom the matching procedure is systematically successful.

There would be a risk to match people who are not partners if among a municipality, several individuals have the same income. Empirically, it is never the case for individuals whose copayment is comprised between 0% and 90%, as the copayment and income reports are really precise (taking into account pensions as well as savings). It is only the case for individuals having a zero or 90% copayment rate who are excluded from the matching and estimation procedures.

7.1.D Descriptive statistics on the pooled sample

Table 2.6 replicates Columns (3) and (4) of Table I of the paper, by presenting the descriptive statistics on the pooled sample (and not on the 2014 sample only).

The pooled sample we derive our baseline estimates from is an unbalanced panel. In this sample, 26% of beneficiaries are present all three waves; another 26% are present only in two waves; finally, 48% are only present in one wave.³⁵ Focusing on the sample of beneficiaries in October 2014, we see that the longer the individual has been receiving APA, the older she is; this translates into a higher proportion of women, who have a longer life-expectancy, and a lower proportion of beneficiaries with a spouse alive among

³⁴The APA copayment schedule takes into account the household income. See Appendix 7.2.A.

³⁵This does not mean that the typical APA recipient benefits from the scheme less than one year. For individuals observed only in 2012, for example, we do not know whether they were receiving APA one year or two years before. Average duration of APA benefits is estimated to be around 4 years (Debout, 2010).

Table 2.6 – Descriptive statistics on the pooled sample (2012-2014)

Variable	Mean [1]	Std-dev. [2]
Care plan volume [a]	20.9	10.7
Care plan monetary value [b]	€456.1	€235.8
Hours effectively subsidized [c]	18.1	10.8
Amount of effective subsidies [d]	€303.1	€199.2
[c] inferior to [a]	60.4%	-
Ratio [c]/[a]	85.6%	19.8pp.
Ratio [d]/[b]	65.5%	21.7pp.
Individualized income	€1,301.5	€415.6
co-payment rate	23.8%	17.2pp.
Provider price	€21.8	€1.3
OOP price	€5.2	€3.8
Total OOP payments on subsidized hours	€91.6	€95.2
Age	84.0	7.3
Woman	73.2%	-
Disability group 1 (most severe)	1.2%	-
Disability group 2	12.8%	-
Disability group 3	20.2%	-
Disability group 4 (moderate)	65.8%	-
	100%	
Lives with a spouse	33.8%	-
Lives alone	65.6%	-
Spouse in institution	0.6%	-
	100%	
Number of individuals	8190	-

NOTES: “pp.” stands for percentage points. Care plan volume and effective home care consumption are expressed in hours per month; income, subsidies and total OOP payments are expressed in euros per month. Sample from October 2012, 2013 and 2014.

the beneficiaries present in two or three waves. Those beneficiaries tend to be more disabled; they have, on average, a higher care plan volume and a higher number of hours subsidized by the APA scheme (consumption relative to the care plan volume being also higher). On the contrary, we do not see any difference in average provider and OOP prices, nor in income.

When using the unbalanced sample, we do not select a specific population (the more recent entrants into the APA scheme that are going to be present in years 2012 to 2014); the shortcoming of such a choice, however, is that the individuals who have been present in several waves weigh more in the estimation than single-observation individuals. The cross-sectional estimates presented in Appendix 7.7.A show that the magnitude of the price elasticity estimate does not change substantially when replicating our estimations using the sample of beneficiaries present in October of either 2012, 2013 or 2014.

7.2 Specifications

7.2.A Income and copayment rate issues in the empirical specifications

In Section 4.2 of the paper, when taking the absolute consumption as the dependent variable, our econometric specification is stated as follows:

$$\ln(h_{it}^*) = \gamma_0 + \beta_1 \ln(p_{it}^j) + (\beta_1 + \beta_2) \ln(I_{it}) + X_{it}' \theta + \lambda_t + \epsilon_{it} \quad (2.7)$$

To ensure a clean identification of the parameters, two features of the data must be taken into account. First, the disposable income recorded in the data at time t is not the current value of income but the income when the copayment rate was computed or last revised, denoted I_{it}^{obs} . We express disposable income at time t as: $I_{it} = \rho_{it} I_{it}^{obs}$, with ρ_{it} the rate of increase of individual disposable income between time t and the year i 's last copayment rate was computed. As the rate of increase in disposable income ρ_{it} is not directly observable, we include a dummy $\mathbb{1}_{it}^d$ equal to one when i 's copayment rate (observed in t) was last revised in year d . Dummy coefficients should capture the rate of increase in income between years d and t .³⁶ In our data, most copayment rates were last computed between 2010 and 2014; for a few observations though, the latest computation of the copayment rate is older ($d = 2002, \dots, 2014$).

Second, the copayment rate is set to be strictly proportional to the disposable income at the time the latest personalized care plan was defined, I_{it}^{obs} , according to the following function:

$$c_{it} = \frac{0.9}{2MTP_{it}^D} I_{it}^{obs}$$

where MTP_{it}^D is the value of a particular disability allowance (*Majoration pour Tierce-Personne*) the year the copayment rate was last computed for individual i observed at time t . For a given observed income, the copayment might differ according to the year d when the copayment rate was last computed. Year dummies $\mathbb{1}_{it}^d$, $d = 2002, \dots, 2014$ thus additionally control for inter-individual and intra-individual variation in this parameter.

For 2% of our sample, the relationship between the income and the copayment rate does not respect the legal formula used to compute the copayment rate. After a careful examination of the data, we hypothesize that most of these errors occurred when the copayment rate was computed; conversely, we assume the values of income and copayment rate are well recorded. We add a dummy variable $\mathbb{1}_{it}^e$ signaling whether the observation

³⁶We implicitly assume the rate of increase in disposable income to be identical for two individuals observed a given year, whose personalized plans were decided upon the same year d . Retirees' income is mostly made of pension benefits (Deloffre, 2009), which are reevaluated every year following the inflation rate. It remains a strong assumption given the heterogeneity in income composition across the income distribution.

is affected by such a calculation error. The full equation to be estimated is then:

$$\ln(h_{it}^*) = \gamma_0 + \beta_1 \ln(p_{it}^j) + (\beta_1 + \beta_2) \ln(I_{it}^{obs}) + \sum_{d=2002}^{2014} \xi^d \cdot \mathbb{1}_{it}^d + \zeta \cdot \mathbb{1}_{it}^e + X_{it}' \cdot \theta + \epsilon_{it} \quad (2.8)$$

Finally, note that our econometric specification includes *disposable* income and not income *per se*. In the APA scheme, disposable income is defined as the individualized income³⁷ minus an amount equal to $0.67 \times MTP_{it}^D$ (€739 per month for an individual whose income and copayment rate was last reassessed in 2014). It roughly equals the old-age minimum income allowance. This amount may be regarded as the minimum income that will ensure the individual can satisfy her basic consumption needs: the individual trades off home care consumption for other consumption goods only when deciding upon the allocation of the part of her income in excess of the minimum income allowance.

7.2.B Specification with relative consumption

When using the specification with relative consumption, we consider as the dependent variable the share of the care plan that is effectively consumed by the individual, h_{it}^*/\bar{h}_{it} (this is the ratio we call the “relative consumption”).

Empirically, we take the log of the ratio and estimate the following specification:

$$\begin{aligned} \ln\left(\frac{h_{it}^*}{\bar{h}_{it}}\right) &= \tilde{\gamma}_0 + \tilde{\beta}_1 \ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_{it}^{obs}) + \beta_3 \ln(\bar{h}_{it}) \\ &+ \sum_{d=2002}^{2014} \tilde{\xi}^d \cdot \mathbb{1}_{it}^d + \tilde{\zeta} \cdot \mathbb{1}_{it}^e + X_{it}' \cdot \tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \end{aligned} \quad (2.9)$$

The dependent variable is still censored when individuals fully consume their care plan volume (exact volume or more), but the censoring point now equals $\ln(h_{it}^*/\bar{h}_{it}) = \ln(1) = 0$. It is the same for all beneficiaries, whatever the volume of the care plan.

³⁷Individualized income equals the individual’s monetary income when the beneficiary has no spouse alive; it is equal to the household monetary income divided by 1.7 when the beneficiary has a spouse alive. The consumption unit attributed to the second adult of the household follows the Oxford (or “old OECD”) scale (OECD, 2013). Compared to the OECD-modified scale, which is nowadays the most frequently used in France, using the Oxford scale to compute APA individualized income implies that the economies of scale in a household with a disabled elderly are lower than in other households.

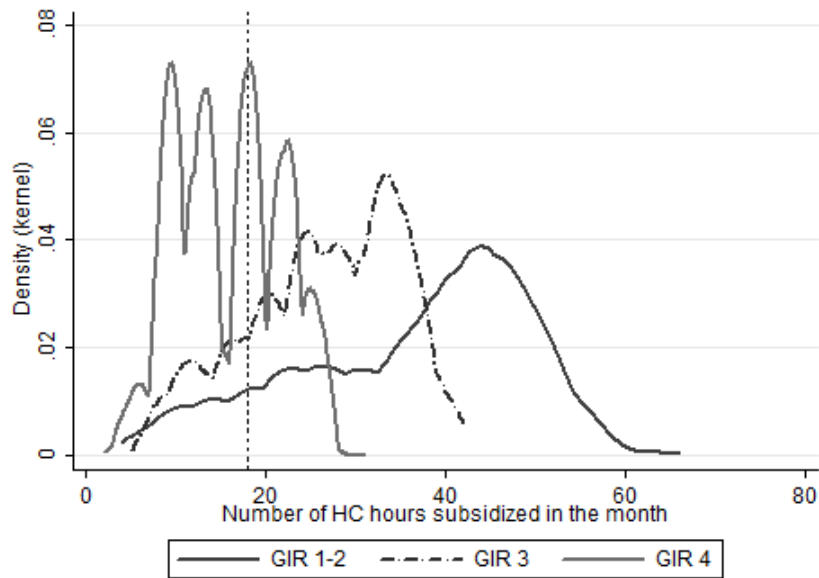
Equation (2.9) is equivalent to:

$$\begin{aligned}
\ln(h_{it}^*) - \ln(\bar{h}_{it}) &= \tilde{\gamma}_0 + \tilde{\beta}_1 \cdot \ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_{it}^{obs}) + \tilde{\beta}_3 \cdot \ln(\bar{h}_{it}) \\
&\quad + \sum_{d=2002}^{2014} \tilde{\xi}^d \cdot \mathbb{1}_{it}^d + \tilde{\zeta} \cdot \mathbb{1}_{it}^e + X'_{it} \cdot \tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \\
\ln(h_i^*) &= \tilde{\gamma}_0 + \tilde{\beta}_1 \cdot \ln(p_{it}^j) + (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_{it}^{obs}) + (\tilde{\beta}_3 + 1) \cdot \ln(\bar{h}_{it}) \\
&\quad + \sum_{d=2002}^{2014} \tilde{\xi}^d \cdot \mathbb{1}_{it}^d + \tilde{\zeta} \cdot \mathbb{1}_{it}^e + X'_{it} \cdot \tilde{\theta} + \tilde{\lambda}_t + \tilde{\epsilon}_{it} \tag{2.10}
\end{aligned}$$

In Equation (2.5), $\tilde{\beta}_1$ can thus be interpreted as the price elasticity of demand. The equation presented in the previous section, Equation (2.8), is nested in this equation. It would be equivalent to Equation (2.10) if we imposed the constraint that $\tilde{\beta}_3 = -1$.

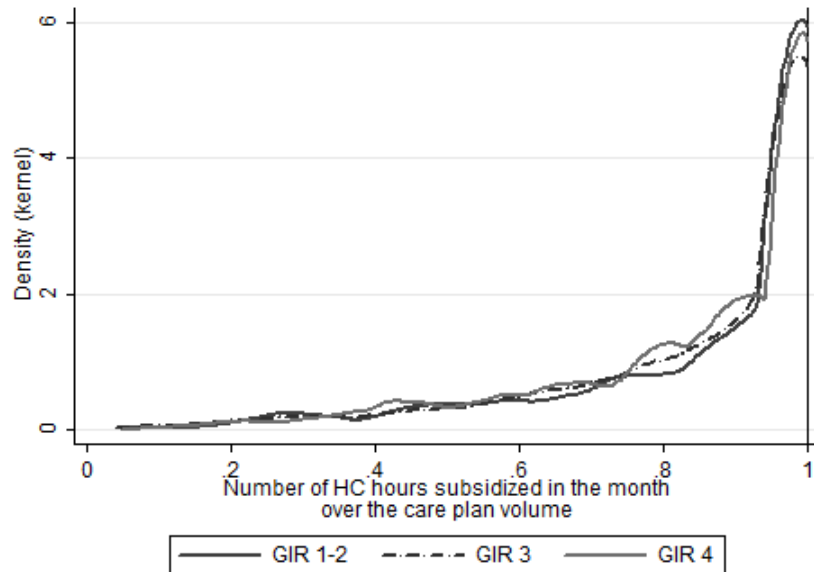
The specification with relative consumption comes with several advantages. First, it includes the care plan volume as a control, which might be a proxy of the unobserved determinants of consumption. Second, relative consumption is a better-behaved outcome than absolute consumption: its distribution is closer to a normal (Figures 2.3 and 2.4) and the consistency of Tobit estimates requires the normality of the error term. Finally, it enables us to overcome the limitation of having an individual-specific censoring point: it eases the implementation of the estimations.

Figure 2.3 – Distribution of absolute home care consumption, by disability level



SAMPLE: Estimation sample (data from October 2012, 2013 and 2014; 8,190 individuals). Sub-sample size: N=1,145 in GIR 1 or 2 (most severe disability levels); N=1,655 in GIR 3; N=5,390 in GIR 4 (least severe disability level).
 NOTES: The “GIR” corresponds to the official disability level of APA beneficiaries. The dashed vertical line indicates the pooled sample median value of home care consumption.

Figure 2.4 – Distribution of relative home care consumption, by disability level



SAMPLE: Estimation sample (data from October 2012, 2013 and 2014; 8,190 individuals). Sub-sample size: N=1,145 in GIR 1 or 2 (most severe disability levels); N=1,655 in GIR 3; N=5,390 in GIR 4 (least severe disability level).
 NOTES: Relative home care consumption designates the ratio h_i/\bar{h}_i . The “GIR” corresponds to the official disability level of APA beneficiaries. The solid vertical line at 1 indicates the censoring point of relative consumption.

7.3 Maximum likelihood estimation

The objective of this appendix is twofold. First, it provides the expression of the likelihood function we maximize to derive our baseline estimates (Tobit estimation). Second, it shows that, within the framework proposed by Moffitt (1986), the censoring of the measure of consumption at the kink and beyond does not prevent the identification of the sample average price elasticity of demand, conditional on some assumptions on the stability of individual preferences.

To keep notations simple and concise, we ignore the time dimension (subscript t and year dummies are not included) and consider home care consumption in level when deriving the likelihood function (while we include its log in the empirical specification).

7.3.A General setting

The demand for home care with the kinked budget constraint generated by APA writes:

$$\begin{cases} h_i^* = g(c_i p_i, I_i; X_i) + \nu_i & \text{if } h_i^* < \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i \leq \bar{h}_i \leq g(c_i p_i, I_i; X_i) + \nu_i & \text{if } h_i^* = \bar{h}_i \\ h_i^* = g(p_i, \tilde{I}_i; X_i) + \nu_i & \text{if } h_i^* > \bar{h}_i \end{cases} \quad (2.11)$$

with ν_i an individual preference shifter. We denote:
 ψ a set of parameters characterizing the function $g(\cdot)$;
 κ a set of parameters characterizing the distribution of the error term ν ;
 S_1 the left-hand side segment of the budget constraint: $i \in S_1 \iff h_i^* < \bar{h}_i$;
 S_2 the right-hand side segment of the budget constraint: $i \in S_2 \iff h_i^* > \bar{h}_i$;
 K the kink of the budget constraint: $i \in K \iff h_i^* = \bar{h}_i$.

7.3.B Observational scheme with censoring

With h_i the consumption in the data and h_i^* the true consumption, our observational scheme is:

$$h_i = \begin{cases} h_i^* & \text{if } h_i^* < \bar{h}_i \\ \bar{h}_i & \text{if } h_i^* \geq \bar{h}_i \end{cases} \quad (2.12)$$

From Systems 2.11 and 2.12, we know that:

1. For all individuals i such that $h_i < \bar{h}_i$, we know that $h_i = h_i^*$; thus we have $h_i^* < \bar{h}_i$ ($i \in S_1$):

$$h_i = g(c_i p_i, I_i; X_i) + \nu_i < \bar{h}_i$$

2. For individuals i such that $h_i = \bar{h}_i$, we know that $h_i^* \geq \bar{h}_i$; these individuals can be split in two different sub-groups:

- (a) Individuals i such that $h_i^* = \bar{h}_i$ ($i \in K$); then:

$$\begin{cases} g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i \leq \bar{h}_i \end{cases}$$

- (b) Individuals i such that $h_i^* > \bar{h}_i$ ($i \in S_2$); then:

$$\begin{cases} g(c_i p_i, I_i; X_i) + \nu_i > \bar{h}_i \\ g(p_i, \tilde{I}_i; X_i) + \nu_i > \bar{h}_i \end{cases}$$

Thus, all censored observations ($i \in S_2$ or $i \in K$) have in common the fact that:

$$g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i$$

We can thus write:

$$h_i = \begin{cases} g(c_i p_i, I_i; X_i) + \nu_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i < \bar{h}_i \\ \bar{h}_i & \text{if } g(c_i p_i, I_i; X_i) + \nu_i \geq \bar{h}_i \end{cases} \quad (2.13)$$

which corresponds to the usual censored regression model setting.

The individual contributions to the likelihood function are derived from this setting. Denote $f(\cdot|c_i, p_i, I_i, \bar{h}_i, X_i)$ the conditional density function of ν and $F(\cdot|c_i, p_i, I_i, \bar{h}_i, X_i)$ its conditional cumulative distribution function. Then the likelihood function writes:

$$L(\psi, \kappa) = \prod_{i=1}^n \left[f\left(h_i - g(c_i p_i, I_i; X_i) | c_i, p_i, I_i, \bar{h}_i, X_i\right) \right]^{\mathbb{I}_{[h_i < \bar{h}_i]}} \\ \times \left[\left(1 - F\left(\bar{h}_i - g(c_i p_i, I_i; X_i) | c_i, p_i, I_i, \bar{h}_i, X_i\right)\right) \right]^{\mathbb{I}_{[h_i = \bar{h}_i]}}$$

In our setting, the censoring of the dependent variable exactly at the kink prevents us from distinguishing between the individuals who consume exactly at the kink and those who actually locate on the right-hand side segment of the budget constraint. Interestingly, it does not prevent the identification of our parameters of interest (which relate to function $g(\cdot)$), although it comes at a cost in terms of precision. Assuming some stability of individual preferences,³⁸ we can interpret the price elasticity estimated using information relating to the left-hand side of the kink as the price sensitivity of demand along the entire budget constraint.

Weaker assumptions on individual preferences would not undermine the identification of the price sensitivity for the selected sample of APA beneficiaries consuming less than their care plan volume. However, if the underlying data generating process actually changes at the kink, censored regression methods would not adequately correct for the bias induced by the non-observability of the individuals consuming at the kink or beyond.

7.3.C Likelihood of our sample

As explained in Section 4.2 of the paper, we assumed the following specification for the demand for home care:³⁹

$$\ln(h_i^*) = \gamma_0 + \beta_1 \cdot \ln(p_i^j) + (\beta_1 + \beta_2) \cdot \ln(I_i) + X_i' \cdot \theta + \epsilon_i$$

We assume a normal distribution for the idiosyncratic shock ϵ :

$$\epsilon \mid p, I, X \sim \mathcal{N}(0, \sigma^2)$$

³⁸ Moffitt (1986) assumes the functional form of $g(\cdot)$ is invariant to changes in consumer price and income.

³⁹ Again, for the sake simplicity, we do not include in the expressions provided in this Appendix the full set of dummies we actually include in our specifications to control for both the unobserved increase in income and the legal relationship between the copayment rate and disposable income (see Appendix 7.2.A).

Our likelihood function thus writes:

$$L(\beta, \gamma, \theta, \sigma) = \prod_{i=1}^n \left[\frac{1}{\sigma} \phi\left(\frac{\ln(h_i) - \gamma_0 - \beta_1 \ln(p_i^j) - (\beta_1 + \beta_2) \ln(I_i) - X_i' \theta}{\sigma}\right) \right]^{\mathbb{I}_{[h_i < \bar{h}_i]}} \\ \times \left[\left(1 - \Phi\left(\frac{\ln(\bar{h}_i) - \gamma_0 - \beta_1 \ln(p_i^j) - (\beta_1 + \beta_2) \ln(I_i) - X_i' \theta}{\sigma}\right)\right) \right]^{\mathbb{I}_{[h_i = \bar{h}_i]}}$$

where $\phi(\cdot)$ (resp. $\Phi(\cdot)$) the conditional density (resp. cumulative distribution) function of a standardized normal variable.

When using the specification with the relative consumption, we have:

$$\ln(h_i^*/\bar{h}_i) = \tilde{\gamma}_0 + \tilde{\beta}_1 \ln(p_i^j) + (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_i) + \tilde{\beta}_3 \ln(\bar{h}_i) + X_i' \tilde{\theta} + \tilde{\epsilon}_i$$

Similarly, we assume a normal distribution for the idiosyncratic shock $\tilde{\epsilon}$:

$$\tilde{\epsilon} \mid p, I, X, \bar{h} \sim \mathcal{N}(0, \tilde{\sigma}^2)$$

The likelihood function writes:

$$\tilde{L}(\tilde{\beta}, \tilde{\gamma}, \tilde{\theta}, \tilde{\sigma}) = \prod_{i=1}^n \left[\frac{1}{\tilde{\sigma}} \phi\left(\frac{\ln(h_i^*/\bar{h}_i) - \tilde{\gamma}_0 - \tilde{\beta}_1 \ln(p_i^j) - (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_i) - \tilde{\beta}_3 \ln(\bar{h}_i) - X_i' \tilde{\theta}}{\tilde{\sigma}}\right) \right]^{\mathbb{I}_{[h_i/\bar{h}_i < 1]}} \\ \times \left[\left(1 - \Phi\left(\frac{\ln(h_i^*/\bar{h}_i) - \tilde{\gamma}_0 - \tilde{\beta}_1 \ln(p_i^j) - (\tilde{\beta}_1 + \tilde{\beta}_2) \ln(I_i) - \tilde{\beta}_3 \ln(\bar{h}_i) - X_i' \tilde{\theta}}{\tilde{\sigma}}\right)\right) \right]^{\mathbb{I}_{[h_i/\bar{h}_i = 1]}}$$

Consistent estimators of β_1 , β_2 and θ (respectively of $\tilde{\beta}_1$, $\tilde{\beta}_2$, $\tilde{\beta}_3$ and $\tilde{\theta}$) can be derived as the arguments of the maximization of the log-likelihood function, provided it is concave.⁴⁰

In order to derive the likelihood function when taking the log-absolute consumption as the dependent variable, we must assume the censoring point \bar{h}_i does not depend on the error term, ϵ_i . In other words, the individual censoring point is assumed to be exogenous, conditional on the observable variables. This assumption is discussed in the next Section and is not needed when we take the log-relative consumption as the dependent variable.

⁴⁰Similarly, though with a little more work, we could derive the likelihood function of the IV-Tobit model. In the version we estimate (using Stata command `ivtobit`), the error terms of the first-stage and second-stage equations are assumed to be jointly normally distributed.

7.4 Determinants of the care plan volume and censoring

When taking the log-*absolute* consumption as the dependent variable, the Maximum Likelihood function (Appendix 7.3) is derived assuming the individual censoring point, defined by \bar{h}_i , is exogenous conditional on explanatory variables. In addition, consistency of estimates relies on the additional assumption that the provider price p_{ij} is exogenous. When estimating Equation (2.7) (Appendix 7.2.A), one particular concern is that the provider price and the care plan volume are correlated even conditional on the control variables.

These two assumptions - exogeneity of the censoring point and no systematic conditional relationship between the care plan volume and the provider price - are relaxed when we take the log-*relative* consumption as the dependent variable. This Appendix nonetheless discusses the plausibility of these assumptions, by presenting elements on the establishing of the care plan volume and additional empirical material.

When setting the care plan volume \bar{h}_i , the evaluation team supposedly takes into account the needs of the beneficiary in terms of assistance with the activities of daily living. By law, the care plan volume should depend on the administrative disability group. Gender and age (which we control for) may influence the care plan volume, as they correlate with unobserved health problems and housekeeping skills. Additionally, even though matrimonial status and family structure are not supposed to influence the care plan volume, anecdotal evidence suggests that the evaluation team takes into account the possible assistance regularly provided by relatives when establishing the care plan.

Additionally, \bar{h}_i could directly relate to the price of the chosen provider in a specific case: when the evaluation team sets the personalized care plan, it has to check that the monetary equivalent of the care plan volume is below the legal ceiling associated with the disability level of the beneficiary. In the case care is provided by a regulated provider, the monetary equivalent of the care plan equals the number of hours granted by the evaluation team times the provider price. If the monetary equivalent of the care plan volume is higher than the legal ceiling, the adjustment will go through a reduction in \bar{h}_i or the choice of a cheaper provider. This may be a source of price endogeneity in both (absolute and relative consumption) specifications.⁴¹

Empirically, once controlling for income, gender, age, disability group, matrimonial status and professional care received on weekends, we find a small positive correlation between the (OOP or provider) price and the volume of the care plan, but the effect is not statistically significant.⁴² Then, a probit estimation of the probability to be censored,

⁴¹Yet it should remain limited: for 7% of our sample at most, the monetary equivalent of their care plan volume would exceed their legal ceiling if they choose the most expensive provider operating in their municipality.

⁴²In the panel analysis, we include fixed effects and cluster at the individual level. Table of results is

$\mathbb{P}(h_i = \bar{h}_i)$, shows that the probability to be censored slightly correlates with the price. A €1 increase in the provider price is predicted to increase the probability to be censored by 2 pp. (as a reminder, the sample censoring rate is around 40% and the standard-deviation in provider prices is of €1.3).

Although they are statistically significant, these effects are small in practical terms. In addition, they fade out when we restrict our attention to beneficiaries living in a municipality where only one provider is operating. This suggests that the strategic choice of a provider (price) to comply with the legal ceiling is empirically negligible in this subsample (see Appendix 7.7.C).

The probability to be censored is higher for individuals with no partner at home, possibly because individuals living with a partner benefit from economies of scale in home care utilization⁴³ and from informal help provided by their spouse. Consuming the care plan volume totally is also more likely for individuals who are entitled to subsidies on formal care served during the weekends.

Individual observable characteristics explain about 50% of the variations observed in the care plan volume. This leaves a large share of the variations unexplained. Ethnographic work suggests that unobserved informal care or health status can influence the evaluation team in the set up of the care plan volume (Billaud *et al.*, 2012). It is likely to rather depend on the general orientation given by the departmental councils to their evaluation team, rather the composition of the evaluation team. Billaud *et al.* (2012) have shown that taking informal care into account is a departmental decision while Gramain, Billaud and Xing (2015) show that the composition of the evaluation team little influence the practices. Overall, if there is a bias in the set up of the care plan volume, it is expected to be common to all individuals in a department, whatever the evaluation team.

As we do not have any good instrument to test the endogeneity of the care plan volume in our dataset, we have to rely on the assumption that it is reasonably exogenous when estimating the specification with log-absolute consumption as the dependent variable. This is one of the reasons why we favour the specification with the relative consumption (Equation (2.5), Appendix 7.2.B).

not included but is available upon request.

⁴³These economies of scale are not factored in by the evaluation team when setting the care plan volume. This is consistent with the fact that APA is meant to be a personal subsidy: legal ceilings do not depend on whether a beneficiary has a partner also receiving APA.

7.5 The home care sector in France

7.5.A Three main types of home care providers

Home care to the disabled elderly can be provided by three types of providers:

- (1) Regulated structures (*services autorisés*), which must receive a special authorization granted by the Departmental Council to enter the market; their price is fixed by the Departmental Council.
- (2) Non-regulated structures (*services agréés non autorisés*) are allowed to provide home care services to APA beneficiaries under lighter conditions than regulated structures; they are free to set their price (with some restrictions on yearly price evolution being set at the departmental level).
- (3) Over-the-counter workers (*gré-à-gré* ou *mandataire*): the beneficiary directly contracts with a home care worker. The beneficiary is free to set her employee's hourly wage provided she complies with general labor law.

There is no regulation for over-the-counter workers. Both regulated and non-regulated structures have to meet quality standards, though requirements are higher for regulated structures. The existence of differences in quality between *regulated* providers is less clear-cut. From a theoretical perspective though, the uncertainties regarding the quality of services in the home care sector lead to rule out vertical differentiation through prices (Messaoudi, 2012).

In our empirical analysis, we focus on regulated providers: technically, we are able to compute the exact OOP price of their customers receiving APA as these services are priced by the Departmental Council. More broadly, APA subsidized professional care is mainly provided by this type of structure: using a survey conducted on the French departments (LEDa-LEGOS and CES, 2012), Hege *et al.* (2014) document that in over 45% of (responding) departments, more than two thirds of APA home care hours are provided by regulated services. Care provided by regulated structures represent less than one third of APA hours in only 15% of departments.⁴⁴

7.5.B The different status for regulated providers

Regulated providers can be either public, for-profit or non-profit. Historically, in France, non-profit organizations were important providers of home care and they remain

⁴⁴Using our data, we study the determinants of the choice of a provider. We find that individuals receiving care from a regulated provider are on average less rich than the overall population of APA beneficiaries; they tend to be younger, less disabled and live more often alone (results available upon request).

predominant in most rural areas. In our department, 5 regulated providers are non-profit, providing care to about 54% of our estimation sample in October 2014. 20 municipal services are providing care to APA recipients (about 43% of the 2014 sample). For-profit structures represent a small share of the regulated home care providers (3 in the department), as they provide home care only to 3% of our 2014 sample.⁴⁵

Theoretically, an APA beneficiary is free to choose her provider. In practice, the spatial coverage by the different types of regulated services is unequal over the territory. In some municipalities, several providers are found to operate, while there is only one provider in others (see Section 7.7.C). In our department, among the beneficiaries living in a municipality where several regulated providers serve APA recipients, more than 50% can choose between the three types of regulated providers. These beneficiaries live in relatively large municipalities: the supply mix is more diversified when there is an important market for home care services, while small municipalities are generally *de facto* served by a unique, non-profit structure. Conversely, the typical supply mix in medium-size municipalities is the combination of non-profit and public regulated providers. Finally, a for-profit provider is never found to be the only regulated service operating in a given municipality.

⁴⁵Proportions are similar in the pooled sample. The small market share of for-profit services among regulated providers is not a specific feature of the department studied.

7.6 Explaining variations in provider prices

7.6.A Components of costs in the home care sector

In this section, we explain why customers may exogenously face different provider prices, by detailing the components of prices in the home care sector.

Regulated providers are priced by the Departmental Council. The hourly price of each provider, for one given year, should be set on the basis of the overall average hourly production cost of the provider, of two years before. The various components of production costs are described in qualitative studies, either in academic works ([Gramain and Xing, 2012](#)) or in public reports.⁴⁶ By order of importance (top-down), production costs can be decomposed as follows:

- Workforce costs (80% of total charges): wages paid to professional caregivers and, for a small part (around 10% of total charges), to the supervising staff. The wage of a caregiver depends on her qualification, according to collective labour agreements. We expect that the larger the proportion of skilled caregivers, the higher the production cost and the price. Wages are also augmented if employees work on Sunday or on public holidays, in accordance with general labour legislation.
- Operating costs (10-15% of total charges): those include rents for the service's offices and other running expenses.
- Transportation costs (5-10% of total charges)⁴⁷ correspond to the compensation for the costs borne by employees to go to the consumer's home. This item is likely to vary largely across services according to their geographical area of intervention.
- Contrary to the health care sector, technological progress and capital costs are negligible in the home care sector.

We represent the relationship between the provider price and several providers' characteristics graphically.⁴⁸ We distinguish between non-public (mainly non-profit) providers and public providers. The latest are likely to receive grants or advantages (e.g., a free office) from local municipalities that reduce operating costs. Such advantages are taken

⁴⁶There is, though, no national, comprehensive benchmark study on the costs of home care services. Public reports regularly deplore the lack of information on costs as a major shortcoming preventing from understanding the functioning of the sector ([Vanlerenberghe and Watrin, 2014](#); [Poletti, 2012](#)).

⁴⁷This item only includes the compensation of employees for the monetary costs associated with transport. The ongoing study mentioned in the paper additionally takes into account the unproductive hours spent on transports by the employees that are paid by the provider.

⁴⁸We explore here other characteristics than the number of served municipalities, that we use as an instrument for the price. The empirical relationship between the two variables is documented by Figure 2 in the paper.

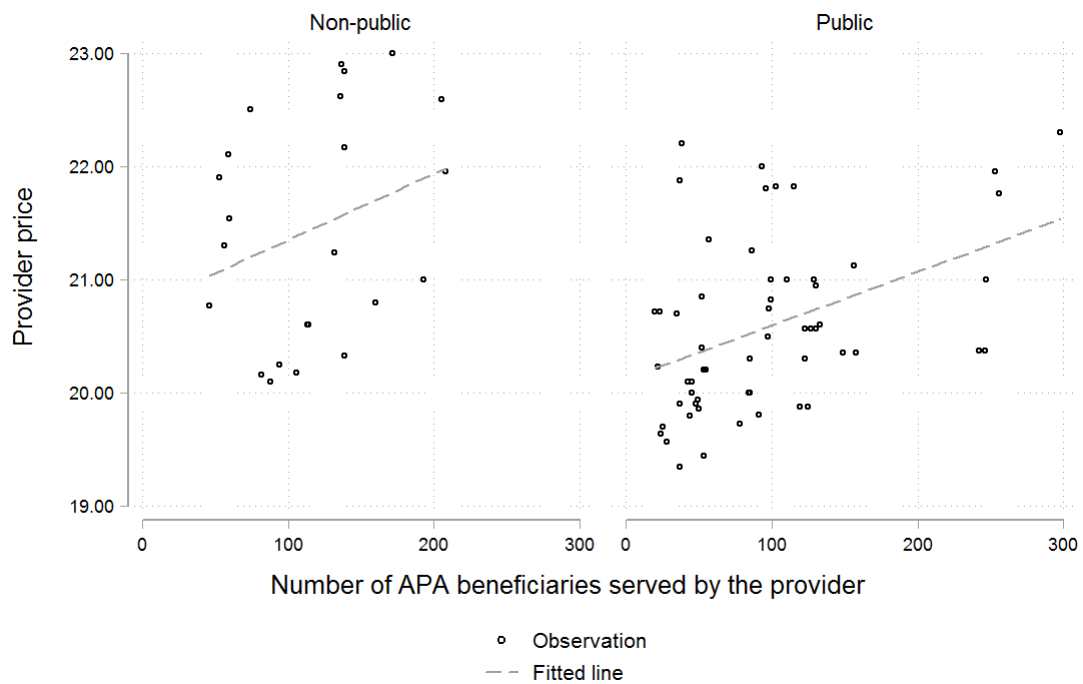
into account in the pricing process done by the Departmental Council and lower down the regulated price of public providers. In the graphical representation, we exclude the largest provider of the department, a nationwide non-profit organization, which has systematically the highest values for the variables we are here interested in (see Appendix 7.7.B).

In Figure 2.5, provider prices are plotted against the number of APA beneficiaries served by the service. Graphically, the more customers the provider has, the higher its price. Having more customers might be associated with more municipalities to serve (see discussion in Section 4.4 of the paper) or more unproductive hours.⁴⁹ This graph should be interpreted cautiously though: we only know the number of APA recipients served by each home care provider, instead of the total number of customers (including non-APA beneficiaries, like other elderly or disabled individuals) served in the department.

Figure 2.6 shows the relationship between the provider price and the share of hours they serve on Sundays or on public holidays. Public providers have a very low share of such hours, as most public services do not operate on weekends and holidays. A higher share of hours made on holidays is associated with a higher price among public structures, which is consistent with the financial compensation of employees for working on public holidays.

⁴⁹Unproductive hours (meetings, training) may become relatively more numerous when a service gets relatively large.

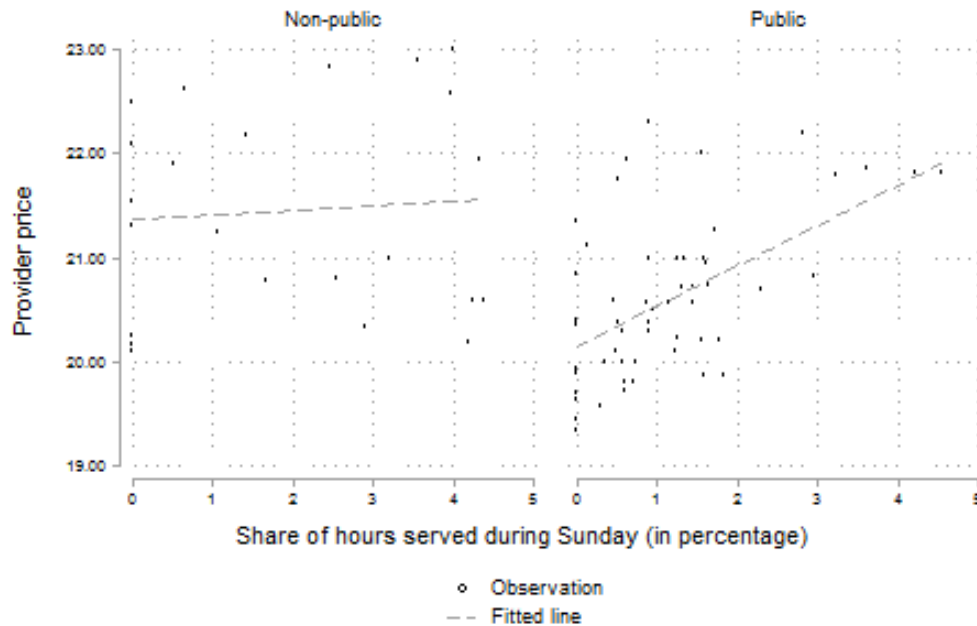
Figure 2.5 – Provider price according to the number of APA beneficiaries served by the provider, by legal status



SAMPLE: Regulated providers of the department serving at least one APA beneficiary in October 2012, 2013 or 2014.

NOTES: The largest provider, which serves 43% of the APA beneficiaries receiving care from a regulated provider in the department in 2014, is not included.

Figure 2.6 – Provider price according to the share of hours served on Sundays and public holidays, by legal status



SAMPLE: Regulated providers of the department serving at least one APA beneficiary in October 2012, 2013 or 2014.

NOTES: The largest provider, which has 1.80% of its home care hours provided on Sundays and holidays in 2014, is not included.

7.6.B Individual characteristics and provider price

We also investigate the importance of the observable characteristics on the choice of a given level of provider price. Table 2.7 presents the individual characteristics associated with the choice of a “low-price” regulated provider, defined as a provider charging a price strictly below the average price charged by the regulated providers operating in the beneficiary’s municipality (in a given month). We estimate the probability of choosing a “low-price” provider by a Probit on the sub-sample of individuals who live in a municipality where several regulated providers serve APA recipients. Beyond a slight age effect, only the disability level is found to have a significant impact. The least severely disabled are more likely to choose a “low-price” provider, possibly reflecting that they perceive home care as less necessary and are thus *ex ante* more sensitive to its price. Income is not found to have any impact on this choice, nor is matrimonial status (Fisher tests reject the joint significance of both the set of income quartile dummies and the set of matrimonial status dummies).⁵⁰

⁵⁰Although we do not find any evidence that beneficiaries who are able to choose between different regulated providers choose a price level according to their income, it might still be the case that there is systematic correlation between income and provider price in the sample, as about 30% of beneficiaries are suspected not to be able to choose between different providers (Appendix 7.7.C). When we take our estimation sample and regress the provider price on income and all the sociodemographic variables we include in our estimations as well as year dummies, we find a negative partial correlation between income and provider price. Although it is statistically significant, it is fairly small: a one standard-deviation increase in disposable income is predicted to decrease provider price by 0.01 standard-deviation. This is small enough not to undermine the separate identification of the price and empirical income elasticities.

Table 2.7 – Individual characteristics and choice of a low provider price

Dependent variable: chooses a “low-price” provider	
	(1)
Income quartile: 1	-0.010 (0.025)
<i>Ref: income quartile: 2</i>	
Income quartile: 3	-0.003 (0.028)
Income quartile: 4	-0.006 (0.029)
Woman	-0.030 (0.019)
Age: 60–69	-0.050 (0.054)
Age: 70–79	-0.040* (0.021)
<i>Ref: age: 80–89</i>	
Age: 90 or more	-0.029 (0.021)
Disability level: 1 (most severe)	-0.102 (0.113)
Disability level: 2	-0.024 (0.036)
<i>Ref: disability level: 3</i>	
Disability level: 4 (moderate)	0.068*** (0.022)
Lives with no spouse	-0.000 (0.021)
Spouse receives APA	0.004 (0.051)
<i>Ref: lives with non-APA spouse</i>	
Spouse in institution	-0.098 (0.110)
Observations	5701
Number of clusters	82

NOTES: Standard errors in parentheses, clustered at the municipality level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimation of a Probit model by Maximum Likelihood. Average partial effects (APE) are displayed. “Low-price” providers are charging a price below the average price of regulated providers within a given municipality (in one given month: October 2012, 2013 or 2014); the estimation uses the sample of beneficiaries served by only a regulated provider living in a municipality where at least two different prices are offered by regulated providers. Data pooled from October 2012, October 2013 and October 2014. Specifications include year fixed effects.

7.7 Robustness checks

7.7.A Additional results: absolute or relative consumption

In this section, we present the results obtained on the pooled sample and by year, fitting several specifications. Table 2.8 presents the estimates of the first specification, when the dependent variable is the absolute consumption (Equation (2.7), Appendix 7.2.A). Tables 2.9 and Table 2.10 present the results obtained with the second specification, when the dependent variable is the relative consumption, either assuming the provider price is exogenous (Table 2.9) or instrumenting it (Table 2.10). In all three tables, Column (1) gives the estimate obtained on the pooled sample, while Columns (2) to (4) display the estimates obtained on October 2012, 2013 or 2014.

Whatever the specification, estimates on 2014 are of a lower precision, essentially because there is one provider less (one provider closed down in 2014). The point estimates are also systematically lower (in absolute value) in 2014 than in the other two years, although the difference from one year to the other is never statistically significant.

When the dependent variable is the absolute consumption, the coefficients associated with the price lie between -0.7 and -1.0: they are higher than those obtained with the relative consumption (between -0.3 and -0.7 with no instrumentation, -0.1 and -0.5 when the IV strategy is implemented). It might be explained by the fact that the care plan volume, which may be a proxy for some unobserved determinants of professional care consumption, is not taken into account in the specification with absolute consumption as the dependent variable.

With the absolute consumption, the income effect within the APA scheme is suggested to be negative. When taking the relative consumption as the dependent variable, and including the care plan volume as a control, point estimates are lower in absolute value (presumably because the omitted variable bias is reduced); the effect of income within the APA scheme is no longer significant. The IV-strategy only little affects point estimates. Except for 2014, we can systematically reject that the price elasticity is zero.

Overall, these results confirm that the price elasticity is significantly different from zero and inferior to one in absolute value. The -0.4 point estimate we finally retain is the one that is the most likely to be unbiased (care plan volume as a control & IV strategy) and the most precise (pooled data with both intra- and inter- individual price variations). Yet we must acknowledge the relatively low precision of our results: the 95%-level confidence interval derived from our favoured specification indicates a price elasticity between -0.01 and -0.76.

Table 2.8 – Censored regression estimates of demand for home care hours (absolute consumption)

Dependent variable: absolute consumption h^* (log)				
	(1)	(2)	(3)	(4)
	2012–14	2012	2013	2014
Price (log)	-0.793*** (0.248)	-0.977*** (0.260)	-0.721** (0.297)	-0.709** (0.290)
Disposable income (log)	-0.039*** (0.010)	-0.033*** (0.012)	-0.039*** (0.015)	-0.048*** (0.019)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls sociodemographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the copayment rate was computed. Column (1) additionally includes year fixed effects.

Table 2.9 – Censored regression estimates of demand for home care hours (relative consumption)

Dependent variable: relative consumption h^*/\bar{h} (log)				
	(1)	(2)	(3)	(4)
	2012–14	2012	2013	2014
Price (log)	-0.450** (0.181)	-0.670*** (0.180)	-0.376 (0.236)	-0.300 (0.238)
Disposable income (log)	-0.010 (0.008)	-0.003 (0.009)	-0.014 (0.009)	-0.014 (0.016)
Care plan volume (log)	0.040* (0.023)	0.054* (0.030)	0.019 (0.027)	0.041 (0.033)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls sociodemographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the copayment rate was computed. Column (1) additionally includes year fixed effects.

Table 2.10 – Censored regression estimates of demand for home care hours (relative consumption, IV)

	(1)	(2)	(3)	(4)
	2012-14	2012	2013	2014
<i>Panel A: Second Stage</i>				
	Dependent variable: relative consumption h^*/\bar{h} (log)			
Price (log)	-0.387** (0.192)	-0.537** (0.209)	-0.460** (0.214)	-0.134 (0.245)
Disposable income (log)	-0.010 (0.008)	-0.003 (0.009)	-0.014 (0.008)	-0.014 (0.016)
Care plan volume (log)	0.040* (0.023)	0.054* (0.030)	0.019 (0.028)	0.042 (0.033)
<i>Panel B: First Stage</i>				
	Dependent variable: provider price p (log)			
Number of municipalities (std.)	0.049*** (0.004)	0.050*** (0.004)	0.046*** (0.004)	0.050*** (0.004)
Other controls	Yes	Yes	Yes	Yes
Observations	8190	2571	2757	2862
Censored observations	36.6%	40.4%	38.2%	40.2%
Number of clusters	28	28	28	27

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data from October 2012, 2013 and 2014. Estimation of an IV-Tobit model by Maximum Likelihood. Price is instrumented by the number of municipalities served by the provider. In the first stage (Panel B), the log-provider price is regressed on the standardized number of municipalities served by the provider. All specifications, for both Panel A and Panel B, include as controls sociodemographic variables, dummies for the year the latest plan was decided upon and dummies for the year in which the copayment rate was computed. Column (1) additionally includes year fixed effects.

7.7.B Clustering and Bootstrap inference

Level of clustering

In the paper, we denote $\tilde{\epsilon}_{it}$ the error term in our favoured specification (Equation (5)). As we cluster at the provider level j , we actually implicitly assume the following structure for the error term $\tilde{\epsilon}$:

$$\tilde{\epsilon}_{ijt} = \tilde{\xi}_i + \tilde{\nu}_j + \tilde{\zeta}_{ijt}$$

with $\tilde{\xi}_i$ capturing the unobserved individual heterogeneity, and $\tilde{\nu}_j$ the provider level time-invariant unobserved heterogeneity. For two individuals i and i' that are served by the same provider j (assume for the sake of simplicity that t is not varying), $\text{corr}(\tilde{\epsilon}_{ijt}, \tilde{\epsilon}_{i'jt}) \neq 0$ as long as there are unobserved shocks taking place at the provider level.

For a given individual observed at t and t' , error terms will be necessarily correlated if there is some individual time-invariant unobserved heterogeneity.⁵¹ As standard with panel data, we would need to cluster at the individual level. Yet, as almost all APA beneficiaries keep the same provider j over time, the latter way of clustering (at the individual level) is essentially nested in the former clustering option (at the provider level). We believe that within-individual correlation of errors is more important than within-provider shock correlation; we nonetheless choose to cluster at the most aggregate level. In our specific setting, in which our main explanatory variable varies at the provider-year level, clustering at the provider level is of due caution as the provider price does not change within one cluster cross-sectionally (Moulton, 1990; Cameron and Miller, 2015).

Inference with few clusters

With clustered standard errors, inference relies on asymptotic properties that kick in as the number of clusters tends to infinity. The “few-cluster issue” was documented notably by Cameron *et al.* (2008): in an OLS setting, Wald hypothesis tests based on the standard cluster-robust estimate of the variance matrix tend to over-reject the null. Rejection rates increase when clusters are of unequal sizes (Imbens and Kolesár, 2015).

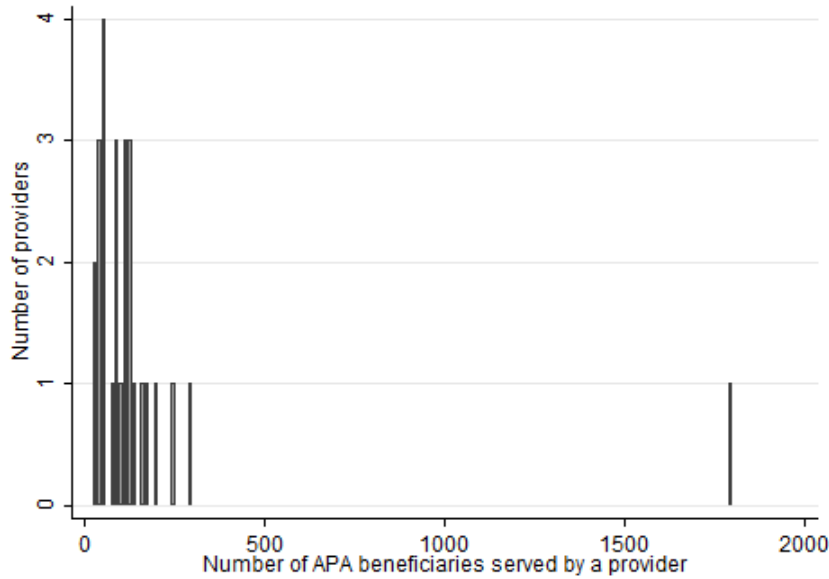
In our department, there are relatively few regulated providers (28 in 2012 and 2013, 27 in 2014 as one provider closed down).⁵² and there is one very large regulated provider (Figure 2.7). This service is a local branch of a long-standing nationwide non-profit home care service; it serves 37% of the APA beneficiaries in our sample. With only 28 clusters, including one being considerably larger than the others, we face the risk that standard cluster-robust inference is biased.

In order to assess the robustness of the inference on the estimates presented in the paper, we use a bootstrap procedure. By bootstrapping the Wald t-statistic associated

⁵¹Note that we are not able to include individual fixed-effects in the type 1-Tobit model, as there is no parametric solution to the incidental parameter problem (Lancaster, 2000).

⁵²This is not a feature specific to our department though (LEDa-LEGOS and CES, 2012).

Figure 2.7 – Distribution of the size of regulated providers (October 2014)



NOTES: Size of a provider is measured by the number of APA beneficiaries it serves. Data from October 2014, 27 regulated providers (one regulated provider closed down in 2014).

with the price elasticity estimate $\hat{\beta}_1$, we may improve small-sample inference by attaining asymptotic refinement (Cameron and Miller, 2015).

We start by estimating our equation on the original sample (by Tobit or IV-Tobit).⁵³ We retrieve the point estimate of the price elasticity, $\hat{\beta}_1$ and its standard error, $se(\hat{\beta}_1)$, and we compute the original sample Wald t-statistic $t = \hat{\beta}_1/se(\hat{\beta}_1)$. We then implement a percentile pair cluster bootstrap, by repeating 1,000 times the following steps:

1. We form 28 “pair” clusters of observations by re-sampling with replacement 28 times from the original clustered sample.
2. For each bootstrap sample $b = 1, \dots, 1000$, we estimate $\hat{\beta}_1^b$ (by Tobit or IV-Tobit), and the associated cluster-robust standard error $se(\hat{\beta}_1^b)$.
3. For each bootstrap sample b , we compute the Wald t-statistic centered in $\hat{\beta}_1$:

$$t_b = \frac{\hat{\beta}_1^b - \hat{\beta}_1}{se(\hat{\beta}_1^b)}, \quad b = 1, \dots, 1000$$

⁵³Here, as well as in the subsequent bootstrap replications, we do not use Stata’s `ivtobit` command, through which standard errors are derived using the observed information matrix (`oim`). Instead, we first regress the (log) provider price on the instrument and the other exogenous controls (clustering at the provider level) and derive a prediction of the log of the provider price. We run the second step by regressing the (log) relative consumption on the *predicted* log-provider price and the other controls, again clustering at the provider level. It gives the inputs we use in the bootstrap procedure.

We then use the empirical distribution of the bootstrap t-statistics t_b to derive the critical values to be used in lieu of the critical values derived from a standard normal or T distribution. We compare the t-statistic associated with the price elasticity coefficient obtained in the observed sample to the symmetrical critical values derived from the bootstrapped t-statistic distribution. The percentile-t p-value for the symmetric two-sided Wald test of $H_0: \tilde{\beta}_1 = 0$ is computed as the proportion of times the absolute value of the bootstrapped t-statistic is greater than the absolute value of the observed sample t-statistic; that is to say, the proportion of times that $|t_b| > |t|$, $b = 1, \dots, 1000$

Issues may arise when using pair cluster resampling with dummy control variables: some of the bootstrap samples may have little or even no variation in the control variables. The computation of t_b in those samples is not possible; using the bootstrap t-statistics that were actually computed is not an option either, as completed replications cannot be assumed to be random.⁵⁴ In order to avoid failure to complete the target number of cluster bootstrap replications, we drop from our original sample the 8 individuals whose copayment rate was last reassessed prior to 2011.⁵⁵

Table 2.11 displays the price elasticity estimates and compares standard inference with bootstrap inference. Columns (1) to (3) display the estimates obtained using a Tobit model to estimate our specification with relative consumption, while Columns (4) to (6) are derived from an IV-Tobit estimation. Columns (1) and (3) display the original consumer price elasticity estimates obtained by either Tobit or IV-Tobit estimations, while Columns (2) and (5) display the same estimates obtained on the sample on which the pair cluster bootstrap can be completed. Comparing (1) and (2) first, then (4) and (5), we see that dropping the 8 aforementioned individuals has virtually no effect on the point estimate.

The Tobit estimation of the specification with the relative consumption produces a t-stat equal to -2.50. The 25th lowest value of the bootstrap t-statistics is -1.87, while its 975th is equal to 1.90. Using a symmetric Wald test, we find that the absolute value of the original t-stat is larger than $|t_b|$ a little less than 99% of times (p-value of 0.018, Column (3) of Table 2.11). Bootstrap inference thus indicates that we can reject the hypothesis that the price elasticity is zero at the 5% level.

Similarly, the IV-Tobit estimation of the specification with relative consumption produces a t-stat equal to -1.93. The 25th lowest value of the bootstrap t-statistics is -1.73, while its 975th is equal to 1.38. Using a symmetric Wald test, we reject the hypothesis

⁵⁴Wild cluster bootstrap has been documented as leading to more robust inference in the case of few clusters, as well as helping in the case that right-hand side dummy variables induce incomplete replications (Cameron and Miller, 2015). To our knowledge though, wild cluster bootstrap has not been extended to nonlinear models.

⁵⁵Our specifications with absolute and relative consumptions include a dummy for the year in which the copayment rate was assessed, as justified in Appendix 7.2.A.

Table 2.11 – Bootstrap inference

Dependent variable: relative consumption h^*/\bar{h} (log)						
	<i>Tobit</i>			<i>IV-Tobit</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
Price (log)	-0.450**	-0.451**	-0.451**	-0.387**	-0.388**	-0.386**
(se)	(0.181)	(0.180)	-	(0.192)	(0.192)	-
<i>p-value</i>	<i>0.013</i>	<i>0.012</i>	<i>0.018</i>	<i>0.044</i>	<i>0.044</i>	<i>0.014</i>
Disposable income (log)	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
(se)	(0.007)	(0.007)	-	(0.007)	(0.007)	-
<i>p-value</i>	<i>0.184</i>	<i>0.184</i>	<i>0.163</i>	<i>0.186</i>	<i>0.186</i>	<i>0.165</i>
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	co-payment reassessed no earlier than 2011		All	co-payment reassessed no earlier than 2011	
Observations	8190	8182	8182	8190	8182	8182
Censored observations	39.6%	39.6%	39.6%	39.6%	39.6%	39.6%
Inference	Default	Default	Bootstrap	Default	Default	Bootstrap
Number of clusters	28	28	28	28	28	28

NOTES: Standard errors in parentheses, the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data pooled from October 2012, 2013 and 2014. Estimation of a Tobit or IV-Tobit model by Maximum Likelihood (Stata commands `tobit` for Columns (1) to (3), and `ivtobit` for Columns (4) and (5)). In Columns (3) and (6), inference is obtained using a bootstrap procedure. Difference in the point estimates between Columns (5) and (6) is due to the fact that in Column (6) we implement manually the IV strategy in two separate steps, rather than using the `ivtobit` command, to make the Bootstrap procedure consistent.

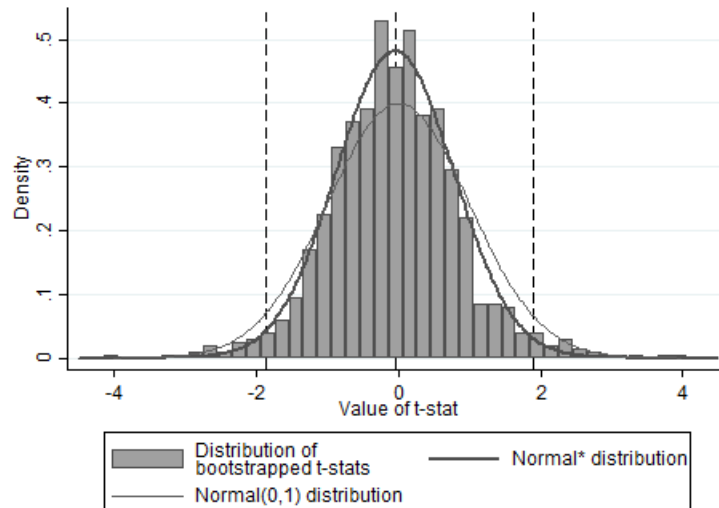
SAMPLES: In Columns (2), (3), (5) and (6), individuals whose copayment rate was reassessed prior to 2011 are not included in the sample (8 individuals).

BOOTSTRAP INFERENCE: We implement a pair cluster percentile bootstrap of the t-statistics (1,000 replications). The percentile-t p-value for the symmetric two-sided Wald test of $H_0: \beta_1 = 0$, is computed as the proportion of times the absolute value of the bootstrap t-statistic is greater than the absolute value of the observed sample t-statistic.

that the relative consumption of home care is price inelastic, again at the 5% level.

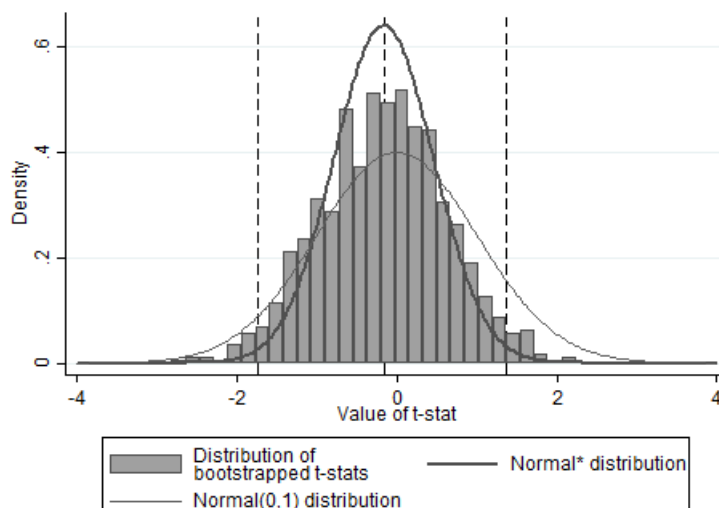
Figures 2.8 and 2.9 display the empirical distribution of the bootstrap t-statistics obtained following either the Tobit or the IV-Tobit estimation of the consumer price elasticity. We display a normal distribution with mean and variance equal to the mean and variance of the empirical distribution of the bootstrap t-statistics, and the normal distribution with mean 0 and variance 1 as a benchmark. Despite the sample containing one very large cluster, we observe a quite smooth distribution of t-statistics in both Figures. All replications are complete and the tails of the distribution do not seem excessively fat, making us confident in the quality of our bootstrap and in the statistical power of the deriving Wald test on the price elasticity estimate.

Figure 2.8 – Percentile-t bootstrap quality: distribution of bootstrap t-statistics (Tobit estimation)



NOTES: t-stats from percentile bootstrap-t (1,000 replications). Output from Tobit estimation on relative consumption (Column (3) of Table 2.11) on sample of 8,182 individuals. *The first normal distribution displayed has a mean and variance equal to the mean and variance of the distribution of bootstrap t-stats. Dashed vertical lines represent the 25th and 975th ordered elements and the mean of the bootstrap t-stat distribution.

Figure 2.9 – Percentile-t bootstrap quality: distribution of bootstrap t-statistics (IV-Tobit estimation)



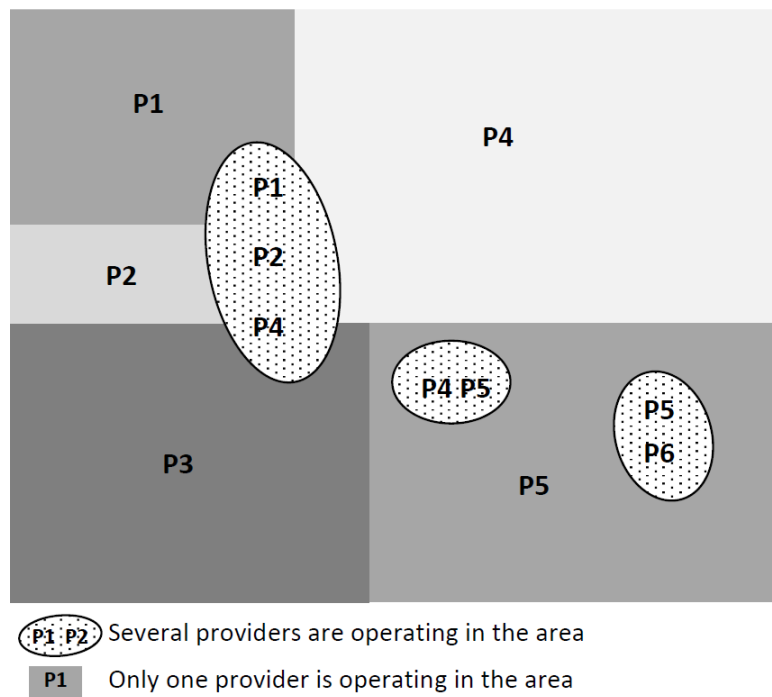
NOTES: t-stats from percentile bootstrap-t (1,000 replications). Output from manual IV-Tobit estimation on relative consumption (Column (6) of Table 2.11) on sample of 8,182 individuals. *The first normal distribution displayed has a mean and variance equal to the mean and variance of the distribution of bootstrap t-stats. Dashed vertical lines represent the 25th and 975th ordered elements and the mean of the bootstrap t-stat distribution.

7.7.C Alternative identification strategy: using single-provider areas

Single-provider and multiple-provider areas

According to their geographical location in the department, beneficiaries may not be systematically able to choose between several providers of the department. We divide our sample into two sub-populations (Figure 2.10): on the one side, beneficiaries living in a municipality where a single provider is found to operate, or single-provider area (denoted “SPA”; areas in plain color). On the other side, individuals living in a municipality where two or more regulated providers have customers, or multiple-provider area (denoted “non-SPA”; dotted areas).⁵⁶

Figure 2.10 – Distribution of providers in the department - Schematic representation



NOTES: We provide only a schematic representation to preserve the anonymity of the department. Different shades of plain grey indicate different areas served by a unique regulated service (single-provider areas, or SPA), each being served by a different provider with a given price level. The dotted areas correspond to multiple-provider (non-SPA) municipalities.

As displayed in Table 2.12, 79% of the municipalities represented in our sample belong to an SPA; 35% of beneficiaries included in the estimation sample live in this type of areas. The remaining beneficiaries live in a municipality where two or more regulated providers have customers. This partition interestingly reflects the spatial concentration of

⁵⁶To identify the two types of areas, we use the full population of APA beneficiaries in the department, not only the APA beneficiaries of our estimation sample.

the APA population: 65% of the beneficiaries in our sample live in 21% of the department municipalities. Consistently, non-SPA municipalities are more often urban centers than SPA municipalities.

Table 2.12 – Single-provider areas and multiple-provider areas (October 2014)

	Municipalities		Beneficiaries		Average price
	<i>Number</i>	<i>Frequencies</i>	<i>Number</i>	<i>Frequencies</i>	
SPA	220	78.9%	995	34.8%	€22.7
Non-SPA	59	21.1%	1867	65.2%	€22.0
Total	279	100%	2862	100%	-

NOTES: Estimation sample from October 2014. Average provider price per type of area is not weighted by the number of customers of the providers.

The spatial distribution of professional care provision is consistent with the fact that transportation costs are an important factor in the provision decision of home care services (cf. Section 4.4 of the paper). Providing services all over the department would be costly for a relatively small service. Typically, municipalities where only one provider is found to operate are served by non-profit home care services. In urban centers, the supply proposed by non-profit services may be complemented with municipal home care services, or even, in the largest municipalities, with one of the few for-profit regulated services found in the department (cf. Appendix 7.5.B).

Table 2.13 presents the descriptive statistics computed on the two sub-samples of APA beneficiaries, depending on the type of area in which they live. The two sub-samples are similar in terms of their sociodemographic characteristics albeit non-SPA residents are richer on average. This is consistent with the fact that non-SPA residents tend to locate in urban centers. The under-consumption rate is higher among non-SPA beneficiaries, but the average number of hours effectively subsidized is similar in both types of areas. This goes against the concern that SPA beneficiaries may experience rationing in the provision of professional care. Although subsidized consumption *relative* to the care plan volume is slightly higher for SPA beneficiaries on average (86% *versus* 84%), the overall distribution of relative consumption is fairly similar in the two sub-samples. Overall, except for the income level, the two populations little differ in terms of outcome and explaining variables.

Price elasticity estimates using SPA and non-SPA beneficiaries

Arguably, SPA beneficiaries have limited choice if they resort to a regulated provider. As a consequence, they are not able to choose their price p_i^j . Note that home care price endogeneity due to residential mobility is suggested to be negligible: the overall residential mobility of the elderly is very low (Laferrère, 2008) and when moves occur, they are mainly

Table 2.13 – Descriptive statistics on the SPA and non-SPA sub-samples (October 2014)

<i>Variable</i>	<i>SPA</i>	<i>Non-SPA</i>	<i>Difference</i> <i>(p-value)</i>
	[1]	[2]	[1] - [2]
Care plan volume [a]	20.1	20.8	0.06
Care plan monetary value [b]	€456.8	€454.8	0.83
Hours effectively subsidized [c]	17.5	17.8	0.38
Amount of effective subsidies [d]	€311.7	€294.9	0.03
[c] inferior to [a]	57.2%	61.2%	0.03
Individualized income	€1,272	€1,339	0.00
co-payment rate	21.9%	24.6%	0.00
Provider price	€22.8	€21.8	0.00
Hourly out-of-pocket price	€5.0	€5.4	0.01
Total OOP payments	€86.0	€94.2	0.03
on subsidized hours			
Consumes during the week-end	9.2%	7.5%	0.11
Age	84.4	84.0	0.18
Women	72.5%	74.7%	0.18
Disability group 1 (most severe)	1.5%	1.0 %	
Disability group 2	12.2%	12.6%	
Disability group 3	20.7%	19.1%	0.54
Disability group 4 (moderate)	65.6%	67.3%	
	100%	100%	
Living with a spouse	34.7%	33.3%	
Living alone	64.7%	66.1%	0.81
Spouse in institution	0.6%	0.6%	
	100%	100%	
Number of individuals	995	1867	-
Number of households	965	1820	-

NOTES: Estimation sample from October 2014. Descriptive statistics are computed on the sub-sample of APA beneficiaries living in single-provider municipalities (SPA) in Column (1) and those living in multiple-provider municipalities (non-SPA) in Column (2). Compared to Table 2.12, average provider price in each sub-sample is weighted by the number of beneficiaries in the sample.

TESTS: P-values from a Student (resp. Pearson χ^2) test for binary or continuous (resp. categorical) variables.

explained by family motives or the need for adapted residences. Price endogeneity should thus be limited in the SPA sub-sample; on the contrary, we suspect it may arise in the non-SPA sample. Comparing the price elasticity estimates obtained on the two sub-samples may thus provide a test of price endogeneity in the estimation sample.

The estimation is run using the specification with the relative consumption, the outcome being h_{it}^*/\bar{h}_{it} . Results are displayed in Table 2.14.⁵⁷ As presented in the paper, the price elasticity is of -0.45 when estimated on the whole sample, significantly different from

⁵⁷We only display the price and income coefficients as the effects of controls are similar to the estimates obtained with the full estimation sample (displayed in Table II of the paper).

zero at the 5% level. Restricting the sample to individuals who are assumed to have no provider choice, the point estimate slightly changes to -0.52. Because of reduced sample size and price variations, precision is lower but the estimate is still significantly different from zero at the 10% level.

The point estimate is higher when we run the estimation on the sub-population of individuals who can choose between different providers, with a point value of -0.63.⁵⁸ The difference between the two sub-sample estimates might potentially be explained by both an omitted variable bias affecting the choice of the provider price and some differences in the characteristics of the individuals of the two samples. However, the difference is not statistically significant even at the 10% level. Overall, this alternative estimation strategy (relying on SPA beneficiaries only) confirms our main results: the consumption of home care by the disabled elderly is price-elastic, with a point estimate inferior to one in absolute value and a magnitude seemingly around -0.5 or -0.4.

Table 2.14 – Censored regression estimates of demand for home care hours (SPA/non-SPA)

<i>Sample:</i>	Dependent variable: relative consumption h^*/\bar{h} (log)		
	<i>All</i>	<i>SPA</i>	<i>Non-SPA</i>
	(1)	(2)	(3)
Price (log)	-0.450** (0.181)	-0.522* (0.305)	-0.626** (0.258)
Disposable income (log)	-0.010 (0.008)	0.001 (0.010)	-0.013 (0.009)
Care plan volume (log)	0.040* (0.023)	0.039*** (0.014)	0.049* (0.029)
Other controls	Yes	Yes	Yes
Observations	8190	2489	5701
Censored observations	39.6%	40.7%	39.1%
Number of clusters	28	18	28
<i>AIC</i>	11454	3277.318	8144
<i>BIC</i>	11643	3376.252	8324

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013, 2014. Estimation of a Tobit model by Maximum Likelihood. All specifications include as controls sociodemographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the copayment rate was computed and year fixed effects. SPA stands for “single-provider area” beneficiaries, non-SPA for “multiple-provider area” beneficiaries.

⁵⁸Because of the non-linearity of the model, the point estimate obtained on the entire sample is not comprised between the two point estimates obtained on the two sub-samples.

This alternative identification strategy has several drawbacks. First, focusing on SPA beneficiaries induces additional intra-departmental selection. We find the non-SPA to be richer than SPA beneficiaries. If richer individuals are more price-elastic, as suggested by Table 2.3 in the main text, the price elasticity obtained on the SPA sub-sample would then be a lower bound (in absolute value) for the average price elasticity of our estimation sample. But we may additionally suspect that the two sub-samples differ in terms of unobservable determinants of professional care consumption. Using the specification with relative consumption, we tested the effect of including a dummy equal to one for SPA beneficiaries (Table 2.15): living in a SPA is found to positively affect home care relative consumption, *ceteris paribus*. The inclusion of the SPA dummy affects the price elasticity estimate (although not statistically significantly). This might suggest that SPA beneficiaries behave differently than non-SPA in terms of care consumption decisions.

One might fear that regulated providers operating as monopolies may set their price in accordance with the price elasticity of demand. In SPA municipalities, provider prices could be higher where the price sensitivity of APA beneficiaries is lower, inducing a potential downward bias (in absolute value) in our point elasticity estimate. Given that the regulated providers operating in an SPA are systematically non-profit structures and that they are priced by the Departmental Council, there is limited scope for consumer surplus extraction by monopolist providers.

A more serious issue *a priori* is that SPA and non-SPA sub-samples are constructed using the available information of our sample. We construct the non-SPA sample by observing the municipalities in which there are beneficiaries served by at least two different regulated providers.⁵⁹ It might be the case, especially in very small municipalities, that there are few beneficiaries living in a municipalities and they happen to all choose the same provider. In this case, we will infer that there is only one provider operating; we do not have any other way to infer from the data whether the individuals were able to choose between different providers. Although such cases are scarce,⁶⁰ we should remain cautious when interpreting the price elasticity estimated on the SPA sample.

Finally, when focusing on SPA beneficiaries, we loose 10 clusters (corresponding to regulated providers who are only found to operate jointly with other providers in the municipalities where they are present). This may undermine the validity of inference in the SPA sub-sample.

⁵⁹We do not have direct information on the supply and geographical coverage by the different providers.

⁶⁰8% municipalities turn out to have a unique APA beneficiary, hosting 1% of the department's beneficiaries. More largely, beneficiaries living in municipalities with 5 or less APA recipients represent around 10% of total beneficiaries.

Table 2.15 – Censored regression estimates of demand for home care hours, controlling for the type of area of residence

Dependent variable: relative consumption h^*/\bar{h} (log)		
	(1)	(2)
Price (log)	-0.450** (0.181)	-0.613*** (0.202)
Disposable income (log)	-0.010 (0.008)	-0.008 (0.007)
Lives in a SPA		0.064*** (0.023)
Other controls	Yes	Yes
Observations	8190	8190
Censored observations	36.9%	36.9%
Number of clusters	28	28
<i>AIC</i>	11454	11431
<i>BIC</i>	11644	11621

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a Tobit model by Maximum Likelihood. Specifications include as controls sociodemographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the copayment rate was computed and year fixed effects. SPA stands for “single-provider area”, non-SPA for “multiple-provider area” beneficiaries.

7.7.D Additional results: inclusion of care received on weekends

As we do not directly observe the informal care received by the individuals, we include as a control in our estimation the formal home care the individual possibly receives during the weekend and public holidays (Table 2.16).

As in our baseline estimations, the latent dependent variable is the number of hours consumed between Monday and Saturday, except for public holidays, divided by the care plan volume open for business days. Consistently, the care plan volume taken into account to compute relative consumption only includes the hours that were prescribed to be consumed over the week. APA beneficiaries may also be entitled to subsidies for a few hours of care to be received during weekends and public holidays, which are set separately in the personalized care plan. Although weekend hours are charged the same price, they are not fungible with week hours. Only 7.5% of our estimation sample has weekend hours included in her personalized care plan, for a median volume of about 5 hours a month.⁶¹ We did not include the home care hours received on weekends as a control in our baseline specifications because of a simultaneity concern.

We hypothesize that, for given disability and sociodemographic characteristics, individuals not receiving professional home care over the weekend are more likely to receive assistance from their relatives. We find that receiving formal care during the weekend is associated with more hours consumed during working days; reassuringly though, it does not significantly affect the price elasticity estimate.

⁶¹As beneficiaries with weekend care plan volume tend to be more severely disabled, their week care plan volume, \bar{h}_{it} , is on average higher than the week care plan volume of the rest of beneficiaries. Among these beneficiaries, APA hours prescribed on weekends amount only to 15% of the week care plan volume on average.

Table 2.16 – Inclusion of home care received on weekends

Dependent variable: relative consumption during the week h_i^*/\bar{h}_i (log)			
	(1)	(2)	(3)
Price (log)	-0.392** (0.193)	-0.452** (0.195)	-0.392** (0.196)
Consumes care on weekends		0.227*** (0.020)	-0.054 (0.054)
Number of hours received on weekends			0.080*** (0.017)
Observations	8190	8190	8190
Censored observations	39.6%	39.6%	39.6%
Number of clusters	28	28	28
<i>AIC</i>	-22073.724	-22168.783	-22215.301
<i>BIC</i>	-21884.435	-21979.495	-22026.013

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014 (population-average model). Estimation of an IV-Tobit model by Maximum Likelihood. Provider price is instrumented by the number of municipalities served by the provider. All specifications, in both the first and second stages, include as controls the care plan volume, sociodemographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the copayment rate was computed and year fixed effects.

7.7.E Robustness check: estimation by a truncated regression model

As a further robustness check, we estimate the price sensitivity of the demand for home care using a truncated regression model. We make as if we did not observe all individuals who consume beyond their care plan volume. As shown in Table 2.17, the truncated regression model gives a price coefficient very close to what the censored regression model does. As we exploit less information when fitting a truncation model (on about 40% of the sample), the precision is much lower. Although the coefficient on income is higher in when using a truncated regression model, this comparison gives credit to the econometric specification of the model. It gives empirical support to the theoretical discussion presented in Appendix 7.3.B: under an assumption of stability of preferences and constant price elasticity along the demand curve, we are able identify the sample average price elasticity by using information on the individuals that locate on the left-hand side of the kink in the budget constraint.

Table 2.17 – Consumer price elasticity estimations: comparing truncated and censored regression models

	Dependent variable: relative consumption (h/\bar{h})	
	(1) Truncated reg.	(2) Censored reg.
Price (log)	-0.304 (0.449)	-0.275** (0.111)
Disposable income (log)	-0.076*** (0.027)	-0.007* (0.004)
Observations	4947	8190
Clusters	28	28
AIC	-4539	6594
BIC	-4363	6783

NOTES: Standard errors in parentheses, clustered at the provider level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a Truncated regression model and a Tobit model by Maximum Likelihood. Specifications include as controls socio-demographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the copayment rate was computed and year fixed effects. The dependent variable is the relative consumption.

7.7.F Robustness check: estimation by a Poisson model

As a further robustness check, we estimate the price sensitivity of the demand for home care using a Poisson regression model, taking into account the censored characteristic

of our data (censored Poisson model).⁶² As it is a count model, we directly use as a dependent variable the number of hours consumed (instead of the logarithm of the relative consumption). The estimated coefficient thus will not be directly comparable to the previous estimations.

Table 2.18 shows the results of the estimation of the censored Poisson model, both while not including clusters at the provider level (Column 1) and including them (Column 2). These estimations show that a 10% increase in the OOP payments is expected to decrease the number of hours consumed by almost 2 hours, but it is only significantly different from zero at conventional threshold when clusters are not included. The effect of disposable income is negative, significantly negative but with a very low magnitude. The difference of results might be due to differences in the fitting of the models to our data. Our data do not seem to follow a Poisson model. In particular, the variance is substantially different from the mean, as is shown in Table 2.1.

Table 2.18 – Consumer price elasticity estimations: censored Poisson model

	Dependent variable: hours consumed (h)	
	(1)	(2)
Tarif (log)	-0.193*** (0.060)	-0.193 (0.150)
Disposable income	-0.000*** (0.000)	-0.000*** (0.000)
Observations	8190	8190
Number of clusters		28
AIC	41684	41676
BIC	41887	41851

NOTES: Standard errors in parentheses, clustered at the provider level in Column 2; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Pooled data from October 2012, 2013 and 2014. Estimation of a censored Poisson regression model by Maximum Likelihood. Specifications include as controls sociodemographic variables, dummies for the year the latest plan was decided upon, dummies for the year in which the copayment rate was computed and year fixed effects. The dependent variable is the volume consumed during the month.

⁶²We use the command Stata `cpoisson`.

Chapter 3

Are there better places to grow old? Decentralized policies and formal care use by the disabled elderly

This chapter was co-authored with
Rémi Kaboré and **Jérôme Wittwer**.

Summary of the chapter

In a context of population ageing, public policies encourage the utilization of professional home care for the elderly living in the community. This chapter studies the determinants of professional home care use by the disabled elderly in the French context. It focuses on the effects of the regulation of the supply and the generosity of public financing. We use departmental variations in both the regulation of providers and the implementation of the main program devoted to the disabled elderly, the APA policy. We exploit an original survey on departmental practices matched with the HSM survey to estimate the determinants of formal care use, at the extensive margin. We find no effect of the departmental generosity while, on the supply side, when non-regulated providers — whose quality is uncertain and price is lightly regulated — dominate the market, the disabled elderly have a lower probability to use formal home care. Our results contribute to discuss both the questions raised by the decentralization of a national policy and the recent reform of the home care sector requiring all home care structures to be regulated.

Classification

JEL Classification: D12, H75, I18, J14

Keywords: demand, long-term care, APA program, decentralization.

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Contents of the Chapter

1	Introduction	174
2	Institutional context	175
2.1	Financing of the demand	175
2.2	Regulation of the supply	176
3	Data and modeling of the demand	178
3.1	Description of departmental practices	178
3.2	A sample of disabled elderly	180
3.3	Modeling formal care use	183
4	Results	184
4.1	Main results	184
4.2	Extensions and robustness checks	193
5	Discussion	193
6	Conclusion	195
7	Appendices	197
7.1	Additional information on the institutional context	197
7.2	Descriptive statistics on departments...	201
7.3	Disability measures	206
7.4	Details on the Logit estimation	208
7.5	Robustness checks	210
7.6	Departmental sociodemographic groups	213
7.7	Comparison with results on the take-up of the APA program	216
7.8	Comparison of <i>SolvAPA</i> survey and <i>Territoire</i>	217

1 Introduction

OECD countries are facing the aging of their population, which results in an increasing demand for long-term care. Most disabled elderly keep on living in the community rather than entering nursing homes (Colombo *et al.*, 2011). In this demographic context, public policies foster the utilization of formal care, defined as the provision at home of basic domestic help and personal care by a paid professional caregiver. In France, the main long-term care program, the APA policy, is granted to the disabled elderly in order to help them financing the consumption of formal care services when they keep on living in the community. In 2015, it counted 748,000 community-dwelling beneficiaries and amounted to an overall public spending of €3.2 billions (0.15% of GDP).¹ The implementation of the program is decentralized to local authorities, the departmental councils. Their role is of utmost importance regarding both the generosity of the allowance and the regulation of the home care providers. According to field studies and public reports, it results in substantial differences in the costs and the availability of professional care across departments (Billaud *et al.*, 2012; Hege *et al.*, 2014; Bourreau-Dubois *et al.*, 2015; Gramain, Hege and Roquebert, 2015; Observatoire National du domicile, 2018).

We use these departmental variations to study the determinants of formal care use by the disabled elderly in the French context. Our question is twofold. Does the demand for formal care depend on the generosity of public financing? Is it sensitive to the regulation of the home care supply? To the best of our knowledge, the latter question has never been addressed in the literature, despite the existing heterogeneity in the regulation of care providers in France (Devetter *et al.*, 2012). A few papers have investigated the effect of public generosity, using territorial variations in long-term care programs. Stabile *et al.* (2006) find that, in Canada, the generosity level of provinces, measured by the yearly spending per individual aged 65 and older, increases formal care utilization and decreases informal caregiving. In France, Arrighi *et al.* (2015) find that the APA take-up increases with the departmental generosity, measured by the rate of APA beneficiaries in the elderly population and the average subsidy rate. Focusing on the effect of formal care use on mental health, Barnay and Juin (2016) use the departmental proportion of APA beneficiaries in the elderly population to instrument formal care consumption.

We exploit an original departmental survey to describe departmental practices regarding long-term care. Matched with the HSM survey (DREES and INSEE, 2008), it makes it possible to study both the individual and departmental determinants of formal care use (at the extensive margin). Departmental determinants are the generosity of the allowance, measured by the way the department council computes the hourly subsidy, and the mar-

¹Source: DREES (2015b).

ket share of regulated providers compared to the others. We discuss the exogeneity of these indicators. We find no effect of the generosity of the policy while, on the supply side, the disabled elderly have a lower probability to use formal care when non-regulated providers, whose price and quality are little regulated, dominate the market.

Though the interpretation of results needs to be cautious, our work has several policy implications. These results first contribute to the debate on the difference of treatment that can result from the decentralization of a national policy and questions the need for further central control. Moreover, they highlight the determinants of formal care use, especially those that depend on public policies, namely the public generosity and the supply regulation. This understanding is needed to increase the efficiency of the long-term care system. Indeed, formal care used has been found to have positive effects on the health of the elderly and it also affects their relatives by relieving the burden of informal care. According to our results, the 2016 reform of the home care program, which requires all providers to be regulated, could help increasing home care utilization.

2 Institutional context

2.1 Financing of the demand

The French APA program² aims at fostering the utilization of professional care services by the elderly requiring assistance in the activities of daily living. To be eligible, an individual must be at least 60 years old and recognized as disabled. The assessment of the disability level is performed by a team from the departmental council, made of medical professionals and/or social workers. The assessment is done using a national standardized scale (“grille AGGIR”). It allows the evaluation team to assign the individual to a disability group (“Groupe Iso-Ressources”, or GIR). Individuals found to be moderately (GIR–4) to extremely disabled (GIR–1) are eligible for APA, while the least severely disabled (GIR–5 or –6) are not. If the individual is recognized as eligible, the evaluation team defines the maximum number of hours of care that can be subsidized given her limitations, called the “care plan volume”.³ Departmental heterogeneity has been proven regarding eligibility decisions and hours open to public financing ([Arrighi *et al.*, 2015](#)).

We focus on another dimension of the generosity of the program that depends on the departmental council. For each hour consumed within the care volume, the OOP price of

²In our work, we describe the scheme before the 2016 reform. This reform has affected the copayment scheme and the regulation of providers. We will discuss the potential effects of the last point with our results.

³The monetary equivalent of the care plan volume (hours of the care plan converted in euros using a tariff fixed by the department) must not exceed a legal ceiling, which is set nationally and depends on the disability level of the beneficiary.

care is lowered by the APA subsidy.⁴ By law, the OOP price depends on the copayment rate of beneficiaries, which is a linear function of the individual's income.⁵ However, the central law does not make clear how the final OOP payment is computed.⁶ Three types of practices are observed : either the copayment is applied to the provider price (rule 1), either it is applied to a lump sum price, lower than the provider price. In this second case, the difference between the price and the lump sum price is supported by the beneficiary (rule 2) or it is paid by a departmental specific grant (rule 3). System 3.1 summarizes these possibilities. Rule 3 is the most generous as it yields the lower OOP payment⁷ while Rule 2 is the less generous.

$$OOP_i = \begin{cases} c_i \cdot p_i & \text{(Rule 1)} \\ c_i \cdot t + (p_i - t) & \text{(Rule 2)} \\ c_i \cdot t & \text{(Rule 3)} \end{cases} \quad (3.1)$$

with OOP_i the OOP price paid by the individual; c_i the copayment rate depending on I_i individual i 's income ($c_i = c(I_i)$); p_i the provider price and t the lump sum price set by the department.

Using the average value for the copayment rate, price and care plan volume in the sample of APA beneficiaries used in Chapter 2, Appendix 7.1.B illustrates the variation in monthly OOP payments that can result from the utilization of one rule or another. In this case, using rule 2 rather than rule 3 would create a difference of €100 per month, or about 8% of the average monthly income. The minimum difference (using rule 1 or rule 3) is of €22, or 2% of average income.

2.2 Regulation of the supply

In France, there is one key distinction in the home care sector: home care providers can be regulated by the departmental council or not. Regulated providers receive a special authorization from the departmental council to enter the market. They have to meet quality standards, including certifications and regular external evaluations. Their price is fixed by the departmental council on the basis of their previous costs of provision (Gramain and Xing, 2012). The other providers, that we call non-regulated providers, are lightly

⁴The financing of the APA allowance by central government and departments is detailed in Appendix 7.1.A.

⁵The participation rate is zero for low-income individuals and it is capped to 90% for high-income individuals.

⁶To illustrate our point, one can see that the official webpage on the OOP payment in the APA scheme only mentions the copayment rate depending on income. See (in French): <https://www.service-public.fr/particuliers/vosdroits/F1802>

⁷Provided that $t < p$, which is systematically the case.

regulated. There are two types of non-regulated providers: non-regulated structures and over-the-counter workers.⁸ Non-regulated structures have lower quality requirements and they are relatively free to set their price.⁹ Over-the-counter workers contract directly with the consumer who is free to set the hourly wage provided that she complies with general labor law. Overall, the uncertainty regarding quality and price is higher when the provider is not regulated.

There are few empirical elements on the market segmentation between regulated and non-regulated providers. All providers can intervene on both publicly and privately financed formal care, and serve consumers with different disability levels. In the department studied in Chapter 2, severe disability levels are less frequently observed among individuals served by a regulated provider. The determinants of the choice of a provider might depend on the availability of providers (serving her municipality), the price and other unobserved characteristics of the provider.¹⁰

To give a visual insight of variations existing in both the financing of the demand and the regulation of the supply, Figure 3.1 shows the differences existing in the OOP payments borne by an APA beneficiary with a copayment of 20%¹¹ and served by the biggest regulated provider in the department.¹² Differences result from the choices of departmental councils regarding the computation formula as well as differences in provider prices. In the last group of our distribution divided by quartiles, the hourly OOP payment is expected to be between €3.7 and €4.1 while in the first group, it is between €4.4 and €6.2. The Figure also reveals differences existing regarding the regulation of the supply, as some departments declare they do not have any regulated provider.

⁸In the General introduction of the thesis, non-regulated providers only refers to non-regulated structures. Here, the term is used in opposition to regulated structures and implies both non-regulated structures and over-the-counter workers.

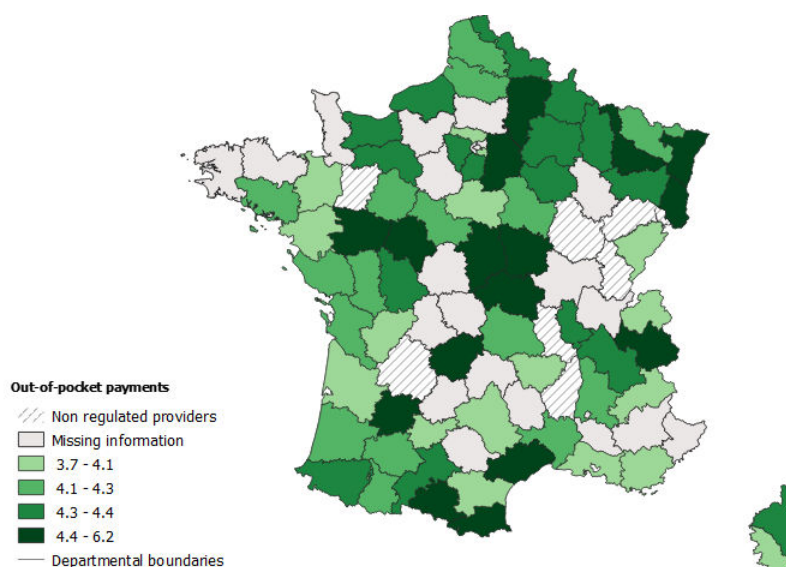
⁹Restrictions on yearly price evolution are enacted at the national level.

¹⁰Appendix 7.6.B in Chapter 2 studies the determinants of the choice of a provider with a low price, but among consumers served by a regulated provider.

¹¹It corresponds to the average copayment rate of APA beneficiaries in the administrative data from the APA program “*Remontées individuelles*” (DREES, 2011).

¹²We use the departmental survey “SolvAPA”. It is not the departmental survey we use in this paper as we do not have concomitant individual information, but it is presented in Section 7 as an additional source of information.

Figure 3.1 – Hourly out-of-pocket payments of an APA beneficiary served by the biggest regulated provider in the department



SOURCE: *SolvAPA* survey (DREES, 2015a)

NOTES: computation by the author. Copayment rate set at 20%.

Realization: Roquebert, 2018.

3 Data and modeling of the demand

3.1 Description of departmental practices

The “*Territoire*” survey (LEDa-LEGOS and CES, 2012) was implemented by a team of sociologists and economists. Field studies were first conducted in eight departmental councils to observe their practices regarding long-term care. They aim at evaluating the latitude they have in the implementation of the policy. Their results underline the variety existing in the organization of the policy (Billaud *et al.*, 2012; Gramain and Xing, 2012).¹³ They have been used to construct a questionnaire that was sent to the 96 metropolitan departmental councils in 2012.¹⁴ 71 departmental councils returned the questionnaire. Appendix 7.2.A compares the characteristics of respondents and non respondent departments with respect to sociodemographic characteristics and social policy indicators and does not find significant differences between the two groups.

We use this original survey to get indicators of both the generosity of public financing and the importance of the regulation of the supply in the department. First, we isolate

¹³In particular, on the basis of interviews with the persons in charge of the management of the allowance, the researchers have identified the existence of the different computation formulas presented in the preceding section.

¹⁴The questionnaire can be found here (in French): <http://modapa.cnrs.fr/questionnaire.pdf>.

departments that have no regulated providers (7 departments). They have a limited intervention on the formal home care sector, not controlling for prices or quality. They use rule 2 to compute the allowance for all (non-regulated) providers. We then measure departmental generosity with the rule used to compute the allowance when the beneficiary is served by a regulated provider.¹⁵ The classical case is when departmental councils use rule 1. A few departments use the third rule for regulated providers. As it implies additional spending for the departmental council, we consider it is a “generous” policy. Interestingly, this indicator of policy generosity does not depend by construction on the distribution of the population nor on its actual consumption, but directly shows the decisions of the departmental councils. Previous indicators used in the literature come from departmental policies and actual consumption of beneficiaries. For instance, the average subsidy per beneficiary depends on the copayment of APA beneficiaries, on the care plan volume and on the share of the care plan that is actually consumed.

Regarding the regulation of the supply, we use the share of APA hours that is provided by regulated providers, as a proxy for the market power of regulated in the home care sector of the department. Either non-regulated providers are dominating the market, or there is competition, or regulated providers providers dominate the market.¹⁶ This indicator does not depend directly on the number of individuals consuming formal care, nor on the volume they consume.

Appendix 7.2.B compares the characteristics of departments in each category. We report here significant differences. In generous departments, the population is, on average, younger and wealthier than the population in other departments. In departments where non-regulated providers dominate the market, the population is, on average, younger, with a lower rate of the elderly population receiving the APA. Interestingly, departments without regulated providers are not different from the majority of departments in other categories. We thus observe a correlation between some departmental practices and the characteristics of the demand. We extensively discuss the endogeneity issues in Section 7 and, in the absence of an alternative empirical strategy confirming the exogeneity of our indicators, we will remain cautious in the causal interpretation of our results.

Table 3.1 summarizes the distribution of departments according to their practices. Each computation rules is represented in every level of supply regulation, suggesting that choices are made independently. The size of categories, though, are unbalanced, with some cases being much more frequent than others. Thus, we will evaluate the effects

¹⁵Departments can use different rules depending on the provider status. Quasi-systematically, beneficiaries served by non-regulated providers are subsidized using rule 2. Variations are observed regarding the rule used for beneficiaries served by regulated providers.

¹⁶The question in the questionnaire is: “What is the proportion of APA hours served by regulated providers?”. Departmental councils choose either less of 1/3, between 1/3 and 2/3, more than 2/3 of APA hours.

of marginal practices compared to the more frequent case (classical with dominance of regulated providers).¹⁷

Table 3.1 – Distribution of departmental practices

	No regulated providers	Classical (rule 1)	Generous (rule 3)	Total
No regulated providers	7	-	-	7
Dominance of non-regulated providers	-	2	1	3
Competition	-	25	3	28
Dominance of regulated providers	-	30	3	33
Total	7	57	7	71

SAMPLE: 71 metropolitan departments respondents to the survey.

SOURCE: *Territoire* survey (LEDa-LEGOS and CES, 2012)

NOTES: Columns correspond to the generosity of the hourly APA subsidies. Lines correspond to the importance of the regulation in the home care sector.

3.2 A sample of disabled elderly

These indicators are used to supplement the HSM survey (DREES and INSEE, 2008). Collected in 2008, this national survey focuses on the disabilities and health limitations encountered by the French population. Our sample of interest gathers together individuals aged 60 or more, who declare having at least one restriction in the activities of daily living, either essential or instrumental (ADL or IADL)¹⁸.

We use as a variable of interest the variable indicating if the individual receives formal home care.¹⁹ This variable comprises both privately and publicly funded formal care. It includes care provided either by regulated or non-regulated providers.

We could alternatively have focused on the variable indicating if the individual receives the APA (or, at least, has applied to receive it). Indeed, our demand indicator is likely to directly influence the take-up of the program. The choice of the broader variable of formal care use is motivated by two reasons. The first is technical: the variables related to the APA program in the HSM survey have been shown to underestimated the actual use of the APA program (Tenand, 2016). The weighted number of elderly declaring they receive the benefit in the survey is much lower than the actual number of APA beneficiary in 2008. In our sample of disabled elderly, among formal care users, only 17% declare they are APA beneficiaries. The second argument relates to the effect of our supply indicator. It might

¹⁷Appendix 7.2.C shows the distribution of the observations in our sample across categories.

¹⁸See Appendix 7.3 for more details on ADL and IADL.

¹⁹In our definition, individuals consume formal care if they have specifically declared they receive care from home care providers.

affect formal care used by disabled elderly, regardless of their APA status. Some disabled elderly are not eligible for the APA program (GIR 5 and 6) but they could nonetheless consume formal care, while being potentially subsidized by other schemes like pension funds.

On the basis of the department of residence, we match the individual data with the *Territoire* survey.²⁰ In our estimations, we will control for a set of sociodemographic characteristics: age, sex, marital status, education level (highest diploma obtained) and monthly income. We distinguish between different disability level using the Katz Index. This index proposes eight categories that are constructed to take into account both the number and the type of ADL restrictions (Katz *et al.*, 1970; Katz, 1983). Group A refers to independent individuals. Activity limitations increases in other groups, up to Group G which gathers together individuals requiring assistance for six activities of daily living (personal hygiene, dressing, toileting, transferring, eating and drinking, and continence). In the last group, Group H, are found persons requiring assistance for at least two activities but not falling in previous categories.²¹ We group some categories to distinguish between independent (group A), moderately disabled (B-C-H), highly disabled (D-E) or severely disabled (F-G) individuals, as has been done previously in the literature (Fontaine, 2012). We also control for the fact that another person could have responded to the survey (proxy), as this variable is correlated with the level of functional limitations and the perception of unmet needs (Davin *et al.*, 2009).²² To take into account the care provided by the relatives, we control for the number of daughters and sons of the individual. In the literature, these variables have been used to instrument informal care (Van Houtven and Norton, 2004); they permit to capture only the effect of potential informal care provision on the formal care use, while avoiding the potential reverse causality that would exist if we include the volume of informal care provided by children.²³ Finally, we also control for the area of residence of the individual (rural or urban).²⁴ Table 3.2 shows the descriptive statistics of these variables on our sample.

²⁰The HSM survey was constructed to be representative at the national level, not at the departmental level. Consequently, we are not able to provide descriptive statistics on individuals by department. In our estimations, the precision of estimates will depend on the number of individuals that have been surveyed in each department. Remarkably, three departments are not represented in our sample.

²¹See Appendix 7.3 for the definition of each category.

²²Some studies have also found that the proxy tends to over-estimate the activity limitations of the individuals, but this is not what is found by Davin *et al.* (2009), working on French data.

²³In that case, the coefficient would capture both the effects of informal care on formal care and the reverse relationship.

²⁴We use the zoning ZAUER proposed by the INSEE. Rural municipalities are those who belong to an employment area defined as rural, or in the halo of such an area and other municipalities predominantly rural.

Table 3.2 – Descriptive statistics on the sample

	%
<i>Individual characteristics</i>	
Consumes formal care	43.89
Woman	69.24
Age: 60-70	21.23
Age: 70-80	38.48
Age: 80-90	33.40
Age: older than 90	6.89
Does not live with a spouse	51.67
Lives in a rural municipality	19.36
No diploma	47.10
Diploma of primary studies	39.61
Diploma of secondary school	7.24
Diploma: <i>baccalauréat</i> (high school)	6.05
Monthly income < €1000	20.59
€1000 ≤ monthly income < €1500	25.28
€1500 ≤ monthly income < €2000	17.34
Monthly income ≥ €2000	26.44
Income missing	10.35
Katz Index: independent	77.54
Katz Index: moderately disabled	13.88
Katz Index: highly disabled	3.41
Katz Index: severely disabled	5.16
Use of a proxy	10.76
Number of sons (mean)	1.22
Number of daughters (mean)	1.25
<i>Lives in a department...</i>	
Non-respondent	27.6
No regulated providers	3.55
Classical	55.70
Generous	13.13
Dominance of regulated providers	30.22
Competition	28.24
Dominance of non regulated providers	10.38

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCE: HSM survey (DREES and INSEE, 2008).

3.3 Modeling formal care use

We focus on the extensive margin and denote y_i the formal care utilization of individual i , with $y_i = 1$ if the individual receives formal care, $y_i = 0$ otherwise. Formal care utilization depends on a latent variable y_i^* modeling the utility the individual gets from formal care consumption. Only y_i is observed. If y_i^* is positive, the utility of formal care is high enough to result in consumption. It can be expressed as follows:

$$\begin{cases} y_i = 1 \Leftrightarrow y_i^* > 0 \\ y_i = 0 \Leftrightarrow y_i^* < 0 \end{cases} \quad (3.2)$$

The utility of formal care is assumed to depend on individual characteristics X_i and on the practices in the department where the individual lives, denoted $D_{d(i)}$.

$$y_i^* = \beta_0 + X_i\beta + D_{d(i)}\alpha + u_i \quad (3.3)$$

With X_i individual characteristics of i and $D_{d(i)}$ departmental variables of the department d of individual i .

We use a Logit²⁵ model explaining the probability to consume formal care with individual and departmental determinants.²⁶ As we are using mixed-level data, we cluster standard errors at the department level to take into account potential correlation of disturbances within departments (Moulton, 1990).²⁷

To control for the characteristics of departments, we use the departmental classification recently proposed by the Ministry of Health (DREES, 2014; Fizzala, 2016).²⁸ It offers an interesting opportunity to control for sociodemographic characteristics of departments. This classification has been established on the basis of a principle component analysis and it creates five departmental groups with respect to demographic and socioeconomic characteristics, that we will call ‘‘sociodemographic groups’’. Variables taken into account relate to the elderly population in the department: importance in the population, health status, wealth, socio-professional characteristics and living arrangements. The classifi-

²⁵Appendix 7.4 details the formalization of the Logit model.

²⁶Appendix 7.5.A repeats our estimations using linear probability and Probit models to test whether our results are sensitive to the functional form.

²⁷We could have used a multilevel modeling, which less straightforward and more demanding in terms of assumptions regarding the distribution error terms (Primo *et al.*, 2007). Appendix 7.5.B discusses this choice and provides the estimation of such a model.

²⁸See Appendix 7.6 for a detailed presentation.

cation also takes into account the equipment rate in institutions²⁹ in the department.³⁰ Controlling for the sociodemographic group of the department decreases the potential omitted variable bias in the analysis of the effect of departmental practices.

4 Results

4.1 Main results

Several estimations of the model are provided. While controlling for individual determinants, we first include the generosity of the financing of demand (Estimation 1) or the regulation of the supply (Estimation 2). Then, we include both types of indicators (Estimation 3). Standard errors are systematically clustered at the department level.³¹

The coefficients of the Logit estimations for departmental practices are provided in Table 3.3. To ease the reading, the odds-ratios derived for departmental variables in Estimations 1 to 3 are presented in Figures 3.2, 3.3 and 3.4.

Without controlling for the supply characteristics, using a classical or generous computation rule for the APA program does not affect the probability to use formal care (Figure 3.2, or Column (1) in Table 3.3). Compared to those living in a department with a classical policy, an individual living in a department with a generous APA computation formula does not have a higher probability to consume formal care. Quite unexpectedly, individuals living in a department that did not respond to the *Territoire* survey have a higher probability to consume formal care.

Turning to the regulation of the supply (Figure 3.3, or Column (2) in Table 3.3), we observe that individuals living in a department with the dominance of non-regulated providers have a significantly lower probability to consume formal care, compared to those living in a department with a dominance of regulated providers. The magnitude of the

²⁹One could want to additionally control for the importance of bed blockers in the department. This phenomenon refers to the situation when individuals stay in short-term care units because a lack of appropriate available infrastructures outside. It is correlated to the long-term care supply in the area (Gaughan *et al.*, 2017) and could give information on the potential saturation of the home care market. Gansel *et al.* (2010) present the construction of this notion in the French context, underlying the coordination issues resulting from the medical specialization and segmentation; but to the best of our knowledge, there is no data available at the national level that would permit to control for this phenomenon in our study.

³⁰The policy regarding institutional care is mainly decided at the regional level by specific health authorities (*Agences régionales de santé*). Departmental councils, however, may negotiate and have a latitude in the implementation regarding this domain. This is all the more so likely that they are also financing the part of the APA scheme devoted to elderly living in nursing homes. However, they are not financing the allocation of elderly across care settings: individuals apply to the APA program for a given part of the scheme (in the community or in nursing homes).

³¹We have 93 clusters, corresponding to the 96 metropolitan departments minus the three departments that are not represented in our sample.

impact, given by the marginal effect for the average individual of our sample³² derived from the observed coefficient, is -0.062. This effect is robust when controlling for both departmental generosity, despite a small loss of precision (statistical significance at the 10% level). Column 3 (and Figure 3.4) suggests that the dominance of non-regulated providers lowers formal care use, whatever the demand side practices. It could reveal that a low level of regulation decreases the incentives to consume formal care, potentially through a price effect: when non-regulated dominate the market, the expected OOP payment is higher. It could also be through a quality effect: when non-regulated dominate the market, the quality is more uncertain. It could also reveal that these departments are less involved into the long term care policy: the low regulation level would signal limited information processes and restrictive practices at the extensive margin of the APA program. Finally, the geographical coverage within the department could be deteriorated when non-regulated dominate the market, as they have no universal coverage obligation. All these interpretations, however, needs to be cautious. Indeed, we additionally observe that the absence of any regulated providers does not correlate with low use.

Table 3.4 presents the effects of individual determinants in Estimation 3.³³ They are consistent with previous findings of the literature. The probability to consume formal care is higher for women, when individuals are older, severely disabled (as captured by the Katz Index) or when they live without a spouse. A lower income and a higher level of education also increase the probability to use formal care. Regarding informal care, we find a negative effect of the number of daughters but no significant effect for the number of sons. Living in a rural area increases formal care use. This interesting result could be explained by the lower availability of substitutes to formal care in rural areas (informal care or other type of formal services) compared to urban areas.

We now want to compare the quality of our models to estimations that do not include departmental information, or that use departmental fixed-effects only. Table 3.5 compares the information criteria obtained on several estimations. The first estimation includes individual determinants only, the second estimation adds departmental fixed-effects and the last three estimations correspond to the estimations with departmental indicators presented in Table 3.3. The Akaike's and Bayesian information criteria (AIC and BIC) make it possible to compare models when they are not nested. They measure the loss of information coming from the model: the lower the indicator, the better the model. As is shown in Table 3.3, the AIC indicates that the loss of information is the lowest with Estimation (4) and (5) — including only supply indicators or both types - followed by Estimation (3) —

³²A woman aged between 70 and 80, living alone, not in a rural area, who did not get a diploma, has a monthly income of at least €2,000, is independent in the Katz Index sense, not using a proxy, having a daughter and a son, living in group D.

³³Their sign and magnitude are stable across the three estimations.

with demand indicators. The BIC more severely sanctions additional explaining variables: thus, its lower value is observed for the first model (without departmental variables), just before models (3), (4) and (5). This comparison shows that including the departmental indicators rather than departmental fixed effects makes it possible to increase the quality of the estimations.

Table 3.3 – Departmental determinants of formal care use

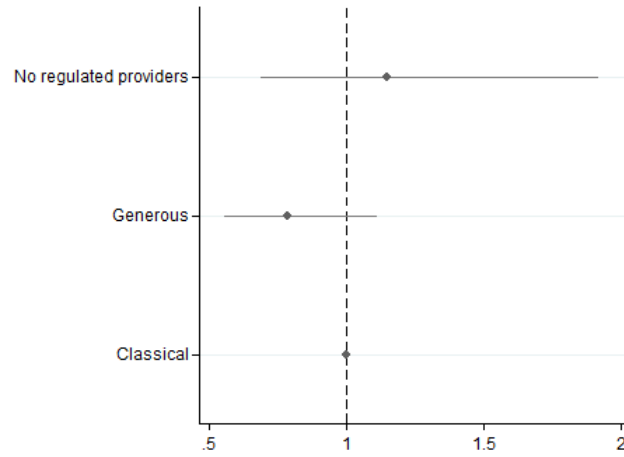
	Consumes formal care		
	(1)	(2)	(3)
<i>Departmental characteristics</i>			
Non respondent	0.200* (0.115)	0.278** (0.140)	0.269* (0.145)
No regulated providers	0.137 (0.262)	0.205 (0.257)	0.199 (0.258)
<i>Ref: classical</i>			
Generous	-0.243 (0.177)		-0.058 (0.157)
<i>Ref: dominance of regulated providers</i>			
Competition		0.166 (0.152)	0.166 (0.153)
Dominance of non regulated providers		-0.320** (0.152)	-0.288* (0.164)
Individual controls	Yes	Yes	Yes
Department socio-demographic group	Yes	Yes	Yes
Observations	4395	4395	4395
Number of clusters	93	93	93
Log-likelihood	-2644.983	-2640.987	-2640.919
AIC	5343.965	5337.974	5339.839
BIC	5516.447	5516.844	5525.097

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: Standard errors in parenthesis, clustered at the department level. * $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$. Estimation of a Logit model explaining the probability to consume formal care. Controls for individual characteristics and the sociodemographic group of the department.

Figure 3.2 – Odds-ratios for the effect of public generosity on formal care use (Estimation 1)

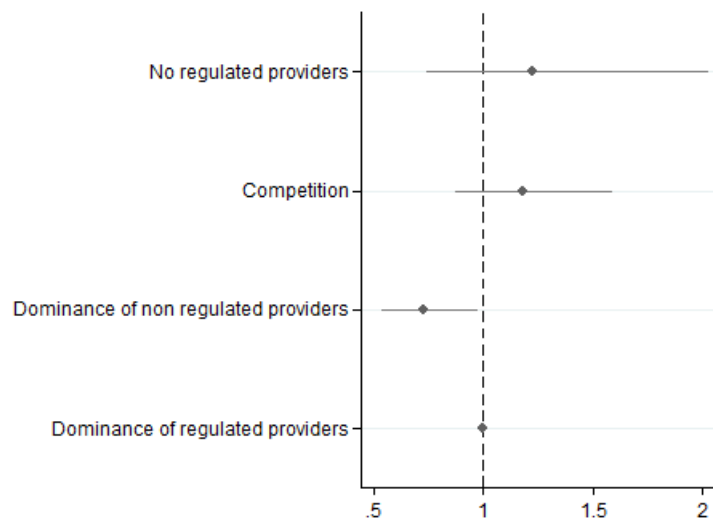


SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCE: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012)

NOTES: odds-ratio derived from the estimation of a Logit model explaining the probability to consume formal care and controlling for individual characteristics and the sociodemographic group of the department (Estimation 1 in Table 3.3).

Figure 3.3 – Odds-ratios for the effect of supply regulation on formal care use (Estimation 2)

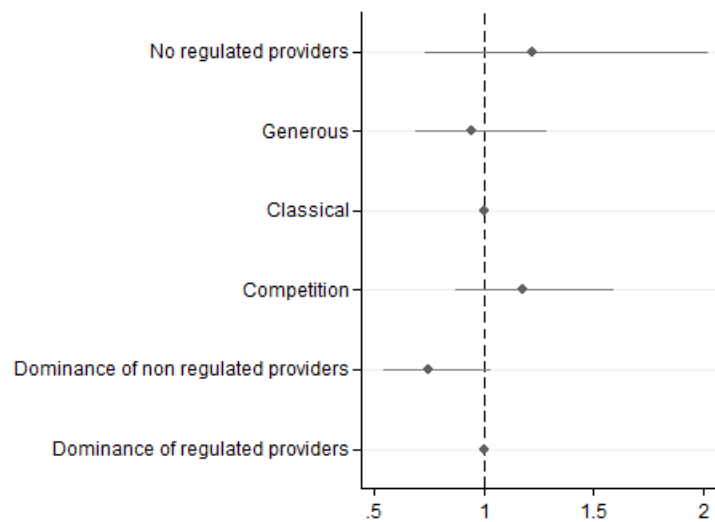


SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCE: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012)

NOTES: odds-ratio derived from the estimation of a Logit model explaining the probability to consume formal care and controlling for individual characteristics and the sociodemographic group of the department (Estimation 2 in Table 3.3).

Figure 3.4 – Odds-ratios for the effect of public generosity and supply regulation on formal care use (Estimation 3)



SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCE: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012)

NOTES: odds-ratio derived from the estimation of a Logit model explaining the probability to consume formal care and controlling for individual characteristics and the sociodemographic group of the department (Estimation 3 in Table 3.3).

Table 3.4 – Individual determinants of formal care use

	Consumes formal care
<i>Individual characteristics</i>	
Woman	0.633*** (0.070)
Age: 60-70	-0.821*** (0.103)
<i>Ref: age 70-80</i>	
Age: 80-90	0.432*** (0.079)
Age: older than 90	0.644*** (0.183)
Does not live with a spouse	0.480*** (0.092)
<i>Ref: lives in an urban municipality</i>	
Lives in a rural municipality	0.268* (0.109)
<i>Ref: no diploma</i>	
Diploma of primary studies	0.183* (0.072)
Diploma of secondary school	0.463** (0.160)
Diploma: <i>baccalauréat</i> (high school)	0.655*** (0.120)
Monthly income < €1,000	0.256* (0.101)
<i>Ref: €1,000 ≤ monthly income < €1,500</i>	
€1,500 ≤ monthly income < €2,000	0.023 (0.107)
Monthly income ≥ €2,000	-0.351*** (0.100)
Income missing	-0.373** (0.133)
Number of daughters	-0.102** (0.032)
Number of sons	-0.023 (0.023)
<i>Ref: Katz Index: A</i>	

Continued on next page

Table 3.4 - *Continued from previous page*

	Consumes formal care
Katz Index: moderatly disabled	0.744*** (0.092)
Katz Index: highly disabled	0.915*** (0.211)
Katz Index: severely disabled	1.065*** (0.164)
Use of a proxy	-0.288* (0.133)
Observations	4395
Number of clusters	93
Log-likelihood	-2640.919
AIC	5339.839
BIC	5525.097

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: Standard errors clustered at the department level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimation of a Logit model explaining the probability to consume formal care. Departmental controls include response to the *Territoire* survey, demand and supply indicators and the socio-demographic group of the department.

Table 3.5 – Information criteria

	(1)	(2)	(3)	(4)	(5)
<i>Estimation characteristics</i>					
Departmental indicators	None	Fixed effects	Demand (D)	Supply (S)	D+S
Clusters	No	No	Yes	Yes	Yes
Department socio-demographic group	No	No	Yes	Yes	Yes
<i>Information criteria</i>					
AIC	5357.394	5342.640	5343.965	5337.974	5339.839
BIC	5485.159	6045.344	5516.447	5516.844	5525.097

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: Estimations of Logit models explaining the probability to consume formal care. Additional controls for individual characteristics and response to the *Territoire* survey.

Coefficients obtained from Estimations (1) and (2) are available upon request. Estimations (3) to (5) are presented in Table 3.3.

4.2 Extensions and robustness checks

We have tested the sensitivity of our results to the form of control for departmental characteristics. Instead of the groups mentioned here-before, we directly include the variables that have been used to construct the classification: the share of individuals aged 75 or more in the population, their poverty rate and the rate of individuals living alone in the community,³⁴ and the equipment rate in institutions. Our results are robust to this change.³⁵

The organization of long-term care is likely to be specific in French metropolis. In Paris, for instance, the department actually corresponds to the capital. As a robustness check, we estimate the models without the departments including the three biggest metropolis: Paris (75), Marseille (13) and Lyon (69). Our results are robust to this exclusion only if we do not control for the departmental sociodemographic group. With the group effect, we considerably loose precision and it prevents us from identifying any significant effect.

5 Discussion

We use the inter-departmental variations to study the effect of public financing and regulation of the supply on formal care use. To treat these variations as exogenous, we assume that the disabled elderly did not choose their department of residence according to their willingness to consume formal care or not. This is a usual hypothesis when focusing on the disabled elderly (see, for instance, [Stabile *et al.* \(2006\)](#)). Indeed, the residential mobility of the elderly is very low and when moves occur, they are mainly explained by family motives or the need for adapted residences ([Laferrère and Angelini, 2010](#)). We thus consider that the departmental practices are exogenous to the location choice of individuals.

To be exogenous to formal care use, departmental practices should not be correlated with unobserved variables that would also affect the individual formal care use (omitted variable bias) nor by the actual demand in the department (reverse causality issue). We control for the sociodemographic group of the department and we are thus comparing departments that are supposedly similar regarding the level of the demand for home care. Indeed, the classification we use specifically builds on the characteristics of the elderly population and the equipment rate in institutions. It does not prevent departmental unobserved heterogeneity from biasing our estimation but it should substantially limit it.

³⁴We use the rate of individuals living alone in the community for the year 2014 as previous rates are not available as open data. Other indicators are from 2012.

³⁵We have not been able, though, to reconstruct and include the variables relating to the share of individuals living in rural areas or the socio-professional characteristics of the population.

Moreover, the criteria we study are little-known by departmental councils and citizens. Field studies have shown that the rules used on the demand side are not identified as key points of the APA policy, nor as a political issue (Billaud *et al.*, 2012) and they essentially results from decisions of the technical desk in charge of the APA program. In parallel, the disabled elderly and their family are poorly rallied around collective action (Weber *et al.*, 2013), such that they are not likely to influence these technical decisions.

Though these reasons support the hypothesis of the exogeneity of departmental practices, in the absence of an alternative empirical strategy confirming it, we will remain cautious and interpret our results in terms of association rather than causal impact. The link between our indicator of departmental generosity and the demand for home care is limited. This is not what we expected, as the literature has shown that the consumption of formal home care is sensitive to its price (Fontaine, 2012; Bourreau-Dubois *et al.*, 2014; Arnault, 2015; Hege, 2016; Roquebert and Tenand, 2017). However, we are focusing on the extensive margin. The variations we study might be negligible for the decision to consume care but more important regarding the volume of care consumed within the program. The next step of research is thus to examine the volume of care consumed, conditional on positive use.³⁶ Moreover, we are studying both publicly and privately funded care, such that our results might be blurred by exclusively privately funded care. Finally, the absence of correlation between the computation formula and the decision to consume care could also reveal that the parameters of importance are those related to the opening of rights (care plan volume), or the other parameters of the OOP payment (provider price and/or lump sum price).

This work interestingly sheds light on the previous results of the literature. Arrighi *et al.* (2015) and Barnay and Juin (2016) find that the rate of APA beneficiaries in the elderly population (above 60 or 75) increases the take-up of the APA program and formal care use. The descriptive part of our work shows that a lower rate of APA beneficiaries among the elderly population correlates with the dominance of non-regulated providers on the supply side. However, we find no effect of departmental generosity regarding computation formal on formal care use, probably because we focus on a very tiny aspect of the long-term care policy compared to the more aggregated indicator used in the literature.³⁷

Finally, on the technical side, we use two surveys that have not been collected the same year. The HSM was collected in 2008 while the *Territoire* survey was implemented in 2012. We thus implicitly assume that the departmental practices observed in 2012 are correlated with those of 2008: either they have not changed, or they have evolved in a way that is

³⁶It could be done using a two-part model, with the first step corresponding to the decision of using formal care and the second step the volume of the formal care consumed.

³⁷Appendix 7.7 provides details on the differences between Arrighi *et al.* (2015)'s approach - which is close to our study - and our work.

consistent with the preceding practices. This assumption could be threatened by the fact that departmental elections occurred between 2008 and 2012.³⁸ However, the points we study are far from being central in the political debate, or even identified as a political issue. Thus, they are likely not to be affected by the departmental elections. To shed some light on the persistence of departmental practices, we use the survey implemented in 2015 by the Ministry of Health (Drees), which collected a survey called SolvAPA focusing on the departmental practices regarding the APA program (DREES, 2015a). Its questionnaire was close to the questionnaire of the *Territoire* survey and offers the opportunity to compare departmental practices in 2012 and 2015 - though, unfortunately, the question on the regulation of the supply was not included -. It is done in Appendix 7.8. It shows that among departments respondent to both surveys, 4 departments over 5 use the same rule in 2012 and 2015. For those who changed, they systematically use a less generous rule in 2015: some were classical department and turned to use rule 2 for regulated providers; other were generous and turned to be classical. This could be explained by the increasing constraints weighting on departmental finances. If we assume that the same trend was ongoing between 2008 and 2012, it means that the departmental practices we observed in 2012 are either the same than those of 2008, or they are less generous. In this last case, the estimates of each category would under estimate the effect of departmental practices.

6 Conclusion

This paper estimates, at the extensive margin, the link between formal care use and two parameters that depend on departmental decisions: the generosity of the hourly APA subsidy and the importance in the regulation of providers. It finds no effect of the generosity of the APA policy while, on the supply side, the dominance of non-regulated providers — whose quality is uncertain and price is little regulated — decreases the probability to consume formal care, potentially due to a price effect or a quality effect. Such an interpretation should be taken cautiously, however, since we additionally observe that the absence of any regulated providers does not correlate with low use.

These results first contribute to the debate on the difference of treatment that can result from the decentralization of a national policy (see for instance Argoud (2007); Chevreul and Berg Brigham (2013); Maarse and Jeurissen (2016)). Indeed, we highlight a little-known latitude of departmental councils in the generosity of the APA program. It does not correlate, however, with the demand for formal care at the extensive margin. We also underline the variety of situations regarding the regulation of the home care providers

³⁸In 2008 for half of the departments, in 2011 for others.

and implications in terms of price and quality for the elderly.

Our results are also of interest for discussing the recent reform of the home care sector, requiring all providers to be regulated. According to our results, it could help increasing formal care use in departments where the regulation level was initially low. This reform, though, did not impose the pricing by the departmental councils to all providers. Then, it could be expected to increase overall quality in the home care sector, while the effect on prices is rather uncertain. If the low level of regulation correlates to a low level of demand because of a low quality, we could expect this reform to increase the demand and have beneficial effects for the health of the elderly.

7 Appendices

7.1 Additional information on the institutional context

7.1.A Financing of the APA allowance

Along with the creation of the APA program in 2002 was organized the financial support from the central government to departmental councils (*Concours APA I*). The central French government is represented by a specific central agency, the *Caisse Nationale de Solidarité pour l'Autonomie* (CNSA). Each year, it allocates to departmental councils resources coming from social contributions and some consumption taxes.

The sharing of these resources proceeds as follows. The characteristics of departments are used to construct a weighted coefficient representing the share of the total of resources the department will get. This coefficient depends on the number of individuals aged 75 or more living in the department compared to the national 75+ population (weight: 50%), the APA spending (weight: 20%), the fiscal capacity³⁹ of the department (weight: -25%) and the number of recipients of unemployment benefits (*Revenu de solidarité active* (RSA)) (weight: 5%). The coefficient affected to department D, c_D , is thus:

$$c_D = \left[\left(\frac{N75_D}{\sum_d N75_d} \right) * 0,5 + \left(\frac{SPEND_D}{\sum_d SPEND_d} \right) * 0,2 - \left(\frac{FC_D}{\sum_d FC_d} \right) * 0,25 + \left(\frac{RSA_D}{\sum_d RSA_d} \right) * 0,05 \right] * 2$$

Where $N75_D$ is the number of individuals aged 75 or more in department D, $SPEND_D$ is the amount of APA spending, FC_D is the fiscal capacity and RSA_d is the number of RSA beneficiaries.

The central resources devoted to the financing of the APA have not notably increased since the creation the program, while the expenditure of the departments have risen. Consequently, the cost of the APA program for the departmental finances is increasing: Figure 3.5 shows that the coverage rate of the APA spendings of departmental councils by central government contributions has fallen from 43% in 2002 to approximately 30% in 2009; it has then slightly increased to 32 % in 2014 and 2015.⁴⁰

In this context, departmental councils have incentives to use the latitude they have in the implementation of the APA program to adjust their expenditures; it can be done

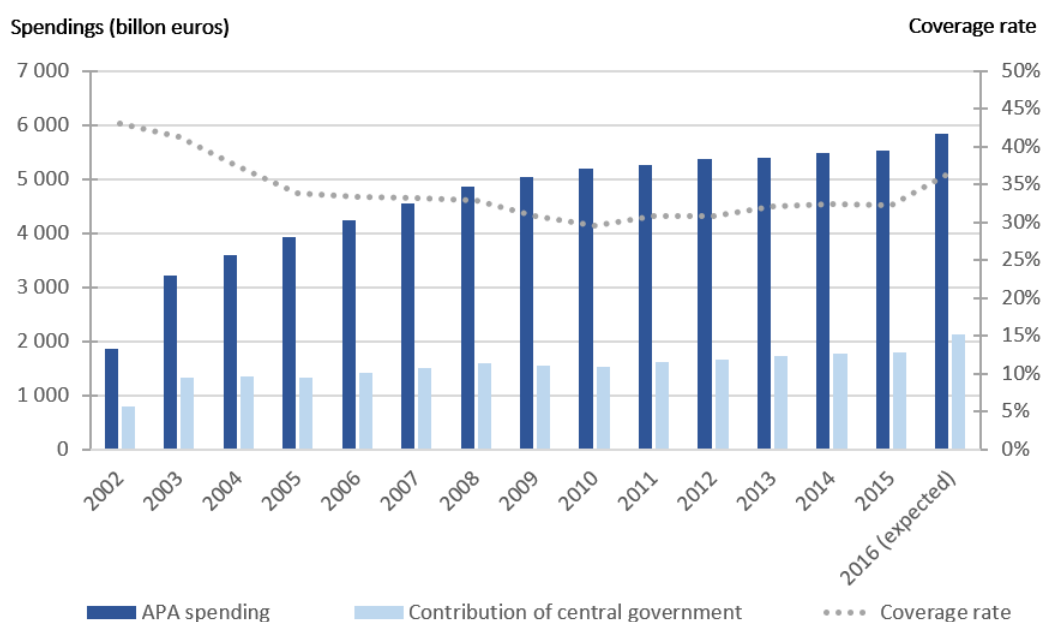
³⁹It corresponds to the expected amount of tax that would be obtained when implementing average tax rates in the department.

⁴⁰Data are available on the following link: <https://www.cnsa.fr/compensation-de-la-perse-dautonomie/financement-des-prestations-concours-aux-departements/le-concours-allocation-personnalisee-dautonomie>.

with the reduction of the number of hours open to subsidies, with potential restrictions of the number of APA beneficiaries at the extensive margin or through variations in the way the care plan volume is translated into a subsidy ([Haut conseil de la famille de l'enfance et de l'âge, 2017](#)). This last point may include both the way the monetary equivalent of care plan volume is computed and the way the hourly subsidy is computed.

With the 2016 reform of the APA program, a second part of the central contribution was created (*Concours APA II*) to take into account the additional spending generated by the reform (increases in legal thresholds for care plan volumes, changes in the copayment scheme, financing of the right to respite for caregivers and increase of the professional caregivers' wages). It explains why, on Figure 3.5, the central contribution and the coverage rate are expected to increase in 2016.

Figure 3.5 – Contribution of the central government to the APA spending of departmental councils between 2002 and 2016



SOURCE: Direction des affaires générales et financières (DAGF), CNSA.

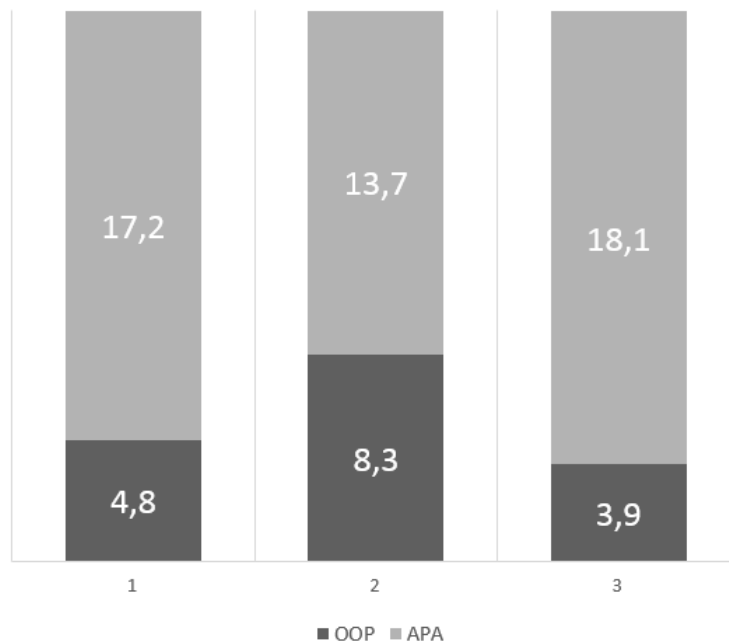
7.1.B Variation in the generosity of the APA subsidy: an example

We illustrate the variation in the generosity of the APA subsidy due to the computation formula used by the departmental council. We consider the sample of APA beneficiaries used in Chapter 2. In this sample, the average provider price is €22, the average copayment rate is 22% and the tariff used with rule 2⁴¹ is €17.6. As shown in Figure 3.6, if the department council chooses rule 3, the hourly OOP payment of the individual is €3.9 per hour of formal care (rule 3). It increases to €8.3 if it chooses rule 2, while rule 1 yields an OOP payment of €4.8 per hour. The maximum difference (between rule 2 and rule 3) is thus of €4.4 per hour of care. This is far from being negligible: with an average care plan volume of 22 hours, it results in a monthly difference of €97, or 8% of the month average net income.⁴² The difference between rule 1 and rule 2, with the average care plan volume, yields a monthly gap of €75 (or 6% of average income). Between rule 1 and rule 3, the monthly gap is of €22 (2% of average income).

⁴¹It corresponds to the rule used to compute the allowance of beneficiaries served by non-regulated providers.

⁴²As underlined by Billaud *et al.* (2012), the choice of the departmental council also has implication regarding the redistributive property of the APA program. Indeed, the rule changes the effective copayment rate of the beneficiary. With rule 2 for instance, the effective copayment rate of the beneficiary equals $(c_i \cdot t + (p_i - t)) / p_i$, which is higher than the APA copayment rate c_i .

Figure 3.6 – Example of the effect of computation formulas



NOTES: example of the effect of variation in computation formulas resulting in different hourly OOP payment, with a provider price at €22, a copayment rate at 22% and a tariff at €17.6. Rule 1 yields an OOP payment of €4.8 (0.22×22); rule 2 yields an OOP payment of €8,3 ($0.22 \times 17.6 + (22 - 17.6)$); rule 3 yields an OOP payment of €3.6 (0.22×17.6).

7.2 Descriptive statistics on departments...

7.2.A ...According to response to the *Territoire* survey

Table 3.6 compares the characteristics of departments according to their (non) response to the *Territoire* survey. We distinguish between two types of characteristics: the sociodemographic characteristics of the department (age distribution of the population, share of households subject to income tax, interdecile range) and indicators more directly related to the needs in terms of social policies in the department (poverty rates, share of APA beneficiaries among the elderly population, rate of recipients of unemployment benefits RSA) or disability benefits (ACTP or *Prestation compensatoire du handicap* (PCH)⁴³). The equipment rate in institutions is also included. Apart from a slightly younger population on average in non respondent departments, no remarkable differences are observed: there are no statistically significant differences at the 10% level.

Table 3.6 – Departmental characteristics and response to the *Territoire* survey

	NR	Respondent	Total	Sources	Difference (p-value)
60+ population/total population (%)	25.27	26.05	25.85		0.42
75+ population/total population (%)	9.88	10.23	10.14	[A]	0.47
Households subject to income tax (%)	62.64	61.54	61.83		0.38
Interdecile range	3.31	3.29	3.30	[B]	0.88
Poverty rate (%)	14.43	14.32	14.35		0.88
Poverty rate in 75+ population (%)	10.62	11.13	11.00	[B]	0.52
Rate of APA beneficiaries (%)	8.14	8.32	8.27		0.63
Mean spending per APA beneficiary (€)	4479.38	4528.12	4515.43	[C]	0.67
ACTP-PCH coverage rate ^a	4.48	4.96	4.83	[C]	0.12
RSA coverage rate ^b	6129.52	5984.82	6022.50	[D]	0.75
Equipment rate ^c	128.72	123.23	124.66	[E]	0.31

SAMPLE: 96 metropolitan departments, with 71 respondents to the *Territoire* survey (LEDa-LEGOS and CES, 2012).

SOURCES: [A]: INSEE (2012); [B]: INSEE-DGFIP-CNAF-CNAV-CCMSA (2012); [C]: DREES (2012); [D]: (CNAF, 2012); [E]: DREES and INSEE (2012).

NOTES: P-values from Student test.

“NR” stands for non-respondent. ^a: number of beneficiaries of the ACTP or PCH for 1,000 individuals in the department.

^b: number of beneficiaries of the RSA for 100,000 individuals in the department.

^c: number of accommodation places for 1,000 individuals aged 75 or more.

⁴³The PCH is an allowance targeted to the disabled individuals younger than 60. It has replaced the ACTP in 2006 but previous beneficiaries of the ACTP can continue to receive the allowance.

7.2.B ...According to the generosity of financing and the regulation of the supply

Tables 3.7 and 3.8 describe the characteristics of the departments according to their practices regarding the financing of the demand and their regulation of the supply. As we did for the comparison of respondent and non-respondent departments, we distinguish between two types of characteristics: the sociodemographic characteristics of the department and indicators relating to the needs in terms of social policies in the department. These tables additionally present the mean of the equipment rate in institution as it is used in the estimations. We perform an analysis of variance (Anova) tests to study whether the difference between group means is significant.

Table 3.7 shows that the population in departments with a generous policy is, on average, significantly younger than those of other departments. The rate of APA beneficiaries, however, is not significantly different, nor is the average level of spending per APA beneficiary. The departments with a generous policy are also significantly wealthier on average, with a higher share of households subject to the income tax and a lower poverty rate in the 75+ population. No significant differences are observed regarding the importance of other social policies.

According to Table 3.8, when non-regulated providers dominate the market, the population is, on average younger and the rate APA beneficiaries among the elderly population is lower, but there is no significant difference in the average expense per APA beneficiary. Although the share of households subject to the income tax is significantly higher in these departments, there is no significant difference in the poverty rates. No significant differences is observed regarding the importance of other social policies.

Overall, there is one atypical category both on the demand side (generous computation formula) and on the supply side (dominance of non-regulated providers). These two categories, however, do not correspond one to each other: there is only one department belonging to these two categories.

The computation formula and the provider mix are potentially influenced by the likely demand in the department. Departments could be incentivized to be more generous when taxes are more important (demand side). When the rate of APA beneficiaries is low compared to the elderly population, they might not be eager to enter into a relatively-costly regulation process. In this context, the causal interpretation of our results will remain cautious.

Table 3.7 – Departmental characteristics and generosity of the APA policy

	No regulated providers	Classical	Generous	Total	Source	Difference (p-value)
60+ population/total population (%)	25.97	26.74	<i>20.55</i>	26.05	[A]	0.00
75+ population/total population (%)	10.23	10.57	<i>7.52</i>	10.23		0.00
Households subject to income tax (%)	62.38	60.45	<i>69.57</i>	61.54	[B]	0.00
Interdecile range	3.15	3.21	<i>4.11</i>	3.29		0.00
Poverty rate (%)	13.50	14.60	<i>12.79</i>	14.32	[B]	0.22
Poverty rate in 75+ population (%)	10.10	11.60	<i>8.37</i>	11.13		0.05
Rate of APA beneficiaries (%)	8.40	8.45	<i>7.17</i>	8.32	[C]	0.11
Mean spending per APA beneficiary (€)	4255.59	4571.83	<i>4444.78</i>	4528.12		0.22
ACTP-PCH coverage rate ^a	5.04	5.05	<i>4.16</i>	4.96	[C]	0.32
RSA coverage rate ^b	5255.00	6147.88	<i>5386.86</i>	5984.82	[D]	0.36
Equipment rate ^c	127.66	123.89	<i>113.49</i>	123.23	[E]	0.50

SAMPLE: 71 metropolitan departments respondents to the *Territoire* survey (LEDa-LEGOS and CES, 2012).

SOURCES: [A]: INSEE (2012); [B]: INSEE-DGFiP-CNAF-CNAV-CCMSA (2012); [C]: DREES (2012); [D]: (CNAF, 2012); [E]: DREES and INSEE (2012).

NOTES: P-values from Anova test. If it is inferior to 0.10, we indicate in italics the mean(s) that is/are significantly different to the mean of classical departments.

^a: number of beneficiaries of the ACTP or PCH for 1,000 individuals in the department.

^b: number of beneficiaries of the RSA for 100,000 individuals in the department.

^c: number of accommodation places for 1,000 individuals aged 75 or more.

Table 3.8 – Departmental characteristics and regulation of the supply

	No regulated providers	Dominance non-regulated	Competition	Dominance regulated	Total	Source	Difference (p-value)
60+ population/total population (%)	25.97	<i>19.07</i>	26.88	26.00	26.05	[A]	0.01
75+ population/total population (%)	10.23	<i>6.79</i>	10.66	10.19	10.23	[A]	0.02
Households subject to income tax (%)	62.38	<i>72.88</i>	61.40	60.45	61.54	[B]	0.00
Interdecile range	3.15	<i>3.82</i>	3.34	3.24	3.29	[B]	0.23
Poverty rate (%)	13.50	12.76	14.08	14.83	14.32	[B]	0.39
Poverty rate in 75+ population (%)	10.10	7.07	11.52	11.38	11.13	[B]	0.14
Rate of APA beneficiaries (%)	8.40	<i>6.06</i>	8.50	8.38	8.32	[C]	0.08
Mean spending per APA beneficiary (euro)	4255.59	4428.63	4564.97	4563.71	4528.12	[C]	0.33
ACTP-PCH coverage rate ^a	5.04	4.44	5.04	4.92	4.96	[C]	0.92
RSA coverage rate ^b	5255.00	5334.33	5646.71	6485.64	5984.82	[D]	0.17
Equipment rate ^c	127.66	128.87	121.15	123.55	123.23	[E]	0.81

SAMPLE: 71 metropolitan departments respondents to the *Territoire* survey (LEDa-LEGOS and CES, 2012).

SOURCES: [A]: INSEE (2012); [B]: INSEE-DGFIP-CNAF-CNAV-CCMSA (2012); [C]: DREES (2012); [D]: CNAF (2012); [E]: DREES and INSEE (2012).

NOTES: P-values from Anova test. If it is inferior to 0.10, we indicate in italics the mean(s) that is/are significantly different to the mean of departments with dominance of regulated providers.

^a: number of beneficiaries of the ACTP or PCH for 1,000 individuals in the department.

^b: number of beneficiaries of the RSA for 100,000 individuals in the department.

^c: number of accommodation places for 1,000 individuals aged 75 or more.

7.2.C Sample distribution in departmental categories

Table 3.9 – Distribution of the sample in the departmental categories

	Non respondent	No regulated providers	Classical (rule 1)	Generous (rule 3)	Total
Non respondent	1214 <i>27.62%</i>	-	-	-	1214 <i>27.62%</i>
No regulated providers	-	156 <i>3.55%</i>	-	-	156 <i>3.55%</i>
Dominance of non-regulated providers	-	-	79 <i>1.80%</i>	377 <i>8.58%</i>	456 <i>10.38%</i>
Competition	-	-	1144 <i>26.03%</i>	97 <i>2.21%</i>	1241 <i>28.24%</i>
Dominance of regulated providers	-	-	1225 <i>27.87%</i>	103 <i>2.34%</i>	1328 <i>30.22%</i>
Total	1214 <i>27.62%</i>	156 <i>3.55%</i>	2448 <i>55.70%</i>	577 <i>13.13%</i>	4395 <i>100%</i>

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.
 SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: the table shows the number of observations in each category and the percentage of the sample they represent (in italics).

7.3 Disability measures

We refer to several measures for the disability levels: ADL and IADL, GIR and Katz Index. We recapitulate here their definitions and we compare the Katz Index to the GIR available in the HSM.

ADL or IADL refers to activities of daily living, either essential or instrumental. The following activities are included in the ADL group: bathing and showering, personal hygiene and grooming, dressing, toilet hygiene, functional mobility and self-feeding. The following activities are included in the IADL: cleaning and maintaining the house, managing money, moving within the community, preparing meals, shopping for groceries and necessities, taking prescribed medications, using the telephone or other form of communication.

The Katz Index proposes eight categories that are constructed to take into account both the number and the type of ADL restrictions. In group A, the person is completely independent and can perform the six following activities: bathing, dressing and undressing, toileting, transferring, eating and drinking once the food is ready, controlling bowel movements and urination. In group B, she can perform independently five over the six activities. In group C, she needs assistance to perform two activities including bathing. In group D, she needs assistance for three activities, including bathing and dressing or undressing. In group E, she needs assistance for four activities, including bathing, dressing or undressing and toileting. In group F, she needs assistance for five activities, including the previous ones and transferring. In group G, the person requires assistance for the six activities. Finally, in Group H, persons requiring assistance for at least two activities but not meeting previous criteria are to be found. Table 3.10 summarizes the definitions. Note that as our sample is restricted to individuals facing limitations in ADL or IADL, those who belong to the group A of the Katz Index have at least IADL limitations.

The GIR corresponds to the disability group (“Groupe Iso-Ressources”, or GIR) of the individual in the APA program, assessed by the evaluation team with a national tool, the AGGIR (Gerontological Independence Iso-Resource Group) classification. In the survey, we don’t know directly the GIR of APA beneficiaries, but we have a simulated GIR (“pseudo-GIR”), computed with an algorithm approaching the logic of the AGGIR classification. It was estimated on the basis of the activity restrictions declared by the individual. This pseudo-GIR indicator suffers from several limitations and, in particular, it cannot be regarded as the official disability group an individual would be assigned to during the APA evaluation (Eghbal-Téhérani and Makdessi, 2011). Thus, in our sample definition and estimations, we prefer using the measures of disability resting on the ADL and IADL.

Nevertheless, we compare in Table 3.10 the consistency of the Katz Index and the

pseudo-GIR. The comparison shows that both indicators are overall consistent, with an increasing share of GIR 1-2 (higher disability level) when going to the high disability level in the Katz Index sense. The highest disability level in the Katz Index (Group G) counts 100% of GIR 1-2. Though, some marginal cases indicate a discrepancy: 1% of individuals regarded as independent with the Katz Index are associated with GIR 1-2.

Table 3.10 – Katz Index: definition and comparison with the GIR indicator

Category	Number of activities requiring assistance	Including	Share of GIR		
			1-2	3-4	5-6
A	0	-	0.9	17.6	81.5
B	1	-	5.9	76.6	17.5
C	2	bathing	16.6	83.4	0
D	3	bathing & (un) dressing	17.7	82.3	0
E	4	bathing & (un) dressing & toileting	55.6	44.4	0
F	5	previous ones and transferring	91.6	8.4	0
G	6		100	0	0
H	2	and is not included in other categories	57	43	0

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCE: HSM survey (DREES and INSEE, 2008).

7.4 Details on the Logit estimation

We have assumed that the utility of formal care depends additively on individual characteristics X_i and on the departmental practices observed where the individual lives, denoted $D_{d(i)}$.

$$y_i^* = \beta_0 + X_i\beta + D_{d(i)}\alpha + u_i \quad (3.4)$$

We express the conditional probability function as follows:

$$P(y = 1|X, D) = P(y^* > 0|X, D) \quad (3.5)$$

$$= P(-u < X.\beta + D.\alpha|X, D) \quad (3.6)$$

$$(3.7)$$

With the assumption that $u \perp\!\!\!\perp X, D$, Equation 3.5 is written:

$$P(y = 1|X, D) = G(X.\beta + D.\alpha) \quad (3.8)$$

With G the cumulative distribution function of u .

We use the logistic function as cumulative distribution function of u . We test, in Appendix 7.5.A, the sensitivity of our results to this choice by estimating Probit and linear probability models.

Then, Equation 7.4 becomes:

$$P(y = 1|X, D) = G(X.\beta + D.\alpha) \quad (3.9)$$

$$= \frac{1}{1 + \exp^{-X.\beta - D.\alpha}} \quad (3.10)$$

And the probability of not consuming is expressed as follows:

$$P(y = 0|X, D) = 1 - P(y = 1|X, D) \quad (3.11)$$

$$= \frac{1 + \exp^{-X.\beta - D.\alpha}}{1 + \exp^{-X.\beta - D.\alpha}} - \frac{1}{1 + \exp^{-X.\beta - D.\alpha}} \quad (3.12)$$

$$= \frac{\exp^{-X.\beta - D.\alpha}}{1 + \exp^{-X.\beta - D.\alpha}} \quad (3.13)$$

As y is binary, the conditional likelihood of the sample can be written as follows:

$$L(y_1, \dots, y_n | X, D, \beta, \alpha) = \prod_{i=1}^n \left[\frac{1}{1 + \exp^{-X_i \beta - D_i \alpha}} \right]^{y_i} \times \left[\frac{\exp^{-X_i \beta - D_i \alpha}}{1 + \exp^{-X_i \beta - D_i \alpha}} \right]^{1-y_i} \quad (3.14)$$

The log-likelihood function writes:

$$\ln L(y_1, \dots, y_n | X, D, \beta, \alpha) = \sum_{i=1}^n y_i \ln \frac{1}{1 + \exp^{-X_i \beta - D_i \alpha}} + (1 - y_i) \ln \frac{\exp^{-X_i \beta - D_i \alpha}}{1 + \exp^{-X_i \beta - D_i \alpha}} \quad (3.15)$$

Consistent estimators of β and α can be derived as arguments of the maximization of the log-likelihood function which can be proved to be concave.

7.5 Robustness checks

7.5.A Functional forms

Table 3.11 presents estimations of our binary models with different functional forms: linear probability models (Columns 1 to 3) and Probit models (Columns 4 to 6), to be compared to the Logit estimations used as main functional form (Table 3.3 in the main body). Our results are little sensitive to the choice of the functional form, though the linear probability model is associated with a loss of precision when both demand and supply side indicators are included.

Table 3.11 – Determinants of formal care use - functional forms

	Consumes formal care					
	(1)	LPM (2)	(3)	(4)	Probit (5)	(6)
No regulated providers	0.030 (0.055)	0.044 (0.053)	0.042 (0.053)	0.086 (0.158)	0.124 (0.152)	0.121 (0.153)
<i>Ref: classical</i>						
Generous	-0.047 (0.037)		-0.011 (0.035)	-0.139 (0.110)		-0.019 (0.101)
<i>Ref: dominance of regulated providers</i>						
Competition		0.032 (0.030)	0.032 (0.030)		0.094 (0.086)	0.094 (0.087)
Dominance of non regulated providers		-0.062* (0.031)	-0.056 (0.035)		-0.204** (0.088)	-0.193* (0.101)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,395	4,395	4395	4395	4395	4395
Number of clusters	93	93	93	93	93	93
Log-likelihood	-2785.317	-2781.648	-2781.587	-2644.378	-2640.118	-2640.097

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: Standard errors in parenthesis, clustered at the departmental level. * $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$. Estimations of linear probability models (LPM) and Probit models explaining the probability to consume formal care. Controls for individual characteristics and the sociodemographic group of the department.

7.5.B Random intercept model

We test an alternative specification using a multilevel modeling. With cross-sectional data, we are only able to estimate the random intercept extension of the Logit model. Ideally, with panel data and provided that departmental practices vary over time, we would have wanted to estimate a fixed-effect model to deal with the omitted variable bias.

The random intercept model interestingly makes it possible to take into account an unobserved effect of each department on the outcome of individuals living there. This effect, however, should be regarded as random and must not be correlated with our departmental variables of interest. This is a strong assumption in our case, where non-observed departmental variables affecting the formal care use could correlate with departmental long-term care practices. Thus, one should remain cautious when interpreting our random-effect coefficients as it is inconsistent when the fixed-effect model is appropriate (Cameron and Trivedi, 2009).

Estimation results obtained with the random intercept model are provided in Table 3.12. As the model directly takes into account the mixed-level nature of the data, we do not cluster standard errors. The sign and magnitude of coefficients are unchanged compared to those of Table 3.3, but using a random model specification generates a loss of precision.

Table 3.12 – Random intercept model

	Consumes formal care		
	(1)	(2)	(3)
<i>Departmental characteristics</i>			
No regulated providers	0.091 (0.242)	0.138 (0.243)	0.131 (0.245)
<i>Ref: classical</i>			
Generous	-0.148 (0.216)		-0.093 (0.214)
<i>Ref: dominance of regulated providers</i>			
Competition		0.121 (0.135)	0.121 (0.135)
Dominance of non regulated providers		-0.311 (0.271)	-0.294 (0.276)
Controls	Yes	Yes	Yes
Observations	4395	4395	4395
Log-likelihood	-2633	-2632	-2632

SAMPLE: 4,395 individuals aged 60 or more, having at least one ADL or IADL limitations.

SOURCES: HSM survey (DREES and INSEE, 2008); *Territoire* survey (LEDa-LEGOS and CES, 2012).

NOTES: Standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$. Estimations of a random intercept Logit model explaining the probability to consume formal care. Controls for individual characteristics and and the sociodemographic group of the department.

7.6 Departmental sociodemographic groups

In order to control for the sociodemographic characteristics of the departments, we use a classification proposed by the Ministry of Health (DREES, 2014; Fizzala, 2016). It offers the interesting opportunity to control for sociodemographic characteristics of departments. It is based on a principle component analysis (PCA), which takes into account variables related to the elderly population in the department: their importance (share of individuals aged 75 or more in the population), their health status (life expectancy for men at 60, share of APA beneficiaries in the 75+ population), their wealth (poverty rate and average standards of living for the 75+ population), their socio-professional characteristics (share of previously farmers among retired) and living arrangements (share of 75+ living alone). It additionally uses the equipment rate in institutions in the department. In the PCA, the more determining variables are the standards of living, life expectancy and equipment rate.

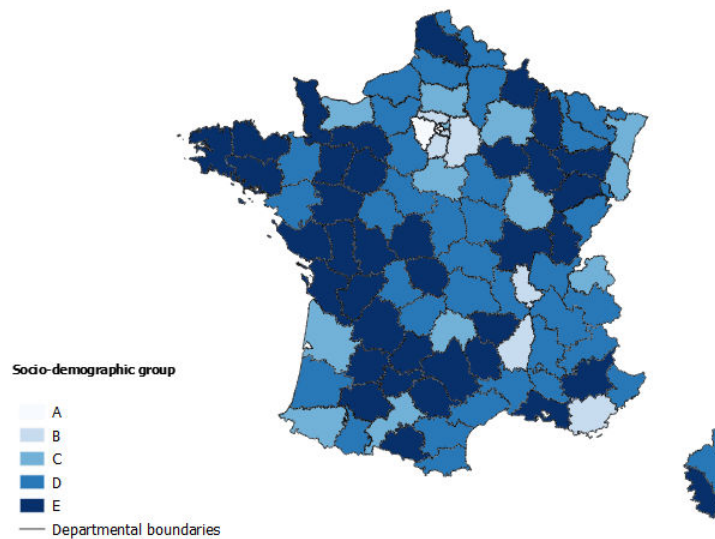
The five groups proposed by the classification are the following (presented by decreasing standards of living):

- Group A is composed of departments with very high living standards, a high urbanization rate and a low equipment rate in institutions. Individuals aged 75 or more are relatively less numerous, they live more frequently alone in in the community.
- Group B, as in the previous group, has high living standards and urbanization rate. The proportion of the 75+ in the population is even lower. The equipment rate is higher and the elderly less frequently live alone at home compared to group A.
- In Group C, the standards of living are closer (but still higher) than the median value. The share of 75+ is higher compared to Group A and Group B, but still lower than the median rate.
- In Group D, departmental sociodemographic variables are close to the median values.
- Group E is constituted of departments with an aging population, poorer and more rural than in other groups. Equipment rates are slightly higher than in other departments.

Figure 3.7 presents the corresponding departments. It shows the relative heterogeneity in the geographical distribution of groups. Table 3.13 presents the distribution of departments according the sociodemographic group and the demand indicator, while Table 3.14 does the same for the supply indicator. Each computation rule is represented in every sociodemographic group, except for the generous one which is never used in the

older and poorer departments (Group E). Similarly, different level of the regulation of the supply are found in each group. No wealthier departments (Group A) are found with the dominance of regulated providers, nor the absence of regulated providers. In median departments (Group D) and older poorer departments (Group E), the dominance of non regulated providers is never observed. Overall, there is a partial correspondence between the sociodemographic group and the departmental practices: when the demand is likely to be higher (Group E), we do observe a high generosity on the demand side, nor the absence of supply regulation.

Figure 3.7 – Five sociodemographic groups



SOURCE: Sociodemographic classification constructed in [DREES \(2014\)](#).
NOTES: Realization: Roquebert, 2018.

Table 3.13 – Sociodemographic groups and departmental practices (demand side)

	Non respondents	No regulated providers	Classical (rule 1)	Generous (rule 3)	Total
Group A	1	0	1	1	3
Group B	1	1	2	2	6
Group C	6	1	4	3	14
Group D	10	2	23	1	36
Group E	7	3	27	0	37
Total	25	7	57	7	96

SAMPLE: 96 metropolitan departments.

SOURCE: *Territoire* survey (LEDa-LEGOS and CES, 2012); sociodemographic classification by DREES (2014).

NOTES: Columns correspond to the generosity of the hourly APA subsidies. Lines correspond to the sociodemographic group of the department.

Table 3.14 – Sociodemographic group and departmental practices (supply side)

	Non respondents	No regulated providers	Dominance non regulated	Competition	Dominance regulated	Total
Group A	1	0	1	1	0	3
Group B	1	1	2	1	1	6
Group C	6	1	1	2	4	14
Group D	10	2	0	11	13	36
Group E	7	3	0	12	15	37
Total	25	7	3	28	33	96

SAMPLE: 96 metropolitan departments.

SOURCE: *Territoire* survey (LEDa-LEGOS and CES, 2012); sociodemographic classification by DREES (2014).

NOTES: Columns correspond to the level of regulation of the supply. Lines correspond to the sociodemographic group of the department.

7.7 Comparison with results on the take-up of the APA program

Our work is close to the study by [Arrighi *et al.* \(2015\)](#). This appendix aims at showing the common points and differences in the two approaches. [Arrighi *et al.* \(2015\)](#) focus on the take-up of the APA program. Their dichotomous dependent variable is equal to one for individuals having applied to the APA program. They find that the generosity of the departmental increases the probability to apply to the program. We focus on the effective consumption of formal care for the disabled elderly (both publicly and privately funded). One complementary study to [Arrighi *et al.* \(2015\)](#) would have focused on the effect of departmental indicators on the probability to be APA beneficiary (which depends on both individual application and departmental decisions). However, the variable in which individuals declare they are APA beneficiaries has been shown to suffer from important shortcomings, and we are studying, more broadly, the determinants of formal care use.

The sample used by [Arrighi *et al.* \(2015\)](#) comprises all individuals aged 60 or more who are not APA beneficiaries.⁴⁴ Among the individuals aged 60 or more, we restrict our sample to individuals who declare they have at least one activity limitation. Our idea is to focus on the determinants of formal care use from individuals needing concrete help and thus some form of care — either formal or informal — or technical help.

The most important difference probably lies in the indicator of departmental generosity used.⁴⁵ The indicator used by [Arrighi *et al.* \(2015\)](#)⁴⁶ is the mean subsidy rate, corresponding to the ratio of per capita subsidized amount of APA to per capita total amount of APA. This aggregated indicator depends on the practices of the department (care plan volumes, computation formulas, regulation of the supply), as well as on the characteristics of the consumption of the APA beneficiaries in the department (average copayment rate, subsidized consumption). They control for a large set of departmental sociodemographic characteristics, which is likely to neutralize the effects of the consumption characteristics of APA beneficiaries. Thus, their indicator captures additional dimensions of departmental generosity compared to our indicator of the computation formula, and these dimensions positively affect the take-up of the APA program.

⁴⁴They exclude individuals who declare they are already APA beneficiaries, because they could have applied to the program earlier, in other departmental conditions.

⁴⁵We have replicated our analysis using [Arrighi *et al.* \(2015\)](#)'s sample or/and dependent variable and our results are robust.

⁴⁶They also test the effect of the generosity at the extensive margin, using the rate of APA beneficiaries among the 60+ population.

7.8 Comparison of *SolvAPA* survey and *Territoire*

The French Ministry of Health has recently conducted a survey on departmental practices regarding the APA program, the “SolvAPA” survey (DREES, 2015a), using a questionnaire close to the one of the *Territoire* survey. It makes it possible to compare the rule implemented by department councils in 2012 and in 2015. Unfortunately, the question regarding the share of APA hours provided by regulated providers was not included.

82 metropolitan departments (over 96) responded to the SolvAPA survey (compared to 71 for the *Territoire* survey). Among the 11 departments that did not answer *Territoire* but did return the questionnaire SolvAPA, 8 are regarded as limited in 2015, 15 as classical and 1 as generous. We observe in 2015 a situation that is new compared to 2012: some departments have regulated providers but they treat them as non-regulated by using rule 2 to compute the APA subsidy. They mostly correspond to previous classical departments. As they treat their regulated providers as non-regulated with respect to the computation of the allowance, we include them in the group of “no regulated providers”. Among departments that have responded to both surveys, 80% (51 over 64 departments) use the same rule for the computation of APA benefit in 2012 and 2015. For those who have changed the rule, 13 classical departments have turned to have no regulated providers and 2 generous departments have turned classical. Interestingly, departmental councils never have increased their generosity level (measured by the computation formula used) between 2012 and 2015. It could reflect decisions following increased financial constraints with the increase in APA spending without augmented participation from the central government.

Table 3.15 – Description of departments according to demand side indicators

		Survey SolvAPA (2015)				
		NR	No regulated providers	Classical	Generous	Total
Survey Territoire (2012)	NR	4	5	15	1	25
	No regulated providers	1	6	0	0	7
	Classical	6	11	40	0	57
	Generous	0	0	2	5	7
	Total	11	22	57	6	96

SAMPLE: 96 metropolitan departments.

SOURCES: *Territoire* survey LEDa-LEGOS and CES (2012); *SolvAPA* survey DREES (2015a).

NOTES: “NR” stands for non respondent. Classical: rule 1 for regulated providers. Generous: rule 3 for regulated providers.

Chapter 4

Moving to the consumer: importance and variations of travel costs in home care provision

Summary of the chapter

Providing care at home generates specific constraints, particularly the travel of caregivers to the consumers' location. This paper analyzes the empirical significance of travel costs in the context of home care provision in France. It makes use of original data obtained from a large home care provider. Travel time and distance generated by caregiver rounds are computed from geographical information in the data, to retrieve the travel costs borne by the provider. They are found to be higher in rural municipalities and to decrease with the size of urban units. This is due to physical constraints in these areas, especially higher travel distances, but also to the characteristics of the demand living there. Indeed, severely disabled individuals are over-represented in costly areas. Their consumption is fragmented and thus generates higher travel costs. In this context, the unique price charged to all consumers entails a redistribution towards rural areas and disabled individuals. I finally test if travel costs affect the length of interventions and find no evidence of such an effect.

Classification

JEL Classification: I11, I18, J14, R32

Keywords: disabled elderly, home care services, travel costs.

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Contents of the Chapter

1	Introduction	222
2	Context	223
	2.1 Existing evidence on travel costs	223
	2.2 Composition of travel costs	225
3	Data	225
	3.1 General presentation	225
	3.2 Descriptive statistics on travels	226
4	Cost computations	228
	4.1 A micro-economic approach of travel costs	228
	4.2 Framework	229
	4.3 Results on costs	230
5	Determinants of travel costs	231
	5.1 Spatial distribution of consumers	231
	5.2 Demand and organization of rounds	233
6	The effect of travel costs on the length of interventions	237
7	Discussion	240
8	Conclusion	241
9	Appendices	243
	9.1 Travel and waiting times in collective agreements	243
	9.2 Data cleaning and matching	246
	9.3 A weekly schedule	247
	9.4 Observation unit at the geographical level	249

1 Introduction

When living at home, disabled elderly require the provision of basic domestic help, such as meal preparation, assistance with personal hygiene or house chores. Long-term care policies encourage the use of professional services: in France, the APA policy partially finances the professional support for the activities of daily living for the disabled elderly. While the scheme is opened to individuals living in the community and those in institutions, 60% of the beneficiaries were community-dwellers in 2016.¹

Providing care at home implies a specific constraint: the provider bears the costs generated by the travels of caregivers to the consumers' location. This feature of the provision influences the costs and the organization of home care providers. The constraint might be unequally binding to providers, depending on the spatial distribution of their consumers. It is expected to depend on the size of the area served, its geographical characteristics and the density of consumers. Several public or research reports have underlined existing differences for consumers, according to where they live, in the number and the type of providers available for care provision and in the price individuals pay for professional home care (Aube-Martin *et al.*, 2010; Blondel *et al.*, 2013; Garabige *et al.*, 2015; Branchu *et al.*, 2015).

This work aims at documenting the importance and the variations of travel costs for home care providers, and their effect on home care provision. Are travel costs negligible? How do they vary? How they influence the organization of the home care provision? The issue of travel costs has been widely addressed in the logistic literature: many works aim at optimizing caregiver rounds in order to reduce costs. In economics, travel costs are often considered from the consumer point of view, in transport economics (Button, 1993). In health economics, travel costs are often studied when looking at the distance necessary to access health services (Lucas-Gabrielli *et al.*, 2016). The economic questions raised by the provision of a service at home are rather close to those of the distribution networks (water, gas or electricity). In both cases, providers serve different points in space; it raises efficiency issues, regarding the optimal size of the network, and equity issues, with respect to the optimal pricing in particular (Fleurbay and Trannoy, 1998; Crampes and Laffont, 2014). In the provision of services, however, demand points are not only connected once, but repeatedly, and serving one consumer excludes the others. It is also the case for postal services, whose cost function has received specific attention in the literature (Cazals, Duchemin, Florens, Roy and Vialaneix, 2004; Cazals, de Rycke, Florens and Rouzaud, 2004). The provision of care is additionally relatively constrained by the demand regarding the day and hours of intervention, while rounds are not similar

¹Source: DREES (2016).

from one day to the other. This paper brings new evidence on the specificity of travel cost in the context of home care provision.

I use original data obtained from a large home care provider serving thousands of consumers spread over a French department. Using geographical tools, rounds of caregivers are reconstituted and travel costs are computed. They are found to be higher in rural municipalities and decreasing with the size of urban units. This is due to geographical constraints, especially higher travel distances, in these areas. It also comes from the characteristics of the demand living there. Indeed, severely disabled individuals are over-represented in rural municipalities and small urban units. Their consumption is more fragmented than those of other consumers, and they receive care from highly qualified caregivers whose wage rate is higher. Overall, serving severely disabled individuals generates higher travel costs. I finally test if travel costs affect the length of interventions and find no evidence of such an effect.

The existence and the variations of travel costs have direct implications for public policies. With a unique price being charged to the consumers of a given service, they organize a redistribution from the consumers who are the less costly to serve to the others. Given our results, the unique price charged to all consumers entails a redistribution towards rural areas and disabled individuals.

2 Context

2.1 Existing evidence on travel costs

The issue of travel costs has been widely addressed in the logistic literature. Many studies use logistic tools to optimize the scheduling and routing of home care nurses in order to reduce costs (see for instance, [Begur *et al.* \(1997\)](#); [Bertels and Fahle \(2006\)](#); [Eveborn *et al.* \(2006\)](#); [Bachouch *et al.* \(2009\)](#)). In economics, spatial constraints of home care providers are sometimes alluded to² but, to the best of my knowledge, there are few works directly dealing with the travel costs of providers serving consumers at home. Hege and Cassou ([Cassou, 2017](#); [Hege, 2018](#))³ have provided a theoretical model analyzing the effects of travel costs on the geographic coverage of firms, in a context of a mixed market with asymmetric universal service obligations. They find that the coverage by the

²“Constraints in this market tend to be associated with rural residence, since it is more difficult for a home care agency to serve patients who are located in remote places” ([Ettner, 1994](#)); “The difficulty in accessing isolated areas in mountainous districts, for example, may imply higher costs of production and higher prices of regulated formal care providers.” ([Arnault, 2015](#)) “Provider costs may differ due to differences in travel costs to reach clients (e.g, higher travel costs in rural areas where clients may be more disperse)” ([Mosca *et al.*, 2010](#)).

³See [Cassou \(2017\)](#) for the English version and [Hege \(2018\)](#) for the French version.

unconstrained firm will be excessive, since its expected surplus from serving an area is often larger than the associate gain in welfare.

Empirically, travel costs represents a non-negligible provision constraint for professional home care providers.⁴ [Chevreul \(2009\)](#) finds that travel costs represent about 21% of total costs in a sample of 36 nursing providers serving consumers at home. In a case study led by [Aube-Martin *et al.* \(2010\)](#), the unproductive hours spent travelling represent 5% of the paid work time. Travel costs are found to vary with the characteristics of the served areas. In [Aube-Martin *et al.* \(2010\)](#), the compensation of employees for travel costs represents 5% of total costs for providers serving rural areas, while it falls to 1% for providers focusing on urban areas. Such a relationship, however, is not systematically observed. Serving urban areas can be associated with costly traffic jam or parking impediments, as is reported by the interviews led by [Ramos-Gorand \(2015\)](#).

Travel costs could then lower the incentives for home care providers to serve consumers in costly areas. According to [Branchu *et al.* \(2015\)](#) and [Blondel *et al.* \(2013\)](#), consumers living in costly areas have a reduced choice of providers, and some have even no provider serving their municipality. [Roquebert and Tenand \(2017\)](#) (Chapter 2 of this thesis) observe, in a French department, that 35% of the APA beneficiaries have only one provider operating in their municipality. These municipalities mostly correspond to small and rural areas.

Travel costs have been found to entail higher prices, either directly or through a pricing process. At this point, it is important to stress the importance of the regulation of the sector. In France, most home care providers serving the disabled elderly are regulated by local authorities, the departmental councils ([Hege *et al.*, 2014](#)). For each regulated provider, the departmental council fixes the price charged by the provider to its consumers, on the basis of average provision cost ([Gramain and Xing, 2012](#)). With such a rule for the pricing process, a higher hourly provision costs (due, for instance, to higher travel costs) should result in a higher price. [Garabige *et al.* \(2015\)](#) find that providers serving costly areas have higher prices because of a higher hourly costs. [Roquebert and Tenand \(2017\)](#) find that providers serving more municipalities, including the remote ones, have a higher price. Consequently, individuals living in remote municipalities have little choice regarding their provider, and they face a higher price on average.⁵ Despite this higher price, providers serving costly areas face more difficulties to balance their budget than other providers ([Branchu *et al.*, 2015](#)).

To sum up, there is empirical evidence that travel costs are a substantial dimension of the care provision, and that it affects the area of intervention of services and their

⁴See Appendix 7.6.A in Chapter 2 for the general decomposition of provision costs in the home care sector.

⁵See Appendix 7.7.C in Chapter 2.

price. This case study aims at measuring the travel costs and highlighting their sources of variations. It builds on a micro-economic approach which precisely reconstitutes caregiver rounds thanks to the rich and original data obtained from a large home care provider.

2.2 Composition of travel costs

Travel costs are borne by the provider when caregivers move from one intervention's location to another. One travel is costly for two reasons. First, the time spent travelling is paid to the caregiver, corresponding to what will be called the *transportation wage*. In most cases, it does not correspond to the time elapsed between two successive interventions of one caregiver in the same day, called the inter-vacation time. Indeed, the inter-vacation period comprises both travel time and waiting time. According to French collective agreements, travel time is part of the effective work and has to be paid as such. Waiting time, however, is not systematically regarded as effective work. It depends on the agreements regulating the provider, on the duration of the break and possibly on the specific rule of the provider.⁶

The second component of travel costs is the *compensation cost*: this is the money paid to the employee to cover, partly at least, the travelling expenses (car gaz, for instance). It should depend on the distance driven by the employee and her means of transport. Collective agreements propose a simplified formula to compensate the caregivers for their distance, in which the compensation costs is a linear function⁷ of the distance driven.⁸

A third component could be added to costs generated by travels, namely the foregone revenue. Indeed, travel time corresponds to time that could have generated profit by treating another patient. In this work, however, I am focusing on the monetary costs paid out-of-pocket by the provider; thus, I won't take this foregone earnings into account.

3 Data

3.1 General presentation

I collected data from a home care provider serving a whole French department.⁹ It counts more than 10,000 consumers spread all over the department. The provider is a

⁶See Appendix 9.1 for more details on French collective agreements.

⁷This rule might not fit the real fees paid by the caregiver. It is relevant when caregivers use a car and there is no congestion. But with public transport or congested areas, the compensation costs might differ from the effective travelling expenses of employees.

⁸The minimum compensation per kilometer is of €0.20 in for-profit enterprises and €0.35 in non-profit structures.

⁹For confidentiality matters, the provider will remain anonymous.

non-profit organization, regulated¹⁰ and priced by the departmental council. I have three databases, presenting information on interventions, consumers and employees. Data are cross-sectional, collected for the month of October 2015.

Our key database presents the recording of the remote management system (data on interventions). For the 88,910 interventions provided during the month of October are observed the starting and ending hours, an identification number for the employee providing home care and an identification number for the consumer receiving care. With these data, caregiver rounds can be reconstructed. Interestingly, the data also give the characteristics of the care that has been provided for each intervention (body care, housekeeping, shopping, meals). One intervention can be spent providing several types of care.

This database can be supplemented with information on consumers and employees, from the billing and pay files. There is substantial heterogeneity in the consumers served by the provider. Half of the consumers served during the month are APA beneficiaries, whose consumption is partially publicly financed. Others are not benefiting from any subsidy and are consuming comfort services that are privately funded.

The pay file provides the wage rate of the employee, her qualification category,¹¹ her experience and her location. It also shows the number of kilometers compensated for during the month. By construction, following the requirements on the collective agreements in the home care sector, the hourly wage rate directly depends on qualification and experience, as illustrated in Figure 4.1. Caregivers are paid according to the time they work, regardless of the type of care they provided, the type of consumers they serve or the area they go to.

The three databases are matched on the basis of consumers and employees identification numbers.¹²

3.2 Descriptive statistics on travels

Travel time and distance are the key elements when investigating travel costs. Both are not directly observed in the data, which only shows the inter-vacation period and the total number of kilometers that is compensated for in the whole month. The information provided on the consumers' location¹³ makes it possible to reconstruct the distance, by

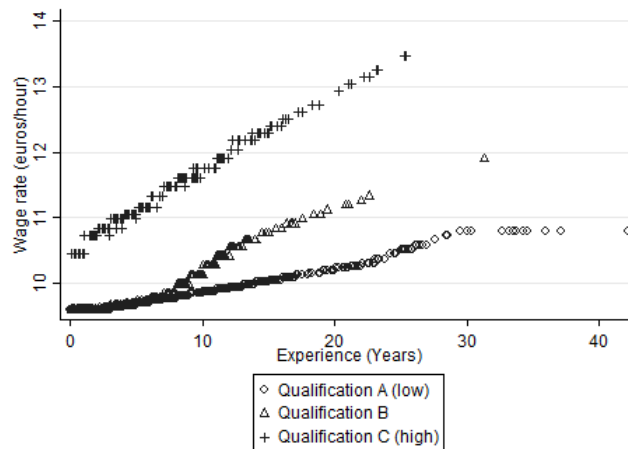
¹⁰The regulated status applies to the structure employing the caregivers, not the caregivers themselves.

¹¹In the French system, the qualification of caregivers is described with three categories. Caregivers belonging to the A-category are the low-skilled one (no specific diploma). The B-category refers to the middle-skilled caregivers (*BAP*, *BEP*, *CAP*) and the C-category to the high-skilled caregivers (*CAFAD*, *DEAVS*, *BEP mention Aide à domicile*, *TISF*).

¹²See Appendix 9.2 for details on the cleaning and the matching of databases.

¹³428 consumers (5% of consumers for the week of observation) receives intervention but are not in the consumer file. According to the provider, they are under the billing process. For them, geographical information is missing and I am not able to reconstruct the time or the distance. 3 other individuals have

Figure 4.1 – Hourly wage depending on years of experience and qualification



SAMPLE: 1,209 caregivers working during the week of observation.
 SOURCE: data from one home care provider.
 NOTES: Category A is the lowest level of qualification; category B is the intermediate level; category C is the highest level of qualification.

the roads, from one location to the other and the associated travel time (in normal traffic conditions).¹⁴

Table 4.1 presents the distribution these variables for one day. As the rounds are organized on a weekly basis,¹⁵ these statistics are provided over one week. For instance, the first column presents the mean of the daily values over the week. I select the second week of October 2015, which is completely observed and not affected by holidays. On average, a caregiver spends a little more than 5 hours and a half in intervention during a day (or 70% of a daily full-time). 0.33 hour (20 minutes) over the inter-vacation time, which is on average of 2 hours and 12 minutes, is devoted to traveling. On average, the travel time represents 5% of the daily working time of caregivers (including both travel and interventions), with a maximum at 30%. There is a considerable variability in kilometers driven across caregivers, with a daily average of 12.9 kilometers, a standard deviation almost as large and a maximum of more than 80.5 kilometers for one day. A caregiver drives 2.2 kilometers per intervention hour, still with substantial variations. This short description of variables relative to the travels of caregivers shows the importance of caregiver travels as a provision constraint for the provider.

inadequate geographical information (located outside of the department). In these cases, the distance and travel time from the preceding intervention or to the next were set to zero. The statistics provided are slightly underestimating actual distance and travel time.

¹⁴I use the Stata command `georoute`, which makes it possible to compute travel distance and time between two points using the geographical information in the data, namely the latitude and longitude of consumers (Weber and Péclat, 2017).

¹⁵See Appendix 9.3 for more details.

Table 4.1 – Distribution of travel variables for one day

	Mean	Standard deviation	Median	Min	Max
Intervention hours [A]	5.59	1.64	5.63	1.38	12.08
Intervacation hours [B]	2.24	0.64	2.25	1.03	4.93
Travel hours [C]	0.33	0.25	0.28	0.00	1.84
Kilometers driven [D]	12.89	12.21	9.14	0.00	80.49
C over (A+C)	0.05	0.03	0.05	0.00	0.29
D over A	2.24	2.00	1.75	0.00	17.20

SAMPLE: 1,209 caregivers working during the week of observation.

SOURCE: data from one home care provider.

4 Cost computations

4.1 A micro-economic approach of travel costs

My approach builds on the micro-costing methodology (Guerre *et al.*, 2018). The cost components are observed at a very detailed level. It makes it possible to identify resource inputs necessary to reach each consumer and their monetary equivalent can be computed. Micro-costing is particularly relevant when it comes to compare costs across consumers and providers. It is generally used to reconstruct costs in order to explain their variations across subgroups of consumers or providers. It considers overall costs tied to the care provision, comprising both fixed costs and variable costs.

I only focus on travel costs. Fixed costs are negligible in the home care provision and they are not varying within one provider. Variable costs comprise intervention costs and travel costs. Intervention costs mechanically correspond to the time spent in intervention, monetary valued by the wage rate of caregivers. Contrary to the health care sector, there is no technological or drug-related costs in the care provision. Thus, costs related to interventions could be appropriately studied by showing the link between the characteristics of consumers, the volume consumed and the characteristics of the caregivers, which is rather straightforward. This will be partly done in this study but the main focus lies in the more ambiguous variations of travel costs according to consumer characteristics.

The micro-costing approach used in this chapter could theoretically be “bottom-up”: we could compute the monetary equivalent of the resource input for each consumer. But there is here a methodological issue tied to the object of study. I am interested in the travel costs generated by the rounds of caregivers. It is methodologically hard to attribute to *each* consumer a given share of the costs generated by the travels necessary to reach her home and then to go to the next consumer. I will thus consider the daily round

each consumer is part of, and compute a mean cost per intervention over the round. The approach thus lies between the bottom-up approach and the top-down one, which consists in computing of an average cost per patient rather than individually evaluating the costs generated by each consumer.

4.2 Framework

Denote k a professional caregiver employed by the provider. I_k is the set of interventions of caregiver k for a given day. $j_{i,i'}^k$ is the journey through which the professional caregiver k goes from intervention i 's location to intervention i' 's location. $J(I_k)$ is the set of journeys needed to provide all interventions in I_k .

The transportation wage for the journey $j_{i,i'}^k$ can be written:

$$w(j_{i,i'}^k) = t_{i,i'}^* \cdot w_k^0 \quad (4.1)$$

Where $t_{i,i'}^*$ is the travel time to go from i to i' and w_k^0 is the hourly wage of the caregiver k in travel.¹⁶ The form of Equation (4.1) implies that the travel time between two interventions does not depend on the caregiver k while the wage rate does.

The compensation costs for the journey $j_{i,i'}^k$, corresponding to the money paid to the employee to cover, partly at least, the travelling expenses (car gaz, for instance), are written:

$$c(j_{i,i'}^k) = d_{i,i'} \cdot r \quad (4.2)$$

Where $d_{i,i'}$ is the distance between i and i' , and r is the fixed compensation rate per distance unit. The form of Equation (4.2), consistently with collective agreements, implies that compensation costs are linearly increasing with distance.

Travel costs for $j_{i,i'}^k$ are expressed as the sum of the compensation costs and the transportation wage:

$$C(j_{i,i'}^k) = c(j_{i,i'}^k) + w(j_{i,i'}^k) \quad (4.3)$$

$$= d_{i,i'} \cdot r + t_{i,i'}^* \cdot w_k^0 \quad (4.4)$$

For each duos of interventions $\{i, i'\}$, I can thus compute the travel costs between the first and the second intervention. In order to compare costs across caregiver rounds, the travel costs created by a round can be compared either to the total number of intervention

¹⁶I could have differentiated between the effective travel time needed to go from i to i' , $t_{i,i'}^*$, and the time paid by the provider to the caregiver for this journey, $t_{i,i'}$, as these two values do not necessarily equal. I also could have defined w_k^1 the wage in intervention and let the possibility that $w_k^1 \neq w_k^0$. But I stick for the moment to a simple framework.

provided during this round, or to the total number of hours provided. The first estimate is the “unitary” travel cost while the second is the “hourly travel costs”.

The unitary travel costs for a caregiver k denoted u_k , is:

$$u_k = \frac{\sum_{i,i' \in J(I_k)} C(j_{i,i'}^k)}{N_{I_k}} = \frac{\sum_{i,i' \in J(I_k)} d_{i,i'} \cdot r + t_{i,i'}^* \cdot w_k^0}{N_{I_k}} \quad (4.5)$$

Where N_{I_k} is the number of interventions provided by caregiver k during the day (I_k).

The hourly travel costs for a caregiver k denoted h_k , is:

$$h_k = \frac{\sum_{i,i' \in J(I_k)} C(j_{i,i'}^k)}{\sum_{i \in I_k} h_i} = \frac{\sum_{i,i' \in J(I_k)} d_{i,i'} \cdot r + t_{i,i'}^* \cdot w_k^0}{\sum_{i \in I_k} h_i} \quad (4.6)$$

Where h_i is the duration of intervention i .

The hourly wage rate w_k^0 is directly observed in the data and $d_{i,i'}$ and $t_{i,i'}^*$ are reconstructed. The compensation rate r used is the minimum rate of €0.35 per kilometer that is set by the collective agreement for non-profit home care providers.¹⁷

The distance and time driven from the caregiver home to the first location (and the return from her last intervention to her home) are not taken into account. According to the labour law, employees are not paid or compensated for these trips.¹⁸ Consequently, isolated interventions, defined as the single intervention of the day for the caregiver, do not generate travel costs. These interventions, though, are quite rare (2.5% of interventions in the week of observation). When she serves several interventions during the day, the caregiver is not supposed to choose the order in which she sees consumers, as it is determined by the provider with the consumer. She is not able to serve the consumers closest to her home at the beginning and at the end, so as to externalize travel costs to the provider.

4.3 Results on costs

Table 4.2 presents the travel costs generated by a daily round and the associated unitary and hourly travel costs, computed with the formula given in Equations (4.4), (4.5) and (4.6). During the week of observation, a caregiver round generates on average a daily cost of approximately €8, with a large dispersion. Comparing this cost to the number of interventions provided during the round, we get the unitary travel cost which is, on average, of about €2.07 per intervention, with a minimum of zero and a maximum

¹⁷This choice is made to grant the anonymity of the provider. This rate is lower than the rate actually used by the provider I study. Then, for a given distance, the cost computation would provided a lower bound for the travel cost borne by the provider I study.

¹⁸They can be compensated for kilometers if the distance is really high. I do not take this case into account.

of €6.7. As interventions are, on average, longer than one hour, the average hourly travel cost falls to €1.4. We compare it to the price range provided by Hege *et al.* (2014) for one hour of care: in 2012, the provider prices of the largest home care providers declared by departmental councils were between €17.1 and €23.¹⁹ The price charged by our provider belongs to this range. Then, the hourly travel costs represent between 6% and 8% of the provider price.²⁰ The maximum value of the hourly travel cost is much higher than the maximum unitary travel cost (€10.6 versus €6.7), revealing rounds with important travel time and distance to provide relatively short interventions.

Table 4.2 – Travel costs over daily rounds

	Mean	Standard deviation	Median	Min	Max
Cost of one daily round	7.95	6.83	6.14	0.00	47.40
Travel cost per intervention	2.07	1.40	1.83	0.00	6.72
Travel cost per hour of intervention	1.39	1.10	1.16	0.00	10.62

SAMPLE: 1,209 caregivers working during the week of observation.

SOURCE: data from one home care provider.

5 Determinants of travel costs

5.1 Spatial distribution of consumers

Travel costs are expected to depend on the spatial distribution of consumers. Several public reports have underlined that serving rural areas is more costly than serving urban areas because of travel costs. In this section, I evaluate how this assessment holds in this case study.

To characterize the place where consumers live, I choose as a spatial unit the “urban unit” (*unité urbaine*).²¹ It is defined by the INSEE as: “a municipality or a group of municipalities which includes a continuously built up zone (no cut of more than 200 meters between two constructions) and at least 2,000 inhabitants.”²² This definition rests mostly on morphological conditions (neighbouring municipalities) and size. The INSEE classification isolates municipalities that are outside an urban unit (rural municipalities)

¹⁹In departments fixing one price per provider (46/67). See Hege *et al.* (2014) for more details.

²⁰I do not compare the unitary cost to the provider price, as it is less meaningful. Indeed, serving one hour of care generates a revenue equal to the hourly price, while it is not necessary the case when serving one consumer.

²¹See Appendix 9.4 for the discussion of the observation unit.

²²Reference: <https://www.insee.fr/en/metadonnees/definition/c1501>

and the others that are differentiated according to their size: less than 10,000 inhabitants (that we will call small urban unit), between 10,000 and 50,000 inhabitants (intermediate urban unit), 50,000 to 1,000,000 (upper-intermediate urban unit) and between 1,000,000 and 2,000,000 (large urban unit). 26.5% of consumers served by the provider live in a rural municipality (Table 4.3). More than one third of consumers live in a urban unit with more than 1,000,000 inhabitants. 21% live in small urban units (with less than 10,000 inhabitants) and the last 15% live in intermediate urban units. For the provider, the heterogeneity of areas to serve is thus remarkably high.

I compute travel distance, time and costs at the urban unit level. For each journey I observe, I attribute the travel distance, time and costs to the urban unit where consumers both live. When the journey connects two consumers who do not live in the same urban unit (40% of travels), I attribute half of the distance, time and costs to each area. The travel distance, time and costs per intervention served are the highest in rural municipalities and they decreases with the size of urban units (Table 4.4). One intervention is associated to 5.36 kilometers on average in rural municipalities, while it falls to 2.60 in large urban units. The difference in unitary times is smaller, though significant. One intervention is associated to 0.12 hours of travel (7 minutes) in rural areas while it is 0.08 in large urban units. Even though the difference is significant, its magnitude is much lower than the difference in the distance. It probably reflects differences in travel speed in the different areas. Hourly variables, when travel distance, time and costs are compared to the number of hours provided, reveals the same trend. Yet, the difference is not significant for the travel time, meaning that the difference in the unitary travel time are compensated by difference in the length of interventions. The difference in travel costs is close to be significant (p-value at 0.13).

Overall, the travel costs are varying according to the area served, especially because of longer distances to drive in rural areas. There is, however, another potential source of variation. Consumers living in each area do not have the same characteristics, as shown in Table 4.4. APA beneficiaries are over-represented in rural municipalities. Among them, severely disabled individuals are also over-represented in rural municipalities and small urban units. Low-income APA beneficiaries are also to be found in rural municipalities, as shown by the increase in the average copayment rate, which is a linear increasing function of income (from 16% in rural municipalities to 23% in the large urban units). Regarding consumption profiles (Table 4.3), the main differences are observed for large urban units, where the average duration of interventions is higher and the number of interventions provided during the week is lower. There is no significant difference between the average volume received by consumers according to the area of residence. One could have expected important gaps in the consumption given the significant differences in the disability status.

The next section focuses more specifically on the link between the disability level and the consumption profile.

Table 4.3 – APA status, consumption profile and area of residence of consumers

	Rural municipalities	Small UU	Intermediate UU	Large UU	Total	Difference (p-value)
Consumers	26.5%	21.2	14.8%	37.5%		
<i>Characteristics</i>						
APA beneficiaries	57.48%	51.81%	51.81%	48.51%	51.51%	0.00
<i>Among APA beneficiaries:</i>						
Co-payment rate	0.16	0.20	0.23	0.23	0.20	0.00
Disability group 1-2 (most severe)	22%	21%	16%	18%	20%	0.02
Disability group 3	24%	23%	26%	27%	25%	
Disability group 4 (moderate)	53%	56%	57%	55%	55%	
<i>Consumption</i>						
Weekly volume (hours)	3.61	3.63	3.62	3.57	3.60	0.91
Length of interventions (hours)	1.79	1.80	1.74	1.87	1.81	0.00
Number of interventions	2.45	2.44	2.54	2.29	2.40	0.04

SAMPLE: 8,078 consumers served during the week of observation.

SOURCE: data from one home care provider.

NOTES: 428 consumers served during this week but with missing geographic information were excluded from the sample. “UU” stands for urban unit. P-values from Anova (resp. Pearson χ^2) test for continuous (resp. categorical) variables.

5.2 Demand and organization of rounds

This section underlines another determinant of travel costs: the organization of rounds depends on the characteristics of the demand and it impacts on travel costs. Indeed, the more severely disabled individuals are, the higher the travel costs of the associated rounds. The consumption of highly disabled individuals is indeed more fragmented than the consumption of others. The volume they consume is higher (Figure 4.2) and they receive interventions more frequently: over the week of observations, GIR 1-2 individuals receive on average 6 interventions, while it falls to 3.6 for GIR 3 individuals, 2 for GIR 4 individuals and less than 1.5 on average for non-APA beneficiaries. The interventions for highly disabled individuals are also shorter than individuals with a lower disability level (Figure 4.3). This is tied to the type of care being provided: interventions including personal care are shorter than the others, like house chores. They are more frequently provided to disabled individuals: 51% of interventions provided to GIR 1-2 individuals

Table 4.4 – Travel costs and area of residence of consumers

	Rural municipalities	Small UU	Intermediate UU	Large UU	Total	Difference (p-value)
Unitary						
Distance (km)	5.36	4.94	3.84	2.60	4.72	0.01
Time (hours)	0.12	0.12	0.10	0.08	0.11	0.05
Cost	3.09	2.92	2.38	1.75	2.82	0.02
Hourly						
Distance (km)	3.66	3.27	2.74	1.69	3.16	0.07
Time (hours)	0.08	0.08	0.07	0.05	0.07	0.24
Cost	2.11	1.94	1.69	1.14	1.88	0.11

SAMPLE: 65 areas with consumers served during the week of observation.

SOURCE: data from one home care provider.

NOTES: “UU” stands for urban unit. P-values from Anova tests. “unit” variables correspond to the variables (distance, time and cost) divided by the number of interventions provided in the urban unit; “hourly” correspond to the variables (distance, time and cost) divided by the number of hours of intervention provided during the day.

READING: in rural municipalities, the average distance driven per intervention is 5.36 kilometers. The average travel time per intervention is 0.12 hours (7 minutes). The travel cost is at €3.09 per intervention.

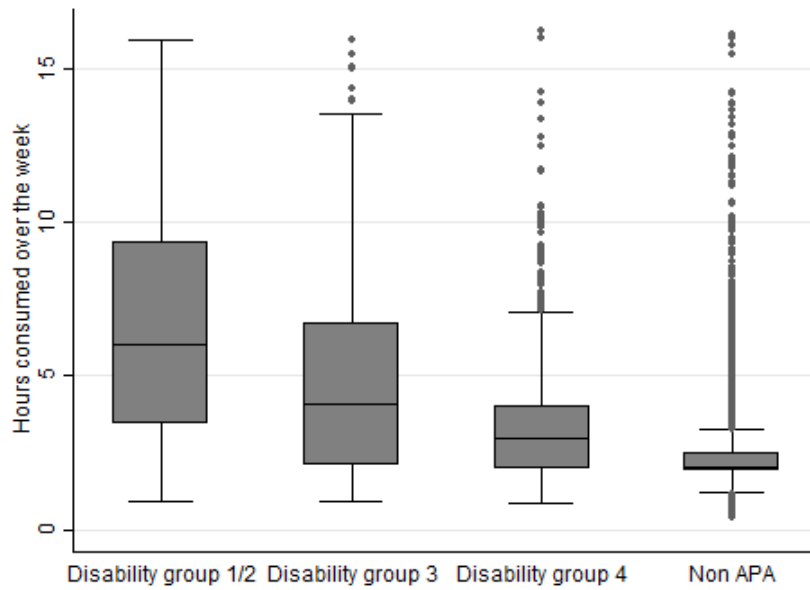
include personal care, while this percentage is of 37% and 20% for GIR 3 and GIR 4 individuals, and it falls to 20% for non-APA individuals. These differences in the structure of the consumption according to the disability level has also been observed in the study of nursing providers serving consumers at home (Chevreul, 2009). It could be reinforced by the prescription of the socio-medical team in the APA program: in some departments, the care plan volume is set up such that the provider has to give frequent and repeated interventions (Ministère des affaires sociales et la santé, 2016). I don’t know, however, if it is the case in the department I study.

A specific matching between the consumer characteristics and the caregiver qualification is additionally observed. When consumers are severely disabled, they are more frequently provided care by a qualified caregiver. 40% of interventions provided to GIR 1 and 2 are served by caregivers with high qualification level (C category), while it is 30% for disability group 3 and 25% for disability group 4 and non-APA consumers. This distribution echoes the specialization according to qualification: when a caregiver is highly qualified, 48% of her interventions on average include personal care whereas this percentage falls to 37% and 14% for middle- and low-qualified caregivers respectively. Conversely, interventions for household chores are more systematically provided by low- and middle-qualified caregivers: when the caregiver belongs to the A or B category, 84% and 67% of interventions include household chores, while it falls to 61.5% when the caregiver is C. Consequently, the more skilled the caregivers, the shorter their interventions (Figure 4.4).

It thus increases the time spent travelling, which is also paid at a higher wage rate.

Overall, rounds including severely disabled individuals tend to be more fragmented than the others. Thus, they generate high travel time and distance. As the caregivers serving disabled individuals are more qualified, this travel time is mechanically paid at a higher wage rate. Rounds serving highly disabled individuals are expected to be more costly for the provider.

Figure 4.2 – Weekly volume consumed, by disability group

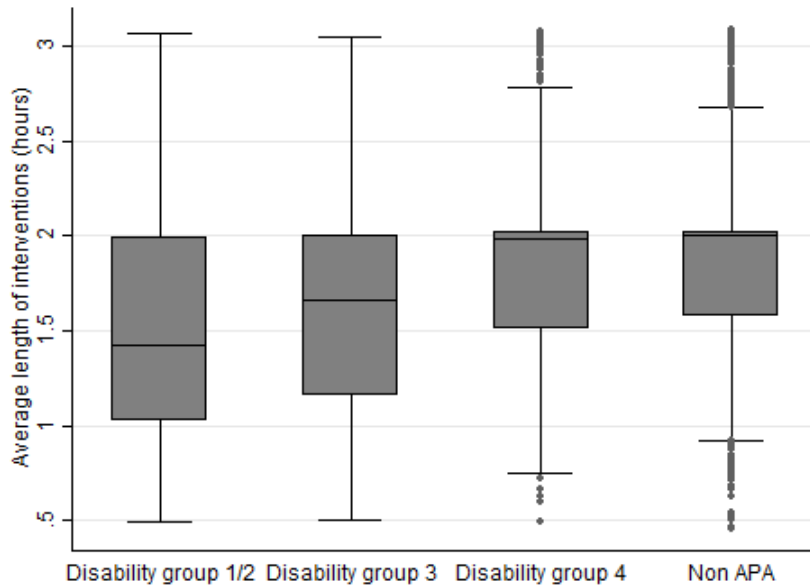


SAMPLE: 8,506 consumers served during the week of observation, among which 85 consumers having the 1% highest volumes have been excluded to ease the reading of the graph.

SOURCE: data from one home care provider.

NOTES: disability group 1-2 corresponds to the more severe disability group in the APA program, while disability group 4 corresponds to a moderate disability level.

Figure 4.3 – Average length of interventions, by disability group

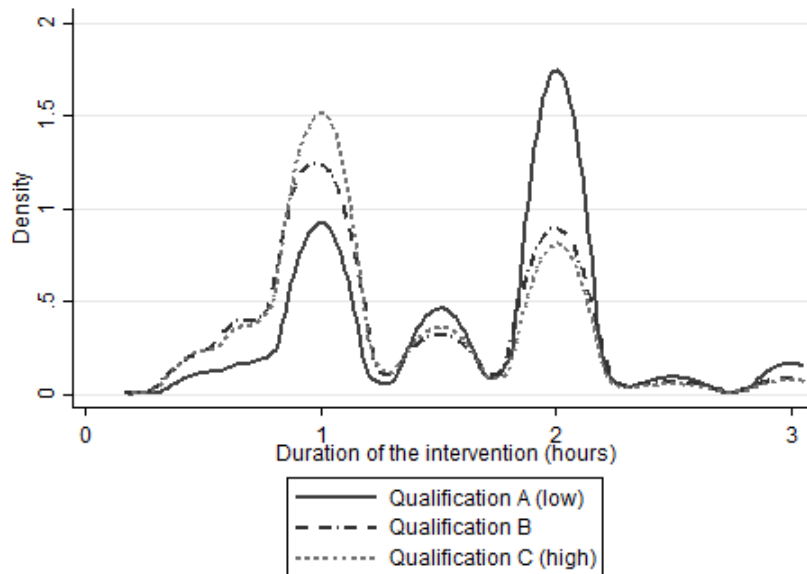


SAMPLE: 8,506 consumers served during the week of observation, among which 76 consumers having the 1% highest duration have been excluded to ease the reading of the graph.

SOURCE: data from one home care provider.

NOTES: disability group 1-2 corresponds to the more severe disability group in the APA program, while disability group 4 corresponds to a moderate disability level.

Figure 4.4 – Duration of interventions depending on qualification



SAMPLE: 20,061 interventions provided during the week of observation, among which 195 interventions having the 1% highest duration have been excluded to ease the reading of the graph.

SOURCE: data from one home care provider.

6 The effect of travel costs on the length of interventions

I am interested in the effect of travel costs on the organization of the home care provision. As the provider I study is a regulated (and non-profit) organization, it is supposed to accept serving any consumer asking for its services, wherever she lives. With our data, we cannot test this hypothesis as we only observe the effective consumers of the provider. Empirically, consumers are highly dispersed on the departmental territory, suggesting there is no *ex-ante* selection by the provider.

Travel costs could influence other dimensions of the organization of rounds. While the provider is not allowed to select consumers, it could adapt the caregiver's rounds to lower its costs and influence, at least marginally, the length of visits. I study econometrically study this link, while controlling for consumer and caregiver characteristics. If the provider is able to manipulate the duration of interventions, it could try to increase the duration of interventions for costly to serve consumers, in order to diminish the number of interventions served during the week. Conversely, the provider might face an important demand and choose to limit the duration of interventions when travel time is important in order to be able to serve an important number of consumers in the area during the day.

I use the unitary travel cost, resting on the number of consumers served during the day, rather than the hourly travel costs, which takes into account the duration of intervention in its construction. The estimated model is the following:

$$\log(y_i) = \beta_0 + \beta_1 X_{c(i)} + \beta_2 X_{k(i)} + \beta_3 X_i + \beta_4 \log(u_k + 1) + \epsilon_i \quad (4.7)$$

Where y_i is the duration of intervention i provided to consumer $c(i)$ by caregiver $k(i)$ on the day of observation. $X_{c(i)}$ is a set of characteristics for the consumer receiving the intervention i (APA status, APA disability group, APA participation rate, consumption on Sunday), $X_{k(i)}$ controls for caregiver's characteristics (qualification, experience, contractual working time) and X_i corresponds to the characteristics of the intervention (tasks performed, day of intervention). $\log(u_k + 1)$ is the logarithm of the unitary cost for the round of caregiver k during that day. ϵ_i is the error term. As our variable of interest, u_k , is at the level of one day for one caregiver, standard errors are clustered at the caregiver level, assuming there might be a correlation of disturbances in the measurement of intervention length at the caregiver level.

Table 4.5 presents the estimation of the linear model, with the duration of intervention and the unitary travel cost with a logarithm transformation. Other things being equal, an increase in the unitary travel cost significantly shortens the intervention. The effect,

though, has a very limited magnitude: when the travel cost of the round is increasing by 1% by per intervention served during the day, the duration decreases by 6%, on average. The decrease is potentially driven by marginal adjustments of caregivers more than by the organization of rounds by the providers. Caregivers may leave consumers more rapidly, or arrive a bit latter, when the relative travel distance and time are important in the day compared to the number of consumers served.

Turning to consumer characteristics, the length of interventions decreases with the disability level: non-APA beneficiaries have longer interventions than APA beneficiaries and in within this group, moderately disabled individuals have longer interventions (GIR-4) than the others. There is no effect of the copayment rate. Individuals having interventions recorded on Sunday have much shorter interventions, suggesting that they need shorter but potentially more frequent interventions. At the caregiver level, a low qualification entails slightly longer interventions, potentially reflecting that productivity correlates with qualification.

Compared to interventions devoted to personal care, interventions for housekeeping or activities like gardening, manual work and shopping are much longer, while there is no difference compared to interventions related to meals (preparation or administration). When several types of tasks are performed, the intervention is also longer. Finally, interventions are shorter during the week-end than during the week. It potentially reveals that interventions are shorter during days when informal care or visits from relatives are more likely.

Other indicators reflecting the organization of rounds would deserve attention, in particular, the number of visits received each week or the total volume consumed. The methodological issue would then be to impute to each consumer a given travel costs. It has not been adressed yet in this work and could be a future developement.

Table 4.5 – Travel costs and lengths of interventions

	Log-duration of the intervention
Travel cost per intervention (log)	-0.064*** (0.010)
<i>Consumer characteristics</i>	
Not APA beneficiary	0.053*** (0.012)
APA disability level 1-2 (severe)	-0.004 (0.012)
<i>Ref: APA disability level 3</i>	
APA disability level 4 (moderate)	0.037*** (0.010)
APA copayment = 0%	-0.017 (0.014)
<i>Ref: 0 < APA copayment < 90%</i>	
APA copayment ≥ 90%	0.052 (0.033)
Consumes on Sunday	-0.252*** (0.013)
Not in the billing file	0.059** (0.024)
<i>Caregiver characteristics</i>	
Qualification A (low)	0.053*** (0.013)
<i>Ref: Qualification B</i>	
Qualification C (high)	0.009 (0.015)
Experience (years)	0.001 (0.001)
<i>Intervention characteristics</i>	
Only housekeeping	0.528*** (0.017)
<i>Ref: Only personal care</i>	
Only meals	0.021 (0.019)
Only gardening, manual work, shopping	0.342*** (0.044)
Several tasks performed	0.264*** (0.015)
<i>Ref: Monday, Tuesday, Thursday, Friday</i>	
Wednesday	-0.006

Continued on next page

Table 4.5 - *Continued from previous page*

	Log-duration of the intervention (minutes)
	(0.006)
Week-end	-0.106***
	(0.015)
Constant	4.147***
	(0.023)
Observations	20,061
Number of clusters	1,233
R-squared	0.437

SAMPLE: 20,061 interventions provided during the week of observation.

SOURCE: remote management system recordings and pay file of a French home care provider.

NOTES: Standard errors in parentheses, clustered at the provider level;

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimation of a linear model.

7 Discussion

The precise information obtained on the rounds is at the price of limited external validity. The results obtained on the travel costs, their sources of variation and their effect on the home care provision are obtained for a given provider, observed during a given week. Nonetheless, the structure of the consumption (with more fragmented for severe disability levels) should not be specific to the provider. Indeed, this organization tends to be structural to the demand of severely disabled individuals, who need short and frequent interventions (Chevreul, 2009). The spatial distribution of the consumers, with APA beneficiaries — and especially those severely disabled — living in rural municipalities or in small urban units, is similar to the general trend observed in France, with the elderly representing a higher share of the population in rural areas (Albertini, 2018). Overall, the evidence of a distortion of travel costs induced by the service of highly disabled individuals could be regarded as a contribution going beyond the case study.

We have limited information on the consumers' sociodemographic characteristics, as well as on the other professional providers serving the department. It is problematic since informal care and potential consumption from other professional providers are likely to be unequally distributed according to the area of residence. Important travel costs for informal caregivers are associated with higher costs for informal care and a higher willingness to pay for formal care (Fevang *et al.*, 2008; Davin *et al.*, 2015). Thus, differences in the

consumption profil according to the area of residence are potentially reflecting differences in informal care provision and availability of other professional services.

The travel costs computed are additionnaly widely depending on the methodological choice I made, especially regarding the computation of the travel time and the monetary valuation of the distance. In general, providers do not observe the exact travel time spent between two interventions and they compute the travel cost rather using flat period of time for each travel. Further developments could compare the travel costs computed with the reconstituted time and the travel costs effectively borne by the provider.

Given our results, the pricing process of providers and its implication for consumers deserves attention. Imposing a uniform price to all the consumers of one provider, as is done in the home care sector, organizes a transfer from less costly to serve to more costly to serve providers. In general, it is economically inefficient as it is similar to a targeted subsidy. This cost balancing, though, has spatial equity purposes ([Fleurbaey and Trannoy, 1998](#)). In our case, we are considering a service that is provided both to a fragile population, whose consumption is partially publicly financed (APA beneficiaries), and to “classical” consumers, who receive privately funded comfort services. Thus, the relevance of the cost balancing organized by the uniform pricing should be assessed with an insight on which group belong the costly to serve consumers. In this case study, the APA beneficiaries are found to be over-represented in costly to serve areas, because of geographical constraints as well as because the characteristics of their demand. Hence, on average, severely disabled individuals — and especially those living in rural areas or small urban units — benefits from the redistribution organized by the uniform price.

8 Conclusion

This paper studies the importance of travel costs borne by a professional home care provider due to the travels of caregivers, and their effect of the organization of the care provision. Travel costs are higher in rural municipalities and small urban units. This is due to geographical constraints, but also to the characteristics of the demand in these areas. Indeed, severely disabled individuals are over-represented in these areas and they generate more costly rounds, due to fragmentation of the interventions they receive and the higher wage rate of caregivers they receive care from. Finally, testing if travel costs affect the length of interventions, I find no strong effect on travel costs on the duration of interventions.

These results are very descriptive and they are obtained on a given home care provider, with its specific organization and a given week of observation. They can hardly be extended beyond this case study but they give an insight of the importance of travel

costs and their consequences for consumers. More work is needed on this topic, regarding the modeling of travel costs in the care provision function and their effect on both the organization of providers and the delivery of care to consumers.

9 Appendices

9.1 Travel and waiting times in collective agreements

In for-profit enterprises, waiting time is paid up to 15 minutes. When the waiting time is higher than 15 minutes, the employee is regarded as free to go on with her own activities. In non-profit providers, the collective agreement does not give a common direction for all providers: it only states that any work break with the employee remaining at the disposal of the employer is regarded as effective paid work.

This section presents extracts from the collective agreements dealing with waiting and travel time, both for the employees of for-profit home care providers (*“Convention collective nationale des entreprises de services à la personne du 20 septembre 2012”*) and for the employees of non-profit home care providers (*“Convention collective nationale de la branche de l’aide, de l’accompagnement, des soins et des services à domicile du 21 mai 2010”*).

Extracts from the collective agreement for for-profit home care enterprises, *“Convention collective nationale des entreprises de services à la personne du 20 septembre 2012”* :

“Le temps de déplacement professionnel pour se rendre d’un lieu d’intervention à un autre lieu d’intervention constitue du temps de travail effectif lorsque le salarié ne peut retrouver son autonomie.” (Section 2, chapitre I)

“Les temps entre deux interventions sont pris en compte comme suit :

- en cas d’interruption d’une durée inférieure à 15 minutes, le temps d’attente est payé comme du temps de travail effectif ;

- en cas d’interruption d’une durée supérieure à 15 minutes (hors trajet séparant deux lieux d’interventions), le salarié reprend sa liberté pouvant ainsi vaquer librement à des occupations personnelles sans consignes particulières de son employeur n’étant plus à sa disposition, le temps entre deux interventions n’est alors ni décompté comme du temps de travail effectif, ni rémunéré.”

(Section 2, chapitre I)

Extracts from the collective agreement of non-profit home care providers, *“Convention collective nationale de la branche de l’aide, de l’accompagnement, des soins et des services à domicile du 21 mai 2010”* :

“Le temps de travail effectif est le temps pendant lequel le salarié est à la disposition de l’employeur et doit se conformer à ses directives sans pouvoir

vaquer librement à des occupations personnelles. Sont donc notamment des temps de travail effectif : [...]

– les temps de déplacement entre deux séquences consécutives de travail effectif ;” (Titre V, chapitre I, A, Article 1^{er})

“Sont comptabilisés comme du temps de travail effectif les temps de pause pendant lesquels les salariés restent en permanence à la disposition de l’employeur.” (Titre V, chapitre I, A, Article 14)

“Les temps de déplacement entre deux séquences consécutives de travail effectif sont considérés comme du temps de travail effectif et rémunérés comme tel.” (Titre V, chapitre I, A, Article 14)

Table 4.6 summarizes the wage for travel time and waiting time according to the status of the home care provider.

Table 4.6 – Travel and waiting time in French collective agreements

	For-profit providers	Non-profit providers
Travel time	Paid as working time	Paid as working time
Waiting time	Paid as working time if inferior to 15 minutes	Paid as working time if the employee remains at the disposal of her employer

SOURCES: collective agreement enforced in for-profit home care enterprises (2012) and collective agreement in non-profit home care providers (2010).

To allow comparisons, I detail how travel time is taken into account in the home care sector in the United-States and in the United-Kingdom.

In the United-States, regulation is closed to what is proposed in France for non-profit providers. According to the Department of labor, travel time from job site to job site must be paid whatever its duration. Travel from worker’s home to work are not paid.²³

“A worker who travels from home to work and returns to his or her home at the end of the workday is engaged in ordinary home-to-work travel which is a normal incident of employment. Normal travel from home to work and return at the end of the workday is not work time. This is true whether the employee works at a fixed location or at a different location each day. [...]

Travel that is all in a day’s work, however, is considered hours worked and must be paid.

²³Source: https://www.dol.gov/whd/homecare/travel_time.htm

Example: Barbara is a personal care aide providing assistance to Mr. Jones. Barbara drives him to the Post Office and grocery store during the workday. Barbara is working and the travel time must be paid.

Travel away from the home is clearly work time when it cuts across the employee's workday. The employee is merely substituting travel for other duties. Thus, if an employee hired to provide home care services to an individual (consumer) accompanies that consumer on travel away from home, the employee must be paid for all time spent traveling during the employee's regular working hours. [...] However, periods where the employee is completely relieved from duty, which are long enough to enable him or her to use the time effectively for his or her own purposes, are not hours worked and need not be compensated."

In the United-Kingdom, a range of types of working time is provided, including time spent "at work and required to be working, or on standby near the workplace" and "traveling in connection with work, including travelling from one work assignment to another". It excludes explicitly "travelling between home and work", "away from work on rest breaks".²⁴

The following examples, based on the home care sector, are provided:

"Example 1

A care worker has 2 appointments in the morning and doesn't take any breaks. The worker must be paid at least the minimum wage for the time hespends at the appointments, plus the travel time between appointments.

Example 2

A care worker has 2 appointments, one in the morning and one in the afternoon. After the first appointment he goes home to have a break before he goes to his afternoon appointment. The time spent travelling from the first appointment to his home and from his home to the second appointment doesn't count towards the minimum wage. If the care worker didn't go home but took a break on the way to his next appointment, he would be paid for any travel time but not for the break."

²⁴Source: <https://www.gov.uk/minimum-wage-different-types-work/overview>

9.2 Data cleaning and matching

The initial billing file counts 18,105 lines, corresponding to 10,234 consumers. The monthly consumption of one consumer was associated with several billing lines when it corresponded to several administrative operations. Administrative lines can be due to cancellations or adjustments (i.e. previous excess payment); other administrative lines are due to a shared financing: when the financing of an intervention is shared between the consumer and an external subsidizing institution (the departmental council for instance), two lines are observed, one for each source of funding. Several lines for the same consumer can also be due to the consumption of different types of hours: the billing file differentiates between week hours, week-end hours or delayed hours.

I reshaped the data to get one line per consumer. I dropped the administrative lines when they were not associated with a consumption line in the month of observation (i.e. adjustment of anterior consumption). Doing so, I loose 7 consumers. I also dropped 9 consumers presenting strong inconsistencies in their consumption. I suppressed consumers when they do not have any consumption billed for the month of observation (18 consumers). I end up with a database of 10,200 lines corresponding to 10,200 individuals.

The pay file initially counted 1,522 lines, corresponding to 1,517 employees. 5 employees have 10 lines, because their work contract changed during the period. I sum the hours they provided and the wage they get in the two lines. I retain the latest value of contractual work hours and the higher level of qualification and years of experience. For one employee, the second line of observation is inconsistent and I drop the line without changing the other line. I end up with a database of 1,517 employees.

The database on interventions (remote management system recordings) initially counted 134,112 interventions, corresponding to 88,929 interventions provided by 1,332 employees to 10,310 consumers.²⁵ One intervention is associated with several lines when several tasks are done during this intervention (body care, housekeeping, shopping, meals). I simply reshaped the database to get one line per intervention, with several variables indicating the type of tasks that have been performed during the intervention. The main cleaning I had to do is related to the starting and ending hours registered in the data: I observe some juxtaposition of interventions the same day for the same caregiver. Some juxtapositions are due to duplication (same hours, same employee, same consumer for the two interventions). I choose to drop one line over the two (19 lines are dropped). The other case is when the starting hour of an intervention is anterior to the end hour of the previous (283 interventions). I assume that the employee forgot to signal the end of the first intervention and I set the end hour of the first intervention at the starting hour of

²⁵The numbers of employees and consumers do not exactly correspond to the billing and pay databases. See below the paragraph on the matching.

the second one (no inter-vacation periods will be observed between these interventions). I end up with a database of 88,910 interventions.

In the database on interventions, I observe the identifying number of the employee and the consumer. I am thus able to matching it with the pay database and the billing database. The matching, however, is not perfect. I detail here the (partial) correspondence between the three database. In the database on interventions, 1,332 employees are providing care. Compared to the pay database, 185 employees are missing. 158 have no working hours registered in the pay database, meaning they are in vacation or previous employees not yet erased from the file. The other 27 employees have working hours registered. It should correspond to the employees providing care to consumers without the remote management system recordings. In the database on interventions, 10,310 consumers are provided care. Compared to the billing database, some consumers are missing: 461 consumers are in the billing database without being in the intervention database. It probably corresponds to the consumers that do not use the remote management system recordings. Other consumers are observed in the intervention database whereas they are not in the billing database: it is the case for 2,933 interventions, corresponding to 570 consumers. According to the provider, there are consumers who were not charged for care yet. Overall, 9,740 consumers are found both the remote management system recordings and in the billing file.

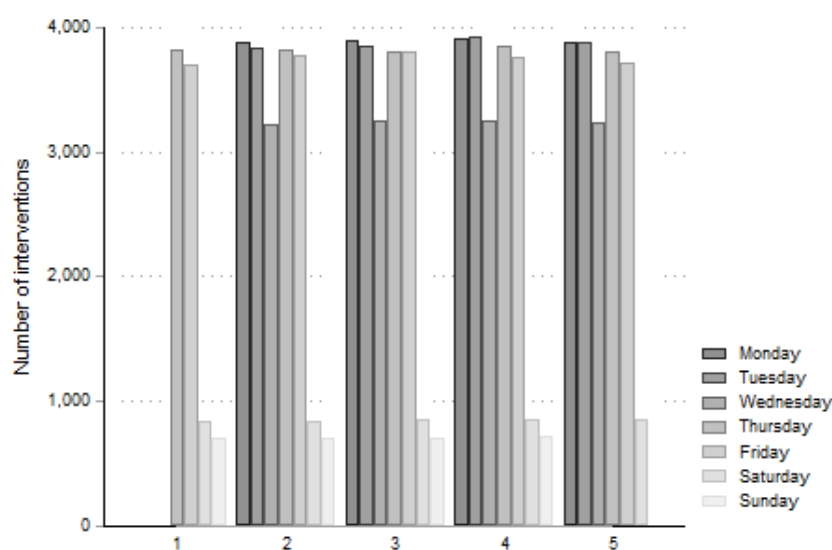
9.3 A weekly schedule

Our data show strong regularities in home care consumption for individuals from one week to another: I observe that individuals most often receive care the same day(s) each week and they consume the same volume of care, at the same hour.

I first describe the distribution of interventions over days in the week, during the month (Figure 4.5). A week correspond to the days between Monday and Sunday. The first and the last weeks are then truncated: the first starts at Thursday and the last ends at Saturday. The number of interventions for each day of the week is stable, with a slightly lower number of interventions during Wednesday and a consequential drop in the number of interventions provided during the week-end. The Figure shows that the daily number of interventions is relatively stable from one week to another. At the individual level, I define individuals as “regular” if they have the same day(s) of consumption each week. For instance, Mister B. will consume every Monday and Wednesday, but will never consume on Tuesday, on Thursday or during the week-end. It is the case for 62% of the 10,310 consumers over the month of October 2015. Overall, the probability of consuming one given day of the week is of 85% when an individual has consumed that day the preceding week, while it falls to 6% when she did not consumed that day the preceding week.

If I add a condition on the beginning hours of the interventions, I see that 81% of interventions occurring during the second week have at least one “twin” intervention, that is to say one intervention occurring the same day of the week, at the same time window (same beginning and ending hours, plus or minus one hour). The volume consumed one given day of the week is also very similar from one week to another. The correlation coefficient between the volume consumed a given day in different weeks is at minimum of 0.74 (week 2 to week 5) and at maximum of 0.82 (week 2 to week 4).²⁶

Figure 4.5 – Distribution of interventions over days of the weeks during the month



SAMPLE: 88,910 interventions recorded in the remote management system during October 2015.

NOTES: the first and the last week are truncated: the first starts at Thursday 1st and the last ends at Saturday 31st.

Another empirical evidence regarding the weekly organization of formal comes from the HSM survey. Individuals who declare they consume formal care are invited to declare the number of hours they receive, either by day, by week or by month. 60% of individuals aged 60 and more have given the weekly volume, whereas it was 33% by day and 7% by month.

The organization of home care provision on a weekly basis deserves emphasis, as the APA program is organized on a monthly basis in France. The maximum number of hours that can be subsidized is set at the monthly level. If consumption depends on the day of the week, individuals could consume more than what they are entitled to during some months because of the size of the month (28 days versus 31) or because of the distribution of days in the month.

²⁶I exclude here the first week which started on Tuesday.

9.4 Observation unit at the geographical level

I choose to observe costs at level of the “urban unit” as it is defined by the INSEE. The units of observation used for the geographical analysis are more frequently employment areas (*bassins d’emploi*), urban area (*aires urbaines*), urban unit (*unités urbaines*) and living zone (*bassins de vie*). Here are the definitions proposed by the INSEE.

An employment area is “a geographical area within which most of the labour force lives and works, and in which establishments can find the main part of the labour force necessary to occupy the offered jobs.” This unit is particularly relevant for studies on employment.

An urban area is “a group of touching municipalities, without pockets of clear land, encompassing an urban centre (urban unit) providing at least 10,000 jobs, and by rural districts or an urban units (urban periphery) among which at least 40% of employed resident population works in the centre or in the municipalities attracted by this centre.”

A urban unit is “a municipality or a group of municipalities which includes a continuously built up zone (no cut of more than 200 meters between two constructions) and at least 2,000 inhabitants.”

The living zone is “the smallest territory on which residents have access to facilities and the everyday services. The everyday services and facilities used to define these living zones include six categories : personal services; commerce; education; health ; sports, recreation and culture; transport.”

The urban unit has the advantage to be directly characterized by the INSEE according to the size of the area (*Tranches d’unité urbaine*). Thus, it is a good starting point that avoids making strong assumptions on the characterization of the different territories. Using employment zones or living zones would have make necessary to select the relevant information to characterize the area. Moreover, urban unit is more precise level than the employment areas or urban areas, while remaining relevant for the different existing types of areas in the department; living zones, conversely, are not optimal to analyze dense urban spaces, as they frequently overlap in these spaces (Chevallard *et al.*, 2015). Overall, the choice of the unit of analysis was pragmatic but it could be interesting to reproduce the analysis using other geographical levels of analysis.

General conclusion

This thesis aims at improving the understanding of home care arrangements for the disabled elderly in France. It specifically highlights the determinants of the demand for formal care and the organization of the provision, both formal and informal. Addressing long-term care issues, it also contributes to adjacent fields of the economic literature, in particular economics of the family, public economics and health services management. The present conclusion proposes an overview of the main results and contributions, as well as future areas of research.

1 Main results and contributions

1.1 Sources of variations of the costs of care provision, formal or informal

Chapter 1 and Chapter 4 offer new contributions on the organization of the provision of both formal and informal care. Chapter 1 focuses on the informal care arrangements in the context of France. It focuses on a sample of elderly declaring they need human assistance for the activities of daily living and highlights the determinants of care provision from their children. Doing so, it helps identifying the variables increasing the utility of being caregiver (thus, relating to the benefits from the care provision) and those decreasing this utility (thus, relating to the costs of care provision). These variables are identified separately for children according to their rank in the sibling, with two definitions of caregiving (broad and restricted definitions). Results show that costs and benefits vary with respect to the rank in the sibling and the definition of caregiving. With a broad definition of care, including domestic care, financial help and moral support, the younger children is more sensitive to her own opportunity costs than the elder child. With the definition restricted to domestic care, behaviors are more convergent. Whatever the care definition and the rank, daughters with a brother are found to be more frequently assigned to care provision compared to other sex compositions. Interactions of care behavior are also found to be asymmetric, meaning that the care behavior of one child differently affects the net utility of the other according to the rank. In this context, a public policy that would build on a substantial informal care provision could potentially increase the inequalities within sibling with respect to the sex and the rank.

Chapter 4 documents the organization of a formal care provider and analyzes the sources of costs variations tied to the specific nature of home delivery. Beyond the physical constraints encountered in rural and small urban municipalities (important travel

distances), it shows that travel costs also generated by the characteristics of the demand living there. Indeed, severely disabled individuals are over-represented in these areas, and their consumption is more fragmented (i.e shorter and more frequent interventions) than others, thus generating more travel costs and distance.

Both chapters thus highlight the sources of variations in the costs of care provision, with a specific focus on one little explored dimension of the care provision: endogenous interactions for informal care, travel costs for formal care. In both cases, predictably, the characteristics of the person receiving care importantly weight on the organization of the care provision: regarding informal care, they influence the care behavior of children and the type of care they provide; regarding formal care, they weight on the organization of the round.

1.2 A limited price sensitivity of the demand for formal care

The two other chapters provide evidence on the price sensitivity of the demand for formal care, both at the intensive (Chapter 2) and extensive margins (Chapter 3). At the extensive margin, the demand is found not to be affected by the generosity of the public financing, measured by the departmental formula used to compute the APA subsidy. At the intensive margin, the sensitivity to the OOP price is significantly different from zero, meaning that long-term care programs financing formal care raise efficiency issues. This price elasticity is also found to be inferior to 1 in absolute value, thus revealing a fairly weak price sensitivity of the demand.

Overall, the price sensitivity of the demand for formal care is thus found to be limited, both at the extensive and intensive margins. In both chapters, however, the demand is substantially affected by the limitations met by the individual and the presence of potential informal care (spouse and children). At the extensive and intensive margins, health status and informal care availability are thus the major explaining factors. Price variations would only conduct to small adjustments at the intensive margin. Such a result echoes the literature on the determinants of nursing home entry presented in the general introduction. It has shown that a deteriorated health status and limited resources in informal care predict nursing home entry while the demand is fairly little sensitive to the price.

1.3 Implications for the regulation of the home care sector

The thesis also contributes to analyze the importance of the regulation of the home care sector. Its results make it possible to conclude on the implications of the supply side regulation for consumers. The first implication relates to spatial equity issues. Chapter

4 reveals differences in travel costs according to the demand and the area served. It shows the costs supported by the provider for the service of rural or small urban unit, generating important travel distances, while residents have a more fragmented demand that is costly to serve. In this context, the non-regulation of providers would be expected to result in an unequal spatial coverage and restricted access to home care for costly to serve areas. The regulation, by departmental councils, of the area served thus ensures a form a spatial equity in the availability of home care, within the department. In addition, the unique price fixed to each structure organizes a redistribution from the less costly to serve to the others. According to Chapter 4, this redistribution benefits to the most disabled individuals. This redistribution, however, is only effective among the consumers of the same provider. Indeed, the pricing of each structure results in potential variations of provider price according to the type and the importance of area they serve. These variations are documented and used as a source of identification in Chapter 2. Individuals served by a provider covering a large number of municipalities are found to be charged a higher price than those served by a provider covering a lower number of municipalities.

A second aspect of the formal care regulation adressed in the thesis is the impact of having a mixed market on the demand for formal care. Chapter 3 shows a correlation between a low level of regulation and a low demand for formal care. If this link is thought to be causal, it would reveal that a low level of regulation decreases the incentives to consume formal care, potentially through a price or quality effect. If the reverse relationship is rather suspected, meaning that departments with a low demand do not get involved into regulation, elderly requiring formal care living in departments where demand is low would have a limited access to providers with regulated price and quality.

A broader implicitation relates to the transparency of the home care sector regulation. Given the complexity of the French institutional context, understanding and forecasting one's OOP payments requires to have a considerable insight of the supply and demand side of the long-term care scheme. In particular, it implies to be aware of the difference between providers, to understand the associated variations in computation formulas and to observe their price. As of today, these three elements are far from being granted for APA beneficiaries. The 2016 reform has targeted the transparency in the nursing homes sector: the same trend could be applied to the professional care provided at home.

1.4 Expectations for the 2016 reform

Holding together these results makes it possible to provide some forecasting about the effects of the 2016 reform of the French long-term care scheme presented in the general introduction. On the demand side, the reform has modified the copayment rate formula to take into account the disability levels of beneficiaries. It has also raised the level of

the legal thresholds binding the care plan volume for each disability level. Overall, these measures are expected to decrease the OOP payments of APA beneficiaries, by diminishing the hourly OOP payments on subsidized hours and increasing the number of hours that can be subsidized. According to the limited demand sensitivity, this decrease in the OOP payment for formal care should have limited volume effects.

On the supply side, all structures are expected to turn to the regulated regime. It could help increasing formal care use in departments where the regulation level was low; it will depend, however, on the mechanisms driving our results (price or quality effect) and on the effect of the reform on the distribution of care hours between (regulated) structures and over-the-counter workers.

These two parts of the reform are going to affect the volume and the structure of APA spending. The central contribution to the financing of the program has increased to take into account additional expenses mainly due to the demand side part of the reform. The effects of the supply part are more indirect and uncertain. In the absence of pricing, the computation formula used for previously non-regulated providers should remain unchanged. But expenses will be affected if the consumption of individuals changes following the change in the supply regulation, as suggested by our results. This potential increase has not been planned in the compensation scheme of the reform.

2 Discussion and future research

Beyond the points of discussion already raised in the general introduction and the chapters, this section identifies areas of future research that could help improving the works presented in the thesis.

2.1 Modeling of the demand for formal care

In the thesis, the modeling of the demand for formal care is relatively rigid and rests on strong hypothesis on individual behavior. In particular, Chapter 2 implicitly assumes that the observed level of consumption corresponds to the consumption maximizing the individual utility, thus resting on a perfect rationality assumption. This assumption is strong, as some irrationnaly is potentially prevailing and prevents the level of consumption to be equal to the one given by the standard consumer theory. An ongoing work within the Modapa project realized by Agnès Gramain and Olivier Supplisson challenges this hypothesis: they find that a model assuming perfect rationality and a model resting on a gaussian optimization error are equivalently misspecifying the formal care demand. Another potential biais that would prevent observed consumption to equal the consumption maximizing utility is related to the time schedule of the APA program compared to

those of the individual consumption. The APA policy is such that care plan volume are established at the monthly level. Yet, there is empirical evidence that the consumption is organized at the weekly level (remember, for instance, Appendix 9.3 of Chapter 4). The existence of such a temporal discrepancy and its implications for the elderly should be further explored.

2.2 Exploiting new databases to update and deepen the analysis

A national survey, the CARE survey, was conducted in France, in 2015, on the French population aged 60 and more. The section devoted to individuals living in the community has included around 15,000 individuals, representative of the 60+ population. It covers health and disability issues, gives information on informal and formal care provision and includes a large set of socio-economic and family information. It will additionally be linked with administrative micro-data from the APA program and the fiscal administration.

With precise information on the OOP payments and volume of formal care consumed, this survey will make it possible to get an alternative estimation of the price elasticity, controlling for informal care provision and without censoring issues. Moreover, results are expected to be reliable in terms of external validity. In methodological terms, the comparison of results obtained with these exhaustive survey data, which are costly to produce, and the alternative strategies and data used within the Modapa project will help measuring the costs of using alternative strategies on easy-to-access data.

Simultaneously to the CARE survey, a departmental survey has been implemented, the SolvAPA survey, which partially builds on the *Territoire* survey. It offers the opportunity to compare departmental practices between 2012 and 2015, as is done in Chapter 3. It could also be used for the identification of the effect of departmental practices on formal care consumption using the CARE survey.

2.3 Exploring the dynamic of care arrangements

Contributions of the thesis are mostly based on cross-sectional data. Chapter 2 is the only one using panel data, which mostly contribute to increase the precision of the estimations rather than bringing evidence on dynamic issues. A dynamic approach would however be relevant to better understand the mechanisms underlying care arrangements. How are care arrangements, both formal and informal, evolving with the disability path of the elderly? A dynamic version of Chapter 1 would be particularly of interest to see whether the results obtained are homogeneous regarding both the seniority and the severity of disabilities. Care provided by children might obey to different rules depending on these two dimensions. Typically, it can be expected that having a parent newly and

sightly disabled differs from the case when she has been highly disabled for years or when she suddenly turns highly disabled following an health shock. In addition, to the best of my knowledge, there is a gap in the literature regarding the care arrangements when the parent is frail (in the sense of [Fried *et al.* \(2001\)](#)), before the occurrence of effective activity limitations. Informal or formal care at this step could potentially have beneficial effects on the functional status of the elderly. The longitudinal survey SHARE, covering a representative sample of non-institutionalised adults between 2004 and 2015 in 22 different European countries,²⁷ offers rich data to study such dynamic issues.

²⁷The seventh has been released in 2017 and has included additional eight countries.

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Glossary

- ACTP** *Allocation compensatrice pour tierce personne.* 46, 197, 199, 200
- ADL** *Activities of daily living.* 37, 39, 57, 65, 78, 100, 176
- AGGIR** *Autonomie, Gérontologie, Groupes Iso-Ressources.* 38
- APA** *Allocation Personnalisée d'autonomie.* 42, 46–48, 50, 51, 53, 56, 57, 104–114, 116–129, 131, 133, 134, 136, 139–141, 143–146, 148, 152, 153, 157–159, 161, 163, 167, 170–177, 180, 181, 190, 191, 193–195, 197–199, 202, 206, 208, 212, 213, 218, 220, 222, 228, 230–234, 236, 237, 244, 248–251, 274–276
- CARE** *Capacités, Aide et Ressources des seniors.* 38, 55, 251
- CNSA** *Caisse Nationale de Solidarité pour l'Autonomie.* 193, 194
- DREES** *Direction de la recherche, des études, de l'évaluation et des statistiques.* 39
- ECHI** *European Community Health Indicators.* 36
- GALI** *Global Activity Limitation Indicator.* 36
- GIR** *Groupes iso-ressources.* 38, 47, 106, 133, 134, 202, 203, 229, 230
- HSM** *Handicap Santé Ménages.* 38, 40, 52, 53, 55, 56, 59, 62–66, 68, 70–73, 83, 87, 95–97, 99, 100, 167, 170, 176–178, 182–185, 187, 188, 190, 201–203, 209, 211, 244
- IADL** *Instrumental activities of daily living.* 37, 39, 57, 65, 100, 176
- INSEE** *Institut nationale de la statistique et des études économiques.* 84, 177, 227, 245, 246
- OOP** *out-of-pocket.* 47, 52, 53, 56, 104–107, 109, 111, 113, 118, 119, 123, 126, 127, 129, 140, 166, 171–173, 181, 190, 195, 196, 248–251
- PCH** *Prestation compensatoire du handicap.* 197, 199, 200
- PSD** *Prestation spécifique dépendance.* 46
- RSA** *Revenu de solidarité active.* 193, 197, 199, 200
- SHARE** *Survey of Health, Ageing and Retirement in Europe.* 63, 89, 90, 252
- WHO** *World Health Organization.* 36

List of tables

1	Home care providers in France	54
1.1	Disabled elderly according to their marital status and the number of children	70
1.2	Caregiver children of disabled elderly individuals	74
1.3	Share of disabled elderly parents provided with care by their children . . .	75
1.4	Sociodemographic characteristics of children (two-child families)	77
1.5	Determinants of care behaviors in two-child families	86
1.6	Synthesis of additional results	91
1.7	Determinants of care provision by younger children	99
1.8	Children characteristics	100
1.9	Parent and family characteristics	101
1.10	Individual and parental determinants of care provision	103
1.11	Interactions in care provision with an enlarged sample	104
2.1	Descriptive statistics on the estimation sample and APA beneficiaries (Oct. 2014)	115
2.2	Censored regression estimates of demand for home care hours	125
2.3	Price elasticity of home care by disability level, income and marital status .	126
2.4	Descriptive statistics for department studied and metropolitan France . . .	129
2.5	Sample selection steps	130
2.6	Descriptive statistics on the pooled sample (2012-2014)	133
2.7	Individual characteristics and choice of a low provider price	151
2.8	Censored regression estimates of demand for home care hours (absolute consumption)	153
2.9	Censored regression estimates of demand for home care hours (relative con- sumption)	154
2.10	Censored regression estimates of demand for home care hours (relative con- sumption, IV)	155
2.11	Bootstrap inference	159
2.12	Single-provider areas and multiple-provider areas (October 2014)	162
2.13	Descriptive statistics on the SPA and non-SPA sub-samples (October 2014)	163

2.14	Censored regression estimates of demand for home care hours (SPA/non-SPA)	164
2.15	Censored regression estimates of demand for home care hours, controlling for the type of area of residence	166
2.16	Inclusion of home care received on weekends	168
2.17	Consumer price elasticity estimations: comparing truncated and censored regression models	169
2.18	Consumer price elasticity estimations: censored Poisson model	170
3.1	Distribution of departmental practices	180
3.2	Descriptive statistics on the sample	182
3.3	Departmental determinants of formal care use	186
3.4	Individual determinants of formal care use	190
3.5	Information criteria	192
3.6	Departmental characteristics and response to the <i>Territoire</i> survey	201
3.7	Departmental characteristics and generosity of the APA policy	203
3.8	Departmental characteristics and regulation of the supply	204
3.9	Distribution of the sample in the departmental categories	205
3.10	Katz Index: definition and comparison with the GIR indicator	207
3.11	Determinants of formal care use - functional forms	210
3.12	Random intercept model	212
3.13	Sociodemographic groups and departmental practices (demand side)	215
3.14	Sociodemographic group and departmental practices (supply side)	215
3.15	Description of departments according to demand side indicators	217
4.1	Distribution of travel variables for one day	228
4.2	Travel costs over daily rounds	231
4.3	APA status, consumption profile and area of residence of consumers	233
4.4	Travel costs and area of residence of consumers	234
4.5	Travel costs and lengths of interventions	239
4.6	Travel and waiting time in French collective agreements	244

List of figures

1	Volume et structure de la population française entre 1900 et 2060	16
2	Population pyramids in European countries - 1990 and 2017	40
3	Public expenditure on long-term care as a share of GDP	45
1.1	Types of care provided by caregiver children of a disabled elderly parent . .	72
1.2	Involvement rates of children according to rank and sibling size	76
1.3	Volume of care provided by children for the activities of daily living	101
2.1	Budget constraint for home care under the APA program	112
2.2	Correlation between provider price and number of municipalities served by the provider	120
2.3	Distribution of absolute home care consumption, by disability level	137
2.4	Distribution of relative home care consumption, by disability level	138
2.5	Provider price according to the number of APA beneficiaries served by the provider, by legal status	148
2.6	Provider price according to the share of hours served on Sundays and public holidays, by legal status	149
2.7	Distribution of the size of regulated providers (October 2014)	157
2.8	Percentile-t bootstrap quality: distribution of bootstrap t-statistics (Tobit estimation)	160
2.9	Percentile-t bootstrap quality: distribution of bootstrap t-statistics (IV- Tobit estimation)	160
2.10	Distribution of providers in the department - Schematic representation . .	161
3.1	Hourly out-of-pocket payments of an APA beneficiary served by the biggest regulated provider in the department	178
3.2	Odds-ratios for the effect of public generosity on formal care use (Estima- tion 1)	187
3.3	Odds-ratios for the effect of supply regulation on formal care use (Estima- tion 2)	188

3.4	Odds-ratios for the effect of public generosity and supply regulation on formal care use (Estimation 3)	189
3.5	Contribution of the central government to the APA spending of departmental councils between 2002 and 2016	198
3.6	Example of the effect of computation formulas	200
3.7	Five sociodemographic groups	214
4.1	Hourly wage depending on years of experience and qualification	227
4.2	Weekly volume consumed, by disability group	235
4.3	Average length of interventions, by disability group	236
4.4	Duration of interventions depending on qualification	236
4.5	Distribution of interventions over days of the weeks during the month . . .	248

Les configurations d'aides formelles et informelles autour des personnes âgées en incapacité en France

Résumé: Le vieillissement de la population et la forte prévalence des incapacités qui lui est associée invitent à s'interroger sur les modes d'accompagnement de la perte d'autonomie. Tandis que l'aide reçue par les personnes âgées dépendantes provient majoritairement de leurs proches, les politiques publiques françaises favorisent le recours à l'aide professionnelle, dite aide formelle, pour les personnes résidant à domicile. Cette thèse se propose d'étudier les configurations d'aides formelles et informelles pour les personnes âgées en perte d'autonomie. Sous quelles conditions les individus ont-ils recours à l'aide professionnelle, et comment se détermine leur niveau de consommation ? Comment les producteurs d'aide familiale et professionnelle s'adaptent-ils aux contraintes de production qui leur sont propres ? Les quatre chapitres de cette thèse étudient empiriquement ces questions dans le contexte français. Mobilisant le cadre micro-économique et les outils économétriques, ils s'appuient sur des données d'enquête, des données administratives et des fichiers de gestion d'un service d'aide à domicile. Le premier Chapitre porte sur l'aide apportée par les enfants à un parent âgé dépendant. Le deuxième Chapitre étudie l'élasticité-prix de la demande d'aide formelle. Le troisième Chapitre analyse comment le financement public de la demande et la régulation de l'offre affectent la décision de consommer de l'aide professionnelle. Le quatrième Chapitre s'intéresse enfin aux coûts de transport des services d'aide professionnelle, comme contrainte de production pesant sur l'organisation de l'offre. Les résultats montrent que la demande d'aide est relativement peu sensible au prix de l'aide professionnelle, tandis que la régulation de l'offre affecte plus notablement les configurations d'aide.

Mots-clefs: vieillissement; dépendance; aide à domicile; politiques publiques.

Formal and informal care arrangements for the disabled elderly in France

Abstract: In a context of population ageing, the demand for long-term care is rising. While relatives remain the major source of care provision for disabled elderly, most OECD countries tend to foster the use of professional care, also called formal care, when individuals live at home. This thesis studies the determinants of home care arrangements for the disabled elderly in the context of France. What are the determinants of formal care consumption, at both the extensive and intensive margins? How do formal and informal care providers adjust to their provision constraints? The four chapters present original empirical evidence on these questions in the French context. They build on micro-econometric frameworks and use national survey data, administrative data or management files from a professional provider. The first Chapter studies the care provided by children to a disabled elderly parent. The second Chapter estimates the price-elasticity of the demand for formal care. The third Chapter analyzes how the decision to consume formal care is affected by the generosity of the public financing and the regulation of home care providers. The fourth Chapter focuses on the travel costs borne by home-care providers and their effect on the home care provision. The demand for formal care is found to be fairly little sensitive to its price, while the regulation of the supply is more likely to affect care arrangements.

Keywords: long-term care; disability; home care; public policies.