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Christian Tekam Tagny

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THÈSE DE DOCTORAT
DE L'UNIVERSITÉ PSL

Préparée à Université Paris Dauphine - PSL

**SUBJECTIVE RISK OF DEPENDENCY AND THE MARKET
FOR LONG-TERM CARE INSURANCE:
THREE ESSAYS ON FRENCH DATA**

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Soutenue par

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Spécialité

Economie

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L'Université Paris-Dauphine n'entend donner aucune approbation ni improbation aux opinions émises dans les thèses ; ces opinions doivent être considérées comme propres à leurs auteurs.

"¹⁷Garde-toi de dire en ton cœur: Ma force et la puissance de ma main m'ont acquis ces richesses.

¹⁸Souviens-toi de l'Éternel, ton Dieu, car c'est lui qui te donnera de la force pour les acquérir, afin de confirmer, comme il le fait aujourd'hui, son alliance qu'il a jurée à tes pères."

Deuteronomie chap 8 v17-18

La Sainte Bible par Louis Second (1910)

À mes parents,

et à Isabelle

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¹<https://www.fondation-mederic-alzheimer.org/>

²<http://www.share-project.org/>

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Christian

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Introduction générale

Cette thèse est une thèse d'économie appliquée aux questions du marché de l'assurance dépendance. L'approche est résolument empirique, et examine, sur des données individuelles françaises, longitudinales et en coupe, trois questions relatives à ce marché :

- Les individus sous-estiment-ils leur risque d'entrée en dépendance ?
- La sélection des risques neutralise-t-elle une antisélection dans les demandes de contrats de couverture du risque de dépendance ?
- Les résiliations peuvent-elles renforcer la sélection initiale opérée par les assureurs à travers le questionnaire médical ?

L'augmentation de la demande de soins chez les personnes âgées dépendantes nécessite des approches globales qui intègrent différents acteurs de la société, des politiques publiques, et même des initiatives privées. Les questions économiques liées à la dépendance des personnes âgées se situent à la croisée de nombreuses sciences sociales [Norton, 2000]. A titre d'exemple, l'augmentation de la demande de soins dans une société vieillissante est d'abord une question de démographie, la concurrence entre les maisons de retraite est une question d'économie industrielle, l'offre de soins informels (aidants), généralement fournie par les femmes, pose des questions d'économie du travail puisque leur participation au marché du travail conditionne cette aide informelle. Enfin, la couverture assurantielle de la perte d'autonomie soulève des questions liées aux notions de risque et d'assurance, notamment lorsque l'assurance est privée, et d'épargne pour anticiper l'entrée en dépendance, qu'il s'agisse d'épargne de précaution ou de legs, relèvent du concept de cycle de vie.

1 La dépendance en France

L'évolution de la population âgée dépendante est directement liée à l'évolution démographique et à la prévalence de la dépendance au sein des personnes âgées.

1.1 Plusieurs indicateurs pour définir et évaluer le nombre de personnes concernées

Le terme de dépendance a été inventé en France en 1973 et se définit comme un état d'incapacité qui s'observe en général aux âges avancés, où le besoin d'être aidé par un tiers est nécessaire pour réaliser les actes de la vie courante (s'habiller, se laver, aller aux toilettes, se déplacer, se nourrir). La dépendance est mesurée selon la grille AGGIR (Autonomie Gérontologie Groupe Iso-Ressources) par les départements afin de distribuer l'APA³ (Allocation Personnalisée

³Lorsqu'une personne âgée éprouve des difficultés à accomplir des actes de la vie quotidienne, elle peut s'adresser au conseil départemental afin de bénéficier de l'APA. Une évaluation in situ de ses « besoins » est alors

d'Autonomie) depuis 2002. Cette grille permet d'établir un score de dépendance GIR (Groupe Iso-Ressources) de 1 à 6 du plus fort au plus faible degré de dépendance. Il s'agit d'un moyen de référence permettant d'évaluer le plan d'aide personnalisé en fonction de l'état de santé. Fin 2018, 1,3 million de personnes de 60 ans ou plus percevaient l'APA dont 59% à domicile [DREES, 2020].

Le volet « senior » des enquêtes Capacités, aides et ressources des seniors en ménages (CARE-M) et en institutions (CARE-I) de la DREES⁴, a permis de repérer les seniors dépendants à l'aide d'une estimation large du groupe iso-ressources (GIR) allant de 1 à 4. Selon cet indicateur (GIR), en 2015, 13% des personnes âgées de 60 ans ou plus (1,9 million d'individus) sont en perte d'autonomie en France métropolitaine. Parmi elles, un quart réside dans un établissement d'hébergement permanent pour personnes âgées. La prévalence des degrés les plus sévères de perte d'autonomie (GIR 1 ou 2) atteint 4%, soit 552 000 personnes. Alors que 49% des personnes en établissement ont un niveau de dépendance sévère, elles ne sont que 2% à domicile. Deux autres indicateurs s'attachent à repérer les situations de dépendance sévère : les indicateurs de Katz et Colvez⁵. Ils sont établis sur la base d'un nombre plus restreint d'activités de la vie quotidienne que le GIR estimé. L'indicateur de Katz évalue la capacité d'une personne à réaliser seule six activités⁶ de la vie quotidienne. Si l'on se réfère à cette mesure, 6% des individus de 60 ans ou plus (845 000 personnes, dont 370 000 en établissement) sont incapables de réaliser seuls au moins une de ces activités. L'indicateur de Colvez, qui permet d'appréhender le besoin d'aide en mesurant la perte de mobilité, concerne 730 000 personnes âgées de 60 ans ou plus (dont 350 000 en établissement), soit 5%.

1.2 L'évolution de la population âgée en France

Selon une étude récente de la DREES, au 1er janvier 2019, 17,5 millions de personnes avaient 60 ans ou plus en France métropolitaine et dans les départements et régions d'outre-mer (DROM), soit plus d'un quart de la population. Parmi elles, 36% avaient 75 ans ou plus (6,3 millions) et 13% avaient 85 ans ou plus (2,2 millions).

Les projections de population réalisées par l'Insee prévoient une hausse importante du nombre

effectuée par une équipe médico-sociale. Si les conditions nécessaires au bénéfice de l'APA sont réunies, le conseil départemental notifie au futur bénéficiaire un plan d'aide, auquel correspond un montant en euros. En fonction de ses ressources, une participation financière, parfois appelée « ticket modérateur », peut lui être demandée.

⁴DREES : Direction de la recherche, des études, de l'évaluation et des statistiques

⁵En plus de ces indicateurs, Benaim et al. [2005] considèrent que le test de Lawton ou « échelle des activités instrumentales de la vie quotidienne » fait référence dans la littérature internationale comme outils d'évaluation de l'autonomie centrée sur la personne.

⁶Six activités permettant de construire l'indice de Katz : soins corporels, habillement, toilette, transfert, continence, alimentation.

de personnes ayant plus de 60 ans. Selon le scénario central⁷ de projection, ils seraient 22,9 millions en 2040 et 26,4 millions en 2070 (+51% entre 2019 et 2070). De plus, leur part dans l'ensemble de la population augmenterait, passant de 26% en 2019 à 32% en 2040, puis à 35% en 2070. La proportion des plus âgés augmenterait encore plus. En 2070, 18% de la population serait âgée d'au moins 75 ans (13,7 millions de personnes), contre 9% en 2019. Deux raisons principales permettent d'expliquer ce net vieillissement de la population à l'horizon de 2070 : un allongement de l'espérance de vie, et l'arrivée aux âges élevés de la génération nombreuse du *baby-boom* entraînant un déséquilibre de la pyramide des âges.

Tout système de protection sociale souhaiterait avoir une population qui vieillit dans de bonnes conditions, et en en bonne santé. En 2020, une femme de 65 ans pouvait espérer vivre 12,1 ans sans incapacité et 18,1 ans sans incapacité sévère ; un homme du même âge, 10,6 ans sans incapacité et 15,7 ans sans incapacité sévère [Deroyon, 2021]. Depuis 2008, l'espérance de vie sans incapacité à 65 ans a augmenté de 2 ans et 1 mois pour les femmes et de 1 an et 11 mois pour les hommes et était en 2019 supérieure de 5 mois à la moyenne européenne. L'espérance de vie sans incapacité à la naissance, qui tient compte de la survenue éventuelle d'incapacités tout au long de la vie, a également augmenté, de 1 an et 5 mois pour les femmes entre 2008 et 2020 et de 1 an et 8 mois pour les hommes pour atteindre 65,9 ans pour les femmes et 64,4 ans pour les hommes.

Sur 10 personnes qui décèdent en France, 4 ont connu la perte d'autonomie dont 2 de façon sévère et 3 ont vécu leurs derniers jours en établissement. Du fait de la démographie, le nombre de personnes âgées en perte d'autonomie va inéluctablement s'accroître même si les progrès de la médecine, les efforts de prévention et l'amélioration des conditions de vie peuvent contribuer à faire diminuer les taux de prévalence [Libault, 2019].

En somme, les Français vivent plus vieux qu'avant, perdent leur autonomie de plus en plus tard, et même légèrement plus tard que les européens en moyenne. Cependant, les prévisions indiquent clairement que le nombre de personnes âgées dépendantes va considérablement augmenter et il faut y faire face.

1.3 Le profil des personnes âgées dépendantes bénéficiaires de l'APA

Une étude de la DREES analyse les plans d'aide des bénéficiaires de l'APA, ce qui permet d'avoir une idée du profil des personnes âgées dépendantes en France. A partir de données individuelles de 2007 et 2001, Fizzala [2016] trouve que les personnes sans conjoint ont plus souvent des

⁷Les principaux indicateurs associés au scénario central de projection sont les suivants [Blanpain and Buisson, 2016] : indice conjoncturel de fécondité (1,95 enfant par femme) ; âge moyen à la maternité (32 ans à partir de 2040) ; valeur du solde migratoire (+70 000 personnes par an).

plans d'aide saturés⁸ que les personnes vivant en couple, toutes choses égales par ailleurs. Les personnes sans conjoint indiquaient être plus souvent aidées par leurs enfants (70%), lesquels ont aussi la possibilité d'être rémunérés par l'APA.

A degré de dépendance donné, autrement dit à niveau de GIR donné, la fréquence des plans saturés augmente avec l'âge. Les bénéficiaires dont les ressources sont inférieures à 710 € par mois (seuil en deçà duquel, en 2011, ils sont exonérés de ticket modérateur et ne participent pas au financement de leur plan d'aide) ont, quel que soit le GIR, plus souvent un plan d'aide saturé que les personnes ayant des ressources mensuelles comprises entre 710 et 2 000 €. A niveau de GIR donné, les plans d'aide des personnes qui bénéficient de l'APA depuis plus longtemps sont plus souvent saturés que les plans d'aide des nouveaux bénéficiaires.

1.4 Les acteurs clés de la prise en charge de la dépendance

La perte d'autonomie peut être prise en charge par la personne âgée dépendante elle-même grâce à son épargne et/ou à son patrimoine immobilier ; sa famille via l'aide informelle, l'Etat (aides sociales) et une assurance privée. Dans cette partie nous parlerons de la famille et de l'Etat, puisque la deuxième section de cette introduction est consacrée au rôle du marché privé à travers l'assurance dépendance.

La famille, principal pourvoyeur de soins et d'aides aux personnes âgées dépendantes

La plupart des individus associent la prise en charge de la dépendance aux maisons de retraite, alors même que le principal fournisseur de tels soins reste la famille [Grabowski, 2014]. Les premiers fournisseurs de l'aide au sein d'une famille sont les conjoints, puis les enfants adultes des personnes âgées. Si la participation croissante des femmes au marché du travail et la dispersion géographique des familles a bouleversé la fourniture de l'aide informelle, il s'agit toujours du type prédominant de prise en charge de la dépendance. Selon Bozio et al. [2016] la majorité des personnes âgées dépendantes résident à domicile, où l'aide de l'entourage est cruciale. Cependant, des problèmes de santé, familiaux et financiers, ou l'aggravation de la dépendance finissent par précipiter le besoin d'une aide plus formelle à domicile ou en institution.

La prestation de soins à domicile par une aide rémunérée reste une alternative aux soins informels. Ces soins peuvent aller d'une aide périodique pour les courses et le ménage, à une aide infirmière à plein temps. Enfin, il est possible pour les individus de vivre en institution, que ceux-ci soient en situation de dépendance ou non. Un senior est considéré comme vivant en institution s'il vit soit en établissement d'hébergement pour personnes âgées (EHPA), soit en établissement

⁸On dit qu'un plan d'aide est saturé lorsque son montant est maximal, c'est-à-dire qu'il atteint le plafond national correspondant au niveau de dépendance (GIR) du bénéficiaire concerné.

d'hébergement pour personnes âgées dépendantes (EHPAD), soit en unité de soins de longue durée (USLD) soit dans une résidence autonomie (anciennement « logement foyer ») adossée à un EHPAD.

Le rôle du gouvernement et de la société

Bien que la prise en charge de la dépendance combine les dimensions santé et aide sociale, la fourniture des soins est généralement tributaire du système de santé déjà en place [Courbage and Plisson, 2012]. Notons que les dépenses liées à la prise en charge de la perte d'autonomie se répartissent généralement en trois postes principaux : celles occasionnées par la dépendance, celles liées aux dépenses médico-sociales et celles liées à l'hébergement.

Face à une augmentation potentielle des dépenses liés à la prise en charge de la dépendance, plusieurs pays ont décidé de considérer la dépendance comme un nouveau risque et de la séparer des soins de santé. Ces pays ont tout simplement établi la dépendance comme une nouvelle branche⁹ de leur système de protection sociale. C'est le cas de l'Allemagne, du Japon et des Pays-Bas par exemple.

La France a longtemps discuté de la création d'un cinquième risque ou encore d'une cinquième branche de la sécurité sociale pour couvrir les risques liés à la dépendance. La cinquième branche de la Sécurité sociale dédiée à l'autonomie a été consacrée par la loi du 7 août 2020 relative à la dette sociale et à l'autonomie. Son pilotage a été confié à la Caisse nationale de solidarité pour l'autonomie (CNSA), qui est désormais une Caisse nationale de Sécurité sociale.

Il faut noter que les régimes de protection sociale ont l'avantage de définir une éligibilité générale ou universelle pour la prise en charge de la dépendance, de combiner des services en nature et le versement en espèces, sans limiter l'accès à ces soins comme les systèmes purement axés sur le marché. L'une des réformes institutionnelles mise en place dans les pays qui optent pour ce type de système est la décentralisation régionale des dépenses liées à la dépendance [Courbage and Plisson, 2012]. En France par exemple, c'est le département qui établit le plan d'aide des personnes âgées afin de procéder le cas échéant au versement de l'APA.

Les principales réformes sur la dépendance en France

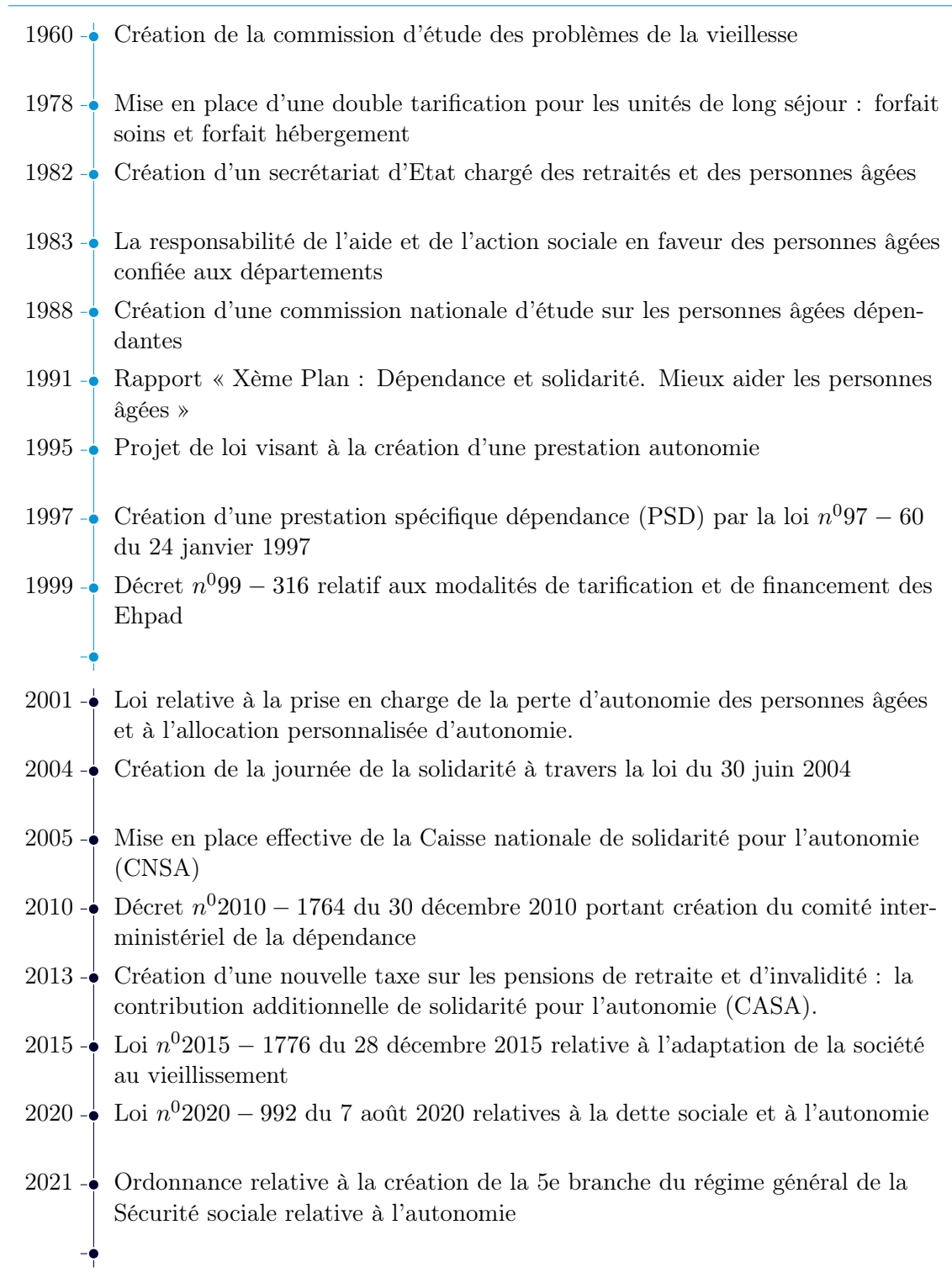
Comme le souligne à juste titre Martin [2001], la définition d'une politique publique permettant de faire face à la dépendance des personnes âgées est cruciale à plus d'un titre. Tout d'abord, elle pose la question de l'articulation entre trois sources de protection : la famille, le marché

⁹Voir rapport du haut conseil de la famille, de l'enfance et de l'âge (HCFEA) pour une comparaison internationale des politiques de soutien à l'autonomie des personnes âgées [Acker and Bonnet, 2019].

et l'État. Deuxièmement, elle bouleverse les frontières établies entre différents secteurs de la protection sociale : frontières entre social et sanitaire, entre politiques familiales et politiques de la vieillesse, voire politiques d'emploi. Troisièmement, elle confronte le décideur politique à une série de choix cruciaux sur la nature du dispositif à élaborer : logique d'assurance, obligatoire ou non, logique d'aide sociale, logique de marché. Quatrièmement, cette politique soulève le problème du financement et de la gestion du dispositif, entre État, collectivités locales et caisses de Sécurité sociale. Enfin, l'aide formelle comme informelle étant majoritairement dispensée par des femmes, elle a des répercussions directes sur la condition des femmes (chargées le plus souvent des tâches de soins ou de *caring*, soit de manière professionnalisée, soit en tant que soignante bénévole, soit en tant que membre d'un réseau de parenté (fille, mère, épouse, belle-fille, etc.)) [[Lesemann and Martin, 1993](#)].

L'Etat français a mis en place différentes réformes au fil des années pour faire face à la perte d'autonomie. On retient principalement l'entrée en vigueur de l'APA en remplacement de la prestation spécifique dépendance (PSD), la création de la CNSA, la revalorisation de l'APA en 2015 avec la loi d'adaptation de la société au vieillissement et plus récemment la création de la cinquième branche du régime général de la Sécurité sociale relative à l'autonomie. Voir [Joël \[2013\]](#) pour une analyse critique de ces différents dispositifs. La figure 0.1 présente les principales réformes intervenues afin d'anticiper et de prendre en charge la dépendance en France. Le lecteur intéressé par le détail des différentes mesures peut se référer à la bibliographie thématique de [Suhard \[2022\]](#).

Figure 1: Principales réformes sur la dépendance en France



Sources: Réalisation de l'auteur à partir de [Suhard \[2022\]](#)

2 Le financement de la dépendance en France

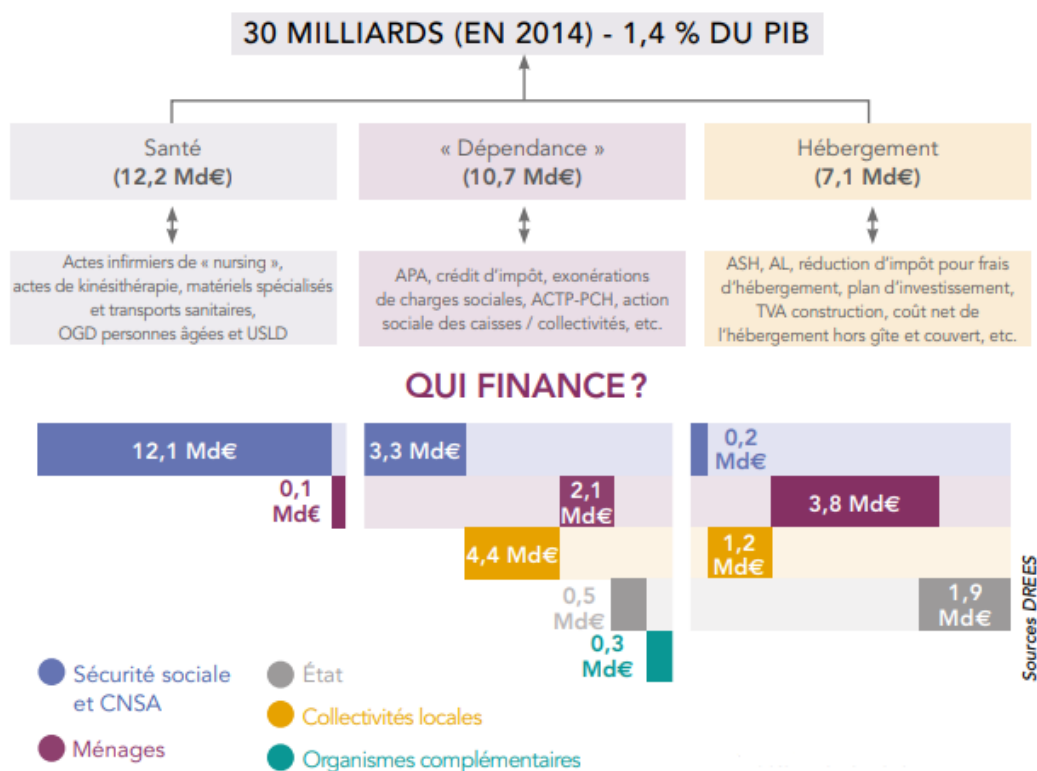
2.1 Le coût de la prise en charge de la dépendance

Le coût de la dépendance pour l'Etat

Selon le compte de la dépendance de la DREES, les dépenses liées à la perte d'autonomie des personnes âgées, évaluées en approche « surcoût », représentaient 1,4% du PIB soit 30 Md€ en 2014, dont 23,7 Md€ de dépenses publiques (79%) et 6,3 Md€ de dépenses à la charge des ménages. Ces dépenses ne prennent pas en compte le travail informel des 3,9 millions de proches aidants auprès des personnes âgées, dont la valorisation atteindrait 7 à 18 Md€ [Libault, 2019].

Les principales dépenses d'accompagnement de la perte d'autonomie des personnes âgées sont : (i) les dépenses de soins pour environ 12,2 Md€ financées à 99% par la dépense publique via l'assurance maladie, leur prise en charge est ainsi universelle ; (ii) les dépenses dites de « dépendance » (aides humaines, techniques et d'aménagement du logement pour compenser la perte d'autonomie) pour 10,7 Md€, et (iii) les dépenses d'hébergement en établissement, soit 7,1 Md€ (auxquelles peuvent être ajoutées 4,4 Md€ de dépenses dites de gîte et de couvert).

Figure 2: Financement des dépenses liées à la dépendance des personnes âgées - extrait du rapport [Libault, 2019]



Sources: DREES

Le coût de la dépendance pour la personne âgée

En 2019, la DREES a estimé la participation des seniors aux dépenses liées à la dépendance une fois les aides déduites, que ce soit à domicile ou en institution [Boneschi and de L’Espinya, 2019].

Les personnes âgées dépendantes qui vivent à domicile peuvent demander à bénéficier de l’APA à domicile. Les différents besoins sont alors recensés dans un plan d’aide mensuel individualisé, valorisé en euros, notifié à chaque demandeur éligible. Ce montant notifié est ensuite partiellement ou intégralement utilisé, et donc « consommé », par le bénéficiaire. Selon Boneschi and de L’Espinya [2019], l’allocation est, en moyenne, de 483 € par senior et par mois, et elle bénéficie à 779 000 seniors en 2019. En moyenne, le conseil départemental prend à sa charge 389 € sur ces 483 € et le senior 94 €. En réalité, la participation du senior peut être inférieure à ce montant, puisque 50% des dépenses restant à la charge du bénéficiaire de l’APA pour l’emploi d’une aide à domicile, dans la limite d’un plafond annuel, donnent droit à un crédit d’impôt (pour ceux qui paient l’impôt sur le revenu). Ainsi, dans l’hypothèse où le plan d’aide finance uniquement de l’emploi d’aide à domicile, 47 € resteraient à la charge du senior une fois le crédit d’impôt déduit. Selon le niveau de dépendance des bénéficiaires (groupes iso- ressources ou GIR), leur participation mensuelle moyenne après APA et crédit d’impôt varie de 33 à 89 € par mois.

Lorsqu’ils sont en institution, les séniors doivent s’acquitter de frais de séjour comprenant les tarifs hébergement et dépendance. Les résidents classés GIR 1 à 4 peuvent recourir à l’APA pour les aider à financer la partie dépendance de ces frais. En ce qui concerne l’hébergement, ils peuvent solliciter les aides au logement (APL ou ALS selon l’établissement). Ces résidents peuvent également bénéficier, sous conditions, d’une réduction d’impôt sur le revenu pour leurs frais de séjour. Enfin, après avoir perçu l’APA et les aides au logement, les personnes ne disposant plus des ressources nécessaires pour acquitter les frais de séjour en établissement, peuvent solliciter l’aide sociale à l’hébergement¹⁰ (ASH), versée par les départements. Au niveau individuel, les frais de séjour s’élèvent en moyenne à 2 385 € par mois en 2019 : 1 875 € pour l’hébergement et 510 € pour la dépendance [Boneschi and de L’Espinya, 2019]. Les personnes âgées touchent un montant moyen d’aides (toutes aides confondues, avant prise en compte de l’ASH) de 428 € par mois : 338 € d’APA, 44 € d’aide au logement et 46 € de réduction d’impôt en moyenne. Le reste à charge moyen (avant prise en compte de l’ASH) est ainsi de 1 957 € par mois.

Ces restes à charges sont très au-dessus de la retraite moyenne dont le montant net des prélèvements sociaux s’élevaient en 2020 à 1 400 € par mois [DREES, 2022]. Enfin, lorsqu’on considère

¹⁰122 000 personnes âgées, soit 1% de la population âgée de 60 ans ou plus bénéficiaient de l’ASH au titre d’un hébergement en établissement fin 2018 [DREES, 2020]. Il faut également noter que l’ASH constitue une avance qui peut être récupérée du vivant ou au décès du bénéficiaire. Les sommes versées peuvent ainsi faire l’objet d’un recours sur la succession du bénéficiaire, même si cette pratique diffère selon les départements.

les restes à charge liés principalement aux dépenses d'hébergement, l'assurance dépendance serait un complément utile pour les classes moyennes [Mayeur, 2020].

2.2 L'assurance dépendance

L'assurance dépendance est un contrat par lequel l'assureur garantit le versement d'une rente viagère, ou parfois d'un capital, à l'assuré en cas de perte d'autonomie constatée médicalement. Il s'agit d'un complément de revenu pour les personnes âgées dépendantes car la perte d'autonomie implique de nombreux frais à domicile, ou encore les coûts liés à la prise en charge dans un établissement spécialisé comme évoqué précédemment.

Le risque de dépendance peut être couvert par un contrat dit « individuel » mais également par un contrat collectif d'assurance, à adhésion facultative ou obligatoire (exemple : contrat souscrit par l'employeur pour ses salariés). La garantie dépendance peut être la garantie principale d'un contrat mais également une garantie optionnelle ou complémentaire d'un contrat d'assurance vie ou d'un contrat collectif de prévoyance. Les contrats dépendance varient également selon les caractéristiques des garanties choisies par l'assuré, en particulier sur le niveau de la rente, le niveau de perte d'autonomie pris en charge ou encore les prestations complémentaires. Le tableau 1 présente les chiffres clés de l'assurance dépendance en France en 2019 [France Assureurs, 2021]¹¹. Pour être assuré, un individu verse à un assureur des cotisations mensuelles dont le montant dépend de son âge, de son état de santé, de ses garanties souscrites et du montant de la rente souscrite. En 2019, l'âge moyen de souscription était de 60 ans ; la rente mensuelle moyenne s'élevait à 601€, pour une cotisation annuelle moyenne par tête de 579€ en ce qui concerne les contrats garantie principale à adhésion individuelle. Si l'assuré met fin à son contrat ou décède sans avoir perdu son autonomie, les versements effectués tout au long de la durée de vie du contrat sont perdus. On parle de contrats « à fonds perdus ».

Un assuré a le droit de mettre fin à son contrat d'assurance dépendance à tout moment. Il est toutefois important de se renseigner sur les conditions de résiliation auprès de son assureur. Dans la plupart des cas, l'assurance dépendance est un contrat à tacite reconduction chaque année. Un assuré qui souhaite mettre un terme à son contrat devra se manifester deux mois avant sa date de reconduction tacite. Deux cas de figures sont à considérer en cas de résiliation. (i) Si la résiliation se fait après 8 années de cotisations, l'individu peut bénéficier d'une rente partielle. On parle de mise en réduction du contrat. (ii) Si la résiliation a lieu avant 8 années de cotisations, l'individu perd automatiquement ses droits, et ne pourra donc pas percevoir la

¹¹France Assureurs est une marque de la Fédération Française de l'Assurance qui réunit l'ensemble des entreprises d'assurance et de réassurance opérant en France, relevant du Code des assurances, soit 247 sociétés représentant plus de 99% de ce marché. Voir <https://www.franceassureurs.fr/>

rente pour laquelle il a cotisé ni récupérer les cotisations déjà versées. Il faut également noter que la résiliation d'un contrat d'assurance dépendance peut être formulée par l'assureur. En général, c'est le cas en l'absence de règlement de cotisations. Les déterminants de la résiliation d'un contrat d'assurance dépendance seront étudiés dans le chapitre 3 de cette thèse.

Table 1: les chiffres clés de l'assurance dépendance en France.

L'ensemble des acteurs en 2020	
Nombre de personnes couvertes	7,4 millions
dont auprès d'une société d'assurance	3,0 millions (soit 40 %)
dont auprès d'une mutuelle « 45 »	4,1 millions (soit 56 %)
dont auprès d'une institution de prévoyance	0,3 million (soit 4 %)
Cotisations	814 M€
dont cotisations auprès d'une société d'assurance	681 M€ (soit 84 %)
Les sociétés d'assurance et contrats dépendance en garantie principale en 2020	
Nombre de personnes couvertes	1,5 million (-2 % sur un an)
Âge moyen de souscription*	60 ans
Souscriptions nouvelles	22 500 (-30 %)
Cotisations	600 M€ (-1 %)
Cotisation annuelle moyenne par tête	398 €
Âge moyen d'entrée en dépendance*	79 ans
Nombre de rentes en cours de service	38 100 (-0 %)
Prestations	291 M€ (+3 %)
Rente mensuelle moyenne	601 €
Les contrats labellisés «GAD** assurance dépendance» en 2020	
Nombre de personnes couvertes	179 100 (+1,9 %)
Souscriptions nouvelles	11 500 (-30 %)
part dans les souscriptions nouvelles de contrats garantie unique dépendance	51 %
Cotisations	103 M€ (+4 %)
part dans les cotisations totales des sociétés d'assurance	15%
Cotisation annuelle moyenne par tête	579 €

Sources : France Assureurs.

(*) pour les contrats garantie principale à adhésion individuelle. (**) GAD: Garantie Assurance Dépendance.

2.3 L'assurance dépendance : que dit la théorie économique ?

La théorie de la demande d'assurance dépendance

Les économistes choisissent généralement de formaliser la décision de souscrire une assurance en utilisant un modèle standard d'espérance d'utilité. Dans ce type de modèle, l'assurance sera

souscrite si l'utilité espérée avec l'assurance est supérieure à celle sans assurance. Les fondements théoriques de l'assurance dépendance diffèrent des théories standard de demande d'assurance, principalement en raison du rôle de la famille et des legs [Konetzka, 2014]. Autrement dit, lorsque les consommateurs envisagent de souscrire une assurance dépendance, ils tiennent compte non seulement de l'utilité directe attendue via le maintien de leur niveau de consommation, mais aussi de l'utilité perçue par la modification attendue du comportement du conjoint, et l'utilité perçue par la transmission du legs aux héritiers (patrimoine à léguer, incitation des proches à fournir l'aide informelle).

Le modèle théorique le plus important dans ce domaine est celui de Pauly [1990], avec une extension par Zweifel and Strüwe [1998]. Dans le contexte américain, et sous l'hypothèse d'un marché des rentes imparfait, Pauly [1990] considère l'optimisation de l'utilité attendue dans plusieurs scénarios : personnes âgées (i) célibataires sans enfant et sans motif de legs, (ii) avec une qualité de soins distincte, et (iii) avec des enfants adultes et un motif de legs possible. Son modèle vise à expliquer l'achat (ou le non-achat) d'une assurance dépendance chez les personnes à revenu moyen, car le non-achat est évident chez les personnes très pauvres susceptibles de bénéficier de Medicaid¹² et chez les personnes plus riches qui peuvent facilement couvrir les coûts associés à la dépendance. Dans chaque scénario, le modèle prédit que la faible demande d'assurance dépendance peut être rationnelle. Une des contributions les plus importantes de l'article de Pauly [1990] est peut-être l'introduction de la négociation intrafamiliale dans la conceptualisation de la demande d'assurance dépendance, en s'inspirant de travaux antérieurs dans la littérature sur les legs, selon lesquels les parents utilisent les legs pour obtenir l'attention ou les soins souhaités de la part des enfants.

Zweifel and Strüwe [1998] formalisent cet argument de négociation intrafamiliale en utilisant un cadre principal-agent et un modèle à deux générations, indépendant des hypothèses sur l'altruisme. Le parent âgé choisit un niveau de consommation (de biens et services) et l'achat ou non d'une assurance dépendance afin de maximiser son espérance d'utilité ; et la quantité de soins fournis par les enfants est un argument dans la fonction d'utilité à l'état malade (en perte d'autonomie). L'enfant maximise sa propre utilité espérée, en choisissant également son niveau de consommation et la quantité de soins à fournir si le parent devient dépendant. En prodiguant des soins, l'enfant est censé renoncer à travailler, mais aussi s'attendre à un legs plus important, car le parent dépensera moins en soins formels de longue durée. Zweifel and Strüwe [1998] montrent que, dans ces circonstances, la réponse de l'enfant à la souscription d'une assurance dépendance dépend fortement du taux de salaire de l'enfant. Anticipant cette réaction,

¹²Aux États-Unis, Medicaid est un programme fédéral et d'État qui aide à couvrir les coûts des soins de santé pour certaines personnes dont les revenus et les ressources sont limités.

l'achat d'une assurance dépendance n'est souvent pas dans l'intérêt des parents qui souhaitent que leurs enfants à bas salaire s'occupent d'eux, pour les mêmes raisons que celles avancées par [Pauly \[1990\]](#).

Ce modèle est loin dans ses hypothèses du cas français, où des règles régissent l'héritage et la part des enfants. Il est clair toutefois que, même en France, la possibilité de soins informels peut décourager la souscription d'une assurance dépendance.

La théorie de l'offre d'assurance dépendance

Comme sur d'autres marchés d'assurance, les assureurs prennent en compte des potentiels phénomènes de sélection adverse et d'aléa moral sur le marché privé de l'assurance dépendance lorsqu'ils décident d'offrir un produit [[Konetzka, 2014](#)]. L'un des rares articles à considérer cette perspective est celui de [Cutler \[1993\]](#) qui traite les asymétries d'information comme d'importantes défaillances sur ce marché.

Selon [Konetzka \[2014\]](#), la sélection adverse peut être une préoccupation plus sérieuse sur le marché de l'assurance dépendance si on la compare à une complémentaire santé, car la population âgée est naturellement plus hétérogène en termes d'état de santé qu'une population plus jeune, et cette hétérogénéité n'est pas toujours observable par les assureurs. L'engagement de l'assureur est à long terme et il peut le conduire à couvrir un groupe de risque qui se révèle au final plus défavorable qu'anticipé. [Cutler \[1993\]](#) soulève également la question du risque intertemporel à long terme. Dans d'autres types d'assurance (une complémentaire santé par exemple) où les primes sont fixées annuellement, les prix peuvent être ajustés assez rapidement aux évolutions de tendance imprévues des sinistres et des prix des prestataires. En revanche, dans le cas de l'assurance dépendance, la réalisation du risque assuré peut se matérialiser plusieurs décennies plus tard, alors que l'inflation est un risque difficile à diversifier.

Par conséquent, les assureurs transfèrent généralement ce risque aux consommateurs. Les contrats proposés par les assureurs reflètent leurs craintes concernant à la fois l'ampleur de la sélection adverse et de l'aléa moral, le risque intertemporel ainsi que le manque d'expérience en matière de sinistres pour ce produit relativement nouveau. Plusieurs stratégies ont été développées par les assureurs pour transférer le risque, notamment : une souscription stricte (soumise à un questionnaire médical), des politiques d'indemnisation particulières (délai de carence), des charges administratives plutôt élevées, et par conséquent des primes onéreuses, rendant ainsi le produit peu abordable pour la plupart des acheteurs potentiels. Finalement, les assureurs sont eux-aussi confrontés à un certain nombre de risques qui forgent la relation contractuelle proposée aux potentiels assurés. Nous examinerons particulièrement comment ces derniers tentent

de neutraliser les phénomènes d’anti-sélection dans le chapitre 2 de cette thèse.

2.4 Les raisons du faible développement du marché de l’assurance dépendance

Le marché de l’assurance dépendance est partout peu développé. Il a une existence non anecdotique aux Etats-Unis et en France mais tout en étant encore très en deça de la couverture des besoins.

Les raisons du point de vue des assureurs

La possibilité d’élaborer une tarification sur le marché de l’assurance dépendance repose sur trois données fondamentales, fonction elles-mêmes de trois lois biométriques (mortalité, survenance, longévité) comme le souligne à juste titre [Mayeur \[2020\]](#) :

- Le nombre de personnes âgées dépendantes
- L’âge d’entrée en perte d’autonomie (totale) : il est en moyenne de 85 ans aujourd’hui.
- La durée de leur survie en situation de perte d’autonomie : selon une étude de la DREES, la durée moyenne de séjour en 2015 dans un Ehpad était de trois ans et quatre mois [[Muller and Roy, 2018](#)].

Comme évoqué dans le paragraphe précédent, la dépendance constitue un risque long qu’il convient de piloter de façon stratégique puisque l’assureur n’a pas la même souplesse pour rétablir l’équilibre que lorsqu’il s’agit d’un contrat d’assurance santé où les ajustements peuvent se faire d’une année à l’autre. Dans ces conditions, l’assureur doit réaliser le calcul complexe qui est de prévoir un rendement financier de long terme. C’est l’une des raisons pour lesquelles les capitaux propres et les provisions techniques fournies par les cotisations des assurés, doivent être suffisamment élevées pour éviter une banqueroute. Au final, les consommateurs trouvent les contrats onéreux pour une couverture incomplète et sous forme d’indemnité forfaitaire.

Le marché se concentre sur quelques assureurs qui forment un oligopole. Ces assureurs disposent de peu de données fiables pour bâtir des hypothèses prudentes de tarification. On observe également un attentisme de la part des acteurs qui serait lié aux manques de lisibilité des politiques publiques annoncées.

Les raisons du côté de la demande

Du côté de la demande individuelle, différentes explications rendent compte de la faible disposition des individus à souscrire une assurance dépendance. Selon [Fontaine and Bonnet \[2017\]](#), la

première renvoie à l'incapacité financière d'une partie des ménages à souscrire des assurances à couverture viagère dont le coût représente au minimum 25 € par mois (pour la souscription d'une rente de 500 € par mois en dépendance lourde souscrite à 60 ans). La faible disposition des individus à s'assurer s'expliquerait également par la prise en compte d'autres formes d'assurance, telles un patrimoine financier ou immobilier, ou par les ressources en aide informelle dont ils disposent.

On peut également souligner la méconnaissance du risque de dépendance, des couvertures disponibles (publiques ou privées) et du risque financier auquel les expose une entrée en dépendance. On parlera de myopie ou de déni . Les liens entre l'estimation de leur risque et la souscription d'assurance dépendance par les individus sera analysé plus dans le détail dans le chapitre 1 de cette thèse. Enfin une dernière série d'explications renvoie aux spécificités du risque de dépendance et la manière dont celles-ci, au regard des préférences des individus, freinent l'adoption de comportements spontanés de couverture. Le risque de dépendance présente en effet au moins trois caractéristiques importantes pouvant conduire un individu, même parfaitement informé des risques et de leurs coûts, à ne pas s'assurer : l'éloignement temporel du risque de dépendance ; le manque d'intérêt pour l'individu dépendant que l'on pourrait devenir ; l'existence d'une aide informelle potentielle. En conséquence, moins de 10% des Français de plus de 40 ans possède une assurance dépendance [Plisson, 2011].

2.5 Les propositions des assureurs à travers le livre blanc

A la veille de l'élection présidentielle de 2022, [France Assureurs \[2021\]](#) publiait un livre blanc présentant une nouvelle proposition de prise en charge de la dépendance, co-construite avec la Fédération Nationale de la Mutualité Française (FNMF). Il s'agit d'un dispositif de prise en charge du risque « dépendance » via un nouveau contrat de complémentaire santé responsable, accessible à tous, à moindre coût, reposant sur une mutualisation du risque au sein d'un pool de coassurance. Son tarif serait unique pour tous les cotisants.

Assorti d'une garantie viagère, ce dispositif permettrait aux assurés d'accéder à une gamme étendue de services, notamment à domicile, d'aides au réaménagement du logement ainsi qu'à un soutien aux aidants. Les principales propositions sont les suivantes :

- Un tarif unique, défini en fonction de l'âge à partir duquel la cotisation dépendance est prélevée et du niveau de la rente viagère garantie en cas de dépendance.
- Une garantie viagère prévoyant le versement d'une rente viagère en cas de dépendance totale caractérisée par les critères de la Sécurité sociale.

- Le rattachement d'une telle garantie à des contrats de complémentaire santé.
- La mutualisation du risque au sein d'un pool de coassurance qui permettra une totale transparence dans la gestion du risque.
- Une gestion du risque permettant une prise en charge immédiate des personnes totalement dépendantes sans période de carence.

3 L'objet de la thèse

Cette thèse se propose de contribuer à la compréhension du faible développement du marché privé de l'assurance dépendance en France. La thèse s'articule autour de trois chapitres qui traitent dans un premier temps de la perception du risque de dépendance par les agents (chapitre 1). Ensuite, nous nous intéressons à la demande d'assurance et au rôle du questionnaire médical dans la sélection des risques (chapitre 2). Enfin, nous essayons de comprendre les raisons pouvant amener un agent à résilier son contrat d'assurance dépendance (chapitre 3).

3.1 Les données utilisées dans la thèse

Les données utilisées sont une enquête en coupe (PATER/ELDERS¹³) pour le chapitre 2 et des données longitudinales sur quelques vagues de l'enquête SHARE¹⁴ pour les chapitres 1 et 3. Ces données sont assez nombreuses pour des analyses statistiques pertinentes, mais elles ne comportent pas de configuration permettant une mise en évidence de causalités, alors que l'économétrie appliquée se concentre actuellement de plus en plus vers des sujets et des données propices à des analyses causales. Dans cette thèse, de telles analyses ne sont pas possibles, mais ces données sont précieuses pour la compréhension d'une question essentielle pour la politique publique, qui est la prise en charge de la dépendance pour les années à venir, et le rôle potentiel du marché de l'assurance sur cette question. Il nous a paru important de documenter les questions qui pouvaient l'être avec les données existantes, et de contribuer ainsi à l'amélioration de la compréhension du faible développement de ce marché.

Dans le chapitre 1, nous utilisons les données des vagues 4, 6 et 8 de l'enquête SHARE. L'aspect longitudinal de ces données permet de suivre les individus dans le temps, et donc d'observer pour certains leur entrée en dépendance. Grâce à la vague 8 de l'enquête SHARE et au *Drop-Off* qui lui est associé, il nous est possible d'avoir des informations sur les probabilités subjectives d'être dépendant dans 5 ans et dans 10 ans. Il est ensuite possible de confronter ces anticipations aux

¹³PATER : PATrimoine et préférences vis-a-vis du TEmps et du Risque ;
ELDERS : Enquête Longevité DEpendance Risque et Soutien

¹⁴SHARE: Survey of Health, Ageing and Retirement in Europe

probabilités d'entrée en dépendance observées grâce aux informations longitudinales obtenues par les vagues 4 et 6 de l'enquête.

Dans le chapitre 2, nous profitons d'une opportunité unique offerte par la base de données françaises PATER/ELDERS, qui permet d'observer des individus qui ont connu un refus d'assurance (dépendance) de la part des assureurs pour des raisons de santé. Elle comprend des données en coupe sur des individus interrogés en 2015, et âgés de 48 à 79 ans, précisément au moment où la question de l'assurance dépendance se pose. Les données sur les refus de couverture et la détention d'une assurance permettent de construire la demande d'assurance. Les données comprennent également des informations sur les préférences individuelles et les opinions vis-à-vis du risque de dépendance, ainsi que des informations qui reprennent les questionnaires réalisés par les compagnies d'assurance pour filtrer les risques. Les répondants ont en moyenne 60 ans, qui est l'âge moyen de souscription d'un contrat d'assurance en France dont la garantie principale est la dépendance (cf. Tableau 1). C'est une originalité par rapport à la littérature disponible sur la sélection sur le marché de l'assurance dépendance, où les données concernent des individus qui ont en moyenne 78 ans (voir les articles de [Finkelstein and McGarry \[2006\]](#), [Hendren \[2013\]](#)), alors proche de l'entrée en dépendance.

Dans le chapitre 3, nous utilisons les données des vagues 5, 6 et 7 de l'enquête SHARE. Les individus qui sont couverts par un contrat d'assurance dépendance sur une base individuelle, c'est-à-dire volontaire/supplémentaire, constituent notre principale source d'intérêt. Nous nous intéressons particulièrement aux individus qui étaient présents dans au moins deux vagues d'enquête consécutives afin d'observer le phénomène de résiliation. A partir de ces données, nous repérons la résiliation par le fait de détenir une assurance dépendance à une vague d'enquête, et de ne plus en avoir à la vague suivante. Cette approche avait déjà été utilisée dans d'autres études comme celle de [Konetzka and Luo \[2011\]](#); et diffère de celle utilisée par [Finkelstein et al. \[2005\]](#) avec les données HRS où une question sur la résiliation est plus explicite. Nous identifions également les individus qui entrent sur le marché sur la période des trois vagues. Dans ce chapitre, les enquêtés sont âgés en moyenne de 69 ans.

3.2 Résumés des chapitres

La thèse comporte trois chapitres en forme d'articles de recherche. Le premier chapitre analyse les probabilités subjectives d'entrer en dépendance que forment les individus, et examine si une éventuelle sous-estimation du risque peut expliquer une faiblesse de la détention d'assurance. Le deuxième examine le rôle de la sélection des risques sur le marché de l'assurance dépendance. Le troisième étudie les comportements de résiliation, et l'impact qu'ils peuvent avoir sur la sélection

ou l'anti-sélection sur ce marché.

Chapitre 1 : Do individuals underestimate their dependency risk when applying for long-term care insurance?

Le financement de la dépendance chez les personnes âgées peut être influencé par la perception de devenir dépendant à un moment donné dans le futur. L'objectif de cet article est de comprendre comment les individus perçoivent le risque de dépendance. Nous utilisons les données des vagues 4, 6 et 8 de l'enquête SHARE. Nos résultats montrent que les personnes surestiment modérément leur risque de devenir dépendantes à 5 ans : la probabilité subjective moyenne est égale à 15,1%, soit 3,4 points de pourcentage de plus que la probabilité moyenne prédite ("objective"), égale à 11,7%. Cependant, la surestimation moyenne va de pair avec une distribution où la plupart des personnes sous-estiment légèrement leur risque tandis que les autres le surestiment fortement. La probabilité subjective de dépendance augmente considérablement à un horizon de 10 ans : la majorité des individus surestiment leur risque, la surestimation moyenne est égale à 15,5 points de pourcentage, et en tête de la distribution, les gens ont des risques subjectifs énormes et excessifs. En examinant les déterminants des anticipations individuelles, nous constatons que les individus perçoivent avec précision le rôle de l'âge, de la mauvaise santé actuelle et des limitations au niveau des membres inférieurs. En effet, ces variables influencent de manière significative le risque de dépendance observé. Enfin, nos estimations montrent que les individus qui sous-estiment leur risque ont une probabilité plus faible de détenir une assurance dépendance, avec un impact qui dépend de l'importance de l'écart entre le risque subjectif et le risque prédit.

Chapitre 2 : Risk selection in the private long-term care insurance market: evidence from France

L'objectif de ce chapitre est d'analyser la demande d'assurance dépendance et les déterminants du refus d'assurance. Nous examinons si les personnes présentant un risque plus élevé sont plus susceptibles de demander une assurance dépendance (phénomène d'anti-sélection), et si la sélection par les assureurs parvient à éliminer la sélection adverse. Nous examinons ensuite les déterminants de la sélection et les caractéristiques des personnes qui ont été rejetées. Dans le chapitre 2, nos résultats indiquent qu'il existe une sélection adverse en ce qui concerne la demande d'assurance ; et que la sélection des risques par les assureurs parvient effectivement à éliminer les mauvais risques. Par conséquent, il n'y a pas de sélection adverse sur les assurés : plus précisément, il n'y a pas une plus grande proportion de hauts risques lorsque l'on compare les assurés et les non-assurés. Enfin, nous trouvons des éléments qui vont dans le sens de littérature justifiant les refus d'assurance sur le marché d'assurance : la variabilité du risque subjectif

est beaucoup plus importante chez les individus refusés. Nous trouvons que le questionnaire permet aux assureurs de prédire très bien le risque chez les individus à qui ils refusent un contrat d'assurance. En revanche le questionnaire ne permet pas de bien prédire les risques subjectifs des demandeurs acceptés, qui ont une proportion non négligeable de risque élevés totalement ignorée des assureurs. Il est difficile à ce stade de savoir si les individus surestiment à tort leur risque (le questionnaire aurait raison), ou bien si les individus ont une information privée sur leur risque qui est ignorée par le questionnaire.

Chapitre 3 : Lapse behaviour in the LTCI market in France

L'assurance dépendance pourrait difficilement être une solution durable pour la prise en charge financière de la dépendance si les contrats souscrits ne sont pas conservés jusqu'à l'entrée en dépendance. Souscrire une assurance dépendance revient également à se couvrir contre le risque d'être demain (aux âges plus élevés) un plus mauvais risque ; c'est le risque de reclassification. Si les assurés sont sûrs d'avoir pris la bonne décision en souscrivant un tel contrat, encore faut-il qu'ils gardent leur contrat dans la durée. Or le délai entre la souscription et la réalisation éventuelle du risque étant particulièrement long, on observe de nombreux individus qui abandonnent leurs obligations contractuelles. Cela peut être le cas pour des raisons stratégiques, financières ou non rationnelles. L'objectif de ce chapitre est de mieux comprendre la dynamique du marché privé de l'assurance dépendance, en se concentrant sur le comportement de résiliation. Le modèle de résiliation met en évidence trois principaux résultats. Tout d'abord, les personnes qui ont connu une amélioration de leur état de santé ou celles qui ont une baisse de leurs actifs nets ont une probabilité plus élevée de mettre fin à leur contrat. Enfin, les personnes qui bénéficient d'une nouvelle aide informelle sont plus susceptibles de résilier leur contrat d'assurance dépendance. Nous montrons par ailleurs que deux ans en moyenne après avoir résilié leur contrat d'assurance dépendance, ces individus voient leur santé "objective" se détériorer tandis que leur santé subjective tend à s'améliorer. Ce résultat devrait être une bonne nouvelle pour les assureurs, car non seulement ils ont perçu des primes non remboursables de la part des assurés, mais également voient mauvais risques sortir de leur portefeuille.

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Chapter 1

Do individuals underestimate their dependency risk when applying for long-term care insurance?

This chapter is co-authored with Brigitte Dormont (Université Paris-Dauphine, PSL).

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1 Introduction

Long-term care at home or nursing home plays a crucial role in the management of the loss of autonomy of elderly people. However, reliance on institutional care is sometimes accompanied by high out-of-pocket expenses, as shown for France in a study by [Fizzala \[2016\]](#). In this context, long-term care insurance (LTCI, hereafter) is one of the ways that elderly people can afford to cover themselves against the risk of catastrophic expenditures. In 2010, less than 10% of people in France over the age of 40 were covered by LTCI [\[Plisson, 2011\]](#). Even if the French private insurance market remains one of the most developed in the world, this coverage remains insufficient when compared to the needs. It is also much lower than the proportion of individuals with complementary health insurance in France. There is a considerable body of literature explaining the reasons for the low development of the private LTCI market ([Pauly \[1990\]](#); [Brown and Finkelstein \[2009\]](#); [Grignon and Bernier \[2012\]](#); [Fontaine and Zerrar \[2013\]](#); [Lambregts and Schut \[2020\]](#) for examples.)

This literature tends to show that there is a link between the demand for insurance and the perception by individuals of their dependency risk. In general, individuals who purchase LTCI consider their subjective probability of becoming dependent. [Dormont and Tekam \(chapter 2\)](#) have shown evidence of this using French data. This awareness of risk could be through contact with a dependent close relative, and through information about the costs and burdens associated with dependency. Most available studies use proxies to measure risk awareness, whereas in this chapter and in [chapter 2](#) we can take advantage of direct elicitation of individual expectations (in terms of probabilities) about this risk. In addition, most studies are not able to observe under- or over-statement of the risk and to examine whether people who underestimate their subjective probability of becoming dependent demand less insurance.

Understanding the expectations of the elderly about long-term care risk is important for several reasons [\[Lindrooth et al., 2000\]](#). First, the lack of or at least poor anticipation of long-term care could partly explain the low development of the LTCI market. In theory, individuals who underestimate their long-term care risk are unlikely to buy insurance. Second, expectations of long-term care influence the financing of long-term care services. Individuals who are planning to enter a retirement home, for example, will build up savings and real estate assets that could help support their care in a few years. Under these conditions, it is crucial to form accurate expectations.

Risk perception could be subject to several biases. Agents tend to overestimate events

with low cost and high probability of occurrence. This observation is closely related to the fact that individuals find it easier to imagine or remember frequent events [Tversky and Kahneman, 1974]. This would explain, for example, why individuals would be more likely to take out insurance to cover their medical visits but less likely to insure themselves against a pandemic. Individual expectations are also based on the information that individuals acquire over time. Viscusi [1990] refers to this as Bayesian learning. Hurd and McGarry [2002] found that individuals actually modify their subjective survival probabilities according to new information like for example the onset of a new disease.

This work aims to understand how individuals perceive the risk of becoming dependent. In particular, we try to find out if individuals have an optimism bias for such a risk, which could explain a low demand for LTCI. We take advantage of the fact that we can observe in wave 8 of the SHARE survey (more precisely the Drop-off¹) the subjective probabilities of becoming dependent within 5 years and 10 years. In addition, we use two preceding waves, 4 and 6, which precede wave 8 of about 5 and 10 years respectively, to observe the occurrence of dependency in a delay of 5 and 10 years. This enables us to estimate probabilities of dependency. Based on these estimations, we can predict probabilities that can be compared with the subjective ones.

Our results show that people overestimate moderately their risk of becoming dependent at 5 years: the average subjective probability is equal to 15.1%, which is 3.4 percentage points greater than the average predicted (“objective”) probability, equal to 11.7%. However, the average overestimation goes with a distribution where most people underestimate slightly their risk while the others make a large overestimation of their risk. The subjective dependency probability rises considerably at an horizon of 10 years: the majority of individuals overstate their risk, the average overstatement is equal to 15.5 percentage points, and at the top of the distribution people have huge and excessive subjective risks. Looking at the determinants of individual expectations, we find that individuals accurately perceive the role of age, of current poor health and lower body disabilities. Indeed, these variables influence significantly the observed risk of dependency. Finally, our estimations show that individuals who underestimate their risk have a lower probability of holding LTCI, with an impact that depends on the size of the gap between subjective and predicted risk.

¹For wave 8, a drop-off questionnaire for France contained several questions on supplementary health insurance, individual risk preferences, and expectations of the risk of becoming dependent. The questionnaire is available online at the following address: http://www.share-project.org/fileadmin/pdf_questionnaire_wave_8_preliminary/Wave_8_DropOffs/FR_FR_SHAREw8_Main_DropOff.pdf

The rest of the chapter is organized as follows. The literature review section presents previous work showing the links that may exist between misperceptions of risk and low demand for LTCI. In the next section, we present our empirical approach. Then, we present our results before concluding.

2 Literature review: Risk misperceptions and low take-up in the LTCI market

Individual subjective risk can be affected by a set of biases. Cognitive biases are characterized by a proclivity to perceive more intensely high probability low-cost events (Slovic [1987]; Kunreuther and Slovic [1978]), risks that are taken unintentionally (e.g., pandemics), or those that are perceived inequitably (e.g. risk of malnutrition). Another bias that might be connected to availability effects is that regular occurrences are often easier to picture and recall than unusual events [Tversky and Kahneman, 1974]. Another source of bias is the underestimate of unpublicized risk information [Viscusi, 1990].

By eliciting subjective probabilities and expectancies, survey questions allow us to scientifically investigate those biases (Hurd and McGarry [2002]; Hakes and Viscusi [1997]; Viscusi [1990]). Subjective probabilities can be used to explain decision making. Hurd and McGarry [2002] show that as new knowledge is acquired (for example, the onset of new illnesses), people’s perceived probability of survival changes.

Longevity or survival risk is strongly correlated with long-term care risk because the latter is measured conditionally on being alive. Most of the studies on longevity risk show that subjective beliefs about longevity (elicited via a survey) are consistent with observed trends of individual survival. According to Hurd and McGarry [2002], subjective survival predicts future death. Dormont et al. [2018] provided evidence of the value of considering uncertainty about longevity in end-of-life decisions. They define subjective uncertainty regarding longevity as the standard deviation of each individual’s subjective distribution of her or his own longevity and found that more uncertainty on longevity decreases the probability of unhealthy lifestyle. Using SHARE data from 15 European countries, Rappange et al. [2015] found that subjective survival probabilities were correlated with socio-demographic, socio-economic and strongly with health characteristics.

Pauly [1990] was the first to suggest that low demand for LTCI could be explained by agents’ misperceptions of risk. According to Pauly [1990], many elderly people in the

United States are unaware of government-sponsored long-term care programs and mistakenly expect that Medicare will pay all of their expenditures. He also argues that rational non-purchase of long-term care services is due to people's lack of awareness of the likelihood of needing long-term care services. [Zhou-Richter et al. \[2010\]](#) found that the more informed adult children are of the dependency risk, the more likely LTCI will be obtained, either by the children on behalf of their parents or by the parents under the influence of their children.

[McCall et al. \[1998\]](#) establish evidence that demand for LTCI is higher among people who have a care-needing family member or acquaintance and are thus more aware of the risk. Similar result is found by Dormont et Tekam (chapter 2). In other words, as more information about the risk becomes available, the likelihood of coverage increases.

To our knowledge, very few studies focus on the subjective risk of being dependent in the literature. Using HRS data, [Finkelstein and McGarry \[2006\]](#) compare the subjective likelihood of attending a nursing home within five years for respondents with an average age of 78 to the actual decisions of the same respondents five years later. They observe that on average, respondents properly estimate their likelihood of using a nursing home, indicating on average 18% whereas the real average chance is 16%. [Costa-Font and Costa-Font \[2011\]](#) use a representative survey of the Catalan population in 1999 to investigate individuals' perceptions and expectations about the distribution of lifespan and disability risks in old age, as well as their determinants. They reveal that individuals perceive higher risks for other people than for themselves. Self-perceived health was shown to be the most important variable in determining risk perceptions of both disability and longevity in their study. Healthier people are less likely to foresee themselves as disabled in old age and are more likely to foresee themselves having longer life expectancy. [Boyer et al. \[2017\]](#) explore how risk misperceptions interact with individual characteristics and how they influence LTCI intentions and purchases in two Canadian provinces for people aged 50 to 70. They contrast subjective (stated) probability with objective (predicted) probability for several aspects of dependency risk, and misperceptions are defined as the disparities between them. To assess objective probability, respondents were matched with a health microsimulation model -named COMPAS- [[Boisclair et al., 2016](#)]. Although misperceptions have a considerable impact on both intentions to acquire LTCI and actual LTCI purchases, they cannot explain the low LTCI take-up rate in their sample.

This chapter addresses several research questions. Are subjective probabilities distribu-

tions different from the distributions of probabilities predicted on the basis of observed dependency occurrences? Do people accurately identify the drivers of dependency? Do people massively understate the risk, or is there heterogeneity across individuals regarding over- and understatement? Can an understatement of the risk explain a lower demand for LTCI?

3 Data and methods

3.1 Study sample

We use data from three waves 4, 6 and 8 of the Survey of Health, Ageing and Retirement in Europe (SHARE) respectively collected in 2011, 2015 and 2020 and we focus on French data since our variables of interest are obtained from the French drop-off questionnaire. Wave 8 is considered as our baseline survey since subjective probability are observed that year. Data are collected by the CAPI method (computer-assisted, face-to-face personal interviewing technique) in the three survey waves. However, wave 8 includes a data module collected by post office (Drop-off interview) in order to obtain, among other things, individuals' elicitation on their probability of becoming dependent in 5 or 10 years. Details on the sampling procedure and questionnaire contents are reported by Börsch-Supan et al. [2013]; Börsch-Supan [2022] and at the SHARE website (<http://share-project.org/>). A total of 2,124 individuals were interviewed during the three survey waves.

Our study sample is made up of two balanced datasets: first, individuals present in waves 4 and 8; and second, those present in waves 6 and 8. For our analysis, we kept only individuals aged under 85 at the time of the wave 8 survey, and therefore unlikely to be dependent at that time, the idea being to understand their anticipation of this risk.

We define dependency by the fact of having at least one difficulty with activity of daily life. We exclude from our sample individuals who were already dependent in wave 4 and wave 6, to observe elderly's entry into dependency about 5 years and 10 years later (in wave 8). We also exclude from our sample the individuals who did not answer in wave 8 to the questions on the subjective probability of becoming dependent in 5 years or in 10 years. Finally, we drop individuals who reported for a given target year a positive probability of becoming dependent and at the same time reported that they had no chance of being alive. We end up with a sample of 1,654 individuals observed in waves 4 and 8; and 1,734

individuals observed in waves 6 and 8.

3.2 Elicitation of subjective probability of becoming dependent

As well as [Viscusi \[1990\]](#), [Hurd and McGarry \[2002\]](#), the following question was asked to elicit individual probability of being dependent: “*In your opinion, what is the risk that you will be dependent in 5 years? In 10 years?*”. The questionnaire clarifies that being "dependent" means having difficulties and needing help to perform daily living activities such as washing, cleaning or shopping. Those surveyed could express responses in terms of percentages in the range of 0 to 100. We re-scaled this variable to take values between 0 and 1, as would a probability.

Even though the questionnaire does not explicitly mention it, we analyze the responses to this question as the probability of becoming dependent and alive. Only people who are alive can be described as dependent. In the questionnaire sent by post, the question on survival is asked after the question on dependency and formulated as follows: “*In your opinion, what are your chances of being alive in 5 years? In 10 years?*”. Those surveyed could express responses in terms of percentages in the range of 0 to 100. We re-scaled this variable to take values between 0 and 1. As mentioned earlier by and [Slovic \[1987\]](#) and more recently by [Costa-Font and Costa-Font \[2011\]](#), one drawback of this elicitation method may be the individual difficulties in conceptualizing mathematical probabilities of adverse outcomes. Although various biases can affect the elicited subjective probabilities, we believe that they give information about beliefs that drive individual decision, including private information.

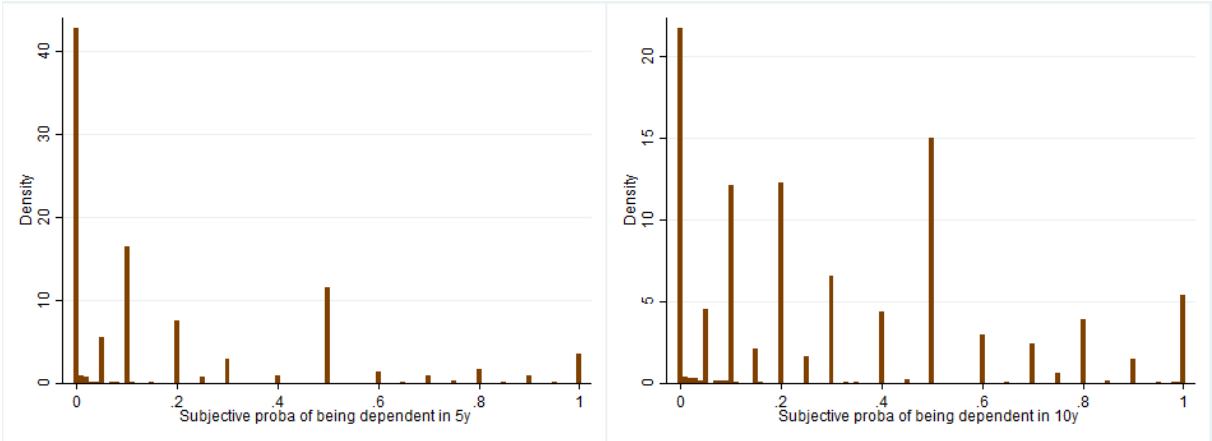
3.3 Subjective probabilities in our sample

Figure 1.1 shows the distribution of subjective probabilities of becoming dependent in 5 and 10 years. Almost half of the respondents think that the risk of becoming dependent in 5 years is zero, in 10 years they are slightly less than 20% to consider this risk. Nearly 10% of the respondents declare that they have a 50% chance of becoming dependent in 5 years, while almost 20% express the same level of risk in 10 years. Less than 5% of respondents state that they are certain (100% probability) of becoming dependent in 5 years or 10 years. As observed in Figure 1.1, elicited probabilities show some answer accumulation at focal points such as 0% and 50%, but accumulation is not dominant, and it changes with the hypothetical horizon presented for expectation in a way which is quite consistent.

Figure 1.2 displays the average subjective probability of becoming dependent by age group. For each age group, respondents reveal a higher probability of becoming dependent in 10 years than in 5 years, which is consistent with the fact that loss of autonomy is an increasing function of age. Similarly, older people report a higher probability of becoming dependent than younger people, regardless of the time horizon.

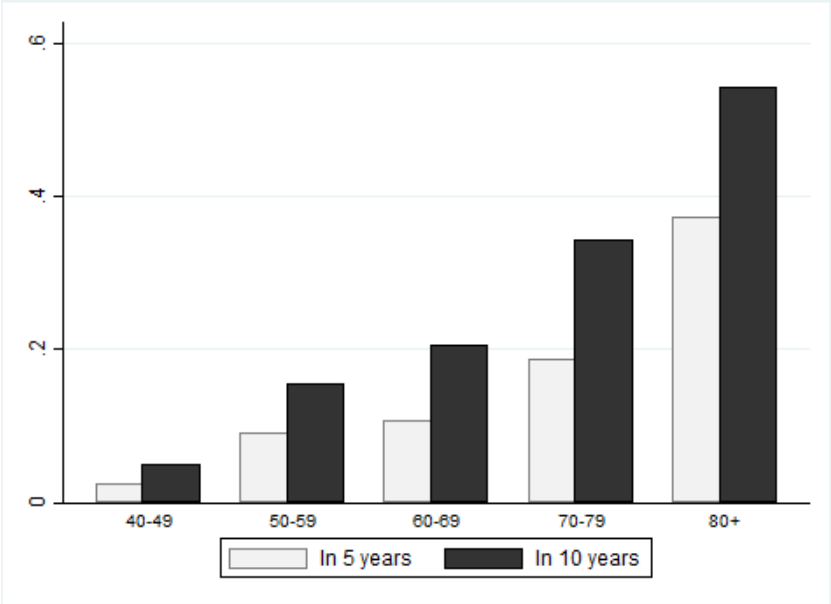
Figure 1.1: Subjective probability of being dependent

(a) In 5 years (b) In 10 years



Source: Author’s calculations from SHARE data wave 8.

Figure 1.2: Subjective probability of becoming dependent by age groups.



Source: Author’s calculations from SHARE data wave 8.

3.4 Control variables

Our analyses try to understand the determinants of subjective dependency risk elicited in 2020 (wave 8) on one side, and the determinants of dependency realization observed between waves 6 and 8 and between waves 4 and 8 on the other side.

First, we control for socio-demographic variables, namely age, gender and individual income. As a reminder, long-term care risk is an increasing function of age, as defined here in years. Gender is used here because the literature has shown that women have a higher chance of living longer and hence enter dependency. We also control for total household income. In our analyses, after identifying respondents who do not know their income level, we divided the rest of the sample into 3 equal parts. We then have four categories: low income, middle income, high income, and unknown income. To explain insurance ownership, we also control for being in a couple (binary variable), and the number of children in the household.

Regarding risk behaviors (lifestyle), we selected physical exercise, smoking and body mass index (BMI). The variable Exercise is a dichotomous variable which is worth 1 when the individual declares to practice sports or a vigorous or moderate physical activity at least once a week. The variable Smoking is a binary variable that is worth 1 if the individual has ever smoked daily for a period of at least one year. The body mass index is calculated according to the individual's height and weight, and classified into five categories: Underweight ($\text{bmi} < 18.5$), Healthy weight ($\text{bmi} \in [18.5-25[$), Overweight ($\text{bmi} \in [25-30[$); Obese ($\text{bmi} \in [30,+[$), Bmi (unknown).

Several indicators of health status are considered in our regressions: self-assessed health (SAH), lower body disabilities, hospitalization in the past 12 months, and cognitive score. SAH is a binary variable that is worth 1 when the respondent indicates poor or very poor general health. Lower body disabilities (LBD, hereafter) refer to a variable with a value of 1 if the respondent has difficulty on doing each of the following everyday activities: Walking 100 meters, getting up from a chair after sitting for long periods; climbing several flights of stairs without resting; stooping, kneeling, or crouching; lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries. In their conceptual model of disablement process, [Lawrence and Jette \[1996\]](#) have shown that LBD influence limitations with instrumental activities of daily living (see Figure 1.8 in the Appendix). Cognitive skills are captured by using simple tests of episodic memory (learning and recall) and executive skills (verbal fluency). We combine the two cognitive tests index in one

score of cognition that we standardized (See Figure I.3 in the Appendix). The hospital variable is a binary variable that equals 1 when the respondent answers yes to the following question: "*During the last twelve months, have you been in a hospital overnight?*" The ADL variable represents the number of limitations with activities of daily living (ADL).

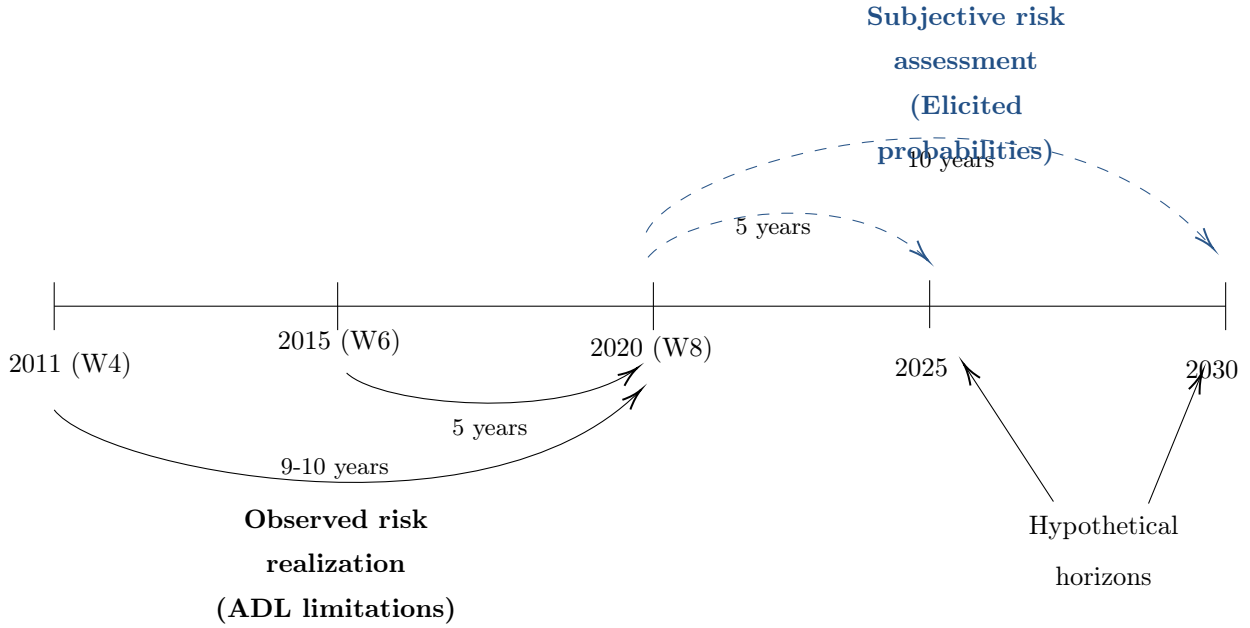
Some psychological traits, or individual preferences, are also measured in the Wave 8 Drop-off. The risk aversion score is measured on a Likert scale where individuals are asked to rank their degree of risk aversion on a scale from 0 (very cautious) to 10 (likes to take risks). The preference-for-the-present score is calculated based on the same method as mentioned above, where individuals give a score on a scale from 0 (lives day to day) to 10 (forward-looking, thinks about the future).

Finally, we have added a variable named "interview gap" to explain the objective (predicted) probability of becoming dependent. In order to compare the objective and subjective probabilities for everyone, with an unchanged time horizon (5 years and 10 years), this variable measures the gap between the interview dates of the two survey waves. It reflects the fact that between waves 4 and 8, and waves 6 and 8, individuals were not interviewed at the same time, and thus the observation of the realization of the risk would not correspond exactly to the discrepancies stated in the questions on subjective probabilities. The more the variable decreases, the closer we are to the 5- or 10-year gap between the observation of the explanatory variables and the realization of the "objective" risk (ADL limitations).

4 Empirical approach

Figure 1.3 below helps to understand our empirical approach. As a reminder, the data used in this study are collected in waves 4, 6 and 8. In wave 8 (2020), individuals form anticipations of their risk of becoming dependent within 5 and 10 years, i.e, in 2025 and in 2030: we refer to this as subjective risk assessment. Still in wave 8, we observe individuals who fell into dependency, and use these observations to predict "objective" risk in the future 5 and 10 years on the basis of estimations run for the same individuals on past waves.

Figure 1.3: Data over time



Sources: Author's construction.

We begin by analyzing how our explanatory variables, namely socio-demographic characteristics, risky behaviors, and health status, influence the predicted and subjective probabilities of becoming dependent in 5 years and 10 years. The predicted probability is an indicator to measure the “objective” risk of dependency. It is defined through the realization of the risk of dependency (defined as the fact of having at least one limitation with activities of daily living, denoted $(ADL \geq 1)$ in wave 8, i.e, within a period of 5 years (between waves 6 and 8) and 10 years (between waves 4 and 8) later. We control in our model for the gap between the two survey periods since the individuals are not all surveyed at the same time (in the same month), even though we are looking for a gap of 5 years and 10 years respectively with respect to the formulation used for the elicitation of subjective probabilities.

In the following equations, $t20$ designates the year 2020 (wave 8). Denoting $Pr_Sub_{i,h}$ $h = 5, 10$ the subjective probability of dependency elicited in 2020 (wave 8) for the horizons h equal to 5 or 10 years, we estimate for each horizon equations explaining this subjective probability:

$$Pr_Sub_{i,h} = \alpha_0 + \alpha_{1,h} SocioDemo_{i,t20} + \alpha_{2,h} Lifestyle_{i,t20} + \alpha_{3,h} Health_{i,t20} + \mu_{1,h,t20} \quad h = 5, 10 \quad (1.1)$$

$Pr_Sub_{i,h}$ is the subjective probability of becoming dependent for individual i in 5/10 years, i.e. the probability of becoming dependent in 2025 or 2030. $SocioDemo_{i,t20}$ includes the age, gender, and income of individual i at date $t20$. $Lifestyle_{i,t20}$ represents for individual i at date $t20$, exercise practice, tobacco use, and body mass index. $Health_{i,t20}$ provides information on self-reported health status, lower body disabilities, being in a hospital last 12 months, and the cognitive score of individual i at date $t20$.

Besides this, we estimate the probability of becoming dependent within 5 years by looking at the transitions of our individuals between 2015 and 2020. Some of them fall into dependency, the others are not touched by dependency, so that we can use these observations to explain on the same individuals the objective probability of dependency between 2015 and 2020. Our explanatory variables are here observed in 2015:

$$Pr(ADL_{i,h=5,t20} \geq 1) = F(\beta_{0,h=5} + \beta_{1,h=5}SocioDemo_{i,t15} + \beta_{2,h=5}Lifestyle_{i,t15} + \beta_{3,h=5}Health_{i,t15} + \beta_{4,h=5}Interview_Gap_{i,t15}) \quad (1.2)$$

We explain the dependency occurrence between 2015 and 2020 (i.e, in a time span of $h = 5years$) by a linear probability specification (in which case the explained variable is dichotomic), or through a probit model, as specified in equation (2), where $F(\cdot)$ is the normal distribution function.

The same approach is developed regarding probability of becoming dependent between 2011 and 2020:

$$Pr(ADL_{i,h=10,t20} \geq 1) = F(\beta_{0,h=10} + \beta_{1,h=10}SocioDemo_{i,t11} + \beta_{2,h=10}Lifestyle_{i,t11} + \beta_{3,h=10}Health_{i,t11} + \beta_{4,h=10}Interview_Gap_{i,t11}) \quad (1.3)$$

Our explanatory variables are here observed in 2011.

Equations (1.2) and (1.3) enable us to calculate the predicted probability for each individual who answered the subjective probability question in wave 8 using a probit model. We denote that predicted probability $Pr(Obj_{i,h,t20})$ which is the "objective" probability of becoming dependent conditional on being alive for individual i in h years ($h=5$ or 10 years).

$$\begin{aligned}
Predict_prob_{i,h=10,t20} = & F(\hat{\beta}_0 + \hat{\beta}_{1,h=5}SocioDemo_{i,t15} + \hat{\beta}_{2,h=5}Lifestyle_{i,t15} \\
& + \hat{\beta}_{3,h=5}Health_{i,t15} + \hat{\beta}_{4,h=5}\overline{Interview_Gap}_{i,t15}) \quad (1.4)
\end{aligned}$$

Note at this point that the predicted probability - *Predict_prob* - is the probability of becoming dependent, conditional on being alive. Indeed, we were able to observe dependency occurrence in our sample only on people who have survived, whereas our elicited subjective probability of becoming dependent is the probability of being dependent and alive. To compare the two probabilities, we multiplied the predicted probability of becoming dependent by the probability to have survived in the coming 5 or 10 years. For that purpose, we used survival rate² for the corresponding years and individuals of the same age and sex, as provided by the French National Institute of Demography, INED.

In what follows, we will examine the distributions of predicted and subjective dependency probabilities. Then we will define groups of individuals according to their tendency to over or under-estimate their risk. Finally, we will run estimations to capture the characteristics of people who underestimate their risk, and examine if they hold LTCI contract in lower proportions than other individuals.

5 Results

5.1 Descriptive results

Basic features of the data are presented in Table 1.1. The average age in our sample is 61 in 2011, 64 in 2015 and 69 in 2020, respectively. The proportion of women is steady over the three survey waves, around 56%. Regarding individual income, 24% of respondents do not know their income level in 2020 (postal survey), while 13% and 11% respectively do not declare their income level in 2011 and 2015. More than 3 out of 4 respondents reveal that they perform physical exercise. The proportion of individuals who smoke daily is about 68% in 2011, and does not exceed 50% in 2015 and 2020. Obese

²In order to compare the subjective probabilities (of becoming dependent and alive) and the predicted probability (of becoming dependent conditional on being alive), the survival rate must be considered in the predicted probability. We first considered the observed deaths in our data. For example, in our sample there are 55 deaths between 2015 and 2020. This death rate is very low due in part to attrition in our data, and we do not know if these individuals are deceased. Then, we considered as deceased all individuals present in the survey in 2015 and absent in 2020. We then counted 992 individuals out of 2,290 observations, which corresponds to not credible mortality rate. In the end, we chose to apply the INED³ rates to our entire sample, for individuals of the same age and sex.

individuals represent 17.7%, 19.3% and 17.1% of respondents in 2011, 2015 and 2020 respectively. More than 20% of individuals report poor or fair health regardless of the survey year. Approximately one in ten individuals reports having been to the hospital in the last twelve months. Preference scores show that on average respondents have a low risk aversion (average of 3.58) and a low preference for the present (6.50).

Table 1.1: Descriptive statistics by survey year

	Wave 4 (2011)		Wave 6 (2015)		Wave 8 (2020)	
	mean	sd	mean	sd	mean	sd
<i>Socio-demographics</i>						
Age	61.195	7.072	64.287	7.512	69.091	7.576
Female	0.573	0.495	0.566	0.496	0.561	0.496
Low Income	0.333	0.471	0.318	0.466	0.252	0.434
Middle	0.249	0.433	0.281	0.450	0.266	0.442
High income	0.287	0.452	0.293	0.455	0.238	0.426
Income (unknown)	0.132	0.338	0.108	0.311	0.244	0.430
<i>Lifestyle</i>						
Exercise	0.783	0.412	0.768	0.422	0.761	0.427
Ever smoked daily	0.678	0.467	0.467	0.499	0.462	0.499
Underweight	0.004	0.060	0.010	0.101	0.016	0.125
Healthy weight	0.437	0.496	0.416	0.493	0.362	0.481
Overweight	0.368	0.482	0.381	0.486	0.310	0.463
Obese	0.177	0.382	0.193	0.395	0.171	0.376
Bmi (unknown)	0.014	0.120	-	-	0.142	0.349
<i>Health status</i>						
Poor or Fair SAH	0.229	0.420	0.229	0.420	0.242	0.428
Lower body disabilities	0.322	0.467	0.351	0.477	0.348	0.476
In hospital last 12 months	0.109	0.312	0.099	0.299	0.121	0.326
Standardized cognitive score	0.010	0.998	-0.001	1.004	0.000	1.000
<i>Preferences</i>						
Score risk aversion					3.582	2.398
Score present preference					6.497	2.468
<i>Dependency risk</i>						
Dependent in 2020	0.095	0.294	0.073	0.261	-	-
Subj proba dependent in 5y					0.130	0.213
Subj proba dependent in 10y					0.267	0.264
<i>Survey gap (in months)</i>						
Gap between w4 and w8					103,131	1,673
Gap between w6 and w8					55,930	1,732
<i>N</i>	1,657		1,734		2,021	

Sources: Author's calculations from SHARE data wave 4,6,8.

This table presents descriptive statistics on two cylindrical samples. 1,657 individuals were present at waves 4 and 8; while 1,734 were present at waves 6 and 8 of the SHARE survey. 2,201 individuals responded in 2020 (wave 8) to questions about the subjective probability of becoming dependent in 5 years and in 10 years.

5.2 Determinants of subjective dependency risk and of the probability of risk realization

Tables 1.2 and 1.3 display the results from estimation of equations (1.1), (1.2) and (1.3). They allow us to compare determinants of subjective dependency risk (table 1.2) and the drivers of risk realization (table 1.3). Note that at this stage the two concepts are not quite comparable since the subjective probability concerns the probability to be dependent (event A) and alive (event B) in the coming 5 years - $P(A \cap B)$ - while we observed the risk realization, in the past 5 years, only for people who survived - $P(A|B)$. We make the corrections with INED survival rates afterwards for the distributions comparison.

Concerning expectations for a 5-year horizon, we find that individuals accurately perceive the role of age and of current poor health and lower body limitations. These variables influence similarly the subjective risk and risk realization, with differences in the magnitudes of the coefficients, though (we will come back to this hereafter). On the other hand, people think that having a low income influences the dependency risk, while it does not significantly explain the risk realization. Conversely, smoking influences the risk realization, while it is not significant in the model explaining the subjective probability.

Similar results are obtained for the 10-year horizon: we find that individuals accurately perceive the role of age, of current poor health and of lower body disabilities, with differences in the magnitudes of the coefficients, though. These variables are the only ones which influence the subjective probabilities, while the probability of the risk realization depend also on the income level and on the occurrence of a hospitalization within the last 12 months. To understand the discrepancies observed between estimates explaining subjective probabilities and risk realization about the role of smoking, income and hospitalization, we run auxiliary regressions⁴ to examine the correlation between smoking and income on one side, and between hospitalization and income on the other side. We found no strong correlation: smoking and hospitalization are not good proxies of income.

⁴When we run the regressions from specifications (3) and (4) without hospitalization variable of table 1.2, income remains significant. When we run regressions from specifications (1) and (2) of the same table without the variable smoking, the effect of income remains insignificant.

Table 1.2: Determinants of subjective risk assessment in 5 years and in 10 years

Dependent variable: Subjective probability of becoming dependent		
	In 5 years (1)	In 10 years (2)
Age	0.00666*** (0.001)	0.0125*** (0.001)
Female	-0.00356 (0.013)	-0.0174 (0.016)
Low Income	0.0518*** (0.018)	0.00250 (0.021)
Middle Income: ref	ref	ref
High Income	-0.00235 (0.014)	-0.0175 (0.016)
Missing Income	0.000236 (0.021)	0.00896 (0.025)
Exercise	-0.00497 (0.015)	0.0177 (0.017)
Ever smoked daily	0.00922 (0.012)	-0.00265 (0.015)
Underweight	0.138** (0.065)	-0.0226 (0.078)
Healthy weight	0.00247 (0.017)	-0.0128 (0.020)
Overweight	0.0124 (0.017)	0.0206 (0.021)
Obese:ref	ref	ref
Poor or Fair SAH	0.0984*** (0.017)	0.124*** (0.018)
Lower body disabilities (LBD)	0.0405*** (0.014)	0.0493*** (0.016)
In hospital last 12 months	0.0217 (0.021)	0.0202 (0.024)
Std cognitive score	-0.0130** (0.006)	-0.00364 (0.007)
N	1,297	1,226
R ²	0.163	0.204
Adjusted R ²	0.154	0.195

Sources: Author's calculations from SHARE data, waves 4,6, and 8.

Notes: * p<.1, ** p<.05, *** p<.01 LPM stands for Linear Probability Model. This table presents the coefficients (standard errors in parentheses) of the determinants of the subjective risk assessment defined in equations 1 and 1bis. Column (1) regresses the subjective probability of becoming dependent in 5 years by the explanatory variables observed in wave 8. Column (2) regresses the subjective probability of becoming dependent in 10 years by the explanatory variables observed in wave 8.

Table 1.3: Determinants of observed risk realization in 5 years and in 10 years

Dependent variable: Observed risk realization (at least one ADL limitation)				
	In 5 years		In 10 years	
	LPM	Probit	LPM	Probit
Age	0.00203*	0.00220**	0.00270**	0.00275**
	(0.001)	(0.001)	(0.001)	(0.001)
Female	-0.00784	-0.00889	-0.0101	-0.0131
	(0.017)	(0.017)	(0.018)	(0.018)
Low Income	-0.0307	-0.0236	0.0637**	0.0602**
	(0.024)	(0.021)	(0.027)	(0.024)
Middle Income: ref	ref	ref	ref	ref
High Income	-0.0302	-0.0284	0.0487**	0.0504**
	(0.019)	(0.020)	(0.020)	(0.021)
Don't know	0.0190	0.0186	0.0192	0.0179
	(0.032)	(0.030)	(0.026)	(0.025)
Exercise	-0.0157	-0.00800	-0.0125	-0.00603
	(0.021)	(0.018)	(0.023)	(0.020)
Ever smoked daily	0.0401**	0.0439***	0.0282	0.0296
	(0.017)	(0.017)	(0.019)	(0.019)
Underweight	0.0797	0.0542	-0.0895**	0
	(0.092)	(0.076)	(0.038)	(.)
Healthy weight	-0.0151	-0.0152	-0.0524*	-0.0511**
	(0.025)	(0.022)	(0.029)	(0.025)
Overweight	-0.00819	-0.0102	-0.0388	-0.0326
	(0.026)	(0.021)	(0.030)	(0.026)
Obese: ref	ref	ref	ref	ref
BMI (no reply)	-	-	-0.0179	-0.0138
			(0.075)	(0.067)
Poor or Fair SAH	0.110***	0.0795***	0.110***	0.0820***
	(0.025)	(0.016)	(0.027)	(0.019)
Lower Body Disabilities	0.114***	0.103***	0.0790***	0.0725***
	(0.020)	(0.017)	(0.022)	(0.019)
In hospital last 12 months	0.0462	0.0250	0.0755**	0.0562**
	(0.032)	(0.021)	(0.035)	(0.023)

continued on next page →

Dependent variable: Observed risk realization (at least one ADL limitation)				
	In 5 years		In 10 years	
	LPM	Probit	LPM	Probit
Std cognitive score	-0.0133 (0.008)	-0.0166** (0.008)	-0.0128 (0.010)	-0.0139 (0.010)
Interview gap	0.00206 (0.005)	0.00271 (0.005)	0.00988* (0.005)	0.00981* (0.005)
N	1,297	1,297	1,226	1,225
R ²	0.109		0.0978	
Adjusted R ²	0.0987		0.0859	

Sources: Author's calculations from SHARE data, waves 4,6, and 8.

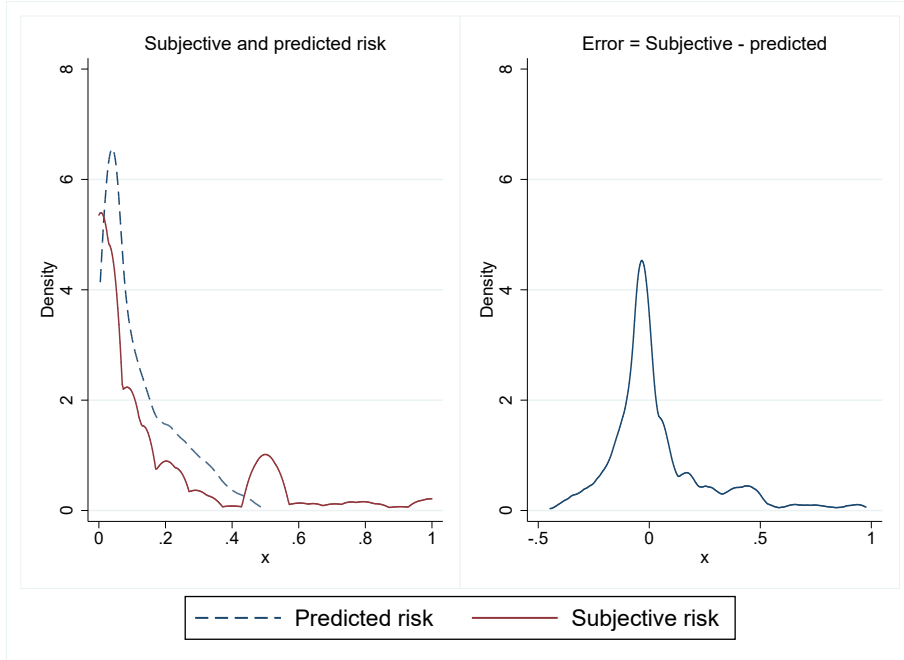
: * $p < .1$, ** $p < .05$, *** $p < .01$ This table presents the coefficients (standard errors in parentheses) of the determinants of the observed risk realization conditional on being alive, defined in equations 2 and 2bis. Columns (1) and (2) respectively regress the observed realization risk in 5 years (having at least one ADL limitation) on the variables observed in wave 6 using OLS and probit model (marginal effects displayed). Specifications (3) and (4) respectively regress the observed realization risk in 10 years (having at least one ADL limitation) on the variables observed in wave 4 using respectively OLS and probit model (marginal effects displayed in the table).

5.3 Distribution of subjective dependency probabilities and probabilities of observed risk realization

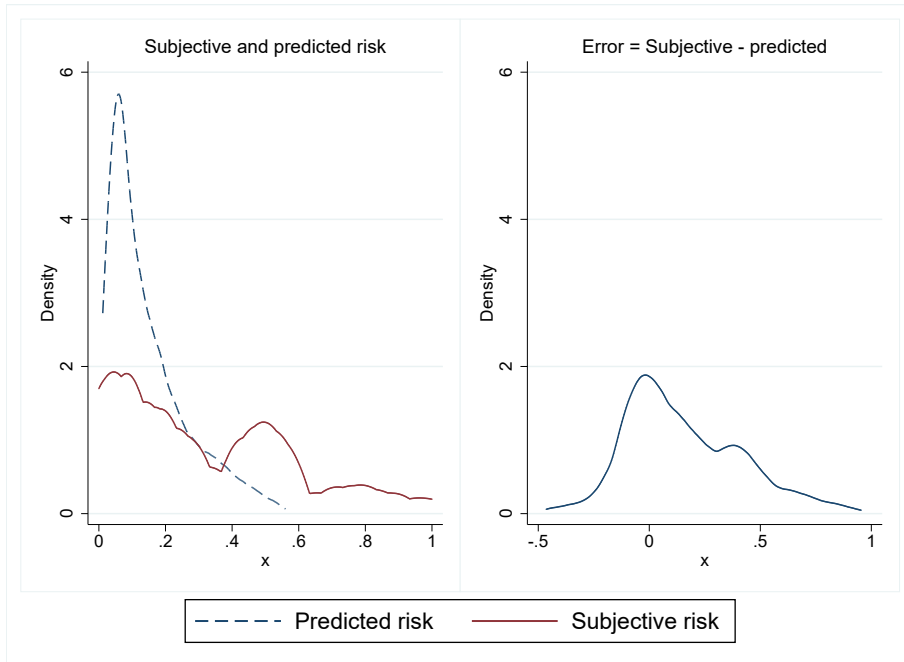
Table 1.4a shows the means and different quantiles of subjective estimates and predicted risks for an horizon of 5 years. On average people overestimate their risk of becoming dependent, but only slightly: the average subjective probability is equal to 15.1%, which is 3.4 percentage points greater than the average predicted (“objective”) probability, equals to 11.7%. However, this average overestimation goes with a distribution where most people underestimate slightly their risk while the others make a large overestimation of their risk. The subjective dependency probability rises considerably at a horizon of 10 years (Table 1.4b): individuals increase their subjective probability very strongly, which doubles on average for this twice as distant horizon, whereas the predicted risk based on observations is far from doubling. As a result, the average overstatement is equal to 15.5 percentage points and most individuals overstate their risk. From the median, the quantiles of subjective risks are more than twice the corresponding quantiles for predicted risks (Table 1.4b). At the top of the distribution people have huge and excessive subjective risks. The magnitude of the overestimation at the top of the distribution of subjective and predicted risks of dependency is clearly seen in the figures 1.4a and 1.4b.

Figure 1.4: Density of the probability of becoming dependent

(a) In 5 years



(b) In 10 years



Source: Author's calculations from SHARE data, wave 8.

Table 1.4: Distributions of objective and subjective risk assessment

(a) In 5 years			(b) In 10 years		
5 YEARS	Subjective	Predicted	10 YEARS	Subjective	Predicted
Mean	0.151	0.117	Mean	0.300	0.145
sd	0.234	0.106	sd	0.272	0.117
Diff. (mean)	0.034		Diff. (mean)	0.155	
D1	0	0.020	D1	0	0.035
Q1	0	0.032	Q1	0.05	0.055
MED	0.05	0.075	MED	0.20	0.106
Q3	0.20	0.175	Q3	0.50	0.200
D9	0.50	0.287	D9	0.70	0.322
N	1,297		N	1,226	

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

D1: 1st decile. Sd: standard deviation. Q1: 1st quartile. MED: mediane. Q3: 3rd quartile. D9: 9th decile.

5.4 Definition of individual profiles according to the difference between perceived and predicted risks

After this first analysis, we try to examine the characteristics and behaviors of individuals according to whether they underestimate or overestimate their risk. Hereafter we can qualify individuals as pessimistic or optimistic, considering that optimists are those who underestimate the risk of becoming dependent and pessimists those who overestimate it. A rough but straightforward approach is to assume that underestimation corresponds to the case where the subjective probability is lower than the predicted probability, the opposite corresponding to an overestimation of the risk. We will call this criterion Definition 1.

However, our estimate of the probability of becoming dependent, and the resulting predictions, are realizations of random variables and hence affected by a variability, so that a margin of error must be incorporated to define over and under-estimation more reasonably. Assuming an arbitrary margin of error of ± 5 percentage points (pp), we can define three categories of individuals in this second approach (Definition 2). To do this, we first define an interval, $I = [I_{low} = \text{predicted probability} - 5 \text{ pp}; I_{high} = \text{predicted probability} + 5 \text{ pp}]$. The respondent is then considered optimistic when the elicited subjective probability (P_{subj}) is lower than the lower bound of our confidence interval ($P_{subj} < I_{low}$). If $P_{subj} > I_{high}$ the individual is considered as pessimistic, finally if $P_{subj} \in I$ then he or she is within the margin error.

A third approach (Definition 3) is based on the estimation of 95% confidence interval for the predicted probabilities. We have the same reasoning or classification as with the second approach; the only difference is that we use theoretical results concerning the variance of predicted probabilities from a probit estimation to build the confidence interval.

We favor the first two definitions at this stage of the analysis, as definition 3 leads to very wide confidence intervals, with the average error of those within the margin (i.e, those judged to be correctly assessing their risk) being excessive: equal to +34 percentage points. With the latter approach, we also observe very little variation of the lower and upper bounds of the confidence interval across quantiles (see Tables 1.11a and 1.11b in the Appendix). On the other hand, with the margin of error of \pm percentage points, the average error of those who are in the margin amounts to -1.5 percentage points at the 5-year horizon and to -0.9 percentage point at 10 years. The results corresponding to this third approach are presented in the Appendix (Tables 1.10a-b).

5.5 Statistics by individual profile

Tables 1.5a-b and 1.6a-b present some statistics concerning the subjective and predicted risks, according to the profile of the individual as defined in the previous paragraph. With the first approach, at the 5-year forecast horizon, the sample is divided between 798 optimists (who underestimate their risk) and 499 pessimists (Table 1.5a). The former underestimate their risk by an average of 9.1 percentage points, while the latter overestimate it by 23.7 points. Both have the same average risk predicted by our estimation based on the transitions observed in this sample, i.e 11.7% chance of becoming dependent at 5 years. But the optimists have an average subjective risk of 2.6%, while the pessimists estimate an average 35.4% chance of becoming addicted at 5 years. The size of the error is therefore much larger for the pessimists.

For a 10-year horizon, as we have already seen with the distributions, the subjective probabilities increase much more than the probabilities predicted by our estimates (Table 1.5b). As a result, the proportion of pessimists is reversed, with 784 pessimists and 441 optimists. Once again, their average error is larger than that of those who underestimate their risk: +28 points instead of -11 points.

The same features are observed when considering Definition 2, with a split into three equal group between optimists, pessimists and those within the margin of error at the

5-year horizon (Table 1.6a), but a sharp increase in the number of pessimists at 10 years (Table 1.6b). Again, the magnitude of the overestimation is huge for the pessimists for a 10-year horizon: their average subjective probability (46.8%) is equal to more than three times the objective predicted risk (14.3%).

All these elements are well illustrated in Figures 1.5 and 1.6, which display the distribution functions of subjective and predicted risks.

Table 1.5: Definition 1 - Distributions objective and subjective risk assessment

(a) In 5 years				
5 YEARS	Underestimate		Overestimate	
	Subjective	Predicted	Subjective	Predicted
Mean	0.026	0.117	0.354	0.117
Difference	-0.091		0.237	
N	798		499	

(b) In 10 years				
10 YEARS	Underestimate		Overestimate	
	Subjective	Predicted	Subjective	Predicted
Mean	0.063	0.173	0.433	0.152
Difference	-0.110		0.281	
N	441		784	

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Table 1.6: Definition 2 - Distributions objective and subjective risk assessment

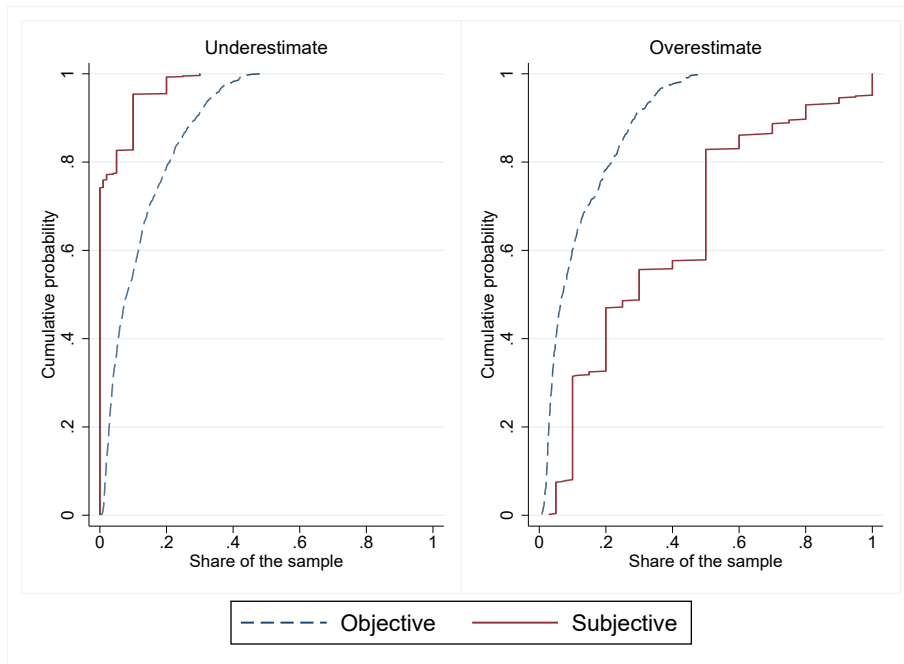
(a) In 5 years						
5 YEARS	Underestimate		Within the error margin		Overestimate	
	Subjective	Predicted	Subjective	Predicted	Subjective	Predicted
Mean	0.031	0.177	0.038	0.053	0.415	0.126
Difference	-0.146		-0.015		0.289	
N	435		460		402	

(b) In 10 years						
10 YEARS	Underestimate		Within the error margin		Overestimate	
	Subjective	Predicted	Subjective	Predicted	Subjective	Predicted
Mean	0.046	0.193	0.093	0.102	0.468	0.143
Difference	-0.147		-0.009		0.325	
N	256		261		709	

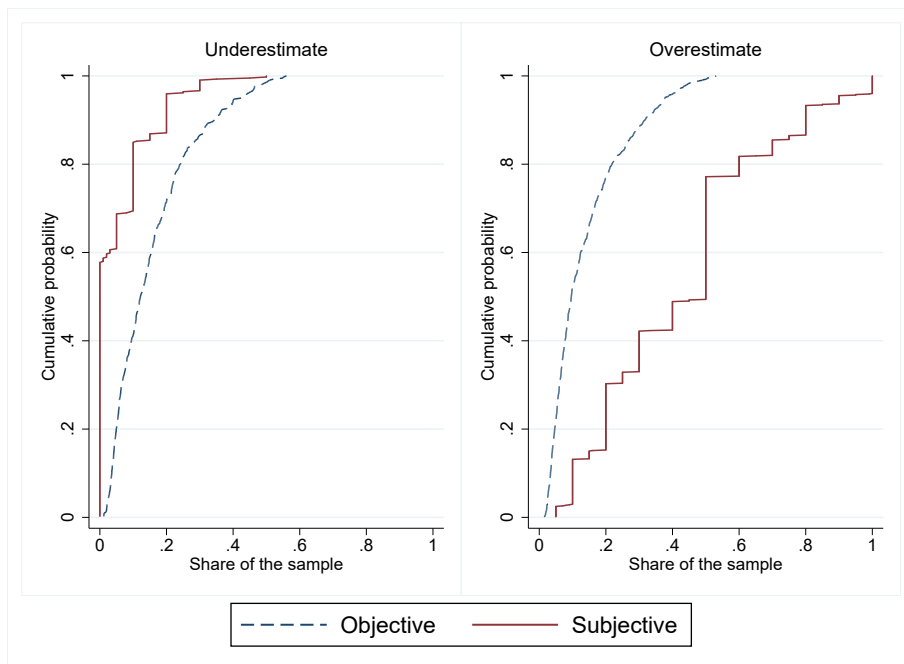
Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Figure 1.5: Definition 1 - Cumulative distribution of Objective and subjective risk by profile

(a) In 5 years



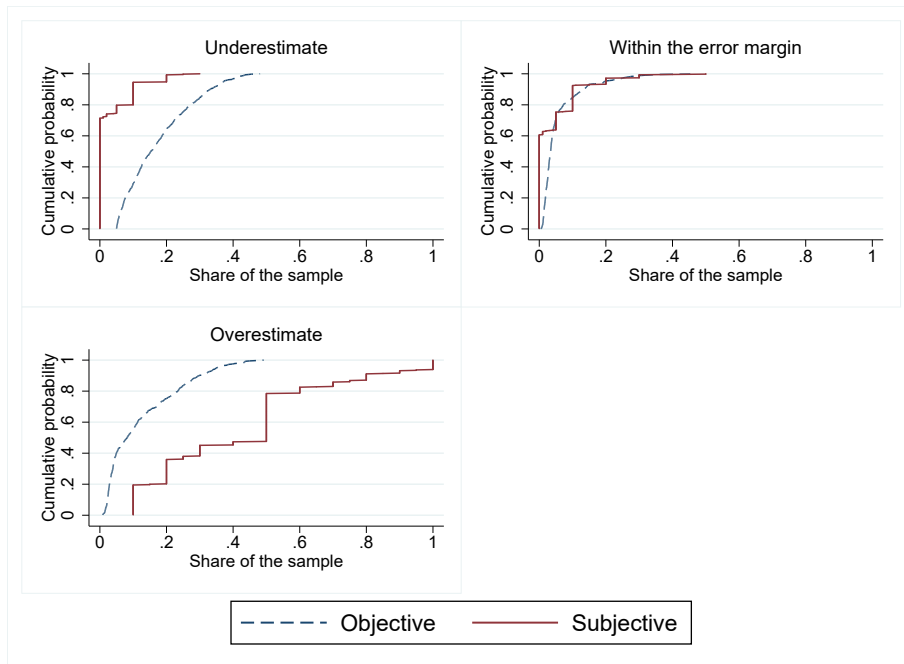
(b) In 10 years



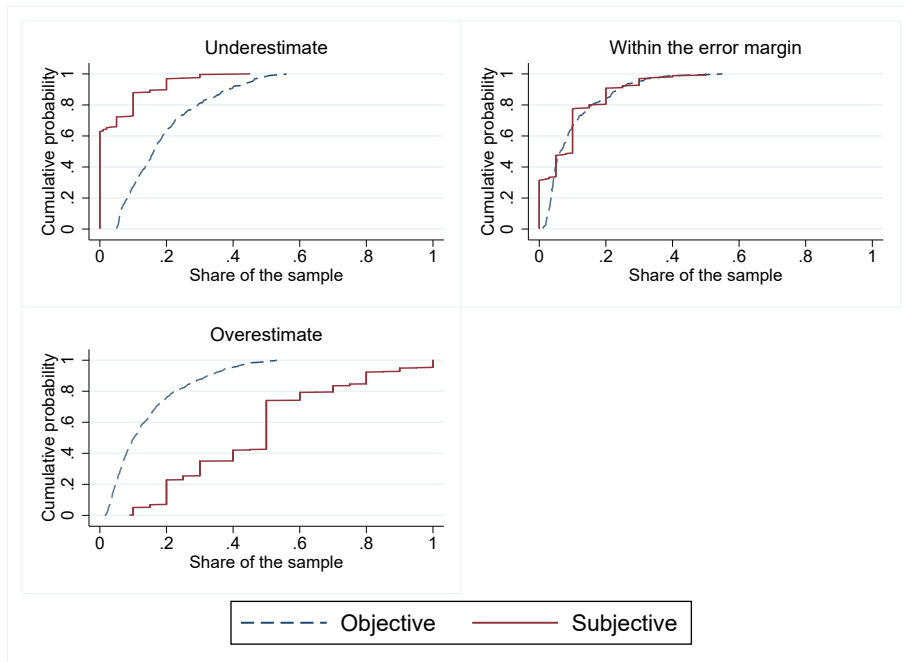
Source: Author's calculations from SHARE data, wave 8.

Figure 1.6: Definition 2 - Cumulative distribution of Objective and subjective risk by profile

(a) In 5 years



(b) In 10 years



Source: Author's calculations from SHARE data, wave 8.

5.6 Who are the optimistic individuals?

Using the first definition of risk profile, individuals are divided between those who underestimate and those who overestimate, so we estimate a dichotomous probit model to characterize them. For Definition 2, there are three modalities, the individuals are divided between those who are within the margin of error, and those who are outside (under- or overestimating the risk). In this case we specify an ordered probit with three modalities.

The results are shown in Table 1.7. We have seen (see Tables 1.2 and 1.3) that the objective factors of becoming dependent within 5 years are age, smoking, being in poor health, having some mobility problems, and a low score in cognitive tests. We find that these different factors influence significantly the fact of underestimating the risk of becoming dependent, whether the individual neglects some of these factors (smoking does not significantly influence the subjective probability), or whether he or she attributes to them a weaker influence than what is observed. Interestingly, we find also that risk aversion has a significant influence on the subjective probabilities, as it leads individuals to overestimate their risk of becoming dependent. Similar results are obtained for the 10-year forecasts, except that the influence of risk aversion disappears, and an influence of BMI appears, with obese individuals having a greater tendency to underestimate their risk of becoming dependent. In any case, the tendency to underestimate the risk of becoming dependent decreases with age.

Table 1.7: Characteristics of optimistic individuals

Dependent variable= 1 if underestimates, according to risk profile definition				
	In 5 years		In 10 years	
	Probit Definition 1	Oprobit Definition 2	Probit Definition 1	Oprobit Definition 2
Age	-0.0150*** (0.002)	-0.00902*** (0.001)	-0.0146*** (0.002)	-0.0179*** (0.002)
Female	0.0100 (0.029)	-0.00641 (0.023)	0.0225 (0.029)	0.0188 (0.026)
Low Income	-0.0297 (0.035)	-0.0532* (0.028)	0.113*** (0.037)	-0.00808 (0.033)
Middle Income: ref	ref	ref	ref	ref
High Income	0.0124 (0.034)	0.0114 (0.028)	0.147*** (0.033)	0.0479 (0.030)

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Dependent variable= 1 if underestimates, according to risk profile definition				
	In 5 years		In 10 years	
	Probit Definition 1	Oprobit Definition 2	Probit Definition 1	Oprobit Definition 2
Missing Income	0.0261 (0.048)	0.0666 (0.043)	0.0246 (0.045)	0.0186 (0.042)
Exercise	-0.0443 (0.032)	-0.0204 (0.026)	-0.0224 (0.032)	-0.0372 (0.030)
Ever smoked daily	0.0589** (0.027)	0.0860*** (0.022)	0.0768*** (0.028)	0.0149 (0.025)
Underweight	-0.183* (0.104)	-0.0423 (0.080)	-0.0501 (0.144)	0.0526 (0.117)
Healthy weight	0.00550 (0.037)	-0.00562 (0.031)	-0.0887** (0.039)	-0.0192 (0.033)
Overweight	-0.0451 (0.037)	-0.0210 (0.031)	-0.0885** (0.038)	-0.0578* (0.032)
Obese: ref	ref	ref	ref	ref
Interview gap	-0.0165** (0.008)	-0.0151** (0.006)	-0.00304 (0.008)	-0.0164** (0.007)
Poor or Fair SAH	-0.0714** (0.032)	0.0243 (0.027)	-0.0292 (0.032)	-0.128*** (0.027)
Lower body disabilities	0.104*** (0.030)	0.226*** (0.023)	0.0749** (0.030)	-0.0572** (0.026)
In hospital last 12 months	-0.0190 (0.042)	0.0389 (0.036)	0.0671 (0.042)	-0.0124 (0.036)
Std cognitive score	-0.0476*** (0.015)	-0.0473*** (0.012)	-0.0276* (0.014)	0.00569 (0.013)
Score risk aversion	-0.0125** (0.006)	-0.00900* (0.005)	-0.00617 (0.006)	0.00350 (0.005)
Score present preference	0.00819 (0.006)	0.00875* (0.005)	-0.00402 (0.006)	-0.000706 (0.005)
N	1,248	1,248	1,179	1,180

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

* p<.1, ** p<.05, *** p<.01 This table displays the marginal effects (standard errors in parentheses) of the probit and ordered probit (oprobit). The dependent variable of the probit model is a dummy variable which is equal to one when individual underestimate the risk of becoming dependent, according to the first Definition defining risk profile. The dependent variable of the Oprobit model is a categorical which three outcomes of whether individual: Underestimates, is Within the margin error, or Overestimates the risk. The two columns labeled "Oprobit" display the marginal effects for the outcome 'Underestimates'. The marginal effects here show that when an explanatory variable increases by one unit, the individual has a greater or lesser chance (sign of the coefficient) of being in the "Underestimates" category.

5.7 Do optimists hold less LTCI?

As stated above, we have restricted our sample to individuals who do not hold LTCI and to those who have acquired a policy voluntarily (we have removed observations concerning people who are covered passively by a group policy thanks to their employer). What we observe is the holding of a contract, which means that the individual has applied for it and that it has been taken out, i.e. that the insurer has agreed to cover him/her for an acceptable premium. The SHARE data do not allow us to distinguish between insurance demand and insurance ownership. We only observe LTCI's ownership, which is the result of demand, and of the absence of selection from the insurer.

As we will see in Chapter 2, while demand does depend on the individual's subjective assessment of his or her risk of becoming dependent, ownership is not correlated with this risk because insurers' selection strategies eliminate bad risks. Here, our research question is whether an underestimation of their risk of becoming dependent is correlated with a limitation in their demand for insurance. We therefore examine the impact of subjective risk assessment on insurance ownership by estimating the role of over- or underestimation of risk in an equation explaining insurance ownership. More precisely, we introduce in the regression dichotomic variables indicating the existence of over- or underestimation of risk, together with these same indicators interacted by the absolute value of the error (difference between the subjective risk and the predicted probability).

The results are given in Tables 1.8 (Definition 1) and 1.9 (Definition 2), and in the Appendix (Table 1.12) for Definition 3 of risk estimation bias. All results show a non-significant impact of subjective risk on insurance ownership, as well as a negative role for the number of ADL limitations, which can be interpreted in terms of the effect of risk selection in the LTCI market.

For 10-year expectations, we obtain a significant and negative impact of risk underestimation crossed with the magnitude of the error (it is worth noting that this cross-variable allows us to examine the impact of subjective risk underestimation in a way that is relatively robust to the criteria used for definition of under or over estimation). The magnitude of the impact is quite large: a 10-point underestimation of risk at the 10-year horizon should lead to an 8-percentage-point decrease in the probability of holding insurance.

This negative impact of the underestimation of risk crossed with the estimation error at 10 years is observed systematically whatever the definition used: Definition 2 (Table 1.9) or Definition 3 (Table 1.12 in the Appendix). We know that the selection of risks by

insurers is based on a medical questionnaire. However, they contain no question that can elicit a variable related to the individual's expectations or expectation errors. So, we must consider that this significant impact concerns the demand for insurance.

Our estimates therefore allow us to conclude that this is a result showing that a significant number of individuals underestimate their risk of becoming dependent, which limits their demand for insurance.

Table 1.8: Determinants of LTCI ownership – Definition 1 for risk profile

Dependent variable= 1 if individual has LTCI - Definition 1				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Subjective proba of being dependent	-0.0318 (0.053)	-0.0714 (0.193)	-0.0170 (0.043)	-0.136 (0.190)
Age	0.00476*** (0.002)	0.00495*** (0.002)	0.00553*** (0.002)	0.00636*** (0.002)
female	0.0400* (0.023)	0.0388* (0.023)	0.0220 (0.024)	0.0173 (0.023)
Low Income	0.0426 (0.033)	0.0459 (0.033)	-0.0110 (0.032)	0.0125 (0.038)
Middle Income: ref	ref	ref	ref	ref
High Income	0.00129 (0.029)	-0.000287 (0.028)	0.000548 (0.029)	0.00891 (0.030)
Missing Income	-0.0345 (0.039)	-0.0292 (0.040)	-0.0245 (0.038)	-0.0182 (0.037)
In couple	-0.000646 (0.029)	-0.00255 (0.028)	-0.0417 (0.028)	-0.0451 (0.027)
Number of children	-0.0157* (0.009)	-0.0163* (0.009)	-0.000586 (0.009)	-0.0000289 (0.009)
Poor or Fair SAH	-0.0104 (0.027)	0.00936 (0.035)	-0.0236 (0.027)	0.00699 (0.038)
Number of ADL limitations	-0.0458** (0.023)	-0.0384 (0.023)	-0.0365* (0.022)	-0.0265 (0.022)
In hospital last 12 months	-0.000415 (0.037)	0.00394 (0.038)	0.0395 (0.035)	0.0569 (0.040)
Score risk aversion	0.00152 (0.005)	0.000847 (0.005)	-0.000146 (0.005)	-0.00154 (0.005)
Score present preference	-0.00172 (0.005)	-0.00197 (0.005)	0.00217 (0.005)	0.00181 (0.005)

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Dependent Variable= 1 if individual has LTCI- Definition 1				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Overestimate		ref		ref
Underestimate		-0.00717 (0.035)		-0.00143 (0.036)
Underestimate × Error		-0.311 (0.215)		-0.823*** (0.275)
Overestimate × Error		-0.0361 (0.214)		0.00569 (0.198)
N	1,165	1,165	1,109	1,108

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

* $p < .1$, ** $p < .05$, *** $p < .01$ This table displays the coefficients (standard errors in parentheses) of equation (6) at 5 and 10 years estimated by a probit model. The dependent variable is a dummy which is equal to 1 when the individual has LTCI. Columns (1) and (3) controls for the subjective probability of becoming dependent in 5 years, socio-demographic variables, health status and individual preferences. Columns (2) and (4) consider the profile of the individual defined according to the 2nd Definition (Under/overestimate, within the margin error) and the estimation error.

Table 1.9: Determinants of LTCI ownership – Definition 2 for risk profile

Dependent variable= 1 if individual has LTCI- Definition 2				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Subjective proba of being dependent	-0.0318 (0.053)	-0.0478 (0.186)	-0.0170 (0.043)	-0.107 (0.191)
Age	0.00476*** (0.002)	0.00478*** (0.002)	0.00553*** (0.002)	0.00667*** (0.002)
Female	0.0400* (0.023)	0.0412* (0.023)	0.0220 (0.024)	0.0197 (0.023)
Low Income	0.0426 (0.033)	0.0423 (0.033)	-0.0110 (0.032)	0.00630 (0.038)
Middle Income: ref	ref	ref	ref	ref
High Income	0.00129 (0.029)	0.00153 (0.028)	0.000548 (0.029)	0.00455 (0.030)
Missing Income	-0.0345 (0.039)	-0.0311 (0.040)	-0.0245 (0.038)	-0.0230 (0.037)
In couple	-0.000646 (0.029)	-0.00443 (0.028)	-0.0417 (0.028)	-0.0442 (0.027)
Number of children	-0.0157* (0.009)	-0.0162* (0.009)	-0.000586 (0.009)	0.000113 (0.009)
Poor or Fair SAH	-0.0104 (0.027)	0.0103 (0.035)	-0.0236 (0.027)	0.00237 (0.037)
Number of ADL limitations	-0.0458** (0.023)	-0.0392* (0.023)	-0.0365* (0.022)	-0.0288 (0.023)
In hospital last 12 months	-0.000415 (0.037)	0.00461 (0.038)	0.0395 (0.035)	0.0563 (0.039)
Score risk aversion	0.00152 (0.005)	0.000883 (0.005)	-0.000146 (0.005)	-0.00162 (0.005)
Score present preference	-0.00172 (0.005)	-0.00185 (0.005)	0.00217 (0.005)	0.00177 (0.005)

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Dependent Variable= 1 if individual has LTCI- Definition 2				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Underestimate		0.0556 (0.056)		0.133 (0.085)
Within the margin error		ref		ref
Overestimate		0.0683 (0.056)		0.00706 (0.052)
Underestimate \times Error		-0.303 (0.266)		-1.597*** (0.447)
Within the margin error \times Error		2.175 (1.557)		-2.832* (1.702)
Overestimation \times Error		-0.0663 (0.210)		-0.0631 (0.197)
N	1,165	1,165	1,109	1,108

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Notes:* $p < .1$, ** $p < .05$, *** $p < .01$ This table displays the coefficients (standard errors in parentheses) of equation (6) at 5 and 10 years estimated by a probit model. The dependent variable is a dummy which is equal to 1 when the individual has LTCI. Columns (1) and (3) controls for the subjective probability of becoming dependent in 5 years, socio-demographic variables, health status and individual preferences. Columns (2) and (4) consider the profile of the individual defined according to the 2nd Definition (Under/overestimate, within the margin error) and the estimation error.

6 Conclusion

This work aims to understand how individuals perceive the risk of becoming dependent. In particular, we try to find out if individuals have an optimism bias for such a risk, which could explain a low demand for LTCI. We take advantage of the fact that we can observe in wave 8 of the SHARE survey (more precisely the Drop-off) the subjective probabilities of becoming dependent within 5 years and 10 years.

Our results show that people overestimate moderately their risk of becoming dependent at 5 years: the average subjective probability is equal to 15.1%, which is 3.4 percentage points greater than the average predicted (“objective”) probability, equal to 11.7%. However, the average overestimation goes with a distribution where most people underestimate slightly their risk while the others make a large overestimation of their risk. The subjective dependency probability rises considerably at a horizon of 10 years: the majority of individuals overstate their risk, the average overstatement is equal to 15.5 percentage points, and at the top of the distribution people have huge and excessive subjective risks. Looking at

the determinants of individual expectations, we find that individuals accurately perceive the role of age, of current poor health and lower body disabilities. Indeed, these variables influence significantly the observed risk of dependency. Finally, our estimations show that individuals who underestimate their risk have a lower probability of holding LTCI, with an impact that depends on the size of the gap between subjective and predicted risk.

7 Appendix

Appendix 1.A: Results with Definition 3 risk profile

Table 1.10: Definition 3 - Distributions objective and subjective risk assessment

(a) In 5 years						
5 YEARS	Underestimate		Within the 95% CI		Overestimate	
	Subjective	Predicted	Subjective	Predicted	Subjective	Predicted
Mean	0.065	0.107	0.510	0.170	0.854	0.187
Difference	-0.042		0.340		0.667	
N	1,098		127		72	

(b) In 10 years						
10 YEARS	Underestimate		Within the 95% CI		Overestimate	
	Subjective	Predicted	Subjective	Predicted	Subjective	Predicted
Mean	0.146	0.131	0.515	0.155	0.827	0.203
Difference	0.015		0.360		0.624	
N	843		231		152	

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Table 1.11: Confidence intervals (CI) - Definition 3 of risk profile

	(a) In 5 years		(b) In 10 years		
	Lower bound	Upper bound	Lower bound	Upper bound	
Mean	0.438	0.612	Mean	0.419	0.592
sd	0.029	0.028	sd	0.017	0.019
Diff. (mean)	-0.174		Diff. (mean)	-0.173	
D1	0.407	0.583	D1	0.400	0.572
Q1	0.420	0.593	Q1	0.411	0.580
MED	0.434	0.606	MED	0.420	0.591
Q3	0.453	0.629	Q3	0.430	0.603
D9	0.479	0.654	D9	439	0.616
N	1,297		N	1,225	

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Table 1.12: Determinants of LTCI ownership – Definition 3 for risk profile

Dependent variable= 1 if individual has LTCI- Definition 3				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Subjective proba of being dependent	-0.0318 (0.053)	0.204 (0.125)	-0.0170 (0.043)	0.225** (0.103)
Age	0.00476*** (0.002)	0.00496*** (0.002)	0.00553*** (0.002)	0.00547*** (0.002)
Female	0.0400* (0.023)	0.0410* (0.023)	0.0220 (0.024)	0.0204 (0.023)
Low Income	0.0426 (0.033)	0.0507 (0.033)	-0.0110 (0.032)	-0.0137 (0.033)
Middle Income: ref	ref	ref	ref	ref
High Income	0.00129 (0.029)	0.0000123 (0.028)	0.000548 (0.029)	-0.00629 (0.029)
Missing Income	-0.0345 (0.039)	-0.0296 (0.039)	-0.0245 (0.038)	-0.0249 (0.038)
In couple	-0.000646 (0.029)	-0.00243 (0.028)	-0.0417 (0.028)	-0.0473* (0.027)
Number of children	-0.0157* (0.009)	-0.0156* (0.009)	-0.000586 (0.009)	-0.00127 (0.009)
Poor or Fair SAH	-0.0104 (0.027)	0.00104 (0.029)	-0.0236 (0.027)	-0.0365 (0.028)
Number of ADL limitations	-0.0458** (0.023)	-0.0437* (0.024)	-0.0365* (0.022)	-0.0342 (0.023)
In hospital last 12 months	-0.000415 (0.037)	-0.00487 (0.037)	0.0395 (0.035)	0.0312 (0.036)
Score risk aversion	0.00152 (0.005)	0.00150 (0.005)	-0.000146 (0.005)	-0.00100 (0.005)
Score present preference	-0.00172 (0.005)	-0.00175 (0.005)	0.00217 (0.005)	0.00201 (0.005)
Underestimate		0.112 (0.103)		0.0531 (0.103)
Within the 95% CI		ref		ref

continued on next page →

Dependent variable= 1 if individual has LTCI- Definition 3				
	5 YEARS		10 YEARS	
	(1)	(2)	(3)	(4)
Overestimate		-0.109 (0.085)		-0.142 (0.089)
Underestimate × Error		-0.275* (0.164)		-0.420*** (0.146)
Within the 95% CI × Error		-0.169 (0.386)		-0.170 (0.265)
Overestimation × Error		0.384 (0.305)		0.0588 (0.207)
N	1,165	1,165	1,109	1,108

Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

* $p < .1$, ** $p < .05$, *** $p < .01$ This table displays the coefficients (standard errors in parentheses) of equation (6) at 5 and 10 years estimated by a probit model. The dependent variable is a dummy which is equal to 1 when the individual has LTCI. Columns (1) and (3) controls for the subjective probability of becoming dependent in 5 years, socio-demographic variables, health status and individual preferences. Columns (2) and (4) consider the profile of the individual defined according to the 3rd Definition (Under/overestimate, within the 95% confidence interval) and the estimation error.

Appendix 1.B: Proportion of optimists and pessimists without focal points on subjective probabilities

The main disadvantage of using elicited probabilities, is heaping at focal values such as 0, 50 and 100. In table I.12a-b, we show the distributions of subjective and predicted risks when focal values are excluded from the analysis.

Table 1.13: Distribution of Subjective and objective risk without focal points (0, 50, 100)

(a) In 5 years			(b) In 10 years		
5 YEARS	Subjective	Predicted	10 YEARS	Subjective	Predicted
Mean	0.200	0.131	Mean	0.306	0.142
sd	0.208	0.110	sd	0.248	0.114
Diff. (mean)	0.069		Diff. (mean)	0.164	
D1	0.05	0.023	D1	0.10	0.034
Q1	0.10	0.037	Q1	0.10	0.054
MED	0.10	0.099	MED	0.20	0.105
Q3	0.20	0.204	Q3	0.40	0.200
D9	0.6	0.306	D9	0.80	0.309
N	553		N	723	

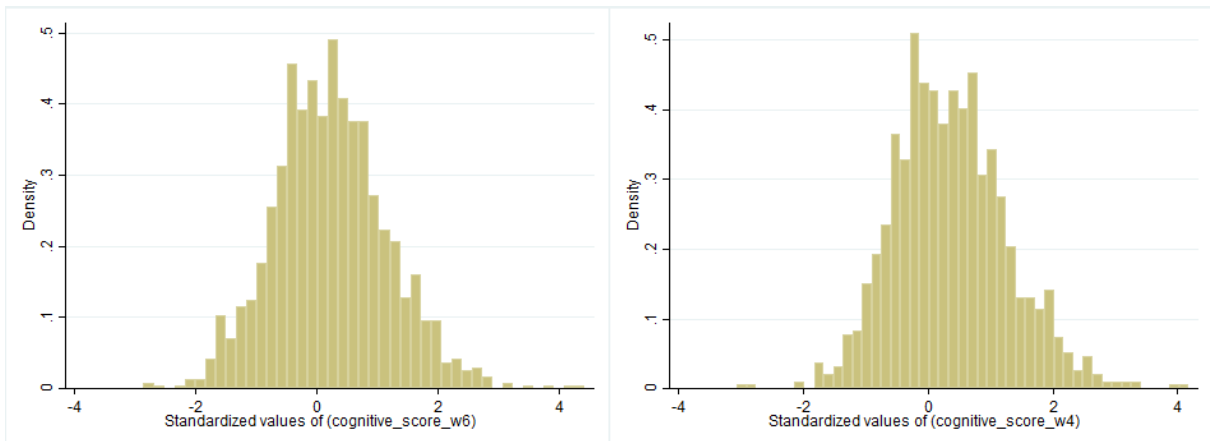
Sources: Author's calculation from SHARE data, waves 4, 6 and 8.

Appendix 1-C: Distribution of the index for cognitive skills

Figure 1.7: Distribution of standardized cognitive score - wave 4 and wave 6

(a) Wave 5 - 2015

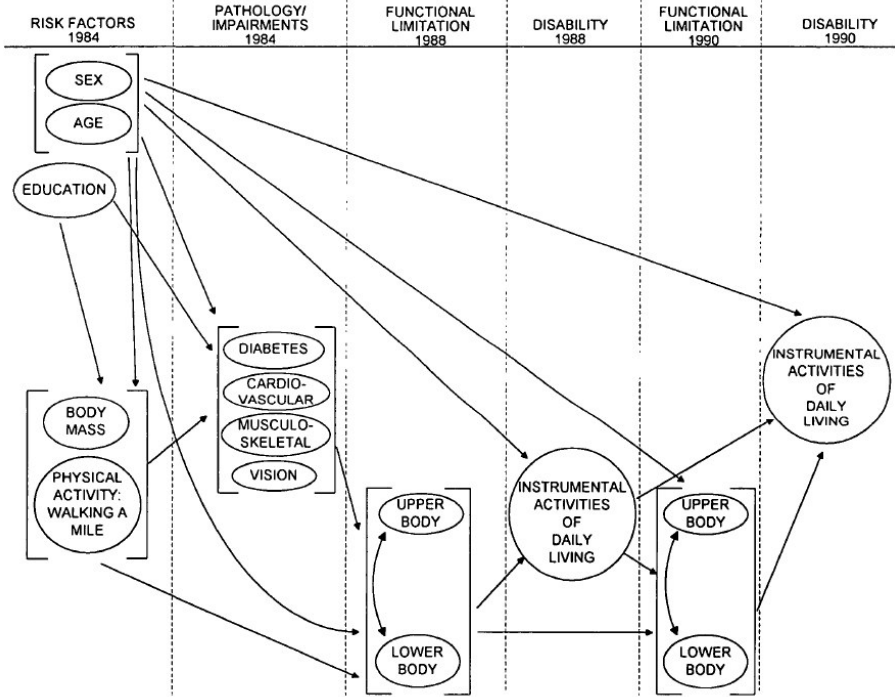
(b) Wave 4 - 2011



Source: Author's calculations from SHARE data, waves 4 and 6.

Appendix 1-D: Conceptual model of disablement process by Lawrence and Jette [1996]

Figure 1.8: Conceptual model of disablement process.



Source: Extract from Lawrence and Jette [1996]

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Chapter 2

Risk selection in the private long-term care insurance market: evidence from France

This chapter is co-authored with Brigitte Dormont (Université Paris-Dauphine, PSL).

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The empirical analysis in this chapter is conducted using data from the Enquête Longévité DEpendance Risque et Soutien vague 2 (2014) of the Fondation Médéric Alzheimer.

1 Introduction

The increase in longevity observed all around the world makes governments expect a dramatic increase in the number of elderly with functional or cognitive impairments. There are four ways to gain access to long term care services (hereafter, LTC). You can pay for services yourself (self-fund), rely on family or friends for informal care, count on the public aid, or rely on long term care insurance.

In France, there is a universal public coverage for LTC. This public coverage is partial and decreases with income. The corresponding expenditure amounts to 1.4 percent of GDP in 2014. This level of public expenditure is deemed insufficient by many experts, because the coverage does not prevent from large out-of-pockets payments,¹ and because services currently provided in nursing homes have poor quality. For the current levels of coverage and care quality, economists forecast the public expenditure for LTC to raise to 2.1 percent and even 2.8 percent of GDP by 2060, depending on assumptions regarding growth [Roussel \[2017\]](#). To favor an improvement in the quality of services, while limiting the increase in public expenditures, policy makers might turn to the market for private long term care insurance.

Public debates on this issue are similar in France, in the USA and in most European countries. The consequences of the increase in longevity, together with the fact that the numerous baby boomers now approach the age of 70, have not been faced seriously yet. However, people are dubious about the possibilities offered by the market for private long term care insurance because it remains under-developed. In the USA, the subscription rate was equal to 12.4 percent for people aged 65 and older in 2013 [Frank et al. \[2013\]](#). For France the corresponding figure is 13-17 percent in 2012-2015 [Fontaine and Bonnet \[2017\]](#).

As stated by [Frank et al. \[2013\]](#) underinsurance can derive from problems on the two sides of the market. On the demand side, underinsurance might stem from an underestimation by individuals of their dependency risk, from their behavior relative to financial decisions (savings and insurance purchase), from the existence of possible substitutes with informal care, and from mistrust of the industry. On the supply side, the efficiency of the private insurance market can be questioned.

Insurers who provide long-term care insurance face three major risks: escalating costs,

¹The average monthly OOP for a nursing home resident amounts to €1,758 [Fizzala \[2016\]](#), which is greater than the net pension which is around €1,400 in 2020 [DREES, 2022\]](#)

adverse selection and moral hazard [Kessler \[2008\]](#). Many theoretical papers consider that the low take-up of LTCI contracts results from adverse selection ([Assous and Mahieu \[2002\]](#); [Grignon and Bernier \[2012\]](#)). In LTCI, benefits are paid at best 20-30 years after insurance purchase. At the time of subscription, it is difficult for insurers to extract relevant information from applicants about their risks of needing long-term care services.

The literature on the existence of adverse selection in insurance markets is plentiful. Papers examine whether subscribers have better information than insurers about their own risk (or if the informational advantage is on the insurer side), and whether the factors explaining the demand for insurance result in adverse or advantageous selection. In their survey, [Cohen and Siegelman \[2010\]](#) show that results are not the same, depending on the type of insurance: automobile insurance, health insurance, life insurance or annuities.

As concerns LTCI, there is empirical evidence that people with a higher risk of needing long term care are more likely to apply for LTCI ([Sloan and Norton \[1997\]](#); [Courbage and Roudaut \[2008\]](#)). Conversely, a paper by [Finkelstein and McGarry \[2006\]](#) (FMG (2006), hereafter) questioned the existence of adverse selection. They do not find that holders of a LTCI are more likely than uninsured people to enter a nursing home later on. They argue, however, that this does not rule out the possibility of private information (unobserved by the insurer) on the risk linked with insurance demand: there might be sources of advantageous and adverse selection that result, on average, in a lack of adverse selection. Using the same data than FMG, [Hendren \[2013\]](#) argues that the reason for not observing adverse selection among insurance holders is that insurers succeed in eliminating bad risks when recruiting enrollees. Insurance refusals for some risk levels would explain partly the under-development of private LTCI.

Our chapter focuses on the consequences of selection practices implemented by insurers to counteract adverse selection. We take advantage of a French survey that provides original information at the individual level. It enables us to observe the demand for LTCI, and its outcome in terms of rejection or subscription. More exactly, we observe if the individual has applied for LTCI, and whether he or she was accepted or rejected by the insurer.

The empirical evidence provided by FMG (2006) and [Hendren \[2013\]](#) uses the Health and Retirement Survey (HRS), which is an individual-level panel survey of elderly. The event covered by LTCI is defined as entering a nursing home in the five years following observation, which makes it possible to observe its realizations in longitudinal data like HRS.

So, FMG and Hendren observe the LTCI ownership and the risk occurrence. They do not observe individual characteristics when people are 50 years old, i.e, when they are supposed to try to purchase insurance, and when they are exposed to rejection by the insurer.

This chapter addresses the question of risk selection in LTCI with different data. We observe individuals "earlier", when people are around 60 and might consider purchasing LTCI. For the 2,252 surveyed individuals we observe socio-economic characteristics, as well as indicators of their preferences for the present, their risk aversion, and of how their marginal utility of income varies with health. Our survey also elicits self-assessed health, and subjective expectations regarding survival after 80 and the probability of functional or cognitive impairments after 80. So, we observe both private information that can motivate the purchase of LTCI. In addition, questions are asked, that mimic the questionnaires used by insurers to select risks. So we observe the individual private information, and the part of it that can be unveiled by the questionnaire. This enables us to analyse accurately the demand for LTCI and the determinants of insurance refusal. On the other hand, because several decades generally separate the purchase of LTCI and the risk realization, we do not observe the risk occurrence. This is ineluctable on the issue of LTC insurance: either one observes demand for insurance and possible rejection, but not risk realization; or one observes risk realization and insurance ownership, but not demand for insurance and the determinants of rejection at the time of demand.

The purpose of this chapter is to analyse the demand for LTCI and the determinants of rejection. We examine if there is adverse selection in insurance demand (i.e if individuals with higher risk are more likely to demand LTCI), and if selection by insurers succeeds in eliminating adverse selection. Then we analyse the determinants of selection and the characteristics of people who are rejected. Our empirical investigations are performed on a sample of 2,252 individuals drawn from a survey carried out in France in 2015 on the market for LTCI.

We contribute to the literature on LTCI because our data enables us to provide a direct check of the interpretations proposed by [Hendren \[2013\]](#) versus FMG (2006) to explain the apparent lack of adverse selection among LTCI holders. Our results give empirical support to Hendren's interpretation: the lack of adverse selection observed on holders results from selection by insurers of high risk individuals who have tried to purchase

insurance. Moreover, we find that risk aversion encourages insurance demand and is also negatively correlated with the risk level. This goes in the direction of the interpretation suggested by FMG, but the estimated effect, while mitigating the influence of adverse selection, is not sufficient to remove it totally from the demand for insurance.

The remainder of this chapter proceeds as follows. Section 2 provides some institutional background on the private long-term care insurance in France, and gives an overview of the related literature. In section 3, we describe our data and provide some descriptive analysis. In section 4, we estimate the demand for LTCI. Section 5 analyses selection by insurers and the characteristics of individuals who are rejected. The final section concludes.

2 Background

2.1 Medical underwriting in the long term care insurance market in France

The French market is the second largest worldwide market of private LTCI (behind the United States market) with around 3 million policyholders. In France, LTCI benefits consist of a monthly cash payment, while in the U.S.A., LTCI provides coverage for care and services up to a certain limit, with multiple options. Individual and employer-sponsored contracts are also offered in both countries.

Outside employer-sponsored contracts, the individual must answer to a medical questionnaire to purchase a contract for LTCI. Up to the age of 75, LTCI can be purchased; after that, it is usually no longer possible. For many insurers, the medical questionnaire includes five questions to evaluate the risk of major dependency and six additional questions for partial dependency. In order to facilitate underwriting, other insurance companies first ask only one question: "Are you in long-term illness (LTI)" (in the sense of National Health Insurance scheme)? If the answer is *NO*, the application is accepted. If not, the second step in the application process is to complete a more detailed medical questionnaire. If the applicant answers *NO* to all the questions, a menu of contracts is proposed. If the answer is *YES* to one or more questions, the insurer will require the applicant to pass a thorough medical examination, the results of which will be studied by the medical consultant of the insurance company.

The medical selection process is not totally homogeneous across insurance companies, but the criteria used for risk selection are very close.

2.2 Adverse selection in the long-term care insurance market: available literature

The concept of adverse selection in insurance markets refers to a possible correlation between insurance coverage and risk realization. Over the past decades, many papers tested the presence of adverse selection in different markets (see, for instance, [Cawley and Philipson \[1999\]](#); [Chiappori and Salanié \[2000\]](#); [Finkelstein and McGarry \[2006\]](#); [Cohen and Siegelman \[2010\]](#) for a survey).

Two major articles deal with the asymmetry of information on the long-term care insurance market. The FMG (2006) study focus on the fact that two types of individuals are likely to buy insurance: those who have private information correlated with a high risk level, and those who have a strong preference for insurance.

FMG (2006) find evidence of private information in the U.S, but fail to find adverse selection in their data. Their interpretation relies on the idea that private information is multidimensional. Among people who own a contract, there are individuals who present a higher-than-average risk, which leads to a positive correlation between insurance coverage and risk realization, and there are also people with a strong preference for insurance, which leads to a negative correlation². The presence of both sub-populations would lead to compensation phenomena, which can explain the lack adverse selection.

[Hendren \[2013\]](#) argues that the result found by FMG (2006) relies on the fact that their data concern people who are insured, ruling out the bad risks that have been rejected. [Hendren \[2013\]](#) focuses on refusal behavior by insurers. He develops a theoretical model which defines the "no-trade condition", i.e the conditions under which private information on risk held by applicant lead insurers not to offer any contract in order to avoid negative profit. In other words, its theoretical model highlights the idea that the private information of policyholders can explain an insurer's refusal. Examining the markets for life, LTCI, and disability insurance, he finds that individuals have private information about their risk exposure, even after controlling for the variables that are observable by the insurer through the questionnaire.

The studies afore mentioned deal with data where only contract ownership is observable. As a consequence, the authors dealt with data relative to individuals that were admitted to insurance after the selection of high risks. Thus, analyses are performed on a portfolio

²A theoretical paper by [Chade and Schlee \[2020\]](#) brings a complementary explanation of coverage denials based on provision costs.

of rather low-risks, which can explain the fact that they fail to find evidence of adverse selection. This is why Hendren's empirical strategy is based upon the entire population and uses insurers guidelines to simulate the process of risk selection.

3 The Data

3.1 The Pater/Elders survey

We exploit the wave 2 of a French survey called Pater/Elders³. It is a cross-sectional data from the Fondation Mederic Alzheimer, that interviewed in 2015 a national sample of 5,897 individuals aged 18 and over. To understand the preferences and opinions of individuals about the dependency risk, the questionnaire focus on individuals aged between 48 and 79.

We restrict our sample to those who answered central questions about insurance. Because we focus on individual's decision, we exclude those who owned employer-provided contracts, which represent about half of the sample. For the purpose of replicating the insurer's information set, we also exclude those who did not answer questions similar to those used by insurance companies for medical underwriting⁴. We thus end up with a sample of 2,252 individuals.

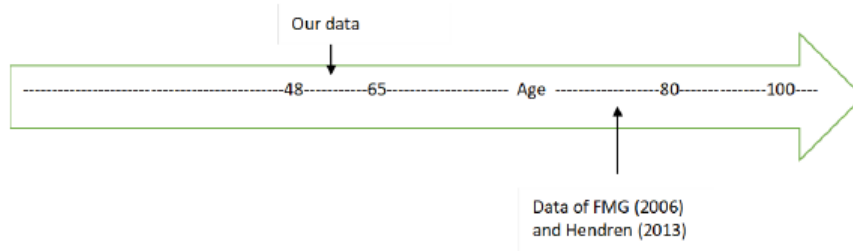
As stated in the introduction, FMG and Hendren observe the LTCI ownership and the risk occurrence, but they do not observe individual characteristics when people are 50 years old, i.e when they can express demand for LTCI, and when they are exposed to rejection by the insurer. Our data are original because we observe individuals when people are around 50 and might consider purchasing LTCI. Our data are particularly relevant to analyse the process of risk selection. As a counterpart, we do not observe risk realization⁵: our analysis will use the subjective probability of dependency elicited through the survey. The diagram (2.1) and Table (2.1) below illustrate how the information provided by our data is situated with respect of the information used by FMG and Hendren.

³Pater stands for : PAtrimoine et préférences vis-a-vis du TEmps et du Risque; and Elders : Enquete Longevite Dependance Risque et Soutien

⁴According to article L. 113-2 of the Insurance Code, the insured is required "*to answer exactly the questions asked by the insurer, in particular in the risk declaration form by which the insurer questions her at the time of conclusion of the contract, on the circumstances which are likely to cause the insurer to assess the risks he assumes*"

⁵Note that the risk realization observed by FMG and Hendren is restricted to entering a nursing home within a span of five years.

Figure 2.1: Our data vs data in the literature



Sources: Author's construction.

Table 2.1: Information in our data vs in the literature

Available information	Hendren (2013), FMG (2006)	This chapter
Type of data	longitudinal	cross-sectional (2015)
Information on risk realization	yes	no
Underwriting guidelines	yes	yes
Individual's expectations	yes	yes
Demand for insurance	no	yes
Insurance rejection	no	yes

Sources: Author's construction.

Our variables can be broken into six categories.

3.1.0.1 Insurance demand and rejection In Pater/Elders, the question on insurance covering long-term care is : "*Have you taken out long-term care insurance on an individual basis?*" The respondents could answer "yes", "yes, but I then cancelled it" or "no". In the sample, 12.5 percent own an individual contract.

Insurance rejection is observed through this question : *Have you ever been refused by an insurer because of your state of health.* In the sample, 3.2 percent were rejected by an insurer. With these two questions, we construct the demand for insurance, which includes accepted and rejected individuals by insurers in this market.

3.1.0.2 Socio-demographic variables We included variables for age, gender, occupation, and residence area. The residence area variables fall into five categories : (1) Paris region; (2) West; (3) North/East; (4) Southwest; (5) Southeast/Mediterranean. The occupation variables fall into seven categories : (1) Farmer; (2) Craftsman/Merchant/Business Manager; (3) Self-employed/manager; (4) Intermediate Profession; (5) Employee; (6) Worker; and (7) Retired.

3.1.0.3 Substitutes to insurance Bequest motives and altruistic behaviour can influence demand for LTCI. To take this into account, we included variables on family structures, global wealth and income of respondents. To measure crowding out effect of public assistance or informal care documented in the literature ([Brown and Finkelstein \[2007\]](#); [Mellor \[2001\]](#)), we take advantage on this question : *On which financial resource(s) would you be able to count if you were to face a situation of dependency ?* This question enables us to define two binary variables, one corresponding to people relying or not on their "children's resources", the other one corresponding to people relying or not on "public aid".

3.1.0.4 Individual preferences It is well-known that psychological traits can influence the demand for insurance. Following [Arrondel et al. \[2004\]](#), we compute two scores for risk aversion and preference for the present.⁶ We also included an indicator of how the marginal utility of income varies with health (u_{12} score), that we assess through these questions : *Do you agree with these statements: (1) It's better to enjoy your money while you're healthy; (2) It's not useful to have a lot of money when you're sick because you can't fully enjoy it.* u_{12} score is a binary variable which equals one if the respondent asks "yes" to these two questions, and is expected to be negatively correlated with the demand for insurance.

3.1.0.5 Elicitation of the self-assessed dependency risk (individual's private information) The individual demand for LTCI is expected to increase with the level of perceived dependency risk. We have two measures of the self assessed dependency risk on the basis of the following questions:⁷ (i) *If you turn 80, what are the chances that you'll be dependent at that age?* (ii) *Suppose you're still alive at 80. According to you, will you then need help to : "Housework"; "Personal care"; "Manage your budget"; "Monitoring"?* (for this question, we construct four binary variables according the four responses modalities). The answer to question (i) is a self-assessed probability to be dependent at 80, conditional on being alive at 80. We can build an unconditional self-assessed risk in combining answer to (i) with answer to a question about survival chance: (iii) *Personally, how much do you estimate your chances of still being alive at the age of 80?* So,

⁶We used 13 items for the risk aversion score, where the most influential items were related to these questions *do you take an umbrella when the weather outlook is uncertain ?* or *do you agree with the statement "marriage is a form of insurance ?* For the preference for the present score, we used 34 items and one of the most relevant question is this one : *"as a result of an unexpected workload, your employer asks you to forego a week's holiday this year, in exchange for x extra days next year : do you agree ?"*

⁷A scale between 0 and 100 is proposed to the respondent.

our data enables us to build variables measuring beliefs on chances to be dependent in the future: the subjective conditional probability to be dependent, denoted P_{80} , and the unconditional probability $uncondP_{80}$, that takes the chance to be alive at 80 into account.

In principle the demand for insurance might rely on conditional or unconditional chance, but selection by insurer relies on unconditional probability to be dependent at 80. In what follows, we present results obtained using the conditional probability P_{80} . Our motivations are the following: P_{80} is more pure, because it is not the product of two elicited probabilities; the elicited survival probability used to compute $uncondP_{80}$ is affected by a strong focal point bias toward 50%.

3.1.0.5.1 Information on current health and dependency in the family (individual's private information) To capture determinants of dependency risk, we include variables for self-assessed health, limitations in physical activities, and the fact of having a member of the family or a relative affected by dependency.

3.1.0.6 Medical questionnaire (information known by the insurer) One advantage of our survey is that some questions reproduce the medical underwriting practices operated by most insurers in the LTCI market. The eight questions listed below are representative of the questionnaire that applicants are required to fill.

1. Do you have a chronic or long-term illness (LTI) or health problem?
2. Have you received or are you currently receiving a disability pension for a disability rate above 40 percent or is your disability status being recognized?
3. Have you been eligible for the 100 percent coverage by the National Health Insurance for a long-term illness (LTI) or are you eligible, or do you have an application in progress?
4. Have you or will you receive an old-age pension for disability?
5. Have you been followed or are you being followed for a rheumatological or neurological or mental or cardiac or vascular disability or condition?
6. Have you in the last 5 years:
 - a) been hospitalized for more than seven consecutive days?
 - b) been on sick leave for more than three consecutive months?

- c) taken medication for more than one month?

3.2 Basic features of the data

The descriptive statistics of the variables used in our estimates are presented in Table 1 and show the representativeness of our sample in terms of population coverage against the risk of dependency. Indeed, the coverage rate of 15 percent⁸ that we obtain with this survey is comparable with that of the SHARE⁹ survey in wave 5 (14 percent of insured persons against the dependency risk). The average age in our sample is 61 years; and the average age at which a policy is purchased is 57 years. Women represent 51 percent of our sample. 65 percent of the respondents declare to be in couple, and the respondents have on average 2 children. Roughly 40 percent are retired. 15 percent of respondents live alone and without children.

Individuals expect an average 31 percent chance of being dependent if they turn 80, and over 21 percent believe they will need help (for household chores, for personal care, etc.) by age 80. Note that these expectations are remarkably closed to what we find on SHARE data, where subjective dependency probability were elicited in wave 8: we found an average subjective dependency risk of 30% within a horizon of 10 years for people whose average age is 69 years (see chapter 1). This result is striking, even if these statistics are not quite comparable because they are based on answers to questions that are differently formulated (and a target age as in the Pater/Elders survey is not the same as a given horizon as in the SHARE survey).

Almost one third of individuals reports that they have received or are receiving full coverage from the National Health Insurance (Sécurité sociale) for a long-term illness (LTI) or have applied for it, while 8 percent have received a disability pension.

These people (in LTI) are significantly older, less wealthy, and have had fewer health checks in the last five years preceding the survey. They also report more subjective risk of dependence, less subjective chances of survival, more demand for insurance, and more refusal of insurance. These individuals also report poor health status if we look at the variables that correspond to the health declaration required by the insurer at the time of purchase.

⁸15% of respondents have either an individual contract or an optional employer-sponsored contract.

⁹Survey of Health Ageing and Retirement in Europe.

Table 2.2: Descriptive statistics

	Mean	sd
Demographics variables		
Age	60.316	7.802
<i>Age groups</i>		
48-59	0.487	0.500
60-69	0.367	0.482
70-79	0.146	0.353
Female	0.514	0.500
<i>Occupation</i>		
Farmer	0.008	0.091
Craftsman/Merchant/business manager	0.020	0.141
Liberal profession/manager	0.085	0.279
Intermediate profession	0.123	0.329
Employee	0.154	0.361
Worker	0.115	0.319
Retired	0.396	0.489
Don't know	0.099	0.298
<i>Residence area</i>		
Paris region	0.158	0.364
West/west Paris basin	0.235	0.424
North/East/Paris Basin East	0.236	0.425
Southwest	0.115	0.319
Southeast/Mediterranean	0.257	0.437
In couple	0.654	0.476
Number of children	1.719	1.248
Substitutes to an insurance		
Count on children's resources if dependent	0.049	0.217
Count on public aid if dependent	0.365	0.482
<i>Family structures</i>		
With spouse; without children	0.061	0.239
With spouse; one child	0.133	0.340
With spouse; two children or more	0.457	0.498
Without spouse; without children	0.154	0.361
Without spouse; one child	0.057	0.231
Without spouse; two children or more	0.138	0.345
<i>Annual income</i>		
0; 8 000	0.174	0.379
8 000; 20 000	0.384	0.486
20 000; 30 000	0.251	0.434
30 000; and more	0.183	0.386
Don't now	0.009	0.094
<i>Global wealth</i>		
Less than 8 000; 149 999	0.297	0.457
150 000; 299 999	0.287	0.452
300 000; and more	0.315	0.465
Don't know	0.101	0.302

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	Mean	sd
Individual preferences		
Risk aversion score	6.250	1.278
Preference for the present score	4.333	1.221
U_{12} score	0.468	0.499
Dependency risk		
<i>Current info on dependency risk</i>		
Physical limitations	0.354	0.478
Poor self-assessed health	0.123	0.329
Knows a close elderly dependent person	0.505	0.500
<i>Expectations on dependency risk</i>		
Need help for housework at 80	0.204	0.403
Need help for personal care at 80	0.064	0.245
Need help to manage budget at 80	0.059	0.235
Need help for monitoring at 80	0.035	0.184
Subjective probability of being alive at age 80	0.562	0.272
Subjective probability of being dependent at age 80 (P_80)	0.310	0.243
Subjective P_80 with context information	0.273	0.232
Subjective P_80 without context information	0.348	0.248
Insurance coverage		
Demand for LTCI	0.155	0.362
Own an individual contract	0.123	0.329
Has been rejected by an insurer	0.032	0.176
Medical questionnaire		
Long-term illness (LTI)	0.434	0.496
Being covered for LTI	0.313	0.464
Received disability pension	0.075	0.264
Received an old-age pension	0.026	0.158
Followed for neurological condition	0.325	0.468
Hospitalized for more than 7 days	0.143	0.350
Sick leave for more than 3 months	0.097	0.296
Medication for more than 1 month	0.600	0.490

Sources: Author's calculation from Pater/Elders data, wave 2.

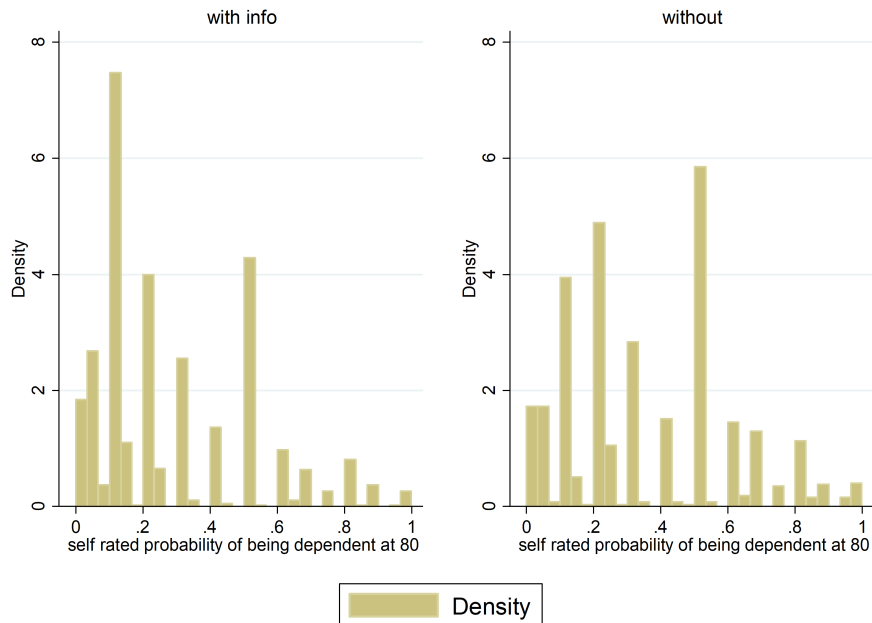
3.3 The elicited dependency risk

We use the subjective probability of dependency, as an indicator of the probability of risk realization. This variable is relevant for several reasons. First, it does not focus on entering nursing homes as other studies do. This is important for France, where the elderly prefer to stay at home even if they are dependent, and where insurance benefits are cash payments that can be used both to enter a nursing home or for covering formal care at home. There is now a growing literature focusing on elicited individual expectations ([Manski \[2004\]](#) ; [Hurd \[2009\]](#), [Delavande and Rohwedder \[2011\]](#)). The available results show that using individual expectations can be more relevant than the rational expectation hypothesis. In particular,

individuals use private information that can be more accurate than predictions based on life tables [Dormont et al., 2018]. Many studies show that expectations were closely correlated with outcomes observed hereafter (Hurd [2009], Delavande and Rohwedder [2011]). We find that our proxy is strongly correlated with the health variables in our survey, showing that individuals rely on their present health status to build their beliefs about future.

Figure 2.2 displays the distribution of elicited probability of dependency in the future P_{80} . A significant proportion of respondents, that is 50.6% had the following information before questions on dependency: "*according to experts, the risk of being dependent at 80 is on average equal to 10%. However, the dependency risk varies considerably across individuals, given their life style, current and past health status, etc.*" So, in all our empirical investigations, we deal with the fact that some individuals answered the question with this informational framework. The distributions shown in Figure 2.2 distinguish between respondents with (left panel) or without (right panel) informational framework. There is an accumulation of answers at 50%, but there are also a lot of answers lower than 50%: the focal point problem appears to be very limited, if we compare it to the probabilities elicited in HRS (see Hendren [2013] for example).

Figure 2.2: Subjective probability of being dependent at 80

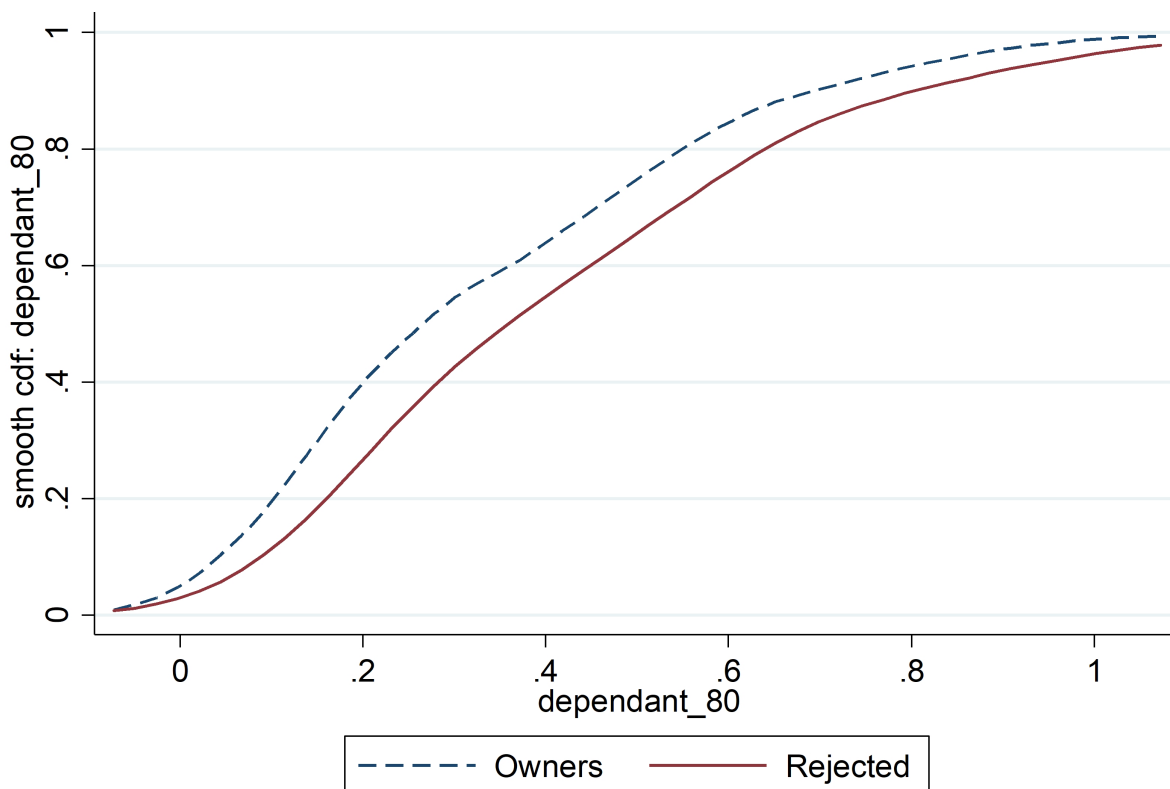


Sources: Author's calculation from Pater/Elders data, wave 2.

4 Adverse selection and selection in LTCI market: descriptive analysis

Our data enable us to observe adverse selection and selection in the French LTCI market. Among people who applied for LTCI, the average subjective probability of being dependent at 80 is significantly higher among individuals who were rejected: 40.3% instead of 32.9% (see table 2.6 in the appendix). To go further, we can compare cumulative distributions of subjective dependency probabilities for people who accepted with people who were rejected. Figure 2.3 displays cumulative distributions of P_{80} for the two subpopulations. We observe clearly a stochastic dominance of order 1, i.e, for any level of subjective risk π , there is always a higher proportion of people among the rejected who have a higher risk than π , in comparison with the proportion of insurance holders (accepted people) who have a higher risk than π . Note that P_{80} is private information not observed by insurers. This result shows that the process of selection succeed in identifying higher risks, as measured by applicants' beliefs.

Figure 2.3: Cumulative distribution function



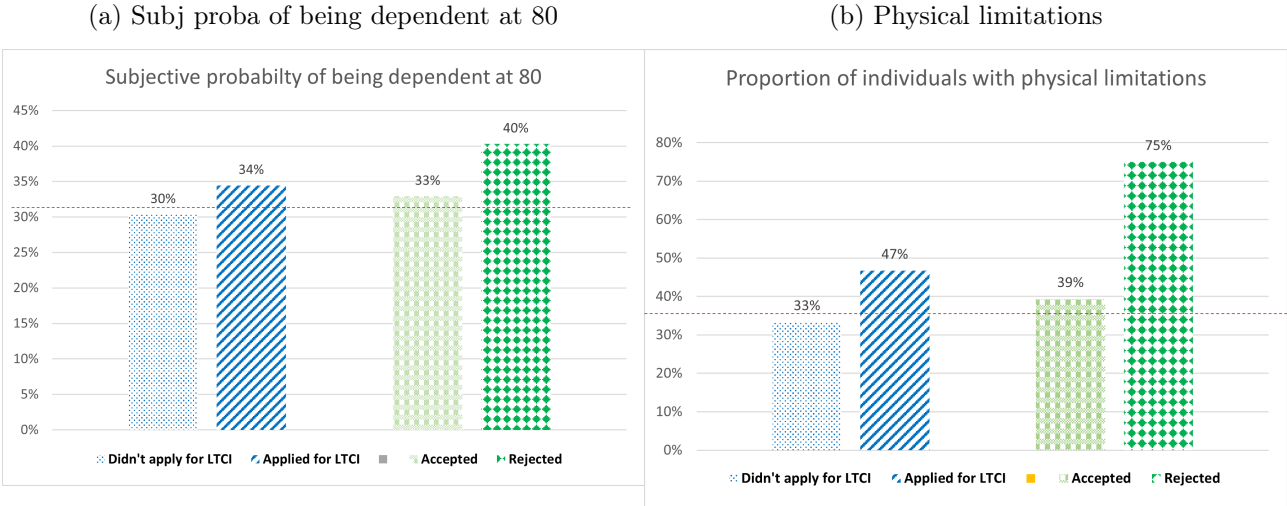
Sources: Author's calculation from Pater/Elders data, wave 2.

Figures 2.4 and 2.5 show the average levels of the subjective dependency risk (private information), the proportion of people who report poor health status or physical limitations (private information) and the proportion of people with long term illness (information known by the insurer through the questionnaire). The means are computed for the whole sample (see the red horizontal line in graphs), and separately for people who applied (versus didn't apply) for LTCI. Among applicants, we compute the means separately for people who were accepted and those who were rejected.

The blue bars in the graphs show clearly that the demand for insurance is increasing with the subjective risk level (Figure 2.4a), with physical limitations (Figures 2.4b), with poor self-assessed health (Figure 2.5a) and the fact of being affected by a long term illness (Figure 2.5b). This suggests that adverse selection affects demand for insurance: bad risk are more likely to try to purchase insurance.

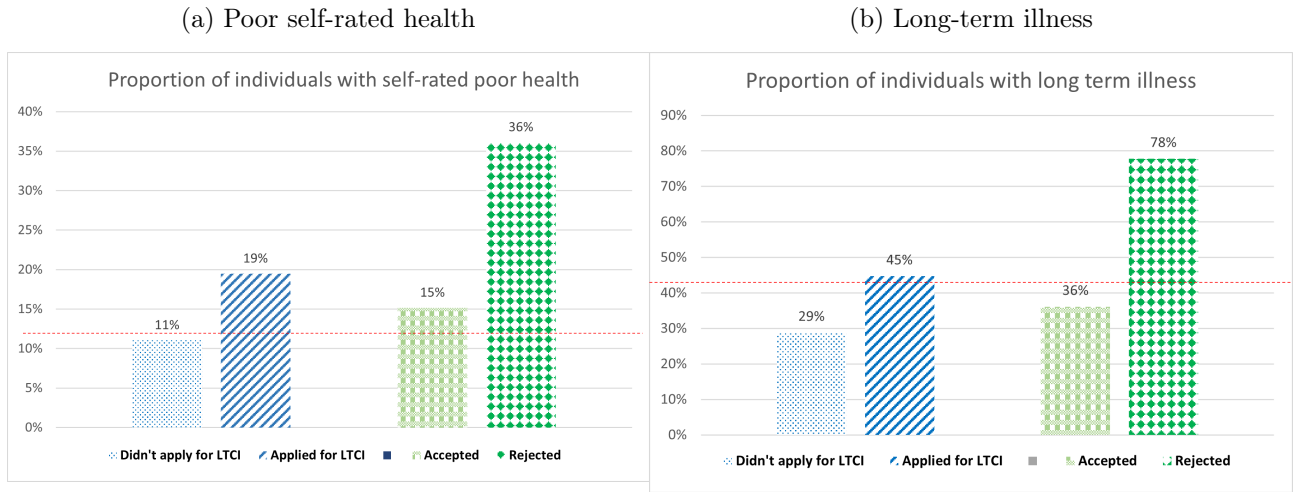
The green bars in Figures 2.4a-b and 2.5a-b compare applicants according to whether they have been accepted or rejected. It illustrates clearly the outcome of the selection process: the average values of accepted individuals are put back to the average level in the sample, while we observe a high level of subjective dependency risk among rejected, as well as very high proportion of people with poor self-assessed health, physical limitations and long term illness.

Figure 2.4: Selection in the LTCI market



Sources: Author's calculation from Pater/Elders data, wave 2.

Figure 2.5: Selection in the LTCI market



Sources: Author's calculation from Pater/Elders data, wave 2.

5 Econometric analysis of the demand for LTCI

We estimate two specifications explaining (2.1) the demand for LTCI, (2.2) the ownership of a long-term care insurance policy. Table 2.3 displays the marginal effects obtained with a probit estimator. The explanatory variables are grouped into five categories: socio-demographic variables, substitutes to insurance, individual preferences (risk aversion, preference for present, etc.), private information on risk, denoted PIR , which entails (beliefs about risk of future dependency and private information on current health and dependency in the family), answers to questions similar to a medical questionnaire, denoted Q , which correspond to the information observable by the insurer in case of application. We estimated two versions of equations explaining demand and ownership of insurance, with or without variables Q , i.e with or without the information available to the insurer through the questionnaire.

For individual i the specifications are the following, where $F(\cdot)$ denotes the standard normal distribution function:

$$\Pr \{LTCI_Demand_i = 1\} = F(\alpha_1 Demo_i + \beta_1 Subst_i + \gamma_1 Pref_i + \omega_1 PIR_i + \kappa_1 Q_i) \quad (2.1)$$

$$\Pr \{LTCI_Ownership_i = 1\} = F(\alpha_2 Demo_i + \beta_2 Subst_i + \gamma_2 Pref_i + \omega_2 PIR_i + \kappa_2 Q_i) \quad (2.2)$$

5.1 Results

Table 2.3: Demand and ownership of a LTCI contract

Dependent variables	Demand for LTCI		Ownership	
	(1)	(2)	(3)	(4)
Demographic factors				
<i>Age</i>				
48-59	ref	ref	ref	ref
60-69	-0.013 (0.022)	-0.014 (0.022)	-0.011 (0.020)	-0.012 (0.020)
70-79	0.004 (0.030)	0.003 (0.030)	0.009 (0.028)	0.008 (0.028)
Female	-0.013 (0.017)	-0.004 (0.017)	-0.006 (0.015)	-0.005 (0.015)
<i>Occupation</i>				
Farmer	0.192* (0.108)	0.203* (0.110)	0.082 (0.092)	0.089 (0.095)
Craftsman/trader/business manager	0.016 (0.051)	0.017 (0.051)	-0.045 (0.039)	-0.048 (0.038)
Liberal profession/manager	0.055 (0.035)	0.059* (0.035)	0.020 (0.032)	0.020 (0.032)
Intermediate profession	0.012 (0.027)	0.014 (0.028)	-0.006 (0.025)	-0.008 (0.026)
Employee	0.017 (0.026)	0.016 (0.027)	-0.011 (0.025)	-0.012 (0.025)
Worker	ref	ref	ref	ref
Retiree	0.109*** (0.029)	0.106*** (0.029)	0.075*** (0.028)	0.073*** (0.029)
Don't know	0.035 (0.031)	0.009 (0.029)	0.003 (0.029)	-0.001 (0.029)
<i>Residence area</i>				
Paris region	ref	ref	ref	ref
West/west Paris basin	0.061** (0.024)	0.058** (0.023)	0.054*** (0.021)	0.052** (0.021)
North/East/Paris Basin East	0.041* (0.023)	0.044* (0.023)	0.050** (0.021)	0.049** (0.021)
Southwest	0.032 (0.027)	0.029 (0.027)	0.028 (0.025)	0.025 (0.025)
Southeast/Mediterranean	0.042* (0.023)	0.038* (0.022)	0.037* (0.020)	0.034* (0.020)
Substitutes to an insurance				
<i>Family structures</i>				
with spouse without children	-0.003 (0.039)	-0.001 (0.038)	0.010 (0.038)	0.009 (0.038)

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Dependent variables	Demand for LTCI		Ownership	
	(1)	(2)	(3)	(4)
with spouse; one child	-0.022 (0.029)	-0.020 (0.029)	-0.026 (0.027)	-0.027 (0.027)
with spouse; two children or more	-0.015 (0.024)	-0.009 (0.024)	-0.019 (0.023)	-0.021 (0.023)
without spouse without children	ref	ref	ref	ref
without spouse; one child	-0.053 (0.034)	-0.054 (0.034)	-0.050 (0.032)	-0.052 (0.032)
with spouse; two children or more	-0.001 (0.030)	0.000 (0.029)	-0.022 (0.027)	-0.023 (0.027)
<i>Global wealth</i>				
Less than 8 000; 149 999	0.032 (0.022)	0.030 (0.022)	0.013 (0.020)	0.013 (0.020)
150 000; 299 999	-0.002 (0.019)	-0.003 (0.019)	0.001 (0.017)	0.000 (0.017)
300 000; and more	ref	ref	ref	ref
Don't know	0.077** (0.033)	0.069** (0.032)	0.056* (0.030)	0.053* (0.030)
<i>Annual income</i>				
0; 11 999	-0.038 (0.023)	-0.045* (0.023)	-0.030 (0.021)	-0.030 (0.021)
12 000; 19.999	-0.014 (0.022)	-0.016 (0.022)	-0.007 (0.020)	-0.007 (0.020)
20 000; 29 999	ref	ref	ref	ref
30 000; and more	-0.029 (0.025)	-0.029 (0.025)	-0.034 (0.022)	-0.033 (0.022)
Don't know	0.047 (0.087)	0.055 (0.087)	-0.004 (0.071)	-0.005 (0.070)
Count on children's resources if dependent	0.082*** (0.031)	0.079** (0.031)	0.069** (0.029)	0.073** (0.029)
Count on public aid if dependent	-0.031* (0.016)	-0.038** (0.016)	-0.036** (0.015)	-0.037** (0.015)
Individual preferences				
Risk aversion score	0.024*** (0.007)	0.022*** (0.006)	0.024*** (0.006)	0.023*** (0.006)
Preference for the present score	-0.014** (0.007)	-0.016** (0.007)	-0.013** (0.006)	-0.013** (0.006)
Marginal utility of income dependent on health (U_{12})	-0.035** (0.015)	-0.034** (0.015)	-0.026* (0.014)	-0.026* (0.014)
Private information on dependency risk				
<i>Expectations on dependency risk</i>				
Subjective P_80 with context information	0.045 (0.049)	0.039 (0.049)	0.063 (0.046)	0.060 (0.045)
Subjective P_80 without context information	0.095** (0.044)	0.089** (0.044)	0.050 (0.040)	0.053 (0.040)
Context information on subj P_80	0.017 (0.025)	0.016 (0.025)	0.006 (0.023)	0.007 (0.023)

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Dependent variables	Demand for LTCI		Ownership	
	(1)	(2)	(3)	(4)
Subjective probability of being alive at age 80	0.009 (0.030)	0.006 (0.030)	0.003 (0.028)	0.000 (0.027)
Need help for housework at 80	0.050** (0.021)	0.043** (0.021)	0.034* (0.020)	0.036* (0.020)
Need help for personal care at 80	-0.055 (0.038)	-0.057 (0.038)	-0.040 (0.036)	-0.041 (0.036)
Need help to manage budget at 80	-0.051 (0.045)	-0.047 (0.045)	-0.031 (0.043)	-0.032 (0.043)
Need help for monitoring at 80	0.126** (0.052)	0.118** (0.051)	0.057 (0.050)	0.053 (0.051)
<i>Current info about dependency risk</i>				
Knows a close elderly dependent person	0.029* (0.015)	0.031** (0.015)	0.021 (0.014)	0.021 (0.014)
Physical limitations	0.035** (0.017)	0.017 (0.019)	-0.000 (0.016)	0.011 (0.018)
Poor self-assessed health	0.064*** (0.024)	0.044* (0.025)	0.029 (0.023)	0.039 (0.024)
Medical questionnaire				
Being covered for LTI		0.045** (0.020)		0.020 (0.019)
Long-term illness		-0.015 (0.020)		-0.032* (0.019)
Received disability pension		0.105*** (0.031)		0.021 (0.031)
Received an old-age pension		0.010 (0.045)		-0.012 (0.046)
Followed for neurological cond't		0.002 (0.019)		-0.016 (0.018)
Hospitalized for more than 7 days		-0.001 (0.023)		-0.011 (0.022)
Sick leave for more than 3 months		-0.017 (0.027)		-0.025 (0.027)
Medication for more than 1 month		-0.003 (0.020)		0.008 (0.018)
N	2199	2199	2199	2199
Adjusted R ²	0.077	0.0884	0.0672	0.0711
p-value Wald test Private Info on Risk (PIR)=0	0.0000	0.0047	0.1674	0.0983
p-value Wald test Insurer information Q=0	-	0.0040	-	0.4941

Sources: Author's calculation from Pater/Elders data, wave 2.

Table 2.3 presents the marginal effects resulting from probit estimations of equations (2.1) and (2.2). The dependent variable in columns (1-2) is equal to one if the individual has applied for an insurance contract; and in columns (3-4) the dependent variable is equal to one if the individual holds a contract on an individual basis. Standard errors are in parentheses. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The results show that low income people are less likely to demand LTCI. We find that the demand for LTCI is significantly increasing with risk aversion and decreasing with preference for the present and u_{12} . These signs are in accordance with theoretical predictions regarding the influence of psychological traits on the demand for insurance.

Turning to the question of adverse selection, we find that a higher risk of dependency influences positively the insurance demand (Table 2.3, column 1 and 2). This is true as regards private information on dependency risk (PIR): having a high subjective probability of dependency, poor self-assessed health or physical limitations, having a member of the family affected by dependency, and expecting the need for help at 80 encourage the demand for LTCI. This is also true regarding information on risk that the insurer can collect through a questionnaire: being covered for a chronic disease or receiving a disability pension encourage insurance purchase.

At the bottom of Table 2.3 we give the p-values of the Wald test for significance of private information on dependency risk ($H_0 : PIR = 0$) and the p-value of the Wald test for significance of potential insurer information on dependency risk ($H_0 : Q = 0$). When Q is not introduced in the estimated equation (column 1), the Wald test leads to the rejection of the null hypothesis: this confirms the significant influence of private information on risk on the demand for insurance. When the insurer information is included into the specification, when find that Q is significantly different from 0, and we find again that $PIR \neq 0$. So, there is adverse selection as concerns insurance demand. Interestingly, PIR is still significant when we control for insurer information. So, the information that can be extracted by the questionnaire (Q) is not equal to private information, the latter remaining significant in the specification with Q .

Columns 3 and 4 of Table 2.3 give the estimation of the equation explaining insurance ownership. The explanatory variables are the same. The difference is that the process of risk selection performed by insurers has determined ownership among the applicants. We study here the probability to hold a LTCI contract (as do by researchers working on HRS). Looking directly at the bottom of Table 2.3, we find that PIR is no longer significant in column 3. This is also true in column 4, where PIR and Q are non significant.

The interpretation is clear. There is adverse selection as concerns demand for LTCI. When focusing on insurance holders, we observe that risk selection by insurers succeeded in eliminating high risks. As a consequence, there is no adverse selection on insurance

holders. These results give empirical support to Hendren’s interpretation of the reason why there is no adverse selection among insurance holders.

5.2 Risk perception and risk aversion

We have found that a high risk aversion and a high subjective dependency risk P_{80} influence positively the demand for LTCI. This is in accordance with theoretical prediction. If, in addition, risk aversion is negatively correlated with the risk level, this could support FMG interpretation of a lack of adverse selection among insurance holders.

We find this negative and significant correlation, equal to -0.134 for applicant.

However, the correlation is not large enough to change the previous conclusion, namely that it is selection that eliminates adverse selection.

6 Econometric analysis of risk selection

To estimate the probability of being rejected, we consider only variables that correspond to the information available to insurers: age, gender, occupation and residence area, as well as answers to the medical questionnaire. We first use a heckprobit estimator, where the likelihood incorporates the possible correlation ρ between the disturbance of the decision to apply for insurance and the disturbance of the rejection model. Results are given in Table 2.4. The heckprobit estimates (column 1) allow us to conclude that ρ is not significant. Hence the decision to apply for insurance and the probability to be rejected are independent processes, conditional on the explanatory variables.

So, we consider a simple probit model where the probability of being rejected is explained by the information available to insurers regarding applicant i , denoted X_i . The answers to the questionnaire Q_i are included in X_i . We get:

$$Pr \{rejection_i = 1\} = F(a.X_i) \tag{2.3}$$

6.1 The rejection decision

Table 2.4: LTCI rejection

Dependent variable =1 if the respondent has been rejected by an insurer	Heckprobit (1)	Probit (2)	Probit (3)	Probit (4)
Demographic factors				
<i>Age</i>				
48-59	ref	ref	ref	ref
60-69	0.140 (0.22)	0.021 (0.05)	0.019 (0.05)	0.013 (0.06)
70-79	0.047 (0.29)	0.017 (0.06)	-0.013 (0.06)	-0.037 (0.07)
Female	-0.098 (0.17)	-0.015 (0.04)	-0.011 (0.04)	-0.053 (0.04)
In couple	-0.188 (0.17)	-0.036 (0.04)	-0.043 (0.04)	-0.070 (0.04)
<i>Occupation</i>				
Farmer	0.770 (0.78)	0.209 (0.15)	0.201 (0.13)	0.170 (0.16)
Craftsman/trader/business manager	2.328** (1.01)	0.629*** (0.22)	0.626*** (0.23)	0.538** (0.23)
Liberal profession/manager	0.806 (0.54)	0.179** (0.08)	0.187** (0.07)	0.158* (0.08)
Intermediate profession	0.761 (0.53)	0.150* (0.09)	0.167* (0.09)	0.101 (0.08)
Employee	0.931* (0.51)	0.195** (0.08)	0.189** (0.08)	0.173** (0.09)
Worker	ref	ref	ref	ref
Retired	0.449 (0.53)	0.115* (0.06)	0.127** (0.06)	0.108* (0.06)
Don't know	0.492 (0.45)	0.085 (0.07)	0.096 (0.07)	0.195** (0.09)
Residence area				
Paris region	ref	ref	ref	ref
West/west Paris basin	-0.262 (0.25)	-0.039 (0.06)	-0.024 (0.06)	-0.043 (0.07)
North/East/Paris Basin East	-0.541** (0.27)	-0.100 (0.06)	-0.082 (0.06)	-0.123* (0.07)
Southwest	-0.296 (0.31)	-0.058 (0.07)	-0.021 (0.07)	-0.028 (0.09)
Southeast/Mediterranean	-0.099 (0.26)	-0.008 (0.07)	-0.004 (0.06)	-0.011 (0.07)

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Dependent variable	Heckprobit	Probit	Probit	Probit
=1 if the respondent has been rejected by an insurer	(1)	(2)	(3)	(4)
Medical questionnaire				
Being covered for LTI	0.243 (0.26)	0.069 (0.05)	0.074 (0.05)	
Long-term illness	0.780** (0.31)	0.184*** (0.05)	0.167*** (0.06)	
Received disability pension	0.531 (0.40)	0.166*** (0.05)	0.167*** (0.05)	
Received an old-age pension	0.128 (0.36)	0.030 (0.08)	0.021 (0.08)	
Followed for neurological cond't	0.283 (0.22)	0.078* (0.04)	0.078* (0.04)	
Hospitalized for more than 7 days	0.300 (0.21)	0.076* (0.04)	0.070 (0.04)	
Sick leave for more than 3 months	0.140 (0.25)	0.042 (0.05)	0.023 (0.06)	
Medication for more than 1 month	-0.427* (0.25)	-0.101** (0.05)	-0.102** (0.05)	
Private information on dependency risk				
<i>Expectations on dependency risk</i>				
Subjective P_80 with context information			-0.167 (0.11)	-0.159 (0.11)
Subjective P_80 without context information			0.063 (0.11)	0.078 (0.12)
Context information			0.025 (0.06)	0.024 (0.07)
Subjective probability of being alive at age 80			0.026 (0.07)	-0.008 (0.08)
Need help for housework at 80			-0.026 (0.05)	0.027 (0.05)
Need help for personal care at 80			0.013 (0.08)	-0.001 (0.08)
Need help to manage budget at 80			0.063 (0.09)	0.024 (0.09)
Need help for monitoring at 80			0.042 (0.09)	0.081 (0.10)

continued on next page →

Dependent variable	Heckprobit	Probit	Probit	Probit
=1 if the respondent has been rejected by an insurer	(1)	(2)	(3)	(4)
<i>Current info about dependency risk</i>				
Knows a close elderly dependent person			0.008 (0.04)	-0.016 (0.04)
Physical limitations			0.046 (0.05)	0.183*** (0.04)
Poor self-assessed health			0.003 (0.05)	0.106** (0.05)
rho	-0.5293	-	-	-
p-value	0.3239	-	-	-
Observation	2199	349	349	349
adj.R-squared	-	0.2746	0.2950	0.1677
p-value Wald test PIR=0	-	-	0.5825	0.0000
p-value Wald test Q=0	-	0.0000	0.0000	-

Sources: Author's calculation from Pater/Elders data, wave 2.

Table 3 presents the marginal effects resulting from heckprobit and probit estimations of equations (2.3). The dependent variable in this table is equal to one if the individual has been rejected by an insurer. Standard errors are in parentheses. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The estimates displayed in Table 2.4, column 2 show that the rejection decision is significantly based on the answers to the questionnaire: the p-value of the wald test for $Q = 0$ is lower than 10^{-4} . As a check, we add the individual's private information on dependency risk, which is not observed by the insurer, and find as expected that it is not significant (column 3: the p-value for $PIR = 0$ is equal to 0.5825). Otherwise, if we remove the answers to the medical questionnaire and add the individual's private information on dependency risk, we find that PIR is significant: in column 4, the p-value of the wald test for $PIR = 0$ is lower than 10^{-4} .

To sum up, the PIR is not observed by the insurer but is correlated to his or her assessment of risk computed on the basis of the answers to the questionnaire Q . Conditional on Q , the information provided by PIR is not significant: the information on risk that is orthogonal to Q is not observed by the insurer, and hence not used to decide rejection.

6.2 Who is rejected?

We have seen that among applicants people who are rejected are those with a higher subjective dependency risk, in poor self assessed health, with more physical limitations and affected by a chronic disease. As shown above the selection is based on variables X only, i.e the information available to insurers.

Denoting π_i the subjective probability of dependency at 80 (measured by P_{80}). This individual belief on dependency risk is based on the individual's information: one part is known by insurers (X_i), another part is private information and denoted Y_i : current self-assessed health, physical limitations, the fact that one family member or close relative is dependent. The subjective probability of dependency can be written:

$$\pi_i = X_i b + Y_i c + \xi_i , \quad (2.4)$$

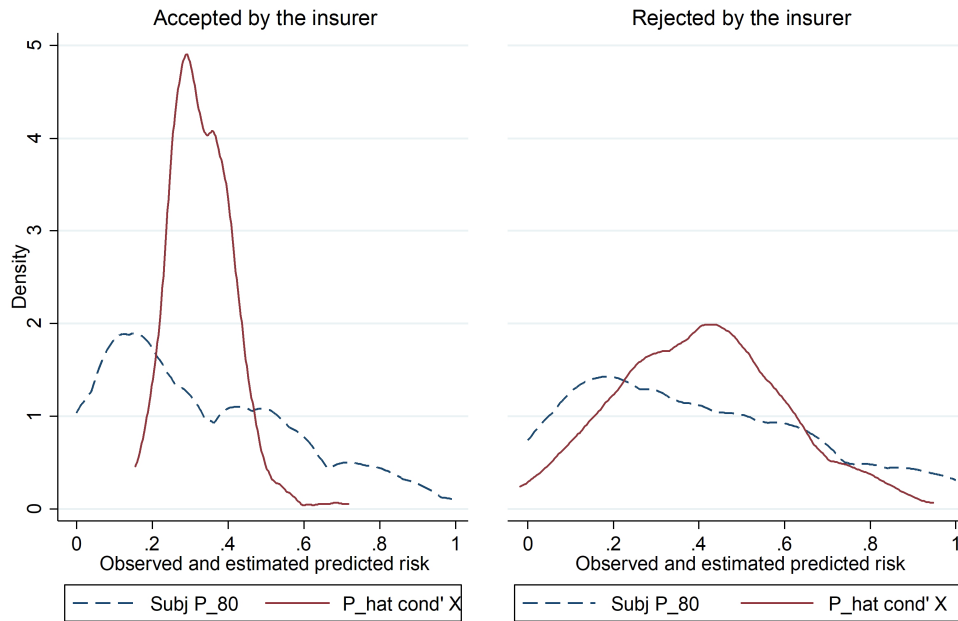
We suppose a simple linear and separable formula for simplicity. ξ_i stands for the individual way of using information X and Y to build the expectation of risk (pessimism, rationality, omitted variables relative to information that is relevant to predict dependency).

To decide selection, insurers use predictions of dependency risk based on correlations between X and realizations of dependency observed in the general population. We suppose that an approximation of these predictions can be given by the regression of π_i on X_i .

One has: $\pi_i = X_i \hat{d} + \hat{v}(Y_i c + \xi_i)$. We split π_i into two parts: $X_i \hat{d}$, the variability of π_i which is correlated to X_i , in other words, the prediction of π_i that can be deduced from a regression of π_i on X_i and $\hat{v}(Y_i c + \xi_i)$, which is the residual of the same regression, i.e the part of π_i which is orthogonal to X_i . In other words, $\hat{v}(Y_i c + \xi_i)$ represents the part of private information that is uncorrelated with the information available to insurers X_i .

Figure 2.6 gives the superimposed distributions of $X_i \hat{d}$ and π_i for the applicants that have been accepted on the left side, and for applicants that have been rejected on the right side.

Figure 2.6: Subjective $P_{.80}$ and predicted value conditional on X



Sources: Author's calculation from Pater/Elders data, wave 2.

The result is striking: the subjective probabilities of dependency π_i are much more correlated with X_i for the rejected than for the accepted. More exactly, the correlation between π_i and $X_i \hat{d}$ is equal to 0.336 for the applicants that have been accepted, and equal to 0.669 for rejected applicants.

The insurers do not observe π_i but use statistics computed on the population to predict the risk on the basis of X_i . Applicants who are rejected have a large variability of their subjective dependency probability π_i but this variability is correlated, and hence well predicted with X_i which is the information available to the insurer. The situation for applicants who are accepted is very different: for some of them the subjective probability of dependency π_i (which is on average weakly correlated with X_i) is not well predicted by the information available to insurers. Do they make mistakes in their expectations, with an overstatement as observed in chapter 1? Or do they have relevant private information that would be very useful for insurers, but cannot be used by them? More investigations are needed to better understand the relevance of actual selection decisions by insurers.

7 Conclusion

The purpose of this chapter is to analyse the demand for LTCI and the determinants of rejection. We examine if there is adverse selection in insurance demand (i.e if individuals with higher risk are more likely to demand LTCI), and if selection by insurers succeeds in eliminating adverse selection. Then we analyse the determinants of selection and the characteristics of people who are rejected.

We contribute to the literature on LTCI because our data enables us to provide a direct check of the interpretations proposed by [Hendren \[2013\]](#) versus FMG (2006) to explain the apparent lack of adverse selection among LTCI holders. Our results indicate that there is adverse selection on the demand for insurance; and that risk selection by insurers is effective in eliminating high risks. Therefore, there is no adverse selection on the insured: specifically, there is no greater proportion of high risks when comparing the insured and the uninsured. Finally, we find evidence that is consistent with the literature justifying insurance denials in the insurance market: the variability of subjective risk is much greater among denied individuals. We find that the questionnaire allows insurers to predict risk very well in individuals who are denied an insurance contract. On the other hand, the questionnaire does not predict well the subjective risks of accepted applicants, who have a non-negligible proportion of high risk that is totally ignored by insurers. It is difficult at this stage to know whether individuals wrongly overestimate their risk (the questionnaire would be right), or whether individuals have private information about their risk that is ignored by the questionnaire.

Appendix

Appendix A1

Table 2.5: Differences in means - Applied and Didn't apply

	All sample		Applied		Didn't apply		Difference
	mean	N	mean	N	mean	N	p-value
Subj proba of being dep' at 80 (P_80)	0.31	2252	0.34	349	0.30	1903	0.00
Unconditional P_80	0.16	2252	0.17	349	0.16	1903	0.08
Subj proba of being alive at 80	0.56	2252	0.54	349	0.56	1903	0.21
Need help for housework at 80	0.20	2252	0.27	349	0.19	1903	0.00
Need help for personal care at 80	0.06	2252	0.08	349	0.06	1903	0.12
Need help to manage budget at 80	0.06	2252	0.07	349	0.06	1903	0.38
Need help for monitoring at 80	0.04	2252	0.06	349	0.03	1903	0.00
Physical limitations	0.35	2230	0.47	349	0.33	1881	0.00
Poor self-assessed health	0.12	2252	0.19	349	0.11	1903	0.00
Being covered for LTI	0.31	2252	0.45	349	0.29	1903	0.00
Received disability pension	0.08	2252	0.15	349	0.06	1903	0.00
Long-term illness (LTI)	0.43	2252	0.53	349	0.42	1903	0.00
Risk aversion score	6.25	2252	6.55	349	6.19	1903	0.00
Preference for the present score	4.34	2252	4.16	349	4.38	1903	0.00

Sources: Author's calculation from Pater/Elders data, wave 2.

Appendix A2

Table 2.6: Differences in means - Rejected and Accepted

	Applied		Rejected		Accepted		Difference
	mean	N	mean	N	mean	N	pvalue
Subj proba of being dependent at 80 (P_80)	0.34	349	0.40	72	0.33	277	0.03
Unconditional P_80	0.17	349	0.19	72	0.17	277	0.48
Subj proba of being alive at 80	0.54	349	0.51	72	0.55	277	0.19
Need help for housework at 80	0.27	349	0.38	72	0.25	277	0.03
Need help for personal care at 80	0.08	349	0.14	72	0.07	277	0.05
Need help to manage budget at 80	0.07	349	0.11	72	0.06	277	0.11
Need help for monitoring at 80	0.06	349	0.13	72	0.05	277	0.02
Physical limitations	0.47	349	0.75	72	0.39	277	0.00
Poor self-assessed health	0.19	349	0.36	72	0.15	277	0.00
Being covered for LTI	0.45	349	0.78	72	0.36	277	0.00
Received disability pension	0.15	349	0.40	72	0.08	277	0.00
Long-term illness (LTI)	0.53	349	0.88	72	0.44	277	0.00
Risk aversion score	6.55	349	6.19	72	6.65	277	0.01
Preference for the present score	4.16	349	4.35	72	4.11	277	0.13

Sources: Author's calculation from Pater/Elders data, wave 2.

Appendix B: score of preference calculation

In the literature, the measurement of individuals' attitudes towards risk is generally done using lotteries such as Barsky et al. [1997]; Holt and Laury [2002], not to mention all of them; or risk scales à la Likert Dohmen et al. [2011]. The limitations of these approaches will not be revisited here. [Arrondel et al., 2004] propose a different methodology based on scoring, for which they have developed a survey since 1998 and tested the consistency and robustness of their measurements.

The data we use in this chapter draw on these surveys and, as mentioned earlier in the text, allow us to understand respondents' perceptions of the risk of dependency. This is one of the reasons why we apply this scoring methodology to our data. The method itself consists of three steps: (i) selection of questions for score calculation; (ii) coding of responses; and finally (iii) statistical validation and correction of "raw" scores.

The advantage of this method is that it aims at "profiling" the respondents according to their risk preference, their perception of the present, based on concrete issues - such as saving for retirement, or playing risky sports. The questions cover different areas of life: work, professional career, income; family and intergenerational transfers; investments and money management; retirement; consumption, leisure, travel; old-age dependency; society and politics; economic context.

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Chapter 3

Lapse behaviour in the private long-term care insurance market: evidence from France

Acknowledgements for this chapter

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1 Introduction

In France, the coverage of expenditures associated with loss of autonomy remains a major concern for public policy, as evidenced by various reports¹ produced on the subject over the past two years. This financing may be provided by the State², by the market (long-term care insurance, hereafter LTCI), by the family (informal care) or by the person concerned (savings, life insurance, etc.). Overall, the out-of-pocket expenses in the event of loss of autonomy, whether at home or in an institution, remain high, as shown by a recent study by DREES. According to [Boneschi and de L’Espinya \[2019\]](#) the average monthly out-of-pocket expenditure after APA and tax credit varies from 33 to 89 euros per month, depending on the level of disability. In nursing homes, the average out-of-pocket expenditure is 1,957 euros per month.

LTCI is very often evoked to protect against out-of-pocket expenditures. For this to be the case, the insured individuals would have to keep their contracts between the subscription and the realization of the risk. In this chapter, I am interested in the phenomenon of lapse in the LTCI market in France. This phenomenon is rather neglected in the literature even though it could be a threat to the development of this market. In France, the annual lapse rate in the LTCI market is around 14% [[Plisson, 2009](#)]. In a recent report, the Long-Term Care Valuation Work Group of the American Academy of Actuaries and the Society of Actuaries Research Institute found a termination rate of between 2 and 7 percent for policyholders over age 60, who have held their contracts for five years or less [[AAA and SOA, 2021](#)].

Elderly people can terminate their contracts or let them expire – stop paying insurance premiums – for several reasons [[Friedberg et al., 2017](#)]. The most common reason in the literature concerns financial reasons. This may be due to a change in financial circumstances (e.g., income shock, liquidity constraints), premiums that become more expensive, or a change in an individual’s spending priorities. Another reasons are related to risk reclassification.³ This concerns to the shift in risk that the insured perceives, for instance as a result of changes in their health or family situation. However, it is important to note the double penalty faced by individuals who cancel their contract: they do not only

¹Recently, the Vachey report on the autonomy branch [Vachey \[2020\]](#) and the Libault report [Libault \[2019\]](#), resulting from a major consultation on old age and autonomy, have helped to shed light on the public debate on the financing of the loss of autonomy in France.

²In France, the APA (allocation personnalisée d’autonomie) and the ASH (aide sociale à l’hébergement), administered by the regions, are the main forms of social assistance paid to the elderly.

³Risk reclassification in literature refers to the risk of becoming worse health risks over time.

lose the premiums they have paid so far but also bear a significant financial risk if they become dependent.

From a theoretical point of view, the decision to cancel or keep one's LTCI contract can be analyzed through the expected utility model [[Konetzka and Luo, 2011](#)]. Each time an agent has to renew his contract or terminate it, he compares the cost of the insurance premium and the expected utility of the insurance coverage. The expected utility of keeping one's contract is a function of the perceived probability of becoming dependent, the likelihood of needing formal assistance for long-term care, risk aversion, intra-family altruism (to leave an inheritance or to relieve caregivers). The decision to cancel the contract, on the other hand, indicates changes in various factors that occurred after the contract was taken out, such as a health shock or an income shock. These changes can modify the decision taken from the optimization computation because the terms of the computation (financial constraints, health) have changed.

This paper aims to understand the determinants of termination in the LTCI market in France and to examine the presence of adverse selection phenomena. For this purpose, I use data from waves 5 to 7 of the SHARE survey. I find that individuals who report an improvement in their health status have a significantly higher probability of canceling their LTCI contract. Furthermore, I find that individuals who have experienced negative asset shocks have a significantly higher probability of canceling. Finally, I show the presence of advantageous selection in this market since individuals who have terminated their contracts turn out to be in poorer health two or four years later than those who kept their contracts.

This paper is the first, to my knowledge, to look at the reasons for terminating a LTCI contract in the French case. In this sense, I contribute to the literature that tries to understand the reasons for the low development of the LTCI market (See [Brown and Finkelstein \[2009\]](#); [Grignon and Bernier \[2012\]](#); and more recently [Lambregts and Schut \[2020\]](#) for a systematic review. I also contribute to the literature that studies the presence of adverse selection in insurance markets ([Cohen and Siegelman \[2010\]](#); [Chiappori and Salanié \[2000\]](#)).

The remainder of this paper proceeds as follows. Section 2 provides some institutional background on cancellation conditions in private long-term care insurance in France, and gives an overview of the related literature. In section 3, I describe the data and outline the empirical approach. The results are discussed in section 4. The final section concludes.

2 Background

2.1 Lapse behaviour in the long-term care insurance market in France

LTCI offers financial benefits to insured persons who are medically recognized as suffering from loss of autonomy, enabling them to cover the costs of medical follow-up, home adaptation or even care in a nursing home. The French market is the second largest worldwide market (behind the United States market) with around 3 million policyholders. In France, LTCI offers a monthly lump sum payment, while in the US, policyholders receive the reimbursement of care and service costs up to a certain limit, with multiple options. Individual and employer-sponsored contracts are offered in both countries.

The purchase of a LTCI policy occurs several years before the risk arises. The conditions of subscription make it possible to subscribe from the age of 18. After the age of 75, it is generally no longer possible to subscribe. The insurer relies on the information about the state of health gathered by the medical advisor (medical questionnaire, medical examination) to accept, refuse the subscriber or propose to pay a premium surcharge. Any false declaration in the medical questionnaire will result in the nullity of the contract without reimbursement of the contributions paid.

The amount of the annuity chosen at subscription is not fixed: it will benefit from revaluations according to a certain rate and under the conditions decided by the insurer (revaluation at fixed dates, calculated with reference to an index such as AGIRC (Association Générale des Institutions de Retraite des Cadres), ARRCO (Association des Régimes de Retraite Complémentaire) points, the consumer price index, etc.). Likewise, the contracts plan for a change in the amount of contributions: if the insured refuses the increase in contributions, the pension may be reduced proportionally, or the contract may be terminated by the insurer. Some contracts consider possible financial difficulties of the insured. They then guarantee an indemnity calculated on the amounts paid out, even if the insured has stopped contributing. This is referred to as a reduction of benefits⁴.

Long-term care insurance is not a savings contract but a precautionary measure. Individuals pay monthly contributions, and the guarantees are activated only if, one day, the risk occurs, i.e a partial or total loss of autonomy is observed (depending on the level of dependency covered by the contract). Thus, this is a non-refundable contract: if the risk does not materialize, individuals will have paid irrecoverable premiums. The same applies

⁴Mise en réduction des garanties

if the policyholder (or the insurer) cancels the contract: he will not be able to ask for a refund of the contributions paid. The sums committed will be definitively lost. Likewise, the guarantees will logically end on the effective date of the cancellation. The individual will no longer be covered in case of loss of autonomy, unless he or she has contributed for a certain period⁵ and the reduction value is reached. Some LTCI contracts do include an option: the "anti-lost funds" benefit. It works relatively simply: if the insured dies before becoming dependent, a capital sum (calculated based on the contributions paid) will be granted to his or her relatives. Of course, this option has a significant cost which translates into higher premium.

Any covered person may decide to cancel his or her LTCI contract at any time. Several scenarios could lead to such a choice. The policyholder may find that premiums are more expensive than initially planned, and affect their budget significantly. The insurer has increased the premiums, and the insured refuses this re-calculation. The insured has found a cheaper contract elsewhere for an equivalent level of coverage⁶, or the insured has found a more generous for a similar price (higher level of annuity for the paid contribution, better assistance benefits, etc). It can also happen that the insured no longer wishes to be covered for dependency. Finally, the policy may be terminated because the insured has opted to take out a contract (e.g. life insurance) whose core benefit is not the risk of dependency.

2.2 Literature review

Only a few studies have investigated the issue of termination in the LTCI market. The absence of longitudinal data to address the issue has been one restriction.

Using U.S. data and based on the model of [Hendren \[2013\]](#), [Finkelstein et al. \[2005\]](#) find that respondents who report having had to let their contracts expire (or terminate their contracts) return to nursing home less often than others who would have kept their contracts. This is evidence of *ex post* adverse selection in this market. Indeed, the agents who cancel their contracts estimate, according to the authors' hypothesis, are at lower risk than at the time of purchase of the insurance. Five years later, those individuals are less likely to move to a retirement home.

[Cramer and Jensen \[2008\]](#) seek to understand the conditions that would lead an individual

⁵In France, it is necessary to have paid contributions for at least 8 years to be able to benefit from a reduction of the guarantees within the context of a long-term care insurance.

⁶The transferability of contracts only concerns group contracts.

to change his or her decision (insurance coverage) over time. Using Health and Retirement Survey (HRS) data from 2002-2004, they model consumer decisions to drop or renew an existing LTCI policy. They find that the price of the contract significantly explains the probability of terminating a contract, and that agents with new contracts are less inclined to let it expire. The financial aspect therefore appears to be the main reason for the duration of contracts.

[Konetzka and Luo \[2011\]](#) study the importance of health and wealth on the probability of terminating one's LTCI contract. Using HRS data, the authors find that individuals who terminate their contracts also have a greater need for long-term care. One of the interpretations given by the authors would be related to the fact that individuals made a mistake in purchasing this type of contract, or the decision to cancel would be the result of a reassessment of their budgetary constraints over time (in order to ensure contributions) or of the real value of the contract.

[Friedberg et al. \[2017\]](#) use changes in reported policy holding across waves to measure lapses from 2002 to 2006 in the Health and Retirement Study. They find that lapse rates are substantially higher among the cognitively impaired. This generates a pernicious form of dynamic advantageous selection, as the cognitively impaired are more likely to use care. [Li and Jensen \[2012\]](#) analyze how often and why individuals drop their LTCI coverage, using data from the 2002-2008 Health and Retirement Study. They find that the probability of LTCI lapse increases with a lack of consumer knowledge about their policy's benefit provisions, with less expensive policies, (i.e policies without inflation protection), and with less generous policies (i.e policies that limit coverage to in-home care only or nursing home care only).

3 Theoretical framework lapse behaviour

[Basu \[2016\]](#) proposed a theoretical framework to understand lapse decision regarding LTCI. According to a standard expected utility model for demand for health insurance, a policyholder of LTCI will make an optimal decision to renew or lapse the policy by comparing expected utility of retaining the LTCI policy against expected cost of the premium over the future years before needing care.

Consider that the individual has an income Y_t , and that he or she pays a premium P_t in case of LTCI subscription. If he or she becomes dependent in year $t + k$, he or she will have to pay for the associated cost of formal care C_{t+k} but will be covered by the

insurance, up to the amount of I_{t+k} . If the individual does not hold LTCI policy, the net income is Y_t instead of $Y_t - P_t$ before $t + k$, but in case of dependency he has to pay for the total cost of care i.e C_{t+k} , instead of $C_{t+k} - I_{t+k}$ so that his net income is lower in the state of dependency than if he were insured. Note that the cost of care C_{t+k} in the state of dependency can be lowered by the availability of informal care provided by members of the family.

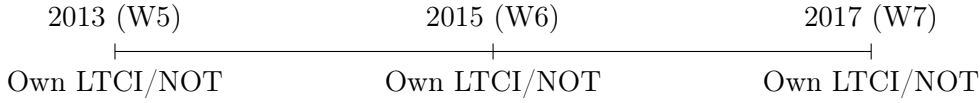
So, the decision to subscribe LTCI contract will be affected by these variables, level of income, costs of care (which depends on availability or not of informal care), premium level, benefit offered, probability of dependency in each year t , $t+1$, $t+2$, etc. Lapse behaviour can be understood as change in the decision after the year of subscription. This can be due to changes in the level of income, change in the level of health (if health improves, this decreases the probability of dependency), change of the availability of potential caregivers.

My prediction is that lapse should be positively affected by an improvement in health and the new availability of caregivers. Changes in wealth or income are anticipated to also have an impact on the likelihood of canceling LTCI. LTCI is purchased by people when they are still relatively young and have little financial responsibilities. After making payments for a while, if their family status changes, they may be forced to terminate their insurance due to additional costs and even cash flow issues. Sometimes the cancellation is simply due to the fact that they have accumulated information over the years about their probability of becoming dependent, and the economic calculation made at the time of subscription is no longer relevant.

4 Empirical approach

The empirical approach is a two-step process. First, I'm interested in the potential predictors of lapse decision. Then, I look at whether such a decision can lead to adverse or advantageous selection in this market. In a preliminary step, I test whether the factors influencing LTCI ownership are the same as those documented in the literature. The empirical analysis is based on the observation of insurance ownership across the three survey waves as shown in the figure [3.1](#) below.

Figure 3.1: LTCI ownership



Sources: Author's construction.

Then, I propose a model that explains the decision to lapse. The theoretical model predicts that lapse behaviour depends on health status changes, assets changes, and variation of informal care. The analysis here concerns individuals who were interviewed for at least two consecutive waves, and who have LTCI in the early wave.

Lapse is considered to be the fact of being insured in t , but no longer having LTCI in the next survey wave. In this case, I obtain:

$$Pr(Lapse_{i,t+2} = 1) = F(\beta_1 Year2017_t + \beta_2 \Delta X_{i,t} + \beta_3 \Delta Health_{i,t} + \beta_4 \Delta Finance_{i,t}) \quad t = 2015, 2017 \quad (3.1)$$

Where $\Delta X_{i,t}$ represents the changes of control variables across time. For each variable, I compute a categorical variable for whether the variables increase, decrease, or remain unchanged between two waves. $\Delta Health_{i,t}$ is a variable measuring changes in health status. It is a categorical variable depending on whether health status improves, remains unchanged, or deteriorates. Several indicators of change in health status such as self-reported health, the number of limitations with ADL, or the grip strength are integrated in the specification of the model to be estimated. $\Delta Finance_{i,t}$ is captured through changes in indicators (three categories for each indicator): annual household income and household real assets.

To examine whether the individual's prior conditions influence her probability of cancelling the contract, we estimate the following model, inspired by [Konetzka and Luo \[2011\]](#).

$$Pr(Lapse_{i,t+2} = 1) = F(\lambda_1 Year2017_t + \lambda_2 \Delta X_{i,t} + \lambda_3 \Delta Health_{i,t} + \lambda_4 \Delta Finance_{i,t} + \lambda_5 X_{i,t-1} + \lambda_6 Health_{i,t-1} + \lambda_7 Finance_{i,t-1}) \quad (3.2)$$

Indeed, an influence of baseline characteristics on lapse decision could reinforce possible selection mechanisms associated with lapse decision.

In a second step, I examine if lapse decision contributes to dynamic adverse selection by looking at cognitive function, mental health and physical health of individuals after two, four years. Adapting an approach from [Finkelstein et al. \[2005\]](#), the idea is to see whether individuals who have terminated their contracts are lower risks *ex-post* than those who have kept their policy. To make this possible, I regress different outcomes ($Proxy_DepRisk_{i,t+k}$) related to health in $t+k$, $k>0$ on lapse decision that occurred in t , controlling for age, gender, marital status and being retired.

$$Proxy_DepRisk_{i,t+k} = \tau_0 + \tau_1 Lapse_{i,t} + \tau_2 Control_{i,t} + \mu \quad k \in \{2; 4\} \quad (3.3)$$

5 Data

SHARE is a multi-disciplinary survey including people aged 50 and over, collected in 18 European countries and Israel. I use in this paper release 7.0.0 of waves 5, 6 and 7, which were collected respectively in 2013, 2015 and 2017. These are the three waves that include questions related to LTCI. The survey contains information on demographic aspects, physical health, behavioural risks, cognitive function, mental health, health care, household income, assets, activities, expectations, just to name a few. The data were collected using computer-assisted personal interviewing (CAPI). For more details on the sampling procedure, questionnaire contents and fieldwork methodology, readers should refer to [Börsch-Supan et al. \[2013\]](#).

5.1 Sample selection criteria

I use data from waves 5, 6 and 7 (respectively collected in 2013, 2015 and 2017) of the Share survey on France. Wave 7 is somewhat different from the other waves because its main goal was to collect information on the past and especially the childhood of the respondents as it was done with wave 3 of the Share survey (named Sharelife). This explains the low number of observations in 2017 compared to observations in previous waves. The three waves provide information on the respondents' insurance coverage with respect to the risk of dependency. In order to analyze the determinants of contract termination, I only include individuals who were surveyed in at least two consecutive waves and who had insurance coverage in the first wave. Individuals aged 85 and over (the average age of entry into long-term care) are also excluded because by definition lapse occurs before becoming dependent. Lapse after 85 is likely to be a wrong answer. In this sample, there

are 6 individuals aged more than 85 who would have terminated their contract between two survey waves.

5.2 Dependent variables

In all three waves of the survey, the following question is asked regarding coverage against the dependency risk: "*Do you have any of the following public or private long-term care insurances?*". Respondents can choose between the following response options: 1) Mandatory private (group, provided by your employer); 2) Voluntary / supplementary private; 3) None. In this chapter, I focus on people who report having voluntary or supplementary private LTCI, in the case of France. For obvious reasons, people who have mandatory insurance are excluded from the rest of the analysis. Over the three survey waves, almost 19% of individuals report holding LTCI on a voluntary basis. Table 3.1 reports the proportion of long-term care insurance ownership over the three waves.

Table 3.1: Proportion of individuals with LTCI

Year of interview	2013	2015	2017
Has a LTCI	512	665	230
Frequency	16.29	20.63	22.77
N	3,143	3,223	1,010

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

The longitudinal aspect of the data allows to build the variable of interest: the fact of having canceled or let LTCI contract expire. This concerns the cancellations of individuals who declare being insured in 2013 (296 + 216) and are no longer insured in 2015 (216 individuals), the same reasoning is made for the years 2015 and 2017.

Table 3.2 shows the transitions across waves. One observes that, among people who own a contract in 2013, 42.19% had their contract terminated in 2015. The corresponding proportion between 2015 and 2017 is 35.36%. Regarding new entries, one observes 13.80% [363/(363+2,268)] between 2013 and 2015; and 13.62% between 2015 and 2017. In the end, the proportion to lapse appears considerable in this sample, and much larger than the proportion of people entering the market for LTCI even though there has been an overall increase in the number of policyholders in this market⁷.

It should be noted that the survey does not provide information on the date the contract

⁷According to figures from France [France Assureurs \[2021\]](#), the number of LTCI contracts labeled GAD (Garantie Assurance Dépendance) has been steadily increasing since 2013. Note that these are general population statistics, as opposed to the sample in this chapter, which is cylindrical in order to have longitudinal data.

was purchased nor the date the contract was terminated. It is therefore not possible to know how long the respondents have been insured.

Table 3.2: Two-years transitions according to LTCI coverage

		2015			2017				
		LTCI	NO LTCI	Total					
2013	LTCI	296	216	509	2015	LTCI	117	64	181
	NO LTCI	363	2,268	2,631		NO LTCI	113	716	829

Sources: Author’s calculation from SHARE data, waves 5, 6 and 7.

To examine dynamic selection, I consider different indicators of cognitive, mental and physical health. I also use an indicator of individual well-being: the CASP⁸ (control, autonomy, self-realization and pleasure).

5.3 Explanatory variables

Variables that explain insurance ownership are presented in Table 4. The overall sample is made up of people with an average age of 69 years, who are mostly women in couples. 70% of respondents are retired. 88% report being physically active, while 18% have received help from a relative. People who think they are in fair or poor health represent respectively 14.7% and 44.1% of the sample. 86.3% of this sample was interviewed between 2013 and 2015. Variables measuring actual household income and assets were each divided into three classes to simplify the analysis.

Table 12 in the appendix shows the difference in mean between those who retain their contract and those who cancel it. The people who cancel their contracts are on average younger, with greater grip strength⁹. There are fewer retirees, and fewer women among those who lapse, compared to those who keep their contract. There are no differences in income between lapsers and non-lapsers. On the other hand, we observe that lapsers are less wealthy and more pessimistic than non-lapsers.

⁸CASP score (Control, Autonomy, Self-realization, and Pleasure scale) is one of the most common internationally used measures for quality of life in older adults. See [Amparo et al. \[2021\]](#) for more details.

⁹Grip strength quantifies the respondent’s maximum handgrip strength with the aid of a dynamometer. Using SHARE data, [Marques et al. \[2021\]](#) have shown that grip strength can be considered as an indicator and screening tool for depression.

Table 3.3: Summary statistics of the pooled sample

	mean	sd	min	max	count
Age	68.84	10.21	39	99	7380
<i>Age groups</i>					
Less than 55	0.0707	0.256	0	1	7380
55;64	0.337	0.473	0	1	7380
65;74	0.317	0.465	0	1	7380
75;84	0.200	0.400	0	1	7380
Female	0.578	0.494	0	1	7380
<i>Marital status</i>					
In couple	0.649	0.477	0	1	7380
Single	0.0752	0.264	0	1	7380
Divorced	0.0955	0.294	0	1	7380
Widowed	0.181	0.385	0	1	7380
Retired	0.707	0.455	0	1	7380
<i>Self-assessed health</i>					
Excellent	0.0594	0.236	0	1	7378
Very good	0.147	0.355	0	1	7378
Good	0.442	0.497	0	1	7378
Fair	0.251	0.434	0	1	7378
Poor	0.101	0.301	0	1	7378
=1 if receives help from others	0.181	0.385	0	1	7380
# of caregivers	0.261	0.626	0	3	7380
# of ADL limitations	0.237	0.786	0	6	7379
Chronic bis	0.789	0.408	0	1	7380
Number of chronic diseases	1.739	1.493	0	10	7380
Max. of grip strength measure	32.06	11.25	1	83	7066
Physical activity	0.887	0.317	0	1	7380
Overweight or Obese	0.582	0.493	0	1	7380
<i>Household income</i>					
Low income	0.283	0.450	0	1	7380
Middle income	0.296	0.457	0	1	7380
High income	0.290	0.454	0	1	7380
<i>Household real assets^a (hrass)</i>					
Low hrass	0.266	0.442	0	1	7380
Middle hrass	0.243	0.429	0	1	7380
High hrass	0.241	0.428	0	1	7380
Pessimism (part of EURO-D)	0.219	0.414	0	1	7299

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	mean	sd	min	max	count
<i>Interview year</i>					
2013	0.426	0.495	0	1	7380
2015	0.437	0.496	0	1	7380
2017	0.137	0.344	0	1	7380
<i>LTCI coverage</i>					
LTCI private mandatory	0.0366	0.188	0	1	7376
LTCI private voluntary	0.191	0.393	0	1	7376

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Notes: Summary statistics on pooled data from the three survey waves.

^a In SHARE, household real assets (*hrass*) is calculated as follows: $home \times perho/100 + vbus * \times sbus/100 + car + ores - mort$ where *home*: value of the home residence; *perho*: percentage of house owned; *vbus*: value of own business; *sbus*: share of own business; *car*: value of cars; *ores*: value of other real estate -amount-; *mort*: mortgage on main residence.

5.3.0.1 Dynamic predictors In principle decision to lapse is determined by changes in variables that have influenced the decision to subscribe a contract covering long-term care.

Variables of interest in this regard are changes in health status and changes in income level and assets, as well as changes in the availability of possible informal caregivers. Information on changes in other regressors are presented in the appendix (Table 3.12).

For each variable measuring health status (SAH, limitations with ADL, grip strength), I coded changes into 3 groups: improvement, no change, deterioration. I also consider the onset of a new chronic disease, new physical activity and of overweight/obese. Changes in household income and real assets are also specified with three-category variables corresponding to improvement /status quo /deterioration.

In table 3.4, those who report a better health status are more likely to terminate their contract: 25% versus 18%. Those who report less household real assets are more likely to drop their contract, compared to those who keep it: 20% versus 15%. There is no significant difference in income decline between lapsers and non-lapsers as can be seen in Appendix Table 3.12.

Table 3.4: Delta SAH and delta household assets by Lapse

Delta Household real				Delta Self-assessed			
assets (hrass)	Keep	Drop	Total	health (SAH)	Keep	Drop	Total
Less hrass	14.89	19.85	16.93	Improved SAH	18.35	25.19	21.16
Unchanged hrass	66.22	60.69	63.95	Unchanged SAH	55.32	53.05	54.39
More hrass	18.88	19.47	19.12	Worsened SAH	26.33	21.76	24.45
Total (Obs)	376	262	638	Total (Obs)	376	262	638

Sources: Author’s calculation from SHARE data, waves 5, 6 and 7.

6 Estimation results

Before examining the lapse behaviour, I have checked that determinants currently observed in the literature regarding LTCI possession are similar these data from SHARE. Table 3.13 in the appendix presents the estimation results for the LTCI take-up using a linear probability model and a probit model. The sample construction is shown in Table 3.10 in the Appendix.

I find that age, being a woman, being retired and being widowed are associated with a higher probability of holding a LTCI policy. People in the low-income class compared to those in middle-income class, are associated with a significantly lower probability of having long-term care insurance. Households with high net assets tend to be less likely than households with middle-class assets. Self-assessed health (SAH) does not influence the chances of having a LTCI policy. On the other hand, individuals who report at least one chronic condition tend to have more LTCI.

These results are consistent with the literature on LTCI ownership. I find a negative association between income and insurance ownership suggesting as Lambregts and Schut [2020] point out that income initially enables purchase of LTCI, but above a certain income level people rely more on self-insurance. As in Chapter 2 of this thesis, I find that self-reported health does not influence LTCI ownership. A plausible explanation can be related to the medical selection made by insurers, although having a chronic condition influence here positively the insurance ownership.

6.1 Determinants of lapse behaviour

Table 3.5 presents the estimation results of equations (3.1) using a linear probability model and a probit model. The sample construction for the regressions in equations (3.1) and (3.2) selects people who hold initially an insurance contract. The criteria used for observation selection are shown in Table 3.10 in the Appendix.

Estimates reported in table 3.5 refer to the specification where lapse decision is explained only by changes over time (between two waves) in several variables related to health, income and assets. The main result is that only three variables are significant, and only weakly significant (greater than 5% and under 10%). Changes in self-reported health status, income, or net assets do not influence the probability to lapse.

People who start receiving help (while when not receiving help at the previous wave) have a higher propensity to lapse suggesting that the arrival of substitutes for formal care triggers lapsing, but this result is not significant. Otherwise, individuals who report fewer ADL limitations have a lower probability of terminating than individuals whose number of ADL limitations did not change between two survey waves (p-value=0.070), which is a counterintuitive result. Conversely, falling into overweight/obese limits the propensity to lapse, which is in line with my theoretical predictions.

Table 3.5: Determinants of lapse behaviour

	Dependent variable: =1 if individual cancels LTCI policy	
	LPM (1)	Probit (2)
Delta Age	0.0751 (0.060)	0.0736 (0.059)
New couple/Single	-0.144 (0.189)	-0.166 (0.209)
Unchanged	ref	ref
Separated	-0.0485 (0.131)	-0.0478 (0.127)
Newly retired	-0.0289 (0.074)	-0.0301 (0.073)
New help receiver	0.0922 (0.060)	0.0909 (0.058)

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	LPM	Probit
	(1)	(2)
Improved SAH	0.0724 (0.053)	0.0716 (0.052)
Unchanged SAH	ref	ref
Worsened SAH	-0.0409 (0.050)	-0.0397 (0.049)
Less ADL limitations	-0.155* (0.082)	-0.153* (0.078)
Unchanged ADL lim	ref	ref
More ADL lim	0.0440 (0.083)	0.0424 (0.081)
New chronic disease	-0.0226 (0.077)	-0.0217 (0.074)
Lower grip strength	-0.0453 (0.068)	-0.0450 (0.068)
Unchanged grip strength	ref	ref
Higher grip strength	-0.0804 (0.069)	-0.0797 (0.068)
New physical activity	0.0703 (0.120)	0.0699 (0.114)
New Overweight/Obese	-0.179** (0.083)	-0.197** (0.099)
Less income	0.0153 (0.052)	0.0150 (0.051)
Unchanged income	ref	ref
More income	0.00379 (0.051)	0.00511 (0.050)
Less HH real assets	0.0830 (0.057)	0.0827 (0.056)
Unchanged hrass	ref	ref
More HH real assets	0.0457 (0.054)	0.0454 (0.054)
Interview year: 2015	ref	ref
Interview year: 2017	-0.0553 (0.047)	-0.0568 (0.046)
Obs	593	593
R2	0.0385	

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Notes: This table presents the estimation results of equation (3.1), estimated by OLS in column (1). Column (2) presents the marginal effects of the probit model. Standard errors are in parentheses. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 3.6 present the estimates of specification (8), where lapse decision is explained by changes over time in several variables related to health, income and assets, and by levels of variables characterizing the individual in the initial year (wave). Such specification makes it possible to deal with possible individual heterogeneity that might be correlated with lapse behaviour and lead to selection or adverse selection created by lapse decision.

The non-significant coefficients obtained on the previous specification may indeed be due to heterogeneity in the lapse decisions. The results obtained on this specification show behaviours that confirm the theoretical intuitions: new help receiver is very significant, and it encourages the lapse, idem improvement of health (but only at 10%). On the other hand, income is still not significant, but having a loss on one's assets encourages the lapse. On the level variables, I see that those who have significant assets lapse less (at 10 %) and that those who consider their health as poor lapse less than those who are in good health. With regard to health, the estimation of my model leads to significant results which are consistent with an adverse selection through lapse behaviour. Indeed, those who lapse the most are those who are in good or very good health and whose health is improving.

Table 3.6: Determinants of lapse behaviour adjusted for baseline characteristics

Dependent variable: =1 if individual cancels LTCI policy		
	LPM	Probit
	(1)	(2)
<i>Changing variables</i>		
Delta Age	0.0714 (0.060)	0.0715 (0.057)
Delta Marital status: New couple/Single	-0.214 (0.217)	-0.189 (0.196)
Unchanged	ref	ref
Separated	-0.00193 (0.133)	-0.00662 (0.130)
Newly retired	-0.0852 (0.090)	-0.0854 (0.087)
New help receiver	0.121* (0.062)	0.121** (0.059)
Delta SAH: Improved SAH	0.0976* (0.057)	0.0965* (0.055)
Unchanged SAH	ref	ref
Worsened SAH	-0.0510 (0.054)	-0.0483 (0.051)

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	LPM (1)	Probit (2)
Delta ADL: Less ADL limitations	-0.131 (0.118)	-0.129 (0.108)
Unchanged ADL lim	ref	ref
More ADL lim	0.0700 (0.090)	0.0691 (0.086)
New chronic disease	0.0744 (0.099)	0.0758 (0.095)
Delta Grip strength: Lower grip strength	-0.0662 (0.071)	-0.0676 (0.068)
Unchanged grip strength	ref	ref
Higher grip strength	-0.0985 (0.072)	-0.0979 (0.069)
New physical activity	0.0899 (0.172)	0.0915 (0.173)
New Overweight/Obese	-0.151* (0.089)	-0.174* (0.105)
Delta HH Income: Less income	0.0225 (0.057)	0.0229 (0.055)
Unchanged income	ref	ref
More income	0.0302 (0.055)	0.0317 (0.052)
Delta HH rass: Less HH real assets	0.125* (0.065)	0.128** (0.062)
Unchanged hrass	ref	ref
More HH real assets	0.0290 (0.059)	0.0291 (0.056)
<i>Baseline characteristics</i>		
Female	-0.108 (0.069)	-0.105 (0.066)
Lag Age	-0.00682* (0.004)	-0.00681* (0.004)
Lag Marital status: In couple	ref	ref
Single	-0.0237 (0.080)	-0.0243 (0.075)
Divorced	0.0590 (0.076)	0.0562 (0.071)
Widowed	0.0479 (0.062)	0.0529 (0.061)
Lag retired	-0.0343 (0.073)	-0.0316 (0.070)
Lag number of caregivers	0.0509 (0.036)	0.0502 (0.035)
Lag SAH: Excellent	0.0767 (0.091)	0.0765 (0.087)
Very good	-0.00330 (0.061)	-0.00243 (0.059)
Good	ref	ref
Fair	-0.114* (0.058)	-0.111** (0.054)
Poor	-0.0681 (0.094)	-0.0663 (0.086)

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	LPM (1)	Probit (2)
Lag number of ADL limitations	0.0139 (0.067)	0.0121 (0.064)
Lag Chronic disease	0.102 (0.075)	0.103 (0.072)
Lag Max grip strength	0.000274 (0.004)	0.000315 (0.003)
Lag physical activity	0.00123 (0.135)	0.00336 (0.140)
Lag Overweight/Obese	0.00868 (0.046)	0.00825 (0.044)
Lag HH Income: Low income	ref	ref
Middle income	0.000514 (0.060)	0.000944 (0.057)
High income	-0.0258 (0.066)	-0.0246 (0.063)
Missing (income)	0.0265 (0.087)	0.0271 (0.086)
Low HH real assets	ref	ref
Middle hrass	-0.139 (0.121)	-0.134 (0.113)
High hrass	-0.200* (0.116)	-0.198* (0.108)
Missing (hrass)	-0.262** (0.122)	-0.258** (0.113)
Lag Pessimism	0.0474 (0.054)	0.0495 (0.052)
Interview year: 2015	ref	ref
Interview year: 2017	-0.0415 (0.048)	-0.0423 (0.047)
Obs	593	593

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Notes: This table presents the estimation results of equation (3.2), estimated by OLS in column (1). Column (2) presents the marginal effects of the probit model. Standard errors are in parentheses. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

6.2 Does lapse behaviour reinforce selection or adverse selection?

Table 3.7 give an idea of the level of *ex-post* risk of those who terminated their contracts compared to those who kept them. The estimation results suggest that individuals who terminate their contracts are less happy in 2015 (lower CASP score). Cognitive score is not significantly associated with lapse behaviour. Conversely, lapse behaviour is associated with poorer mental health (higher depression score, increased loneliness). Finally, lapers have poorer physical health (more chronic illness, more limitations with ADL and IADL) but are less likely to report poor health.

If we look at the 'objective' health indicators (even if this remains declarative), we see that those who terminate their contract experience a deterioration in their health status. On the other hand, the latter experience an improvement in their subjective health, which is consistent with the result found in the previous section. One might therefore ask whether the policyholders who terminate their contracts are not mistaken, since their health is deteriorating. Under these conditions, lapse behaviours are helpful to insurers insofar as they contribute to eliminating high risks that would not have been eliminated at the time of the subscription of their contract (or that were not at risk at the time of subscription).

Table 3.7: Dynamic adverse selection

Subsequent outcome	Mean of outcome	Coef on lapse
Wellbeing		
CASP score 2015	37.695	-1.001** (0.545)
CASP score 2017	39.120	-1.080 (0.896)
Cognitive function		
Cognitive score 2015	21.183	-0.159 (0.490)
Cognitive score 2017	23.010	-0.863 (1.287)
Mental health		
Depression scale 2015	2.883	0.454** (0.193)
Depression scale 2017	2.571	-0.250 (0.304)
Loneliness 2015	3.985	0.237* (0.128)
Loneliness 2017	3.795	0.433** (0.193)
Physical health		
Number of chronic diseases 2015	1.959	0.253* (0.137)
Number of chronic diseases 2017	1.807	0.184 (0.247)
Number of ADL limitations 2015	0.260	0.057 (0.075)
Number of ADL limitations 2017	0.166	0.194* (0.109)
Number of IADL limitations 2015	0.476	0.209* (0.112)
Number of IADL limitations 2017	0.347	0.162 (0.167)
Self-assessed health (SAH)		
Poor of Fair SAH in 2015	0.331	0.045 (0.044)
Poor of Fair SAH in 2017	0.309	-0.159** (0.071)

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Notes: These results are estimated using a linear probability model. This table is based on regressions of each outcome on lapse and risks factors used by insurers to underwrite policies such as age, gender, marital status and being retired. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

7 Discussion

When controlling for differences in levels across individuals, I find that lapse behaviour is linked with improvement in health, having new informal help and experiencing a decrease in assets. Moreover, lapse is more likely among people with better health. These results suggest that lapse behaviour contribute to an adverse selection in the LTCI market. This result is confirmed in the *ex-post* adverse selection analysis, as individuals who have dropped their LTCI policy are less likely to report poor health.

Observing lapse of LTCI is not simple in general population surveys. In the literature, two approaches have been used. The first in HRS is based on the question that was asked until 2002, and which was very explicit: '*have you ever lapse a LTCI contract*'. This question is not asked in the SHARE survey. This method was used in particular by [Finkelstein et al. \[2005\]](#). The second measure, which I use in this chapter, is based on the difference in insurance coverage over time. This measure was used by [Konetzka and Luo \[2011\]](#). I recognize that this measure is not perfect, but it at least offers an advantage. That of knowing the risk profile of the respondent in a time around the termination date.

[Konetzka and Luo \[2011\]](#) have shown in examining the issue of ex post adverse selection that they obtained the same results using the two methods mentioned above. They find little evidence for adverse selection associated with lapse. I find a different result which is the presence of advantageous selection in this chapter. This result should be taken with caution since I only observe individuals two years on average after they lapse, and the measures of health status are not as precise.

Finally, although it would have been interesting, I do not have information on the duration of coverage of individuals, and even less on the details of their contract (price, partial or total dependence, etc). Also, it is impossible to know whether individuals took out LTCI again (with another insurer, for example) after terminating it, or even whether they terminated an individual policy to switch to a group policy with their employer.

8 Conclusion

The long-term care insurance market could be a means of financing the loss of autonomy. However this market is characterized by a low proportion of subscribers, even in France and in the USA, which are countries where this market is particularly developed. In this chapter I study the lapse behaviour in France using data from SHARE. I show that in addition to the low subscription rate, this market is characterized by a high proportion of contract termination: around 38% in the data of this chapter.

The model explaining LTCI ownership allows us to confirm a result well identified in the literature, namely that people belonging to the low income classes are less likely to be insured. I also find that those with higher incomes tend to have less LTCI, perhaps because of their ability to mobilize other resources (savings, life insurance, etc.). This model also shows that being in poor health has no effect on insurance ownership. However, this result raises questions about possible selection effects. Do individuals in poor health ask for less insurance or is this the result of insurers' selection by rejecting bad risks through the medical questionnaire? ([Hendren \[2013\]](#); Dormont and Tekam, (chapter 2)).

The lapse model, on the other hand, points out three points. First, that people who have experienced an improvement in their health status are more likely to let their contract expire. Next, those who experienced a negative assets shock have a higher probability of terminating their contract. Finally, and perhaps most importantly, people who receive new informal care are more likely to cancel their LTCI policies.

Finally, I show that after two years on average, individuals who lapse their LTCI experience a deterioration in their 'objective' health and an improvement in their subjective health. This result should be good news for insurers as they will not only have collected non-refundable premiums from policyholders, but will also be getting rid of bad risks in their portfolio.

These results support the idea that there is indeed an intertemporal calculation underlying the purchase of LTCI, but that the decision resulting from this calculation can be revised later if contextual elements are changed: health/income/wealth shock/change in availability of potential caregivers.

Faced with the high cancellation rate on the LTCI market in France, and the difficulties of policyholders in combining strategic and financial difficulties, one of the solutions could be to encourage individuals to subscribe earlier and therefore pay lower contributions.

9 Appendix

9.1 Appendix related to the Data description

Table 3.8: Definition of the variables

Variables	Type	Definition
Age	N	Individual's age
Female	D	Individual is a woman
Marital status	Q	Marital status (1= In couple, 2=Single 3=Divorced 4=Widowed)
Retired	D	Individual is retired
Pessimism	D	Pessimism (part of EURO-D)
Self-assessed health	Q	Self perceived health status
Excellent	D	Excellent health status
Very good	D	Very good health status
Good	D	Good health status
Fair	D	Fair health status
Poor	D	Poor health status
Received help	D	Received help from others
Chronic disease	N	Number of chronic disease
Physical activity	D	Physical activity
Overweight or obese	D	$bmi \geq 25$
Max grip strength	N	Maximum of grip strength measures
CASP score	N	quality of life and well-being
Numeracy	N	score of numeracy test
Cognitive score	N	=memory+fluency
Depression scale	N	Depression scale EURO-D
Loneliness	N	Loneliness; high is lonely
ADL	N	number of limitations with activities of daily living (ADL)
IADL	N	number of limitations with instrumental activities of daily living (ADL)

Where Type Q: categorical variable; type D: dummy variable; type N: continuous variable.

Table 3.9: Descriptive statistics on change variables

Variables	Type	Definition	Mean
Delta marital status	Q	Δ in marital status	-
New couple/single	D	=1 if New couple or single	0.009
Unchanged	D	=1 if unchanged marital status	0.969
Separated	D	=1 if separated	0.022
Newly retired	D	=1 if the individual retires	0.084
New help receiver	D	=1 if individual reports receiving help for the first time	0.159
			-
Delta self-assessed health	Q	Δ in health status (categories)	-
Improved SAH	D	=1 if individual reported a better health status before	0.205
Unchanged SAH	D	=1 if individual reports the same health status	0.206
Worsened SAH	D	=1 if individual reports a worse health status	0.241
			-
Delta ADL	Q	Δ in number of ADL limitations	-
Less ADL	D	=1 if individual reported less ADL limitations	0.062
Unchanged ADL	D	=1 if individual reports the same number of ADL limitations	0.842
More ADL	D	=1 if individual reported more ADL limitations	0.094
			-
New chronic	D	New diagnosis of chronic disease	0.082
New physical activity	D	=1 if the individual has started a physical activity	0.045
Newly overweight/obese	D	=1 if individual becomes overweight/obese	0.046
	Q		-
Delta maxgrip	Q	Δ in maximum of grip strength measures	-
More maxgrip	D	=1 if individual has a higher grip strength score	41.46
Unchanged maxgrip	D	=1 if individual has the same grip strength score	10.83
Less maxgrip	D	=1 if individual has a lower grip strength score	47.72
			-
Delta household income	Q	Δ in income categories	-
Less income	D	=1 if the household has less income between two waves	0.209
Unchanged income	D	=1 if the household stays in the same income category	0.555
More income	D	=1 if the household has more income	0.234
			-
Delta household real assets	Q	Δ in assets categories	-
Less assets	D	=1 if the household has less net assets	0.168
Unchanged assets	D	=1 if the household stays in the same assets category	0.638
More assets	D	=1 if the household has more net assets	0.193
			-
Delta caregivers	Q	Δ in number of caregivers	-
Less caregivers	D	=1 if individual reports less caregivers	0.097
Unchanged	D	=1 if individual reports the same number of caregivers	0.716
More caregivers	D	=1 if individual reports more caregivers	0.185

Where Type Q: categorical variable; type D: dummy variable.

Table 3.10: Construction of the dependent variables for equations 5 to 7

Has LTCI? 1=Yes; 0=No		
2013	2015	2017
1	1	1
1	1	0
1	0	1
1	0	0
0	1	1
0	1	0
0	0	1
0	0	0

Sample - LTCI ownership model

Has LTCI? 1=Yes; 0=No		
2013	2015	2017
1	1	1
1	1	0
1	0	1
1	0	0
0	1	1
0	1	0
0	0	1
0	0	0

Sample Equations (3.1) and (3.2)

Sources: Author's construction.

Notes: The two tables above represent LTCI ownership across the three survey waves used in this study. "1" indicates the respondent has LTCI, and "0" indicates no coverage. To estimate the model explaining LTCI ownership, I consider, here in red, as the dependent variable the fact of holding LTCI regardless of the survey wave.

Table 3.11: Difference in mean lapsers vs non-lapsers

Variable	Keep LTCI	Drop LTCI	Mean Diff.
Age	72.11	70.20	-1.907***
Female	0.65	0.57	-0.079**
<i>Marital status</i>			
In couple	0.61	0.57	-0.042
Single	0.08	0.09	0.005
Divorced	0.09	0.10	0.016
Widowed	0.22	0.24	0.021 †
Retired	0.86	0.79	-0.072**
<i>Self-assessed health</i>			
Excellent	0.06	0.09	0.028
Very good	0.10	0.13	0.027
Good	0.49	0.45	-0.036
Fair	0.24	0.23	-0.010
Poor	0.11	0.10	-0.009
Number of caregivers	0.35	0.36	0.011
ADL limitations	0.21	0.28	0.067
Number of chronic diseases	1.87	1.99	0.118
Max. of grip strength	30.35	31.99	1.637**
Physical activity	0.88	0.90	0.017
Overweight or obese	0.60	0.58	-0.022
Pessimism	0.19	0.27	0.084***
<i>Household income</i>			
Low income	21,636.06	20,242.79	-1,393.278
Middle income	31,597.68	32,022.21	424.522
High income	47,457.50	46,133.65	-13,23.857
<i>Household real assets</i>			
Low assets	25,526.24	15,632.27	-9,893.979***
Middle assets	21,603.61	28,536.44	6,932.836***
High assets	38,407.54	38,008.52	-399.025

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

The asterisks indicate the level of significance of the difference in means: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 3.12: Other dynamic predictors vs Lapse

Delta ADL	Keep	Drop	Total	Delta Income	Keep	Drop	Total
Less ADL lim	7.51	4.29	6.20	Less income	20.10	22.14	20.92
Unchanged ADL	83.05	86.07	84.27	Unchanged income	56.17	54.64	55.56
More ADL lim	9.44	9.64	9.52	More income	23.73	23.21	23.52
Total (Obs)	413	280	693	Total	413	280	693

Delta Marital status	Keep	Drop	Total	Delta Maxgrip	Keep	Drop	Total
New couple/single	1.21	0.36	0.87	Lower grip strength	47.59	48.09	47.80
Unchanged mstat	96.61	97.50	96.977	Unchanged	9.89	12.21	10.85
Separated	2.18	2.14	2.16	Higher grip strength	42.51	39.69	41.35
Total (Obs)	413	280	693	Total (Obs)	374	262	636

Delta ADL limitations status	Keep	Drop	Total	Delta Caregivers	Keep	Drop	Total
Less ADL lim.	7.51	4.29	6.20	Less caregivers	7.99	12.14	9.67
Unchanged ADL lim.	83.05	86.07	84.27	Unchanged	74.58	67.50	71.72
More ADL lim.	9.44	9.64	9.52	More caregivers	17.43	20.36	18.61
Total (Obs)	413	280	693	Total (Obs)	413	280	693

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Table 3.13: Determinants of LTCI take up

	(1)	(2)	(3)	(4)
	LPM	LPM	Probit	Probit
Age	0.024*** (0.01)	0.025*** (0.01)	0.028*** (0.01)	0.029*** (0.01)
Age square	-0.000*** (0.00)	-0.000*** (0.00)	-0.000*** (0.00)	-0.000*** (0.00)
Female	0.031*** (0.01)	0.035** (0.02)	0.031*** (0.01)	0.034** (0.02)
In couple	0.000	0.000	0.000	0.000
Single	0.029 (0.02)	0.032* (0.02)	0.030 (0.02)	0.033* (0.02)
Divorced	-0.001 (0.02)	-0.008 (0.02)	-0.000 (0.02)	-0.007 (0.02)
Widowed	0.040*** (0.01)	0.034** (0.01)	0.040*** (0.01)	0.034** (0.02)
Retired	0.035** (0.01)	0.032** (0.02)	0.034** (0.02)	0.030** (0.02)
Low income	-0.039*** (0.01)	-0.037*** (0.01)	-0.039*** (0.01)	-0.037*** (0.01)
Middle income	ref	ref	ref	ref
High income	-0.024* (0.01)	-0.023* (0.01)	-0.024* (0.01)	-0.024* (0.01)
Missing (income)	-0.042*** (0.02)	-0.038** (0.02)	-0.042*** (0.02)	-0.037** (0.02)
Low HH real assets	-0.028** (0.01)	-0.024* (0.01)	-0.027* (0.01)	-0.023 (0.01)
Middle hrass	0.000	0.000	0.000	0.000
High hrass	-0.045*** (0.01)	-0.043*** (0.01)	-0.045*** (0.01)	-0.042*** (0.01)
Missing (hrass)	-0.028* (0.01)	-0.027* (0.01)	-0.027* (0.01)	-0.026* (0.01)
Pessimism	-0.017 (0.01)	-0.013 (0.01)	-0.017 (0.01)	-0.013 (0.01)
Year of interview - 2013	ref	ref	ref	ref
2015	0.043*** (0.01)	0.045*** (0.01)	0.043*** (0.01)	0.045*** (0.01)
2017	0.052*** (0.01)	0.049*** (0.02)	0.053*** (0.02)	0.049*** (0.02)
Excellent		0.027 (0.02)		0.027 (0.02)
very good		-0.006 (0.01)		-0.006 (0.01)
Good		ref		ref
Fair		-0.019 (0.01)		-0.018 (0.01)
Poor		-0.006 (0.02)		-0.005 (0.02)

continued on next page →

	(1)	(2)	(3)	(4)
	LPM	LPM	Probit	Probit
Number of ADL limitations		-0.016*		-0.017*
		(0.01)		(0.01)
Received help		0.021		0.021
		(0.01)		(0.01)
1+ chronic disease		0.023*		0.023*
		(0.01)		(0.01)
Physical activity		-0.010		-0.010
		(0.02)		(0.02)
Overweight/Obese		0.013		0.013
		(0.01)		(0.01)
Max grip strength		0.000		0.000
		(0.00)		(0.00)
_cons	-0.688***	-0.729***		
	(0.23)	(0.24)		
Obs	7031	6783	7031	6783
R2	0.017	0.019		

Sources: Author's calculation from SHARE data, waves 5, 6 and 7.

Notes: The dependent variable is equal to 1 when the respondent has LTCI, 0 when he/she does not have insurance. Individuals with mandatory (group) insurance are excluded from the analysis.

These results are estimated using a linear probability model in order to compare them to other studies. Same results are obtained by using a probit model. The number of observations is different because of the inclusion of some explanatory variables.

Standard errors are in parentheses. The asterisks indicate the level of significance of the coefficients: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

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Conclusion générale

Cette thèse se propose de contribuer à la compréhension du faible développement du marché privé de l'assurance dépendance en France. La thèse s'articule autour de trois chapitres qui traitent dans un premier temps de la perception du risque de dépendance par les agents (chapitre 1). Ensuite, nous nous intéressons à la demande d'assurance et au rôle du questionnaire médical dans la sélection des risques (chapitre 2). Enfin, nous essayons de comprendre les raisons pouvant amener un agent à résilier son contrat d'assurance dépendance (chapitre 3).

1. Principaux résultats et contributions

Dans le chapitre 1 nos résultats montrent que les personnes surestiment modérément leur risque de devenir dépendantes à 5 ans : la probabilité subjective moyenne est égale à 15,1%, soit 3,4 points de pourcentage de plus que la probabilité moyenne prédite ("objective"), égale à 11,7%. Cependant, la surestimation moyenne va de pair avec une distribution où la plupart des personnes sous-estiment légèrement leur risque tandis que les autres le surestiment fortement. La probabilité subjective de dépendance augmente considérablement à un horizon de 10 ans : la majorité des individus surestiment leur risque, la surestimation moyenne est égale à 15,5 points de pourcentage, et en tête de la distribution, les gens ont des risques subjectifs excessifs par rapport au risque prédit. En examinant les déterminants des anticipations individuelles, nous constatons que les individus perçoivent avec précision le rôle de l'âge, de la mauvaise santé actuelle et des limitations au niveau des membres inférieurs. En effet, ces variables influencent de manière significative le risque de dépendance observé. Enfin, nos estimations montrent que les individus qui sous-estiment leur risque ont une probabilité plus faible de détenir une assurance dépendance, avec un impact qui dépend de l'importance de l'écart entre le risque subjectif et le risque prédit.

Dans le chapitre 2, nos résultats indiquent qu'il existe une sélection adverse en ce qui concerne la demande d'assurance ; et que la sélection des risques par les assureurs parvient effectivement à éliminer les risques élevés. Par conséquent, il n'y a pas de sélection adverse sur les assurés : plus précisément, il n'y a pas une plus grande proportion de hauts risques lorsque l'on compare les assurés et les non-assurés. Enfin, nous trouvons des éléments qui vont dans le sens de littérature justifiant les refus d'assurance sur le marché d'assurance : la variabilité du risque subjectif est beaucoup plus importante chez les individus refusés. Nous trouvons que le questionnaire permet aux assureurs de prédire très bien le risque chez les individus à qui ils refusent un contrat d'assurance. En revanche le questionnaire

ne permet pas de bien prédire les risques subjectifs des demandeurs acceptés, qui ont une proportion non négligeable de risque élevés totalement ignorée des assureurs. Il est difficile à ce stade de savoir si les individus surestiment à tort leur risque (le questionnaire aurait raison), ou bien si les individus ont une information privée sur leur risque qui est ignorée par le questionnaire .

Dans le chapitre 3, notre modèle de résiliation met en évidence trois principaux résultats. Tout d'abord, les personnes qui ont connu une amélioration de leur état de santé ou celles qui ont une baisse de leurs actifs nets ont une probabilité plus élevée de mettre fin à leur contrat. Enfin, les personnes qui bénéficient d'une nouvelle aide informelle sont plus susceptibles de résilier leur contrat d'assurance dépendance. Nous montrons par ailleurs que deux ans en moyenne après avoir résilié leur contrat d'assurance dépendance, ces individus voient leur santé "objective" se détériorer tandis que leur santé subjective tend à s'améliorer. Ce résultat devrait être une bonne nouvelle pour les assureurs, car non seulement ils ont perçu des primes non remboursables de la part des assurés, mais également voient mauvais risques sortir de leur portefeuille.

2. Peut-on se reposer sur le marché privé pour couvrir le risque de dépendance à la lumière des résultats ?

Comme l'a évoqué [Pauly \[1990\]](#) la méconnaissance du risque de dépendance est un facteur important expliquant la faible demande sur le marché de l'assurance dépendance. Nos analyses permettent de confronter les anticipations des individus avec un risque prédit sur la base de leurs caractéristiques. Nous trouvons un résultat qui ne soutient pas tout à fait l'interprétation de [Pauly \[1990\]](#). La sous-estimation du risque de dépendance n'influence la détention d'assurance que pour les anticipations à 10 ans. Or, à cet horizon une grande majorité des individus surestiment leur risque de dépendance. La sous-estimation ne concerne qu'une petite partie des individus, et son impact est probablement loin de pouvoir expliquer à lui seul un sous-développement du marché privé de l'assurance.

Nous pensons que des campagnes d'information sur la nature du risque de dépendance, et les charges associées permettront aux individus de mieux savoir à quoi s'attendre. Et donc d'anticiper quels moyens de financement ils aimeraient mettre en place en cas d'entrée en dépendance. Dans cette optique, nous serions ravis de travailler sur un projet de veille scientifique à l'image de celui de l'association américaine d'assurance dépendance qui recense des articles et des données actualisées notamment sur les comportements des

consommateurs, sur les taux de résiliation, sur les primes d'assurance, les raisons qui déclenchent le versement d'une indemnité, et bien d'autres.

Les résultats du chapitre 2 montrent que le questionnaire médical utilisé par les assureurs est efficace pour sélectionner les risques. Cependant, quelle proportion d'individus est rejetée au moyen de cette procédure, et parmi les rejetés combien rentrent en dépendance dans les années qui suivent ? Quelle est la répartition par âge et par sexe des personnes rejetées en population générale ? Nous pensons que les réponses à ces questions permettraient aux ménages de mieux comprendre ce marché, et peut-être mieux planifier leurs besoins.

En tout état de cause, les mécanismes de sélection étudiés dans ce chapitre montrent qu'en l'absence d'une modification de la réglementation actuelle un marché privé de l'assurance dépendance ne peut pas offrir à tous une couverture.

On peut se demander quelles solutions s'offrent aux personnes rejetées par les assureurs ? Le livre blanc des assureurs formule des propositions intéressantes comme la mise en place d'un tarif unique, défini en fonction de l'âge à partir duquel la cotisation dépendance est prélevée et du niveau de la rente viagère garantie en cas de dépendance [France Assureurs, 2021]. Et d'autres propositions qui supposent une gestion du risque en lien avec la Sécurité sociale.

Les résultats du chapitre montrent que les individus qui résilient leur contrat d'assurance dépendance voient leur santé objective se détériorer au bout de deux ans. Dans de telles conditions, le marché ne serait pas viable puisque la résiliation réduit mécaniquement la mutualisation dans un portefeuille d'assurés. Nous espérons que si la validité externe de notre résultat est démontrée, cela incitera les ménages à davantage conserver leur contrat dans la durée.

3. Limites et développements futurs

La plupart des études sur l'assurance dépendance qui utilisent des données d'enquête portent sur de faibles échantillons, limitant ainsi la puissance statistique des modèles utilisés. Par ailleurs, les données sont généralement des données en coupe transversale rendant difficile l'étude de certaines problématiques comme celle de la résiliation des contrats. A titre d'exemple, la dernière vague de l'enquête ESPS (Enquête Santé et Protection So-

ciale) conduite par l'Irdes¹⁰, et contenant un module sur l'assurance dépendance date de 2012 [Célant et al., 2014].

Les résultats du chapitre 2 débouchent sur une sorte d'énigme car parmi les assurés « acceptés » figurent des individus qui ont un niveau de risque subjectif très supérieur à celui prédit par l'assureur, sans que l'on puisse savoir si les individus se trompent en surestimant leur risque, ou bien s'il ont une information privée non captée par l'assureur. Il serait très important d'obtenir des informations avec les mêmes variables, mais avec une profondeur temporelle suffisante pour pouvoir observer la réalisation du risque. Bien que les données Pater/Elders contiennent des données originales, nous attendons avec impatience les prochaines vagues d'enquête qui permettront peut-être d'observer dans les données l'entrée en dépendance des personnes âgées.

Pour ce qui est des données SHARE, les questions du Drop-Off de la vague 8 ont constitué une opportunité bienvenue qui a permis de mieux comprendre les anticipations des agents face au risque de dépendance et les liens avec la détention d'assurance. Comme avec Pater/Elders, nous pensons qu'une approche longitudinale avec les mêmes individus permettrait de mieux comprendre cette question. Pour ce qui est du chapitre sur la résilience, les informations sur les prix des contrats et sur leur durée auraient permis de mieux comprendre le phénomène. Nous espérons que les futures enquêtes pourront procéder à ces améliorations.

¹⁰Institut de recherche et de documentation en économie de la santé

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RÉSUMÉ

Cette thèse se propose de contribuer à la compréhension du faible développement du marché privé de l'assurance dépendance en France. La thèse s'articule autour de trois chapitres qui peuvent se lire de façon indépendante. Tout d'abord, le premier s'intéresse à la perception du risque de dépendance par les individus. En comparant le risque élicité et le risque prédit, les résultats montrent que le fait de sous-estimer son risque est associé à une probabilité plus faible de détenir une assurance dépendance. Ensuite, le deuxième chapitre étudie la demande d'assurance dépendance et le rôle du questionnaire médical dans la sélection des risques. Les résultats indiquent qu'il existe une sélection adverse en ce qui concerne la demande d'assurance ; et que la sélection des risques par les assureurs parvient effectivement à éliminer les mauvais risques. Par conséquent, il n'y a pas de sélection adverse sur les assurés. Enfin, l'intérêt est porté sur les raisons pouvant amener un agent à résilier son contrat d'assurance dépendance dans le troisième chapitre. Les résultats révèlent que les personnes qui ont connu une amélioration de leur état de santé, celles qui ont connu une baisse de leurs actifs nets ou encore celles qui bénéficient d'une nouvelle aide informelle ont une probabilité plus élevée de mettre fin à leur contrat.

MOTS CLÉS

Personnes âgées, Assurance, Dépendance, Risque subjectif, Asymétrie d'information.

ABSTRACT

This thesis contributes to the understanding of the weak development of the private long-term care insurance market in France. The thesis is structured around three chapters that can be read independently. Next, the demand for insurance and the role of the medical questionnaire in risk selection is examined. Finally, interest is shown in the reasons why an agent may lapse his or her long-term care insurance policy. The first chapter examines how individuals perceive the risk of becoming dependent. By comparing elicited and predicted risk, the results show that underestimating one's risk is associated with a lower probability of owning long-term care insurance. The second chapter analyzes the demand for long-term care insurance and the role of the medical questionnaire in risk selection. The results indicate that there is adverse selection in the demand for insurance; and that risk selection by insurers is effective in eliminating bad risks. Therefore, there is no adverse selection on the insured. Finally, the third chapter focuses on the determinants of lapse behaviour in the long-term care insurance market in France. The results reveal that people who have experienced an improvement in their health status, those who have experienced a decline in their net assets, or those who receive new informal care have a higher probability of terminating their contract.

KEYWORDS

Elderly, Insurance, Long-term care, Subjective risk, Information asymmetry.