Efficiency and gender stereotypes : applications to the allocation of resources within households and educational choices

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Efficience et stéréotypes de genre : applications à l'allocation des ressources dans les ménages et aux choix éducatifs

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Avertissement

L'introduction générale de cette thèse est rédigée en français, ainsi que le chapitre 2. Les chapitres 1, 3 et 4 sont rédigés en anglais. Mis à part l'introduction, les différents chapitres sont issus d'articles de recherche dont la structure est autonome. Par conséquent, des termes "papier" ou "article" y font référence.

Notice

The general introduction and the chapter 2 were written in French. Chapters 1, 3 et 4 were written in English. Except the introduction, all chapters of this thesis are self-containing research articles. Consequently, terms "paper" or "article" are frequently used.

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Introduction Générale

Le genre est devenu depuis plusieurs décennies une catégorie d'analyse majeure dans de nombreuses disciplines. Les économistes ont commencé à s'intéresser à la question du "genre" sous un angle appliqué, partant de l'observation que les comportements économiques sont très largement dépendants du genre. En effet, des différences sexuées s'observent nettement dans les processus de décision, que ce soit les comportements d'offre de travail, de consommation ou d'épargne. La détermination des salaires, les probabilités d'accès à l'emploi et à la promotion, ainsi que le risque de pauvreté, sont également très dépendants du sexe de l'individu. L'analyse économique s'est particulièrement attelée à comprendre pourquoi les inégalités de genre sur le marché du travail, bien que réduites, persistent.

En effet, avec une progression considérable de la participation des femmes au marché du travail depuis la seconde moitié du 20$^{\text{ième}}$ siècle (Marchand et Thélot, 1991, Sofer, 2005), le taux d'emploi des femmes entre 20 et 64 ans atteint aujourd'hui 65 % en France (2012). Les autres pays développés à économie de marché ont connu le même phénomène, et totalisent même des taux supérieurs à la France : 71.5 % en Allemagne, 76.8 % en Suède, 68.4 % au Royaume-Uni, et 54 % en Espagne [1].

Malgré cet acquis en terme d'accès des femmes au marché du travail, force est de constater que les inégalités sur le marché du travail persistent. En France, les hommes perçoivent en moyenne, un salaire supérieur de 25 % (en équivalent temps plein) à celui des femmes, selon les données de l'INSEE en 2010. Depuis 1995, les écarts de revenu salarial ont légèrement diminué entre hommes et femmes, en particulier du fait que la part des femmes progresse parmi les cadres. Cependant, la ségrégation des métiers reste forte et les femmes occupent

1. Source : Eurostat, enquêtes sur les forces de travail dans l'Union européenne.

encore plus de 70 % des postes d'employés, qui présentent des niveaux de salaire assez bas[2]. Ces écarts de salaires sont fortement liés aux décisions en amont du marché du travail lors des choix d'orientation scolaire durant l'adolescence. Les choix éducatifs sont en effet très genrés: les filles se tournent très souvent vers les sciences humaines, les langues, l'éducation et les Arts, tandis que l'ingénierie et les sciences restent des filières majoritairement "masculines". Cette ségrégation de genre apparaît problématique dans la mesure où les filières "féminines" conduisent très souvent à des métiers faiblement rémunérés et des carrières moins prestigieuses que celles suivies par les garçons, alors même que les filles réussissent aussi bien que les garçons à l'école, voire davantage puisqu'elles font des études plus longues et sont moins souvent en échec scolaire. En effet, à titre d'exemple, en 2009 en France, 87% des filles et 85% des garçons ont obtenu le Baccalauréat.[3].

Le temps de travail constitue un second facteur contribuant fortement aux écarts de rémunération car le temps partiel concerne principalement les femmes. Selon les données de 2009 publiées par le ministère du travail, dans les entreprises de 10 salariés ou plus du secteur concurrentiel, la rémunération annuelle brute moyenne des femmes est inférieure de 24 % à celle des hommes, alors que l'écart est de 14 % quand on se réfère au salaire horaire. Par ailleurs, les écarts de salaires horaires sont les plus forts dans les catégories où les salaires horaires sont les plus élevés, c'est-à-dire parmi les cadres (21 %). Ainsi, le positionnement moins favorable des femmes dans l'échelle des salaires s'explique d'une part par leurs situations professionnelles et leur moindre temps de travail en moyenne. D'autre part, à caractéristiques voisines, les femmes ont un salaire horaire inférieur de 9 points en

2. INSEE Première, n° 1436 - mars 2013
3. Toutes les séries du Bac sont prises en compte. Source: DEPP: Direction de l'évaluation, de la prospective et de la performance, RERS: Repères et références statistiques sur les enseignements, la formation et la recherche

moyenne à celui des hommes [4].

Au delà de ces inégalités de salaire, qui tendent à se réduire mais lentement, la position des femmes sur le marché du travail reste encore très liée aux emplois à faible qualification, assortie de précarité, d'un risque d'exclusion ou d'un manque de protection sociale, et d'une plus grande difficulté à retrouver un emploi lorsqu'elles sont chômeuses.

Une branche de l'analyse économique s'est alors dévelopée autour de l'impact du marché du travail sur la persistance des inégalités de genre. Il s'agit notamment des travaux sur la discrimination sur le marché du travail et sa mesure. D'autres pistes de recherche s'intéressent à la sphère privée comme source de ces inégalités, en particulier dans la famille et en amont lors des choix éducatifs, et c'est dans ce champ de recherche que s'inscrit ma thèse.

Les inégalités au sein de la famille ont très peu évolué, en tout cas beaucoup moins si l'on compare avec l'évolution sur le marché du travail et l'investissement massif des femmes dans ce domaine. La plupart des autres inégalités observées (économiques, politiques...) semblent d'ailleurs y prendre leur source. En effet, le partage des tâches au sein du couple est très asymétrique, très marqué par les rôles de genre. Selon une étude réalisée par l'OCDE en 2011 à partir de l'ensemble des Enquêtes Emplois du Temps existant dans le monde [5], quel que soit le pays, les femmes consacrent davantage de temps que les hommes au travail non rémunéré, avec un écart de 2,5 heures en moyenne par jour. La différence de travail domestique est la plus faible au Danemark (50 minutes par jour), Suède et Norvège

4. Dares Analyses, n°16, ministère du travail, mars 2012.
5. Miranda, V. (2011)

(72 minutes) et Finlande (91 minutes). L'Allemagne compte une différence de TD de 105 minutes par jour, 122 en France, 187 en Espagne et 223 en Italie.
Ainsi, la participation désormais massive des femmes au marché du travail ne s'accompagne pas d'une redéfinition des rôles de genre au sein de la famille, et les conséquences économiques de cette situation apparaissent d'ailleurs immédiates : inégalités de salaires (particulièrement des salaires mensuels, qui augmentent avec le temps de travail), "plafond de verre" qui freine ou interdit l'accès des femmes aux emplois à responsabilités, plus grande exposition de celles-ci au risque de pauvreté...

Les inégalités au sein de la famille vont au-delà de la division du temps. L'allocation des ressources monétaires dans le ménage est-elle aussi sujette à un partage inégal, bien que beaucoup plus difficilement perceptible et mesurable à premier abord, car cela exige des données très fines sur les transferts réalisés à l'intérieur du ménage. De manière générale, la question "qui obient quoi dans le couple " en terme de ressources monétaires et de temps, a ouvert la voie à un champ de recherche très riche et foisonnant, qui ne cesse de s'enrichir dans la modélisation et les réponses empiriques apportées.
Les travaux pionniers de Gary Becker ont joué un rôle essentiel dans ce domaine. Il a été le premier à faire entrer la famille dans l'analyse économique, en représentant le ménage comme un centre d'activités de consommation et de production marchande et non marchande (Becker, 1974, 1981). La famille y est représentée comme un centre de décision unique (le "dictateur", "altruiste" ou "patriarcal", selon les interprétations) et l'approche qualifiée de modèle unitaire. La notion de temps y est également très importante.
La deuxième avancée majeure proviendra du développement des modèles qualifiés de "mod-

èles de ménage", où il est désormais admis que chaque conjoint possède ses propres préférences relatives au travail et à la consommation, et que les décisions observées proviennent d'une interaction entre les partenaires, dépendant du pouvoir de négociation de chacun. Différentes représentations ont été proposées dans cet objectif. Les modèles de négociation ouvrent la boîte noire du ménage en spécifiant le processus de décision. Ces modèles requièrent alors des hypothèses fortes sur le comportemenent du ménage. Il s'agit de modèles de théorie des jeux qui modélisant l'interdépendance des décisions de chacun. Une partie de ces modèles va être qualifiés de "modèles non-coopératifs", considérant que l'allocation intra-ménage n'est pas déterminée par un accord, mais qu'elle s'appuie plutôt sur une solution auto déterminé prenant la forme d'un équilibre Cournot-Nash (Ulph, 1988, Udry 1996, Carter et Katz, 1997, Konrad et Lommerud, 2000). Quand aux "modèles coopératifs", la famille y est considérée comme un lieu de négociation où la confrontation des intérêts individuels conduit à une solution coopérative et efficiente (Mc Elroy et Horney, 1981, Manser & Brown, 1980, Lunberg & Pollak, 1993).

Ces modèles apportent donc une représentation plus réaliste de la famille par rapport au modèle unitaire de Becker, mais des hypothèses *ad hoc* très fortes relatives au processus de decision des ménages doivent être avancées. Chiappori (1988, 1992) et Apps & Rees (1988) vont alors contourner cette difficulté en développant le "modèle collectif". Cette représentation comporte l'avantage considérable de reposer sur des hypothèses minimalistes: le processus de décision est toujours supposé efficient, dans le sens habituel où aucune autre décision alternative n'aurait été préféré par les membres du ménage. Quelque soit la manière dont les couples prennent leurs décisions (négociation, règles formelles ou autre), les choix effectivement réalisés sont optimaux au sens de Pareto. Le modèle collectif est donc compatible avec les modèles coopératifs et certains modèles non-coopératifs, qu'il intègre comme des cas particuliers.

Il est montré que dans ce cadre, la seule observation des consommations assignables (biens ou loisirs) permet de retrouver les préférences et la rège de partage (les parts individuelles de revenu obtenues par chacun des conjoints), à une constante près. En effet, grâce au Second Théorème Fondamental de l'Economie du Bien-Etre, toute allocation efficiente peut être décentralisée par un choix de prix et de (re)distribution de revenu. Selon la procédure de décentralisation, chaque personne reçoît une part du revenu total du ménage, qu'elle dépense ensuite pour ses propres biens privés, selon sa propre fonction d'utilité. Cette notion de règle de partage capture l'idée de pouvoirs de décision respectifs de chacun des partenaires. Le modèle collectif possède donc le grand avantage de représenter et estimer ces pouvoirs de négociation ainsi que les conséquences des pouvoirs de chacun sur les décisions prises, ce qui est extrêmement novateur et instructif pour la mise en place des politiques publiques. Ce type d'analyse a d'ailleurs conduit à faire des mères (et non des pères) les principales bénéficiaires des subventions visant à favoriser l'éducation des enfants (Thomas, 1990, 1994).

Depuis les travaux pionniers de Chiappori (1988, 1992) et Apps & Rees (1988), le modèle collectif n'a cessé d'être enrichi, les applications empiriques ont foisonné, devenant très rapidement le modèle de prise de décision intra-ménage le plus prometteur et le plus répandu. Focalisé en premier lieu sur les decisions de consommation, il a été enrichi à l'analyse des offres de travail des conjoints (Chiappori, 1992, 1998, Fortin & Lacroix, 1997, Chiappori et al., 2002), à la prise en compte de la production domestique (Apps & Rees, 1997, Chiappori, 1997, Aronsson, Daunfeldt & Wickstrom, 1999, Bourguignon & Chiuri, 2005, Rapoport, Sofer & Solaz, 2011, Sofer & al. 2011), puis des biens publics ou des enfants du ménage (Donni, 2002 et 2009, Blundell, Chiappori & Meghir, 2005, Couprie, 2007, Matteazzi & Picard, 2009). Les estimations empiriques du modèle collectif ont été permise par le développement de bases de données intégrant des indicateurs de plus en plus riches, telles que les enquêtes budget des familles et les enquêtes emploi du temps qui sont de plus en plus standardisées selon les pays, permettant d'effectuer des comparaisons internationales. La plupart de ces travaux montrent que les salaires de chacun des conjoints, et plus particulièrement les salaires relatifs constituent un important déterminant des pouvoirs de décision. Les revenus relatifs, l'âge relatif, et le niveau d'éducation relatif constituent souvent des variables influençant la négociation.

La rationalité collective sur laquelle repose le modèle collectif a été testée à de nombreuses reprises, grâce aux implications testables générées par le modèle collectif. La plupart des études montrent que le modèle collectif est bel et bien validé, et la représentation unitaire du ménage rejetée.

Le premier chapitre de cette thèse s'inscrit dans le cadre théorique du modèle collectif, et a pour objectif de mieux comprendre les déterminants de “qui obtient quoi" dans le couple, c'est-à-dire la règle de partage. La règle de partage est la plupart du temps estimée à une constante près, permettant de retrouver les dérivées par rapport à ses déterminants, mais la part de revenu reçu par les conjoints reste indéterminée, car l'ensemble des consommations assignables de chacun des partenaires n'est pas observée. En effet, la plupart des enquêtes fournissent des données de consommation au niveau du ménage et non au niveau de l'individu, à l'exception de certains biens comme les vêtements. Le niveau de la règle de partage a pu être estimé par Browning, Chiappori & Lewbel (2009), mais sous l'hypothèse forte que les préférences des célibataires et des individus mariés sont les mêmes. Cependant, la dernière Enquête Emploi du Temps Française de 2009-2010 fournit de précieuses informations sur l'allocation des dépenses dans le couple. En effet, dans cette enquête, chaque conjoint indique le montant de ses dépenses personnelles du mois dernier. Une règle de partage "empirique" a pu ainsi être construite, en niveau, prenant en compte à la fois l'allocation des ressources en argent (grâce à cette nouvelle variable) et en temps (grâce au carnet journalier). Selon cette règle de partage, les femmes reçoivent en moyenne 45% du revenu complet du ménage, et il est montré que les salaires restent le principal déterminant du partage entre les conjoints. Il est alors possible d'analyser dans quelle mesure cette règle de partage empirique est proche des prédictions du modèle collectif, en estimant un modèle collectif d'offre de travail avec production domestique, comme si la répartition des dépenses n'était pas observée. Enfin, la pertinence de nouveaux facteurs de distribution [6] non économiques peut être directement testée à partir de la règle de partage empirique. Cela permet également d'analyser si ajouter de la structure relative aux pouvoirs de chacun améliore l'estimation du modèle collectif. Ce premier chapitre montre que l'introduction de facteurs de négociation non traditionnels, relatifs au passé familial et conjugal des deux partenaires, permet d'améliorer légèrement la convergence entre le modèle collectif et la règle de partage empirique. Cependant, même si l'introduction d'information plus fine améliore l'estimation du modèle, même si la règle de partage empirique et celle prédite par le modèle collectif présentent des similarités quant à

6. Un facteur de distribution est une variable influençant les pouvoirs de négociation de chacun des conjoints, donc le processus de décision, mais sans impact sur les préférences ni sur l'ensemble budgétaire du ménage.

certains aspects, de fortes disparités demeurent. Le modèle collectif est très instructif dans la compréhension des décision prises au sein des ménages et la prise en compte des pouvoirs de décision de chacun. Cependant ce modèle peine à rendre compte de l'ensemble des choix de consommation. L'hypothèse minimaliste d'efficience offrait le grand avantage de ne pas avancer d'hypothèses trop fortes quand au processus de décision dans les couples, mais il apparaît finalement qu'ajouter davantage de structure permet d'améliorer les résultats. Les nouvelles enquêtes vont actuellement dans ce sens en fournissant des informations très précises sur les décisions, mais peut-être n'est-ce pas encore suffisant. Ou bien l'hypothèse d'efficience ne serait pas entièrement adpatée pour étudier l'ensemble des décisions prises par les ménages. Plus particulièrement, c'est dans la sphère production que cette hypothèse a du mal à rendre compte des choix observés, ce que va montrer le chapitre suivant.

Le second chapitre de cette thèse se focalise sur l'allocation du temps au sein des couples, afin de mieux comprendre les déterminants de cette source d'inégalité. Ce chapitre s'inscrit dans la littérature qualifiée de "time use research" qui s'est largement développée grâce à la qualité croissante des enquêtes d'emploi du temps, ayant fait l'objet d'une harmonisation à l'échelle internationale. L'étude de Veerle Miranda en 2011 est très représentative de cet intérêt grandissant pour ce type d'enquête, puisqu'il est désormais possible de dresser un état des lieux mondial sur l'allocation du temps dans les familles. Ce travail offre en effet une synthèse sur le travail non marchand des hommes et des femmes, à partir d'enquêtes emploi du temps provenant de 26 pays de l'OCDE et 3 pays émergeants.

Quand aux représentations théoriques du partage du temps au sein des ménages, la plupart se fondent sur l'hypothèse d'efficience. Les travaux pionniers de Becker (1965, 1981) et Gronau (1976) considèrent que les conjoints répartissent leurs activités de manière à maximiser le bien-être de la famille : chacun se spécialise dans les activités pour lesquelles le rendement de son temps est relativement plus élevé. Ainsi, le partenaire percevant le salaire le plus élevé devrait consacrer moins de temps aux tâches domestiques, mais davantage au travail à l'extérieur, étant donné qu'il possède un avantage comparatif dans ce domaine. Si un homme gagne un salaire plus élevé que sa partenaire, il est optimal qu'elle se consacre d'avantage à la production domestique, et lui au travail marchand, afin d'obtenir le revenu maximum à moindre coût. Même une petite différence de salaire, à productivité identique dans le travail domestique, rend ce choix efficient. Le modèle collectif intégrant la production domestique repose également sur une hypothèse d'efficience puisque la détermination des temps de travail domestique résulte de la maximisation du profit issu de la production domestique. La sphère production et la sphère consommation sont d'ailleurs séparables dans l'analyse collective.

Les études empiriques ont alors cherché à tester ces prédictions, à savoir la dépendance du temps de travail domestique de chacun des conjoints aux variables économiques observées, telles que les salaires, le revenu hors travail ou les niveaux d'éducation. De ces travaux ressort la conclusion que l'hypothèse d'efficience semble largement infirmée, dans le sens où même si les variables économiques habituelles rendent bien compte en partie de la division du temps au sein des couples, celle-ci semble cependant, sous certains aspects, irréductible à l'analyse économique standard. Cela se vérifie dans de nombreux pays (en Grande-Bretagne: Kalenkoski, Ribar et Stratton (2009) par exemple; aux Etats-Unis: Connelly et Kimmel (2007), en Espagne: Sevilla-Sanz, Gimenez-Nadal et Fernandez (2010), en France: Bloemen et Stancanelli (2014), Ponthieux et Schreiber (2006)).

Dans la lignée de ces études, l'objectif de ce second chapitre est de tester l'impact des variables économiques observables sur le partage du temps, tout en affinant la mesure du capital humain. Plus précisément, il s'agit d'identifier les femmes qui investissent beaucoup dans leur carrière, puis à tester l'impact de cet investissement sur le partage des tâches domestiques et familiales. En particulier, selon l'hypothèse d'efficience, au sein des couples où la femme se consacre de manière intensive à sa carrière, l'homme devrait prendre en charge de manière plus importante les tâches domestiques par rapport aux autres couples, et même en faire davantage par rapport à sa partenaire. Cette étude est menée à partir de deux enquêtes emploi du temps française: 1998-1999 et 2009-2010, permettant d'apprécier l'évolution du phénomène sur dix années.

De cette étude ressort la conclusion que la femme diminue fortement son travail domestique lorsqu'elle se consacre de manière intensive à sa carrière. Le travail domestique de l'homme semble plus inélastique à la situation professionnelle de sa compagne. Même si l'investissement de l'homme dans les tâches domestiques est plus fort dans ce cas (mais très souvent de manière non significative), il apparaît qu'il ne se produit jamais de renversement des rôles de genre, au sens où la femme en fait toujours plus que son conjoint, et l'augmentation du travail domestique de l'homme ne permet jamais de compenser la diminution du travail domestique de la femme. En définitive, ces résultats vont à l'encontre de l'hypothèse d'efficience, ou de minimisation des coûts habituellement faite dans les modèles de ménage. Les tâches domestiques restent une activité sexuée, et les rôles de genre traditionnels persistent puisque la femme continue à prendre en charge la majorité du travail domestique même lorsqu'elle participe au marché du travail avec une forte intensité, et même lorsque les différences hommes/femmes de salaire et de statut sont inversées par rapport au modèle traditionnel.

Notons que l'hypothèse d'efficience fut également rejetée dans le contexte de pays en développement. Udry (1996) montre notamment que les parcelles des femmes sont cultivées moins intensivement que celle de leur mari au Burkina, ce qui est contradictoire avec l'hypothèse d'efficience allocative des ressources au sein du ménage, c'est-à-dire avec le modèle efficient. Duflo et Udry (2004) testent également l'hypothèse d'efficience sur un échantillon de ménages agricoles ivoiriens et concluent que l'allocation des ressources à l'intérieur des ménages n'est pas efficace mais influencée par les normes sociales.
L'hypothèse d'optimalité semble également soumise à interrogation dans le cadre des choix éducatifs. En effet, Beffy, Fougère & Maurel (2012) mettent en évidence, en France, une très faible élasticité des choix de filière à l'Université aux revenus espérés, et suggèrent que les déterminants non monétaires sont un facteur clé des choix éducatifs. La théorie du capital humain initiée par Becker (1964) ne parvient effectivement pas à expliquer les choix d'éducation genrés, puisque dans la plupart des pays développés, hommes et femmes obtiennent des niveaux similaires d'éducation.

Finalement, si l'hypothèse d'efficience des décisions prises par les agents économiques ne peut être vérifiée dans le cadre des choix éducatifs et des choix productifs des ménages, comment représenter alors les comportements ? Chercher à représenter un optimum de second rang, intégrant des contraintes ou des représentations sociales, pourrait sans doute offrir une modélisation plus proche des comportements observés. Des travaux se sont développé dans ce sens ces dernières années, cherchant à étendre la théorie du capital humain, ou s'inspirant de concepts qui étaient jusqu'alors propres à la sociologie et la psychologie.

Initialement, il semble difficile d'imaginer une motivation monétaire poussant les femmes à accomplir la majorité des tâches domestiques, et les adolescentes à choisir des métiers moins rémunérateurs (England & Folbre, 2005). Les théoriciens du capital humain ont alors tenté d'expliquer ces choix en étendant la théorie, plus précisément en intégrant un horizon temporel long. En effet, lorsque les individus prennent leurs décisions, les anticipations qu'ils formulent impactent très probablement les choix finalement réalisés. Les filles anticipant d'éventuels congés maternité, leurs objectifs à long terme seraient ainsi différents de ceux des garçons, impactant directement leurs choix éducatifs. Elles seraient alors amenées à se diriger vers des métiers avec une faible dépréciation du capital pendant les années d'absence, dans le but de minimiser la perte monétaire (Polachek, 1981, 1984). Cette explication est validée sur des catégories professionnelles larges (Polachek), mais reste infirmée lorsque les catégories sont plus détaillées (England 1982, 1984, Sofer 1990).

Les anticipations de discrimination sur le marché du travail pourraient également jouer un rôle similaire, dans la mesure où les femmes pourraient anticiper des phénomènes de discrimination à l'embauche ou à l'occasion de promotions. Elles anticient des comportements différents des employeurs envers des hommes et des femmes ayant des niveaux de qualification similaires, ou bien l'existence de critères de sélection de la part des employeurs ayant un impact non intentionel mais différent selon le sexe (Reskin & Roos 1990; Reskin 1998). Ces anticipations conduiraient ainsi les filles à choisir des métiers dans lesquels la discrimination à leur égard est moins présente. De plus, ce type de discrimination pourrait conduire les couples à anticiper que le capital humain des femmes sera moins bien valorisé sur le marché du travail par rapport aux hommes, amenant les femmes à investir relativement plus dans le travail domestique, et les hommes à se spécialiser plus fortement dans le travail sur le marché (Apps, 1982).

Ces thèses ramènent finalement les choix observés vers l'efficience. D'autres types d'explications vont davantage puiser leurs sources en sociologie et en psychologie, et considérer les décisions prises comme un équilibre de second rang, induit par des contraintes non monétaires.

Les comportements observés pourraient effectivement provenir de préférences sexuées. Les filles auraient un goût plus prononcé pour les sciences humaines alors que les garçons préfèreraient s'orienter vers des professions scientifiques. Ou de la même manière, les femmes auraient une désutilité plus faible que les hommes pour effectuer des tâches domestiques. D'un point de vue théorique, introduire de telles préférences sexuées complexifierait fortement le modèle de maximisation du profit issu de la production domestique, puisque la partie production du ménage comporterait maintenant une composante consommation. Des coûts non monétaires (ou avantages) devraient être ajoutés (ou soustraits) aux coûts monétaires dans la maximisation du profit. Afin de parvenir à l'allocation du temps actuellement observée, la différence de coûts non monétaires entre les hommes et les femmes devrait être suffisemment élevée pour compenser les différences de salaires lorsque le salaire des femmes est plus élevé. De la même manière, les préférences des filles envers les lettres devrait être suffisemment fortes et leur désintérêt pour les sciences suffisemment fort pour que les choix observés comblent la différence de revenu espéré. De nombreux travaux en sociologie vont répondre qu'effectivement, des différences existent dans les préférences, mais qu'ils s'agit plutôt de préférences indirectes, dans le sens où celles-ci sont construites socialement et culturellement, et sont façonnées par l'environnement dans lequel l'individu se trouve. Des normes, des prescriptions sociales vont ainsi conduire les individus à agir en conformité avec ces règles et modeler leurs préférences. Les études dans ce domaine montrent que ces normes sociales sont particulièrement fortes et influentes en ce qui concerne les rôles de genre et la manière dont garçons et filles, hommes et femmes doivent se comporter. Huston (1983) montre que dès l'âge de 5 ans, les enfants ont une idée très précise des rôles de genre concernant les comportements et les traits appropriés. Eccles & Hoffman (1984) et Huston (1983) montrent que les enfants adaptent leurs comportements et aspirations selon ces normes. Ainsi les rôles de genre semblent impacter les situations et choix scolaires dès le début de la scolarité. Akerlof et Kranton (2000) ont été les premiers à introduire cette notion dans un cadre économique, sous le concept d'identité, afin d'étudier son influence sur les comportements économiques. Ils développent une fonction d'utilité dans laquelle l'identité est associée à différentes catégories sociales et à la manière dont les individus au sein de ces catégories sont censés se comporter. Les individus souffrent d'une perte d'utilité si leur action ne correspond pas à la prescription correspondant à leur catégorie, homme ou femme par exemple. Ainsi, les adolescents (ou travailleurs) étudiant (travaillant) dans des secteurs associés au sexe opposé, souffrent d'une perte de bien-être du fait d'avoir enfreint leur propre identité ou celle de leurs collègues (Janssen & Backes-Gellner, 2011). Le même mécanisme pourrait jouer au sein du ménage, expliquant l'asymétrie observée dans l'allocation du temps au sein des couples, et permettant même de comprendre le phénomène de "doing gender" (West et Zimmerman, 1981). En particulier, Bittman et al. (2003) montrent qu'en Australie, dès que la contribution des femmes aux revenus du ménage dépasse celle de leur conjoint, les femmes font davantage de travail domestique. Aux Etats-Unis, ils montrent que les hommes diminuent leur temps consacré au travail domestique quand leur contribution aux revenus du ménage diminue. Les résultats diffèrent un peu selon le pays étudié, mais tout se passe comme si les individus essayaient de neutraliser la "déviance" due à la dépendance économique des hommes. Selon la norme sociale, les hommes "ne devraient pas" alors que les femmes "devraient" effectuer le travail domestique, et les hommes "devraient" gagner davantage que les femmes sur le marché du travail. Ainsi, les hommes perdraient en partie leur identité lorsqu'ils prennent en charge très fortement les tâches domestiques et quand leur partenaire gagne un salaire plus élevé. L'égalité des utilités est restaurée lorsque la femme prend en charge le travail domestique dans de plus grandes proportions par rapport à son conjoint, permettant de contrer la déviance par rapport à la norme des salaires entre les hommes et les femmes (Akerlof et Kranton, 2000). Des modèles de ménage non coopératifs intégrant des normes sociales ont d'ailleurs été développés par Carter & Katz (1997) et par Cudeville & Recoules (2009).

Au lieu de provenir des préférences (indirectes), la raison des ces différences sexuées dans les comportements observés pourrait plutôt avoir son origine dans la sphère de production. En effet, le choix de s'orienter vers telle ou telle filière dépend en grande partie de ses propres compétences dans la discipline en question. Ou bien lequel des deux membres du ménage va s'investir plus fortement que l'autre dans le travail à la maison / le travail sur le marché est très vraisemblablement dicté par les compétences de chacun dans les différents domaines. Est-ce à dire que les garçons sont plus talentueux pour les sciences, les filles pour les lettres, et qu'elles seraient d'autant plus douées pour effectuer les tâches domestiques ? Si tel était le cas, quelle serait l'origine de différences systématiques de compétences des garçons et des filles ? Les travaux actuels des neurobiologistes infirment largement l'hypothèse de traits innés impactant de manière décisive les compétences des adultes. Ces études et en particulier les travaux de Catherine Vidal en France soulignent les capacités de plasticité du cerveau qui se façonne en fonction de l'apprentissage et de l'expérience vécue. L'argument biologique semble alors difficilement tenable quand il est prouvé par ailleurs que la variabilité des caractéristiques du cerveau entre les individus d'un même sexe égale ou dépasse la variabilité entre les sexes. Si de telles différences de compétences sont effectivement observées selon le genre, cela semble donc moins dû à des caractéristiques génétiques qu'à des croyances sur ces compétences qui auraient la particularité d'être auto-réalisatrices. Nous nous trouvons là au coeur de la littérature en psychologie portant sur les stéréotypes, et en particulier les stéréotypes de genre. Les stéréotypes sont des jugements sur les compétences ou les attributs des individus basés sur leur appartenance à un groupe social (Ruble, Cohen, & Ruble, 2001). Le mécanisme par lequel est véhiculé le stéréotype a été étudié pour la première fois par Steele & Aronson (1995), sous le concept de "menace du stéréotype". Dans cette étude fondatrice, il est montré que les étudiants noirs réussissent moins les tests standardisés que les étudiants blancs dès lors que leur origine est soulignée. Lorsque leur origine n'est pas mentionnée, les étudiants noirs améliorent leurs performances et réussissent aussi bien que les étudiants blancs. De nombreuses expériences ont été menées par la suite, dans des domaines variées (l'éducation, le sport, la négociation, la conduite), sur des sujets variés (en fonction de l'origine, du milieu social, du genre), et la menace du stéréotype conduit de manière quasi-systématique à réduire les performances des individus appartenant au groupe négativement stéréotypé. Parmi les nombreuses expérimentations menées, beaucoup s'intéressent aux compétences des étudiants en fonction du genre. La menace du stéréotype nuit aux performances académiques des filles en math (Good, Aronson, & Harder, 2008; Inzlicht & Ben-Zeev, 2000; Spencer, Steele, & Quinn, 1999). Une exposition constante à la menace du stéréotype portant sur les compétences des filles en math peut réduire le degré d'appréciation du domaine en question par les individus (Aronson, et al. 2002; Osborne, 1995; Steele, 1997). Il peut conduire les étudiants à ne pas poursuivre la discipline en question, et par conséquent réduire l'éventail de métiers qu'ils pourraient envisager. Les effets à long terme de la menace du stéréotype pourraient donc contribuer aux inégalités dans la domaine de l'éducation et aux inégalités sociales plus largement (Good et al., 2008a; Schmader, Johns, & Barquissau, 2004).

Ce mécanisme a été intégré à l'analyse économique pour mieux comprendre le phénomène de discrimination sur le marché du travail, par Coate et Loury (1993). Ils supposent l'existence d'un stéréotype relatif à la différence de productivité respective des travailleurs blancs et noirs. Les travailleurs noirs sont perçus (à tort) comme moins qualifiés en moyenne par rapport aux travailleurs blancs. Ne pouvant observer de manière certaine le niveau de compétence de chacun, les employeurs sont amenés à fixer des règles de recrutement plus difficiles pour les travailleurs noirs, qui seront donc effectivement moins souvent recrutés. Les travailleurs noirs anticipent ce processus de sélection, et décident de moins se former, puisque les chances d'être embauché sont de toutes façons plus faibles. Les travailleurs noirs se retrouvent effectivement moins compétents que les travailleurs blancs, et les employeurs sont alors confortés dans leur croyance. Cela conduit à un équilibre entièrement auto-réalisateur.

Ce mécanisme ainsi décrit pourrait jouer un rôle majeur dans le domaine de l'éducation et au sein du ménage lorsqu'il s'agit d'allouer le temps des partenaires aux différentes activités. Une croyance erronnée de la société envers les compétences en lettres et en sciences des filles et des garçons conduirait à des choix d'effort et d'orientation scolaire sexués. De même, des croyances sur les productivités domestiques des hommes et des femmes pourrait amener les femmes à se spécialiser relativement plus dans le travail à la maison et les hommes dans le travail sur le marché, amenant les femmes à devenir effectivement plus compétentes pour effectuer les tâches domestiques.

Notons également que l'économie expérimentale et comportementale apportent des éléments clé de compréhension de ces comportements genrés, qui sont en relation très forte avec les concepts d'identité de genre et de stéréotype. Notemment, de nombreuses expérimentations ont montré que les garçons sont moins averses au risque que les filles (Croson & Gneezy, 2009, pour une revue), les garçons ont tendance à avoir une confiance en eux plus forte (Barber & Odean, 2001 ou Bengtsson & al. 2005), les garçons présentent un goût accru pour les environnements compétitifs (Datta Gupta, Poulsen, Villeval, 2013, Couprie, Cudeville, Sofer, 2014, par exemple).

L'ensemble de ces études, à la fois économiques, psychologiques et sociologiques, conduisent à la conclusion fondamentale que les différences de genre actuellement observées ne sont pas figées, et que des volontés et incitations politiques dans ce domaine ont la possibilité d'infléchir le phénomène. En effet, si les choix effectués ne proviennent pas seulement des préférences, dans l'objectif à la fois d'une réduction de l'écart salarial de genre et d'une meilleure allocation des ressources humaines, il est important de comprendre pourquoi les garçons et les filles, les hommes et les femmes, effectuent des choix apparaissant comme traditionnels. De telles analyses sont hautement instructives en terme d'implications de politiques publiques.

Ce sera l'objectif des chapitres 3 et 4 de cette thèse, qui vont se concentrer tout particulièrement sur les déterminants relatifs aux stéréotypes de genre, c'est-à-dire aux croyances de la société envers les compétences des hommes et des femmes, et en particulier envers les talents relatifs aux différentes disciplines scolaires (chapitre 3) et à la production de biens domestiques (chapitre 4).

Le troisième chapitre constituant cette thèse cherche à mieux comprendre pourquoi les garçons et les filles effectuent des choix éducatifs différents, et plus particulièrement pourquoi les filles prennent des décisions apparaissant comme préjudiciables en terme de salaires notamment. Ce chapitre propose une analyse basée sur les compétences et les résultats scolaires dans les différentes disciplines, en examinant si les filles et les garçons effectuent des choix différents en fonction de leurs notes obtenues dans chaque matière. Il s'agit donc de regarder si l'information obtenue par les jeunes sur leurs compétences est interprétée de manière différenciée selon le genre, afin de révéler l'existence éventuelle de croyances genrées sur les compétences. Cette étude montre qu'effectivement, garçons et filles interprètent différemment leur note lorsqu'ils effectuent des choix de filière, même si les différences ne sont pas si marquées selon les différentes disciplines, en particulier sciences versus lettres. Le processus à l'oeuvre est différent selon qu'il s'agisse des choix de filière de Baccalauréat ou des choix de filière d'études supérieures. Finalement, des différences sexuées apparaissent moins dans le choix de disciplines que dans le type de filière: Baccalauréat Général versus Technique, et classes préparatoires aux grandes écoles versus autres types d'études supérieures. De manière générale, les filles réagissent moins à leurs notes que les garçons dans les choix d'orientation scolaire, et elles utilisent d'avantage leurs notes en lettres qu'en sciences pour choisir telle ou telle voie.

Le quatrième et dernier chapitre de cette thèse va quant à lui se concentrer sur les décisions d'allocation du temps dans les ménages, et sur les effets d'un stéréotype de genre sur les productivités domestiques. La croyance supposée ici dans la société postule que les femmes seraient plus compétentes que les hommes pour effectuer des tâches domestiques. Une modèle théorique permet de comprendre comment cette croyance influence le programme de maximisation du profit issu de la production domestique. Le stéréotype conduit à un équilibre de second rang, dans lequel le stéréotype va amplifier l'effet de l'écart salarial entre les hommes et les femmes, conduisant à ce qu'elles se spécialisent relativement plus que les hommes dans le travail à la maison. Il est également montré qu'en terme de politique publique, un affaiblissement du stéréotype entraine une augmentation de l'investisement des hommes dans les tâches domestiques dans des proportions bien plus fortes qu'une réduction de l'écart salarial, même quand cet écart salarial diminue très fortement. De plus, agir sur la prévalence du stéréotype dans la société conduit à un cercle vertueux où les femmes investissent de manière plus intensive la sphère professionnelle, les amenant à recevoir des salaires plus élevés, et donc à réduire leur investissement dans la sphère domestique, et ainsi de suite.

CHAPTER 1

Allocation of resources within couples: some new evidence about the sharing rule

1.1 Introduction

Decision making within couples has been widely studied by economists within the framework of the Collective Model (Chiappori, 1988, 1992, Apps and Rees, 1988). This theoretical representation allows for different preferences concerning the allocation of time and money within the family. The considerable advantage of the Collective model consists in minimalist assumptions: the decision-making process is only assumed to be Pareto-optimal, and the only observation of individual labour supplies (in the case of the Collective model of labour supply) allows estimation of individual shares of the household income, according to the so-called "sharing rule". Actually this notion in a sense captures the idea of respective decision powers of each partners. The sharing rule is a very usefull measure as it can be estimated through empirical data, so we are able to recover information about the economic well-being of household members. Implications are very informative, as for example, the sharing rule allows to study inequalities across individuals rather than across households (Lise and Seitz, 2011). This is particularly relevant for policy makers, especially in the introduction on targeting benefits or taxes to particular household members, as we have now tools to understand how reforms may increase the members negotiation weight and the impact on decisions.

However, this sharing rule is most of the time identified up to a constant, given that private expenditures of each partners are generally unknown. Indeed, consumption information contained in household surveys are generally collected only at the household level but not at the individual level, making impossible to assign expenditures to each partner. Thus most papers cannot retrieve the exact level of this sharing rule but rather its derivatives.

Chiappori (1992) demonstrates that the unidentified constant is welfare irrelevant, in the sense that changing the constant affects neither the comparative statics nor the welfare analysis derived from the model. However, if the objective is to study the intrahousehold inequality, the Collective Model can identify the changes affecting intrahousehold inequality, but not its initial level, which can be usefull. Indeed, many of the uses of sharing rule estimates, such as calculation of poverty lines, indifference scales, and distributions of income and welfare, depend on the level of the sharing rule (Cherchye and al., 2012).

Very recently, four main household surveys have tried to go beyond this difficulty, by asking precisely the amount of personnal expenditure to each partner. The first three surveys are all based on the Danish population. The first was conducted by Browning and Bonke who have added a supplement to the Danish Household Expenditure Survey (DHES) for 1995 to 2005. Then the Danish Time Use Survey (DTUS) of 2001 was mainly used by Browning and Gortz (2012). And Cherchye, De Rock and Vermeulen (2012) used the new LISS (Longitudinal Internet Studies for the Social sciences) Panel representative of Dutch population, in which they added a module on time use and consumption. Finally, the last survey is based on the French population: the new French Time Use Survey of 2010. Since expenditures are allocated in these data, a sharing rule can be constructed for each household. This allows for the identification of the location of the sharing rule as well as its dependence on distribution factors. Furthermore, consumption and time use information usually make the object of two different surveys. Collecting both types of information for the same household, which is the case in the French Time Use survey, the DTUS and the LISS, has the great advantage to modelise and estimate together the allocation of expenditures and time within couples, and investigate very precisely "who gets what" within couples.

In addition to assignable expenditures, a notable feature of the new French Time Use survey and the DHES is that they contain very precise and novative information on decision process for the surveyed households, providing a rich set of potential distribution factors. Consequently it is now possible to study the allocation of resources within couples using a large set of sociological and psychological determinants.

In this paper, I exploit the richness of the last french Time Use Survey conducted in 2009-2010 to analyze intra-household allocation of resources. This paper contains three main ideas.

The first idea is to describe the level of the sharing rule (allowed by the richness of our data), that I call the "empirical sharing rule", and that represents partners' shares of household full income. Each share is the sum of personal expenditures plus leisure time valued at the wage rate. I examine the distribution of the observed sharing of resources within households and its general economic determinants.

The exact level of the sharing rule has already been computed in some previous works, but only considering the sharing of expenses. The first paper was led by Browning and al. in 1994, using Canadian Family Expenditure Survey data on men and women's clothing. Then Bronwing and Bonke (2009) use a supplement to the Danish Household Expenditure Surveys for 1995 to 2005 in which respondents record for every expenditure in an expenditure diary for whom the item was bought. Browning, Chiappori and Lewbel (2009), Couprie (2007) and Lewbel & Pendakur (2008) also estimate the location of the sharing rule, making the strong assumptions that the preferences of singles and married people are the same.Kalugina et al. (2009a, 2009b) also retrieve the sharing rule itself using subjective data on income satisfaction or life satisfaction in Russia, by assuming a correspondence between, first, the perception of income that household members report and their true income sharing, and, second, between their answer to a satisfaction question and their utility. Alessie, Crossley, & Hildebrand (2006), Bonke & Browning (2009) use answers to financial satisfation questions as direct measures of the utility derived from consumption to estimate parameters of the sharing rule.

The novelty of my approach here is to take into account, in a simple way, both the allocation of time and money, leading to a more complete and precise representation of decision-making within families.

The second general idea is to compare this "empirical sharing rule" observed in our data with the predictions of the Collective Model. Indeed, the computation of empirical shares does not refer to a particular model of decision-making within couples, as this sharing rule could be the result of a collective decision process, but also a non-cooperative process for example (Ulph, 1988, Carter et Katz, 1997, Konrad et Lommerud, 2000), or even an unitary process (Samuelson, 1956, Becker, 1974, 1981). Investigating how much the sharing rule revealed by the data and predictions of the Collective Model are close provides a quite direct and simple test of the Collective Model, at least according to French data. Such an analysis has not been carried out before.

Thus in a second section, I use a Collective Model to estimate derivatives of the sharing rule, as if I did not have information about private expenditures and I call it the "theoretical sharing rule". It allows me to compare directly this "theoretical sharing rule" with the "empirical sharing rule".

The last idea is to test the relevance of non-traditional economic variables compared to more classical variables usually used in household studies, to explain the sharing rule. This is now possible with the novative module of the French survey, entirely focused on decision-making inside couples, with questions about financial arrangements, negociation between partners, harmony between partners and biography elements (about parents, conjugal past, beginning of the partnership). Actually, this amounts to introduce more distribution factors, not necessarily related to the marriage market, as is usually done. I include variables similar to those used by Browning and Bonke in 1999 (if partners' mothers worked full time when they were 16 years old and if they have child from past partnership), and some new distribution factors about the number of years since partners live together, the professional situation of partners when they met for the first time, the distribution of personal assets between partners, and the level of education of partners' mothers. I investigate the influence of these variables on the empirical sharing rule, and then I examine if adding them in a collective model as distribution factors allows to bring better estimates of sharing rule, in the sense that they are closer to what I observe in the survey.

Leading such a synthesis about the sharing rule appears really important since as explained by Browning, Chiappori and Weiss (2011), there is no coherent theory of the sharing rule. Indeed, potential distribution factors differ widely across different data sets and the excluded distribution factors could be correlated with the included ones. The new

French Time use survey solves in a sense this difficulty, as the "Decision-Making Module" includes a really broad set of variables, among them most of distribution factors previously used in other studies and new one. Comparisons across countries and surveys become now possible, providing a quite good test of the validity of these new kind of distribution factors. In addition, as said before, I compare in this paper predictions of the Collective Model with the empirical sharing rule, to test to what extent this theoretical representation is close to what I observe in the survey. But on the other hand, including some new distribution factors within the empirical sharing rule allows me to test their relevance by comparing results with predictions of the Collective Model which is the best well-established intra-household decision-making model. In all, I am able to test the global coherence of both approaches one over the other.

To carry out this study, I develop a Collective model of labour supply with household production. Most of Collective Models define the sharing rule on non-labour income, which means that they study how non-labour income is shared between partners. However, the empirical sharing rule I compute is based on shares of the full income minus the other expenditures that are not exclusive (the full income contains non-labour income plus the maximum amount of labour income that could be earned by partners). Thus in order to compare directly the theoretical and the empirical sharing rule, I need to develop a Collective Model which leads to a theoretical sharing rule defined on full income minus the other goods that are not exclusive. In this objective, I use a version of the Collective Model developed by Rapoport, Sofer and Solaz (2011), that I modify in that sense. I also use literature about Collective Models including public goods, as Donni (2009) and Couprie

(2007). I show that the theoretical sharing rule is also identified in this case.

Both in the empirical and theoretical analysis, I consider two different models, one defined in a framework without considering domestic production in the household, and the other taking into account this household production. The first version considers that domestic work time is actually pure leisure time, while in the second version, domestic work is added to labour market time, and not considered as leisure anymore. In fact, these two measures refer to two versions of the Collective Model of labour supply, without domestic production (Chiappori, 1992, 1998, Fortin and Lacroix, 1997, Chiappori and al., 2002) and with domestic production (Apps and Rees, 1997, Chiappori, 1997, Aronsson, Daunfeldt and Wickstrom, 1999, Bourguignon and Chiuri, 2005, Rapoport, Sofer and Solaz, 2011). Many papers show that results differ significantly considering domestic work as pure leisure or not, the first assumption leading to under-estimate inequalities within household. Moreover, collective model including domestic production have been shown to bring more precise estimates of the sharing rule.

This paper is organized as follows. The first part develops the version of the collective model on which I base my paper. In a second part, I examine the distribution of the empirical sharing rule and its classical economic determinants, as own's and partner's wage, household non labour income, sex ratio, age difference and ratio of diploma. Main results show that the level of this empirical sharing rule is in the range of previous estimated sharing rules since I find that the woman's share represents 45 % of the household full income, on average. Own wages and the presence of children remain the principal determinants of the sharing rule. Furthermore, knowing the exact amount of household sharing provides a quite direct test of the theoretical sharing rule implied by the collective model. So in a third part, I will compare the empirical sharing rule with derivatives of the sharing rule estimated in the framework of the collective model. In the last part, I test the relevance of non-traditional variables compared to more classical variables usually used in household studies. I investigate whether including such variables in the collective model brings better estimates of the theoretical sharing rule closer to what I observe in my data.

1.2 The Collective Model and characterization of the theoretical sharing rule

1.2.1 General considerations and specific assumptions

The main objective of this paper is to compare an empirical sharing rule directly observable from the data, with a theoretical one derived from the collective model. The empirical sharing rule is defined as the share received by each partner, which is equal to his/her personal expenditures plus his/her leisure time valued at his/her wage rate. Indeed, the opportunity cost of a person's time is determined by the person's wage. The objective of this first part of the paper is to develop a Collective Model of labour supply leading to a theoretical sharing rule directly comparable with this empirical one, at least in its derivatives.

Thus the theoretical sharing rule is based on the Collective Model framework (Chiappori, 1988, 1992, Apps and Rees, 1988), the most widespread representation of household decision-making. This model has the great advantage to avoid making strong *ad hoc* assumptions on the household decision process. The only assumption consists in assuming that decisions are Pareto efficient, which means that whatever the way couples make decisions (bargaining, formal rules or others), the resulting choices are Pareto efficient. Moreover, a very interesting result is that the decision process can be decentralised. Indeed, thanks to the Second Fundamental Theorem of Welfare Economics, any efficient outcome can be decentralized by a choice of prices and the (re)distribution of income. According to the decentralization procedure, each person is given a share of the total household income and allowed to spend it on their own private goods, using their own private sub-utility function. More precisely, when all commodities are privately consumed, the decision process can be decomposed into two phases: a sharing phase in which partners determine the sharing rule and a consumption phase, in which they allocate their share between the various commodities available. Thus only the second phase relates with efficiency: whatever the sharing rule, the resulting allocation will be efficient provided that agents maximize their utility during the consumption phase. The first stage relates with the collective part of the process (a review about Collective Models in found in Browning, Chiappori, Weiss, 2011).

As is usually done, I assume here that the household production function exhibits constant returns to scale. Indeed, a standard problem in household economics is that the production function cannot be estimated independently of the utility function unless the home produced commodities are independently observable (Pollak and Wachter, 1975, Gronau, 2006). The output may be observable in agricultural production or children's health and education, but it is impossible for domestic tasks, as cleaning for instance. Nevertheless, when outputs are not observable, under the assumption of constant returns to scale and no joint production (in the sense that partners' domestic times do not appear directly in the utility function), we are able to recover information about the technology provided that the input supply (as a function of relative wages) are observed (Pollak and Wachter, 1975, Gronau, 2006).

In addition, as in Chiappori (1997), Chiappori and al. (2002), and Rapoport and al. (2011), I make the assumption that household production is marketable. This means that domestic goods have perfect market substitutes and that domestic production in any quantity can be bought and sold at market prices by all households. Thus the price of the domestic good is exogeneous for the household.

In the alternative situation, the non-marketable case, the price of the household commodity is endogenous to household decisions and has to be estimated (as a function of wages and incomes). Actually, a consequence of missing markets is that the separability property, which implies that the demand side is totally divorced from production, no longer holds. Estimation of nonseparable models is much more difficult. Particularly, Chiappori (1997) shows that in this case, if the household production exhibits constant returns to scale, the sharing rule can be recovered only up to an additive function of wages. Thus endogeneity of the domestic price has a cost in terms of identification.

Admittedly, the marketability assumption is quite strong, at least in developed market economies. Indeed, a majority of the population of a developing economy typically work in agriculture, often producing marketable commodities at the household level, but in other contexts, it appears quite unusual that people think of selling their domestic production, as cleaning services for instance. Nevertheless, almost all usual domestic goods produced within the household have nearly perfect market substitutes that are widely bought by households. But if domestic goods can only be purchased but not sold, some households may reach a corner solution, in which the market purchase of domestic goods is nil, and the normalized marginal productivity of a person's domestic work exceeds the person's wage. This is equivalent to the domestic good not being marketable (Browning and al, 2011).

To conclude, from a theoretical point of view, not to make the assumption of marketable domestic production strongly complicates the analysis. With the objective to compare a theoretical sharing rule in a simple form, derived from the collective model, with the empirical one, as it is usual in the literature, I assume in the following that household production is marketable.

Finally, I assume that goods can be either public or private, and the last fundamental assumption consists in assuming a separability in the individual utilities between the public goods and the private sphere that involves consumption and leisure. The maximization of the utility on private goods conditionally to public goods is the same than the maximization of the non-conditional utility on private goods. This assumption allows me to not explicitely take into account the presence of public good that are produced and publicly consumed within the household, since my data do not contain information about partners' contribution to the public good. In addition, including public goods within the collective framework much more complicates the analysis. When a good is private, all agents face

the same price and choose different quantities, while with public goods, they all consume the same quantity but would be willing to pay different marginal prices for it.
In this paper, I will assume that the domestic goods are publicly consumed within the family.

1.2.2 The definition of the theoretical sharing rule

The estimation of the theoretical sharing rule is based on the version of the Collective Model developed in Rapoport, Sofer, Solaz (2011). This is a Collective Model of labour supply, including household production. I also use some of the literature on collective models including public goods (Donni, 2009, Couprie, 2007).

However, in Rapoport, Sofer, Solaz (2011), but also in most of empirical applications of the Collective Model, the sharing rule is defined on the "non-labour income", which means that in the first stage of the decision process, the couple agree on the sharing of the non-labour income between them. Assuming ψ_f the share of the woman, and ψ_m the share of the man, ψ_f [ψ_m] can be considered as the extra income allocated to the wife [husband] from the sharing of "non labour-market income". This definition of the theoretical sharing rule does not allow me to make direct comparison with the empirical one. Thus rather than considering the allocation of the non-labour income, I will consider here the allocation of the full income, in order to have a theoretical sharing rule consistent with the data. The full income is defined as the sum of non-labour income plus the maximum amount of labour income that could be earned if spouses would spend all time working on the labour market. In the case of the collective model with household production, the profit from this production is included to full income.

Considering that the household consists of two indiviudals i, male $(i = m)$ and female $(i = f)$, total time available is denoted by T, w_f and w_m are the wage rates of f and m, respectively. y is the non-labour income, and Π the profit from household production. Thus the full household income $\sum_{i=f,m} Tw_i + y + \Pi$ is divided between partners, and each partner's share is used for his/her personal consumptions C_i^m (the Hicksian composite good bought on the market, whose price is assumed to be equal to 1) and C^d (consumption of the good produced at home, whose price p is the same for all households as domestic production is assumed to be marketable) and leisure l_i whose price is the individual wage rate, such that:

$$\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i + pC^d = \sum_{i=f,m} Tw_i + y + \Pi$$

Note that the full income includes the profit from household production, although largely unobserved. But let's remember that the household production function is assumed to exhibit constant returns to scale, which implies that the profit is zero, and removes the problem.

Moreover, a more complete definition of full income would include public goods C^P, and other kinds of expenditures:

$$\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i + pC^d + PC^P + rC^C + S = \sum_{i=f,m} Tw_i + y + \Pi$$

Indeed, the household also makes expenditures for market public goods C^P (such as housing, insurance payments, heating, etc.), expenditures for the community C^C, which will be privately consumed (food is the typical example), and savings S. The exogeneous price for market public goods is P, and r for common goods. However, the French time use survey does not provide information about these three kinds of expenses. Note also that the consumption of the domestic good C^d is not observable. Thus the sum of the two empirical shares $\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i$ is not strictly equal to the full income $\sum_{i=f,m} Tw_i + y + \Pi$. However, in addition to the assumption that the public good is separable from the other goods, I will also assume that the sum of the "other" goods (including market public goods, expenditures for the family, savings, and the good produced at home) is separable from exclusive (or assignable) goods (Donni, 2009). Thus derivatives of the sharing rule based on the full income and derivatives of the sharing rule based on the remaining income (the full income minus the other expenses) are the same.

1.2.3 Development of the Collective Model

Formally, the household consists of two individuals i, male ($i = m$) and female ($i = f$). Their own utility function $U_i(l_i, C_i^m, C^P, C^C, C^d)$ is defined on observed own leisure, l_i, consumption of a Hicksian composite good bought on the market, C_i^m, usually unobserved in most surveys, market public goods C^P, the common good C^C, and the domestic good produced at home and publicly consumed C^d. The price of C_i^m is assumed to be equal to 1.

A major assumption is to assume a separability in individual utilities between the private sphere (consumption and leisure) and the "other" goods (public goods, common goods, domestic good produced at home). The marginal rate of substitution between personal consumption and leisure is not affected by the level of "other" consumptions. Separability imposes:

$$U_i(l_i, C_i^m, C^p, C^c, C^d) = W_i[u_i(l_i, C_i^m), C^p, C^c, C^d]$$

where u is the individual's sub-utility from exclusive goods consumption.

The quantity of home-produced goods is denoted by Q and produced by time inputs of household members, t_i, according to the production function $F(t_f, t_m)$. As discussed before, I assume that this household production function exhibits constant returns to scale. Profit, Π, or net value of domestic production, is given by:

$$\Pi = Q - w_f t_f - w_m t_m$$

where w_f and w_m are the wage rates of f and m, respectively.

Total time available is denoted by T, market labour supply by L_i and total working time (domestic labour + market labour supply) by H_i. Thus we obtain the time constraint $H_i + l_i = T$, where $H_i = t_i + L_i$.

Conditional on public expenditures, the allocation of exclusive expenditures is Pareto-optimal. The household maximizes a generalised weighted utilitarian household welfare function:

$$(P0) \quad \max_{l_i, C_i^m} \mu(.)\, u_f(l_f, C_f^m) + (1 - \mu(.))\, u_m(l_m, C_m^m)$$

subject to the constraint

$$\begin{aligned}
&\sum_{i=f,m} C_i^m + C_i^d + C^P + C^C = \sum_{i=f,m} L_i w_i + y + F(t_f, t_m) \\
\Leftrightarrow &\sum_{i=f,m} C_i^m + A = \sum_{i=f,m} L_i w_i + y + F(t_f, t_m), \\
&with\ A = C_i^d + C^P + C^C
\end{aligned}$$

where A represents the sum of the other expenditures. $\mu = \mu(w_f, w_m, y, s_1, ..., s_r, ..., s_R)$ is a continuously differentiable weighting factor contained in [0,1]. **s** is a R-vector of distribution factors. By definiton, the vector **s** only appears in $\mu(.)$. As such, changes in the **s** variables do not affect the Pareto frontier but only the equilibrium location on it, through the resulting changes in shares of full income.

The above constraint can be rewritten as:

$$\begin{aligned}
&\sum_{i=f,m} C_i^m + A = \sum_{i=f,m} H_i w_i + y + \Pi \\
\Leftrightarrow &\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i = \sum_{i=f,m} T w_i + y + \Pi - A \\
\Leftrightarrow &\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i = Y - A
\end{aligned}$$

Contrary to Chiappori and al. (2002) and Sofer and al. (2011), I consider that the theoretical sharing rule applies to $Y - A$, the household full income net of savings [1], minus the "other" expenditures. I assume a separability between personal goods C_i^m and l_i on the one hand, and the other goods A, on the other hand.

1. I do not modelize intertemporel behavior in this paper. Contributions extending the collective model to an intertemporal setting are mainly due to Mazzocco (2004, 2007)

Let us describe formally each step of the decision process. Assuming that good C^d is marketable, efficiency and further separability between consumption and production have an immediate implication, namely profit maximization. Specifically, t_f and t_m must solve

$$(P1) \quad \max_{t_f, t_m} \Pi = Q - w_f t_f - w_m t_m$$

which gives solutions:

$$t_f = t_f(w_m, w_f)$$

$$t_f = t_f(w_m, w_f)$$

$$\Pi^* = \Pi(w_m, w_f)$$

According to Donni (2009) and Couprie (2007), in a decentralized fashion, we obtain that each individual maximises his/her individual sub-utility, given the conditional sharing rule ρ_i:

$$\max_{l_i, C_i^m} u_i(l_i, C_i^m)$$

under the member-specific budget constaint:

$$w_i l_i + C_i^m = \rho_i$$

where ρ_i is the sharing rule, i.e. the proportion of exclusive expenditures (total full income minus "other" expenditures) going to individual i within the family, such that

$\rho_f + \rho_m = Y - A.$

The separability principle implies that the demand side is totally separated from production and "other" goods consumption decision. All occurs *as if* the household maximizes the profit from household production on one hand, makes decisions about the "other" expenditures A on the other hand, and then each partner separately chooses his/her consumption of exclusive good and leisure time.

Thus there exists two functions $\rho_f(w_f, w_m, y, \mathbf{s})$ and $\rho_m(w_f, w_m, y, \mathbf{s})$, and in the following, I set $\rho = \rho_f$. ρ is the share of the full income minus other expenditures allocated to the wife. Thus the shares are a function of wages, non-labour income, and distribution factors.

The identification results are developped below. Total labour supplies have the form:

$$H^f = L^f(w_f, \rho(w_f, w_m, y, \mathbf{s})) \tag{1.1}$$

$$H^m = L^m(w_m, \Pi(w_f, w_m) + y + (w_f + w_m)T - \rho(w_f, w_m, y, \mathbf{s}) - A) \tag{1.2}$$

I now show that derivatives of the sharing rule are identified up to a constant, which means that we can compute its derivatives [2].

2. The sharing rule being conditional to the level of the "other" expenditures, A is a constant and is removed in the derivatives of labour supplies.

I define:

$$A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y}$$
$$B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y}$$
$$C = \frac{\partial H^f/\partial s_r}{\partial H^f/\partial y}$$
$$D = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial y}$$

whenever $\partial H^f/\partial y \neq 0$ and $\partial H^f/\partial y \neq 0$ for $r = 1, ..., R$. Note that all these variables are observable and can thus be estimated.

Assuming that $C \neq D$, we find derivatives of the sharing rule (where the subscript $r = 1$ has been removed for notational covenience):

$$\frac{\partial \rho}{\partial y} = \frac{D}{D - C} \tag{1.3}$$
$$\frac{\partial \rho}{\partial s} = \frac{CD}{D - C} \tag{1.4}$$
$$\frac{\partial \rho}{\partial w_m} = \frac{AD}{D - C} \tag{1.5}$$
$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D - C} - t_f + T \tag{1.6}$$

Details about calculations are in Appendix 1. Thus only one distribution factor is sufficient to identify the sharing rule up to an additive function.

Note that, with reference to derivatives of the sharing rule found in Rapoport, Sofer, Solaz (2011) (in which the sharing rule is based on the non-labour income), only the derivative with respect to w_f changes. The fact that derivatives with respect to y and s are not impacted is not surprising. Indeed, an increase in y leads to an increase in the full income (minus "other" expenditures) and in the non-labour income exactly in the same level, and a variation in s has no impact on the level of household full income. The derivative with respect to w_f changes, in the sense that the term T is added. Indeed, an increasing in w_f leads to an increasing in household full income, which modifies the effect of the wife's wage on the sharing rule defined on full income compared to non-labour income. What's more surprising is that the derivative with respect to w_m does not change, while the full income becomes higher following w_m increase. But actually, what's happen is that this increase in wage's partner has an impact on negociation powers of both partners, but this impact appears in the full income as in non-labour income exactly in the same way.

Finally, the sharing rule is also identified up to a constant when it is defined on full income minus "other" expenditures rather than non-labour income, and only the derivative with respect to w_f is changed.

With no domestic production, $\Pi = 0$, and $\frac{\partial \Pi}{\partial w_f} = 0$, and thus Y is now non-labour income plus maximum of labour market income. In this case, $\frac{\partial \rho}{\partial w_f}$ reduces to:

$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D - C} + T$$

Finally, the theoretical sharing rule defined in this part corresponds exactly to the empirical sharing rule, in level, and in its derivatives.

The next part focuses on how I measure this empirical sharing rule from the French time use survey.

1.3 Distribution of the empirical sharing rule and its economic determinants

1.3.1 Data: the French Time Use Survey

Time Use surveys are now generalised in more and more countries, and european countries have led a harmonization work to make cross-country comparison more relevant. These surveys consist in collecting very precise information about daily activities. Interviewed household members write down their activities in a booklet, indicating the time spent on each activity, according to a certain time periods (10-minutes in France for example). In France, time use surveys are implemented almost every each ten years. The last survey (on which this paper is based) is very recent and has been developed in 2009-2010. This new french Time Use Survey contains a traditional section common to each existing time use survey, plus a very innovative section called "Couple Decision-Making Module" (*Module Décision dans les Couples*).

The classical part of the survey is composed of a "household" questionnaire and one "individual" questionnaire for each member of the couple, with many information about family, place of residence and its caracteristics, professional situation of family members, wages, total income of the family etc. This classical part of the survey contains 12069 households and 18521 individuals.

Respondants filled two daily time-use booklets, one on a week day, the other on a week-end day. But if the household agrees to answer the "Decision-Making Module", they only fill one time-use booklet, during a day of the week or the week-end. On the day(s) of the survey, respondants wrote down their activities, indicating the time spent on each activity, according to 10-minutes time periods. 27 903 booklets have been completed. A subsample of time use booklets has been enriched with the evaluation by individuals about the pleasant or unpleasant nature of the moment, but I do not use this information here.

As for the "Couple Decision-Making Module", it deals with financial arrangements, daily family management, sharing of responsibilities and decisions, and biography elements. Only a subsample of couples replied to this module: those having accepted to answer it, and on this basis, three conditions had to be satisfied: both partners live in the same housing since at least one year; neither of the two is a student; and at most one of them is retired. Thus 2349 households and 4371 individuals answered the "Couple Decision-Making Module", which contains four parts. A "household level" questionaire includes information about couple formation and financial arrangement between spouses. An "individual level" questionaire, separately asked to each spouse, collects biography items, personal activities and social relations information, relations with partner, decision-making on several areas, independance in money use. Last but not least, a self-administered questionnaire (a couple part and an individual part) gathers information about individual and common property, and bank organisation of the couple. Our key variable is included in the individual self-administered questionnaire and asks to each partner: "Last month, how do you have spent for personal purchases ?". In a second variable, the respondant tells if this is representative of monthly usual expenditures, more, or less.

In this paper, I use the sample of individuals who answered the "Couple Decision-Making Module". I select people living in a couple, with or without children, reporting a professional activity, that is 1163 households, so 2326 spouses. I drop 77 couples in which at least one of the spouses did not report monthly wage or hours of work per week, making it impossible to compute an hourly wage for them. In addition, in 124 couples, at least one of the members did not report the amount of monthly personal purchases, so that I drop these households. I also drop 22 couples for which personal expenditures were excessively high. In all, my final sample contains 940 couples, so 1880 individuals.

1.3.2 Personal expenditures

In the French Time Use survey, respondents to the "Decision Making Module" recorded the amount of personal expenditures during the last month. This question was adressed in the self-administered part of the module. Instruction was given to couples to fill in the questionnaire separately, and each partner had his own envelope to insert the document. The question was the following: "Last month, how much did you spend on your personal purchases?". Another question asked whether this amount is representative of his/her usual monthly expenditures, and possible answers was: Yes / More than usual / Less than usual. No particular instruction was given to respondents to record their purchases, meaning that they take into account all items bought for themeselves, more precisely all items they feel they bought for themselves, without any restriction. In order to estimate a sharing rule, we need expenditures that are *assignable* to husband and wife. As in Browning and Bonke (2009), I define as *assignable* any expenditure that respondents say was bought for himself or herself. This excludes all items bought for the household, even if they are privately consumed. The general formulation of the question in the survey is very convenient for me, because it avoids the problem of the classification of some goods in a precise category, as assignable or not: respondents make that imputation themselves in the survey. For example, food is likely to be bought for the household, even if it is strictly a private good in the sense that there is rival consumption, so food should be considered as a non assignable good. However, it does not exclude that sometimes in a couple, food is bought for oneself (at home or in a restaurant), and that the respondent considers this purchase as a personal expenditure. Thus private goods that are bought exclusively for one person or another are defined to be assignable goods, whereas private goods that are bought for the household are defined to be non-assignable (Browning and Bonke, 2009). For all these reasons, I believe that the expenditure variable of the french time use survey represents quite well the sharing of assignable expenditures between partners.

The Danish surveys including assignable expenditures use different methods to collect this information. The Danish Household Expenditure Survey (DHES), mainly used by Browning and Bonke (2009), takes the form of respondents recording for every expenditure in a conventional expenditure diary for whom the item was bought: mainly for the household, for the husband, for the wife, for the children and outside the household. In the Danish Time Use Survey of 2001 (DTUS), mainly used by Browning and Gortz

(2011), the following questions were asked to the respondent: "When you think of your own personal expenditures, how much do you estimate it is normally on the following items during one month: clothing and shoes; leisure activities, hobbies, etc. (e.g., sports, sports equipment and club membership); other personal consumption (e.g., cigarettes, perfumes, games, magazines, sweets, bars, and cinema)". The respondent was then asked the same questions for their spouse/cohabitant. One advantage of the French survey consists in each spouse reporting his own expenditures, very likely reducing measurement errors. In addition, the amount of assignable expenditures is not delimited by particular categories. On one hand, reporting expenses in a broad category appears quite difficult as it requires to remember all expenses during the last month, and breaking down in several items eases the task, but on the other hand, answers of respondents are not constrained by specific categories.

Table 1.1: Monthly Personal Expenditures (in Euros)

	French survey 2009-10 *940 couples*		**DHES 1995-05** *1537 couples*		**DTUS 2001** *615 couples*	
	Men	Women	Men	Women	Men	Women
Mean	190.1	197.6	183.3	192	163,5	161,2
(Std Err)	(202.0)	(201.0)				
Median	120	150				

Table 1.1 shows that on average, the amount of assignable expenditures reported in the French Time Use Survey is very closed to amounts recorded in the two Danish surveys, particularly in the DHES. In the three surveys, women and men expenditures are very close on average. In the french survey and in the DHES, women's expenditures are a little higher than men's (7,5 additional euros for women in France, 8.6 additional euros in the DHES), but this is very close. These figures are obviously not comparable as they are

collected in different time periods and different countries, thus the share of personal expenses in the total household budget is more informative. We observe that in french data, total assignable expenditures of men and women represent 10,5 % of the total household income (non-labour income + both monthly wages). Assignable goods accounts for 11 % of disposal income according to the DHES. In all, our personal expenditures seem to be in the range of earlier Danish studies.

Another way to check the validity of expenditure responses would be to compare them to the french Family Budget Survey ("Budget des familles", 2011). [*Forthcoming*]

As for french data, table 1.1 shows that women and men expenditures are very closed in mean, with female expenditures a little higher than male expenditures, and the median is 30 euros higher for women. However, this hides a very large dispersion for both groups. Note that the distribution of expenditures for men and women is very similar (Kernel density, graph 1.1 at the top left).

Let's investigate more precisely the intrahousehold share of expenditures between partners. Within couples, it seems that the more one partner spends, the more the other spends, with a correlation of 0.49 and a t-value of 17.03. However, the graph at the top right shows that the allocaton of expenditures within households is very dispersed. Note that 87 men and 38 women report a monthly personal expenditure equal to 0. In 22 couples, both members report a nul personal expenditure. In order to compute relative expenditures of couples (expenditure of the wife / expenditure of the husband), I set a purchase of 1 euro for these individuals reporting no purchase. Note also that for 177 couples, the man and the woman report the same amount of personal expenditure, that is 18.8 % of the sample.

Figure 1.1: Monthly Personal Expenditures (in Euros)

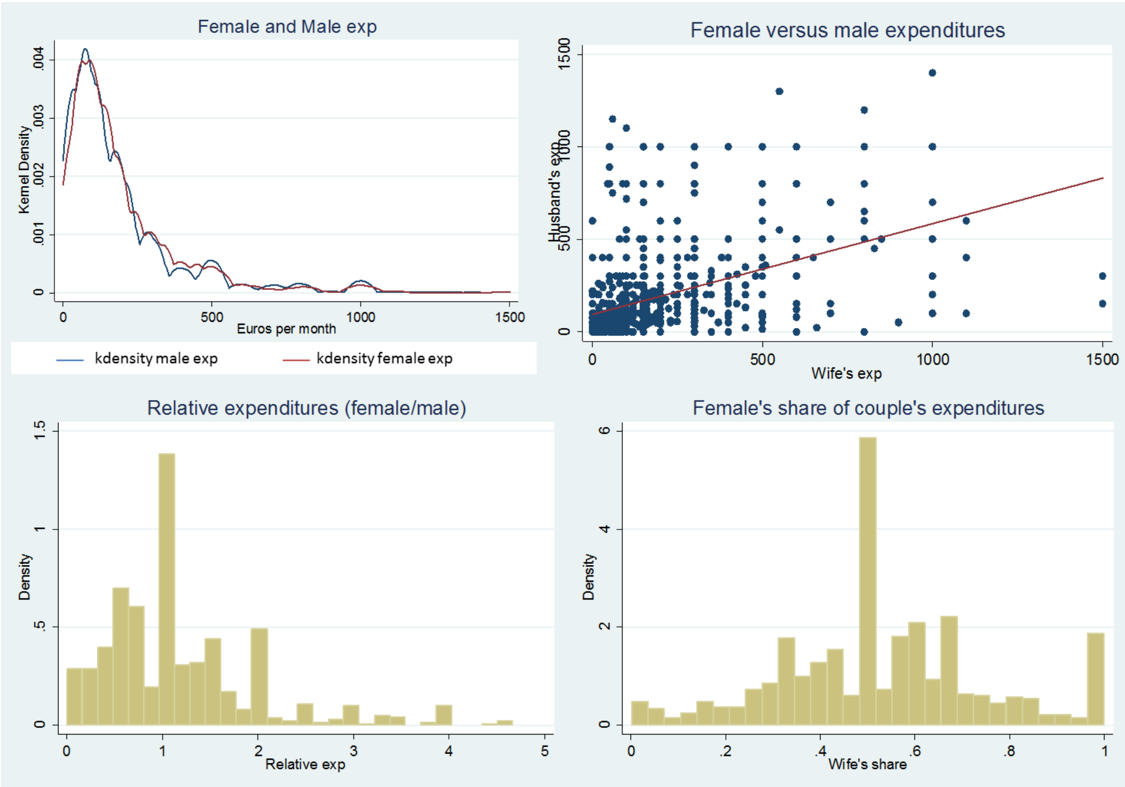


Table 1.2: Allocation of personal expenditures within couples

Percentile	Wife's share	Relative exp (f/m)
1 %	1.0 %	0.01
5 %	17.6 %	0.2
10 %	28.6 %	0.4
25 %	40.0 %	0.6
50 %	50.0 %	1
75 %	66.7 %	2
90 %	83.3 %	5
95 %	98.0 %	50
99 %	99.3 %	150

Number of couples: 940

The distribution of the wife's share in the total amount of personal expenditures of the couple (in %), with $Woman's\ share = \frac{expenditure_f}{expenditure_f + expenditure_m} \times 100$ (f for women, m for men), and relative expenditures, with $rel\ expenditure = \frac{expenditure_f}{expenditure_m}$, are shown in Table 1.2 and figure 1.1. Two highlights appears. First, the mode is unity for relative expenditures, reflecting the high proportion of households reporting the same value of expenditures. Does it mean that expenditures are really shared in an equality way in these couples ? This variable comes from the self-administered questionnaire. As said before, separate questionnaires were adressed to the man and the woman in the couple and they had to fill in it separately. Actually we have no information about whether or not they respected instructions. Perhaps some couples answered together to this part of the survey, and there is a bias towards equality. But we could think that reporting the same expenditures could reflect a global equal sharing within the couple, or at least a feeling of equality between partners. However, at the same time, table 1.2 and graph 1.1 show a large dispersion of expenditure shares and a wide variety of situations among couples. Indeed, 25 percent of households have a relative expenditure above 2 (the wife's share is above 67%), and 25 percent have a value below 0.6 (the wife's share is below 40%), so that close to half of households have one partner receiving twice as much as the other.

1.3.3 Relative leisures

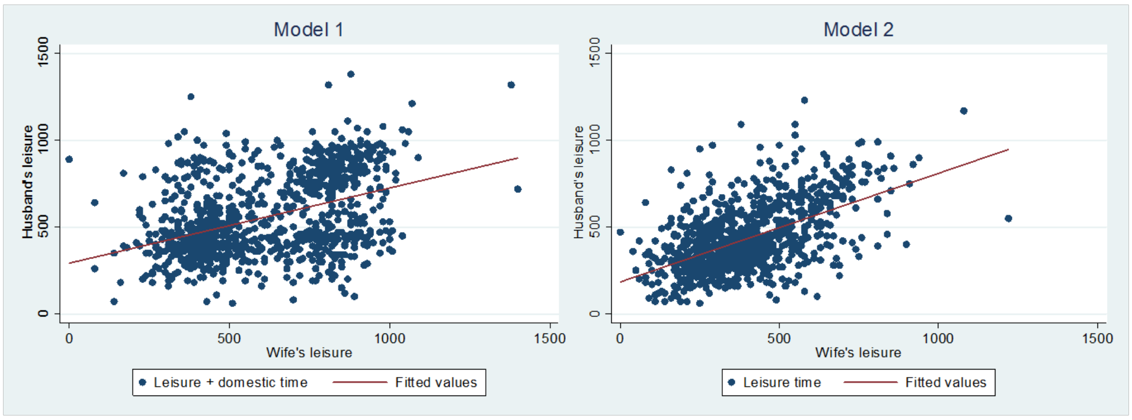
I consider two measures of leisure, which refer to Model 1 and Model 2 all along the paper. Model 1 implicitly assumes that non-market time is leisure, and therefore leisure includes domestic work and childcare, whereas Model 2 excludes them from leisure. This refers to the definition of the collective model without domestic production (Model 1), and the collective model including domestic production (Model 2). Physiological activities (sleeping, personal and medical care) are not included in leisure time in both models.

Table 1.3: Daily leisure time

Model:	**1. without domestic prod**		**2. with domestic prod**	
Leisure time (in minutes/day)				
	Men	**Women**	**Men**	**Women**
Mean	564.3	629.4	427.9	390.1
(Std Err)	(230.6)	(218.5)	(185.3)	(167.0)
Median	490	650	390	360
Relative leisure (f/m)				
Mean	1.290		1.006	
(Std Err)	0.791		(0.503)	
Median	1.050		0.934	
Wife's share of leisure				
Mean	53%		47%	
(Std Err)	(11%)		(10%)	
Median	51%		48%	

Number of couples: 940

Figure 1.2: Male and female leisure time



According to Table 1.3, as expected, we observe really different patterns considering domestic work as leisure time or not. Considering only "pure" leisure (Model 2), leisure time is shared in a more inequality way than personal expenditures, in favour of the man. However, including household work time in leisure time leads to the opposite: the wife spends more time making "leisure" activities than men, because she devotes more time making domestic tasks. The difference of means in absolute value is higher in Model 1 (65 min) than in Model 2 (37.8 min). Leisure time of the man is very correlated with leisure time of his wife, in both specifications, but in larger extent in Model 2 (the ordinary least-squares (OLS) value is 0.62 and the t-value of 20.89 for Model 2, and OLS value of 0.43 and t=13.78 with Model 1). This could be the result of assortative mating on wages (so that two partners with high wages will both take more or less leisure), or assortative mating on preferences for leisure or complementarities in leisure (Browning and Gortz, 2012).

1.3.4 The empirical sharing rule

The empirical sharing rule I consider in this paper takes into account both the sharing of time and money between partners, leading to a quite complete representation of the allocation of resources within couples. This approach is quite new in the literature, as previous estimations of the location of the sharing rule were only about the sharing of money (Browning and Bonke, 2009, Browning, Chiappori and Lewbel, 2013).

I compute the empirical household resources share of each partner (according to a sharing rule) as the sum of his/her personal expenditures plus his/her leisure time valued at his/her wage rate. Thus the empirical sharing rule includes both measures of personal expenditures and leisure time described in the last two sections. I measure two different shares according to the definition of leisure (Model 1 or 2).

Table 1.4 displays some general statistics about the shares. The man receives a higher

Table 1.4: The sharing rule

Model:	**1. without domestic prod**		**2. with dom production**	
The sharing rule, in Euros per month				
	Men	Women	Men	Women
Mean	3889.2	3892.0	2999.0	2506.8
(Std Err)	(3717.2)	(5083.9)	(3061.8)	(3166.9)
Median	3005.4	3009.3	2285.0	1917.7
Woman's share				
Mean	49.4 %		45.1 %	
(Std Err)	(15.4)		(15.2)	
Median	50 %		44.7 %	
Hourly wage				
	Men		Women	
Mean	12.80		11.21	
(Std Err)	(10.28)		(12.09)	

Number of couples: 940

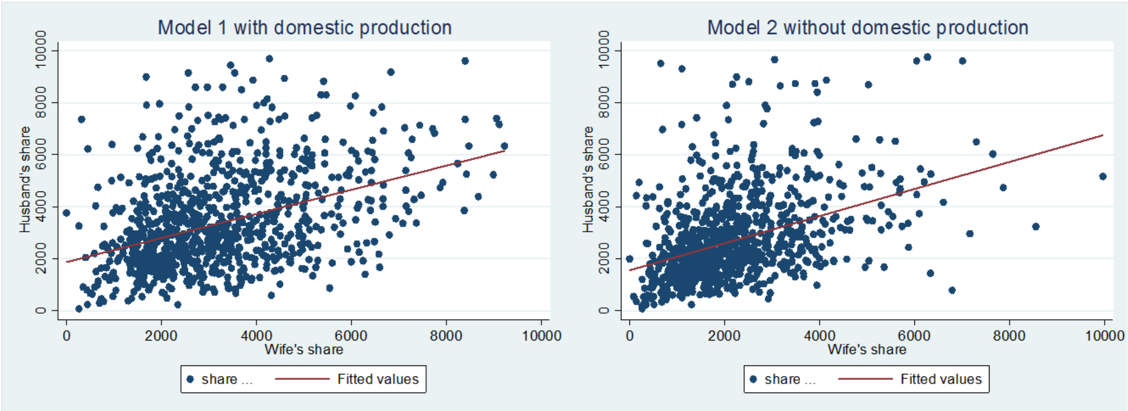
Table 1.5: The sharing rule

Model:	**1. without domestic prod**		**2. with domestic prod**	
Percentile	Wife's share	Relative shares (f/m)	Wife's share	Relative shares (f/m)
1 %	10 %	0.11	10 %	0.12
5 %	24 %	0.32	19 %	0.24
10 %	30 %	0.43	26 %	0.36
25 %	39 %	0.65	35 %	0.54
50 %	50 %	1.00	44 %	0.80
75 %	58 %	1.42	55 %	1.24
90 %	68 %	2.18	64 %	1.79
95 %	76 %	3.27	70 %	2.36
99 %	87 %	7.28	84 %	5.54

Number of couples: 940

share than his wife in the second model, with a difference of 492.2 euros, while they receive very similar shares in the first model. According to model 1, the wife receives 49.4% of the household full income, on average, and 45.1% according to model 2. Table 1.5 shows that Model 1 over-estimates the share of the wife compared to the second model, in each percentile of the distribution. Particularly, according to the second model, we observe that in half of households, the woman receives less than 44% of resources. In addition, model 2

Figure 1.3: Female versus male share (Absolute shares, in Euros per month



shows that in 25% of households, she receives more than 55%, and in 25% of households, she reveives less than 35%, depicting a somewhat unequal intra-household repartition of income. Graph 1.3 shows that the amplitude of partners' shares are positively correlated within household, in a higher extent in Model 2 (OLS value of 0.14 and t=4.6 in Model 1 against OLS value of 0.09 in Model 1 with t=4.04). Couple allocations are more dispersed with Model 1 than Model 2.

1.3.5 Traditional determinants of the empirical sharing rule

Let's now investigate if traditional variables usually founded to exert an influence on the theoretical sharing rule have a direct impact on the level of the empirical sharing rule. Main variables are the following:

- Wife's hourly wage and husband's hourly wage (plus an interaction term of wife and husband wages).
- The household non labour income. Note that total household income is collected only at the household level. I compute monthly non-labor income as the difference

between this total income minus monthly spouses' earnings on the labor market. If the difference was found to be negative, I set the non-labour income equal to 0 (this is the case for 101 households, that is 10,5% of the sample).

– The sex ratio, computed at the "departemental" level from the French National Statistics in 2009. Considering X_m, the number of men in the department of the same age as the husband in a couple, and X_f, the number of women of the same age as his wife, the sex ratio is computed as $\frac{X_m}{X_m+X_f}$. Data about age are given in 5-years intervals. The sex ratio is of very high theoretical importance: it is most of the time used in the collective model literature as a distribution factor, which influences decision process, so negociation powers of each partner (Pareto weights), but without affecting neither preferences nor budget constraints (Browning and al, 1994, Chiappori, Fortin, Lacroix, 2002). Such a variable has great properties, and facilitate the identification of the sharing rule. Until now, most of distribution factors used to estimate the Collective Model refer to the marriage market. Indeed, according to Becker (1991), marriage market is an important determinant of intra-household decision process, in the sense that negociation powers are linked to the situation outside the couple. If the situation in case of divorce is more favorable for one partner than the other, this confers to the first partner a higher negociation power, as his/her divorce threat becomes more credible. That's why the sex ratio has been largely used in the literature as it summarizes the state of the mariage market for a man and a woman, with the advantage to be exogeneous and easily available. If for instance, the number of women is lower than the number of men in the society, then women are "scarce" and it will be more difficult for a man to find a partner, but easier for a woman to get married. Then divorce threat for women is stronger, as women can threat their partners to leave and easily find another man in case of strong disagreement.[3] Thus the sex ratio has good qualities to be considered as distribution factors since it influcences decision process without influencing the budget constraint nor preferences.

- Age difference between partners: $age_f - age_m$.
- The ratio of years of education: $\frac{Educ_f}{Educ_m}$.

I also add controls about the number of children below 3 and the number of children between 3 and 18 years old, a dummy variable if the couple lives in a rural area and another if the couple lives in Paris, a dummy if the couple is homeowner, a control about the day partners fill in the diary (weekday or week-end day). Descriptive statistics about our variables are shown in Table 4.2.

I estimate male share and female share equations simultaneously, using the generalised method of moments (GMM). This method allows to take into account the possibly correlation between the error terms of the two equations. Another important advantage is that GMM computes efficient estimators even when errors are heteroskedastic of an unknow form (which is not the case for 3SLS or simulated maximum likelihood).

I instrument wages and non-labour income, as unobserved individual characteristics explaining shares may also be correlated with these variables. In addition, as the individual wage is the price of leisure, the wage rate is included in the dependent variable,

3. Legislation governing divorce has been also used as a distribution factor (Chiappori, Fortin, Lacroix, 2002) to represent the situation of partners outside the couple.

Table 1.6: General Descriptive statistics

	Men	**Women**
Individual level		
Hourly wage	12.80	11.21
	(10.28)	(12.09)
Monthly wage	2138.3	1526.9
	(1304.7)	(804.3)
Age	41.9	40.0
	(9.48)	(9.56)
DIPLOMA, *expressed in years of educ*		
Without diploma	9.93 %	9.19 %
Brevet	3.87 %	5.79 %
CAP/BEP (Before Bac)	41.49 %	28.95 %
Bac (general & technical)	10.47 %	14.77 %
Bac + 2	16.39 %	19.53 %
Bac + 3	6.76 %	11.99 %
Master and PhD	11.10 %	9.78 %
Working time (min/day)	349.0	255.2
	(259.2)	(242.8)
Domestic time (min/day)	136.3	239.3
	(137.4)	(160.8)
Total work (labor market+domestic)	485.4	494.6
	(211.1)	(191.7)
Leisure time (min/day)	427.9	390.0
	(185.3)	(167.0)
Household level		
Non-labour income	259.0	
(in euros per month)	(480.3)	
Sex ratio $\frac{X_m}{X_m+X_f}$	0.495	
	(0.020)	
Age diff $age_f - age_m$	-1.857	
	(4.196)	
Ratio diplom $\frac{Diplom_f}{Diplom_m}$	1.058	
	(0.302)	
Rural	27.43 %	
Paris	10.18 %	
Owner	70.26 %	
Nb of children<3	0	85.58 %
	1	14.22 %
	2	0.19 %
Nb of children 3-18	0	46.40 %
	1	25.60 %
	2	22.10 %
	>3	5.90 %

Number of couples: 940. Values in (.) are standard errors.

that is the share received by each partner. Consequently, the wage rate (as an explanatory variable) is correlated with the error term of the equation, and the wage rate has to be instrumented by some variables explaining the wage but not the share of the income received by each partner, which is a difficult task as the wage enters the share. Nevertheless, wages are endogeneous by construction, and I will still use some instruments for wages and non-labour income usually used in labour supply equations, and specific instruments for the non-labour income.

I include as instruments variables about employment sector (public sector, private sector or self-employed). I also include variables about geographical area: region dummies and a dummy for living in a small town, as opposed to living in a big town (in which wages are higher on average) and the countryside, and dummies indicating whether or not the workers are foreign-born (to capture some possible discrimination on the labour market). I use a more flexible functional form of age and education in specifying the equations for wages and non-labour income than for the shares (a fourth-order polynomial of age and a second-order polynomial of education).

Of course these instruments have their limitations [4]. Nevertheless, I will show estimations using exogeneous wages and non-labour income to make the comparison, even if wages are correlated with the error term of the equation by definition.

I include new specific instruments for household non-labour income. The first instrument is related to the assets of the household, which are correlated with higher non-labour income. The new french Time Use Survey includes unique information about the amount of household common assets, and the amount of personal assets of each partner. These

4. Using some variables related with experience and seniority would have constituted quite good instruments, as retaled with wages, but certainly not with the share received by each partner.

three variables include real properties (except main housing), savings account, equity savings plan, life assurance, investment security, work of art and jewels etc. These assets bring information about general wealth of the couple and thus explain well the level of non-labour income [5]. They are given in brackets, so I compute for each of them the middle of the bracket. Then I use the logarithm of the sum of the three amounts to instrument the non-labour income. Later I will use information about the division of personal assets as a distribution factor.

Information about parents are often used as good instruments for non-labour income. Unfortunately, the survey does not include variables about inheritance. We have information about the level of education of the father of both partners, but it does not significantly explain non-labour income.

One concern with assets is that they seem to be good instruments for non-labour income in a higher extent for wealthy households, who are more likely to have income from capital than other households. For more modest couples, non-labour income is more likely to come from state allowances and benefits. So I add to instruments a dummy variable indicating if the household receive benefits or not. These benefits include child benefit or sickness allowance for example.

The Hansen test does not reject the over identification restrictions. Table 1.7 presents some general descriptive statistics about the instruments for wages and non-labour income used in this paper.

5. This variable constitutes a good instrument for non-labour income in labour supply equations, but still contains some quite strong limitations in the share equations.

Table 1.7: Descriptive statistics about instruments of wages and non-labour income

	Men	**Women**
	Individual level	
French born	94.99 %	94.05 %
Public sector	19.64 %	28.07 %
Private sector	67.79 %	63.18 %
Self-employed	12.57 %	8.75 %
Personal assets (in Euros)	48409.1	35939.9
	(120703.9)	(91805.9)
	Household level	
Common assets (in Euros)	73991.6	
	(146126.4)	
Benefits	44.9 %	
Little town	16.59 %	
REGION		
1: Paris and its region	37.90 %	
2: North	6.20 %	
3: East	8.75 %	
4: West	13.87 %	
5: Southwest	11.79 %	
6: Center East	11.59 %	
7: Mediterranean	9.90 %	

Number of couples: 940
Values in (.) are standard errors.

Results about the GMM estimation of the empirical sharing rule are presented in Table 1.8. The first two columns show results based on Model 1, and the two other columns results based on Model 2. The two dependent variables represent the amount of the household full income the husband and the wife receive, in Euros per month. The construction of this variable was described in previous part of this section. Thus leisure time is now expressed in hours per month.

We observe that in both specifications, partners' shares increase with own's wage. According to Model 2, an increase in female hourly wage by 1 euro leads to an increase in

Table 1.8: The empirical sharing rule, GMM estimation of the husband's and wife's share (Absolute shares, in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	326.26	-7.16	184.90	-12.32
	(38.42)***	(32.12)	(36.21)***	(26.32)
w_f	16.11	350.47	-76.27	210.96
	(47.11)	(40.87)***	(40.88)*	(33.78)***
$w_m \times w_f$	-1.64	1.91	3.18	1.31
	(2.14)	(1.94)	(2.10)	(1.51)
Non-labour inc	0.36	0.22	0.09	0.41
	(0.41)	(0.30)	(0.33)	(0.26)
Sex ratio	4,318.66	3,001.28	3,876.59	-838.81
	(3392.93)	(2554.83)	(2911.63)	(1971.69)
Child<3	297.91	438.50	-282.38	-355.60
	(179.49)*	(153.86)***	(145.14)*	(125.40)***
Child<18	-13.41	26.73	-175.84	-157.42
	(62.17)	(55.92)	(51.19)***	(43.67)***
Age (m;f)	2.90	-1.12	13.04	-9.67
	(8.80)	(8.18)	(7.33)*	(6.68)
Age diff (f-m)	4.38	10.07	10.20	-0.60
	(14.56)	(15.20)	(12.03)	(11.11)
Educ (m;f)	-19.91	-42.36	30.44	-11.44
	(39.94)	(25.66)*	(35.52)	(20.78)
Ratio educ (f/m)	205.81	51.31	161.18	-2.57
	(222.48)	(196.36)	(175.50)	(146.15)
Rural	-71.85	254.94	112.51	21.35
	(141.33)	(105.67)**	(132.62)	(77.45)
Paris	170.75	-17.40	165.37	66.42
	(234.28)	(226.66)	(190.43)	(140.18)
Owner	133.66	-348.43	-12.58	-128.66
	(138.27)	(121.68)***	(117.57)	(87.45)
Weekday	-1965.55	-1221.09	-1179.12	-866.45
	(135.16)***	(97.22)***	(121.01)***	(84.27)***
Constant	-1161.54	-246.03	-1109.16	1823.84
	(1757.43)	(1343.10)	(1516.10)	(1047.32)*
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

her share by 227.7 Euros (computed at the mean male wage[6]), and an increase in male hourly wage increases his share by 220.54 Euros (computed at the mean female wage). Considering domestic work as pure leisure (Model 1), we find higher sensitivity of shares with own's wage: a 1-euro increase in female wage increases her share by 374.9 Euros, and a 1-euro increase in male wage increases his share by 307.8 Euros. So in Model 1, we find that the sensitivity of the woman's share with her wage is higher than the sensitivity of the man's share with his wage (the difference between coefficients is really small in Model 2). Note that these effects are consecutive to a one-euro increase per hours of work, wich is a really strong wage rise.

As for cross wage effects, we find that the individual share decreases as the wage of his/her partner increases (almost not significantly), except for the husband's share in Model 1, in which the coefficient of female wage is positive, meaning that the man performs more domestic work as his wife's wage increases, but in a no significantly way. However, we observe that the man's share decreases significantly as his wife's wage is increasing.

Thus as usually found, own's wages are a very important determinant of the sharing rule, but partner's wages exert a small effect, surprisingly.

Household non-labour income is associated with higher shares for both partners, although the effects are not statistically significant, and the coefficient is very low for the man in Model 2. In model 1, a one-euro rise in non-labour income increases wife's share by 0.22 Euros, and husband's share by 0.36 Euros (although not significant). The remaining 0.42 euros not used for personal expenditures should be devoted to saving, public goods or

6. The effect of female wage, computed at the mean male wage, is obtained in the following way: [coefficient of w_f] + [coefficient of $w_m \times w_f$] $\times$ [mean of w_m]

common expenses.

Theory predicts that the share of the wife should increase as the sex ratio is increasing, and the opposite for the husband's share. In model 1, coefficients of the sex ratio are positive both for men and women and not significant. In model 2, they have the opposite sign, but in the 'wrong' direction compared to the theory. Thus french data does not confirm the use of the sex ratio as a distribution factor.

The influence of the presence of children in the family is different according to the model used. Note that child care time is included in the shares of model 1, but not in model 2. The presence of children of any age decreases what's receive the man and the woman according to model 2, as they have less time to spend on leisure and perhaps less money to spend on personal expenditures. The presence of children below 3 decreases in a higher proportion the amount received by partners than the presence of older children. Interestingly, woman's share decreases more than man's share with the presence of very young children, and we find the opposite for older children (but the difference is very small in this case). Now in Model 1, shares are significantly and positively impacted by the presence of very young children, and the impact is really stronger for women. This is not surprising as domestic time increases considerably with the presence of children (due to child care time) and women devote more time than men doing child care. The presence of older children does not exert an influence.

Age variables do not exert any impact, except that in model 2, the man increases his share as he becomes older. This is quite unexpected for the age difference because several studies (Browning and al. 1994, for example) have shown that this variable exerts an influence on household decision process. Diploma has a very weak impact, except that women with a high level of education receive a lower share according to Model 1, meaning that higher educated women spend less time making domestic tasks.

In all, own's wages and the number of children are found to be the main determinants of the empirical sharing rule.

Table 1.9 shows the results if I do not instrument wages and non-labour income. I only show key variables. The coefficients of own wage are higher in amplitude. The effect of the wage of the woman is significantly related with a higher share for the man, while this coefficient was negative and significant in the second model. The effect of the man's wage in explaining the share of the woman is always not significant, but positive (negative considering wages as endogeneous). The coefficient of non-labour income is really low compared with the endogeneous case. The sex ratio explain now significantly the wife's share.

In the next part, I will use the Collective Model of labour supply presented in section 2 in order to estimate derivatives of the sharing rule with respect to wages, non-labour income and the sex ratio. This allows me to compare these derivatives with direct results about determinants of the empirical sharing rule, that is coefficients obtained in Table 1.8.

Table 1.9: The sharing rule, Seemingly unrelated regression of the husband's and wife's share. Exogeneous wages and non-labour income (Absolute shares, in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	341.83	7.63	274.95	25.56
	(43.46)***	(11.82)	(47.27)***	(17.69)
w_f	44.18	434.56	27.26	294.08
	(22.89)*	(27.17)***	(14.44)*	(43.52)***
$w_m \times w_f$	-2.96	-1.66	-2.17	-2.73
	(1.31)**	(1.24)	(0.82)***	(1.72)
Non-labour inc	0.09	0.04	-0.00	-0.00
	(0.14)	(0.10)	(0.10)	(0.08)
Sex ratio	6,269.68	-284.42	5,530.03	-1,276.77
	(3,988.01)	(2,902.86)	(3,329.53)*	(2,080.81)
Constant	-2,020.81	879.49	-1,885.65	1,324.32
	(2,136.64)	(1,501.47)	(1,780.14)	(1,155.60)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

1.4 Which links between the empirical sharing rule and predictions of the Collective model ?

In this part, I will first develop the methodology to compute derivatives of the theoretical sharing rule from the Collective Model. Then I present results and comparisons with the coefficients of the empirical sharing rule.

1.4.1 Estimation of the Collective Model: Econometric specification

As in Rapoport, Sofer and Solaz (2011), I estimate female and male labour supply (model 1) and total work equations (model 2) of the following form, where for convenience and to reflect the empirical analysis of this section, one distribution factor is assumed:

$$H^f = f_0 + f_1\, lnw_f + f_2\, lnw_m + f_3\, y + f_4\, s + \mathbf{f_5}\, \mathbf{z} + f_6\, lnw_f\, lnw_m \tag{1.7}$$

$$H^m = m_0 + m_1\, lnw_f + m_2\, lnw_m + m_3\, y + m_4\, s + \mathbf{m_5}\, \mathbf{z} + m_6\, lnw_f\, lnw_m \tag{1.8}$$

$\mathbf{z}$ is a K-vector of preference factors, such as age and education of the two agents.

From these equations and from derivatives of the sharing rule obtained in section 2, I can compute:

$$A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y} = \frac{f_2 + f_6\, lnw_f}{f_3\, w_m}$$
$$B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y} = \frac{m_1 + m_6\, lnw_m}{m_3\, w_f}$$
$$C = \frac{\partial H^f/\partial s}{\partial H^f/\partial y} = \frac{f_4}{f_3}$$
$$D = \frac{\partial H^m/\partial s}{\partial H^m/\partial y} = \frac{m_4}{m_3}$$

If I let $\Delta = f_3 m_4 - m_3 f_4$, then I obtain the following expressions for derivatives of the theoretical sharing rule based on the full income:

$$\frac{\partial \rho}{\partial y} = \frac{D}{D-C} = \frac{f_3 m_4}{\Delta} \tag{1.9}$$

$$\frac{\partial \rho}{\partial s} = \frac{CD}{D-C} = \frac{f_4 m_4}{\Delta} \tag{1.10}$$

$$\frac{\partial \rho}{\partial w_m} = \frac{AD}{D-C} = \frac{(f_2 + f_6 lnw_f) m_4}{w_m \Delta} \tag{1.11}$$

$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D-C} - t_f + T = \frac{(m_1 + m_6 lnw_m) f_4}{w_f \Delta} - t_f + T \tag{1.12}$$

All derivatives of the sharing rule based on the household full income are computed at sample means using these expressions, from the estimation of partners labour supplies. In the derivative of ρ with respect to w_f, the term $-t_f + T$ appears. T is total time available for each individual. It is equal to the total amount of hours available during one month, that is 732 hours, minus "physiologic time", devoted to sleeping and personal care. I assume that an individual needs 8 hours per day for sleeping and personal care, so that T is equal to 488 hours (per month). t_f is the mean of female domestic work time, that is 121.4 hours per month.

Note that if domestic production is not taken into account (Model 1), only $\frac{\partial \rho}{\partial w_f}$ is changed and is equal to $\frac{(m_1+m_6 lnw_m)f_4}{w_f \Delta} + T$.

As in Sofer and al. (2011), and as in the estimation of the empirical sharing rule, I estimate male and female labour supply equations simultaneously, using the generalised method of moments (GMM), considering wages and non-labour income as endogeneous. Market and domestic work are computed from the activities booklet. I control if the booklet has been filled during a week day or a week-end, by adding a dummy variable that takes a value of 1 if the day of observation is a week day. As before, Model 1 implicitly assumes that non-market time is pure leisure, and therefore excludes domestic work from labour supply variable, whereas model 2 takes time inputs in household production into account, so that we add domestic work in labour supply variable.

1.4.2 Determinants of the labour supplies

I start with estimation of men and women labour supplies. Then I will use estimated parameters in order to compute derivatives of the theoretical sharing rule (in the next part).

Results about male and female labour supplies are presented in Table 1.10. I find that the amplitude of wage coefficients is lower in model 2. Male labour supply decreases with both own's and partner's wages, with the second coefficient lower than the first. Female labour supply appears inelastic to own's wage and partner's wage. Although not significant, both coefficients are positive in Model 2, while Sofer and al. (2011) found negative wage coefficients also for women labour supply. Suprisingly, non-labour income does not influence labour supplies here.

According to the theory, the sex ratio should influence labour suplies of the man and the woman in the opposite direction, with a rise in female labour supply as the sex ratio decreases. Although in both models, coefficients have the opposite sign in male and female labour supply, they take the "wrong" direction, and are not significant. Thus once again, the sex ratio does not seem to exert the theoretical expected role in my data.

The presence of children has a major impact. Having children increases female and male labour supplies in model 2, because child care time increases, and having children decreases

Table 1.10: GMM estimates of men's and women's working times. In hours per month

Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
lnw_m	-351.45	-91.36	-159.75	4.61
	(96.02)***	(70.25)	(67.07)**	(55.86)
lnw_f	-247.95	-23.42	-130.13	4.09
	(90.90)***	(75.37)	(61.11)**	(60.77)
$lnw_m \times lnw_f$	139.10	32.06	66.53	-4.86
	(42.08)***	(35.46)	(29.36)**	(29.36)
Non-labour inc	0.01	0.04	0.03	0.01
	(0.04)	(0.03)	(0.02)	(0.02)
Sex ratio	-216.27	95.49	-159.02	78.78
	(252.60)	(193.50)	(194.92)	(149.52)
Child<3	-32.70	-52.40	17.74	25.53
	(14.43)**	(14.24)***	(10.10)*	(9.89)***
Child<18	-4.33	-8.68	8.33	12.75
	(5.46)	(4.72)*	(3.97)**	(3.30)***
Age (m;f)	-1.32	-1.00	-0.70	0.76
	(0.79)*	(0.85)	(0.58)	(0.61)
Age diff (f-m)	-0.48	1.33	0.25	0.45
	(1.34)	(1.19)	(1.06)	(0.93)
Educ (m;f)	-5.63	-0.97	-3.61	0.73
	(3.42)*	(3.02)	(2.61)	(2.45)
Ratio educ (f/m)	-59.27	13.24	-22.28	-3.64
	(25.32)**	(19.08)	(17.48)	(16.13)
Rural	9.31	-28.26	4.23	-9.38
	(10.49)	(9.31)***	(7.49)	(6.91)
Paris	0.47	-6.66	3.75	2.08
	(19.95)	(16.65)	(13.74)	(10.65)
Owner	-8.24	21.15	8.75	19.14
	(12.85)	(11.60)*	(9.77)	(8.79)**
Weekday	193.66	149.70	139.06	110.40
	(9.71)***	(8.59)***	(8.04)***	(7.43)***
Constant	985.84	115.30	616.07	77.91
	(248.63)***	(180.28)	(184.01)***	(141.35)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

labour supplies in Model 1. Note that these effects are higher in absolute value with the presence of very young children compared with older children, and that women always adjust more their time compared to the man with the presence of children of any age.

The ratio of female years of education on male years of education exerts a noticeable impact on male labour supply in model 1: the man reduces his work time as his partner has a higher level of education compared to him. This ratio also has a negative impact in model 2, although not significant. Owner women work significantly more than other women in both specifications, but there is no effect for men. In the next section, I use these parameters to compute derivatives of the theoretical sharing rule according to wages, non-labour income and the sex ratio.

1.4.3 Parameters of the theoretical sharing rule

Table 1.11 shows results about tests of the collective rationality and the computation of derivatives of the theoretical sharing rule. In the first row of Table 1.11, we observe that collective rationality cannot be rejected at the 10% level in both specification. Next rows present partial derivatives of the sharing rule, and the χ^2 statistics ot the Wald test of the null hypothesis. The partial derivatives represent the change in the household full income share that the wife can claim, as a function of changes in the male wage, the female wage, non-labour income and the sex ratio. In model 2, full income includes the profit from household production, while there is no such profit in model 1.

Derivatives of the theoretical sharing rule must be interpreted cautiously as no parameter is found to be significant in both models. In both models, the woman's share seems to increase (not significantly) as her own's wage increases, meaning that if the woman hourly

Table 1.11: Estimation of the woman's share (marginal effects) and test of collective rationality

Model:	**1. without domestic prod**		**2. with domestic prod**	
Derivatives of woman's share	$\frac{\partial \rho}{\partial variable}$	(χ^2)	$\frac{\partial \rho}{\partial variable}$	(χ^2)
w_f	405.3	(-0.03)	305.1	(0.12)
w_m	-38.4	(0.00)	-7.16	(-0.00)
Non labour income	0.93	(-0.02)	0.32	(0.03)
Sex ratio	2376.1	(-0.01)	3787.6	(0.05)

* significant at 10%

wage increases by 1 euro, she will receive 305 extra euro of the household full income, according to model 2. The sign of the derivative with respect to w_m is negative in both models. If the hourly wage of her partner increases by 1 euro, her full income share decreases by 38.4 euros according to model 1, and by 7.1 according to model 2. This seems to indicate that wages have an impact on power: the more she earns, the more she gets, but the more he earns, the less she gets (although not significant here).

The woman's share of a 1-euro rise in non-labour income is estimated to be 93 cents in model 1, which is really high. Indeed, she receives almost the totality of this additional income. Model 2 predicts a lower increasing of the share of the wife: she gets 32 cents of a 1-euro increase in non-labour income. The effect of the sex ratio is higher in model 2 than 1, with the "good" sign here according to the theory. Globally, except for derivatives with respect to the sex ratio, parameters are higher in absolute value in the first model, showing that not taking into account domestic production could over-estimate the share of the woman, and under-estimate inequalities within couples.

If we compare these results with derivatives obtained in Rapoport, Sofer and Solaz

(2011), we observe different patterns. This is due to the fact that variables exert different effects on labour supplies in 1999 compared to 2010 (according to the french time use survey). It appears that labour supplies are quite inelastic in 2010 compared to 1999, particularly we find that female labour supplies are really less elastic to wages in 2010 compared to 1999. So computation of derivatives of the sharing rule is mainly based on non-significant coefficients in 2010, while it was mainly based on significant coefficients in 1999, making impossible to compare derivatives between the two studies, even taking into account that one is computed from full income and the other on non-labour income.

1.4.4 Comparison of the theoretical sharing rule with the empirical sharing rule

In this part, I compare results about the empirical sharing rule obtained in section 3, with results about the theoretical sharing rule computed in the previous part, in the framework of the Collective Model. Indeed, coefficients of Table 1.8 are directly comparable with coefficients of Table 1.11, as they represent the effect of a change of the variable (wages, non-labour income or the sex ratio) on the full income share received by the woman, in euros by month.

Table 4.1 summarizes these coefficients. Derivatives of the empirical sharing rule with respect to w_f and w_m are computed at sample mean wage. We observe that the Collective Model and the empirical sharing rule lead to very closed derivatives with respect to w_f (particularly in model 1), except that the Collective Model predicts a non-significant im-

Table 1.12: Parameters of the empirical and theoretical sharing rule

Model:	**1. without domestic prod**		**2. with domestic prod**	
Sharing rule	Theoretical	Empirical	Theoretical	Empirical
Derivative w.r. to:				
w_f	405.3	374.9***	305.1	227.7***
w_m	-38.4	17.28	-7.16	4.44
Non-labour inc	0.93	0.22	0.32	0.41
Sex ratio	2376.1	3001.28	3787.6	-838.81

* significant at 10%; ** significant at 5%; *** significant at 1%

pact while our data shows very significant effects. Derivatives of female share with respect to w_m are very different according to the empirical and theoretical method, with different signs, but they are insignificant in all cases. Derivatives with respect to non-labour income are very different in the first model, as the collective model predicts that the woman receives 93 cents following an increase in non-labour income by 1 euro, while the empirical sharing shows that she gets only 22 cents. Both coefficients get closer in the second model, although the empirical sharing rule predicts that the women receives 9 extra-cents compared with the theoretical sharing rule (41 cents with the empirical rule, and 32 cents with the theoretical one). The estimated impacts of the sex ratio are really similar according to model 1, but not significant, while they have an opposite direction in model 2 (the theoretical rule presents a 'correct' sign according to the theory).

In all, predictions of the Collective Model and what we observe in our data show quite different patterns. In particular, the effects of male wage, non-labour income (in model 1) and the sex ratio (model 2) are very different. Nevertheless, the effects of female wage on what she gets are noticeably similar according to both estimations, particularly in model 1.

However, it seems hard to draw conclusions at this stage. Indeed, estimations here only involve economic variables (wages and non-labour income) and one distribution factor related to the marriage market. Such a model seems quite restrictive to analyse the sharing of resources within couples and the distribution of powers between partners. Intra-household decision making could be more complex, involving variables more closely related to individual, in addition to the sex-ratio, and non-economic variables. In the last section, I will try to take into account more information about the couple to better understand the allocation of resources within couples, and investigate whether including more precise distribution factors helps the convergence of the estimation of the theoretical sharing rule from the Collective Model and the empirical sharing rule from observed data.

1.5 The influence of monetary versus non-monetary variables in explaining the sharing rule

Let's remind that a distribution factor is a variable affecting Pareto weights in a household's optimization model but not the preferences of individual household members or the household budget set. In the collective model, changes in distribution factors lead to variations in outcomes while the set of efficient allocations remains unchanged. Thus distribution factors provides very useful information on the decision process in the household, and it is in general crucial to explicitly take them into account in the model.

Until now, most of distribution factors used to estimate the Collective Model refer to pure economic variables (as relative wages of partners, relative income or unearned income, relative education) or to the marriage market. However, including only factors related to divorce threat appears quite restrictive and extreme. Indeed, it seems quite unexpected that negociation involves systematically divorce threat, except for couples in which harmony between partners is bad and the last alternative of divorce could be really considered. But in most cases, threats and processes at stake could be not too extreme and perhaps more internal to the household and related to cultural determinants, more precisely habits, elements of context and biography of each partner. In addition, summarizing decision making and distribution of powers only with pure financial outcomes (particularly their division between partners) seems quite restrictive, as non-economics factors are likely to influence intra-household decision-making.

In order to go beyond the sex ratio and financial outcomes as distribution factors, the household black-box has to be opened to find information that could proxy the way partners negociate. This becomes possible with the new french Time Use Survey as these data contain a rich set of potential distribution factors. Information are collected about current partnership (harmony within couples, financial arrangement), health information, details about beginning of the relationship, fertility histories of the two partners, division of assets, information about education and labor force participation of mothers' partners, etc. In this section, I will estimate the dependance of the empirical sharing rule on these non-traditional distribution factors. Then I will include them as distribution factors in the collective model and investigate whether this brings better estimates of the theoretical sharing rule.

Indeed, as seen before, the Collective Model brings predictions quite distant from what we observe (at least according to our french data and the definition of the empirical sharing rule), and one objective here is to analyze whether adding information about intra-household negociation within a Collective Model improves its predictions. The Collective Model is constructed on minimalist assumptions, but adding more information through distribution factors could help predictions.

Browning and Bonke (2009) were the first to test some new non-economic distribution factors on the level of a sharing rule defined on the allocation on expenditures within couples, using data from the DHES. The novelty of my approach is to test the relevance of non-economic variables on the level of a sharing rule defined not only on the allocation of money but also of time. In addition, rather than only investigating the impact of these new variables on an observed empirical sharing rule, I also analyze whether these new distribution factors might improve the convergence of the sharing rule estimated through the Collective Model towards the observed one.

I test here similar distribution factors as in Browning and Bonke (2009), but also new factors related to the division of assets, if he/she worked or not when partners met for the first time, the level of education of the mother of each partner, and the number of years since they live in the same housing.[7] A 'good' distribution factor should impact in the

7. Many other types of information are given in our data, but they are likely to suffer from an endogeneity bias, so I do not include them: financial arrangement (income is pooled or not, they do accounts regularly or not, they make precise budgets, they have a joint account), possession of a common real property, global harmony between partners and frequency of quarrels, if he/she feels one makes more concessions than the other, frequency of contacts with friends. Other variables could have constituted good exogeneous distribution factors, but as they appear insignificant to explain the empirical sharing rule or are highly correlated with other distribution factors, I do not include them in this analysis: partners lived with family when they met, religious ceremony for the marriage if any, they moved in the woman's housing when they began to live together / man's housing / a new housing, Body Mass Index, he/she has already lived in a couple before the current partnership, the number of years since they first met until the moved together.

opposite direction the share received by the woman and the share received by the man, or at least impact one partner's share without influencing the other.

Note that some potential distribution factors I test (particularly the first two variables) may be finally though in term of (indirect) economic or divorce determinants in a sense. These factors are the following:

- A dummy variable if the couple is married or not. Actually, the influence of this variable may be related to the marriage market, but also to economic considerations. The cost of seperation is higher if couples are married, and may be different for the wife and the husband, influencing differently partners' negociation powers. This variable may also capture some traditional behaviours. However, a dummy variable about whether a religious ceremony occured did not exert a significant impact.
- The repartition of personal assets between partners. Usually, the repartition of non-labour income is included to study the allocation of resources within couples, but the repartition of assets is quite unique. I use the ratio of the logarithm of female assets on the logarithm of male assets. This variable is related to economic determinants of powers, but also to divorce as the share of assets each partner keeps in case of divorce may matter.
- Two variables about the mother of each partner: the mother worked full time or not when the partner was 16 years old, and the level of education of the mother [8]. I add interaction terms of man and woman variables. Browning and Bonke (2009) also used full time employment of the mother, but not her diploma. These two variables

8. As in the level of education of partners, the level of education of the mother is expressed in years of education.

may impact partners' values, particularly opinion about women independence. Thus a man or a woman (or both) having a mother with a high level of education and who worked full time may be a characteristics in favour of the woman, perhaps because the man is less reluctant to "give more" to his wife, and/or this confers a higher decicion power to the women. On the other hand, men in this situation may be more desirable partners (perhaps because they contribute more to domestic work) and receive a higher share of household income (Browning and Bonke, 2009, Fernandez and al., 2004).

- A dummy variable for children from past union + an interaction term for the man and the woman. This is also a variable used in Browning and Bonke's (2009) paper. There is no theory providing explanation whether this variable may be related with decision powers of each partner. Actually, previous children of a woman are more likely to live with her, so with the current couple, while previous children of the man are likely to live with the ex-wife. Consequently, a man having a child from a past union is likely to pay an alimony, but if this is his wife who has a previous child, the man is more likely to live with this child. Thus we may think that having previous child does not exert the same impact for men and women. In addition, this may increase conflicts within couples. In all, this variable may exert a different impact on decision powers of the man and the woman.
- A dummy if the partner had a stable work when the couple first met + an interaction term for the man and the woman. The idea here is to capture some information about the beginning of the relationship, that may create habits for future and become rooted with impact on decision powers.

– The number of years since they live together. Browning and Bonke have tested the number of years of the current partnership (founded to have no impact, which is also what I find with french data), but not the number of years since they live in the same housing, which exerts an influence here. We may think that specialization and habits between partner become stronger over the years with direct and differentiated impact on individual decision powers.

We can notice here that some distribution factors appear less exogeneous than other. Especially, the variable indicating whether they had a stable job when the couple met for the first time may not be entirely exogeneous, and provide more information about who are these people rather than about powers. Indeed, there is a selection issue, as women who worked at this time may not be the same than the other women who did not work. That is why we must be cautious about the interpretation of this variable. In addition, some other distribution factors may be challenged because possibly related with preferences. Particularly, it could be the case with the 'married' dummy. Globally, there is a trade-off between pure exogeneous factors as the sex ratio and legislation about divorce for instance, and more precise variables about negociation, but not entirely exogeneous.
Descriptive statistics about these variables are given in Table 1.13.

In a general setting, Bourguignon, Browning and Chiappori (1995) show that testable restriction arises on labour supplies, when there are at least two distribution factors:

$$\frac{\partial H^f/\partial s_r}{\partial H^f/\partial s_1} = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial s_1} \quad \forall r = 2, ..., R \tag{1.13}$$

This result says that distribution factors affect consumption and labor supply choices only

Table 1.13: Descriptive statistics about non-traditional distribution factors

	Men	**Women**
Individual level		
Personal assets, in €	48409.1	35939.9
	(120703.9)	(91805.9)
Mother worked	47.09 %	47.72 %
Both mothers worked	26.13 %	
MOTHER DIPLOMA, *expressed in year of education*		
No diploma	43.40 %	36.06 %
Primary educ	25.39 %	25.57 %
Brevet	5.98 %	5.97 %
CAP/BEP	10.70 %	15.77 %
Bac (General or Techn)	6.48 %	7.00 %
Bac +2	3.50 %	3.56 %
Bac >2	4.55 %	6.07 %
Children from past union	11.17 %	10.89 %
Both had children	5.80 %	
Worked when they met	57.60 %	42.25 %
Both worked	35.83 %	
Household level		
Married couples	70.65 %	
$\frac{ln(female\ assets)}{ln(male\ assets)}$	1.16	
	(1.79)	
Years life together	15.79	
	(10.09)	

Number of couples: 940
Values in (.) are standard errors.

through the location chosen on the Pareto frontier or, equivalently, through the implicit weighthing of each spouse's utility. Since this weighting is unidimensional, this implies that the ratios of the impacts of all distribution factors on the two labor supplies are equal. These restrictions provide a test for Pareto efficiency in a collective model of labour supply.

If there are several distribution factors ($r = 1, ..., R$), Chiappori, Fortin and Lacroix (2002) show that the partial derivatives of the sharing rule with respect to the additional distribution factors are given by

$$\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}, \quad \forall r = 2, ..., R \tag{1.14}$$

An additional set of necessary and sufficient conditions are (Chiappori and al., 2002) :

$$\frac{C_r}{D_r} = \frac{C_1}{D_1}, \quad \forall r = 2, ..., R \tag{1.15}$$

Theoretical results of the Collective Model are not changed with several distribution factors. Labour supplies have now the following form:

$$H^f = f_0 + f_1\, lnw_f + f_2\, lnw_m + f_3\, y + \sum_{r=1}^{R} f_{4(r)}\, s_r + \mathbf{f_5}\, \mathbf{z} + f_6\, lnw_f\, lnw_m$$
$$H^m = m_0 + m_1\, lnw_f + m_2\, lnw_m + m_3\, y + \sum_{r=1}^{R} m_{4(r)}\, s_r + +\mathbf{m_5}\, \mathbf{z} + m_6\, lnw_f\, lnw_m$$

There are now as many parameters C and D as distribution factors:

$$C_r = \frac{f_{4(r)}}{f_{3(r)}} \quad and \quad D_r = \frac{m_{4(r)}}{m_{3(r)}}, \quad \forall r = 1, ..., R$$

and

$$\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}, \quad \forall r = 1, ..., R$$

In addition, we have seen that we can test the collective model using an additional set of necessary and sufficient conditions, given in equation (1.15), which implies here that:

$$\frac{f_{4(r)}}{f_{4(1)}} = \frac{m_{4(r)}}{m_{4(1)}}, \quad \forall r = 2, ..., R \tag{1.16}$$

Estimation results including these distribution factors are presented in next tables. Table 1.14 presents estimations of the empirical sharing rule, Table 1.15 estimation results of labour supplies, and Table 1.16 results about the theoretical sharing rule.

1.5.1 Impact of non-traditional distribution factors on the empirical sharing rule

Table 1.14 shows impact of these "non-traditional" distribution factors on the empirical sharing rule, and to what extent traditional variables are changed when including this new kind of information.

We observe that impacts of own's wage are the same compared to previous estimations without non-traditional distribution factors. The negative impact of the woman's wage on the man's share in model 2 remains. But other cross-wages always do not exert an influence on shares. The influence of non-labour income is a little smaller in amplitude in all specifications, although still insignificant. The sex ratio takes the same sign as before, and it is now significant in explaining the husband's share in both models, with the 'good' sign. The sex ratio only exerts the 'wrong' direction in model 1 in explaining the wife's share. Finally, the sex ratio seems to play the anticipated role in model 2, although not significant in the wife's share. The presence of children in the household has similar impacts too.

Table 1.14: The empirical sharing rule, GMM estimation of the husband's and wife's share (in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	331.19	3.70	184.75	-13.35
	(36.95)***	(33.49)	(37.58)***	(25.77)
w_f	37.39	350.62	-60.92	202.82
	(46.36)	(46.63)***	(36.20)*	(34.06)***
$w_m \times w_f$	-1.75	2.06	3.65	1.81
	(2.12)	(2.21)	(2.28)	(1.50)
Non-labour inc	0.32	0.17	0.03	0.36
	(0.41)	(0.32)	(0.34)	(0.26)
Sex ratio	6,025.85	3,351.97	5,486.22	-156.05
	(3,554.58)*	(2,784.64)	(2,901.70)*	(2,073.96)
Child$<$3	310.00	463.24	-258.85	-329.73
	(178.64)*	(158.53)***	(144.67)*	(132.11)**
Child$<$18	9.50	37.98	-182.32	-153.61
	(65.82)	(55.78)	(56.85)***	(44.55)***
Age (m;f)	-1.95	2.49	20.73	15.17
	(15.02)	(13.62)	(14.39)	(12.17)
Age diff (f-m)	0.59	2.76	3.66	-22.63
	(18.71)	(17.84)	(15.08)	(13.18)*
Educ (m;f)	-27.39	-51.73	27.56	-20.44
	(41.43)	(29.03)*	(37.59)	(22.99)
Ratio educ (f/m)	208.81	75.55	194.78	55.93
	(241.19)	(201.42)	(192.63)	(151.06)
Rural	-73.59	252.90	90.88	30.44
	(140.68)	(107.66)**	(127.99)	(74.78)
Paris	125.64	-24.91	136.41	53.16
	(239.75)	(230.84)	(195.70)	(148.10)
Owner	88.00	-378.30	-94.54	-122.09
	(152.71)	(129.77)***	(136.87)	(93.57)
Weekday	-1,966.46	-1,216.82	-1,181.13	-876.19
	(135.07)***	(105.48)***	(125.05)***	(83.82)***
Married	-252.38	-82.30	-152.97	-133.84
	(133.39)*	(121.59)	(111.44)	(85.69)
Ratio ln(assets) (f/m)	-93.93	3.04	-51.67	0.65
	(46.29)**	(31.08)	(37.06)	(23.59)

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Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
Educ mother (m)	-43.69	15.92	-15.44	29.02
	(36.65)	(30.66)	(31.20)	(23.32)
Educ mother (f)	-58.85	7.08	-30.27	9.01
	(32.15)*	(27.06)	(27.85)	(18.55)
Educ mother (m*f)	3.85	-1.43	0.47	-1.81
	(3.18)	(2.64)	(2.88)	(1.99)
Mother worked (m)	-226.27	-99.57	-207.92	-18.71
	(159.68)	(153.51)	(130.39)	(102.55)
Mother worked (f)	-269.77	-149.27	-148.16	-72.96
	(158.75)*	(148.96)	(137.45)	(100.32)
Mother worked (m*f)	364.19	216.58	380.05	95.73
	(229.13)	(197.05)	(198.36)*	(140.94)
Children before (m)	-230.30	-318.27	-721.21	-308.54
	(346.52)	(381.33)	(382.14)*	(298.42)
Children before (f)	-308.47	294.45	-186.29	261.30
	(242.22)	(216.49)	(206.42)	(168.01)
Children before (m*f)	231.81	-84.91	602.90	-236.45
	(469.10)	(464.33)	(445.87)	(371.14)
Worked begin (m)	113.41	-59.99	-172.78	-182.63
	(163.48)	(133.42)	(137.42)	(95.85)*
Worked begin (f)	243.23	-21.95	21.36	46.70
	(216.88)	(203.55)	(201.20)	(186.82)
Worked begin (m*f)	-296.07	104.69	-44.45	24.56
	(269.12)	(239.98)	(242.91)	(204.80)
Life together	7.64	-3.94	-2.71	-22.02
	(12.79)	(11.56)	(12.88)	(9.98)**
Constant	-1,092.13	-499.40	-1,565.03	929.76
	(1,797.19)	(1,463.09)	(1,464.81)	(1,151.91)
Observations	940	940	940	940

* significant at 10%; ** significant at 5%; *** significant at 1%

As for new variables, we find that people in married couples spend less than unmarried couples with similar characteristics. This effect is higher in amplitude for men, and significant only for men in the first model (a married man spends on average 252 Euros less than an unmarried man living in a couple), meaning that he performs less domestic work when he is married. As the effect is strongly negative both for men and women, this variable can not be assimilated with a distribution factors correlated with partners powers, since we expect that a good distribution factor influences in an opposite direction the woman's share and the man's share.

The more the assets of the wife are important compared to those of her husband, the less he receives. This effect is significant only in model 1, although always negative in model 2. This has no significant effect on the amount received by the woman. Thus having more assets for a wife seems to lower negociation power of her partner.

The sign of the level of education of the mother of the man and the mother of the woman is negative in husband's share in both models, and significant only for the mother of his wife in model 1. This means that as the mother of the wife is more educated, the man performs less domestic tasks. No existing theory allows to explain this phenomenon. Note that the effect of the mother's education of one partner on the share receive by the other partner is always higher in amplitude than the effect on the share received by this partner. The effect on woman's share is positive but not significant. The sign of these coefficients would suggest that having a mother highly educated lowers negociation power of the man, and increase power of the woman. Perhaps partners in these couples have a better perception about the economic role of women, leading men to "accept" to allocate resources in a more equality way, and reduce their share. However, caution should be taken when interpreting this result as the effects are not statistically significant.

Results in model 1 suggest that if the mother of the wife worked full time when she was 16 years old, but not the mother of the husband, the man receives significantly less. But this effect disappears when mother of both partners worked full time. In model 2, we observe that the man seems to receive more as mother of both partners worked full time. This conclusion seems to confirm results by Browning and Bonke (2009) and Fernandez and al. (2004) who find that a husband having grown up in a household in which his mother was in full-time employment increases his share of expenditure. They explain this result by the fact that such men make more desirable husbands (perhaps because they contribute more in housework) and hence do better in any match. However, although not significant, the signs of the three coefficients related to mother employment are similar for the wife's share and the husband's share, making it difficult to interpret this variable as a distribution factor.

A man with chidren from a past partnership receives a strongly lower share than another man without this characteristic, only in the case where his wife does not have previous children, especially in the second model. We find that a man who has had a previous child and who is in a couple with a woman who has no previous child receives 721 euros less per month compared to another man without previous child. If this is the woman who has had a previous child but not him, his share is not impacted. However, if both partners have had previous child before, the negative effect for the man is strongly reduced. These variables have no significant impact on the share the woman receives. So what reason leads men to receive 721 euros less when they have had a previous child but not her current wife ? One explanation may be that previous child of the wife are more likely to live with her, while previous child of the husband are more likely to live with the ex-wife. Consequently, men in this case are more likely than women to have an alimony to pay, and this certainly reduces their personal expenses. Note that Browning and Bonke (2009) found different patterns: if either the husband or the wife has a previous child then the wife's share is lower.

Now if the couple met while he had a stable job and she had not, she receives 182 euros less than a similar woman who had a stable job at this time, according to the second model. The same characteristic decreases also the man's share, but this is not significant. There is no significant effect if this is her who worked when the couple met for the first time while he did not work. A reason to this phenomenon could be that if he worked while she did not when they met for the first time, the beginning of the relationship is marked by a traditional gender role situation, in which the woman has a lower negociation power because no economic activity. This situation can create habits for future, and lead the woman to receive a lower share of the full income, even several years after they met. Note that in our sample, most of people who did not work when they met their partner were students. 49% of women in the sample were student when they met their partner, and 12% did not worked or had an insecure job. Men were respectively 36% in the first category and 9.9% in the second one. Women who were student at this time had anticipation about a future higher wage, but nevertheless they met their partner in an inegalitarian basis that lasts. Nevertheless, as said before, there are concerns over the exogeneity of this variable. Finally, we find that the longer they live together, the less she receives, only in model 2. The number of years since they live together does not influence the man's share. Note that the duration of the partnership (the number of years since they met) was not significant, even when I dropped the first variable about the number of years since they moved in the same housing, which are highly correlated. This may mean that habits and specialization in leisure and expenses are increasing over time.

In all, we find that different distribution factors impact the amount received by the man and the amount received by the woman. Biography variables (information about mothers, child from past partnership) have a strong impact on the man's share, while the situation of partners when they met for the first time and the number of years since they live together noticeably impact what the woman gets.

1.5.2 Impact of non-traditional distribution factors on the theoretical sharing rule

Table 1.15 presents estimation results of labour supplies including non-economic distribution factors. Traditional economic variables do not differ from previous estimations using only the sex ratio as distribution factor. Labour supplies appear insignificant to new distribution factors in model 1, while female labour supply is more elastic to these new factors in model 2. If the mother of her partner worked full time when he was 16 years old, but not her mother, she will work significantly more. As the effect is not significant in model 1, this means that she performs more domestic tasks in that case (note that working time in model 2 includes domestic work). In addition, if she met her partner while he worked but she did not work, she spend more time working, meaning again that she performs more domestic work as this variable is not significant in model 1. We find the same conclusion for the variable 'number of year since they live together': she performs more domestic work over the years. Note that these two last variable were found to decrease the share received by the woman.

Table 1.16 shows results about the computation of the derivatives of the theoretical

Table 1.15: GMM estimates of men's and women's working times. In hours per month

Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
w_m	-330.46	-76.07	-154.90	18.94
	(96.72)***	(75.68)	(70.06)**	(60.37)
w_f	-223.43	13.63	-110.37	36.14
	(94.59)**	(84.31)	(66.82)*	(68.15)
$w_m \times w_f$	128.20	16.33	60.47	-17.59
	(44.19)***	(40.28)	(32.46)*	(33.19)
Non-labour inc	0.01	0.03	0.04	0.02
	(0.04)	(0.03)	(0.03)	(0.02)
Sex ratio	-248.83	85.17	-177.02	72.41
	(258.39)	(200.36)	(200.67)	(151.02)
Child$<$3	-32.70	-49.44	15.19	25.84
	(13.95)**	(13.83)***	(10.03)	(9.93)***
Child$<$18	-4.88	-6.56	8.49	13.81
	(5.43)	(4.64)	(4.17)**	(3.55)***
Age (m;f)	-1.21	-0.52	-0.74	-0.70
	(1.29)	(1.33)	(0.97)	(1.02)
Age diff (f-m)	-1.19	1.29	0.14	1.78
	(1.55)	(1.37)	(1.18)	(1.06)*
Educ (m;f)	-5.65	-0.07	-4.50	2.39
	(3.35)*	(3.08)	(2.69)*	(2.45)
Ratio educ (f/m)	-60.42	8.40	-28.79	-12.73
	(24.21)**	(19.19)	(17.54)	(16.00)
Rural	7.95	-29.99	4.02	-11.25
	(10.23)	(9.41)***	(7.48)	(6.95)
Paris	6.85	1.72	2.27	6.74
	(19.10)	(16.52)	(13.93)	(10.87)
Owner	-10.26	21.32	7.38	16.76
	(14.12)	(12.82)*	(11.13)	(9.53)*
Weekday	191.09	148.52	138.04	111.43
	(9.65)***	(8.89)***	(8.15)***	(7.40)***
Married	9.13	2.63	8.33	3.76
	(12.02)	(11.32)	(9.42)	(8.52)
Ratio ln(assets) (f/m)	-0.70	-0.93	-0.68	-0.08
	(2.24)	(2.51)	(1.59)	(1.56)

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Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
Educ mother (m)	4.18	1.42	0.20	-1.75
	(2.83)	(2.42)	(2.19)	(2.01)
Educ mother (f)	2.51	0.17	-0.02	-1.12
	(2.87)	(2.19)	(2.14)	(1.72)
Educ mother (m*f)	-0.26	-0.03	0.09	0.10
	(0.26)	(0.22)	(0.20)	(0.18)
Mother worked (m)	5.45	19.08	6.79	15.17
	(13.23)	(13.27)	(9.89)	(9.13)*
Mother worked (f)	13.05	10.36	6.38	11.52
	(12.43)	(11.33)	(9.49)	(8.46)
Mother worked (m*f)	-4.96	-9.11	-4.60	-14.76
	(17.86)	(17.50)	(13.49)	(12.65)
Children before (m)	-34.15	1.57	-7.77	14.47
	(31.40)	(22.33)	(23.36)	(17.37)
Children before (f)	16.23	-27.27	-7.68	-16.80
	(23.84)	(21.49)	(16.06)	(16.53)
Children before (m*f)	28.67	22.07	15.90	24.16
	(39.76)	(29.23)	(28.06)	(25.76)
Worked begin (m)	16.29	18.88	14.09	17.46
	(12.74)	(11.96)	(9.96)	(8.46)**
Worked begin (f)	-7.68	10.97	1.08	4.82
	(19.36)	(18.93)	(15.06)	(15.70)
Worked begin (m*f)	-14.54	-29.80	-13.10	-9.13
	(24.04)	(21.67)	(18.33)	(17.42)
Life together	0.18	0.26	0.03	1.62
	(1.08)	(1.18)	(0.83)	(0.85)*
Constant	902.90	29.67	600.32	57.58
	(243.92)***	(182.00)	(186.19)***	(146.28)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

sharing rule with respect to traditional variables and new distribution factors, and tests of the collective rationality. The first row of the table shows that collective rationality is not rejected in both models at the 10 % level. Then, I present in the first column the theoretical derivative of the sharing rule with respect to different variables, in the second column the χ^2 statistic of the Wald test of the null hypothesis. In the third column, we find the χ^2 statistic for the additional test of the collective model from distribution factors (Eq (1.16)). These first three columns indicate results according with the Collective Model. Finally, to facilitate comparisons, I report results of the empirical sharing rule in the fourth column, founded in the last subsection (Table 1.14). Next four columns show the same results, but according to model 2.

We find that once again, theoretical derivatives with respect to w_f are quite close with the empirical sharing rule, while derivatives with respect to male wage are very different, with opposite signs. In the first model, the impact of non-labour income is found to be very different if we compare estimations from the Collective Model and estimations of the empirical sharing rule. The effects of the non-labour income are closer in model 2. However, the theoretical sharing rule in model 2 overestimate the amount got by the wife, as it predicts an egalitarian sharing of an extra non-labour income by 1 euro, while the empirical sharing rule predicts that the wife receives 36 cents. The two measures of the impact of the sex ratio are quite similar in model 1, but the similarity between coefficients in model 2 is worst than previous estimations without new distribution factors.

Let's now turn to new distribution factors. Globally, tests of equation (1.16) validate the collective model for all distribution factors. Nevertheless, no distribution factor is found to be significant according to the collective model. However, to what extent amplitude of these coefficients are similar in the empirical and the theoretical sharing rule ? Recall that distribution factors founded to have an impact on the share received by the woman in model 2 were "her partner worked when they first met", and "the number of years since they live together". We find that the first impact is estimated in the same direction but with a higher amplitude: it predicts that having met her husband while he had a stable job but she had not decreases her share by 596 euros per month, while the empirical sharing rule predicts a decrease by 183 euros. The second effect is found to be very low according to the collective model, so very different compared to the empirical sharing rule. The three variables about full-time employment of mothers are found to be estimated in the same direction than the empirical sharing rule, but most of the time over-estimated compared to this empirical sharing rule. Most of the other variables are estimated in a very different way compared to the empirical sharing rule, in both models. Estimations in model 1 are even more distant from the empirical sharing rule compared with model 2.

Table 1.16: Estimation of the woman's share (marginal effects) and test of collective rationality

Model:	**1. without domestic prod**				**2. with domestic prod**			
Derivatives of woman's share	$\frac{\partial \rho}{\partial variable}$	(χ^2)	*Test* *Eq* (1.16)	Empirical	$\frac{\partial \rho}{\partial variable}$	(χ^2)	*Test* *Eq* (1.16)	Empirical
w_f	407.9	(0.06)	-	376.9***	328.7	(0.19)	-	225,9***
w_m	-98.01	(-0.01)	-	30.06	-48.0	(-0.02)	-	9,81
Non labour income	0.92	(0.03)	-	0.17	0.53	(0.07)	-	0.36
Sex ratio	2699.0	(0.01)	-	3351.97	2190.5	(0.04)	-	-156.05
Married	97.06	(-.042)	*0.14*	-82.30	7588.7	(-.766)	*0.26*	-133.8
Ratio ln(assets) (f/m)	-46.8	(.211)	*0.12*	3.04	-6.08	(.011)	*0.03*	0.65
Educ mother (m)	52.91	(-.037)	*0.42*	15.9	-4.97	(.002)	*0.14*	29.02
Educ mother (f)	6.08	(.004)	*0.14*	7.1	0.48	(.000)	*0.12*	9.01
Educ mother (m*f)	-1.14	(.002)	*0.19*	-1.44	-4.04	(-.003)	*0.20*	-1.81
Mother worked (m)	4238.5	(-2.279)	*0.21*	-99.5	-226.8	(.033)	*0.31*	-18.71
Mother worked (f)	439.7	(-.148)	*0.32*	-149.2	-226.9	(.014)	*0.30*	-72.96
Mother worked (m*f)	-562.4	(.202)	*0.14*	216.5	142.0	(-.019)	*0.24*	95.73
Children before (m)	53.12	(.008)	*0.09*	-318.2	164.3	(.030)	*0.09*	-308.5
Children before (f)	-665.5	(.106)	*0.10*	294.4	257.7	(-.062)	*0.26*	261.3
Children before (m*f)	930.0	(.081)	*0.26*	-84.9	-605.7	(.028)	*0.27*	-236.4
Worked begin (m)	900.0	(-.362)	*0.29*	-59.9	-595.8	(-.035)	*0.42*	-182.6*
Worked begin (f)	279.7	(-.091)	*0.05*	-21.9	-31.8	(.008)	*0.06*	46.7
Worked begin (m*f)	-2025.9	(.322)	*0.22*	104.6	1041.7	(-.121)	*0.26*	24.5
Life together	13.48	(-.116)	*0.04*	-3.9	-0.8	(.004)	*0.22*	-22.02**

* significant at 10%; ** significant at 5%; *** significant at 1%

1.5.3 Discussion about the relevance of including non-traditional distribution factors

Table 1.17: Summary of results: estimation of the woman's share

Model:	**1. without domestic prod**				**2. with domestic prod**			
	Only sex ratio		**Many dist fact.**		**Only sex ratio**		**Many dist fact.**	
	Theor	Emp	Theor	Emp	Theor	Emp	Theor	Emp
w_f	405.3	374.9***	407.9	376.9***	305.1	227.7***	328.7	225.9***
w_m	-38.4	17.28	-98.01	30.06	-7.16	4.44	-48.0	9.81
Non labour inc	0.93	0.22	0.92	0.17	0.32	0.41	0.53	0.36
Sex ratio	2376.1	3001.2	2699.0	3351.97	3787.6	-838.8	2190.5	-156.05

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 1.17 summarizes all main results about the comparison between the theoretical and the empirical sharing rule, in a configuration with only one distributon factor, the sex ratio, and another configuration with several non-traditional distribution factors. Let's remind that the general idea was to investigate whether adding information about negociation within couples helps the convergence between the allocation of resources observed in the data and prediction of the collective model. It appears that adding some new distribution factors does not change much results, and particularly the convergence between the empirical and the theoretical sharing rule.

In the first model, the impact of the woman's wage is really similar in all specifications (theoretical or empirical, with and without new distribution factors). The impact of the man's wage on the amount received by the woman shows opposite effects according to the empirical and theoretical sharing rule. This is even worst when new distribution factors are taken into account. The impact of an increase in the non-labour income is also very badly estimated by the collective model in the first model. The sex ratio exerts the theoretical expected impact as it increases the share of the woman, but this effect is never significant.

In the second model, adding some new distribution factors does not change the estimation of the woman's wage on her own share. We find the same problem as for the estimation of the effect of the man's wage. The impact of non-labour income is better estimated in model 2 than in model 1, but small differences appears, and adding some distribution factors does not improve the convergence. The estimation from the collective model under-estimates the woman's share compared with the empirical sharing rule, considering only the sex ratio, while it over-estimates the share when the new distribution factors are taken into account. The sex ratio takes the 'good' sign according with predictions of the collective model, but the opposite sign according to the data.

Globally, the collective model appears to over-estimate the share received by the woman, in model 1 as in model 2, and adding some new distribution factors does not improve the estimation.

The estimation of derivatives with respect to distribution factors leads to quite mixed results. Even if the effects are sometimes in the same direction, we can say that the collective model predicts quite over-estimated effects compared to the empirical sharing rule. The collective model tends to overvalue the share of household full income received by the woman compared to what's data directly show. The divergence is stronger when we do not take into account domestic production.

Note that the theoretical estimation of the effects of these new distribution factors is mainly based on insignificant parameters in the labour supplies estimation. Actually, the derivatives with respect to distribution factors are computed from the coefficient of non-labour income in labour supplies equations, and the coefficient of each respective factor. However, except for professional situation when they met, the mother of the man worked, and the number of years since they live together, all other distribution factors are found to be insignificant in explaining labour supplies, as for non labour income. Consequently, the computation of these different effects from the collective model is very imprecise, and partly explains why predictions of the collective model are far from what we find in the data.

However, adding this new information about decision process within the couple helps to better understand how partners share resources, as shown by estimation of the empirical sharing rule. This particularly shows that biography elements may be quite strong determinants of individual decision powers and then the final allocation of resources within couples. These new variables may capture the effect of social norms, cultural determinants, that are found to impact decision-making within couples.

1.6 Conclusion

This paper provides, for the first time, direct comparisons between an empirical sharing rule directly available from the data, and a theoretical sharing rule computed in the framework of the Collective Model. Surveys usually do not provide enough information to compute directly who gets what within couples. However, the new french Time Use Survey provides unique information allowing to compute a sharing rule representing both the allocation of time and money within the household. According to this empirical sharing rule, women receive on average 45% of the household full income. Then it seems important to compare determinants of this empirical sharing rule with predictions of the Collective Model, the most widespread representation of decision-making within couples. A first comparison is based on a simple model using an unique distribution factor, the sex ratio. The second part tries to evaluate whether adding more information about negociation within the Collective Model allows to bring estimations closer to the empirical sharing rule.

The sex ratio is found to not exert the assumed theoretical role, and it seems very important to find new distribution factors. This paper highlights some already used and some new distribution factors which exert an influence on the decision process. Particularly, the man's share seems to be impacted by biography elements: the employment situation of his mother and partner's mother, and the presence of child from past partnership. Indeed, if the mothers of the man and the woman were both employed full-time, he receives a higher share of household income, and if he has a child from a past partnership, he receives a lower share. On the other hand, the woman's share in mainly influenced by the professional situation of partners when they met for the first time (if the man had a stable job when they met while the woman did not work or had an insecure job, she receives a lower share of the household income), and by number of years since they live together (she receives less over the years since they live together).

Several conclusions can be drawn. First, it appears that taking into account domestic production when analyzing the sharing of resources within couples largely matters. Indeed, predictions of the collective model and the empirical sharing rule are more divergent if we omit domestic production, both considering only usual determinants (wages, non-labour income and the sex ratio), but also considering additional information about non-traditional distribution factors. This confirms results of previous papers showing that domestic production matters and not taking it into account may bias results (Rapoport, Sofer and Solaz, 2011, for instance).

Then, globally, the Collective Model seems to overestimate the effect of variables on the share the woman receives, leading to underestimate intra-household inequalities within couples compared to the empirical sharing rule. Note however that this may be due to poor estimations from the collective model as they are mainly based on not-significant coefficients.

Finally, I show that even if adding some new distribution factors in the collective framework does not allow to improve the convergence with the empirical sharing rule, these new distribution factors do matter in the decision-making of couples. It appears that classical distribution factors explain well partners' labour supply, but as soon as we aim at better understanding negociation powers and decision-process within couples, economic variables are not enough. Indeed, non-monetary variables, as social norms, culture, gender roles are likely to influence decision powers, although not observable. However, it is shown in this paper that introducing some variables which partly capture these norms, particularly biography elements about partners, allows to better understand the empirical sharing rule as they constitute good determinants in explaining the allocation of resources. Moreover, the shares received by the woman and the man seem to be driven by different factors, which seems to indicate that social norms result in different observed determinants for the man and the woman. Thus, non-economic variables are a key determinant of the allocation of time and money within couples as they capture a part of these unobserved social norms. In addition, we notice that the introduction of non-monetary determinants appears more significant in labour supplies of the second model, thus when domestic production is taken into account. Gender norms may also influence the determination of domestic work times of the man and the woman, and these new distribution factors allow to better represent the allocation of resources in model 2, in which domestic production in included.

Moreover, one reason why estimations of the collective model do not converge towards results from the empirical one may be that the efficiency assumption in which the collective model is based is not entirely satisfied. The estimation of the theoretical sharing rule is also based on quite strong assumptions, as the fact that the domestic good is marketable, there is a strict separability in the individual utilities between the "other" goods and the private sphere.

Finally, modelizations allowing the existence of social constraints leading to a second-best optimum, may be considered to better understand the whole allocation of resources within couples, and constitutes a line for further research.

Appendix 1: Proof of derivatives of the theoretical sharing rule

Recall that $\rho = \rho_f$. By differentiation of the labour supply equations

$$H^f = L^f(w_f, \rho(w_f, w_m, y, \mathbf{s}))$$

$$H^m = L^m(w_m, \Pi(w_f, w_m) + y + (w_f + w_m)T - \rho(w_f, w_m, y, \mathbf{s}) - A)$$

we obtain:

$$\begin{aligned}
\frac{\partial H^f}{\partial w_m} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial w_m} \\
\frac{\partial H^m}{\partial w_f} &= \frac{\partial L^m}{\partial \rho_m}\left(\frac{\partial \Pi}{\partial w_f} - \frac{\partial \rho}{\partial w_f} + T\right) \\
\frac{\partial H^f}{\partial w_f} &= \frac{\partial L^f}{\partial w_f} + \frac{\partial L^F}{\partial \rho}\frac{\partial \rho}{\partial w_f} \\
\frac{\partial H^m}{\partial w_m} &= \frac{\partial L^m}{\partial w_m} + \frac{\partial L^m}{\partial \rho_m}\left(\frac{\partial \Pi}{\partial w_m} - \frac{\partial \rho}{\partial w_m} + T\right) \\
\frac{\partial H^f}{\partial y} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial y} \\
\frac{\partial H^m}{\partial y} &= \frac{\partial L^m}{\partial \rho_m}\left(1 - \frac{\partial \rho}{\partial y}\right) \\
\frac{\partial H^f}{\partial s} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial s} \\
\frac{\partial H^m}{\partial s} &= \frac{\partial L^m}{\partial \rho_m}\left(-\frac{\partial \rho}{\partial s}\right)
\end{aligned}$$

The sharing rule being conditional to the level of the "other" expenditures, A is a constant and is removed in the derivatives of labour supplies.

Note that, with reference to the results in Rapoport, Sofer and Solaz (2011), only $\frac{\partial H^m}{\partial w_f}$ and $\frac{\partial H^m}{\partial w_m}$ include a new specific term T.

We define $A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y}$, $B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y}$, $C = \frac{\partial H^f/\partial s}{\partial H^f/\partial y}$, $D = \frac{\partial H^m/\partial s}{\partial H^m/\partial y}$. The partial derivatives of the sharing rule with respect to wages, non-labour income and the distribution factor are given by: $\frac{\partial \rho}{\partial y} = \frac{D}{D-C}$; $\frac{\partial \rho}{\partial s} = \frac{CD}{D-C}$; $\frac{\partial \rho}{\partial w_m} = \frac{AD}{D-C}$. Only $\frac{\partial \rho}{\partial w_f}$ is modified. From Hotelling's lemma, we obtain : $\frac{\partial \Pi}{\partial w_f} = -t_f$, and then $\frac{\partial \rho}{\partial w_f}$ is given by: $\frac{\partial \rho}{\partial w_f} = \frac{BC}{D-C} - t_f + T$. Note that $-t_f + T$ is fully observed in the data.

If there are several distribution factors, then Chiappori, Fortin and Lacroix (2002) show that distribution factors can enter labour supply functions only through the same function ρ. This implies that

$$\frac{\partial H^f/\partial s_r}{\partial H^f/\partial s_1} = \frac{\partial \rho/\partial s_r}{\partial \rho/\partial s_1} = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial s_1}$$

for all r. Moreover, equations $\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}$, $\quad \forall r = 2, ..., R$, are obtained in the same way as the equation for $\frac{\partial \rho}{\partial s}$ in the case of one distribution factor.

1.7 Database

Emploi du temps - 2010 - (2010), INSEE, Centre Maurice Halbwachs (CMH)

CHAPTER 2

La division du travail selon le genre est-elle efficiente ? Une analyse à partir de deux enquêtes d'emploi du temps

This chapter is a joint work with Catherine Sofer.

2.1. Introduction

Avec une progression considérable de la participation des femmes au marché du travail depuis la seconde moitié du 20^{ième} siècle (Marchand et Thélot, 1991, Sofer, 2005), le taux d'emploi des femmes entre 20 et 64 ans atteint aujourd'hui 65 % en France (2012)[1]. Les autres pays développés à économie de marché ont connu le même phénomène, et totalisent même des taux supérieurs à la France : 71.5 % en Allemagne, 76.8 % en Suède, 68.4 % au Royaume-Uni. Malgré cet acquis en terme d'accès des femmes au marché du travail, force est de constater que les inégalités au sein de la famille persistent (Goldschmidt-Clermont et Pagnossin-Aligisakis, 1995, Rizavi et Sofer, 2010, Ponthieux et Schreiber, 2006, Anxo, Flood et Kogoglu, 2002). Le partage des tâches domestiques et familiales au sein du couple reste encore inégalitaire. Selon une étude réalisée par l'OCDE en 2011 à partir de l'ensemble des Enquêtes Emplois du Temps existant dans le monde[2], quel que soit le pays, les femmes consacrent davantage de temps que les hommes au travail non rémunéré, avec un écart de 2,5 heures en moyenne par jour. La différence de temps de travail domestique (TD dans ce qui suit) entre les femmes et les hommes, en minutes par jour, est la plus faible au Danemark (50 minutes), Suède et Norvège (72 minutes) et Finlande (91 minutes). L'Allemagne compte une différence de TD de 105 minutes par jour, 122 en France, 187 en Espagne et 223 en Italie.

Ainsi, de manière paradoxale, cette participation désormais massive des femmes au marché du travail ne s'accompagne pas d'une redéfinition des rôles de genre au sein de la famille. Les conséquences économiques de cette situation sont d'ailleurs immédiates : inégalités de salaires (particulièrement des salaires mensuels, qui augmentent avec le temps de travail), « plafond de verre » qui freine ou interdit l'accès des femmes aux emplois à responsabilités,

[1] Source : Eurostat, enquêtes sur les forces de travail dans l'Union européenne.
[2] Miranda, V. (2011)

plus grande exposition de celles-ci au risque de pauvreté… Si la division du temps observée au sein des ménages n'est pas uniquement le résultat de préférences sexuées ou de différences systématiques de productivités, dans un objectif de diminution de l'écart salarial et d'une meilleure allocation des ressources, il apparaît important de comprendre pourquoi les hommes et les femmes effectuent des choix apparaissant comme traditionnels. Une telle analyse pourrait avoir des fortes implications en termes de politiques publiques.

Alors, qu'en est-il des causes ? Les économistes se sont saisis de cette question, afin de mieux comprendre comment les choix d'offre de travail et d'allocation du temps des ménages s'effectuent, dans l'objectif de mener des politiques publiques adéquates. Les premières approches furent théoriques, et les modèles développés qualifiés de « modèles de ménage ». Ces représentations supposent le plus souvent l'efficience des décisions prises dans les couples, aussi bien dans la sphère de la consommation que dans celle de la production. Les travaux pionniers de Becker (1965, 1981) et Gronau (1976) considèrent que les conjoints répartissent leurs activités de manière à maximiser le bien-être de la famille : en ce qui concerne la production, chacun se spécialise dans les activités pour lesquelles le rendement de son temps est relativement plus élevé. Ainsi, le partenaire percevant le salaire le plus élevé devrait consacrer moins de temps aux tâches domestiques, mais davantage au travail à l'extérieur, étant donné qu'il possède un avantage comparatif dans ce domaine. Si un homme gagne un salaire plus élevé que sa partenaire, il est optimal qu'elle se consacre davantage à la production domestique, et lui au travail marchand, afin d'obtenir le revenu maximum à moindre coût. Même une petite différence de salaire, à productivité identique dans le TD, rend ce choix efficient.

La plupart des approches développées par la suite, à savoir les modèle dit collectifs (Chiappori, 1997) et les modèles coopératifs (Manser et Brown, 1980, McElroy et Horney, 1981, Chiappori, 1997) se basent également sur une représentation des décisions fondée sur l'efficience.

Quant aux études empiriques, elles cherchent à tester l'impact d'incitations économiques sur les décisions d'allocation du temps au sein des ménages. Les Enquêtes Emploi du Temps permettent de mener de tels travaux, et même d'effectuer des comparaisons internationales, étant donné que ces enquêtes sont maintenant standardisées dans de nombreux pays. De ces travaux ressort la conclusion que l'hypothèse d'efficience semble largement infirmée, dans le sens où même si les variables économiques habituelles (salaires, niveau d'éducation, revenu hors travail etc.) rendent bien compte en partie de la division du temps au sein des couples, celle-ci semble cependant, sous certains aspects, irréductible à l'analyse économique standard.

Parmi ces études, Kalenkoski, Ribar et Stratton (2008) ont étudié l'impact des salaires sur le temps parental en Grande-Bretagne. Alors que l'allocation du temps des femmes entre le travail sur le marché et le temps parental répond dans le sens attendu à leur propre salaire ainsi qu'à celui de leur conjoint, l'allocation du temps des hommes n'est pas impactée par ces variables. Aux Etats-Unis, Connelly et Kimmel (2007) ont montré que lorsque le salaire de la femme augmente par rapport à celui de son conjoint, il consacre moins de temps à la production domestique le week-end.

Ce résultat est quelque peu similaire à celui de Bittman et al. (2003). Ils s'intéressent aux écarts de revenus dans les couples et montrent qu'en Australie, lorsque le revenu des femmes augmente et que l'écart de revenu entre les conjoints diminue, elles effectuent moins de travail domestique, mais que ceci est vérifié uniquement tant que leur salaire reste inférieur à celui de leur conjoint. Dès que leur contribution aux revenus du ménage dépasse celle de leur conjoint, les femmes font davantage de travail domestique et on remarque peu de modifications sur le temps consacré au travail domestique par les hommes. Tandis qu'aux Etats Unis, ils montrent que lorsque la contribution financière des femmes augmente, elles effectuent moins de travail domestique et que ceci reste vérifié quand elles ont un salaire supérieur à leur conjoint. En revanche les hommes diminuent leur temps consacré au travail domestique quand leur contribution aux revenus du ménage diminue. Les auteurs en déduisent que les résultats diffèrent un peu selon le pays étudié et que tout se passe comme si les femmes australiennes et les hommes américains essayaient de neutraliser la "déviance" due à la dépendance économique des hommes. Ce phénomène peut alors être qualifié de « doing gender[3] ». Notons que dans les deux pays, quels que soient les écarts de revenus entre les femmes et les hommes, les femmes consacrent beaucoup plus de temps au travail domestique que les hommes.

Brines (1994) aboutit au même type de conclusion aux Etats-Unis. Elle montre que moins les femmes sont dépendantes économiquement de leur conjoint moins elles réalisent de travail domestique, alors que plus les hommes sont dépendants économiquement de leur conjointe moins ils réalisent de tâches domestiques. L'hypothèse de « doing-gender » est également vérifiée en Espagne (Sevilla-Sanz, Gimenez-Nadal et Fernandez, 2011), mais uniquement en ce qui concerne le travail domestique de base, puisque le temps parental ne réagit pas aux revenus relatifs.

Quant à la France, plusieurs études se sont basées sur les données de l'Enquête Emploi du Temps 1998-99. Rizavi et Sofer (2010) ne confirment pas, pour la France, le phénomène de «doing gender ». Bloemen et Stancanelli (2008) estiment simultanément trois décisions

[3] Dans leur article, Bittman et al. rappellent que les premiers à avoir employé l'expression « Doing Gender » sont West et Zimmerman (1981). D'après eux, Brines (1994) a choisi le terme « gender display » alors que Greenstein (2000) préfère celui de "deviance neutralization". Bittman et al préfèrent combiner les deux termes pour parler de "gender deviance neutralization".

d'emploi du temps : le travail rémunéré, le travail domestique et le temps parental. Leurs résultats suggèrent que le travail domestique est impacté négativement par le niveau de salaire, alors que le temps parental n'est pas modifié par des variations de salaire. Le temps non marchand des femmes est indépendant du salaire du conjoint, mais le travail domestique et le temps parental de l'homme réagissent positivement à une augmentation du salaire de leur femme. Enfin, Ponthieux et Schreiber (2006) montrent que dans les couples de salariés, la part des tâches domestiques accomplies par les hommes est sensible à l'écart entre leur salaire et celui de leur conjointe. En effet, lorsque la femme gagne plus, son conjoint en fait un peu plus, mais cela ne suffit pas à combler l'écart de temps passé par les conjoints aux tâches domestiques.

Dans la lignée des études précédemment citées, notre objectif est de tester l'impact des variables économiques observables sur le partage du temps. Cependant, nous souhaitons aller plus loin dans la définition de ces variables, en affinant la mesure du capital humain. Plus précisément, nous cherchons à identifier les femmes qui investissent beaucoup dans leur carrière, puis à tester l'impact de cet investissement sur le partage des tâches domestiques et familiales. En effet, selon l'hypothèse d'efficience, au sein des couples où la femme investit beaucoup dans sa carrière, l'homme devrait prendre en charge de manière plus importante les tâches domestiques que dans les autres couples. Nous allons tester cette hypothèse. Nous identifions les couples dans lesquels la femme investit beaucoup dans sa vie professionnelle en utilisant plusieurs critères : elles passent relativement plus de temps que les autres femmes sur le marché du travail, ou gagnent un salaire plus élevé que les autres femmes. Nous comparons leur temps de travail et leur salaire par rapport à des femmes atteignant des niveaux d'éducation ou un statut professionnel similaires. Nous identifions ainsi des sous-groupes de femmes sur la base de niveaux d'éducation identiques ou de même statut professionnel. Puis nous comparons la situation professionnelle des femmes avec celle de leur partenaire, afin d'identifier les femmes touchant des salaires plus élevés, atteignant des niveaux d'éducation plus hauts, ou ayant un meilleur statut professionnel que leurs conjoints. En principe, dans ce derniers cas, et sous l'hypothèse de productivité égale dans le TD, on devrait observer un renversement des rôles : l'homme devrait prendre en charge la majorité des tâches domestiques tandis que la femme devrait se consacrer davantage au travail marchand. Nous testons également ici cette hypothèse.

Nous étudions l'impact sur la division du temps au sein des couples des divers indicateurs d'investissement professionnel des femmes définis ci-dessus et des indicateurs de comparaison par rapport au conjoint. Conditionnellement à l'investissement des femmes dans leur carrière, nous regardons comment leurs partenaires allouent leur temps, et plus particulièrement leur temps de production domestique. Est-ce que ces couples partagent les tâches d'une manière plus égalitaire, en prenant en compte l'avantage comparatif de la femme sur le marché du travail ? Est-ce que ces hommes font d'avantage de travail domestique par rapport à la moyenne, ou prennent en charge une part plus grande du travail domestique ? Ou bien est-ce que le ménage fait plutôt appel à une aide extérieure dans ce cas ?

Afin de répondre à ces questions, nous nous basons sur la nouvelle enquête Emploi du Temps 2009-10, mais également sur l'enquête précédente de 1998-99 (à partir des résultats de l'étude de Rizavi et Sofer, 2010), nous permettant d'analyser l'évolution du phénomène sur dix années. Cette analyse prolonge donc et affine celle réalisée en 2010 par Rizavi et Sofer et permet une comparaison entre les enquêtes Emploi du temps 1998-1999 et 2009-2010.

2.2. Données et Méthodologie

2.2.1. Un état des lieux des inégalités professionnelles et domestiques

Cette étude se base donc sur les deux dernière Enquêtes Emploi du Temps, 1998-99 et 2009-2010. Dans les deux enquêtes, nous sélectionnons un sous-échantillon de couples (mariés ou non mariés) où les deux partenaires travaillent sur le marché (à temps plein ou non). Les couples avec et sans enfants sont inclus. Nous obtenons un échantillon de 1736 ménages pour l'enquête 1998-99. Pour l'enquête 2009-2010, nous supprimons 214 couples pour lesquels au moins un des partenaires n'a pas reporté de salaire mensuel ou d'heures de travail par semaine (et où ni le semainier, ni le carnet journalier ne permettent de retrouver cette information). Nous supprimons 2 couples pour lesquels le salaire mensuel de l'homme était excessivement élevé. Enfin, nous supprimons 23 couples pour lesquels au moins un des conjoints n'a pas complété le carnet journalier d'emploi du temps. Notre échantillon final pour l'enquête 2009-2010 contient 2402 couples et 4804 individus. Notons également que les couples renseignent leurs activités durant une ou deux journées (les couples ayant répondu au module 'Décision Dans les Couples' remplissent un seul carnet dont le jour est tiré au sort, les autres couples remplissent deux carnets, le jour du premier carnet étant tiré au sort). Nous utilisons le 1er carnet dans cette étude, puisque notre échantillon comporte à la fois des individus ayant répondu au module 'Décision Dans les Couples' et des individus n'ayant pas répondu. Le **tableau 1** ci-dessous présente les statistiques descriptives relatives aux deux enquêtes, à partir des échantillons sélectionnés.

Nous observons que l'écart de salaire entre les hommes et les femmes s'est amplifié de 1999 à 2010. Le ratio du salaire mensuel (salaire de l'homme divisé par le salaire de la femme) était de

1,89 en 1999, et a augmenté jusqu'à 2,31 en 2010. Le ratio du salaire horaire a également légèrement augmenté entre ces deux dates.

Tableau 1: Description des échantillons

	1998-99* *1736 couples bi-actifs*				**2009-10** *2402 couples bi-actifs*			
	Hommes		**Femmes**		**Hommes**		**Femmes**	
Variables	**Moy.**	**Ec.type**	**Moy.**	**Ec.type**	**Moy.**	**Ec.type**	**Moy.**	**Ec.type**
Age	41.34	(8.98)	39.24	(8.77)	41.55	(9.70)	39.70	(9.63)
Travail marchand *déclaré. (heures par mois)*					180.57	(49.71)	152.26	(43.54)
Salaire horaire *(à partir de travail déclaré)*	9.49		8.10		12.90	(13.33)	10.82	(10.15)
Salaire mensuel	1663.75		1164.87		2102.8	(1348.1)	1513.8	(790.7)
Travail marchand carnet *(min par jour)*	293.55	(248.48)	237.67	(227.45)	321.56	(249.1)	244.82	(230.5)
Travail domestique (y.c. soin enfants) *(min par jour)*	158.66	(142.83)	259.28	(157.65)	140.47	(145.4)	229.14	(158.2)
Soin aux enfants (si au moins 1 enfant) *(min/jour)*					48.95	(71.68)	93.04	(100.1)
Travail dom sans soin aux enfants *(min/jour)*					110.39	(127.7)	172.36	(130.9)
	Mean		**Std Dev**		**Mean**		**Std Dev**	
Ratio salaire horaire (Homme/Femme)	1.38				1.45		(1.89)	
Ratio salaire mensuel (H/F)	1.89				2.31		(106.4)	
Différence travail dom (F-H)					88.67		(188.38)	
Ratio travail dom (F/H)					33.81		(95.31)	
Différence soin enfants (F-H)					44.09		(111.60)	
Différence travail dom sans enfants (F-H)					61.97		(156.06)	
Nombre d'enfants (< 15 ans 1998-99, <18 2009-10)	1.21		(1.07)		1.16		(1.03)	
EDUCATION (en %)								
Mesure utilisée pour 1998-99								
	Hommes		**Femmes**		**Hommes**		**Femmes**	
Sans diplôme/CEP/DFEO	17.16		18.6		11.24		9.50	
BEPC,CAP,BEP	38.23		43.75		44.02		33.36	
BAC (général et technique)	15.83		12.61		11.02		15.65	
Bac+2 et plus	28.79		25.04		33.72		41.49	
Mesure utilisée pour 2009-10								
sans diplôme/CEP/BEPC					15.23		15.16	
CAP,BEP					40.03		27.70	
Bac (géné et techn)					11.02		15.65	
Bac + 2					16.47		18.79	
Bac +3 ou +4					6.92		13.03	
3ième cycle, gde école, doc					10.32		9.67	

* Rizavi & Sofer (2010)

Le temps de travail marchand utilisé pour le calcul du salaire horaire se base sur le temps de travail déclaré dans l'enquête, c'est-à-dire le temps officiel de travail, et correspond à la variable `Travail marchand *déclaré*'. Nous observons que les hommes déclarent travailler en moyenne 28.3 minutes de plus que les femmes.

Concernant le salaire horaire, calculé à partir du salaire mensuel déclaré et du temps de travail déclaré, il atteint 2.08 euros de plus pour les hommes par rapport au salaire horaire des femmes. De plus, un homme gagne en moyenne 589 euros de plus par mois par rapport à sa partenaire, alors que cette différence était de 498.9 euros par mois en 1998-99[4].

Quand au temps de travail marchand journalier mesuré à partir du carnet, qui sera utilisé comme temps de travail marchand dans le système d'équations simultanées de la dernière partie de ce papier, nous prenons en compte à la fois les individus qui ont travaillé ou non ce jour. Il est exprimé en minutes par jour. Notons que ce temps de travail inclut le travail proprement dit, et n'inclut pas les pauses et les repas sur le lieu de travail, ni les trajets domicile-travail. Il a augmenté de 28 minutes par jour pour les hommes, et de 7 minutes pour les femmes de 1999 à 2010. Une tendance à la baisse des heures de travail est actuellement observée en France pour la population dans son ensemble. Concernant la population particulière des couples de bi-actifs, nous observons que le temps de travail a augmenté à la fois pour les hommes et les femmes. En 1999, les hommes travaillaient sur le marché du travail 56 minutes de plus que les femmes par jour, alors qu'en 2010, ils travaillent 76,7 minutes de plus qu'elles.

Ainsi, les différences observées entre les hommes et les femmes sur le marché du travail semblent s'écarter de plus en plus de l'égalité, si nous comparons la situation actuelle à celle d'il y a dix ans. Qu'en est-il au sein de la sphère domestique ?

[4] Francs de 1999 convertis en Euros.

Les hommes ont diminué leur travail domestique (temps parental + tâches domestiques) de 18,2 minutes par jour en 10 ans, et les femmes de 30,1 minutes. En 1999, les femmes consacraient 100,6 minutes de plus que les hommes à cette activité. Elles y consacrent 88,7 minutes de plus en 2010. Donc, à l'inverse, la différence homme/femme dans le partage des tâches domestique s'est plutôt légèrement réduite.

En 1999, les femmes étaient moins diplômées que les hommes, mais la tendance s'inverse en 2010 avec 41.5 % de femmes ayant un diplôme de niveau Bac+2 ou plus, contre 33,7 % des hommes ayant obtenu un tel diplôme. Nous utilisons une classification différente du diplôme selon les deux enquêtes. En effet, le nombre de diplômés Bac+2 et plus a considérablement augmenté en l'espace de dix ans. Le pourcentage d'individus ayant obtenu un diplôme de ce niveau est très important en 2009-10. Il est donc nécessaire de diviser cette catégorie de diplôme pour l'enquête 2009-10, et nous séparons alors les diplômés de niveau Bac +2, Bac +3 ou +4, et Bac+5 ou doctorat. Les hommes sont un peu plus souvent diplômés de niveau Bac+5 et plus, et les femmes sont plus diplômées de niveau bac +3 et +4 que les hommes (6,1 points de pourcentage en plus) et un peu plus diplômées de niveau bac +2 que les hommes (2.3 points de pourcentage en plus).

2.2.2. Méthodologie : indicateurs de l'investissement des femmes dans leur carrière

Afin de développer les indicateurs de fort investissement des femmes dans leur carrière, nous identifions plusieurs facteurs pouvant potentiellement refléter le fait qu'une femme investisse fortement dans sa vie professionnelle (cf. Rizavi et Sofer, 2010). Ces facteurs peuvent être les suivants : travailler plus, gagner un salaire plus élevé, ou avoir un meilleur statut professionnel par rapport aux autres femmes appartenant au groupe de référence. Le groupe de référence pourra être basé sur le niveau d'éducation ou bien sur le statut professionnel. Un second ensemble de facteurs sera relatif à une comparaison avec le partenaire sur la base du niveau d'éducation, du statut, ou du salaire. Cela nous conduit à définir trois types de groupes de référence : le premier basé sur le niveau d'éducation, le second sur le statut professionnel ou le type de profession, le troisième sur le conjoint. En effet, les femmes investissant intensément dans leur carrière peuvent gagner plus que les autres femmes ayant un niveau d'éducation similaire, ou un statut professionnel identique, ou encore par rapport à leur partenaire, comme classifié ci-dessus. De plus, ces femmes peuvent avoir investi avant de commencer leur carrière, en atteignant des niveaux d'éducation plus élevés que leur groupe de référence. Notons que ce sont vraiment les deux premiers groupes d'indicateurs, définis par rapport aux autres femmes, qui permettent d'apprécier le degré d'investissement des femmes dans leur carrière, alors que c'est davantage par rapport au troisième groupe d'indicateur, défini par rapport au conjoint, que l'on peut vraiment tester directement l'hypothèse d'efficience.

Les indicateurs suivants ont donc été développés sur la base de ces idées. Il s'agit de variables binaires prenant une valeur de `1' si la femme a été identifiée comme investissant avec intensité dans sa carrière dans le domaine considéré.

① **Plus de travail/éducation** : nous classifions les femmes en fonction des niveaux d'éducation, correspondant au plus haut diplôme obtenu. Nous utilisons des classifications différentes pour chacune des deux enquêtes, étant donné que la distribution des individus selon le diplôme a beaucoup évoluée en dix ans. Concernant l'enquête 1998-99, nous définissons 4 catégories : Sans diplôme/CEP/DFEO - BEPC,CAP,BEP - BAC (général et technique) - Bac+2 et plus. Pour l'enquête 2009-2010, nous regroupons les individus en six catégories : sans diplôme/CEP/BEPC - CAP,BEP - Bac (général, technique et professionnel) - Bac + 2 – Bac +3 ou +4 - Bac+5, grande école, doctorat. Ces niveaux d'éducation sont tous basés sur le système d'éducation français. Dans chacun des sous-groupes d'éducation, nous identifions les femmes dont le temps de travail déclaré se situe dans le quartile supérieur. Nous assignons à ces femmes une valeur de `1' à la variable binaire `Plus de travail/éducation', et une valeur de `0' aux autres femmes.

② **Salaire élevé/éducation** : Basé sur la classification précédente des femmes en fonction de leur niveau d'éducation, nous identifions les femmes qui gagnent un salaire mensuel les positionnant au quartile supérieur dans chaque sous-groupe d'éducation. Une valeur de `1' est assignée à ces femmes pour la variable `Salaire élevé/éducation'.

④ **Plus de travail/statut** : Les femmes investissant fortement dans leur carrière pourraient effectuer des temps de travail plus importants comparé à leur sous-groupe ayant la même position professionnelle (ou statut) qu'elles. Par statut nous entendons le statut professionnel identifié grâce aux variables `*Classification dans l'emploi*' et `*Statut dans l'emploi*'. Nous identifions quatre niveaux ordonnés de la manière suivante: Ouvrier et Employé – Technicien et Agent de maîtrise – Indépendant – Cadre. Ces quatre catégories ont été ainsi ordonnées étant donné le niveau de salaire moyen qui s'élève à mesure que l'on augmente dans l'échelle des statuts. Nous identifions les femmes qui se trouvent dans le quartile supérieur du temps de travail déclaré dans chaque sous-groupe respectif de statut.

⑤ **Salaire élevé/statut** : Basé sur la classification précédente des femmes selon le statut professionnel, nous identifions les femmes qui gagnent un salaire mensuel les plaçant dans le quartile supérieur de leur sous-groupe de statut professionnel. Une valeur de `1' leur est assignée pour la variable binaire `Salaire élevé/statut'.

Les trois indicateurs suivants considèrent le partenaire comme la personne de référence. Ici, puisque chacun des trois indicateurs implique un coût plus élevé du temps de la femme comparé à celui de l'homme (au moins théoriquement, en ce qui concerne le diplôme), nous nous attendons à un investissement plus important de l'homme dans le travail domestique, et éventuellement même à un renversement des rôles « genrés ».

⑥ **Diplôme > conjoint** : Une variable binaire permet d'identifier les femmes ayant un niveau d'éducation plus élevé que leur conjoint.

⑦ **Salaire > conjoint**: Une autre variable binaire a été développée pour identifier les femmes gagnant un salaire mensuel plus élevé que leur partenaire.

⑧ **Statut > conjoint**: Enfin, une variable binaire indique si la femme a atteint un statut professionnel plus élevé que son partenaire.

Le **tableau 2** présente des statistiques descriptives à partir des variables d'investissement considérant le conjoint comme référence. De 1999 à 2010, le pourcentage de femmes ayant obtenu un diplôme plus élevé que leur conjoint a légèrement diminué, en se basant sur la mesure utilisée pour 1998-99. Cependant, en se basant sur la mesure utilisée pour 2009-10, nous constatons que ce pourcentage a augmenté. Les deux autres indicateurs mettent également en évidence une meilleure situation des femmes. En effet, en 10 ans, le nombre de femmes avec un statut plus élevé que leur conjoint a augmenté de 3 points de pourcentage, et le nombre de femmes gagnant un salaire mensuel plus élevé que leur partenaire a augmenté de 1.8 points de pourcentage. Le pourcentage de femmes gagnant un salaire horaire supérieur à celui de leur conjoint est bien plus élevé, de 36,4% en 2010, traduisant le fait que les femmes totalisent des heures de travail plus faibles que les hommes. Ajoutons que relativement peu de femmes atteignent un statut supérieur à leur conjoint, par comparaison avec les autres indicateurs.

Tableau 2 : % de couples identifiés par les indicateurs d'investissement de la femme sur le marché du travail

	1998-99*		2009-10	
	0 = Non	**1 = Oui**	**0 = Non**	**1 = Oui**
Diplôme > conjoint *(Mesure utilisée pour 98-99)*	67.01	32.99	69.26	30.74
Diplôme > conjoint *(Mesure utilisée pour 09-10)*			63.68	36.32
Statut > conjoint	88.72	11.28	85.66	14.34
Salaire > conjoint *(salaire horaire - déclaré)*			63.59	36.41
Salaire > conjoint *(salaire mensuel)*	78.58	21.42	76.78	23.22

*source : (Rizavi & Sofer, 2010)

2.2.3. Temps de travail domestique en fonction de l'indicateur

Le **tableau 3(1)** montre le temps de travail domestique journalier moyen (soin aux enfants compris) des hommes et des femmes selon la valeur des différents indicateurs d'un fort investissement de la femme sur le marché du travail. Pour les femmes, le résultat est univoque : quel que soit l'indicateur et l'année de l'enquête, les femmes investissant dans leur carrière (ayant une valeur de 1 aux indicateurs d'investissement) effectuent moins de travail domestique que leurs homologues féminines comptant une valeur 0 à ces mêmes indicateurs. C'est seulement pour les femmes ayant une valeur de 1 aux indicateurs `éducation > conjoint' et `statut > conjoint' que cette différence n'est pas significative (il n'y a d'ailleurs aucune différence de temps de travail domestique pour l'indicateur `éducation > conjoint'). Les femmes investissant dans leur carrière, tout comme celles n'investissant pas ont diminué leur temps de travail domestique de 1999 à 2010. Nous observons globalement que les différences de moyenne de TD lorsque la femme obtient une valeur de 1 à l'indicateur considéré par rapport à une valeur de 0 sont plus grandes en 1999 qu'en 2010, ce qui signifierait que les femmes ajustaient dans de plus grandes proportions leur temps de TD à leur investissement professionnel dix ans auparavant. Pour les hommes, les résultats ne sont pas uniformes selon les indicateurs. En 2009-2010, comme en 1998-99, les hommes effectuent plus de travail domestique quand leur femme obtient une valeur de 1 aux trois indicateurs où le conjoint est la personne de référence, en particulier lorsque celle-ci a un statut professionnel plus élevé qu'eux. Notons que les écarts de travail domestique des hommes étaient légèrement plus importants en 1999 qu'en 2010 pour ces trois indicateurs.

Tableau 3(1): Temps de TD journalier moyen (en minutes) selon la valeur des différents indicateurs d'un fort investissement de la femme sur le marché du travail

Indicateurs	**1998-99****						**2009-10**					
	Femme			**Homme**			**Femme**			**Homme**		
	0	**1**	**Diff**	**0**	**1**	**Diff**	**0**	**1**	**Diff**	**0**	**1**	**Diff**
Tps de travail par Statut *(déclaré)*	277.0	236.9	40.1	164.1	156.5	7.6	235.8	205.2	30,6*	139.9	142.3	-2,4
Tps de travail par Education *(déclaré)*	275.2	228.1	47.1	165.2	146.0	19.2	236.0	204.8	31.2*	140.1	141.7	-1.6
salaire mensuel par Statut	269.5	237.5	32.0	160.0	165.2	-5.2	235.1	206.8	28,3*	138.0	149.6	-11,6
salaire mensuel par Education	272.3	226.2	46.1	163.9	152.8	11.1	234.5	208.9	25,6*	143.0	131.0	12
Niv d'éducation + élevé (ref. : partenaire)	268.7	252.7	16.0	153.9	169.6	-15.7	228.4	230.4	-2	135.9	148.3	-12.4
Statut + élevé (ref. : partenaire)	265.0	248.3	16.7	158.0	186.8	-28.8	230.3	221.9	8,4	136.9	161.3	-24.4*
Salaire mensuel + élevé (ref. : partenaire)	265.0	238.8	26.2	161.3	173.2	-11.9	236.8	203.5	33,3*	138.8	145.9	-7,1

* : significatif, au seuil de 5 %.
** source : (Rizavi & Sofer, 2010)

Pour les hommes, ces différences sont beaucoup plus systématiquement négatives en 2010 qu'en 1999, puisque l'écart est positif en 2010 uniquement pour l'indicateur 'salaire mensuel par Education'.

La différence de temps de travail domestique des hommes est très faible pour les deux indicateurs de temps de travail des femmes par rapport aux autres femmes ayant le même statut et le même niveau d'éducation, alors qu'en 1999, nous observions que l'homme effectue moins de travail domestique dans ces deux situations. Il semblerait y avoir une évolution vers l' efficience pour ces deux indicateurs. Globalement, nous pouvons alors ajouter que ces résultats réfutent le phénomène de « doing gender ».

Nous constatons également, à la fois en 1999 et en 2010, malgré la diminution du travail domestique des femmes lorsqu'elles investissent, que les hommes ne font jamais plus de travail domestique que leur femme (en moyenne). Les données montrent donc qu'il n'existe pas de renversement des rôles, même quand la femme investit de manière intense dans sa carrière et même lorsque le coût de son temps est supérieur à celui de son partenaire.

Ces moyennes simples semblent mettre en évidence une réaction un peu moins importante aujourd'hui qu'il y a 10 ans du travail domestique des femmes à leur investissement professionnel, même si cet ajustement est net. Concernant les hommes, l'ajustement de leur temps de TD semble plus systématique aujourd'hui et dans le sens de l'efficience, même si l'amplitude de l'ajustement est un peu plus faible pour les 3 indicateurs en référence au partenaire. Les sections suivantes vont alors chercher à tester ces conclusions préliminaires.

Le **tableau 3(2)** présente cette fois-ci uniquement le temps moyen de soin aux enfants en fonction de la valeur des différents indicateurs. Pour cela, nous sélectionnons un sous-échantillon de couples ayant au moins un enfant âgé de 18 ans ou moins. Nous observons que les hommes et les femmes adaptent beaucoup moins leurs activités parentales à la situation professionnelle de la femme dans le couple, par rapport au temps de travail domestique total. Les femmes consacrent certes plus de temps à cette activité lorsqu'elles investissent moins dans la sphère professionnelle, mais la différence n'est significative que pour les indicateurs 'salaire par éducation' et 'salaire>conjoint'. Pour les hommes, il n'y a aucune évidence qu'ils ajustent ce temps en fonction des différents indicateurs.

Tableau 3(2): Temps de soin aux enfants journalier moyen (en minutes) selon la valeur des différents indicateurs d'un fort investissement de la femme sur le marché du travail

Indicateurs	2009-10					
	Femme			Homme		
	0	1	Diff	0	1	Diff
Tps de travail par Statut *(déclaré)*	95.5	82.2	13.3	48.5	50.5	-2
Tps de travail par Education *(déclaré)*	94.9	85.2	9.7	49.3	47.4	1.9
salaire mensuel par Statut	95.7	81.6	14.1	46.1	60.6	-14.5
salaire mensuel par Education	97.2	73.6	23.6*	50.6	40.9	9.7
Niv d'éducation + élevé (ref. : partenaire)	89.4	98.4	-9	47.2	51.5	-4.3
Statut + élevé (ref. : partenaire)	91.9	99.6	-7.7	48.6	50.5	-1.9
Salaire mensuel + élevé (ref. : partenaire)	96.3	81.0	15,3*	49.3	47.6	1,7

* : significatif, au seuil de 5 %.

Le **tableau 3(3)** montre que les couples où la femme investit de manière intensive dans sa carrière effectuent au total (TD de l'homme + TD de la femme) moins de travail domestique que les autres couples, à l'exception des indicateurs `Education>conjoint' et `Statut>conjoint'. Ces couples font peut-être appel à une aide extérieure, ce que nous allons tester dans les sections suivantes.

Tableau3(3): Temps de TD total du ménage (TD de l'homme+TD de la femme) journalier moyen (en minutes) selon la valeur des différents indicateurs.

Indicateurs	2009-10		
	0	1	Diff
Tps de travail par Statut *(déclaré)*	380.7	355.2	25.5*
Tps de travail par Education *(déclaré)*	382.5	352.3	30.2*
salaire mensuel par Statut	380.0	356.4	23,6*
salaire mensuel par Education	383.8	347.4	36,4*
Niv d'éducation + élevé (ref. : partenaire)	373.1	378.0	-4,9
Statut + élevé (ref. : partenaire)	372.0	389.6	-17,6
Salaire mensuel + élevé (ref. : partenaire)	381.7	353.8	27,9*

* : significatif, au seuil de 5 %.

2.3. Résultats initiaux

Nous estimons ici le temps de travail domestique (TD) de l'homme, puis de la femme, et enfin la différence et le ratio du temps de TD de l'homme et de la femme. Nous utilisons la technique des MCO simples (Moindres Carrés Ordinaires) dans cette partie, afin de tester différentes spécifications et mesures, et mettre en évidence quels sont les facteurs qui influencent la répartition des tâches au sein du couple.

Concernant le temps de TD de chacun des individus, nous adoptons deux spécifications différentes : nous estimons d'abord le temps de TD en minutes par jour de l'homme et de la femme, puis nous considérons la part de TD de chacun dans le ménage, en contrôlant par le temps de TD total du ménage (TD de la femme + TD de l'homme). Cela nous permet de prendre en compte la quantité totale de production domestique effectuée au sein du ménage.

De plus, nous utilisons successivement plusieurs mesures différentes du travail domestique. La première mesure correspond au temps de TD global effectué par chacun des partenaires, composé des tâches domestiques de base (cuisine, vaisselle, ménage, linge, bricolage, jardinage), mais aussi du temps consacré aux enfants ou temps parental (soins aux enfants, aide au devoir, jeux etc.). Une présentation détaillée des différentes activités se trouve dans l'**annexe A**. La seconde mesure consiste à prendre uniquement en compte le temps de TD de base, hors temps parental. La troisième mesure considère quand à elle uniquement le temps consacré aux enfants. Ces différentes mesures nous permettent de tester si les variables d'investissement exercent un impact différent selon la nature de la production domestique.

Les variables de contrôle sont décrites dans l'**annexe B**.

L'ensemble des **tableaux 4** présente les estimations du temps de travail domestique de l'homme. Le **tableau 4(1)** est le tableau de base, où nous estimons le temps de TD de l'homme, sans prise en compte du niveau global de production domestique du ménage. Chaque colonne du tableau correspond à une estimation MCO différente, utilisant successivement chacun des différents indicateurs d'investissement. Nous présentons les résultats à partir de l'enquête 1998-99 et 2009-10. Nous observons, à partir des deux enquêtes, que l'homme adapte fortement son travail domestique à la présence d'enfants dans le ménage, et encore plus lorsqu'au moins un des enfants est âgé de moins de 3 ans. Son temps de TD augmente d'ailleurs environ deux fois plus en 2010 par rapport à 1999 lorsqu'il y a des enfants dans le ménage. En effet, le temps de TD de l'homme augmentait en moyenne d'environ 40 minutes par enfants âgés de moins de 3 ans en 1999, et de 99 minutes environ en 2010. Le TD augmentait de 10 min environ par enfant de 3 à 15 ans en 1999, et de 13 minutes en 2010 (par enfant de 3 à 18 ans).

Par ailleurs, un homme vivant en milieu rural effectuait plus de travail domestique qu'un citadin en 1999, mais cette variable n'explique plus le temps de TD de l'homme en 2010. Le temps de TD augmente avec l'âge. Comme attendu, les hommes font moins de travail domestique en semaine par rapport à un jour de week-end, et l'effet s'est accentué en 2010.

Concernant les variables d'éducation, un homme ayant un diplôme de niveau CAP-BEP ou Bac effectuait plus de TD en 1999 par rapport à un homme sans diplôme, mais les autres diplômes n'avaient aucun impact. Dix ans après, le diplôme n'exerce plus aucune influence significative, à part pour le niveau le plus élevé, puisqu'un homme ayant un diplôme de 3$^{\text{ième}}$ cycle effectue significativement moins de travail domestique qu'un homme sans diplôme. Notons que le salaire horaire de l'homme n'exerçait aucune influence en 1999, et dix ans après, il influence à la hausse (très légèrement) le temps de travail domestique de l'homme. Le sens de l'effet est cependant contre-intuitif : en effet, plus le salaire gagné est élevé (correspondant donc à un coût du temps élevé), plus le temps de travail domestique de l'individu est élevé.

Tableau 4(1) : Estimation par les MCO du **TD de l'homme** (en minutes/jour).

		1998-99 **							2009-2010							
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Enfants < 3		39.99***	38.49***	43.64***	42.96***	39.87***	39.89***	42.40***	99.54***	99.96***	100.13***	99.79***	99.71***	98.56***	99.24***	99.95***
Enfants 3-18 ***(3-15 pour 1998-99)***		9.44***	9.48***	11.87***	11.75***	10.12***	10.21***	12.01***	13.94***	14.02***	13.98***	14.12***	13.73***	13.61***	14.13***	14.09***
Rural		18.51**	20.33**	19.11**	19.23**	21.20**	19.76**	19.89**	10.79	10.71	10.59	11.23	10.29	10.89	10.20	10.61
Age-homme		0.91*	0.90*	0.86*	0.98*	1.10**	0.7	0.95*	1.00***	1.01***	1.01***	0.95**	1.13***	1.13***	1.01***	1.01***
Jour de semaine		-71.83***	-71.79***	-68.97***	-67.55***	-71.04***	-73.17***	-67.93***	-94.99***	-94.94***	-94.95***	-95.03***	-94.86***	-95.23***	-94.64***	-95.04***
Education de l'homme, dummy, référence: pas de diplôme/CEP																
CAP/BEP		17.67*	18.74*	17.77*	18.32*	22.10**	11.76	17.88*	-5.64	-5.49	-5.57	-6.21	-4.91	-2.42	-6.25	-5.78
BAC (Gen & Technique)		18.31	23.70*	18.26	22.38	27.37*	13.03	20.67	-4.20	-3.88	-3.98	-4.61	-3.10	-0.43	-4.28	-4.69
Bac+2 et plus		-5.76	-4.56	-5.1	-5.12	4.84	-12.37	-6.95								
Bac+2									12.46	12.90	12.75	11.92	13.19	18.43	11.89	12.43
Bac+3 ou +4									3.28	3.78	3.68	2.46	5.04	10.65	3.46	3.28
3ième cycle, gde école, doctorat									-22.78*	-22.11	-22.40*	-23.04*	-20.70	-12.27	-21.72	-22.21*
Log du salaire horaire de l'homme		5.11	5.93	2.77	4.64	4.55	12.47	9.65	12.87	10.19	10.19	8.85	10.89	9.69	10.83	12.29*
Log ratio du salaire horaire (H/F)									-3.67							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**	-5.53								4.17						
	Travail par Education		-15.83*								4.97					
	Salaire par Statut			15.53*								11.21				
	Salaire par Education				-0.15								-9.11			
Variable Dummy: Femmes avec reference au partenaire	**Education plus élevée**					18.33**								13.28*		
	Meilleur statut						28.13**								19.89**	
	Salaire plus élevé							17.56*								12.03
Constante		127.29***	124.70***	126.72***	116.85***	105.19***	104.92***	94.94**	110.80***	114.99***	115.00***	119.90***	111.01***	103.85***	112.24***	108.72***
Observations		1475	1489	1437	1444	1520	1494	1444	2402	2402	2402	2402	2402	2402	2402	2402

La première colonne pour les résultats de 2009-2010 inclut le log du ratio du salaire horaire de l'homme sur le salaire horaire de la femme plutôt qu'un indicateur d'investissement. Cette variable n'impacte pas le temps de TD. En 2010, les hommes ne semblent que peu réagir aux indicateurs d'investissement professionnel de leur femme, ni même à leur salaire, sauf pour les variables 'Education plus élevée' et 'Meilleur Statut'. Ainsi, un homme ayant un statut professionnel plus faible que sa partenaire effectuera en moyenne 19,9 minutes de TD par jour de plus qu'un autre homme. Un homme ayant un niveau d'éducation plus faible que sa partenaire effectuera en moyenne 13,3 minutes de TD par jour de plus qu'un autre homme. Qu'en était-il en 1999 ? Les hommes semblaient réagir beaucoup plus à la situation professionnelle de leur femme. En effet, ils prenaient davantage en charge les tâches domestique lorsque leurs femmes avaient une meilleure situation qu'eux, dans les trois domaines `éducation', `statut' et `salaire', et également dans le cas où elles gagnaient un salaire plus élevé par rapport aux autres femmes ayant le même statut. Cependant, ils effectuaient significativement moins de TD quand elles travaillaient beaucoup par rapport aux autres femmes ayant le même niveau de diplôme. Peut-être avaient-ils d'avantage recours à une aide extérieure.

Examinons maintenant les résultats lorsque la part de TD de l'homme dans le ménage constitue la variable expliquée plutôt que le temps en niveau, tout en contrôlant par le temps de TD total du ménage, en 2010 (**tableau 4(2)).** Ces résultats doivent donc être interprétés en considérant le TD total du ménage constant. Nous ajoutons, en plus des variables de contrôle précédentes pour l'homme, des variables relatives à sa partenaire : le niveau d'éducation et l'âge de la femme. Nous montrons que même si, comme nous l'avons vu, l'homme passe plus de temps à effectuer des tâches domestiques lorsqu'il a des enfants, sa part de TD dans le ménage ne change pas: il en fait plus, mais sa femme accroît son temps de TD dans des proportions similaires, voire un peu plus encore (d'où les signes négatifs).

Tableau 4 (2): Estimation par les MCO de la **part de TD de l'homme**. **2009-2010**

	1	2	3	4	5	6	7	8
Enfants < 3	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Enfants 3-18	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Rural	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Age-homme	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age-femme	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Jour de semaine	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
TD total (Homme+Femme)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC								
CAP/BEP	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.00
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
BAC (Gen & Technique)	0.04	0.04	0.04	0.04	0.04	0.05*	0.04	0.04
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.028)
Bac+2	0.03	0.03	0.03	0.03	0.03	0.05*	0.03	0.03
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Bac +3 ou +4	0.02	0.02	0.02	0.02	0.02	0.05	0.03	0.02
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.029)	(0.032)	(0.032)
3^{ième} cycle, gde école, doctorat	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	-0.01	-0.01
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)	(0.029)	(0.032)	(0.032)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC								
CAP/BEP	-0.01	-0.00	-0.00	-0.00	-0.00		-0.01	-0.01
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)		(0.025)	(0.025)
BAC (Gen & Technique)	0.02	0.03	0.02	0.02	0.02		0.02	0.02
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)		(0.030)	(0.030)
Bac+2	0.02	0.03	0.02	0.02	0.03		0.02	0.02
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)		(0.028)	(0.028)
Bac +3 ou +4	0.02	0.03	0.03	0.03	0.03		0.02	0.02
	(0.033)	(0.032)	(0.032)	(0.032)	(0.032)		(0.034)	(0.033)
3^{ième} cycle, gde école, doctorat	0.04	0.06	0.06	0.05	0.06		0.04	0.04
	(0.037)	(0.036)	(0.036)	(0.036)	(0.036)		(0.037)	(0.037)
Log du salaire horaire de l'homme	0.04**	0.01	0.01	0.00	0.01	0.01	0.01	0.02
	(0.018)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Log ratio du salaire horaire (H/F)	-0.04***							
	(0.014)							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.								
Travail par Statut		0.02						
		(0.018)						
Travail par Education			0.02					
			(0.017)					
Salaire par Statut				0.03				
				(0.018)				
Salaire par Education					0.01			
					(0.019)			
Variable Dummy: Femmes avec reference au partenaire								
Education plus élevée						0.02		
						(0.016)		
Meilleur statut							0.04**	
							(0.020)	
Salaire plus élevé								0.05***
								(0.019)
Constante	0.22***	0.26***	0.26***	0.28***	0.27***	0.27***	0.27***	0.24***
Observations	2402	2402	2402	2402	2402	2402	2402	2402

La part de TD de l'homme n'est pas impactée par son propre salaire horaire. Cependant, la première colonne montre qu'à ratio des salaires horaires constants, une augmentation du salaire horaire de l'homme le conduit à augmenter sa part de TD (donc dans la situation où le salaire de sa partenaire augmente dans les mêmes proportions). De plus, pour un salaire de l'homme constant, plus le ratio des salaires entre l'homme et la femme est élevé (donc plus le salaire de sa partenaire diminue par rapport au sien), plus sa part de travail domestique diminue. Sa contribution est positivement influencée par les variables 'Meilleur statut' et 'Meilleur salaire', mais devient non significative concernant l'indicateur 'Education plus élevée'.

Ainsi, le temps de TD de l'homme est faiblement impacté par l'investissement professionnel de sa femme, sauf lorsqu'elle a un statut supérieur ou un niveau d'éducation supérieur au sien. La part de TD de l'homme, quant à elle, est influencée de manière positive par un indicateur différent ('Salaire plus élevé'), et l'indicateur 'meilleur statut' exerce à nouveau une influence à la hausse. Ces influences, lorsqu'elles sont significatives, semblent s'exercer dans le sens de l'efficience. Notons cependant que finalement, même si on trouve toujours un faible effet positif, peu de variables d'investissement augmentent significativement le temps de TD de l'homme, et son salaire horaire exerce un rôle inattendu.

Nous avons considéré jusqu'ici le temps de TD global journalier effectué par l'homme. Qu'en est-il lorsque nous nous intéressons uniquement au temps de TD de base, n'incluant pas le temps consacré aux enfants ? Les tableaux détaillés ne sont pas montrés ici, mais voici les principaux résultats.

Le temps de TD de base de l'homme (en minutes) augmente d'environ 28 minutes lorsqu'il a un très jeune enfant, et n'est pas impacté par la présence d'enfants âgés de 3 à 18 ans. Ces coefficients sont donc beaucoup plus faibles que lorsque nous considérions le temps de TD global, ce qui signifie que la grande majorité du surplus de production domestique lorsque le couple a de très jeunes enfants est lié à leur présence, c'est-à-dire du temps consacré à ces derniers, ce qui n'est pas surprenant. Le salaire horaire de l'homme ne joue pas. La variable d'investissement 'Meilleur statut' exerce une influence positive très forte à nouveau, bien qu'un tout petit peu affaiblie par rapport aux résultats à partir du temps de TD total. Cependant, le fait qu'une femme ait un niveau d'éducation plus élevé que son partenaire n'influence pas le temps de TD de base de ce dernier, alors qu'il influençait le temps de TD total. Les hommes ne semblent donc pas ajuster leur temps de TD global et TD de base exactement de la même manière.

En considérant maintenant la part de TD de l'homme hors soin aux enfants, l'effet des variables d'investissement professionnel de la femme est très similaire si on compare aux estimations à partir du TD global puisque les variables 'Meilleur statut', 'Salaire plus élevé' influencent de manière positive la contribution de l'homme au TD total de base du ménage. Notons que la variable 'Travail par éducation' augmente également la part de TD de base de l'homme, alors qu'elle n'influençait pas la part de TD incluant les soins aux enfants.

Les **tableaux 4(3)** et **4(4)** présentent maintenant les résultats lorsque nous considérons uniquement les activités liées aux enfants. Ces estimations sont donc réalisées sur les couples ayant au moins un enfant de moins de 18 ans. Le temps de soins aux enfants réagit de manière différente par rapport au temps de travail domestique de base et même au travail domestique global. Le niveau de diplôme exerce un effet bien plus fort : un homme ayant un diplôme de niveau Bac+2 à Bac+4 effectue davantage de soins aux enfants comparé à un homme sans diplôme, alors que le niveau de diplôme le plus élevé (Bac+5 ou doctorat) n'apparaît pas significatif. Le salaire horaire de l'homme exerce maintenant un effet positif et significatif : plus l'homme gagne un salaire élevé, plus il consacrera du temps à ses enfants. Nous observons également que les activités parentales de l'homme réagissent à des indicateurs d'investissement de la femme différents de ceux mis en avant pour le temps de travail domestique global. En effet, l'homme consacre plus de temps à ses enfants si sa femme gagne un salaire élevé par rapport aux autres femmes ayant le même statut, et si elle atteint un niveau d'éducation supérieur à lui.

Tableau 4 (3): Estimation par les MCO du **Temps de l'homme consacré aux soins aux enfants** (en minutes/jour).

		2009-2010							
		1	2	3	4	5	6	7	8
Enfants < 3		46.56***	47.19***	47.31***	46.98***	47.22***	45.84***	47.27***	47.25***
		(8.302)	(8.291)	(8.335)	(8.276)	(8.326)	(8.268)	(8.355)	(8.345)
Enfants 3-18		2.13	2.12	2.13	2.44	2.05	1.92	2.18	2.17
		(2.963)	(2.964)	(2.966)	(2.925)	(2.996)	(2.947)	(2.984)	(2.978)
Rural		-5.04	-5.22	-5.33	-4.55	-5.41	-5.65	-5.42	-5.36
		(4.317)	(4.369)	(4.347)	(4.230)	(4.348)	(4.326)	(4.354)	(4.327)
Age-homme		-1.48***	-1.44***	-1.43***	-1.55***	-1.39***	-1.41***	-1.43***	-1.44***
		(0.332)	(0.327)	(0.324)	(0.343)	(0.342)	(0.328)	(0.330)	(0.329)
Jour de semaine		-15.96**	-16.05**	-16.08**	-15.88**	-16.07**	-16.02**	-16.05**	-16.10**
		(6.417)	(6.397)	(6.380)	(6.340)	(6.394)	(6.362)	(6.439)	(6.397)
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC									
CAP/BEP		-1.87	-2.16	-2.06	-3.03	-1.89	0.13	-2.13	-1.99
		(5.425)	(5.453)	(5.460)	(5.388)	(5.445)	(5.659)	(5.441)	(5.422)
BAC (Gen & Technique)		4.14	4.37	4.44	4.01	4.59	7.07	4.39	4.51
		(7.274)	(7.300)	(7.324)	(7.265)	(7.332)	(7.260)	(7.302)	(7.320)
Bac+2		13.01*	13.35*	13.41*	12.48*	13.49*	18.27**	13.38*	13.49*
		(7.082)	(7.044)	(7.080)	(7.140)	(7.055)	(7.290)	(7.043)	(7.067)
Bac+3 ou +4		32.72**	33.39**	33.58**	31.12*	33.94**	38.93**	33.47**	33.49**
		(16.416)	(15.930)	(15.906)	(16.861)	(16.426)	(15.724)	(16.320)	(16.334)
3ième cycle, gde école, doctorat		2.42	3.68	3.78	2.50	4.06	11.25	3.76	3.82
		(8.846)	(8.855)	(8.877)	(8.851)	(8.716)	(9.040)	(8.850)	(8.881)
Log du salaire horaire de l'homme		14.89***	10.40**	10.35**	8.85**	10.66**	10.07**	10.44**	10.75**
		(5.657)	(4.601)	(4.587)	(4.407)	(4.649)	(4.479)	(4.555)	(4.638)
Log ratio du salaire horaire (H/F)		-5.63							
		(3.899)							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**		2.40						
			(7.104)						
	Travail par Education			0.39					
				(6.680)					
	Salaire par Statut				14.74**				
					(7.318)				
	Salaire par Education					-3.08			
						(5.727)			
Variable Dummy: Femmes avec reference au partenaire	**Education plus élevée**						9.77**		
							(4.780)		
	Meilleur statut							1.79	
								(6.123)	
	Salaire plus élevé								2.53
									(4.791)
Constante		66.01***	73.68***	73.62***	79.71***	72.03***	67.17***	73.36***	72.56***
Observations		1482	1482	1482	1482	1482	1482	1482	1482

* significatif à 10%; ** significatif à 5%; *** significatif à 1%; Ecarts-type entre parenthèses.

Tableau 4 (4): Estimation par les MCO de **la part de soins aux enfants de l'homme**.

		1	2	3	4	5	6	7	8
Enfants < 3		-0.04	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.031)
Enfants 3-18		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
		(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Rural		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
		(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Age-homme		-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age-femme		-0.01***	-0.01**	-0.01**	-0.01***	-0.01***	-0.01**	-0.01**	-0.01***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Jour de semaine		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
TD total (Homme+Femme)		0.00**	0.00*	0.00*	0.00*	0.00**	0.00*	0.00*	0.00*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC									
CAP/BEP		-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02
		(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.034)	(0.035)	(0.035)
BAC (Gen & Technique)		0.07*	0.07	0.07	0.07*	0.07	0.09*	0.07	0.08*
		(0.045)	(0.045)	(0.046)	(0.044)	(0.045)	(0.044)	(0.046)	(0.045)
Bac+2		0.07*	0.07*	0.07*	0.07*	0.07*	0.09**	0.07*	0.08**
		(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.039)	(0.040)	(0.040)
Bac +3 ou +4		0.09*	0.09*	0.09*	0.08	0.08*	0.13***	0.09*	0.09*
		(0.047)	(0.048)	(0.048)	(0.047)	(0.047)	(0.047)	(0.048)	(0.048)
$3^{ième}$ cycle, gde école, doctorat		0.04	0.04	0.04	0.05	0.04	0.09**	0.04	0.06
		(0.051)	(0.050)	(0.051)	(0.050)	(0.051)	(0.047)	(0.051)	(0.051)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC									
CAP/BEP		-0.04	-0.03	-0.03	-0.03	-0.03		-0.03	-0.03
		(0.047)	(0.048)	(0.047)	(0.048)	(0.048)		(0.048)	(0.047)
BAC (Gen & Technique)		0.02	0.03	0.03	0.03	0.03		0.03	0.02
		(0.053)	(0.054)	(0.053)	(0.053)	(0.054)		(0.053)	(0.053)
Bac+2		-0.03	-0.02	-0.02	-0.03	-0.01		-0.02	-0.03
		(0.048)	(0.048)	(0.048)	(0.048)	(0.049)		(0.048)	(0.048)
Bac +3 ou +4		0.03	0.05	0.05	0.05	0.05		0.05	0.03
		(0.050)	(0.049)	(0.049)	(0.049)	(0.050)		(0.050)	(0.050)
$3^{ième}$ cycle, gde école, doctorat		0.01	0.04	0.04	0.01	0.04		0.04	0.01
		(0.061)	(0.060)	(0.060)	(0.060)	(0.061)		(0.060)	(0.062)
Log du salaire horaire de l'homme		0.06**	0.00	0.00	-0.01	-0.01	0.00	0.00	0.01
		(0.026)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.020)
Log ratio du salaire horaire (H/F)		-0.07***							
		(0.022)							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**		0.01						
			(0.028)						
	Travail par Education			-0.01					
				(0.028)					
	Salaire par Statut				0.09***				
					(0.028)				
	Salaire par Education					0.06**			
						(0.032)			
Variable Dummy: Femmes avec reference au partenaire	**Education plus élevée**						0.03		
							(0.024)		
	Meilleur statut							0.01	
								(0.031)	
	Salaire plus élevé								0.08***
									(0.030)
Constante		0.48***	0.57***	0.57***	0.62***	0.60***	0.53***	0.57***	0.54***
Observations		1482	1482	1482	1482	1482	1482	1482	1482

Le **tableau 4(4)** présente la part de l'homme dans les activités liées aux enfants du couple. Nous observons là encore que les résultats sont similaires en ce sens que l'effet trouvé est (presque) toujours positif, mais différent en ce que les indicateurs significatifs changent. En effet, la part des activités parentales de l'homme augmente significativement cette fois pour les indicateurs 'Salaire par Statut', 'Salaire par Education' et 'Salaire>conjoint'.

Etudions maintenant les déterminants du travail domestique de la femme, et en particulier regardons si le temps de TD de base et les activités parentales de la femme réagissent également de manière différente aux indicateurs d'investissement. Le **tableau 5(1)** présente les résultats du temps de TD global, et le **tableau 5(2)** le temps de soins aux enfants. Les estimations de la part de TD de la femme sont symétriques aux estimations calculées pour l'homme, elles ne sont donc pas représentées.

Le **tableau 5(1)** montre que le TD de la femme augmente considérablement lorsqu'elle a un très jeune enfant (environ 133 minutes de TD en plus par très jeune enfant) et dans une moindre mesure quand elle a un enfant de plus de 3 ans (35 min de TD en plus environ). Cela est plus élevé que pour l'homme qui effectuait 99 min en plus avec la présence d'un très jeune enfant, et 13 min en plus avec un enfant plus grand. Son niveau de diplôme n'exerce pas d'influence significative. La première colonne du tableau présente une estimation sans indicateur, mais incluant le salaire de la femme et le ratio des salaires dans le couple. Nous observons qu'elle diminue de manière nette son temps de TD à mesure que son propre salaire augmente, mais le ratio des salaires n'a pas d'influence. Concernant les indicateurs d'investissement, nous observons qu'elle ajuste de manière nette son temps de TD à son investissement professionnel, en particulier pour l'ensemble des indicateurs où les autres femmes constituent la référence, ainsi que dans le cas où elle gagne un salaire supérieur à son conjoint. Ainsi, une femme ayant une valeur de 1 à ces indicateurs d'investissement effectuera

Tableau 5 (1): Estimation par les MCO du **TD de la femme** (en minutes/jour).

		2009-2010							
		1	2	3	4	5	6	7	8
Enfants < 3		135.21***	132.33***	131.74***	132.86***	133.05***	133.38***	133.17***	131.96***
		(13.520)	(13.615)	(13.664)	(13.461)	(13.582)	(13.596)	(13.572)	(13.418)
Enfants 3-18		35.36***	34.91***	35.13***	35.03***	35.27***	35.62***	35.47***	34.83***
		(4.036)	(4.036)	(4.022)	(4.036)	(4.049)	(4.050)	(4.048)	(4.041)
Rural		12.32	13.51	13.98	12.41	12.87	13.57	14.55	15.27*
		(8.947)	(8.914)	(8.901)	(8.823)	(8.919)	(8.944)	(8.883)	(8.881)
Age-femme		2.42***	2.24***	2.27***	2.44***	2.53***	2.20***	2.22***	2.22***
		(0.409)	(0.392)	(0.394)	(0.411)	(0.424)	(0.394)	(0.392)	(0.392)
Jour de semaine		-68.12***	-68.53***	-68.41***	-67.90***	-67.80***	-68.42***	-68.30***	-68.05***
		(8.591)	(8.577)	(8.579)	(8.576)	(8.673)	(8.615)	(8.615)	(8.659)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC									
CAP/BEP		-2.80	-6.53	-3.54	-4.09	-4.23	-6.35	-4.68	-4.06
		(13.676)	(13.796)	(13.823)	(13.827)	(13.758)	(13.936)	(13.779)	(13.759)
BAC (Gen & Technique)		-2.15	-7.85	-2.65	-4.14	-6.31	-11.86	-6.72	-4.71
		(15.207)	(15.444)	(15.374)	(15.329)	(15.228)	(16.570)	(15.336)	(15.208)
Bac+2		3.81	-4.23	-1.04	1.50	-3.19	-7.88	-2.91	-0.34
		(14.625)	(14.552)	(14.550)	(14.692)	(14.469)	(15.305)	(14.572)	(14.566)
Bac+3 ou +4		-10.45	-18.35	-16.22	-16.55	-16.77	-23.14	-16.92	-15.41
		(15.581)	(15.179)	(15.322)	(15.365)	(15.235)	(15.657)	(15.430)	(15.268)
3^{ième} cycle, gde école, doctorat		-9.59	-21.91	-20.42	-14.86	-23.21	-28.73	-22.43	-17.68
		(17.871)	(17.041)	(17.089)	(17.335)	(16.954)	(17.713)	(17.378)	(17.174)
Log du salaire horaire de la femme		-24.00**							
		(10.702)							
Log ratio du salaire horaire (H/F)		4.57							
		(8.145)							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**		-25.36***						
			(9.161)						
	Travail par Education			-26.71***					
				(8.813)					
	Salaire par Statut				-28.63***				
					(10.318)				
	Salaire par Education					-25.26**			
						(10.702)			
Variable Dummy: Femmes avec reference au partenaire	**Education plus élevée**						7.03		
							(8.666)		
	Meilleur statut							-8.89	
								(10.533)	
	Salaire plus élevé								-28.12***
									(9.328)
Constante		184.67***	151.00***	147.10***	140.12***	137.68***	146.44***	145.66***	149.32***
Observations		2402	2402	2402	2402	2402	2402	2402	2402

moins de travail domestique que les autres femmes. Cependant, son TD ne réagit pas significativement aux indicateurs `Education>conjoint' et `Statut>conjoint'. Il semble donc, en comparant le tableau 4(1) pour l'homme et le tableau 5(1) pour la femme, que cette dernière adapte son temps de TD à son investissement professionnel dans tous les cas où d'autres femmes forment le groupe de référence, alors que c'est plutôt lui qui s'adapte lorsque c'est le conjoint qui constitue la référence, sauf lorsque sa conjointe a un salaire plus élevé où alors elle réduit significativement son temps de TD .

Lorsque nous considérons uniquement le travail domestique de base hors activités liées aux enfants, les résultats sont très similaires aux précédents, et les femmes ajustent leur temps de TD de base aux différents indicateurs de la même manière que le temps de TD total, à ceci près que l'amplitude des coefficients est légèrement inférieure. Notons que la très forte augmentation de TD global dû à la présence de très jeunes enfants est presque entièrement consacrée aux soins aux enfants, puisque les variables du nombre d'enfants ne sont pas significatives ici.

Le **tableau 5(2)** présente les résultats lorsque le temps considéré est uniquement celui lié aux enfants. Notons que les femmes effectuent un peu plus de soins aux enfants en semaine qu'en week-end, mais cette augmentation n'est pas significative, alors que les hommes diminuent significativement cette activité en semaine. Le niveau de diplôme n'exerce ici pas d'impact, tout comme le salaire horaire de la femme (1ère colonne). La femme adapte beaucoup moins son temps de soin aux enfants à son investissement professionnel par rapport à son temps de TD de base, puisqu'elle diminue significativement ses activités liées aux enfants uniquement pour les indicateurs 'Travail par Statut' et 'Salaire>conjoint'.

Tableau 5 (2): Estimation par les MCO du **temps de soin aux enfants** de la **femme** (en minutes/jour).

		2009-2010							
		1	2	3	4	5	6	7	8
Enfants < 3		98.37***	97.21***	97.09***	97.12***	97.12***	97.24***	97.35***	96.85***
		(11.848)	(11.975)	(11.950)	(11.886)	(11.931)	(11.964)	(11.919)	(11.710)
Enfants 3-18		15.55***	15.64***	15.69***	15.40***	15.56***	15.69***	15.86***	15.20***
		(4.374)	(4.356)	(4.363)	(4.414)	(4.424)	(4.355)	(4.333)	(4.343)
Rural		1.27	1.28	1.69	1.31	1.58	1.68	1.40	2.50
		(7.032)	(7.162)	(7.078)	(6.990)	(7.025)	(7.028)	(7.009)	(7.036)
Age-femme		-2.20***	-2.29***	-2.30***	-2.22***	-2.25***	-2.31***	-2.33***	-2.24***
		(0.482)	(0.473)	(0.472)	(0.483)	(0.484)	(0.477)	(0.470)	(0.476)
Jour de semaine		7.21	7.25	7.34	7.37	7.44	7.39	7.47	7.60
		(6.712)	(6.710)	(6.731)	(6.722)	(6.741)	(6.664)	(6.716)	(6.738)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC									
CAP/BEP		-4.74	-6.41	-5.09	-5.15	-5.30	-5.26	-5.44	-5.06
		(11.771)	(11.649)	(11.652)	(11.646)	(11.722)	(11.695)	(11.677)	(11.571)
BAC (Gen & Technique)		-4.78	-6.34	-5.32	-5.54	-6.03	-6.35	-6.19	-5.09
		(13.419)	(13.412)	(13.147)	(13.265)	(13.284)	(13.358)	(13.316)	(13.075)
Bac+2		9.33	6.67	7.31	8.29	6.85	6.58	6.31	7.99
		(12.411)	(11.928)	(11.924)	(12.123)	(12.010)	(12.699)	(11.987)	(11.853)
Bac+3 ou +4		5.29	2.54	2.83	2.87	2.76	2.17	1.50	4.13
		(12.912)	(12.228)	(12.353)	(12.329)	(12.463)	(12.851)	(12.430)	(12.245)
3ième cycle, gde école, doctorat		14.34	10.71	9.82	12.30	9.36	8.87	7.67	13.28
		(15.056)	(14.304)	(14.366)	(14.348)	(14.378)	(15.262)	(14.772)	(14.551)
Log du salaire horaire de la femme		-7.75							
		(7.942)							
Log ratio du salaire horaire (H/F)		4.59							
		(5.945)							
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**		-14.82*						
			(8.373)						
	Travail par Education			-4.93					
				(7.998)					
	Salaire par Statut				-9.17				
					(7.527)				
	Salaire par Education					-4.75			
						(8.448)			
Variable Dummy: Femmes avec reference au partenaire	**Education plus élevée**						0.71		
							(6.862)		
	Meilleur statut							4.78	
								(8.018)	
	Salaire plus élevé								-14.91**
									(7.374)
Constante		137.63***	129.21***	126.98***	124.67***	125.45***	126.72***	127.01***	126.66***
Observations		1482	1482	1482	1482	1482	1482	1482	1482

* significatif à 10%; ** significatif à 5%; *** significatif à 1%; Ecarts-type entre parenthèses.

Ainsi, pour les femmes, le temps passé aux soins aux enfants apparaît donc beaucoup moins élastique à sa situation professionnelle que le temps domestique hors enfants. Pour les hommes, nous observions que ces deux types d'activité réagissaient à certains indicateurs différents, mais sans observer que l'un était plus sensible que l'autre à la situation professionnelle de la femme. Le salaire de l'homme apparaissait néanmoins très significatif dans les équations de soin aux enfants, et positif, ce qui n'était pas le cas pour le travail domestique global. Le contraire se produit pour la femme : elle diminue fortement son temps de travail domestique global et de base à mesure que son salaire augmente, mais elle n'adapte pas son temps de soins aux enfants à son niveau de salaire. Donc le sens du coefficient va à l'encontre de l'efficience pour l'homme dans le cas des activités parentales, et dans le sens de l'efficience pour la femme en ce qui concerne le temps de TD hors enfants.

Les estimations de la différence de TD global (TD de la femme – TD de l'homme) sont représentées dans le **tableau 6,** à la fois à partir de l'enquête 1998-99 et de l'enquête 2009-10. Lorsque le couple a de très jeunes enfants, la femme effectue en moyenne 72 minutes de TD de plus que son conjoint en 1998-99, alors que la différence se réduit et, de plus, n'est plus significative en 2009-10. La différence est un peu plus réduite et devient significative lorsque le couple a des enfants de 3 à 18 ans, d'environ 18 minutes en 2009-10, et ceci est très similaire à 1998-99. La différence de TD est 24 minutes plus élevée en semaine qu'en week-end en 2009-10, alors que l'effet n'est pas significatif en 1998. Un couple dans lequel l'homme a le baccalauréat verra la différence de TD diminuer par rapport à un couple dont l'homme n'a pas de diplôme. Nous trouvons un effet similaire pour les niveaux de diplôme Bac + 2 et Bac +3 ou +4. Avoir un diplôme de niveau Bac +5 et plus n'a pas d'effet significatif sur la différence de TD par rapport au fait de n'avoir aucun diplôme. Nous observons que le diplôme était un déterminant important de la différence de TD en 1999, où il était montré que la différence diminue à mesure que l'homme obtient un niveau d'éducation plus élevé. Concernant le ratio des salaires, plus le salaire de l'homme est élevé par rapport à celui de sa femme, plus la différence est grande, mais l'effet n'est pas toujours significatif, en 2010 comme en 1999.

Tableau 6: Estimation par les MCO de la différence de TD (TD de la femme – TD de l'homme), en minutes/jour.

		1998-99[1]							2009-10						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
Enfants, âge < 3 ans		72.70***	73.75***	71.47***	71.05***	75.65***	70.67***	75.01***	22.86	21.85	21.56	23.09	26.70	24.38	22.65
Enfants, âge 3-18 ans		13.56***	14.66***	15.70***	15.02***	15.65***	15.23***	15.51***	17.86***	18.20***	18.13***	18.69***	19.53***	18.60***	18.46***
Rural		-8.23	-8.52	-10.67	-11.34	-10.07	-7.31	-10.24	5.21	6.10	3.92	5.83	5.44	6.61	6.39
Jour de semaine		6.6	5.22	7.63	7.46	5.68	7.56	5.76	24.46**	24.63**	25.15**	25.07**	25.40**	24.53**	25.16**
Dummy d'éducation de l'homme: référence pas d'éducation ou < BEPC,CAP,BEP															
BEPC/CAP/BEP		-27.23**	-25.99*	-26.02**	-26.91**	-38.41***	-22.10*	-27.69**	-5.74	-5.12	-3.05	-4.76	-8.46	-4.05	-4.45
BAC (Gen & Technique)		-33.69*	-33.56*	-30.67*	-36.65**	-46.73***	-27.86	-37.37**	-44.82**	-44.18**	-42.36**	-44.60**	-48.48***	-44.38**	-43.06**
Bac+2 et plus		-37.92**	-32.52**	-30.46**	-31.08**	-52.83***	-29.60**	-34.53**							
Bac+2									-39.81**	-38.78**	-35.67**	-38.82**	-45.08**	-37.64**	-38.39**
Bac +3 ou +4									-40.15**	-39.64**	-35.63*	-40.52**	-48.79**	-40.60**	-40.53**
$3^{ième}$ cycle, gde école, doctorat									4.68	6.32	9.33	4.18	-7.66	3.09	2.59
Log ratio du salaire horaire (H/F)		15.98*	15.88	6.17	6.7	7.34	7.38	-2.71	15.13*	15.16*	8.30	11.68	11.19	9.92	1.99
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**	-31.86***							-32.09**						
	Travail par Education		-25.02**							-33.23***					
	Salaire par Statut			-37.58***							-33.21***				
	Salaire par Education				-31.65***							-5.64			
Variable Dummy: Femmes avec référence au partenaire	**Education plus élevée**					-36.75***							-17.07		
	Meilleur statut						-39.72**							-27.32**	
	Salaire plus élevé							-39.99***							-36.35***
Constante		127.3***	124.7***	126.72***	116.8***	105.19***	104.9***	94.94**	72.14***	71.23***	70.14***	64.96***	73.42***	67.64***	73.48***
Observations		1475	1489	1437	1444	1520	1494	1444	2402	2402	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%
[1]Source : Rizavi & Sofer (2010)

Nous observons également que cette différence diminue lorsque la femme investit beaucoup dans sa carrière, à l'exception des variables 'Salaire par éducation' et 'Education plus élevée', dont les coefficients sont bien négatifs, mais non significatifs. En 1999, tous les indicateurs étaient significatifs.

Si nous faisons porter la différence uniquement sur les activités liées aux enfants, nous observons que celle-ci est beaucoup plus insensible aux indicateurs d'investissement : en effet, le temps de soins aux enfants de la femme diminue significativement par rapport à celui de son conjoint uniquement lorsqu'elle gagne un salaire supérieur par rapport aux autres femmes ayant le même statut.

Quant au ratio du TD global (TD de l'homme /TD de la femme) (**tableau 7**), en 2009-2010, il diminue avec le ratio des salaires. Cependant, les divers indicateurs d'investissement exerçaient une influence nette positive sur le ratio de TD en 1998-1999. En 2010, bien que ces coefficients aient sensiblement augmenté, en moyenne aucun n'apparaît significatif, et il en va de même lorsque nous considérons uniquement le temps lié aux enfants.

Les résultats de ces estimations simples ne permettent pas de fournir des conclusions définitives sur la répartition des tâches domestiques dans les couples où la femme investit beaucoup dans sa vie professionnelle. En effet, les estimations du temps de TD montrent que le TD de l'homme est plus inélastique à la situation professionnelle de sa partenaire, ou élastique de façon moins significative en 2010, qu'en 1999. Cependant, le TD de la femme, lui, est bien élastique aux indicatrices d'investissement, tout comme la différence de travail domestique. De plus, les hommes comme les femmes semblent réagir de manière différente au temps de TD lié aux enfants et à celui hors enfants, avec, du côté des hommes comme de celui des femmes, un bien moindre ajustement du temps consacré aux enfants aux investissements professionnels de la femme.

Dans la partie suivante, nous cherchons à enrichir ces résultats initiaux, en prenant en compte à la fois la simultanéité des décisions de TD de l'homme et de la femme, ainsi que l'offre de travail marchand de l'homme, tout en considérant l'aide extérieure et l'indicateur d'investissement comme endogènes.

Tableau 7: Estimation par les MCO du **ratio de TD** (TD de l'homme /TD de la femme).

		1998-99 **							2009-10						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
Log ratio du salaire horaire (homme/femme)		-0.029	-0.03	0.05	0.038	0.025	0.028	0.118	-0.46	-1.03*	-0.96*	-0.78	-0.79	-0.98	-0.93*
Variable Dummy: Femmes dans le quartile supérieur, dans sous-groupes Statut ou Education.	**Travail par Statut**	0.19**							1.60						
	Travail par Education		0.18*							0.83					
	Salaire par Statut			0.29***							0.90				
	Salaire par Education				0.20*							0.72			
Variable Dummy: Femmes avec référence au partenaire	**Education plus élevée**					0.22**							-1.09		
	Meilleur statut						0.23							-0.29	
	Salaire plus élevé							0.32**							3.35
Observations		1428	1435	1428	1435	1435	1417	1435	2402	2402	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

** Source : Rizavi & Sofer (2010)

2.4. Le modèle complet

Nous présentons maintenant un modèle reflétant la simultanéité des décisions prises dans le ménage concernant les différents types de travail de chacun des deux partenaires. Nous incluons les équations de travail domestique de chacun des conjoints et de travail marchand de l'homme. Plutôt que d'intégrer une équation du travail marchand de la femme, nous incluons une équation pour l'indicateur d'investissement considéré. Cela revient à endogénéiser son investissement professionnel. En effet, des facteurs inobservables individuels (comme les préférences ou les productivités) pourraient avoir une influence à la fois sur l'investissement de la femme, et sur les choix d'allocation du temps. L'indicateur d'investissement considéré serait ainsi endogène, car corrélé avec les termes d'erreurs des équations du travail domestique de l'homme, de la femme, et du travail marchand de l'homme.

Le recours à une éventuelle aide extérieure rémunérée (hors garde d'enfants) pourrait également être endogène dans les équations de travail domestique des deux conjoints. En effet, des facteurs inobservables pourraient expliquer à la fois les décisions d'allocation du temps domestique et le recours à une aide ménagère[5]. Nous ajoutons donc une équation capturant la décision de recourir à une aide disponible rémunérée pour le travail domestique à partir d'une source extérieure au ménage, et cette variable dépendante va apparaître comme variable explicative du travail domestique de l'homme et de la femme.

Nous estimons ainsi un système composé de 5 équations, permettant la corrélation des erreurs entre ces 5 équations.

[5] Il s'agit d'une aide ménagère pour le travail domestique de base (excluant la garde des enfants).

2.4.1. Méthodologie

Nous estimons un modèle joint de recours à une aide-ménagère extérieure, d'investissement professionnel de la femme, d'offre de travail domestique de l'homme et de la femme et de travail marchand de l'homme. Le modèle comporte cinq équations, dont les termes d'erreur sont supposés corrélés.

Les deux premières équations sont binaires. La première équation décrit si le couple i a recours ou non à une aide extérieure rémunérée pour les tâches domestiques.

$$Aide_i = I(Aide_i^* \geq 0),$$

$$\text{où } Aide_i^* = X_{aide,i}\,\beta_{aide,i} + \varepsilon_{aide,i}$$

La seconde équation décrit l'investissement professionnel de la femme pour l'indicateur considéré.

$$Ind_i = I(Ind_i^* \geq 0),$$

$$\text{où } Ind_i^* = X_{ind,i}\,\beta_{ind,i} + \varepsilon_{ind,i}$$

Les trois dernières équations de ce système sont continues. Les troisièmes et quatrièmes équations décrivent le temps de travail domestique effectué par la femme et l'homme.

$$TD_{f,i} = X_{TDf,i}\beta_{TDf,i} + \varepsilon_{TDf,i}$$

$$TD_{m,i} = X_{TDm,i}\beta_{TDm,i} + \varepsilon_{TDm,i}$$

La cinquième équation décrit le temps de travail marchand de l'homme.

$$TM_{m,i} = X_{TMm,i}\beta_{TMm,i} + \varepsilon_{TMm,i}$$

Finalement, nous supposons que tous les termes aléatoires dans le modèle sont corrélés. La matrice de variance-covariance des erreurs de ce système n'admet aucune contrainte (n'est pas restreinte) afin de permettre la simultanéité des choix d'allocation des conjoints, de l'indicateur d'investissement considéré, ainsi que la décision de recourir à une aide extérieure.

Ce modèle est estimé avec la méthode du Maximum de Vraisemblance Simulée, en utilisant la méthode GHK, nous permettant d'estimer à la fois la partie continue et binaire du modèle.[6]

2.4.2. Identification du modèle : Variables d'exclusion

La stratégie d'identification repose sur les restrictions d'exclusion.

Une variable d'exclusion binaire est intégrée dans l'équation « aide extérieure »: le fait d'habiter dans la région parisienne, augmentant la probabilité de recourir à une aide ménagère. Cette variable n'influence pas les autres équations du modèle. En particulier, elle n'a pas d'impact significatif sur les temps de TD de l'homme et de la femme.

De plus, la variable 'propriétaire' n'influence pas le recours à une aide extérieure, c'est pourquoi elle apparaît uniquement dans les équations de TD. La variable « aide » est incluse comme variable explicative du travail domestique de l'homme et de la femme.

Les indicateurs d'investissement professionnel de la femme sont également endogénéisés, à l'exception des modèles à partir des indicateurs `Travail par Statut' et `Travail par Education', où cela reviendrait à ajouter une équation liée à l'offre de travail de la femme, et perturberait les résultats. Certaines variables d'identification sont communes à tous les indicateurs, alors que d'autres varient selon l'indicateur considéré. Nous incluons notamment dans chaque système des variables géographiques pouvant influencer le niveau d'investissement de la femme. Il s'agit de la région de résidence, ainsi que des indicateurs concernant le fait de

[6] Nous utilisons la commande Stata CMP écrite par David Roodman, 2011.

résider en milieu rural, ou dans une petite ville, par opposition à une grande ville, où le niveau de salaires est en général plus élevé, et où l'on peut observer des niveaux d'investissement des femmes dans leur vie professionnelle différents.

Concernant l'indicateur « salaire par statut », nous incluons comme variable d'exclusion spécifique le niveau de diplôme de la femme, qui pourrait lui conférer un salaire supérieur selon le niveau de statut professionnel. Nous ajoutons également des variables binaires indiquant si sa mère travaillait, à temps plein ou à temps partiel, quand elle avait 16 ans. Il apparaît effectivement que la probabilité que la femme ait une valeur de 1 à cette indicateur augmente lorsque sa mère travaillait à temps partiel (par opposition à ne pas travailler) lorsqu'elle avait 16 ans. Concernant l'indicateur 'Salaire par Education', nous utilisons des indicatrices pour le statut professionnel de la femme. En effet, un haut statut pourrait expliquer pourquoi elle gagne un salaire élevé par rapport aux autres femmes ayant le même niveau d'éducation. Nous ajoutons également des indicatrices pour le statut professionnel de ses parents, à savoir si son père et sa mère travaillaient chacun dans le secteur privé, public, ou étaient indépendants, ou bien ne travaillaient pas. Nous trouvons en effet que la probabilité qu'une femme gagne un salaire élevé par rapport aux autres femmes ayant le même niveau d'éducation augmente si son père travaillait dans le secteur public, alors que cette probabilité diminue si c'est sa mère qui travaillait dans le secteur public.

Les variables d'exclusion utilisées pour l'indicateur 'Diplôme > conjoint' sont la différence d'âge entre les conjoints et le niveau de diplôme de l'homme. Nous incluons également le nombre d'années d'études de chacun des parents des partenaires. Ces variables apparaissent influencer très fortement cet indicateur : plus le niveau de diplôme des parents de la femme est élevé, plus la probabilité qu'elle soit en couple avec un homme ayant un diplôme inférieur à elle est élevé. Plus le niveau d'éducation du père de l'homme est élevé, plus ce dernier a des chances d'avoir un diplôme inférieur à sa partenaire, alors que le niveau de diplôme de sa mère n'a aucun impact.

Le niveau d'éducation de chacun des deux conjoints est inclus comme variable d'exclusion de l'indicateur 'Statut > conjoint', ainsi que la différence d'âge entre les partenaires. Nous incluons également des variables binaires pour le statut professionnel de l'homme, deux indicatrices décrivant si chacun des partenaires travaille dans le secteur public. Nous incluons également des variables décrivant le niveau d'éducation des parents des conjoints, et des indicatrices décrivant si la mère de l'homme et la mère de la femme travaillaient à mi-temps ou à temps plein quand ils avaient 16 ans.
Enfin, concernant l'indicateur 'Salaire > conjoint', nous incluons la différence d'âges entre les conjoints, le salaire de l'homme, le diplôme de chacun, et le statut professionnel de la femme.

L'indicateur d'investissement considéré dans chacun des systèmes est inclus comme variable explicative du TD de la femme, de l'homme, et du travail marchand de l'homme.

2.4.3. Résultats

- **Système sans indicateurs**

Les deux **tableaux 9** présentent une première spécification du modèle, où nous n'incluons aucun indicateur d'investissement de la femme dans sa carrière, mais plutôt les variables d'éducation de l'homme et de la femme, ainsi que le ratio du salaire des partenaires. Cette estimation, à partir du temps de TD global (TD de base + soins aux enfants, **tableau 9(1)**), montre que le niveau de diplôme de chacun des conjoints explique très faiblement le temps consacré au travail domestique, mais explique très bien le temps de travail marchand de l'homme. Plus le niveau d'éducation est élevé par rapport à la référence `Sans diplôme', plus l'homme travaillera sur le marché, à l'exception de « Bac +2 et Bac +3ou +4 ». Quand au niveau d'éducation de la femme, il diminue son propre travail domestique, mais sans que cet effet soit significatif. Ce sont plutôt les salaires qui déterminent en grande partie le TD, mais dans le « mauvais sens » pour l'homme. En effet, plus il gagne un salaire élevé, plus il effectue du travail domestique, et moins il travaille à l'extérieur. Notons cependant que l'équation comporte le ratio des salaires parmi les variables : une augmentation de son salaire, à ratio constant, implique également une augmentation du salaire de sa femme. Le travail domestique de la femme diminue avec son propre salaire. Quand au ratio du salaire de l'homme sur celui de la femme, il n'apparaît pas expliquer de manière significative le temps de TD de l'homme et de la femme. Cependant, nous pouvons constater que son signe est positif pour l'équation de TD de la femme, et négatif pour celle de l'homme, ce qui irait bien, cette fois, dans le sens d'une répartition efficiente des tâches. L'aide extérieure joue négativement et significativement sur le temps de TD de l'homme. En revanche, de façon inattendue, elle n'influence pas significativement le TD de la femme, et son coefficient est même positif.

Un système équivalent, à partir du TD de base (hors soin aux enfants), montre des résultats très similaires, à ceci près qu'une hausse du salaire de l'homme (de la femme) entraine une hausse (une baisse) de son temps de TD de base, mais l'effet n'est plus significatif dans les deux cas.

Tableau 9(1): Système de 4 équations simultanées du **TD global** des partenaires, sans prise en compte des indicateurs de l'investissement dans la carrière. **2009-10**

Sans indicateurs				
Variables Dépendantes → **Variables explicatives ↓**	Aide	TD femme	TD homme	Travail marchand H
Enfants < 3	0.31**	135.42***	95.59***	-14.40
	(0.145)	(14.090)	(12.473)	(15.354)
Enfants 3-18	0.14***	35.12***	10.44***	11.04*
	(0.048)	(5.276)	(3.959)	(5.883)
Age de la femme	0.02**	4.04		
	(0.007)	(3.541)		
Age^2 de la femme		-0.02		
		(0.045)		
Age de l'homme			1.18	-11.97**
			(3.353)	(5.089)
Age^2 de l'homme			-0.01	0.14**
			(0.040)	(0.060)
Age homme - Age femme	0.01			
	(0.013)			
Paris	0.73***			
	(0.167)			
Nombre de pièces	0.23***	-1.54	3.86*	
	(0.037)	(3.698)	(2.315)	
Propriétaire		-11.10	23.90***	
		(10.257)	(7.216)	
Log du Revenu hors travail	0.02***	-0.57	1.35***	-1.73***
	(0.006)	(0.511)	(0.422)	(0.668)
Jour de semaine		-67.34***	-95.64***	328.32***
		(8.555)	(8.661)	(10.613)
Aide		49.32	-45.65**	
		(47.654)	(22.037)	
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC				
CAP/BEP			-8.13	34.88**
			(10.413)	(17.432)
BAC (Gen & Technique)			-6.96	43.47**
			(13.896)	(21.119)
Bac+2			9.33	-2.71
			(12.991)	(20.696)
Bac +3 ou +4			1.49	34.67
			(14.768)	(22.399)
3^{ième} cycle, gde école, doctorat			-25.53*	68.31***
			(13.504)	(21.407)
Education de la femme, dummy, référence: pas de diplôme/CEP/BEPC				
CAP/BEP		0.24		
		(13.543)		
BAC (Gen & Technique)		1.07		
		(15.174)		
Bac+2		3.90		
		(14.627)		
Bac +3 ou +4		-10.03		
		(15.494)		
3^{ième} cycle, gde école, doctorat		-12.93		
		(18.022)		

Suite page suivante

Suite du tableau 9(1) :

Variables Dépendantes → Variables explicatives ↓	Aide	TD femme	TD homme	Travail marchand H
Log du salaire horaire de l'homme	0.43***		15.23*	-25.88**
	(0.089)		(8.707)	(13.197)
Log du salaire horaire de la femme	0.45***	-31.45**		
	(0.108)	(13.877)		
Log ratio du salaire horaire (H/F)		0.46	-4.68	1.53
		(9.136)	(6.574)	(10.497)
Constante	-5.50***	180.55**	91.28	344.87***
Observations	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

Considérant uniquement le temps lié aux enfants (**tableau 9(2)**), les coefficients des salaires de l'homme et de la femme sont finalement très similaires à ce que l'on observait pour le temps de TD global. Une hausse du salaire horaire de la femme l'amène à diminuer significativement ses activités parentales (le coefficient n'apparaissait pas significatif avec les MCO), et une hausse du salaire horaire de l'homme le conduit à passer plus de temps à s'occuper de ses enfants. Le ratio des salaires est à nouveau non significatif. On voit également que le coefficient de la variable aide extérieur est cette fois, pour la femme, non seulement positif mais significatif : une aide extérieur pour le travail domestique de base lui permet de dégager plus de temps pour s'occuper de ses enfants.

Tableau 9(2): Système de 4 équations simultanées du **temps de soins aux enfants** des partenaires, sans prise en compte des indicateurs de l'investissement. **2009-10**

Sans indicateurs				
Variables Dépendantes → **Variables explicatives ↓**	Aide	TD femme	TD homme	Travail marchand H
Enfants < 3	0.17	97.20***	44.80***	-18.73
	(0.187)	(12.161)	(8.062)	(20.702)
Enfants 3-18	0.05	15.54***	0.91	17.92*
	(0.072)	(4.887)	(3.298)	(9.793)
Age de la femme	0.02**	4.09		
	(0.010)	(4.113)		
Age^2 de la femme		-0.08		
		(0.052)		
Age de l'homme			1.12	-24.01***
			(3.160)	(8.176)
Age^2 de l'homme			-0.03	0.27***
			(0.036)	(0.100)
Age homme - Age femme	0.01			
	(0.013)			
Paris	0.86***			
	(0.192)			
Nombre de pièces	0.20***	-5.70**	-3.13*	
	(0.044)	(2.866)	(1.697)	
Propriétaire		-1.32	5.45	
		(8.286)	(5.719)	
Log du Revenu hors travail	0.02***	-0.88**	0.73**	-2.73***
	(0.008)	(0.424)	(0.296)	(0.927)
Jour de semaine		7.79	-16.36**	312.27***
		(6.362)	(6.365)	(14.329)
Aide		74.39**	6.60	
		(29.767)	(14.057)	
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC				
CAP/BEP			-2.45	23.04
			(5.605)	(25.414)
BAC (Gen & Technique)			3.20	30.18
			(7.166)	(30.432)
Bac+2			12.45*	-12.76
			(6.980)	(28.197)
Bac +3 ou +4			31.90**	13.87
			(16.221)	(30.435)
3^{ième} cycle, gde école, doctorat			1.05	58.32**
			(8.667)	(29.496)
Education de la femme, dummy, référence: pas de diplôme/CEP/BEPC				
CAP/BEP		-3.41		
		(11.737)		
BAC (Gen & Technique)		-5.49		
		(13.265)		
Bac+2		9.26		
		(12.426)		
Bac +3 ou +4		4.11		
		(13.064)		
3^{ième} cycle, gde école, doctorat		13.09		
		(15.059)		

Suite page suivante

Suite du tableau 9(2) :

Variables Dépendantes → Variables explicatives ↓	Aide	TD femme	TD homme	Travail marchand H
Log du salaire horaire de l'homme	0.40***		14.28**	-16.88
	(0.108)		(6.824)	(18.222)
Log du salaire horaire de la femme	0.51***	-21.51*		
	(0.139)	(11.306)		
Log ratio du salaire horaire (H/F)		-0.98	-5.87	-6.83
		(6.800)	(4.243)	(13.675)
Constante	-5.53***	75.37	28.34	602.05***
Observations	1482	1482	1482	1482

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

L'ensemble des tableaux en **Annexe C** présente les résultats des estimations du modèle par Maximum de vraisemblance simulé, pour chacun des indicateurs d'investissement des femmes dans leur carrière, considérant le temps de TD global. Le **tableau 10(1)** résume les résultats principaux pour les indicateurs où les autres femmes constituent la référence, et le **tableau 10(2)** les résultats principaux pour les indicateurs où le conjoint constitue la référence. Les **tableaux 11(1)** et **11(2)** présentent les principaux résultats lorsque nous tenons compte uniquement du temps de soin aux enfants.

- **Système avec indicateurs : temps de travail domestique global**

Considérons tout d'abord le temps de TD global des deux partenaires. Notons que la présence d'enfants augmente la probabilité de recourir à une aide extérieure, et encore davantage lorsque ceux-ci ont moins de 3 ans, comme attendu[7]. Il est intéressant de noter que le salaire horaire de l'homme et de la femme ont un impact positif très fort sur le recours à une aide extérieure, et l'effet est très similaire pour les deux variables. Un couple habitant à Paris aura plus souvent recours à une aide ménagère. La probabilité de recourir à une aide rémunérée

[7] Rappelons que la garde d'enfants a été exclue des tâches effectuées dans la définition de l'aide extérieure, car la garde d'enfants est trop directement liée à la présence d'enfants et au travail de la mère.

est également très dépendante du nombre de pièces dans le logement : plus celui-ci est élevé, plus les couples font appel à une aide ménagère. Le revenu hors travail explique également de manière positive cette probabilité.

Tableau 10(1) : Résultats synthétiques du système de 4 ou 5 équations simultanées du **TD global** des partenaires, incluant les **indicateurs en référence aux autres femmes**. 2009-10.

Variables Dépendantes → Variables explicatives ↓	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H
	Travail par Statut				
Aide			62.84	-40.82*	
			(46.078)	(22.707)	
Log du salaire horaire de l'homme	0.43***			11.36	-24.19**
	(0.090)			(7.096)	(10.280)
Log du salaire horaire de la femme	0.45***		-40.89***		
	(0.110)		(10.749)		
Travail par Statut			-35.25***	3.91	15.32
			(8.944)	(9.030)	(12.624)
	Travail par Education				
Aide			68.78	-41.40*	
			(45.586)	(22.391)	
Log du salaire horaire de l'homme	0.43***			11.44	-24.13**
	(0.090)			(7.105)	(10.213)
Log du salaire horaire de la femme	0.45***		-41.12***		
	(0.110)		(10.681)		
Travail par Education			-35.90***	4.18	21.15*
			(8.533)	(8.728)	(12.363)
	Salaire par Statut				
Aide			20.17	-44.53*	
			(38.263)	(24.895)	
Log du salaire horaire de l'homme	0.43***			10.60	-24.24**
	(0.090)			(7.130)	(10.754)
Log du salaire horaire de la femme	0.44***	1.41***			
	(0.109)	(0.169)			
Salaire par Statut			-55.82**	6.20	2.73
			(24.759)	(20.028)	(33.444)
	Salaire par Education				
Aide			22.28	-48.21**	
			(35.625)	(23.561)	
Log du salaire horaire de l'homme	0.43***			11.41	-25.61**
	(0.091)			(7.113)	(10.654)
Log du salaire horaire de la femme	0.45***	1.47***			
	(0.110)	(0.187)			
Salaire par Education			-60.56***	9.78	9.00
			(21.253)	(23.332)	(31.116)

<u>Tableau 10(2)</u> : Résultats synthétiques du système de 4 ou 5 équations simultanées du **TD global** des partenaires, incluant les **indicateurs en référence au conjoint**. 2009-10

Variables Dépendantes → Variables explicatives ↓	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H
	Education > conjoint				
Aide			-21.62	-46.47*	
			(31.085)	(24.500)	
Log du salaire horaire de l'homme	0.44***			10.36	-23.65**
	(0.090)			(6.841)	(10.047)
Log du salaire horaire de la femme	0.44***				
	(0.112)				
Education > conjoint			16.25	6.78	-3.93
			(22.327)	(13.350)	(39.123)
	Statut > conjoint				
Aide			-28.30	-38.41	
			(28.960)	(25.064)	
Log du salaire horaire de l'homme	0.44***			11.88*	-26.19***
	(0.090)			(7.168)	(10.107)
Log du salaire horaire de la femme	0.43***				
	(0.112)				
Statut > conjoint			7.87	40.68*	-95.14***
			(27.568)	(22.971)	(34.818)
	Salaire > conjoint				
Aide			-25.40	-41.77	
			(29.209)	(25.408)	
Log du salaire horaire de l'homme	0.43***	-0.71***		16.87*	-31.94**
	(0.091)	(0.169)		(9.665)	(12.724)
Log du salaire horaire de la femme	0.48***				
	(0.114)				
Salaire > conjoint			-25.16	26.86	-37.55
			(25.859)	(35.282)	(41.551)

Nous n'avons pas inclus l'équation de l'indicateur d'investissement pour les estimations utilisant `Travail par Statut' et `Travail par éducation'. En effet, cela revient à ajouter une équation liée à l'offre de travail de la femme, et perturbe les résultats.

Le temps de travail marchand de l'homme diminue avec la présence d'enfants de moins de 3 ans, mais l'effet est non significatif. Par contre il travaille davantage lorsqu'il a des enfants plus âgés. Le revenu hors-travail exerce un effet à la baisse sur le temps de travail marchand de l'homme, effet qui ressort habituellement. Son niveau de diplôme semble expliquer de manière positive le temps de travail, à l'exception du niveau « Bac +2» par comparaison à ne pas avoir de diplôme. Plus l'homme gagne un salaire élevé, moins il consacre de temps au marché du travail, l'effet revenu semblant donc l'emporter.

Enfin, il semble que l'homme adapte son temps de travail marchand aux différents indicateurs d'investissement professionnel de sa partenaire, mais de façon différente selon que l'indicateur est en référence aux autres femmes ou au partenaire. En effet, les premiers types d'indicateurs ont un signe positif mais non significatif (à l'exception de 'Travail par Education' qui entraine une hausse significative du temps de travail marchand de l'homme), alors que les seconds types d'indicateurs semblent diminuer son temps de travail marchand. L'effet n'est significatif que pour l'indicateur 'Statut>conjoint' : quand la femme a un statut professionnel supérieure à son conjoint, il travaille 95 minutes de moins sur le marché du travail par jour par rapport aux autres hommes ayant un statut supérieur à leur partenaire, ce qui est très fort. L'effet est de 37 minutes si la femme gagne un salaire supérieur à son conjoint, mais non significatif.

Ainsi, à l'exception de l'indicateur 'Statut>conjoint', ces résultats ne confirment que très partiellement l'hypothèse de spécialisation dans le ménage. Notons d'ailleurs que c'est également pour cet unique indicateur que l'on trouve que l'homme adapte son temps de travail domestique de façon significative. En définitive, malgré quelques exceptions, le travail marchand de l'homme semble assez inélastique, ce qui correspond au résultat habituellement trouvé dans la littérature.

En ce qui concerne le TD, pour ce qui est des femmes, nous observons que les variables 'Travail par Statut' et 'Travail par Education' exercent à nouveau un impact négatif sur le TD de la femme, légèrement plus fort par rapport aux estimations MCO (tableau 5(1)), puisqu'obtenir une valeur de 1 à ces indicateurs avaient pour effet de diminuer le temps de TD des femmes de 25 minutes environ selon les estimations MCO, et de 35 minutes environ selon le système. Les variables 'Salaire par Education' et 'Salaire par Statut' voient également leur effet s'amplifier lorsque nous les endogénéisons. Ces deux variables avaient pour effet d'entrainer une baisse du temps de TD des femmes de 25 et 28 minutes respectivement lorsqu'elles étaient considéré comme exogènes, alors que les endogénéiser amplifie l'effet, puisque nous observons une diminution de 60 et 55 minutes respectivement cette fois.

Le fait d'endogénéiser les indicateurs 'Education>conjoint' et 'Statut>conjoint' ne change pas les résultats par rapport aux MCO : ces deux variables n'influencent pas le temps de TD de la femme. Notons que le signe de ces deux coefficients est d'ailleurs positif. Selon l'estimation MCO, une femme gagnant un salaire supérieur à son conjoint effectuait moins de TD par rapport aux autres femmes, alors que selon le système complet, cette baisse n'est plus significative. Mais ce résultat provient sans doute de l'ajout de la variable « aide » aux équations : si, comme c'est probable, les femmes pour lesquelles les indicateurs 'Education>conjoint', 'Statut>conjoint' et 'Salaire>conjoint' ont plus souvent recours à une aide extérieure (ce qui fait baisser leur temps global de TD), alors l'introduction de cette variable risque de diminuer l'impact des variables précédentes.

Les estimations à partir du système révèlent donc un fort ajustement du temps de TD de la femme aux différents indicateurs de son investissement professionnel, au moins lorsque celui-ci est mesuré par rapport aux autres femmes. Qu'en est-il pour l'homme ?

L'ensemble des indicateurs en référence aux autres femmes n'exerce toujours aucun impact sur le temps de TD de l'homme. Notons que l'indicateur `Salaire par Education' n'apparaît jamais significatif, mais le fait de l'endogénéiser se traduit par une augmentation du coefficient pour le TD de l'homme, qui atteint maintenant 10, contre -9 avec l'estimation MCO. Ainsi, sans être significatif, le fait d'avoir endogénéisé cet indicateur change le résultat dans le sens de l'efficience de l'allocation du temps entre les conjoints.

Quant aux indicateurs où l'homme constitue la référence, un homme dont la femme atteignait un niveau d'éducation supérieur à lui effectuait 13 minutes de TD en plus lorsque l'indicateur était considéré comme exogène (tableau 4(1)), alors que le considérer comme endogène révèle qu'il n'exerce finalement pas d'influence. Par contre, un homme dont la femme atteint un statut supérieur à lui augmentera de manière significative son temps de TD de 40 minutes, et l'effet apparaît amplifié par comparaison avec l'estimation MCO, où son temps de TD augmentait de 20 minutes. Nous observons qu'un homme dont la femme gagne un salaire plus élevé effectuera plus de travail domestique, 26 minutes en plus, mais l'effet n'est pas significatif. Finalement, le fait d'endogénéiser l'indicateur d'investissement de la femme augmente la taille des effets, mais uniquement l'indicateur 'Statut>conjoint' influence de manière significative le temps de TD de l'homme. Notons que l'indicateur `Statut > conjoint' influence négativement le temps de travail marchand de l'homme. Il semble donc qu'il y ait en partie une substitution du travail domestique au travail marchand.

Ainsi, la diminution du TD de la femme n'est jamais compensée par l'augmentation du TD de l'homme. Est-elle alors compensée par le recours à une aide extérieure ?

En ce qui concerne le temps de travail domestique de chacun des deux conjoints, les résultats montrent que les femmes semblent augmenter leur TD lorsqu'elles bénéficient d'une aide extérieure, et cela lorsque les indicateurs sont en référence aux autres femmes. Cependant, l'effet n'est jamais significatif, alors même que son salaire exerce une forte influence sur la probabilité de faire appel à une aide ménagère. Lorsque les indicateurs sont mesurés par rapport au partenaire, elles semblent diminuer, au contraire, leur temps de TD lorsque le couple fait appel à une aide extérieure, mais l'effet n'est à nouveau pas significatif. Nous observons que le recours à une aide extérieure a un impact plus fort, et significatif cette fois sur le travail domestique de l'homme, puisqu'il lui permet de diminuer son temps de travail domestique de manière significative pour la majorité des indicateurs, et ceci d'une quarantaine de minutes. Notons que le coefficient de l'aide n'apparaît pas significatif pour les systèmes avec les indicateurs 'Statut>conjoint' et 'Salaire>conjoint', même si l'ordre de grandeur est similaire aux autres systèmes.

Remarquons également que le salaire de l'homme et de la femme augmentent très fortement la probabilité de faire appel à une aide ménagère.

Par conséquent, prendre en compte la simultanéité des décisions d'allocation du temps entre les partenaires, tout en corrigeant de la possible endogénéité du recours à une aide rémunérée et de l'indicateur d'investissement des femmes dans leur carrière, augmente le plus souvent substantiellement la taille des effets par rapport aux estimations MCO. En effet, l'impact de l'investissement professionnel de la femme sur son temps de travail domestique semblait sous-estimée avec l'estimation MCO, à l'exception des indicateurs où le conjoint constitue la référence, pour lesquels l'effet est inverse. L'effet sur le temps de travail domestique de l'homme était quand à lui sous-estimé notamment pour l'indicateur 'Statut>conjoint' et 'Salaire>conjoint' (bien que toujours non significatif pour ce dernier), mais surestimé pour l'indicateur 'Education>conjoint'.

Le modèle complet met ainsi en avant une plus forte diminution du temps de TD de la femme lorsqu'elle se consacre de manière intensive à sa carrière en comparaison aux autres femmes, une légère augmentation du TD de l'homme lorsqu'il occupe un statut inférieur à sa partenaire. L'homme et la femme adaptent leur temps de TD avec des modalités un peu différentes selon les indicateurs, mais la tendance est toujours la même, et la contribution de l'homme ne permet jamais de compenser la diminution de la contribution de sa partenaire.

- **Système avec indicateurs : temps de travail domestique hors enfants**

Lorsque nous considérons uniquement le temps de travail domestique hors enfants, les résultats du système apparaissent très similaires aux estimations précédentes. La diminution du temps de TD des femmes lorsque leur investissement professionnel est fort par rapport aux autres femmes reste significative. Les coefficients sont réduits en amplitude, mais très légèrement. Nous trouvons cette fois qu'elle réduit significativement son temps de TD hors enfants lorsqu'elle gagne un salaire supérieur à son conjoint. Les deux autres indicateurs où le conjoint constitue la référence restent non significatifs. Pour l'homme, le coefficient de la variable 'Statut>conjoint' est plus faible et à la limite de la significativité à 10%. Les autres indicateurs restent non significatifs. Ainsi, à parts quelques exceptions, les résultats du système à partir du temps de TD global et hors enfants sont très semblables.

- **Système avec indicateurs : temps de soin aux enfants**

Les **tableaux 11(1)** et **11(2)** présentent maintenant les résultats du système à partir du temps de soin aux enfants. Notons tout d'abord que la femme augmente de manière significative son temps parental lorsque le couple fait appel à une aide extérieure. Cela pourrait signifier que le temps économisé sur le travail domestique de base est reporté sur les activités liées aux enfants. Ce résultat semble se confirmer par les estimations portant sur le temps de TD hors enfants, qui lui diminue sensiblement pour la femme lorsqu'une aide extérieure est présente (plus ou moins significativement selon les cas).

Le temps de soin aux enfants diminue pour la femme lorsque celle-ci obtient une valeur de 1 aux indicateurs en référence aux autres femmes. Ces effets à la baisse sont cependant non significatifs pour les variables 'Travail par éducation' et 'Salaire par statut'. Les trois indicateurs en référence au partenaire ne sont pas significatifs. Notons d'ailleurs que la femme semble consacrer plus de temps à ses enfants lorsqu'elle atteint un statut supérieur à son conjoint, mais de manière non significative. Le système complet montre des effets des indicateurs plus forts par rapport aux estimations MCO, pour la femme, mais notons que seulement deux indicateurs apparaissent significatifs. L'indicateur 'salaire>conjoint' apparaissait significatif dans l'estimation MCO, ce qui n'est pas le cas dans le système complet. Le temps de soin aux enfants de l'homme apparaît peu sensible aux différentes variables de manière générale, sauf vis-à-vis de son propre salaire, qui a un impact positif. Néanmoins, notons que l'indicateur 'Salaire par Education' est très fort en amplitude (coefficient de 45), et les indicateurs 'Education>conjoint' et 'Statut>conjoint' sont négatifs. Le coefficient 'Salaire>conjoint' est très fort et significatif : l'homme augmente son temps de soins aux enfants de 100 minutes lorsqu'il gagne moins que sa partenaire. Un problème d'endogénéité est cependant soupçonné pour ce dernier résultat.

Ainsi, la femme semble adapter son temps passé avec ses enfants à son investissement professionnel, mais de façon moins sensible si l'on compare au travail domestique de base. Le temps de TD de l'homme est très peu sensible à l'investissement de sa partenaire, et encore moins lorsqu'il s'agit du temps parental.

Tableau 11(1) : Résultats synthétiques du système de 4 ou 5 équations simultanées du **temps de soin aux enfants**, incluant les **indicateurs en référence aux autres femmes.** 2009-10.

Variables Dépendantes → Variables explicatives ↓	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H
	Travail par Statut				
Aide			77.67***	15.55	
			(25.207)	(24.450)	
Log du salaire horaire de l'homme	0.39***			8.79	-21.82
	(0.112)			(5.503)	(14.432)
Log du salaire horaire de la femme	0.52***		-25.41***		
	(0.139)		(8.276)		
Travail par Statut			-20.72***	3.38	18.23
			(7.629)	(7.063)	(18.646)
	Travail par Education				
Aide			77.91***	15.21	
			(25.635)	(23.009)	
Log du salaire horaire de l'homme	0.39***			8.75	-21.94
	(0.112)			(5.395)	(14.162)
Log du salaire horaire de la femme	0.52***		-23.60***		
	(0.139)		(8.288)		
Travail par Education			-9.97	0.04	37.49**
			(7.578)	(6.595)	(17.111)
	Salaire par Statut				
Aide			69.75**	8.90	
			(35.346)	(17.731)	
Log du salaire horaire de l'homme	0.40***			8.07*	-21.09
	(0.109)			(4.872)	(14.878)
Log du salaire horaire de la femme	0.46***	1.53***			
	(0.142)	(0.223)			
Salaire par Statut			-19.44	12.59	1.01
			(24.036)	(14.215)	(37.855)
	Salaire par Education				
Aide			78.00***	-8.33	
			(28.665)	(21.251)	
Log du salaire horaire de l'homme	0.40***			8.20*	-24.08
	(0.109)			(4.778)	(14.768)
Log du salaire horaire de la femme	0.53***	1.37**			
	(0.156)	(0.594)			
Salaire par Education			-38.32*	45.92	4.84
			(22.264)	(53.057)	(43.339)

Tableau 11(2) : Résultats synthétiques du système de 4 ou 5 équations simultanées du **temps de soin aux enfants**, incluant les **indicateurs en référence au conjoint**. 2009-10

Variables Dépendantes → Variables explicatives ↓	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H
	Education > conjoint				
Aide			52.75	8.94	
			(35.529)	(15.222)	
Log du salaire horaire de l'homme	0.40***			10.19**	-21.89
	(0.111)			(4.860)	(14.382)
Log du salaire horaire de la femme	0.44***				
	(0.156)				
Education > conjoint			-5.26	-11.52	-30.88
			(26.745)	(10.473)	(49.942)
	Statut > conjoint				
Aide			20.21	104.88***	
			(20.743)	(13.040)	
Log du salaire horaire de l'homme	0.26**			-0.63	-22.93
	(0.100)			(4.543)	(14.157)
Log du salaire horaire de la femme	0.31***				
	(0.099)				
Statut > conjoint			42.50	-6.67	-91.07**
			(42.524)	(17.517)	(45.893)
	Salaire > conjoint				
Aide			51.50**	58.59***	
			(22.255)	(21.719)	
Log du salaire horaire de l'homme	0.32***	-0.45***		21.32***	-34.17**
	(0.112)	(0.129)		(7.771)	(17.208)
Log du salaire horaire de la femme	0.39***				
	(0.143)				
Salaire > conjoint			-15.65	102.65***	-77.09**
			(12.189)	(8.191)	(30.321)

2.5. Substitut ou complément ?

Cette dernière partie se propose de tester une hypothèse largement débattue dans la littérature et aux conséquences fondamentales, à savoir si le temps de travail domestique et le temps parental de l'homme et de la femme sont substituables ou complémentaires. Il s'agit ici d'une première tentative de test de cette hypothèse.

Supposer que le temps de travail domestique de l'homme et de la femme dans le couple sont substituts ou compléments conduit à des résultats bien différents. S'ils sont substituts, une augmentation du salaire de la femme devrait l'amener à effectuer moins de travail domestique, compensé en revanche par une hausse du temps de travail domestique de son conjoint. Ainsi, l'hypothèse implicite sous-jacente contenue tout au long de ce chapitre était celle de temps de travail domestique de l'homme et de la femme substituables. D'ailleurs, c'est l'hypothèse faite le plus souvent, explicitement ou implicitement dans les modèles. Mais s'il s'avère que ces deux facteurs sont compléments, cela devient plus complexe. Si elle effectue moins de travail domestique, la productivité de son conjoint diminue, et il ne devient plus si évident que le temps de travail domestique de l'homme augmente en contrepartie. Donc, afin d'analyser le caractère efficient de la division des tâches au sein du couple, savoir si le temps de l'homme et de la femme sont substituables ou complémentaires apparaît fondamental.

Afin de tester cette hypothèse, nous suggérons alors d'ajouter davantage de structure quand à la fonction de production domestique du ménage, puis d'estimer cette fonction de production. Plus précisément, nous allons spécifier deux fonctions de production, l'une portant sur le travail domestique « pur », l'autre sur les activités liées aux enfants. En effet, la technologie de production pourrait être différente que l'on s'intéresse au travail domestique de base hors enfants ou aux soins aux enfants.

Ainsi, comment estimer une fonction de production domestique sans observer l'*output*, c'est-à-dire la quantité de bien domestique produite ? Il est néanmoins possible d'estimer comment les quantités de facteurs de production réagissent aux prix de ces facteurs (sans information sur la production totale), en faisant l'hypothèse d'une fonction de production à rendements constants, ce qui apporte des prédictions assez fortes.

2.5.1. La fonction de production

La spécification de la fonction de production s'appuie sur les travaux de Rapoport et Sofer (2004), et d'Aronsson, Daunfeldt et Wikström (2001).

Nous adoptons également une technologie CES (Constant Elasticity of Substitution) pour la fonction de production domestique. En effet, les caractéristiques influençant les préférences et la productivité du ménage ne peuvent être distinguées l'une de l'autre si le processus de production du ménage n'est pas caractérisé par des rendements d'échelle constants (Pollak et Wachter, 1975). Supposer des rendements d'échelle constants constitue certes une hypothèse assez forte, puisque cela reviendrait à dire que la productivité des conjoints est la même qu'ils entament leur 3ième heure de travail domestique ou seulement la 1ère. Néanmoins, il s'agit ici de tâches peu complexes, pouvant rapidement être effectuées de manière « mécanique ». L'effort physique requis varie bien entendu selon la tâche effectuée, mais la majorité des activités domestiques implique un niveau d'effort physique plutôt faible. Notons également que la moyenne de temps de travail domestique journalier est de 2 heures et 20 minutes pour les hommes, et de 3 heures et 50 minutes pour les femmes, ce qui semble plutôt court pour impliquer de réels rendements décroissants. Au total, l'hypothèse de rendements d'échelle constants est certes forte, mais ne semble donc pas si éloignée de la réalité.

La fonction de production domestique s'écrit donc :

$$Y = f(t_f, t_m) = \left(\propto t_f^{-\rho} + (1-\alpha) t_m^{-\rho}\right)^{-\frac{1}{\rho}}$$

Y représente un vecteur de biens domestiques, t_f et t_m le temps de travail domestique de la femme et de l'homme. Nous supposons que le paramètre de substitution, ρ, est la même pour tous les ménages, alors que le paramètre de distribution α est individuel (par ménage). En maximisant le profit, on obtient :

$$Max\ \Pi(t_f, t_m) = p\left(\propto t_f^{-\rho} + (1-\alpha)t_m^{-\rho}\right)^{-\frac{1}{\rho}} - w_f t_f - t_m t_m$$

w_f et w_m représentent le salaire horaire de la femme et de l'homme, et p le prix du bien domestique produit, endogène et variable de ménage à ménage.

Les conditions du premier ordre pour t_f et t_m donnent :

$$p\frac{\propto t_f^{-\rho-1}}{\left(\propto t_f^{-\rho} + (1-\alpha)t_m^{-\rho}\right)^{1+\frac{1}{\rho}}} = w_f$$

$$p\frac{(1-\propto)t_m^{-\rho-1}}{\left(\propto t_f^{-\rho} + (1-\alpha)t_m^{-\rho}\right)^{1+\frac{1}{\rho}}} = w_m$$

Ces conditions peuvent être combinées pour donner :

$$\frac{1-\alpha}{\alpha}\left(\frac{t_m}{t_f}\right)^{-1-\rho} = \frac{w_m}{w_f}$$

$$\Leftrightarrow ln\left(\frac{t_m}{t_f}\right) = -\frac{1}{1+\rho}\left(ln\left(\frac{\alpha}{1-\alpha}\right) + ln\left(\frac{w_m}{w_f}\right)\right)$$

Cela conduit à estimer l'équation suivante :

$$ln\left(\frac{t_m}{t_f}\right) = -\frac{1}{1+\rho}\left(\gamma + X\beta + ln\left(\frac{w_m}{w_f}\right) + \varepsilon\right)$$

Tout comme Rapoport et Sofer (2004) et Aronsson, Daunfeldt et Wikström (2001), nous allons régresser le logarithme du rapport des temps de travail domestique de l'homme et de la femme, en fonction du logarithme du rapport des salaires de l'homme et de la femme, ainsi qu'un ensemble de variables de contrôle pouvant potentiellement impacter le rapport des temps domestiques.

Nous notons σ l'élasticité de substitution. ρ étant supposé constant pour l'ensemble des ménages, $\sigma = \frac{1}{1+\rho}$ l'est également. Le coefficient du logarithme du rapport des salaires nous donne alors directement la valeur de l'élasticité de substitution entre t_m et t_f, nous renseignant immédiatement sur la nature substituable ou complémentaire du travail domestique de l'homme et de la femme. La constante de cette équation correspond alors au terme $-\frac{1}{1+\rho}\gamma$, avec $\gamma = ln\left(\frac{\alpha}{1-\alpha}\right)$. Il est alors possible d'estimer (individuellement) α.

Notons que dans l'application empirique qui suit, nous définissons deux fonctions de production différentes, l'une pour le travail domestique de base, l'autre concernant les soins aux enfants. En effet, la technologie de production pourrait être différente selon ces deux types d'activité.

2.5.2. Substituables ou complémentaires ? Résultats

Le **tableau 12** présente les résultats de l'estimation du rapport du travail domestique de l'homme et de la femme (colonne 1) puis du rapport des temps de soins aux enfants (colonne 2), en fonction du rapport des salaires et d'un ensemble de contrôles. Ici, un signe positif indique que le travail domestique de l'homme augmente relativement à celui de la femme. Il s'agit d'une régression MCO simple. L'estimation portant sur les soins aux enfants est réalisée sur un sous-échantillon de couples ayant au moins un enfant de moins de 18 ans.

Notons que le nombre d'enfants impacte le rapport des temps de soins aux enfants, mais n'exerce pas d'‘influence sur le temps domestique de base. Les activités parentales de l'homme diminuent significativement par rapport à celles de la femme à mesure que le nombre d'enfants augmente, et d'autant plus que ceux-ci sont très jeunes. Notons également qu'au sein des couples de propriétaires, l'homme participe relativement plus aux soins aux enfants par rapport aux autres couples de non propriétaire, alors que cette caractéristique n'impacte pas le partage des tâches domestiques de base. A l'inverse, l'homme effectuera relativement plus de travail domestique si le couple vit dans une maison, alors que cela n'a aucune influence sur les activités parentales. Plus le revenu hors travail perçu par le couple est important, plus l'homme passe du temps à s'occuper de ses enfants. Le rapport des temps de travail domestique diminue significativement en semaine, alors qu'il n'existe pas un tel effet concernant les soins aux enfants. Le niveau de diplôme des conjoints n'influence globalement pas la répartition des tâches, à l'exception près qu'un homme ayant le baccalauréat effectuera plus de tâches domestiques, alors qu'un homme ayant un diplôme de niveau CAP ou BEP effectuera relativement moins d'activités parentales. Nous introduisons également des informations sur les parents des partenaires. Nous trouvons que si la mère de l'homme travaillait à temps plein lorsqu'il avait 16 ans, il effectue relativement moins de travail domestique. Mais il s'occupe d'avantage de ses enfants à mesure que le niveau d'éducation de sa mère est élevé.

Qu'en est-il de notre variable d'intérêt, le rapport des salaires ? Nous observons que l'homme effectue relativement moins de travail domestique et de soins aux enfants à mesure que son salaire est élevé par rapport à celui de sa femme. L'effet est significatif à 10%, et plus fort concernant les activités parentales. Ces coefficients représentant exactement l'élasticité de substitution $\sigma = \frac{1}{1+\rho}$, ils nous renseignent directement sur le degré de substituabilité entre le temps de l'homme et de la femme. σ atteint une valeur de 0.18 pour le travail domestique de base, et de 0.24 pour les soins aux enfants. Ainsi, il apparaît que ces deux facteurs ont un degré de substituabilité plutôt faible, plus faible encore en ce qui concerne le temps de travail

Tableau 12 : Estimation par les MCO du logarithme du rapport des temps de TD purs (1) et des temps de soins aux enfants (2).

	(1)	(2)
VARIABLES	**Log (t_m/t_f)**	**Log (c_m/c_f)**
Log (w_m/w_f)	-0.18*	-0.24*
	(0.101)	(0.126)
Enfant<3ans	0.16	-0.64***
	(0.191)	(0.247)
Enfant 3-18 ans	-0.07	-0.35***
	(0.065)	(0.102)
Propriétaire	0.05	0.44**
	(0.172)	(0.200)
Maison	0.33*	-0.19
	(0.172)	(0.181)
Age homme	0.01	0.01
	(0.016)	(0.018)
Age femme	-0.01	-0.02
	(0.016)	(0.022)
Log revenu hors travail	0.01	0.03***
	(0.007)	(0.010)
Jour de semaine	-0.36***	-0.21
	(0.130)	(0.176)
CAP, BEP H	0.15	-0.46*
	(0.196)	(0.257)
Bac(Gen & Technique) H	0.49*	0.42
	(0.285)	(0.297)
Bac+2 H	0.31	0.35
	(0.253)	(0.270)
Bac+3 H	0.27	0.18
	(0.270)	(0.342)
3ième cycle, gde école, doc H	-0.01	-0.13
	(0.296)	(0.399)
CAP, BEP F	-0.24	-0.19
	(0.226)	(0.355)
Bac(Gen & Technique) F	-0.17	0.03
	(0.273)	(0.397)
Bac+2 F	0.00	-0.26
	(0.254)	(0.366)
Bac+3 F	-0.06	0.08
	(0.297)	(0.386)
3ième cycle, gde école, doc F	0.28	-0.15
	(0.317)	(0.480)
Mère tps plein H	-0.26*	
	(0.134)	
Mère mi-temps H	-0.00	
	(0.215)	
Mère tps plein F	0.15	
	(0.139)	
Mère mi-temps F	0.14	
	(0.206)	
Diplôme père H		0.03
		(0.025)
Diplôme mère H		0.05**

		(0.022)
Diplôme père F		0.00
		(0.025)
Diplôme mère F		-0.03
		(0.026)
Constante	-0.96*	-0.40
	(0.529)	(0.811)
Observations	2402	1482

domestique qu'en ce qui concerne les soins aux enfants. Ce résultat apparaît plutôt paradoxal si on se réfère aux justifications « naturalistes » de la division traditionnelle du travail entre hommes et femmes qui s'appuient sur l'hypothèse d'une relation privilégiée mère/enfant.

Les travaux de Rapoport et Sofer (2004) et Aronsson, Daunfeldt et Wikström (2001) nous permettent de comparer ces élasticités dans le temps et par rapport à la Suède. Ces estimations étaient cependant effectuées à partir du temps de travail domestique total (travail domestique de base + soins aux enfants). En 1999 et sur données françaises (Rapoport et Sofer, 2004), l'élasticité de substitution était de 0,40 (coefficient significatif à 10% également). Le degré de complémentarité semble s'être accentué en dix années. En Suède, ce taux était de 0.17 en 1984, et de 0.08 en 1993, mais les deux coefficients apparaissaient non significatifs (Aronsson, Daunfeldt et Wikström, 2001).

3.6 Conclusion

Cette étude a permis d'identifier les femmes se consacrant intensivement à leur carrière, et a cherché à analyser si les couples dans lesquels la femme investit fortement dans sa vie professionnelle effectuent un partage des tâches s'éloignant du modèle traditionnel, où les femmes prennent en charge la majorité des responsabilités domestiques.

L'ensemble des estimations MCO, ainsi que le modèle complet à 5 équations simultanées, convergent à montrer que la femme diminue fortement son travail domestique lorsqu'elle se consacre de manière intensive à sa carrière. Le travail domestique de l'homme semble plus inélastique à la situation professionnelle de sa compagne. Même si sa part de travail domestique augmente parfois dans ce cas, en particulier lorsque sa compagne atteint un statut professionnel supérieur à lui, et même si la prise en compte de la simultanéité des décisions et le caractère endogène de cet investissement traduisent un investissement légèrement plus fort de l'homme dans les tâches domestiques, il apparaît qu'il ne se produit jamais de renversement des rôles de genre, au sens où la femme en fait toujours plus que son conjoint, et le travail domestique de l'homme ne réagit que très peu à la situation professionnelle de sa partenaire.

Lorsque nous concentrons l'analyse sur les couples avec enfants et le partage du temps de soin aux enfants, nous observons que les femmes adaptent ces activités à leur investissement professionnel, mais dans une moindre mesure par rapport au travail domestique global, ou de base (hors enfants). Le temps parental de l'homme est très insensible à la situation professionnelle de sa partenaire. Ainsi, le partage des activités liées aux enfants semble encore plus éloigné de l'efficience, en comparaison au partage des tâches domestiques globales.

En définitive, ces résultats vont à l'encontre de l'hypothèse d'efficience, ou de minimisation des coûts habituellement faite dans les modèles de ménage. Les tâches domestiques restent une activité sexuée, et les rôles de genre traditionnels persistent puisque la femme continue à prendre en charge la majorité du travail domestique même lorsqu'elle participe au marché du travail avec une forte intensité, et même lorsque les différences hommes/femmes de salaire et de statut sont inversées par rapport au modèle traditionnel. Enfin, même si cette étude ne confirme pas l'hypothèse d'efficience, elle ne confirme pas non plus le phénomène de « doing gender » pour la France.

Ce résultat se basant sur l'hypothèse implicite de substituabilité entre le travail domestique de l'homme et de la femme, nous avons cherché dans une seconde partie à tester cette hypothèse. Il en ressort que ces deux facteurs ont un degré de substituabilité plutôt faible, plus faible encore en ce qui concerne le temps de travail domestique qu'en ce qui concerne les soins aux enfants. Ce résultat apparaît plutôt paradoxal si on se réfère aux justifications « naturalistes » de la division traditionnelle du travail entre hommes et femmes qui s'appuient sur l'hypothèse d'une relation privilégiée mère/enfant.

Néanmoins, ce résultat doit être considéré avec précaution, et le test de l'hypothèse de substituabilité entre le travail domestique de l'homme et de la femme amélioré, tant il repose sur des hypothèses très précises quand à la fonction de production.

Il convient aussi de se demander d'où proviendrait le caractère substituable ou complémentaire du travail domestique de l'homme et de la femme. La productivité de chacun des partenaires dans ces domaines reflète un investissement spécifique de la part de chacun, mais non observé. Affirmer que les facteurs sont substituables ou complémentaire indique donc un degré de substituabilité à un moment donné, mais ne présage pas du caractère général de cette substituabilité entre le travail domestique de l'homme et de la femme, d'autant plus si l'investissement préalable effectué est dépendant du genre de l'individu. Finalement, cette question mérite d'être approfondie, en développant un test de la substituabilité/complémentarité des temps de travail domestique de l'homme et de la femme plus complet.

ANNEXES

A) Description des tâches domestiques

Les différentes tâches domestiques reportées, maintenant standard dans les Enquêtes Emploi du Temps, sont décrites ici.

Le **travail domestique « pur » ou « de base »** inclus toutes les activités ci-dessous :

- Cuisine : préparation (cuisson, épluchage), présentation (mettre la table, servir le repas), nettoyage (vaisselle)
- Ménage : ménage et rangement (intérieur ou extérieur de la maison), linge (lessive, étendre le linge, repassage, couture, rangement)
- Maintenance, réparations dans la maison et des véhicules, jardinage
- Gestion du ménage: faire ses comptes, courrier administratif
- Courses
- S’occuper des animaux
- Soins aux adultes de son ménage

Le **temps parental** (ou soins aux enfants) :

- S’occuper des enfants, soins médicaux
- Autres : bisous, câlins, gronderies
- Jeux et instruction, surveillance des devoirs, conversations
- Trajets

B) Autres variables importantes

Variable	Signification	Moyenne (Enquête 2009-10)
Rural	Variable binaire pour vie en milieu rural (1=Milieu rural)	0 : 69.39 % 1 : 30.61 %
Paris	Variable binaire pour vie à Paris (1=Paris)	0 : 91.20 % 1 : 8.80 %
Jour de semaine	1= Lundi à Vendredi	0 : 28.82 % 1 : 71.18 %
Aide	Le ménage reçoit une aide extérieure rémunérée pour le ménage (hors garde d'enfants) (1=recours à une aide)	0: 88.10 % 1: 11.90 %

C) Résultats complets du système

Systèmes de 4 ou 5 équations simultanées du TD des membres du couple.

(4 équations pour les indicateurs `Travail par Statut' et `Travail par Education')

Temps de travail : déclaré. **2009-2010**

	Travail par Statut				Travail par Education			
Variables Dépendantes → **Variables explicatives ↓**	Aide	TD femme	TD homme	Travail marchand H	Aide	TD femme	TD homme	Travail marchand H
Enfants < 3	0.31**	134.03***	95.79***	-14.32	0.30**	132.99***	96.03***	-13.53
	(0.146)	(14.159)	(12.520)	(15.278)	(0.149)	(14.234)	(12.544)	(15.301)
Enfants 3-18	0.14***	33.62***	10.38***	11.44*	0.14***	33.88***	10.40***	11.37*
	(0.049)	(5.290)	(3.955)	(5.915)	(0.049)	(5.262)	(3.939)	(5.898)
Age de la femme	0.02**	4.38			0.02**	4.11		
	(0.007)	(3.547)			(0.007)	(3.536)		
Age^2 de la femme		-0.02				-0.02		
		(0.045)				(0.045)		
Age de l'homme			1.17	-12.11**			1.19	-12.09**
			(3.352)	(5.097)			(3.349)	(5.097)
Age^2 de l'homme			-0.01	0.15**			-0.01	0.14**
			(0.040)	(0.060)			(0.040)	(0.060)
Age homme – Age femme	0.01				0.01			
	(0.013)				(0.013)			
Paris	0.73***				0.74***			
	(0.167)				(0.167)			
Nombre de pièces	0.22***	-1.68	3.71		0.22***	-1.71	3.64	
	(0.037)	(3.668)	(2.318)		(0.037)	(3.666)	(2.315)	
Propriétaire		-10.06	24.33***			-10.32	24.26***	
		(10.155)	(7.167)			(10.119)	(7.149)	
Log du Revenu hors travail	0.02***	-0.64	1.35***	-1.70**	0.02***	-0.59	1.34***	-1.73***
	(0.006)	(0.509)	(0.424)	(0.668)	(0.006)	(0.509)	(0.425)	(0.666)
Jour de semaine		-67.93***	-95.61***	328.53***		-67.84***	-95.60***	328.51***
		(8.495)	(8.679)	(10.628)		(8.509)	(8.662)	(10.622)
Aide		62.84	-40.82*			68.78	-41.40*	
		(46.078)	(22.707)			(45.586)	(22.391)	
Education de l'homme (pr équations de l'homme), de la femme (pr TD de la femme), dummy, référence: pas de diplôme/CEP/BEPC								
CAP/BEP		-0.78	-8.01	35.00**		3.45	-8.02	34.65**
		(13.490)	(10.398)	(17.419)		(13.485)	(10.390)	(17.418)
BAC (Gen & Technique)		1.84	-6.69	43.12**		9.15	-6.61	42.75**
		(15.262)	(13.783)	(21.066)		(15.185)	(13.813)	(21.117)
Bac+2		6.19	9.81	-2.83		10.50	9.75	-3.36
		(14.577)	(12.954)	(20.510)		(14.577)	(12.937)	(20.500)
Bac +3 ou +4		-6.72	1.87	33.63		-4.29	1.89	33.22
		(15.216)	(14.551)	(22.091)		(15.377)	(14.522)	(22.118)
3ième cycle, gde école, doctorat		-4.43	-25.26*	66.52***		-3.60	-25.48*	65.32***
		(17.906)	(13.555)	(21.166)		(18.016)	(13.595)	(21.255)
Log du salaire horaire de l'homme	0.43***		11.36	-24.19**	0.43***		11.44	-24.13**
	(0.090)		(7.096)	(10.280)	(0.090)		(7.105)	(10.213)
Log du salaire horaire de la femme	0.45***	-40.89***			0.45***	-41.12***		
	(0.110)	(10.749)			(0.110)	(10.681)		
Travail par Statut		-35.25***	3.91	15.32				
		(8.944)	(9.030)	(12.624)				
Travail par Education						-35.90***	4.18	21.15*
						(8.533)	(8.728)	(12.363)
Constante	-5.48***	200.28***	98.91	341.29***	-5.48***	201.60***	98.44	340.02***
Observations	2402	2402	2402	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

	Salaire par Statut					Salaire par Education				
Variables Dépendantes → Variables explicatives ↓	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H	Aide	Salaire par Education	TD femme	TD homme	Travail marchand H
Enfants < 3	0.32**	-0.21	133.98***	95.82***	-14.44	0.32**	-0.32**	132.27***	96.37***	-14.31
	(0.142)	(0.145)	(14.014)	(12.558)	(15.301)	(0.142)	(0.163)	(14.223)	(12.736)	(15.389)
Enfants 3-18	0.14***	-0.12**	35.42***	10.58***	10.98*	0.14***	-0.14**	35.23***	10.49**	11.31*
	(0.048)	(0.056)	(5.309)	(4.038)	(5.899)	(0.048)	(0.055)	(5.307)	(4.077)	(5.899)
Age de la femme	0.02**	0.07	4.20			0.02**	0.14**	4.28		
	(0.007)	(0.062)	(3.631)			(0.007)	(0.056)	(3.603)		
Age^2 de la femme		-0.00	-0.02				-0.00*	-0.01		
		(0.001)	(0.046)				(0.001)	(0.045)		
Age de l'homme				1.01	-11.75**				1.30	-12.20**
				(3.341)	(5.088)				(3.359)	(5.099)
Age^2 de l'homme				-0.01	0.14**				-0.01	0.15**
				(0.039)	(0.060)				(0.040)	(0.060)
Age homme – Age femme	0.01					0.01				
	(0.013)					(0.013)				
Paris	0.73***					0.72***				
	(0.171)					(0.169)				
Nombre de pièces	0.23***		-0.69	3.81		0.23***		-0.36	4.00*	
	(0.036)		(3.568)	(2.320)		(0.036)		(3.514)	(2.314)	
Propriétaire			-12.61	24.03***				-13.43	24.30***	
			(10.244)	(7.251)				(10.138)	(7.193)	
Log du Revenu hors travail	0.02***		-0.54	1.35***	-1.72***	0.02***		-0.51	1.38***	-1.74***
	(0.006)		(0.501)	(0.422)	(0.668)	(0.006)		(0.501)	(0.424)	(0.667)
Jour de semaine			-67.39***	-95.73***	328.55***			-67.25***	-95.33***	328.13***
			(8.584)	(8.652)	(10.577)			(8.633)	(8.669)	(10.620)
Aide			20.17	-44.53*				22.28	-48.21**	
			(38.263)	(24.895)				(35.625)	(23.561)	
Mère de la femme : Travaillait tps plein		0.15								
		(0.095)								
Mère de la femme : Travaillait tps partiel		0.33**								
		(0.149)								
Diplôme du père de la femme							-0.02**			
							(0.012)			
Diplôme de la mère de la femme							-0.01			
							(0.012)			
Père de la femme : Public (ref: autre)							0.25**			
							(0.119)			
Père de la femme : Privé (ref: autre)							0.03			
							(0.113)			
Mère de la femme : Public (ref: indep)							-0.37*			
							(0.190)			
Mère de la femme : Privé (ref: indep)							-0.17			
							(0.175)			
Mère de la femme : Autre (ref: indep)							-0.21			
							(0.179)			
Région2		0.27					0.11			
		(0.177)					(0.167)			
Région3		0.05					-0.15			
		(0.262)					(0.282)			
Région4		0.04					-0.03			
		(0.218)					(0.198)			

Suite de la table page suivante

Suite de la table :

	Salaire par Statut					Salaire par Education				
Variables Dépendantes → **Variables explicatives ↓**	Aide	Salaire par Statut	TD femme	TD homme	Travail marchand H	Aide	Salaire par Education	TD femme	TD homme	Travail marchand H
Région5		0.08					-0.10			
		(0.188)					(0.173)			
Region6		-0.12					-0.10			
		(0.205)					(0.203)			
Region7		-0.04					-0.07			
		(0.196)					(0.193)			
Rural		-0.23**					-0.14			
		(0.100)					(0.100)			
Petite ville		-0.09					-0.16			
		(0.124)					(0.110)			
Education de l'homme (pr équations de l'homme), de la femme (pr TD de la femme), dummy, référence: pas de diplôme/CEP/BEPC										
CAP/BEP		0.01		-8.73	35.66**				-7.82	34.17*
		(0.147)		(10.395)	(17.394)				(10.427)	(17.447)
BAC (Gen & Technique)		0.21		-6.96	43.11**				-7.25	42.73**
		(0.166)		(13.895)	(21.143)				(13.925)	(21.156)
Bac+2		0.33**		9.19	-2.85				8.95	-3.11
		(0.161)		(13.006)	(20.801)				(12.971)	(20.774)
Bac +3 ou +4		-0.16		1.84	35.30				1.78	33.31
		(0.180)		(14.904)	(22.389)				(14.842)	(22.671)
3ième cycle, gde école, doctorat		0.50***		-24.04*	65.93***				-25.90*	66.85***
		(0.188)		(13.583)	(22.079)				(13.712)	(21.953)
Statut de la femme (ref : Ouvier, employé)										
Technicien							0.18			
							(0.120)			
Indépendant							0.25			
							(0.187)			
Cadre							0.72***			
							(0.131)			
Secteur public (femme)							0.01			
							(0.110)			
Log du salaire horaire de l'homme	0.43***			10.60	-24.24**	0.43***			11.41	-25.61**
	(0.090)			(7.130)	(10.754)	(0.091)			(7.113)	(10.654)
Log du salaire horaire de la femme	0.44***	1.41***				0.45***	1.47***			
	(0.109)	(0.169)				(0.110)	(0.187)			
Salaire par Statut			-55.82**	6.20	2.73					
			(24.759)	(20.028)	(33.444)					
Salaire par Education								-60.56***	9.78	9.00
								(21.253)	(23.332)	(31.116)
Constante	-5.51***	-6.22***	109.87	104.13	336.73***	-5.54***	-7.55***	101.13	96.14	349.98***
Observations	2402	2402	2402	2402	2402	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

	Education > conjoint					Statut > conjoint				
Variables Dépendantes → **Variables explicatives ↓**	Aide	Education >conjoint	TD femme	TD homme	Travail marchand H	Aide	Statut >conjoint	TD femme	TD homme	Travail marchand H
Enfants < 3	0.33**		136.39***	93.55***	-12.29	0.33**	0.03	135.62***	94.31***	-11.61
	(0.141)		(14.190)	(12.408)	(15.399)	(0.140)	(0.136)	(14.190)	(12.540)	(15.528)
Enfants 3-18	0.14***		37.59***	10.07**	11.37*	0.14***	-0.04	37.57***	11.00***	9.37
	(0.048)		(5.162)	(3.970)	(5.903)	(0.048)	(0.046)	(5.213)	(3.917)	(5.828)
Age de la femme	0.02**	-0.02***	3.87			0.02**	0.04***	3.62		
	(0.007)	(0.004)	(3.582)			(0.007)	(0.007)	(3.571)		
Age^2 de la femme			-0.01					-0.01		
			(0.045)					(0.045)		
Age de l'homme				1.35	-11.93**				0.79	-10.85**
				(3.328)	(5.164)				(3.356)	(5.029)
Age^2 de l'homme				-0.01	0.14**				-0.00	0.13**
				(0.039)	(0.060)				(0.040)	(0.059)
Age homme – Age femme	0.01	0.00				0.01	-0.00			
	(0.013)	(0.009)				(0.013)	(0.011)			
Paris	0.71***					0.70***				
	(0.172)					(0.171)				
Nombre de pièces	0.23***		0.26	3.94*		0.23***		0.68	3.50	
	(0.036)		(3.431)	(2.343)		(0.036)		(3.412)	(2.364)	
Propriétaire			-14.73	23.76***				-15.83	23.94***	
			(10.199)	(7.292)				(10.263)	(7.188)	
Log du Revenu hors travail	0.02***		-0.41	1.31***	-1.70**	0.02***		-0.40	1.32***	-1.69**
	(0.006)		(0.497)	(0.426)	(0.670)	(0.006)		(0.498)	(0.424)	(0.659)
Jour de semaine			-67.32***	-95.42***	328.17***			-67.44***	-95.61***	328.60***
			(8.596)	(8.637)	(10.611)			(8.612)	(8.653)	(10.533)
Aide			-21.62	-46.47*				-28.30	-38.41	
			(31.085)	(24.500)				(28.960)	(25.064)	
Diplôme du père de la femme		0.04***					0.01			
		(0.012)					(0.014)			
Diplôme de la mère de la femme		0.06***					0.01			
		(0.012)					(0.014)			
Diplôme du père de l'homme		0.03***					0.02			
		(0.011)					(0.013)			
Diplôme de la mère de l'homme		-0.01					-0.02			
		(0.012)					(0.015)			
Mère de la femme : Travaillait tps plein							-0.10			
							(0.101)			
Mère de la femme : Travaillait tps partiel							0.11			
							(0.155)			
Mère de l'homme : Travaillait tps plein							0.00			
							(0.108)			
Mère de l'homme : Travaillait tps partiel							0.19			
							(0.144)			
Région2		-0.15					-0.14			
		(0.143)					(0.158)			
Région3		-0.29					0.15			
		(0.216)					(0.230)			
Région4		-0.36**					0.04			
		(0.175)					(0.222)			

Suite de la table page suivante

Suite de la table :

	Education > conjoint					Statut > conjoint				
Variables Dépendantes → **Variables explicatives ↓**	Aide	Education >conjoint	TD femme	TD homme	Travail marchand H	Aide	Statut >conjoint	TD femme	TD homme	Travail marchand H
Région5		-0.18					-0.15			
		(0.156)					(0.177)			
Region6		-0.14					-0.30			
		(0.172)					(0.196)			
Region7		-0.14					-0.09			
		(0.159)					(0.175)			
Rural		0.00					0.18*			
		(0.090)					(0.110)			
Petite ville		0.07					0.01			
		(0.108)					(0.139)			
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC										
CAP/BEP		-0.79***			28.85*		0.08		-9.37	38.18**
		(0.103)			(17.265)		(0.136)		(10.349)	(17.408)
BAC (Gen & Technique)		-0.98***			38.62*		-0.21		-6.82	44.48**
		(0.143)			(20.181)		(0.186)		(13.761)	(20.855)
Bac+2		-1.50***			4.68		-0.10		8.42	0.73
		(0.129)			(23.735)		(0.169)		(12.910)	(20.505)
Bac +3 ou +4		-2.00***			36.88		-0.03		2.91	35.15
		(0.194)			(26.770)		(0.253)		(14.587)	(22.119)
3ième cycle, gde école, doctorat					50.52		-0.12		-22.90*	65.51***
					(31.378)		(0.270)		(13.518)	(21.035)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC										
CAP/BEP							0.53***			
							(0.189)			
BAC (Gen & Technique)							0.66***			
							(0.212)			
Bac+2							1.25***			
							(0.206)			
Bac +3 ou +4							1.87***			
							(0.232)			
3ième cycle, gde école, doctorat							2.47***			
							(0.265)			
Statut de l'homme										
Technicien							-0.24**			
							(0.118)			
Indépendant							-0.85***			
							(0.185)			
Secteur public (femme)							-0.16			
							(0.135)			
Secteur public (homme)							0.37***			
							(0.097)			
Log du salaire horaire de l'homme	0.44***			10.36	-23.65**	0.44***			11.88*	-26.19***
	(0.090)			(6.841)	(10.047)	(0.090)			(7.168)	(10.107)
Log du salaire horaire de la femme	0.44***					0.43***				
	(0.112)					(0.112)				
Education > conjoint			16.25	6.78	-3.93					
			(22.327)	(13.350)	(39.123)					
Statut > conjoint								7.87	40.68*	-95.14***
								(27.568)	(22.971)	(34.818)
Constante	-5.51***	0.57*	99.40	90.14	343.77***	-5.51***	-3.38***	111.10*	101.57	335.18***
Observations	2402	2402	2402	2402	2402	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

	Salaire > conjoint				
Variables Dépendantes → **Variables explicatives ↓**	Aide	Salaire> conjoint	TD femme	TD homme	Travail marchand H
Enfants < 3	0.33**	-0.15	135.04***	95.84***	-14.79
	(0.141)	(0.123)	(14.011)	(12.494)	(15.181)
Enfants 3-18	0.14***	-0.05	36.44***	10.81***	10.23*
	(0.048)	(0.041)	(5.204)	(4.005)	(5.852)
Age de la femme	0.02**	0.00	4.23		
	(0.007)	(0.005)	(3.510)		
Age^2 de la femme			-0.02		
			(0.044)		
Age de l'homme				0.99	-11.36**
				(3.336)	(5.001)
Age^2 de l'homme				-0.01	0.14**
				(0.039)	(0.059)
Age homme – Age femme	0.01	0.00			
	(0.013)	(0.009)			
Paris	0.69***				
	(0.170)				
Nombre de pièces	0.23***		0.57	3.64	
	(0.035)		(3.438)	(2.353)	
Propriétaire			-14.49	23.88***	
			(10.258)	(7.221)	
Log du Revenu hors travail	0.02**		-0.42	1.35***	-1.74***
	(0.006)		(0.496)	(0.422)	(0.663)
Jour de semaine			-66.94***	-95.66***	328.50***
			(8.605)	(8.622)	(10.529)
Aide			-25.40	-41.77	
			(29.209)	(25.408)	
Région2		0.19			
		(0.149)			
Région3		0.17			
		(0.246)			
Région4		0.04			
		(0.184)			
Région5		-0.06			
		(0.163)			
Region6		0.07			
		(0.174)			
Region7		0.03			
		(0.161)			
Rural		0.02			
		(0.095)			
Petite ville		0.17			
		(0.112)			

Suite de la table page suivante

Suite de la table :

	Salaire > conjoint				
Variables Dépendantes → **Variables explicatives ↓**	Aide	Salaire> conjoint	TD femme	TD homme	Travail marchand H
Education de l'homme, dummy, reference: pas de diplôme/CEP/BEPC					
CAP/BEP		-0.00		-8.58	35.63**
		(0.118)		(10.421)	(17.384)
BAC (Gen & Technique)		-0.00		-8.23	45.78**
		(0.175)		(14.019)	(21.356)
Bac+2		-0.27*		9.10	-1.63
		(0.143)		(12.896)	(20.525)
Bac +3 ou +4		-0.49***		1.84	36.32
		(0.168)		(14.661)	(22.217)
3ième cycle, gde école, doctorat		-0.92***		-24.34*	69.33***
		(0.197)		(13.508)	(21.059)
Education de la femme, dummy, reference: pas de diplôme/CEP/BEPC					
CAP/BEP		0.18			
		(0.170)			
BAC (Gen & Technique)		0.29			
		(0.195)			
Bac+2		0.55***			
		(0.193)			
Bac +3 ou +4		0.49**			
		(0.210)			
3ième cycle, gde école, doctorat		1.07***			
		(0.233)			
Statut de la femme					
Technicien		0.28***			
		(0.106)			
Indépendant		0.04			
		(0.172)			
Cadre		0.94***			
		(0.125)			
Log du salaire horaire de l'homme	0.43***	-0.71***		16.87*	-31.94**
	(0.091)	(0.169)		(9.665)	(12.724)
Log du salaire horaire de la femme	0.48***				
	(0.114)				
Salaire > conjoint			-25.16	26.86	-37.55
			(25.859)	(35.282)	(41.551)
Constante	-5.56***	0.21	107.13*	85.05	354.6***
Observations	2402	2402	2402	2402	2402

* significatif à 10%; ** significatif à 5%; *** significatif à 1%;

CHAPTER 3

HOW DO STUDENTS MAKE EDUCATIONAL CHOICES ? THE INFLUENCE OF GENDER STEREOTYPES ABOUT ABILITIES

This chapter is a joint work with Benoît Rapoport.

3.1 Introduction

Almost everywhere in developed countries, girls and boys have an equal access to education and seem free to choose their educational field. Nevertheless, educational choices are highly gendered, and partly remain a mystery for an economist. According to the human capital theory, students should make educational decisions in order to obtain the highest future income (Becker, 1964; Mincer, 1974; Ben-Porath, 1967). However, girls choose more often tracks leading to low-paid jobs and less prestigious careers, even though they perform as well as boys at school. Indeed, girls are more likely to choose Humanities, Language, Education and Arts subjects, while Engineering and Sciences remain masculine choices. For example, in France, pupils have to choose a high school graduation track, i.e., a *baccalauréat*[1] track, around the age of sixteen. In 2011, according to DEPP-RERS[2], girls represent 44,9% of pupils in the Sciences track, 70,1% in the Humanities track, and 61,2% in the Economics and social sciences track. After having passed the *baccalauréat*, gendered pattern appears more pronounced. Concerning the preparatory classes for "grandes écoles" (the most selective track among postsecondary tracks), girls represent 29,5% of students in the Sciences major, 54,2% in the Economics major, and 74,2% in the Humanities major. At the University, girls represent 28,2% of students in the Sciences major, 73,33% in Humanities and Language majors. However, girls succeed as well as boys: in 2009, 87%

1. Grade 12 students in the US correspond (roughly) to the French *classe terminale*, and the students of this grade sit an examination called *baccalauréat*. There exist general (Humanities, Economics and Social sciences, or Sciences tracks), technical, and vocational tracks of the diploma. Students choose a *baccalauréat* track at the end of grade 10.

2. DEPP: Direction de l'évaluation, de la prospective et de la performance (French Ministry of Education), RERS: Repères et références statistiques sur les enseignements, la formation et la recherche

of girls and 85% of boys have passed the *baccaulérat* (for all tracks), and 17% of girls and 16% of boys have passed the *baccalauréat* with honours or first class honours. In addition, expected schooling is 18,7 years for girls and 18,2 years for boys.

This gendered educational choices strongly affects future incomes. "Masculine" majors lead to better paid jobs than "feminine" majors: from 2003 to 2009, median wage after having attended an engineering school is 2480 euros, and 2000 euros after a Physics or Mathematics major at University, while the median wage is 1480 euros after a Sociology or Psychology field, and 1600 euros after a French Literature or Philosophy field [3]. Thus gendered educational choices during adolescence strongly interact with women's situation in the labor market and has several negative implications for women: it results in differences in earned wages, and it seems to highly explain occupational choices. "Feminine" fields lead more to part time jobs, which make them more exposed to a risk of poverty, especially in case of divorce. Beyond economic consequences, this, in turn, could have a strong impact on roles and representations of women, and on demographic characteristics of the society.

Education economists study individual educational choices as an investment, bringing best wages for future, under the opportunity cost of the time spent at school. Gary Becker conceptualized this framework as the Human Capital Theory (1964), providing an economic theory of "education demand" and tools to understand how educational choices are influenced by costs and benefits. Becker (1964), and later Mincer (1974) describe educa-

3. Source : INSEE (*Institut national de la statistique et des études économiques*), accumulated employment surveys (enquÃłtes Emploi) from 2003 to 2009

tional levels as a function of expected returns, themselves fonctions of future wages, initial wealth, inequalities of abilities. These pioneer analyses have been enriched to take into account some bias: cognitive or behavioral differences linked to social or familial environment (Bowles and al. 2001), uncertain perspectives (Keane and Wolpin, 1997, Eckstein and Wolpin, 1999). But human capital models do not achieve to explain gendered choices, since, in most of developed countries, men and women obtain similar amounts of education.

More recently, educational choices have been studied throughout structural dynamic models of return to education (Cameron and Heckman, 1998, Eckstein and Wolpin, 1999, Keane and Wolpin, 1997 and 2001, Magnac and Thesmar, 2002, Arcidiacono, 2004, Lee, 2005, Beffy, Fougère and Maurel, 2012, Brodaty, Gary-Bobo and Prieto, 2011, and Belzil 2007 for a review of these models). Among them, Arcidiacono (2004) develops a dynamic model of college and major choice, and shows that differences in monetary return explain little of the ability sorting across majors. Beffy, Fougère and Maurel (2012) find a very low elasticity of major choice to expected earnings in France, and suggest that non pecuniary factors are a key determinant of schooling choices.

In this paper, our general objective is to understand why boys and girls make different educational choices, and particularly why girls make detrimential educational decisions. If the reason is not only a matter of tastes, then, for the sake of both the reduction of the gender wage gap and the efficient allocation of human resources, it is important to know why boys and girls make traditional educational choices. Such an analysis may have important policy implications.

In order to study this phenomenon, an analysis focused on abilities and attainments in different subjects is suggested. Particularly, we investigate whether boys and girls react differently with their test scores in different subjects, when they make educational choices. We first develop a model of educational choices, in which the objective of the pupil is to maximize the expected income, minus the cost of education, depending on skills in specific subjects. All things being equal and independently of sexe, pupils more able in a subject should choose an occupation which allows to value at best this talent. Our starting point is that young pupils have imperfect information about the cost of being in each track. Our main assumption is that there exists a stereotype in the society, which specifies that the anticipated cost is not the same for boys and girls. We expect that boys (girls) overestimate the marginal cost of the skill in Humanities (Sciences) and vice-versa. Then, considering test scores in Sciences and Humanities as a proxy for abilities, we investigate in the French context whether school marks in Sciences and Humanities impact differently boys and girls educational choices, in high school as well as in postsecondary education. We use a multinomial logit model to estimate high school graduation track choices, i.e., *baccalauréat* track choices, then higher education track choices conditional to the *baccalauréat* track chosen before.

In this framework, we investigate the presence of gendered behavior in the way boys and girls make educational choices according with their test scores, from when these differences begin to affect student choices (when choosing the *baccalauréat* track, or after), and which of girls and boys suffer more from these differences. Such a phenomenon may be the result of the existence of a stereotype about abilities, which would lead boys and girls to overestimate or underestimate their abilities in different subjects. Although it is difficult to strictly identify and capture the existence of such a phenomenon, we nevertheless have tools to partly disentangle the prevalence of different kind of explanations. Having controlled for individual and family characteristics of the pupil, the sexe of the pupil (to take into account the possible existence of different preferences according to gender, or the existence of social norms), the gender wage gap (by introducing a variable measuring expected wages after each educational track, which may differ for girls and boys, due to possible discrimination later on the labour market), resulting differences in the way boys and girls make educational choices according with their school marks (captured by the introduction of test scores crossed with the gender variable) may be due to different beliefs about the way their abilities will be valued on the labour market.

The influence of test scores on educational track choices is not new in the literature. Jonsson (1999), Van de Werfhorst, Sullivan, Cheung (2003) and very recently Favara (2012), have studied precisely the gendered pattern of educational choices, by focusing on the impact of test scores on major choices, in Sweeden for the first paper, and in Great Britain for the other two. Van de Werfhorst, Sullivan, Cheung (2003) analyze the impact of family background and ability on the choice of subjects in secondary and tertiary education. Both absolute and relative levels of ability are relevant to the choice of subjects at degree level, but does not explain the gender segregation across disciplines. Favara (2011) shows that gender stereotyping affects educational choices from the age of 14 and this effect is larger for girls than for boys. In addition, attending a sixth-form-single-sex school leads students to less stereotyped educational choices. Jonsson (1999) investigates the comparative advantage theory to explain choices in Sweden. Empirical tests support this theory. Comparative advantages create sex segregation in education, and subsequently in the labour market. However, it is unable to explain a major mart of the sex differences in educational choices. While sex inequalities are relatively small in Scandinavia, but segregation subtantial, this gives very scant support for parental role-model explanation of sex segregation.

Such an analysis has never been led before in France. In addition, we extend previous studies on several points. First, Jonsson (1999) studies educational decisions considering one choice (secondary education), and Van de Werfhorst and al. (2003) and Favara (2012) focus on two decisions, but separately. We also consider two educational decisions (*baccalauréat* track and higher education choices), but besides these papers, we develop a complete model in which choices are related: postsecondary educational choices are studied conditional to *baccalauréat* track choices. In addition, because choices are interrelated, our model fits well the French educational system in which a choice of *baccalauréat* track partly impacts possible higher education alternatives.

In addition, previous works focus on subject choices at school, or college major. In our paper, we investigate not only major choices, but also the type of curriculum for high school graduation track (general, technical or vocational *baccalauréat*) and the type of higher education track, in terms of selection at entry and possible length of studies (University, two-year vocational colleges, or two-year preparatory classes for "grandes écoles" which prepare students to take the entrance examinations for prestigious business and engineering schools). This allows to analyze both sex segregation by subjects/major and by type of track.

The third difference is that we do not only explore the influence of attainments, but also the way girls and boys may perceive their test scores. In addition to school mark variables, we include some interaction variables of sex and school marks, and we control by a set of variables of preferences, in order to capture as much as possible the effect of the perceived ability.

Finally, we include a variable measuring expected wages in different tracks, which differs for boys and girls, to capture some possible anticipation of discrimination on the labor market. To our knowledge, our methodology to compute the expected wages after each track is quite new in the literature, as we use exhaustive measures for wages (the different quartiles) that we weight according to some measure of self-confidence.

We use the French Pupil Panel 1995 (*Panel d'élèves du second degré, recrutement 1995-2011, DEPP*), conducted by the French Ministry of Education [4]. This is a large sample size panel (17830 observations), with a longitudinal setting. Pupils are interviewed since they enter junior high-school (grade 6), in 1995, until they complete higher education. Very precise information about the pupil, his family, his school choices are collected throughout years. Our final sample contains 9365 pupils making a *baccalauréat* track choice, and 4407 pupils making a first-year postsecondary educational choice.

In the next section of the paper, we present a review of the literature about sex differences as determinants of educational sex segregation, considering contributions of the economic literature as well as sociology and psychology. Section 3 presents the French educational system and the data we use. Section 4 develops the model of educational choices. We lead the empirical work in next sections. In section 5 are reported results

4. DEPP: Direction de l'évaluation, de la prospective et de la performance. French Ministry of Education

about *baccalauréat* choices, and section 6 reports and discuss results about postsecondary educational decisions. Section 7 concludes.

3.2 Why sex segregation at school ? A literature review

Initially, it is hard to imagine any money-related motive that would lead women to choose "female" occupations, since they pay less (England and Folbre, 2005). Nevertheless, human capital theorists have tried to explain why men and women getting the same amount of education would choose different fields (England and Folbre, 2005). Polachek (1981, 1984) argue that educational sex segregation could come from different life plans of men and women. Since women anticipate children and family responsibilities, and some future maternity leaves, they may have different life plans than men. Therefore they may choose fields leading to jobs with a low depreciation of the capital during years away from the job, in order to minimize the monetary loss of the leave. This thesis brings educational choices back to efficiency. It is verified using broad occupational categories (Polachek), but not using more detailed categories (England 1982, 1984, Sofer 1990).

Another explanation could be that women may anticipate that employers engage in discrimination in hiring or placement, and treat similarly qualified men and women in a different way, or that employers use criteria for selection that have an unintended but disparate impact by sex (Reskin and Roos 1990; Reskin 1998). This could lead girls to make different educational choices.

As mentioned in introduction, traditional observable variables used by economists (expected wage, abilities, family background) do not completely drive educational choices. But what do other disciplines (sociologists, psychologists, etc.) say about the issue ?

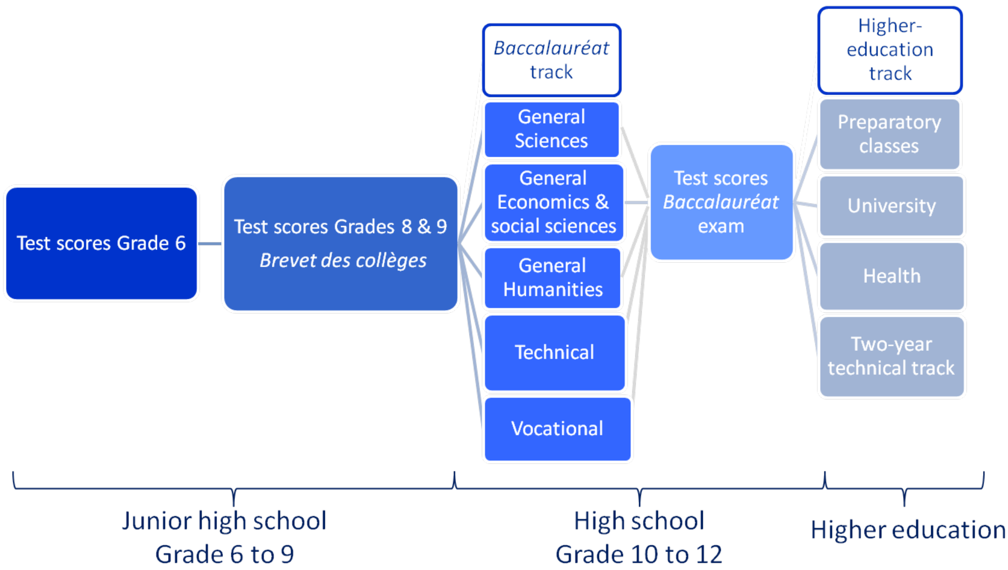
One could say that boys and girls have different preferences and interests, leading them to follow different curriculum at school. However, sociologists argue that these preferences could be socially and culturally built, from childhood. Huston (1983) shows that by age five, children have clearly defined gender roles regarding appropriate behaviour and traits. Furthermore, Eccles and Hoffman (1984) and Huston (1983) show that children appear to monitor their behaviors and aspirations in terms of these norms. Thus gender roles likely influence educational and vocational choices.
Akerlof and Kranton (2000) introduce the concept of gender identity in an economic framework, and emphasize impacts on individual behaviour. They develop an utility function in which identity is associated with different social categories and ways in which people in these categories are expected to behave. Individuals suffer an utility loss if their action does not correspond to gender prescription for behavior. So people in occupations associated with the opposite sex often have ambiguous feelings about their work because they violate their own identity or that of their coworkers (Janssen and Backes-Gellner, 2011). A similar argument could be provided for educational choices. This concept can be qualified of gender identity or social norm.

Actually, the effect we aim at investigating in this paper fits more the framework of the "stereotype threat" literature. Indeed, rather than conformity behaviour, psychologists argue that educational choices could be highly shaped by beliefs or stereotypes. Stereotypes are judgments about abilities or attributes of individuals based on their membership in a social group (Ruble, Cohen, and Ruble, 2001). For instance, people could think that on average, girls are less able than men in mathematics or physics, and these beliefs become self-fulfilled. This mechanism has been emphasized by Steele and Aronson (1995), under the *Stereotype Threat* concept. In their pioneer work, they show that Black college students performed more poorly on standardized tests than White students when their origin was emphasized. When origin was not emphasized, however, Black students performed better and equivalently with White students. Then many experiments have been led, and stereotype threat has been shown to reduce the performance of individuals who belong to negatively stereotyped groups. Among them, many experiments focus on student abilities. Stereotype threat has been shown to harm the academic performance of females in math (Good, Aronson, & Harder, 2008; Inzlicht & Ben-Zeev, 2000; Spencer, Steele, & Quinn, 1999). Consistent exposure to stereotype threat about ability of women in math can reduce the degree that individuals value the domain in question (Aronson, et al. 2002; Osborne, 1995; Steele, 1997). It can lead students to choose not to pursue the domain of study and, consequently, limit the range of professions that they can pursue. Therefore, the long-term effects of stereotype threat might contribute to educational and social inequality (Good et al., 2008a; Schmader, Johns, & Barquissau, 2004). Our educational model of study choices relies on this framework.

Actually, a contribution of our paper is to investigate the presence of the stereotype using a large scale survey based on a cohort of pupils, taking into account all the educational tracks, to go beyond experiments. In addition, experiments mainly focus on the impact of the stereotype on attainments, and our study allow to study the consequences of such a phenomenon on educational choices.

3.3 The Data

3.3.1 The French educational system



Pupils attend junior high-school (i.e., *collège*) from grade 6 to grade 9 (grade 6 is the equivalent of the French *classe de sixième*). At the beginning of junior high-school, pupils take a national evaluation in French and Mathematics. Then at the end of grade 9, pupils take their first national exam, the *Brevet des collèges*. Actually this diploma is awarded on the basis of the pupil's test scores in all the classes taken during grades 8 and 9, as well as in combination with results of end-of-year written national examination in French, Mathematics and History/Geography.

At the end of junior high-school (at the end of grade 9), pupils are tracked into several school streams: the general/technical track, or the vocational track [5]. In the general or technical track, pupils work towards a general or technical *baccalauréat*, which is the national high-school diploma. At the end of grade 10 (French *classe de seconde*), pupils have to make their first fundamental decision: the choice of a high school graduation track (around the age of sixteen), leading to attend the corresponding field in grade 11 and grade 12 (French *classe de première et de terminale*). They can decide to attend a General, Technical or Vocational [6] high school graduation track. In each track, they choose a field (a summary of different *baccalauréat* fields is displayed in Appendix 2). There are three main majors among the general track: Sciences, Economics and Social Sciences, and Humanities [7]. In each of these majors, pupils choose some optional classes, but we do not study them in this paper. Regarding the technical *baccalauréat* tracks, there are four main majors: Industrial science and technology, Tertiary science and technology, Laboratory science and technology, and Medical and social sciences [8]. Pupils opting for a vocational track have the choice among a large set of fields, that we gather into two main majors: production and services.

The choice of a *baccalauréat* track is crucial for future, especially in the technical or vocational track, given that the range of possible postsecondary tracks is almost entirely determined by the major chosen. Indeed, classes are very specialized in technical and

5. Vocational high-shool, in which pupils work toward a *CAP* (*Certificat d'Aptitudes Professionnelles*, Professional Skills Certificate) or *BEP* (*Brevet d'Etudes Professionnelles*, Professional Studies Certificate)

6. The vocational track corresponds to the French *baccalauréat professionnel.*

7. These different fields correspond to the French *baccalauréat Scientifique* or *Bac S* (Sciences major), *baccalauréat Economique et Social* or *Bac ES* (Economics and social sciences major), *baccalauréat Littéraire* or *Bac L* (Humanities major).

8. The corresponding French terminologies are *Sciences et technologies industrielles* or *Bac STI* (Industrial), *Sciences et technologies tertiaires* or *Bac STT* (tertiary), *Sciences et technologies de laboratoire* or *Bac STL* (laboratory), *Sciences médico-sociales* or *Bac SMS* (medical and social)

vocational tracks, while this is less the case in the general track. For instance, pupils in the general Sciences track study intensively Mathematics and Physics, but they continue learning French, Foreign Language and History. In the same way, pupils in the general Humanities track attend a Sciences class and take a Sciences test at the *baccalauréat*. Thus in each general track, pupils continue studying both Sciences and Humanities subjects, but with a different intensity, and coefficients given to each test at the *baccalauréat* are different according with the chosen track. Nevertheless, it could be said that the system is such that all postsecondary tracks remain open for a pupil tracked in a general Scientist field, while a pupil attending a Humanities track is not likely to succeed in a Sciences higher-education field.

Note also that pupils make a *baccalauréat* track choice at the end of grade 10, which is approved or not by during the last staff meeting (i.e., *the conseil de classe*), at the end of the school year, on the basis of test scores in different subjects and other more or less objective assessments of the pupil's ability and potential in the track. Pupils are redirected to other tracks if their choice is not approved.

Once pupils are tracked into a high school graduation field, they work during two years (grade 11 and grade 12) towards the national high school final examination, i.e., the *baccalauréat*.

Then they make their second fundamental decision: the choice of a postsecondary track. Actually, this decision is most of the time taken before pupils pass the *baccalauréat*, during grade 12. They have the choice between several types of higher-education tracks, which differ in terms of selection at entry and possible lenght of studies.

Two-year preparatory classes for "grandes écoles" prepare students to take the competitive entrance examinations for prestigious business and engineering schools. This is the most selective track. Among preparatory classes, there are majors in Sciences, Economics and Business, or Humanities.

Students can also opt for a program at University. French Universities do not impose any selection at entry. There are exams at the end of each of the college years in French universities. Students hold an Associate's degree [9] after two years of college, a Bachelor's degree after three years of college [10], and a Master's degree after five years. Many majors exist at the University that we group into five broad majors: Humanities, Law and Economics-Management, Sciences, Biology, and Sport [11].

Students can also opt for a career in health, at different levels, by studying Medicine, Pharmacy, or Nursing.

The last type of track is a two-year technical track, in which students work toward an advanced vocational certificate [12], or a two-year technical college degree [13]. Many existing majors are aggregated into two broad majors: production and services. Students in this track have the opportunity to start working as soon as they graduated, or may continue their studies, at the university for instance.

There exists other particular higher-education tracks, and we aggregate them into an "other" alternative in this paper.

9. The corresponding French exam is called *Licence 2*
10. *Licence 3*
11. Science and Technique of Physical and Sports Activities, *STAPS*
12. *BTS: Brevet de technicien supérieur*
13. *DUT: Diplôme universitaire de technologie*

3.3.2 The database

We use the Panel of French pupils, 1995-2011 (*Panel d'élèves du second degré, recrutement 1995-2011*), developed by the DEPP (*Direction de l'evaluation, de la prospective et de la performance*, French Ministry of Education). This is a large size panel (17830 individuals), which follows pupils since they enter junior high-school (i.e., *collège*) at grade 6, in 1995, until their entry into the labor market. The principals of a sample of junior high-schools were asked to collect data on all pupils born on the 17th day of each month, with the exception of March, July, and October, and entering grade 6 in September 1995, that is about 1/40th of the whole cohort.

This panel contains several surveys. The first survey is the "recruitment survey", administered at the beginning of the first school year (1995-96), and filled in by junior high-schools principals. It includes some information about the junior high-school, identification of the pupil (sex, nationality, etc.), schooling situation (class, number of pupils in the class...), school level of the pupil when he enters junior high-school, informed by test scores at national evaluation at grade 6, and assessment by the school principal about the level of the pupil in French and Mathematics. Schooling before junior high-school is also reconstituted, and many information about family are collected: size of siblings, occupation of parents, nationality of parents...

A second survey, the "tracking survey", allows to update the situation of the pupil all along schooling, each year during junior high-school and high school. Consequently, for each pupil and each year, we know the attended grade (6 to 12), special courses chosen (Foreign languages, special subjects), as well as school characteristics (*ZEP*: special education zone, i.e., area targeted for special help in education; localisation...). We have access to average course marks (averaged over grades 8 and 9) in Mathematics, French, and Foreign Language, which are part of the *Brevet des collèges* national exam. Detailed test scores in each subject obtained at the national high school final examination, i.e., the *baccalauréat*, are also collected in this survey.

The "family survey" of 1998 is the third survey. If the pupil has not retained a grade since junior high-school, he should be in the last grade of junior high-school (grade 9) when his family answer the survey. Many information are collected, first about the child and his family (family composition, school level of brothers and sisters, parent schooling background...). Other information are collected on schooling at primary school, and on parents relation with schooling: representations and practices of parents linked to child schooling, parent implication in schooling, contacts with teachers...

The "young people survey" is administered in 2002, and is directly filled in by the pupil, who is in last year of high school (grade 12) if he has not retained a grade since junior high-school. This survey provides some information about professional plans, higher education projects, representations about past schooling, and self-image about three socio-emotional areas: physical self-image, capacity to build friendships, self-confidence.

Once the student has completed secondary education and begins higher education, his annual monitoring is made through the "SUP survey". Each year, we know the track and the year he attends.

Finally, when the pupil completes his education and enters into the labor market, he is followed by the "EVA survey" (Entry into adult life survey) which gives some information about professional situation and possible wage.

In this paper, we use all of the existing surveys for secondary education (grade 6 to 12), we use the first year of the "SUP survey" for higher-education, and we do not use the "EVA survey".

3.3.3 The sample of pupils used in this study

Our study about *baccalauréat* track choices is based on pupils whose parents answered the "family survey" in 1998 (86,5 % of the sample), and the "youth survey" in 2002 (78,6 % of the sample), which largely reduces the sample. We also only consider pupils who have taken the *Brevet des collèges* examination, and who study and are followed by the panel at least until grade 11 (to know which *baccalauréat* track they enroll), that is to say a sample of 9365 individuals. We analyze *baccalauréat* track choices according to average course marks obtained one and two years before at grades 8 and 9, in French, Mathematics and Foreign Language.

Our analysis on higher-education choices focus on people who have passed a General *baccalauréat* track, because the previous choice of a field in the Technical or Vocational *baccalauréat* track determines almost entirely the postsecondary educational choice. We consider students having begun a first year of higher-education. This part of the analysis contains 4407 individuals, among them 2308 have previously chosen a Sciences *baccalauréat* track, 1328 an Economics and social sciences track, and 771 a Humanities track. We investigate higher-education choices according to test scores obtained at the *baccalauréat* exam: the average test score in Sciences, in Humanities, and in Foreign Language. Details about different subjects included in these three average test scores are given in Appendix 3.

3.4 A Model of educational choices

3.4.1 The theoretical model

We develop here a simple model of *baccalauréat* track choices, then higher education track choices.

We consider that the pupil first chooses a *baccalauréat* track i, then a higher education track j. When choosing a major of *baccalauréat*, he takes into account the different possible tracks j after the *baccalauréat*. He/she chooses the type of *baccalauréat* i that gives him/her the highest expected utility, depending on the expected wage which depends on the track, and the cost of following the given track.

$$EU_i = Ew_i - C_i$$

We define the expected wage after a *baccalauréat* i as the weighted sum of wages after the different possible higher-education tracks j:

$$Ew_i = \sum_{j=1}^{n} p_{i,j} W_j$$

where $p_{i,j}$ is the objective (observed) probability of following a track j after a *baccalauréat* i, and W_j some measure of the wage after a track j (we assume that it does not depend on the type of *baccalauréat*). In addition, the wage after the different higher-education tracks differ for boys and girls, as the probability of transition $p_{i,j}$, such that the expected wage becomes:

$$Ew_i = \sum_{j=1}^{n} p_{i,j}^{G} W_j^{G}, \quad with\, G \,=\, boy,\, girl$$

Then we define the anticipated cost of choosing the *baccalauréat* track i as a decreasing function of the abilities of the pupil:

$$C_i = C_i(a^S, a^H)$$

To simplify, we only distinguish the skill in Sciences a^S and the skill in Humanities a^H (including Foreign Language).

The utility of choosing a *baccalauréat* i is given by:

$$EU_i = \sum_{j=1}^{n} p_{i,j} W_j - C_i(a^S, a^H)$$

The pupil choose the *baccalauréat* track bringing the highest utility.

However, pupils have only a rough idea about the costs, that they cannot measure exactly. We allow for the possibility that anticipated costs are not the same for girls and boys, in the sense that both might value differently their perceived abilities in Sciences and Humanities. We interpret this as the consequence of the existence of a stereotype. More specifically, we expect that boys (girls) overestimate the marginal cost of the skill in Humanities (Sciences) and vice-versa. So we define

$$C_i^G(a^S, a^H), \quad with\, G \,=\, boy,\, girl$$

Empirically, the utility for individual k is given by:

$$U_{ki} = \sum_{j=1}^{n} p_{i,j}^{G} W_{j}^{G} - C_{i}^{G}(a_{k}^{S}, a_{k}^{H}) + \beta_k X_k + u_{ki}$$

We add control variables through the term $\beta_k X_k$, to describe individual preferences and perhaps the existence of a norm. Particularly, it includes a gender dummy to capture both the fact that boys and girls may have specific preferences for some topics, or that some norms might state that boys and girls should follow some specific tracks. We include some other control variables, for example the parents' education or past schooling that might influence the choices. u_{ki} is a random term, following an Extreme Value distribution. Consequently, the model is specified as a multinomial logit, as we just observe choices, and not the utility of the pupil which is the latent variable. The expected wage is introduced as an alternative-specific variable.

The same decision process prevails for postsecondary field choices.

3.4.2 The key variables

The probability of transition between each type of *baccalauréat* and each postsecondary tracks (i.e. the probability of choosing a postsecondary track j after a *baccalauréat* track i), $p_{i,j}$, comes from data of the French Ministry of education at national level (exhaustive measures), for 2003-2004. They are allowed to differ for boys and girls: $p_{i,j}^{G}$.

W_j, average wages after the different higher-education tracks j, comes from data of the French Ministry of labor [14]. They also differ for boys and girls, which allows to take into account some possible discrimination on the labor market after some specific tracks and the fact that pupils may be conscious of these differences. However, pupils may differ by their level of self-confidence, that is some of them might be optimistic and think they will be rather in the top of the distribution of wages, and some others might think they will be in the bottom. We use a measure of this level of self-confidence in the data: "I usually succed in what I start". This three modality variable (no / quite yes / yes) is regressed with an ordered probit model on different variables (mainly answers to questions on self-image, judgements on capacities, gender ...), and the three predicted probabilities are used to weight three measures of W_j (first quartile Q1, median, third quartile Q3). Note that we do not use the individual answers to the question about self-confidence in itself to weight the wages. Actually, we estimate this variable for the whole population according to a set of individual variables, and we use the estimated coefficients (for the whole population) to predict what is the probability that one pupil answers the first modality, the second, and then the third. These predicted probabilities are used to weight wages. Consequently, this expected wage variable do not incorporate in itself the self-confidence level of each individual, but the predicted probability that he/she answers each modality.

14. The expected wage after each educational track is computed from median wages of active people who have completed their initial education for 10 years or less in France. These data come from accumulated employment surveys (*enquêtes Emploi*) from 2003 to 2009. Repartition of wages between men and women, and between the three quartiles of wages, come from the employment survey of march 2000, for people aged between 25 years and 49 years. This is equivalent to assuming that the distribution of wages according to gender and different quartiles is the same for march 2000 and for 2003-2009 and that there is no deformation over the years. Note also that in our data, pupils choose a *baccalauréat* track at mid-year in 2000, if they have not retained a year since the beginning of junior high-school.

Skills a_k^S and a_k^H are measured by the test scores in Sciences and Humanities at the end of junior high-school (averaged over grade 8 and 9): g_k^S and g_k^H. The anticipated cost is now defined as:

$$\tilde{C}_i^G = \alpha_{iS}^G \, g_k^S + \alpha_{iH}^G \, g_k^H \ (other\ functional\ forms\ are\ possible)$$

Test scores are a measure of how pupils perceive their own ability.

3.4.3 Endogeneous test scores

Until now, we have considered test scores as exogeneous. But test scores are in fact a composite measure as they mix the true ability and the effort made by the pupil. True ability may be viewed as the return to effort:

$$g^{S,H} = a^{S,H} \times e$$

If e is observed, it should be introduced as an additional regressor. But if e is not observed, it must be considered as a part of the error term. In this case g^S and g^H are endogeneous (correlated with the error term) and should be intrumented. More generally, even if we would have an imprecise measure of the global effort in the data, in a more complete model of allocation of effort, the levels of effort in Sciences and Humanities should differ, and this is not enough to control for endogeneity. It is in particular the case if the pupil has an unobserved specific taste for a given topic (say Mathematics). In that case, he will probably both increase his effort in this topic and choose a major accordingly.

To take into account the level of effort in different subjects, we use test scores obtained at the beginning of junior high-school (grade 6 $\approx$ 11 years old) to instrument test scores at the end of junior high-school. Indeed, we make the assumption that there is no strategic choice of effort at this age, and that these test scores represent the true abilities a_k^S and a_k^H plus a white noise. Certainly one could argue that the stereotype is conveyed by the parents, so it is likely to early impact test scores. However, we think that this phenomenon is weakened by the French educational system before junior high-school. First, written homeworks are not allowed at primary school in France, which reduce the role of parents in schooling. In addition, before junior high-school, pupils learn the basics of Mathematics and French, the fundamental knwoledge for future schooling. So it seems likely that pupils learn these two subjects with a similar intensity, in order to reach a necessary threshold of knowledge.

Two other arguments support this methodology. Schooling structure before junior high-school is specific in France: pupils are grouped by classes, in which only one teacher is in charge of the class for all courses. So it is likely that pupils study different subjects at school with a similar intensity, or at least according to teachings of the teacher. But later at the junior high-school, pupils have a different teacher for each course, which means that subject become more independant, and that pupils feel more free to make some effort in specific subjects according to their tastes or future plans. To finish, beginning of junior high-school is the beginning of adolescence, so pupils' tastes develop and could impact effort, in a larger extent than in primary school.

Finally, the methodology we suggest here amounts to estimate educational choices taking into account the effort and other potential sources of endogeneity. Thus our approach allows to separate the particular effort made in French and Mathematics, and to study educational choices conditionnally to these efforts and other sources of endogeneity.

Estimation

In this case, we use the control function approach to take into account the possible endogeneity of the test scores. The control function approach in a discrete choice model has been developped by Petrin and Train (2009). We assume that the error term of the main equation (choice model) is the sum of an iid Extreme Value term and a perturbation which is jointly normal with the error term of the control function. In this case, it can be shown that the model is a mixed model.

Let us describe formally this method. Generally, the utility of the pupil n is the following:

$$U_{nj} = V(y_{nj}, x_{nj}, \beta_n) + \epsilon_{nj}$$

with j the chosen track, x_{nj} the exogeneous variables, y_{nj} the endogeneous test scores at the end of junior high-school, β_n the tastes, and ϵ_{nj} the unobserved utility.

$$y_{nj} = W(x_n, z_n, \mu_n)$$

z_n are the instruments, that is test score got at the beginning of junior high-school. μ_n and ϵ_{nj} are independent from x_n, z_n, but μ_n and ϵ_{nj} are not independent, and that is the source of endogeneity of y_{nj}. But conditionnally to μ_n, ϵ_{nj} is independent of y_{nj}. A special case in which we have a linear function and only one μ_{nj} for each j is the following:

$$y_{nj} = W(x_n, z_n; \gamma) + \mu_{nj}$$

μ_{nj} can be recovered by OLS.

The control function is defined as follows:

$$\epsilon_{nj} = CF(\mu_{nj}; \lambda) + \tilde{\epsilon}_{nj}$$

$$U_{nj} = V(y_{nj}, x_{nj}, \beta_n) + CF(\mu_{nj}; \lambda) + \tilde{\epsilon}_{nj}$$

y_{nj} and $\tilde{\epsilon}_{nj}$ are independent. In the simplest case (linear, but power or interacted terms can be added, if and only if one μ_{nj} for each j):

$$CF(\mu_{nj}; \lambda) = \lambda \mu_{nj}$$

To simplify, assuming an independence over j of the error terms, we specify that the error term consists of a normal component (ϵ^1) and an extreme value following an extreme value distribution (ϵ^2).

$$\epsilon_{nj} = \epsilon^1_{nj} + \epsilon^2_{nj}$$

ϵ^1_{nj} and μ_{nj} are jointly normal (but there is an independence over j), ϵ^2_{nj} is iid and follow an extreme value distribution for all j.

$$U_{nj} = V(y_{nj}, x_{nj}, \beta_n) + \lambda \mu_{nj} + \tilde{\epsilon}_{nj} + \epsilon^2_{nj}$$

with $\tilde{\epsilon}_{nj} = \sigma\eta_{nj} \sim N(0, \sigma)$. Thus this model is a mixed logit model with mixing over η_{nj}, that is mixing over the intercept. We estimate this model using simulated maximum likelihood. Note that it would have been possible to mix also over some elements of β_n, if some of them are random. It would also have been possible to generalize to the case of correlation over j, but much more parameters should have been estimated.

Thus we first regress y_{nj} on x_n and z_n, then we retain the residuals. We estimate the choice model after adding the control function as extra variable(s), and finally we correct the matrix of variance-covariance, because true value of μ_{nj} is not observed, we only have an estimation. We compute the correct standard errors using bootstrap method.

3.5 Results: *Baccalauréat* track choices

3.5.1 Descriptive statistics

Descriptive statistics about the sample we use to study *baccalauréat* choices are presented in Table 3.1. Our sample contains more girls than boys (54.9% of girls and 45.1% of boys). This is very close to national statistics given that 55.1% of pupils in grade 11 are girls in 2002-2003 (DEPP-RERS, 2003). *Baccalauréat* choices are quite more segregated in our sample compared to national statistics (see Appendix 1). Both at the entry (grade 6) and at the end (grade 8-9) of junior high-school, girls obtain better test scores than boys in French and Foreign Language, and this is the contrary in Mathematics. The difference between test scores of boys and girls is always significant, but higher in French and Foreign

Language than in Mathematics. Boys have a comparative advantage in Mathematics, on average, and girls in French, but the difference between test scores in Mathematics and French is higher for boys than girls. Boys have more often a comparative advantage in Mathematics, and girls in French, but more girls have a comparative advantage in Mathematics than boys in French. Boys expect a higher expected wage than girls in all subjects. The higher wage can be expected after a Sciences major, both for girls and boys.

3.5.2 Self-evaluation

Before presenting results about *baccalauréat* track choices, we present here direct results about pupils self-evaluation of their own abilities in Mathematics, French and Foreign Language separately. They answer this question seven years after they enter junior high-school, which means that if they have not retained a grade, they should be at the end of high school at this time (just before taking the *baccalauréat* exam). It is a retrospective measure about their own assessment of their skills when they were at the end of junior high-school. The question is the following: "At the end of junior high-school ($\approx$ 15 years old), would you say that in Mathematics [French, Foreign Language], you are: A pupil with high difficulties / A pupil with few difficulties / A quite good pupil / A very good pupil." So we have three four-modalities variables, one for each subject. In order to investigate whether girls and boys evaluate their skills in a different way, we lead a trivariate ordered probit on sef-evaluation about abilities [15]. This simultaneous estimation allows to take into account the correlation of error terms for each pupil. We use a set of control variables, including test scores obtained at grade 8 and 9 and some indicators about self-confidence

15. We use the Stata CMP command written by David Roodman, 2011.

Table 3.1: **Descriptive statistics: *Baccalauréat* track choice.** 9365 individuals

	Girls	**Boys**
Observations	5144 (54.93 %)	4221 (45.07 %)
% of girls / boys choosing		
General *baccalauréat* track		
Sciences	46.39 %	53.61 %
Humanities	84.58 %	15.42 %
Economics	68.08 %	31.92 %
Technical *baccalauréat* track		
Industrial	7.05 %	92.95 %
Tertiary	63.15 %	36.85 %
Laboratory	60.95 %	39.05 %
Medical&Social	96.33 %	3.67 %
Vocational	47.96 %	52.04 %
Average test scores grade 6 (Std Dev)		
Mathematics	14.05 (2.83)	14.59 (2.80)*
French	15.08 (2.55)	14.34 (2.67)*
Average test scores grade 8-9 (Std Dev)		
Mathematics	11.83 (3.08)	11.90 (2.94)*
French	12.20 (2.21)	11.00 (2.25)*
Foreign Language	12.47 (2.82)	11.53 (2.79)*
Average test score	12.16 (2.41)	11.48 (2.35)*
Gap Math-French	-0.36 (2.27)	0.89 (2.26)*
% of girls/boys having a comparative advantage in		
Mathematics	38.43%	62.85%
French	50.35%	27.01%
Mean expected wage after each track (Std Dev) (according to our calculation)		
Sciences	1639 (168)	2073 (218)*
Humanities	1612 (172)	2020 (223)*
Economics	1627 (171)	2060 (217)*
Industrial	1631 (163)	2060 (217)*
Tertiary	1604 (170)	2048 (220)*
Laboratory	1603 (180)	2040 (216)*
Medical&Social	1598 (177)	2030 (234)*
Vocational	1596 (174)	2045 (218)*
Other variables		
Age entry (Mean)	11.215 (0.44)	11.219 (0.44)
Born abroad (%)	2.64	2.13
Retain a grade (%)	17.57	23.71

*: means are significantly different
between boys and girls, at 5% level

(ambition for future higher-education, a member of the family has already made the same educational track the pupil considers, the pupil has a precise idea about future job, likes speaking publicly in class, is complacent, likes his/her appearance, is easily influenced, feels able to make as well as other people). We add the social-professional category and education of parents, help for homework from parents, and whether the pupil has retained a grade. We also take into account the school establishement of the pupil by adding a school cluster.

Table 3.2: Pupil self-evaluation of their abilities

Self-perception	**Math**	**French**	**Language**
Without test scores interacted with gender			
girl	-0.14*** (0.027)	0.17*** (0.027)	-0.13*** (0.026)
Test score Math	0.37*** (0.008)	-0.11*** (0.006)	-0.12*** (0.006)
Test score French	-0.10*** (0.009)	0.34*** (0.010)	0.05*** (0.009)
Test score Language	-0.05*** (0.007)	0.02*** (0.007)	0.31*** (0.008)
With test scores interacted with gender			
girl	-0.50*** (0.136)	-0.39*** (0.136)	-0.77*** (0.134)
Test score Math *Boy	0.33*** (0.010)	-0.11*** (0.008)	-0.12*** (0.008)
Test score French *Boy	-0.08*** (0.013)	0.34*** (0.014)	0.05*** (0.013)
Test score Language *Boy	-0.04*** (0.010)	0.00 (0.010)	0.28*** (0.011)
Test score Math *Girl	0.40*** (0.010)	-0.10*** (0.008)	-0.13*** (0.008)
Test score French *Girl	-0.11*** (0.013)	0.35*** (0.014)	0.06*** (0.012)
Test score Language *Girl	-0.06*** (0.010)	0.03*** (0.009)	0.34*** (0.011)

Number of observations: 9294
Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3.2 reports a summary of the results, and complete regression results are in Appendix 4. We use two specifications. In the second one, we use test scores interacted with gender variables, while we do not cross test scores with gender in the first one. Introducing control about self-confidence or not does not change results (see Appendix 4). Table 3.2 shows that pupils evaluate their skills according to their test scores. First part of the table shows that girls overestimate themselves in French, and underestimate themselves in Mathematics and Foreign Language. This could be a first evidence of the presence of the stereotype. However, if we allow test scores to have a different impact for boys and girls (by interacting test scores and gender), we observe that girls underestimate themselves in all subject, even French. Consequently, we need to investigate more precisely the question, by studying the impact of test scores on educational choices, and testing whether girls and boys make different choices according to their test scores.

3.5.3 *Baccalauréat* track choices

Table 3.3 displays the main results about *baccalauréat* track choices (gender effect and the impact of test scores), considering the General Sciences track as the alternative reference. Appendix 5 shows complete regression results. This is a multinomial logit model with 8 alternatives corresponding to the different possible *baccalauréat* tracks. Main explanatory variables are gender variable (equal to 1 if the pupil is a girl, 0 otherwise) and test scores obtained at grade 8 and 9 (at the end of junior high-school). In a first specification, we use the average test score (including the test score in Mathematics, French, and Foreign Language) to take into account the average level of the pupil, and the gap between the test score in Mathematic and the test score in French, in order to capture whether the pupil has a comparative advantage in Mathematics or French. In a second specification, we include the three different test scores obtained in each subject (see subsection 5.5.). Test scores are here considered as exogeneous, we relax this assumption in the next section. The expected wage is included as a specific alternative variable. We add a set of control variables: some possible learning difficulties (age at grade 6, a dummy variable indicating whether a grade has been retained during junior high-school), variables about family (education of the father and the mother, born abroad, the mother/the father helps for homeworks), and some indicators about self-confidence (content about himself, feel able to make as well as other people, influenced by other people).

Table 3.3: *Baccalauréat* track choices with exogeneous test scores (at grade 8 and 9). Ref: Sciences track

	General track			**Technical track**				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sciences REF	**Humanities**	**Economics**	**Industrial**	**Tertiary**	**Laboratory**	**Medical Social**	**Vocational**
Expected wage	0.0039*** (2.70)							
Girl		0,60	0,47	-5,45***	0,20	-0,23	3,00*	0,17
		(-0,95)	(-0,63)	(-1,40)	(-0,70)	(-1,52)	(1,68)	(-0,79)
Average test score		-0,21***	-0,26***	-0,64***	-0,64***	-0,67***	-0,65***	-1,01***
		(-0,06)	(-0,03)	(-0,04)	(-0,04)	(-0,09)	(-0,13)	(-0,04)
Average test score *Girl		-0,03	-0,05	0,22**	-0,02	-0,05	-0,09	-0,08
		(-0,06)	(-0,04)	(-0,11)	(-0,05)	(-0,12)	(-0,14)	(-0,06)
Gap Math-French		-0,65***	-0,32***	-0,03	-0,24***	-0,24***	-0,31**	-0,18***
		(-0,05)	(-0,03)	(-0,03)	(-0,03)	(-0,08)	(-0,13)	(-0,03)
Gap Math-French *Girl		0,04	0,02	-0,22***	-0,09**	0,18*	0,03	-0,11***
		(-0,05)	(-0,04)	(-0,09)	(-0,04)	(-0,10)	(-0,14)	(-0,04)

Number of observations: 9365
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

We first observe that the expected wage is positive and significant, which means that all things being equal, pupils have a higher probability to choose a track leading to high-paid jobs. There is a "pure" gender effect for the choice of the Technical Industrial track and Medical-Social track: all things being equal, boys choose more the Industrial track than girls, and girls choose more the Medical and Social track than boys. It's not surprising given that very few girls [boys] choose the Industrial track [Medical-Social track]. We observe that good students (having a good average test score at the end of junior high-school) choose more a General Sciences track rather than all other types of track, given that all parameters are negative and significant. Considering the interaction with the gender variable, we observe that girls and boys behave similarly to their average level, except for the Industrial track. With an higher average test score, girls choose more often the Industrial track than boys. But this effect is actually offsetted by the very important "pure" gender effect. Now, having a comparative advantage in Mathematics increases the probability to choose the Sciences track rather than all other tracks, except for the Industrial alternative, whose coefficient is not significatif and very weak. Regarding gender effect, we show that girls and boys seem to behave differently with their test score difference, especially for Technical tracks. Indeed, pupils choose less often a General Humanities or Economics track and Technical tracks compared to a Sciences track if they obtain good test scores in Mathematics compared to French, but furthermore we show that girls choose even less a Technical track than boys if they have a comparative advantage in Mathematics. Perhaps girls value more a General track rather that boys. We also note that among pupils having a comparative advantage in Mathematics, girls choose more often than boys a Technical Laboratory track rather than a Sciences track, but they both choose more Sciences than Laboratory in all.

In order to make more readable the statistical differences between the different coefficients, we present in Table 3.5 the Wald tests of comparison (explanatory legend is in table 3.4).

Table 3.4: *Baccalauréat* track choices. Variant references. Legend

	Reference		
Choice	Sciences		
Humanities	Average Test score Av Test score*Girl	Gap Math-French (Gap M-F)*Girl	Gender effect

+++ (- - -): Coefficient with a positive (negative) sign, ***
++ (- -): **, + (-): *

Table 3.5: *Baccalauréat* track choices. Variant references

	REFERENCE ALTERNATIVE																			
Choice	Sciences			Humanities			Economics			Industrial			Tertiary			Laboratory			Medical Social	
Humanities	- - -	- - -																		
Economics	- - -	- - -			+++															
Industrial	- - -		- - -	- - -	+++	- - -	- - -	+++	- - -											
	+ +	- -		++	- - -		++	- -												
Tertiary	- - -	- - -		- - -	+++		- - -	+ +			- - -	+++								
		- -			- - -			- - -		- - -										
Laboratory	- - -	- - -		- - -	+++		- - -				- - -	+++								
		+								-	+++			+++						
Medical Social	- - -	- -	+	- - -	+++		- - -				- -	+++			+			+		
										-										
Vocational	- - -	- - -		- - -	+++		- - -	+ + +		- - -	- - -	+++	- - -	++		- - -			- - -	-
		- - -			- - -			- - -		- - -							- - -			

Tables 3.4 and 3.5 allow to directly compare the effects of test scores on choosing a given *baccalauréat* track rather than another. Each line represents a choice alternative, and each column represents a different alternative reference. For example, considering the first column, it shows results concerning successively the choice of a *baccalauréat* track (first Humanities, then Economics, Technical Industrial, etc.) considering Sciences as the reference (this is exactly the table 3.3). The second column represents *baccalauréat* track choices, considering Humanities as the reference, then Economics etc.. Each case is composed of six cells (Table 3.4). The first line represents first the effect of the average test score, then the difference between the test score in Mathematics and in French, and finally the pure gender effect (the gender variable). The second line shows first interaction of the average test score and gender, than the interaction of difference of test scores with gender. If the coefficient is positive and significant at the 1% level, we mention it by "+++", "++" at the 5% level, and "+" at the 1% level. In the same way, a negative sign is indexed by "- - -", "- -" and "-".

We observe that a pupil with a good average test score at grade 8 and 9 chooses less all tracks compared to General Sciences, and choose less all Technical tracks compared to General Humanities or Economics. Consequently, pupils having a good average level choose first more Sciences compared to all other tracks (Humanities and Economics included), and in a second phase choose more Economics and Humanities compared to a Technical track. Moreover, boys and girls behave similarly, except for the choice of Technical Industrial, as seen before. Pupils having a comparative advantage in Mathematics choose more Sciences than all other tracks, but they choose more a Technical track compared to Humanities and Economics. In addition, interaction with gender variable shows that this last effect is lower for girls, in the sense that girls having a comparative advantage in Mathematics will choose less a Technical track than boys, and this is the case for the Industrial track, the Tertiary track, and the Vocational track.

These results seem to show that pupils who are better in Mathematics, but not enough to enroll a General Sciences track (the most favourite track), choose more a Technical track, in order to value at best this skill in Mathematics. But this effect is lower for girls: when they obtain better test scores in Mathematics, they prefer stay in the General track rather than opting for a Technical track. The pure gender effect is significant only for the Industrial and Medical-Social tracks again, because very few girls [boys] choose the first [second].

Considering now Technical and Vocational tracks together, we observe that the Vocational tracks seems to be the less favourite track, as pupils favour more all other tracks if their average test score increases. If they have a comparative advantage in Mathematics, girls choose more Laboratory than boys compared to Tertiary.

To sum up, it appears that Sciences is the favorite track in the sense that if pupils have a good average test score, they choose "by default" this *baccalauréat* track. In addition, pupils seem to make educational choices in an efficient way according with their test scores, as they choose more a track in which they are more talented. Among pupils with a comparative advantage in Mathematics, but having not enough good test scores to enroll the Sciences track, boys choose more often a Technical track oriented in Sciences, to value at best this skill in Mathematics. However, girls prefer a General Humanities or Economic track, while the choice of a Technical track oriented in Sciences would allow to value at best their ability in Mathematics. Therefore, the stereotype does not act as we expected.

It has no impact on the choice of specific majors (Sciences versus Humanities for instance), because girls with good test scores will choose the Sciences track in the same way than boys. But it has more impact on the choice of a General track rather than a Technical track for girls, and more specifically a General Humanities or Economics track rather than a Technical track oriented in Sciences. In addition, we can add that the stereotype does not act on best students, who choose a General Sciences track anyway, but more on average girls best in Mathematics.

Perhaps girls under-evaluate their talent in Mathematics, and their ability to value at best this skill after a Technical track. Of course they choose the Sciences track in the same way than boys, but after this *baccalauréat* track, they can choose many different higher education tracks, not necessarily related to basic Sciences, as Health and Social, Economics etc. in which they could anticipate good returns for them. But after a Technical track, higher education tracks are very determined by the *baccalauréat* major, and they could under-estimate their abilities to succeed in basic Sciences. Or perhaps this is due to a negative perception by girls about Technical tracks which appear as more practical and masculine. This falls more within the social norm. However, if this explanation is the good one, how to explain that the pure gender effect is most of the time not significant ?

3.5.4 Endogeneous test scores

Until now, we have considered test scores as exogeneous regressors. However, as we have explained it in the theoretical part, test scores may be endogeneous, as they contain both the "pure" ability and the effort.

We use the test scores obtained at the beginning of junior high-school (grade 6) in Mathematics and French as instruments for test scores in Mathematics, French, and Foreign Language at the end of junior high-school (grade 8 and 9, *Brevet des collèges*). More precisely, we endogenize the average test score, and the gap between the test score in Mathematics and French. We estimate the model in two stages, using the control function approach (Presentation of the method in section 3.4.3). We first estimate the average test score obtained at grade 8 and 9 [the difference of test scores] according to the average test score [the gap of test scores] obtained at the beginning of junior high-school and a set of control variables. Then we extract residuals and we include them as an estimator in the *baccalauréat* track multinomial logit, so that the model becomes a mixed logit that we estimate by using the simulated maximum likelihood method. The matrix of variance-covariance has been corrected using a bootstrap method. Standard errors have been computed using 200 replications.

The upper part of the Table 3.6 reports previous results with exogeneous test scores, to compare them directly with estimations using instrumented test scores (below).

Results are quite similar, but coefficients are generally higher in absolute value (effects are stronger), specially for the difference between test scores in Sciences and Humanities, suggesting that test scores may be somewhat endogeneous.

3.5.5 Other specifications

Three different specifications are tested in this part. First, we interact the expected wage with the gender variable, to investigate whether boys and girls value differently the

Table 3.6: *Baccalauréat* track choices, with endogeneous test scores. Reference: Sciences track

	General track			Technical track				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sciences REF	**Humanities**	**Economics**	**Industrial**	**Tertiary**	**Laboratory**	**Medical Social**	**Vocational**
	Exogeneous Test scores							
Expected wage	0.0039*** (2.70)							
Girl		0,60	0,47	-5,45***	0,20	-0,23	3,00*	0,17
		(-0,95)	(-0,63)	(-1,40)	(-0,70)	(-1,52)	(1,68)	(-0,79)
Average test score		-0,21***	-0,26***	-0,64***	-0,64***	-0,67***	-0,65***	-1,01***
		(-0,06)	(-0,03)	(-0,04)	(-0,04)	(-0,09)	(-0,13)	(-0,04)
Average test score		-0,03	-0,05	0,22**	-0,02	-0,05	-0,09	-0,08
*Girl		(-0,06)	(-0,04)	(-0,11)	(-0,05)	(-0,12)	(-0,14)	(-0,06)
Gap Math-French		-0,65***	-0,32***	-0,03	-0,24***	-0,24***	-0,31**	-0,18***
		(-0,05)	(-0,03)	(-0,03)	(-0,03)	(-0,08)	(-0,13)	(-0,03)
Gap Math-French		0,04	0,02	-0,22***	-0,09**	0,18*	0,03	-0,11***
*Girl		(-0,05)	(-0,04)	(-0,09)	(-0,04)	(-0,10)	(-0,14)	(-0,04)
	Endogeneous Test scores							
	Standard errors corrected using bootstrap							
Expected wage	0.0036*** (0.001)							
Girl		0,38	0,41	-5,48***	-0,04	0,04	2,86*	-0,02
		(0,92)	(0,55)	(1,53)	(0,63)	(1,41)	(1,89)	(0,73)
Average test score		-0,20**	-0,30***	-0,85***	-0,93***	-0,83***	-0,85***	-1,54***
		(0,08)	(0,06)	(0,08)	(0,08)	(0,15)	(0,17)	(0,11)
Average test score		-0,01	-0,05	0,23*	0,00	-0,04	-0,08	-0,06
*Girl		(0,06)	(0,04)	(0,12)	(0,05)	(0,12)	(0,15)	(0,06)
Gap Math-French		-1,08***	-0,51***	-0,01	-0,38***	-0,16	-0,60**	0,15
		(0,15)	(0,12)	(0,17)	(0,15)	(0,28)	(0,30)	(0,20)
Gap Math-French		0,03	0,01	-0,23***	-0,10**	0,17*	0,03	-0,11***
*Girl		(0,06)	(0,04)	(0,08)	(0,05)	(0,10)	(0,16)	(0,05)

Number of observations: 9365
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

expected wage. In other words, at a given wage, there may be some tracks that girls prefer, other less. We find that the effect of the expected wage is slightly higher for girls than for boys, but the interaction term between the expected wage and gender is not significant. In addition, results about test score are not impacted.

Then, we investigate what happens if we omit the variable measuring the expected wage. And finally, rather than using the average test score, and the test score in Mathematics minus the test score in French, to proxy abilities of pupils, we include directly different test scores got in each subject (Mathematics, French and Foreign Language).

Table in Appendix 6 displays estimation results if we omit the expected wage variable (the above part reproduces benchmark results with the expected wage). Strong significant effects of the gender variable appear now. In particular, girls choose less often the General Sciences and the Technical Industrial track. This suggests that girls take into account gender differences in expected wages when choosing educational tracks. Note that usually, many empirical papers find some gender effects, without taking into account the expected wage. This result would suggest that a part of these gender effects could be the result of different anticipated wages by girls and boys actually.

Directly using grades in Mathematics and in Humanities (average grade in French and Foreing Language) shows that pupils seem to make "efficient choices" according to their test scores, in the sense that the probability to choose a given *baccalauréat* track increases as the corresponding test score increases (Appendix 7). Note that pure gender effects re-

main completely similar to previous results with the average and difference in test scores. Interaction of test scores with gender shows that boys and girls behave in the same way considering different alternatives among the General track (Sciences, Economics and Humanities). However, some differences appear when focusing on Technical and Professional tracks. First, the negative effect of the test score in Mathematics to choose the Industrial, Tertiary and the Vocational tracks (compared to Sciences) is higher for girls. In the same way, the positive effect to choose Tertiary, Laboratory, and a Vocational track (compared to Humanities) if the pupil has a high ability in Mathematics is lower for girls than for boys. These two facts support our conclusion that girls perceive negatively Technical tracks.
On the opposite, the negative effect of the test score in French to choose the Industrial, Tertiary and Vocational tracks (compared to the General track) is lower for girls. At first sight, this finding appears quite surprising. But keep in mind that both in the Tertiary and in the Vocational track, different majors can be chosen, and boys and girls do not seem to make the same choices. Within the Vocational track, girls choose more often Services majors, while boys prefer Production majors. In addition, we could expect a higher percentage of girls within administration or communication majors of the Tertiary track, and a higher proportion of boys within computing or accounting majors for instance. This could explain the direction of these coefficients. But generally, this result could simply say that boys are more sensitive to their test scores in French compared to girls, when making educational choices.

However, estimation with instrumented test scores (see table in Appendix 8) shows that this different impact of the test score in French for girls and boys disappears, except for the Industrial track (but very few girls in our sample choose Industrial, making it difficult to interpret the results for this track). Using endogeneous test scores also suggests that "pure" gender effects are stronger: at given test scores, girls choose more Economics, Tertiary, Medical-Social and the Vocational track compared to boys. The last effect on the Vocational track could be due to the weight of Services majors, as explained before. In general, coefficients of test scores are stronger (higher in absolute value), as well as the negative impact of the test score in Mathematics for girls, in order to choose a Technical track.

To conclude, estimations using endogeneous test scores, and then estimation using test scores level, support our previous conclusions. Gender differences appear less on major choices (Sciences versus Humanities for instance), but more on the choice of a type of track (General versus Technical). The General Sciences track remains the favourite *baccalauréat* track for boys and girls. The negative perception of girls about Technical tracks is still present, and girls seems to be less sensitive than boys with their test scores in French and Foreign Language.

3.6 Results: Higher education choices

In this part, we analyze postsecondary educational choices by focusing only on students having passed a General *baccalauréat* track. Indeed, after a Technical or a Vocational *baccalauréat* track, most of pupils decide to enroll a two-year technical track, and the choice of the major is almost entirely determined by the major chosen in high school. Thus higher-education choices after a Technical or a Vocational *baccalauréat* track are very deterministic.

Furthermore, we study higher-education choices conditional to the General *baccalauréat* track chosen before. Thus we lead three separate multinomial logit, the first on the sample of students having made a *baccalauréat* in Sciences, then in Humanities and finally in Economics. Indeed, test scores obtained in Sciences and Humanities for pupils coming from different *baccalauréat* tracks do not represent the same signal, as they are based on different courses and examinations. Thus it appears necessary to study postsecondary educational choices according to signal about abilities representing the same kind of information. In addition, it is likely that pupils have unobservable characteristics which affect both the choice of the *baccalauréat* track and then the choice of the postsecondary track. Such an analysis based on pupils with the same *baccalauréat* diploma partly reduces this issue.

3.6.1 Descriptive statistics

Postsecondary educational choices can be grouped into four homogeneous sets of tracks in terms of selection at entry and possible lenght of studies (more precise details about the different tracks are given in the section *3.3.1. The French educational system*).

The two-year preparatory classes for "grandes écoles", which prepare students to take the competitive entrance examinations for prestigious business and engineering schools, are the most selective tracks. There are majors in Sciences, Economics and Business, or Humanities.

Pupils can also choose a two-year technical track, in which many majors exist, that we aggregate into two broad majors: production or secondary major, and services or tertiary major.

The third field corresponds to the University, in which students can expect a Master's degree, up to a Ph.D. We classify majors at University into five sets: Economics-Law-Management, Humanities (Literature, Philosophy, Sociology, Foreign Language, etc.), Sciences (Mathematics, Physics), Biology, and Sport.

We add a fourth set of tracks, which differs according with the *baccalauréat* track. For pupils with a *baccalauréat* in Sciences, this fourth category is Health and Social, and includes Medicine, Pharmacy, Nursing, Social worker, and Paramedical professions. For pupils with a *baccalauréat* in Humanities or Economics, this fourth category corresponds to "other", and includes other types of fields, as specific diplomas, or majors in Sciences at University, Health and social fields, because few people choose these tracks after a *baccalauréat* in Humanities or Economics.

Table 3.7: **Higher education choices (First Year of College): total number of students**

	After a *baccalauréat* in Sciences		**After a *baccalauréat* in Humanities**		**After a *baccalauréat* in Economics**	
	%	Tot number	%	Tot number	%	Tot number
	Preparatory classes					
in Sciences	20.1	481	-	-	-	-
in Economics	3.1	74	0.4	3	5.0	64
in Humanities	1.3	31	9.0	65	1.9	24
	Health					
Health&Social	4.9	117	2.6	19	5.1	64
Medicine, Pharmacy	14.4	343	0.1	1	0.4	5
	Two-year technical track					
Secondary	14.1	336	0.3	1	0.5	6
Tertiary	10.7	256	13.5	97	27.2	337
	University					
Eco,Law	4.9	117	12.4	89	24.7	306
Humanities	6.8	163	60.0	430	30.2	373
Sciences	9.9	236	-	-	1.1	13
Biology	6.2	147	-	-	-	-
Sport	3.7	88	1.5	11	3.6	45
Total	100	2389	100	717	100	1237

Table 3.7 reports students' postsecondary educational choices for the first year of College, according to their *baccalauréat* track. We observe that most of people with a *baccalauréat* in Sciences choose a Preparatory class in Sciences (20.1 %), then Medicine (14.4 %), Secondary technical track (14.1 %), Tertiary technical track (10.7 %) and a major in Sciences at University (9.9 %). In smaller proportions, quite numerous yet, these students choose majors in Humanities, Biology, Economics and Law at University. Higher-education choices after a *baccalauréat* in Humanities or Economics are more pronounced. Indeed, among the *baccalauréat* in Humanities, 60 % of students choose a major in Humanities at University, then 13.5 % a Tertiary technical track, 12.4 % a major in Economics and Law at University, and 9 % a Preparatory class in Humanities. Consequently, 95 % of observed choices include 4 fields. After a *baccalauréat* in Economics, 30.2 % choose a major in Humanities at University, 27.7 % a Tertiary technical track, and 24.7 % a major in Economics-Law at University. In the same way, 83 % of choices include three tracks.

Table 3.8 displays the expected wages (according to our calculation method) after each postsecondary track, without differentiating according to the *baccalauréat* track. Highest wages can be expected after a major in Medicine and Pharmacy, and all preparatory class fields. Lower wages correspond to technical tracks, Humanities and Sport at University. For all tracks, boys can expect a higher wage than girls. The gender gap is the highest after a preparatory class in Economics (749), Medicine and Pharmacy (559) and a preparatory class in Sciences (678). The gender gap is the lowest after Health and Social, and a major in Humanities at University.

Table 3.8: **Expected wages**, according to our calculation

	Girls	Boys	Diff
Prepa class in Sciences	1965	2643	678
Prepa class in Economics	2173	2922	749
Prepa class in Humanities	1865	2309	444
Health & Social	1604	1827	222
Medicine, Pharmacy	2347	2905	559
Secondary technical track	1264	1643	379
Tertiary technical track	1276	1658	382
University Eco,Law	1779	2203	424
University Humanities	1443	1786	343
University Sciences	1744	2159	415
University Biology	1597	1977	380
University Sport	1434	1575	380

Table 3.9 shows descriptive statistics about postsecondary choices for the first year of College, according to the *baccalauréat* track chosen before. Gender differences about choices after a *baccalauréat* in Sciences are quite high. Boys choose more a preparatory class in Sciences (26.84 %) or a Secondary technical track (20.05 %), while girls choose more Medicine (21.12 %). Girls choose also more often Health & Social tracks than boys, as well as a major in Economics, Law, Biology and Humanities at University. Aggregating tracks into four categories, we find the same conclusions after a *baccalauréat* in Sciences. After a *baccalauréat* in Humanities, girls choose really more often a technical track than boys. This is certainly due to the weight of services fields. At the opposite, boys choose a little more a major at University than girls. After a *baccalauréat* in Economics, boys seem to choose more a preparatory class than girls, and a little more a technical track.

Considering test scores obtained at the *baccalauréat*, both in the Sciences and Humanities *baccalauréat* tracks, boys obtain quite higher test scores in Sciences than girls, but the difference is significant only for pupils within the Sciences *baccalauréat* track. Girls obtain

Table 3.9: **Descriptive statistics: Higher education choices (First Year of College)**

	After a *baccalauréat* in Sciences 2389 students		**After a *baccalauréat* in Humanities** 717 students		**After a *baccalauréat* in Economics** 1361 students	
	Girls	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**
Observations	1122 (46.97%)	1267 (53.03%)	617 (86.05%)	100 (13.95%)	950 (69.8%)	411 (30.2%)
	% of girls / boys choosing					
Prepa class Sciences	12.57 %	26.84 %				
Prepa class Economics	3.65 %	2.60 %				
Prepa class Humanities	1.87 %	0.79 %				
Health&Social	8.73 %	1.50 %				
Medicine, Pharmacy	21.12 %	8.37 %				
Secondary technical track	7.31 %	20.05 %				
Tertiary technical track	9.00 %	12.23 %				
Univ Eco,Law	6.68 %	3.31 %				
Univ Humanities	9.45 %	4.50 %				
Univ Sciences	8.11 %	11.44 %				
Univ Biology	8.73 %	3.87 %				
Univ Sport	2.76 %	4.50 %				
Total	100 %	100 %				
	Grouped tracks					
Prepa class	18.09 %	30.23 %	8.54 %	8.70 %	5.47 %	8.76 %
Technical track	16.31 %	32.28 %	13.70 %	5.22 %	23.79 %	28.47 %
University	35.74 %	27.62 %	65.68 %	73.04 %	55.47 %	51.09 %
Other	-	-	12.08 %	13.04 %	15.26 %	11.68 %
Health&Social	29.86 %	9.87 %	-	-	-	-
Total	100 %	100 %	100 %	100 %	100 %	100 %
	Average test scores at *baccalauréat* (Std Dev)					
Sciences	11.78 (2.71)	12.16 (2.61)*	11.42 (2.91)	11.79 (3.01)	10.62 (2.70)	10.34 (2.49)
Humanities	11.12 (2.01)	10.24 (2.12)*	10.62 (2.00)	10.52 (2.20)	10.61 (1.81)	10.24 (1.80)*
Foreign Language	11.60 (2.85)	10.65 (2.98)*	11.49 (2.62)	11.32 (2.92)	11.42 (2.61)	10.89 (2.59)*
Average test score	11.49 (1.99)	11.01 (2.01)*	11.18 (1.90)	11.21 (2.01)	10.88 (1.81)	10.49 (1.60)*
Gap Sciences-Huma	0.66 (2.56)	1.93 (2.63)*	0.80 (2.84)	1.27 (3.29)	0.01 (2.58)	0.10 (2.68)

*: means are significantly different between boys and girls, at 5% level

better test scores in Humanities and Foreign Language than boys in all the *baccalauréat* tracks. Test scores of boys and girls are never significantly different within the Humanities *baccalauréat* track. Both boys and girls have a comparative advantage in Sciences in all tracks (as measured by the test score). Perhaps it may be easier to obtain very good test scores in Sciences tests (mathematical exercises for instance) than in Humanities tests (as philosophy essay). However, the difference between the test score in Sciences and the test score in Humanities is higher for boys.

These first descriptive statistics show some gender differences in abilities and educational choices. We analyze them in the next sextions.

3.6.2 Higher education choices, conditional to a *baccalauréat* in Sciences

Table 3.10 shows results about higher education choices for the first year of college, of students having passed a General *baccalauréat* in Sciences, and considering test scores obtained at the *baccalauréat* examination as exogeneous. Full results are shown in Appendix 9. As with *baccalauréat* track choices, we lead a multinomial logit model, with 12 alternatives corresponding to different possible choices described above. The reference alternative is the preparatory class in Sciences, and the expected wage is included as an alternative-specific variable. We consider here test scores obtained at the *baccalauréat*, that we aggregate into three broad subjects. So we take into account the average test score in Sciences subjects, in Humanities subjects, and in Foreign Language (details about specific subjects in each category are given in Appendix 3).

The expected wage is positive and significant, but lower than the expected wage for *baccalauréat* track choices. All things being equal, at equal test scores, girls choose more a preparatory class in Economics than boys (the coefficient for Medicine is also high but not significant), while boys choose more a preparatory class in Sciences. Students seem to behave in an efficient way according with their test scores. As expected, best pupils in Sciences subjects have a higher probability to choose a preparatory class in Sciences than all other tracks. Pupils having good test scores in Humanities subjects choose more a preparatory class in Economics and in a larger extent in Humanities rather than a preparatory class in Sciences, but they choose less a two-year technical track, a major in Sciences and Sport at University rather than a preparatory class in Sciences. However, they have a higher probability to choose a major in Economics and Law at University. Having good test scores in Foreign Language increases the probability to choose a preparatory class in Economics rather than a preparatory class in Sciences, but there is no effect for the preparatory class in Humanities. Having good test scores in Foreign Language decreases the probability to choose all other fields.

We observe that girls behave differently with their test scores in Sciences compared to boys. Having good test scores in Science increases the probability to enroll a preparatory class in Sciences, but this effect is lower for girls, for each alternative. Indeed, the effects of the interaction between the test score in Sciences and gender are almost always positive, which reduces the negative effect of the test score in Sciences to enroll all other tracks

compared to a preparatory class in Sciences. This gender effect is not always significant, but this may be due to the small size of the sample. It means that when test scores in Science increase, girls will choose less a preparatory class in Sciences than boys. We observe the opposite for the test score in Humanities. When this test score increases, girls have a higher probability to choose a preparatory class in Sciences than boys. This is true when the choice of the preparatory class in Sciences is compared with the choice of a major in Humanities and Biology at University. This is also the case when the comparison is made with a preparatory class in Economics, Medicine, secondary technical track and a major in Economics-Law at University, but yet not significant. We find the same direction effect for the test score in Foreign Language, with a significant effect for a preparatory class in Economics, and a negative but not significant effect for a preparatory class in Humanities, a secondary and tertiary technical track, and a major in Sciences, Biology and Sport at University.
These results seem to show that boys may be more sensitive than girls to test scores in Sciences, and girls may be more sensitive to test scores in Humanities and Foreign Language than boys, when choosing a preparatory class in Sciences. Girls consider more their good skills in Humanities and Foreign Language as a good signal to enroll a preparatory class in Sciences than boys, and boys use more their good skills in Sciences to decide to enroll this field.

In addition, we note that interaction terms of test scores with gender for the Medicine track are quite weak and not significant, while the "pure" gender effect is positive, quite strong although not significant. This may indicate that girls choose more Medicine because they have a preference for this field, but not because they value their test scores differently than boys. There is also a "pure" gender effect for the choice of a preparatory class in Economics, but test scores impact also differently boys and girls decisions. This could mean that both preferences and beliefs about abilities impact the choice of a preparatory class in Economics.

Table 3.10: **Higher education choices (First Year of College), according with test scores obtained at the *baccalauréat*, and conditional to a *baccalauréat* in Sciences**

Exogeneous test scores

	Preparatory class			**Health**		**Technical track**		**University**				
	Sciences REF	Economics	Humanities	Health & social	Medicine, Pharmacy	Secondary	Tertiary	Eco, Law	Humanities	Sciences	Biology	Sport
Expected wage	0.0014***											
	(0.0005)											
Girl		3.33**	0.14	0.13	1.89	0.52	0.50	0.18	1.04	0.04	1.37	-0.90
		(1.522)	(3.525)	(1.606)	(1.160)	(1.217)	(1.281)	(1.583)	(1.461)	(1.295)	(1.460)	(1.968)
Test score Humanities		0.19**	0.44***	-0.09	0.06	-0.17***	-0.21***	0.20*	0.06	-0.17***	0.01	-0.29***
		(0.098)	(0.152)	(0.145)	(0.075)	(0.058)	(0.062)	(0.105)	(0.107)	(0.061)	(0.097)	(0.098)
Test score Foreign Lang		0.23***	0.14	-0.37***	-0.11**	-0.14***	-0.06	-0.14**	-0.10	-0.10**	-0.11	-0.20***
		(0.074)	(0.125)	(0.106)	(0.049)	(0.039)	(0.041)	(0.069)	(0.067)	(0.041)	(0.071)	(0.062)
Test score Sciences		-0.33***	-0.50***	-0.42***	-0.31***	-0.35***	-0.25***	-0.57***	-0.52***	-0.35***	-0.54***	-0.39***
		(0.080)	(0.112)	(0.093)	(0.051)	(0.045)	(0.052)	(0.081)	(0.070)	(0.051)	(0.074)	(0.075)
Test score Humanities		-0.08	-0.02	-0.04	-0.08	-0.14	0.00	-0.20	-0.27*	-0.03	-0.25*	0.26*
*Girl		(0.146)	(0.214)	(0.170)	(0.102)	(0.107)	(0.109)	(0.137)	(0.136)	(0.103)	(0.130)	(0.154)
Test score Foreign Lang		-0.22**	-0.06	0.11	0.00	-0.06	-0.11	0.06	0.11	-0.07	-0.03	-0.14
*Girl		(0.108)	(0.161)	(0.123)	(0.067)	(0.076)	(0.068)	(0.092)	(0.089)	(0.070)	(0.092)	(0.100)
Test score Sciences		0.18*	0.15	0.14	0.08	0.08	0.08	0.20**	0.13	0.10	0.18*	-0.03
*Girl		(0.106)	(0.157)	(0.116)	(0.068)	(0.075)	(0.082)	(0.104)	(0.095)	(0.075)	(0.094)	(0.121)
Observations	2449	2449	2449	2449	2449	2449	2449	2449	2449	2449	2449	2449

Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Do these conclusions persist if we aggregate postsecondary educational tracks into broader categories ? We define here six main alternatives: preparatory class in Sciences (the reference), other preparatory classes (in Economics or Humanities), Health (Health & Social, Medicine & Pharmacy, Biology at University), two-year Technical tracks (secondary and tertiary + sport at University), University in Economics, Law or Humanities, and finally Sciences at University. Considering test scores as exogeneous (Table 3.11), girls seem to choose more often than boys a preparatory class in Economics or Humanities and a career in Health, although the coefficients do not appear to be significant. On the contrary, girls seem to choose more often a technical track or Sciences at University rather than a preparatory class in Sciences (but the effects are still not significant).

The previous results using more detailed choice categories are confirmed. Indeed, boys as girls choose more often a preparatory class in Sciences when they obtain a good test score in Sciences, but the effect is lower for girls. Thus compared to boys, girls choose less often than boys a preparatory class in Sciences than other tracks, with a high test score in Sciences. The sign of the coefficient of the interaction term between the test score in Humanities and gender is almost always negative, which may indicate that girls may be more sensitive than boys to test scores in Humanities when choosing a preparatory class in Sciences (but significant only for Economics and Humanities at the University, the other coefficients are vey low). We also notice that the impact of test scores (in each subject) is reduced for girls compared to boys, meaning that globally, girls use less their test scores to make educational choices compared to boys.

Estimating these grouped choices treating test scores as endogeneous leads to an in-

Table 3.11: **Grouped higher education choices, conditional to a *baccalauréat* in Sciences.** Exogeneous test scores

	Prepa class Sciences REF	Prepa class Eco&Huma	Health, Medicine, Bio	Technical track, Sport	University Eco, law, Huma	University Sciences
Expected wage	0.001*** (0.0006)					
Girl		1.22 (1.635)	1.15 (1.101)	-1.03 (1.112)	-0.08 (1.284)	-0.77 (1.314)
Test score Humanities		0.30*** (0.084)	0.06 (0.067)	-0.14** (0.055)	0.17** (0.084)	-0.14** (0.064)
Test score Foreign Lang		0.20*** (0.068)	-0.13*** (0.046)	-0.10*** (0.037)	-0.11** (0.053)	-0.09** (0.043)
Test score Sciences		-0.39*** (0.069)	-0.37*** (0.047)	-0.31*** (0.041)	-0.53*** (0.059)	-0.35*** (0.052)
Test score Humanities *Girl		-0.09 (0.124)	-0.14 (0.094)	-0.02 (0.096)	-0.24** (0.112)	-0.02 (0.106)
Test score Foreign Lang *Girl		-0.16 (0.096)	0.01 (0.064)	-0.04 (0.063)	0.11 (0.074)	-0.04 (0.073)
Test score Sciences *Girl		0.17* (0.096)	0.12* (0.066)	0.11 (0.068)	0.18** (0.081)	0.13* (0.077)
Observations	2449	2449	2449	2449	2449	2449

Significant at 1%: *; at 5%: **; at 10%: ***
Standard errors in parentheses

teraction term of the test score in Sciences and gender still positive but not significant (but borderline significant, and standard errors not corrected). In order to instrument test scores obtained at the *baccalauréat*, we have used the test scores obtained at grades 8 and 9 (two last grades of junior high-shcool), and as before, we use the control function approach. Thus coefficients have the same amplitude but not corrected standard errors are slighly higher.

Table 3.12: **Higher education choices (First Year of College), according with test scores obtained at the *baccalauréat*, and conditional to a *baccalauréat* in Humanities**

	Prepa class REF	Technical track	University Law-Eco	University Literature-Art	University Language	University Humanities
Expected wage	0.004* (0.002)					
Girl		-2.81	-5.34	-5.71	-1.63	-2.70
		(5.321)	(4.094)	(4.137)	(4.361)	(4.028)
Test score Humanities		-1.40***	-0.60**	-0.57**	-1.08***	-0.57**
		(0.474)	(0.240)	(0.277)	(0.344)	(0.251)
Test score Language		0.77*	0.09	0.04	0.88***	0.10
		(0.426)	(0.289)	(0.279)	(0.298)	(0.276)
Test score Sciences		-0.63**	-0.50*	-0.58**	-0.50**	-0.34
		(0.257)	(0.258)	(0.254)	(0.250)	(0.247)
Test score Humanities		0.72	0.07	0.11	0.35	0.01
*Girl		(0.493)	(0.274)	(0.298)	(0.360)	(0.279)
Test score Language		-0.82*	-0.18	-0.28	-0.76**	-0.31
*Girl		(0.438)	(0.301)	(0.291)	(0.309)	(0.289)
Test score Sciences		0.38	0.32	0.44*	0.37	0.27
*Girl		(0.270)	(0.269)	(0.263)	(0.259)	(0.258)
Observations	681	681	681	681	681	681

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

3.6.3 Higher education choices, conditional to a *baccalauréat* in Humanities

In order to investigate postsecondary choices after a *baccalauréat* in Humanities, we aggregate alternatives into six groups: Preparatory class (in Humanities actually), two-year technical tracks, and we take into account four majors at University: Economics-Law, Literature-Art, Language and Humanities. The alternative reference is Preparatory class. Among pupils having passed a *baccalauréat* in Humanities (table 3.12), girls always rather choose a preparatory class but the effects are not significant. We can also note that the expected wage is positive and significant to explain higher-education choices after a *baccalauréat* in Humanities. Results show that good test scores in Humanities and Sciences always reduce the probability of choosing a track which is not a preparatory class. The effects are the strongest for the technical track. However, a good test score in Foreign Language increases the probability of enrolling University with a major in Language or a technical track. However, those effects seem to prevail only for boys, they are much smaller for girls as shown by the coefficients of interacted test scores with the sex variable. In all cases, the specific effect for girls largely compensates the estimated effect of the test scores. This shows that girls are much less sensitive to their test scores than boys after a *baccalauréat* in Humanities.

3.6.4 Higher education choices, conditional to a *baccalauréat* in Economics

The picture is somewhat different after a *baccalauréat* in Economics (Table 3.13). For boys, test scores in Humanities, Foreign Language and Sciences have all a negative impact on the probability of choosing a track which is not a preparatory class and the estimated effects have about the same magnitude for all tracks. However these effects are systematically compensated for girls for the test score in Sciences and somewhat strengthened for the test scores in Foreign Language and Humanities. Thus when choosing the most selective and prestigious track, boys are really more sensitive than girls to test scores in Sciences, and girls are slightly more sensitive to test scores in Humanities and Foreign Language than boys.

3.7 Conclusion

Boys and girls clearly make different educational choices and somewhat value differently their test scores. However we find that the differences are less pronounced than expected. Actually, gender differences appear less on major choices (Sciences versus Humanities for instance), but more on the choice of a type of track (in terms of selection at entry and possible lenght of studies), in high school as in higher education.

Indeed, gendered beliefs may affect the choice of the General *baccalauréat* versus the Technical *baccalauréat*. The General *baccalauréat* in Sciences being the favourite track for all pupils on average, girls choose this *baccalauréat* track in the same way than boys if they have enough good test scores. But for girls who get better test scores in Mathematics but

Table 3.13: **Higher education choices (1st Year of College), according with test scores at the baccalauréat, and conditional to a *baccalauréat* in Economics**

	Prepa class REF	Other	Technical track	University Law-Eco	University Humanities
Expected wage	0.003*** (0.0011)				
Girl		-0.06 (2.225)	-1.96 (2.037)	-2.79 (2.097)	-2.06 (2.160)
Test score Humanities		-0.27* (0.166)	-0.39*** (0.146)	-0.11 (0.141)	-0.22 (0.149)
Test score Language		-0.21* (0.123)	-0.21* (0.110)	-0.24** (0.116)	-0.13 (0.113)
Test score Sciences		-0.31*** (0.085)	-0.25*** (0.075)	-0.23*** (0.071)	-0.33*** (0.083)
Test score Humanities *Girl		-0.11 (0.210)	-0.03 (0.191)	-0.07 (0.186)	-0.06 (0.190)
Test score Language *Girl		-0.15 (0.156)	-0.16 (0.144)	-0.08 (0.148)	-0.11 (0.143)
Test score Sciences *Girl		0.26** (0.110)	0.25** (0.099)	0.20** (0.095)	0.21** (0.102)
Observations	1328	1328	1328	1328	1328

Significant at 1%: *; at 5%: **; at 10%: ***. Standard errors in parentheses not enough to enroll a *baccalauréat* in Sciences, they choose more than boys a General *baccalauréat* in Economics or Humanities rather than a Technical *baccalauréat*, despite the fact that the choice of a Technical *baccalauréat* oriented in sciences would have allowed to value at best their ability in Mathematics. Thus the stereotype does not seem to act on best students, who choose a General Sciences track anyway, but more on average girls best in Mathematics.

In addition, a stereotype seems to affect higher-education choices. Generally, girls react less than boys to test scores. After all types of General *baccalauréat* tracks, girls have a lower probability than boys to choose a preparatory class if they have good test scores in Science, but they have a higher probability than boys to choose a preparatory class as test scores in Humanities increase (this last effect does not exist after a *baccalauréat* in Humanities). This result seems to support the idea that girls may under-estimate (or at least value less) their abilities in Sciences, but over-estimate their abilities in Humanities when choosing the most prestigious and higher-paid track. In other words, girls consider more than boys their talent in Humanities as a good signal they can succeed in preparatory class, while boys use more their skill in Sciences to decide to enroll this track.

Moreover, even when gendered expected earnings after each track are controlled for, as alternative-specific regressors, boys and girls value differently their grades. This may be due to a stereotype, that is different beliefs about abilities of boy and girls. Thus financial incentives do not seem to be appropriate to shape this kind of belief, and reducing wage gap after a given degree might not be sufficient to change educational choices. Consequently, some information campaigns directy focused on the stereotype, in schools and media for instance, could play an important role in order to reduce sex segregation in education. Such an action could aim at struggling against the negative perception of girls about technical tracks, and motivate girls to choose more often preparatory classes. Other types of public policies could aim at preventing girls from under-estimating their abilities in Sciences.

3.8 Appendix

Appendix 1: Educational choices, exhaustive French national statistics, in 2009

***Baccalauréat* track**	**% of boys**	**Higher education track**	**% of boys**
General track		**Preparatory classes**	
Sciences	55	Economics	45
Economics	39	Humanities	26
Humanities	21	Sciences	70
Technical track		**Two-year technical track**	
Industrial	89	Production	75
Tertiary	44	Services	36
Laboratory	44	**University**	
Medical and Social	7	Law-Politics	36
		Management	48
		Humanities	32
		Sciences	72
		Biology	38
		Health	
		Health & social	18
		Medicine	20

Source of data: DEPP French Ministry of Education

Appendix 2: *Baccalauréat* tracks in France

General track	
Bac S	Sciences
Bac L	Humanities
Bac ES	Economics
Technical track	
Bac STI	Industrial
Bac STT	Tertiary
Bac STL	Laboratory
Bac SMS	Medical & Social
Bac Pro	Vocational

Appendix 3: Scientific courses and Humanities courses in high school.

Attended courses depend on the chosen *baccalauréat* track and majors.

Scientific subjects	**Humanities subjects**	**Foreign Language subjects**
Life and Earth Sciences	French	Foreign Language 1
Scientific course *(in Humanities and Economics tracks)*	Economics and Social Sciences	Foreign Language 2
Biochemical Technology	Philosophy	
Biology	Ancient Greek	
Mathematics	History Geography	
Physics Chemistry	Latin	
Physics Chemistry Electricity	French Literature	
Engineering Sciences		

Table 3.14: **Appendix 4: Pupil self-evaluation of abilities at the end of junior high-school**

	(1) Math	(2) French	(3) Lang	(1) Math	(2) French	(3) Lang	(1) Math	(2) French	(3) Lang
Girl	-0.19***	0.11***	-0.18***	-0.14***	0.17***	-0.13***	-0.50***	-0.39***	-0.77***
	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)	(0.136)	(0.136)	(0.134)
Test score Math	0.37***	-0.10***	-0.12***	0.37***	-0.11***	-0.12***			
	(0.007)	(0.006)	(0.006)	(0.008)	(0.006)	(0.006)			
Test score French	-0.09***	0.34***	0.06***	-0.10***	0.34***	0.05***			
	(0.009)	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)			
Test score Lang	-0.05***	0.02***	0.31***	-0.05***	0.02***	0.31***			
	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)			
Test score Math *Boy							0.33***	-0.11***	-0.12***
							(0.010)	(0.008)	(0.008)
Test score French *Boy							-0.08***	0.34***	0.05***
							(0.013)	(0.014)	(0.013)
Test score Lang *Boy							-0.04***	0.00	0.28***
							(0.010)	(0.010)	(0.011)
Test score Math *Girl							0.40***	-0.10***	-0.13***
							(0.010)	(0.008)	(0.008)
Test score French *Girl							-0.11***	0.35***	0.06***
							(0.013)	(0.014)	(0.012)
Test score Lang *Girl							-0.06***	0.03***	0.34***
							(0.010)	(0.009)	(0.011)
TV limited	-0.03	-0.04*	-0.04*	-0.02	-0.03	-0.04	-0.02	-0.03	-0.03
	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)	(0.024)
Insufficient resources	0.02	0.01	-0.00	0.03	0.02	0.00	0.03	0.02	0.00
	(0.036)	(0.035)	(0.037)	(0.036)	(0.035)	(0.036)	(0.036)	(0.035)	(0.036)
Age grade 6	-0.10***	-0.06**	-0.15***	-0.08**	-0.04	-0.13***	-0.08***	-0.04	-0.13***
	(0.029)	(0.029)	(0.028)	(0.030)	(0.028)	(0.028)	(0.030)	(0.028)	(0.028)
Born abroad	0.15*	0.18**	0.36***	0.12	0.16*	0.34***	0.13	0.15*	0.33***
	(0.081)	(0.085)	(0.081)	(0.082)	(0.085)	(0.081)	(0.083)	(0.085)	(0.081)
Father education:									
Primary school	-0.29	-0.13	0.09	-0.28	-0.12	0.11	-0.29	-0.11	0.13
	(0.312)	(0.260)	(0.174)	(0.304)	(0.261)	(0.184)	(0.308)	(0.268)	(0.188)
Junior high-school	-0.37	-0.13	0.09	-0.35	-0.12	0.11	-0.37	-0.11	0.12
	(0.314)	(0.262)	(0.176)	(0.307)	(0.264)	(0.186)	(0.311)	(0.270)	(0.191)
Vocational certificate	-0.37	-0.16	-0.02	-0.35	-0.14	0.00	-0.36	-0.13	0.01
	(0.313)	(0.260)	(0.174)	(0.305)	(0.261)	(0.184)	(0.309)	(0.268)	(0.188)
High-school graduate	-0.32	-0.14	0.03	-0.31	-0.14	0.03	-0.33	-0.13	0.05
	(0.314)	(0.262)	(0.177)	(0.307)	(0.264)	(0.186)	(0.311)	(0.270)	(0.191)
2 years of college	-0.38	-0.25	-0.02	-0.37	-0.25	-0.02	-0.38	-0.24	-0.00
	(0.316)	(0.264)	(0.179)	(0.308)	(0.265)	(0.189)	(0.312)	(0.272)	(0.193)
$\geq$ 3 years of college	-0.27	-0.18	0.10	-0.31	-0.21	0.06	-0.32	-0.20	0.08
	(0.316)	(0.265)	(0.179)	(0.309)	(0.266)	(0.189)	(0.313)	(0.273)	(0.193)
No info	-0.31	-0.24	0.05	-0.28	-0.22	0.08	-0.29	-0.20	0.10
	(0.316)	(0.260)	(0.177)	(0.310)	(0.262)	(0.186)	(0.313)	(0.269)	(0.191)
Mother education:									
Primary school	0.07	-0.06	-0.05	0.07	-0.05	-0.04	0.07	-0.06	-0.05
	(0.089)	(0.088)	(0.088)	(0.089)	(0.088)	(0.088)	(0.090)	(0.088)	(0.089)
Junior high-school	0.07	-0.05	-0.11	0.08	-0.05	-0.09	0.08	-0.05	-0.09
	(0.087)	(0.088)	(0.088)	(0.087)	(0.088)	(0.088)	(0.087)	(0.088)	(0.089)
Vocational certificate	0.04	-0.08	-0.18**	0.05	-0.07	-0.16*	0.04	-0.07	-0.16*
	(0.086)	(0.087)	(0.087)	(0.086)	(0.087)	(0.087)	(0.086)	(0.087)	(0.087)

Continuation of the table (Self-evaluation)

	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	math	french	lang	math	french	lang	math	french	lang
High-school graduate	0.09	-0.03	-0.08	0.09	-0.04	-0.08	0.09	-0.04	-0.07
	(0.089)	(0.089)	(0.090)	(0.089)	(0.090)	(0.090)	(0.089)	(0.089)	(0.090)
2 years of college	0.03	0.06	-0.10	0.02	0.03	-0.12	0.01	0.03	-0.11
	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.094)	(0.093)	(0.093)
$\geq$ 3 years of college	0.08	0.09	-0.12	0.05	0.07	-0.15	0.04	0.07	-0.14
	(0.099)	(0.100)	(0.102)	(0.100)	(0.100)	(0.102)	(0.100)	(0.100)	(0.102)
mother works	-0.01	-0.08***	-0.05*	0.00	-0.07**	-0.05	-0.00	-0.08**	-0.05
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Mother's profession:									
Farmer or tradeswoman	-0.08	0.11	0.19	-0.10	0.09	0.16	-0.10	0.10	0.16
	(0.128)	(0.132)	(0.135)	(0.130)	(0.132)	(0.134)	(0.130)	(0.132)	(0.135)
Executive	-0.20	0.16	0.21	-0.24*	0.14	0.17	-0.23*	0.15	0.17
	(0.125)	(0.128)	(0.129)	(0.127)	(0.128)	(0.129)	(0.127)	(0.128)	(0.129)
Intermediate occup	-0.14	0.05	0.16	-0.15	0.05	0.14	-0.14	0.05	0.14
	(0.122)	(0.125)	(0.127)	(0.124)	(0.125)	(0.126)	(0.124)	(0.125)	(0.127)
White collar	-0.16	0.12	0.16	-0.18	0.11	0.14	-0.17	0.11	0.14
	(0.118)	(0.120)	(0.123)	(0.120)	(0.120)	(0.122)	(0.120)	(0.120)	(0.122)
Blue collar	-0.08	0.15	0.11	-0.10	0.15	0.09	-0.08	0.16	0.10
	(0.122)	(0.122)	(0.127)	(0.123)	(0.122)	(0.126)	(0.123)	(0.122)	(0.126)
Out of the labor force	-0.07	0.18	0.21*	-0.09	0.15	0.17	-0.08	0.16	0.17
	(0.116)	(0.115)	(0.121)	(0.117)	(0.115)	(0.120)	(0.118)	(0.114)	(0.121)
Father's profession:									
Farmer or tradesman	0.40	0.08	-0.04	0.37	0.05	-0.07	0.39	0.04	-0.09
	(0.313)	(0.259)	(0.173)	(0.305)	(0.261)	(0.183)	(0.309)	(0.267)	(0.187)
Executive	0.32	0.22	0.03	0.30	0.21	0.01	0.31	0.20	-0.01
	(0.313)	(0.260)	(0.174)	(0.305)	(0.262)	(0.184)	(0.309)	(0.269)	(0.188)
Intermediate occup	0.37	0.22	-0.02	0.36	0.21	-0.03	0.37	0.20	-0.05
	(0.312)	(0.260)	(0.172)	(0.304)	(0.261)	(0.182)	(0.308)	(0.268)	(0.187)
White collar	0.31	0.14	-0.05	0.30	0.13	-0.06	0.31	0.12	-0.08
	(0.313)	(0.260)	(0.173)	(0.306)	(0.262)	(0.183)	(0.310)	(0.268)	(0.188)
Blue collar	0.35	0.09	-0.04	0.33	0.08	-0.06	0.34	0.07	-0.07
	(0.310)	(0.257)	(0.170)	(0.303)	(0.258)	(0.180)	(0.307)	(0.265)	(0.184)
Help homework:									
Mother: regularly	-0.05*	-0.05*	-0.03	-0.04	-0.05	-0.02	-0.04	-0.05*	-0.03
	(0.029)	(0.028)	(0.029)	(0.029)	(0.028)	(0.029)	(0.029)	(0.028)	(0.029)
Father: regularly	-0.02	-0.05	-0.06	-0.03	-0.05	-0.06	-0.03	-0.06	-0.06
	(0.041)	(0.040)	(0.040)	(0.042)	(0.040)	(0.041)	(0.042)	(0.040)	(0.041)
Mother: never	-0.01	0.01	0.05	-0.02	-0.00	0.04	-0.01	0.00	0.04
	(0.042)	(0.041)	(0.042)	(0.042)	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)
Father: never	-0.03	-0.04	0.00	-0.02	-0.04	0.01	-0.02	-0.04	0.01
	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)	(0.029)
Retained a grade	-0.00	-0.09***	-0.01	0.03	-0.07**	0.01	0.02	-0.08**	0.00
	(0.035)	(0.033)	(0.034)	(0.035)	(0.033)	(0.034)	(0.035)	(0.033)	(0.034)
Ambitious				0.31***	0.22***	0.25***	0.31***	0.22***	0.25***
				(0.031)	(0.032)	(0.030)	(0.031)	(0.032)	(0.029)
Same study project				0.03	-0.00	0.06**	0.03	-0.00	0.06**
than family member				(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Precise study project				0.11***	0.07***	0.03	0.11***	0.07***	0.03
				(0.025)	(0.025)	(0.024)	(0.025)	(0.025)	(0.024)
Likes to speak				0.02	0.12***	0.07***	0.02	0.12***	0.07***
in public				(0.025)	(0.025)	(0.024)	(0.025)	(0.025)	(0.024)

Continuation of the table (Self-evaluation)

	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	math	french	lang	math	french	lang	math	french	lang
not so pleased with himself				0.01	-0.07	-0.07	0.01	-0.08	-0.07
				(0.076)	(0.077)	(0.072)	(0.076)	(0.078)	(0.072)
quite pleased with himself				0.17**	-0.00	0.01	0.18**	-0.00	0.01
				(0.077)	(0.077)	(0.071)	(0.077)	(0.078)	(0.071)
very pleased with himself				0.35***	0.09	0.09	0.36***	0.09	0.08
				(0.089)	(0.087)	(0.082)	(0.089)	(0.087)	(0.082)
not so satisfied with physique				0.02	0.11*	0.16***	0.02	0.10*	0.15**
				(0.062)	(0.060)	(0.059)	(0.062)	(0.060)	(0.060)
quite satisfied with physique				-0.02	0.14**	0.18***	-0.03	0.12**	0.16***
				(0.061)	(0.062)	(0.060)	(0.062)	(0.062)	(0.061)
very satisfied with physique				0.01	0.17**	0.20***	0.00	0.15**	0.18***
				(0.068)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
not influenced by others' opinions				0.01	-0.10***	-0.05*	0.01	-0.10***	-0.05*
				(0.026)	(0.027)	(0.027)	(0.026)	(0.027)	(0.027)
quite influenced by others' opinions				-0.04	-0.17***	-0.03	-0.04	-0.18***	-0.03
				(0.038)	(0.037)	(0.038)	(0.038)	(0.037)	(0.038)
very influenced by others' opinions				-0.02	-0.22***	-0.15**	-0.03	-0.22***	-0.15**
				(0.077)	(0.077)	(0.071)	(0.077)	(0.077)	(0.072)
not so satisfied face				0.11***	0.00	-0.00	0.11***	0.01	-0.00
				(0.028)	(0.027)	(0.027)	(0.028)	(0.027)	(0.027)
quite satisfied face				0.04	-0.05	-0.01	0.04	-0.05	-0.01
				(0.040)	(0.039)	(0.039)	(0.040)	(0.039)	(0.039)
very satisfied face				0.03	0.08	-0.05	0.05	0.08	-0.05
				(0.065)	(0.069)	(0.065)	(0.065)	(0.069)	(0.065)
feel not so able				-0.14	-0.05	-0.01	-0.14	-0.05	-0.01
				(0.110)	(0.107)	(0.100)	(0.110)	(0.106)	(0.099)
feel quite able				-0.03	-0.00	0.05	-0.03	-0.00	0.05
				(0.107)	(0.104)	(0.096)	(0.108)	(0.104)	(0.095)
feel very able				0.03	0.07	0.09	0.04	0.07	0.09
				(0.108)	(0.105)	(0.097)	(0.109)	(0.105)	(0.096)
Observations	9,294	9,294	9,294	9,294	9,294	9,294	9,294	9,294	9,294

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.15: **Appendix 5: *Baccalauréat* track choices** with exogeneous test scores (at grade 8 and 9). Ref: Sciences track

	General Bac			Technical Bac				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sciences REF	**Human-ities**	**Eco-nomics**	**Indus-trial**	**Tertiary**	**Labora-tory**	**Medical Social**	**Voca-tional**
Expected wage	0.0039*** (2.70)							
Girl		0.60 (0.947)	0.47 (0.632)	-5.45*** (1.404)	0.20 (0.696)	-0.23 (1.516)	3.00* (1.677)	0.17 (0.793)
Average test score		-0.21*** (0.055)	-0.26*** (0.031)	-0.64*** (0.035)	-0.64*** (0.039)	-0.67*** (0.089)	-0.65*** (0.132)	-1.01*** (0.042)
Average test score *Girl		-0.03 (0.062)	-0.05 (0.040)	0.22** (0.110)	-0.02 (0.049)	-0.05 (0.122)	-0.09 (0.140)	-0.08 (0.057)
Gap Math-French		-0.65*** (0.045)	-0.32*** (0.029)	-0.03 (0.027)	-0.24*** (0.031)	-0.24*** (0.077)	-0.31** (0.129)	-0.18*** (0.029)
Gap Math-French *Girl		0.04 (0.053)	0.02 (0.037)	-0.22*** (0.085)	-0.09** (0.042)	0.18* (0.097)	0.03 (0.135)	-0.11*** (0.041)
Age grade 6		0.37*** (0.114)	0.34*** (0.088)	0.49*** (0.123)	0.50*** (0.102)	0.46** (0.224)	0.95*** (0.168)	1.16*** (0.102)
Born abroad		0.22 (0.268)	-0.17 (0.251)	-0.48 (0.409)	-0.16 (0.280)	-0.36 (0.755)	-0.59 (0.547)	-0.59** (0.276)
Father education:								
Primary school		-0.06 (0.198)	0.23 (0.172)	0.30 (0.229)	0.42** (0.180)	0.22 (0.411)	-0.05 (0.299)	0.35** (0.174)
Junior high-school		-0.12 (0.183)	0.39** (0.154)	0.08 (0.229)	0.32* (0.175)	0.04 (0.435)	0.03 (0.298)	0.10 (0.174)
Vocational certificate		-0.44*** (0.141)	0.08 (0.122)	0.47*** (0.172)	0.24* (0.137)	0.35 (0.321)	0.13 (0.221)	0.30** (0.133)
High-school graduate		-0.54*** (0.162)	-0.10 (0.135)	-0.16 (0.202)	-0.19 (0.163)	-0.39 (0.416)	-0.60* (0.309)	-0.57*** (0.168)
2 years of college		-0.67*** (0.180)	-0.14 (0.144)	-0.03 (0.224)	-0.31* (0.186)	-0.18 (0.468)	-0.97** (0.419)	-1.02*** (0.209)
$\geq$ 3 years of college		-0.83*** (0.164)	-0.38*** (0.136)	-1.28*** (0.249)	-1.20*** (0.206)	-1.14** (0.451)	-1.22*** (0.382)	-2.49*** (0.249)
No info		-0.32 (0.353)	0.21 (0.290)	0.49 (0.372)	0.12 (0.324)	-0.06 (0.788)	-1.17 (0.780)	-0.07 (0.301)
Mother education:								
Primary school		-0.11 (0.258)	0.36 (0.240)	-0.11 (0.273)	0.37* (0.217)	0.50 (0.506)	0.04 (0.398)	0.12 (0.212)
Junior high-school		-0.02 (0.240)	0.34 (0.228)	0.16 (0.251)	0.20 (0.206)	-0.02 (0.499)	0.07 (0.383)	0.10 (0.201)
Vocational certificate		-0.03 (0.228)	0.49** (0.220)	0.22 (0.236)	0.12 (0.197)	0.02 (0.474)	0.36 (0.361)	-0.11 (0.192)
High-school graduate		-0.21 (0.234)	0.30 (0.220)	-0.13 (0.245)	-0.40* (0.207)	-0.10 (0.482)	-0.48 (0.397)	-0.85*** (0.206)
2 years of college		-0.27 (0.236)	0.01 (0.223)	-1.05*** (0.269)	-0.95*** (0.219)	-0.93* (0.559)	-0.62 (0.414)	-1.41*** (0.224)
$\geq$ 3 years of college		0.07 (0.249)	0.19 (0.232)	-0.79*** (0.303)	-1.49*** (0.296)	-0.58 (0.557)	-1.07** (0.539)	-1.47*** (0.294)

Continuation of the table

	General Bac			Technical Bac				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sciences REF	**Human-ities**	**Eco-nomics**	**Indus-trial**	**Tertiary**	**Labora-tory**	**Medical Social**	**Voca-tional**
Not so pleased with himself		0.06 (0.228)	0.18 (0.200)	0.75* (0.395)	0.35 (0.241)	0.20 (0.560)	-0.07 (0.346)	0.38 (0.247)
Quite pleased with himself		0.12 (0.237)	0.26 (0.207)	1.12*** (0.392)	0.69*** (0.249)	0.49 (0.580)	0.07 (0.363)	0.95*** (0.253)
Very pleased with himself		0.10 (0.288)	0.27 (0.243)	1.07** (0.417)	0.62** (0.285)	-0.05 (0.720)	0.46 (0.439)	1.22*** (0.283)
Feel not so able		0.41 (0.333)	0.08 (0.295)	-0.45 (0.415)	0.09 (0.320)	-0.77 (0.645)	0.42 (0.522)	0.14 (0.319)
Feel quite able		0.13 (0.328)	0.28 (0.287)	-0.73* (0.395)	-0.02 (0.311)	-0.51 (0.612)	0.52 (0.507)	0.12 (0.310)
Feel very able		0.38 (0.333)	0.44 (0.292)	-0.59 (0.397)	0.26 (0.315)	-0.09 (0.623)	0.90* (0.513)	0.27 (0.313)
Not influenced by others' opinions		-0.04 (0.095)	0.09 (0.077)	0.18 (0.112)	0.14 (0.092)	0.12 (0.234)	0.03 (0.172)	0.06 (0.092)
Quite influenced by others' opinions		-0.05 (0.142)	-0.01 (0.114)	0.02 (0.163)	0.14 (0.133)	0.21 (0.301)	0.08 (0.234)	0.10 (0.134)
Very influenced by others' opinions		-0.31 (0.293)	-0.06 (0.225)	0.17 (0.315)	-0.02 (0.256)	0.58 (0.473)	0.49 (0.376)	0.42* (0.244)
Retained a grade		0.65*** (0.169)	0.37** (0.153)	0.85*** (0.159)	1.39*** (0.141)	0.72*** (0.277)	1.41*** (0.204)	1.64*** (0.141)
Help homework:								
Mother: regularly		0.21** (0.108)	0.14* (0.086)	-0.08 (0.119)	0.25** (0.101)	0.25 (0.239)	0.28 (0.175)	0.28*** (0.100)
Father: regularly		-0.13 (0.155)	0.05 (0.118)	0.19 (0.159)	-0.14 (0.144)	-0.12 (0.351)	0.07 (0.247)	-0.05 (0.142)
Constant		-1.27 (1.719)	-0.43 (1.299)	3.45* (1.823)	2.76* (1.548)	1.90 (3.004)	-6.15** (2.784)	-0.08 (1.578)
Observations	9365	9365	9365	9365	9365	9365	9365	9365

Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3.16: **Appendix 6: *Baccalauréat* track choices, with and without the expected wage.** Exogeneous test scores. Ref: Sciences track

	General Bac		Technical Bac				
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Human-ities	**Eco-nomics**	**Indus-trial**	**Tertiary**	**Labora-tory**	**Medical Social**	**Voca-tional**
	With wage						
Expected wage	0.0039*** (2.70)						
Girl	0,60	0,47	-5,45***	0,20	-0,23	3,00*	0,17
	(-0,95)	(-0,63)	(-1,40)	(-0,70)	(-1,52)	(1,68)	(-0,79)
Average test score	-0,21***	-0,26***	-0,64***	-0,64***	-0,67***	-0,65***	-1,01***
	(-0,06)	(-0,03)	(-0,04)	(-0,04)	(-0,09)	(-0,13)	(-0,04)
Average test score	-0,03	-0,05	0,22**	-0,02	-0,05	-0,09	-0,08
*Girl	(-0,06)	(-0,04)	(-0,11)	(-0,05)	(-0,12)	(-0,14)	(-0,06)
Gap Math-French	-0,65***	-0,32***	-0,03	-0,24***	-0,24***	-0,31**	-0,18***
	(-0,05)	(-0,03)	(-0,03)	(-0,03)	(-0,08)	(-0,13)	(-0,03)
Gap Math-French	0,04	0,02	-0,22***	-0,09**	0,18*	0,03	-0,11***
*Girl	(-0,05)	(-0,04)	(-0,09)	(-0,04)	(-0,10)	(-0,14)	(-0,04)
	Without wage						
Girl	1.94**	1.50***	-4.50***	1.18**	1.27	4.59**	1.56**
	(0.756)	(0.512)	(1.177)	(0.602)	(1.356)	(2.294)	(0.608)
Average test score	-0.21***	-0.27***	-0.64***	-0.65***	-0.68***	-0.67***	-1.00***
	(0.053)	(0.032)	(0.036)	(0.039)	(0.097)	(0.210)	(0.038)
Average test score	-0.02	-0.04	0.21**	-0.02	-0.03	-0.07	-0.09*
*Girl	(0.060)	(0.040)	(0.095)	(0.050)	(0.120)	(0.215)	(0.052)
Gap Math-French	-0.66***	-0.32***	-0.03	-0.24***	-0.23***	-0.33**	-0.18***
	(0.045)	(0.028)	(0.027)	(0.030)	(0.075)	(0.160)	(0.027)
Gap Math-French	0.05	0.02	-0.22***	-0.10**	0.19*	0.05	-0.12***
*Girl	(0.054)	(0.038)	(0.084)	(0.041)	(0.097)	(0.165)	(0.039)

Number of observations: 9365
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3.17: **Appendix 7: *Baccalauréat* track choices, with test scores in Mathematics and French-Foreign Language**. Exogeneous test scores.

	General Bac			**Technical Bac**				
	REF: Sciences							
	Sciences	**Humanities**	**Economics**	**Industrial**	**Tertiary**	**Laboratory**	**Medical Social**	**Vocational**
Expected wage	0.0038*** (0.001)							
Girl		0.97	0.69	-4.89***	0.44	-0.39	3.14**	0.41
		(0.949)	(0.632)	(1.361)	(0.694)	(1.502)	(1.600)	(0.788)
Test score Math		-0.76***	-0.41***	-0.23***	-0.48***	-0.43***	-0.56***	-0.54***
		(0.043)	(0.030)	(0.030)	(0.034)	(0.086)	(0.145)	(0.032)
Test score French		0.49***	0.12***	-0.41***	-0.19***	-0.27**	-0.14	-0.49***
		(0.062)	(0.036)	(0.035)	(0.042)	(0.112)	(0.121)	(0.040)
Test score Math		0.01	-0.04	-0.13*	-0.16***	0.08	-0.00	-0.18***
*Girl		(0.053)	(0.039)	(0.079)	(0.046)	(0.109)	(0.151)	(0.046)
Test score French		-0.04	-0.02	0.31***	0.13**	-0.09	-0.08	0.10*
*Girl		(0.073)	(0.046)	(0.112)	(0.055)	(0.135)	(0.133)	(0.055)
	REF: Humanities							
	Sciences	**Humanities**	**Economics**	**Industrial**	**Tertiary**	**Laboratory**	**Medical Social**	**Vocational**
Expected wage	0.0038*** (0.001)							
Girl	-0.97		-0.29	-5.87***	-0.54	-1.36	2.17	-0.56
	(0.949)		(0.795)	(1.445)	(0.817)	(1.478)	(1.558)	(0.838)
Test score Math	0.76***		0.35***	0.53***	0.28***	0.33***	0.21	0.22***
	(0.043)		(0.042)	(0.045)	(0.045)	(0.091)	(0.147)	(0.044)
Test score French	-0.49***		-0.37***	-0.89***	-0.68***	-0.76***	-0.62***	-0.98***
	(0.062)		(0.064)	(0.066)	(0.068)	(0.125)	(0.131)	(0.069)
Test score Math	-0.01		-0.05	-0.14	-0.17***	0.07	-0.01	-0.19***
*Girl	(0.053)		(0.049)	(0.086)	(0.052)	(0.114)	(0.152)	(0.053)
Test score French	0.04		0.03	0.35***	0.17**	-0.05	-0.04	0.14*
*Girl	(0.073)		(0.073)	(0.127)	(0.079)	(0.148)	(0.144)	(0.081)
	REF: Economics							
	Sciences	**Humanities**	**Economics**	**Industrial**	**Tertiary**	**Laboratory**	**Medical Social**	**Vocational**
Expected wage	0.0038*** (0.001)							
Girl	-0.69	0.29		-5.58***	-0.25	-1.07	2.45*	-0.28
	(0.632)	(0.795)		(1.307)	(0.554)	(1.375)	(1.467)	(0.600)
Test score Math	0.41***	-0.35***		0.17***	-0.07**	-0.03	-0.15	-0.13***
	(0.030)	(0.042)		(0.032)	(0.034)	(0.086)	(0.145)	(0.032)
Test score French	-0.12***	0.37***		-0.52***	-0.30***	-0.38***	-0.25**	-0.60***
	(0.036)	(0.064)		(0.042)	(0.046)	(0.114)	(0.122)	(0.044)
Test score Math	0.04	0.05		-0.09	-0.12***	0.12	0.04	-0.14***
*Girl	(0.039)	(0.049)		(0.079)	(0.043)	(0.109)	(0.150)	(0.042)
Test score French	0.02	-0.03		0.33***	0.15***	-0.08	-0.07	0.11**
*Girl	(0.046)	(0.073)		(0.113)	(0.056)	(0.136)	(0.133)	(0.057)

Number of observations: 9365

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3.18: **Appendix 8: *Baccalauréat* track choices, with test scores in Mathematics and French-Foreign Language.** Endogeneous test scores. Ref: Sciences track

	General Bac		**Technical Bac**				
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Human-ities	**Eco-nomics**	**Indus-trial**	**Tertiary**	**Labora-tory**	**Medical Social**	**Voca-tional**
	Exogeneous test scores						
Expected wage	0.0038*** (0.001)						
Girl	0.97	0.69	-4.89***	0.44	-0.39	3.14**	0.41
	(0.949)	(0.632)	(1.361)	(0.694)	(1.502)	(1.600)	(0.788)
Test score Math	-0.76***	-0.41***	-0.23***	-0.48***	-0.43***	-0.56***	-0.54***
	(0.043)	(0.030)	(0.030)	(0.034)	(0.086)	(0.145)	(0.032)
Test score French	0.49***	0.12***	-0.41***	-0.19***	-0.27**	-0.14	-0.49***
	(0.062)	(0.036)	(0.035)	(0.042)	(0.112)	(0.121)	(0.040)
Test score Math	0.01	-0.04	-0.13*	-0.16***	0.08	-0.00	-0.18***
*Girl	(0.053)	(0.039)	(0.079)	(0.046)	(0.109)	(0.151)	(0.046)
Test score French	-0.04	-0.02	0.31***	0.13**	-0.09	-0.08	0.10*
*Girl	(0.073)	(0.046)	(0.112)	(0.055)	(0.135)	(0.133)	(0.055)
	Endogeneous test scores						
	Standard errors not corrected						
Expected wage	0.003*** (0.001)						
Girl	0,93	1,56**	-5,60***	1,76**	0,19	5,16**	2,73***
	(1,22)	(0,77)	(1,87)	(0,90)	(1,92)	(2,35)	(1,01)
Test score Math	-1,20***	-0,66***	-0,22***	-0,78***	-0,45**	-0,94**	-0,78***
	(0,12)	(0,07)	(0,07)	(0,08)	(0,19)	(0,42)	(0,07)
Test score french&lang	0,15***	0,35***	-0,63***	-0,14	-0,39**	0,07	-0,66***
	(0,15)	(0,08)	(0,08)	(0,09)	(0,20)	(0,48)	(0,09)
Test score Math	-0,04	-0,01	-0,69***	-0,22**	-0,06	0,04	-0,42***
*Girl	(0,14)	(0,09)	(0,19)	(0,11)	(0,24)	(0,43)	(0,11)
Test score French	0,03	-0,09	0,93***	0,10	0,04	-0,26	0,14
*Girl	(0,18)	(0,11)	(0,26)	(0,13)	(0,28)	(0,51)	(0,13)

Number of observations: 9365

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3.19: **Appendix 9: Higher education choices (First Year of College), according with test scores obtained at the *baccalauréat*, and conditional to a *baccalauréat* in Sciences**

	Preparatory class			**Health**		**Technical track**		**University**				
	Sciences REF	Economics	Humanities	Health & Social	Medicine, Pharmay	Secondary	Tertiary	Eco, Law	Humanities	Sciences	Biology	Sport
Expected wage	0.0016***											
Girl		3.02**	0.20	-0.17	2.10*	0.98	0.55	0.35	0.93	-0.13	1.82	-1.06
		(1.50)	(3.26)	(1.58)	(1.08)	(1.18)	(1.24)	(1.56)	(1.39)	(1.28)	(1.40)	(1.95)
Test score Humanities		0.24**	0.43***	-0.09	0.06	-0.18***	-0.22***	0.18*	0.06	-0.17***	-0.00	-0.26***
		(0.10)	(0.16)	(0.14)	(0.07)	(0.06)	(0.06)	(0.10)	(0.10)	(0.06)	(0.09)	(0.09)
Test score Language		0.20***	0.13	-0.36***	-0.10**	-0.14***	-0.05	-0.14**	-0.10	-0.09**	-0.10	-0.20***
		(0.08)	(0.11)	(0.10)	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)	(0.04)	(0.07)	(0.06)
Test score Sciences		-0.32***	-0.46***	-0.40***	-0.30***	-0.33***	-0.23***	-0.53***	-0.51***	-0.35***	-0.53***	-0.40***
		(0.07)	(0.10)	(0.09)	(0.05)	(0.04)	(0.05)	(0.08)	(0.07)	(0.05)	(0.07)	(0.08)
Test score Humanities *Girl		-0.14	-0.04	-0.01	-0.08	-0.12	0.01	-0.19	-0.25*	-0.05	-0.22*	0.23
		(0.15)	(0.22)	(0.17)	(0.10)	(0.10)	(0.11)	(0.14)	(0.13)	(0.10)	(0.12)	(0.15)
Test score Language *Girl		-0.21**	-0.07	0.07	-0.02	-0.08	-0.13**	0.03	0.08	-0.08	-0.08	-0.15
		(0.11)	(0.15)	(0.12)	(0.07)	(0.08)	(0.07)	(0.09)	(0.09)	(0.07)	(0.09)	(0.10)
Test score Sciences *Girl		0.18*	0.13	0.13	0.07	0.06	0.07	0.17*	0.12	0.10	0.17*	-0.02
		(0.10)	(0.15)	(0.11)	(0.07)	(0.07)	(0.08)	(0.10)	(0.10)	(0.07)	(0.09)	(0.12)
Age grade 6		0.03	0.75*	0.31	0.18	0.53***	0.54**	0.35	0.12	0.06	-0.08	0.53
		(0.30)	(0.43)	(0.28)	(0.20)	(0.21)	(0.21)	(0.28)	(0.28)	(0.20)	(0.26)	(0.42)
Retained a grade		-13.31***	2.44**	2.28***	1.91***	1.44**	2.23***	1.58*	1.76**	1.42**	1.45*	1.99***
		(0.67)	(1.18)	(0.72)	(0.65)	(0.60)	(0.62)	(0.82)	(0.77)	(0.66)	(0.77)	(0.72)
Born abroad		0.82	0.20	-14.76***	0.61	-0.48	-0.21	0.09	0.63	0.31	-0.30	0.33
		(0.65)	(1.12)	(0.47)	(0.46)	(0.64)	(0.61)	(0.68)	(0.62)	(0.56)	(0.80)	(0.88)
Father education:												
Primary school		-0.90	1.30	0.41	0.61	0.06	0.48	0.56	0.36	0.42	-0.12	0.66
		(1.18)	(1.24)	(0.60)	(0.47)	(0.49)	(0.49)	(0.59)	(0.59)	(0.50)	(0.61)	(0.92)
Junior high-school		-1.98*	-14.63***	0.33	-0.19	-0.22	-0.16	-0.35	0.24	-0.15	-0.20	1.08
		(1.12)	(0.67)	(0.52)	(0.43)	(0.40)	(0.42)	(0.51)	(0.50)	(0.43)	(0.48)	(0.77)
Vocational certificate		-1.38**	0.06	-0.27	-0.29	-0.40	-0.54	-1.51***	-0.26	-0.43	-0.44	1.06*
		(0.59)	(0.79)	(0.43)	(0.33)	(0.31)	(0.34)	(0.45)	(0.40)	(0.34)	(0.37)	(0.63)
High-school graduate		-0.88	0.42	-0.66	-0.54	-0.88***	-0.86**	-0.75*	-0.47	-0.44	-0.72*	0.66
		(0.53)	(0.71)	(0.46)	(0.33)	(0.32)	(0.35)	(0.40)	(0.42)	(0.35)	(0.38)	(0.66)
2 years of college		-1.26**	-0.12	-0.83*	-0.45	-1.01***	-0.69**	-0.83**	-0.51	-0.96***	-1.41***	0.37
		(0.56)	(0.74)	(0.47)	(0.33)	(0.33)	(0.35)	(0.41)	(0.42)	(0.37)	(0.43)	(0.71)
$\geq$ 3 years of college		-0.26	-0.29	-1.49***	-0.46	-1.79***	-1.29***	-0.92**	-1.16***	-0.85***	-1.73***	-0.35
		(0.43)	(0.66)	(0.50)	(0.30)	(0.31)	(0.34)	(0.37)	(0.39)	(0.33)	(0.40)	(0.69)
No info		0.81	-14.81***	0.46	0.20	-1.20	-0.94	0.70	-0.07	-0.20	-15.07***	1.14
		(1.03)	(0.91)	(0.96)	(0.81)	(0.89)	(0.97)	(0.84)	(1.08)	(0.87)	(0.73)	(1.13)
Mother education:												
Primary school		-14.81***	-14.72***	-0.06	0.04	-0.08	-0.18	0.28	0.49	-0.19	0.11	0.40
		(0.84)	(0.99)	(0.68)	(0.55)	(0.55)	(0.60)	(0.82)	(0.83)	(0.59)	(0.75)	(0.78)
Junior high-school		0.58	-1.70	-0.06	-0.64	-0.02	0.10	0.78	0.45	-0.10	0.15	-0.88
		(0.85)	(1.31)	(0.62)	(0.51)	(0.47)	(0.53)	(0.72)	(0.78)	(0.52)	(0.68)	(0.83)
Vocational certificate		0.27	-0.94	-0.54	-0.18	0.07	0.10	0.39	0.40	-0.57	-0.12	-0.31
		(0.82)	(1.04)	(0.60)	(0.47)	(0.44)	(0.50)	(0.69)	(0.75)	(0.50)	(0.66)	(0.72)
High-school graduate		-0.21	-0.28	0.01	-0.21	0.18	0.22	0.42	0.39	-0.50	0.32	0.12
		(0.80)	(0.93)	(0.59)	(0.46)	(0.42)	(0.49)	(0.68)	(0.75)	(0.49)	(0.64)	(0.70)
2 years of college		0.49	-0.09	-0.72	-0.51	-0.24	-0.26	0.62	0.32	-0.61	-0.11	-0.50
		(0.76)	(0.97)	(0.60)	(0.46)	(0.42)	(0.49)	(0.67)	(0.74)	(0.48)	(0.64)	(0.73)
$\geq$ 3 years of college		0.07	-0.03	-1.48**	-0.29	-0.78*	-1.22**	0.63	0.78	-0.97*	-0.01	-0.88
		(0.77)	(1.02)	(0.74)	(0.46)	(0.45)	(0.53)	(0.68)	(0.74)	(0.50)	(0.67)	(0.79)
Constant		-3.69	-11.37**	5.73	1.17	3.97	1.57	1.66	5.44	8.21***	8.94***	3.48
		(3.55)	(5.18)	(3.55)	(2.51)	(2.64)	(2.63)	(3.53)	(3.53)	(2.53)	(3.35)	(5.07)
Observations	2308	2308	2308	2308	2308	2308	2308	2308	2308	2308	2308	2308

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

3.9 Database

Panel d'élèves du second degré, recrutement 1995 - 1995-2006 - (2006) [fichier électronique], DEPP[producteur], Centre Maurice Halbwachs (CMH) [diffuseur]

CHAPTER 4

Stereotypes upon Abilities in Domestic Production and Household Behaviour

This chapter is a joint work with Catherine Sofer.

4.1 Introduction

When analyzing intra-household decision-making, most models assume efficiency in the consumption and production side of the household. This departs with the models developed in the New Home Economics (Becker, 1965) and continues with cooperative models (Manser and Brown, 1980, McElroy and Horney, 1981) and collective models (Apps and Rees, 1988, 1997, Chiappori, 1988, 1992, 1997, Bourguignon and Chiappori, 1992). In the production side of the household, efficiency means that the partner with the lowest opportunity cost, so the lowest human capital, specializes more in domestic production. So an increase in female relative human capital leads to decrease woman domestic work time (Becker, 1981). However, serious doubts about the efficiency assumption can be expressed, especially on the production side of household decisions, i.e. household production which includes domestic tasks and child care.

Participation of women in the labour market has strongly increased during the second half of the century (Marchand & Thélot, 1991, Sofer, 2005). Today, women participate more and more in the labor market, but they are still in charge of the largest burden of domestic work inside the household. The sharing of time among men and women between market work and household work is still highly differentiated by gender (Goldschmidt-Clermont and Pagnossin-Aligisakis, 1995, Rizavi and Sofer, 2008). In particular, women in Europe spend roughly between 60 and 70% of their working time doing household work and between 30 and 40% working in the market, while men devote between 55% and 65% of their working time to market work and thus between 35% and 45% only in household work, with a total working time generally higher for women than for men (Winquist, 2004). For France, for example, Régnier-Loilier (2009) shows that French women contributed in 2009 to around 80% of the domestic tasks. In addition, they show that the presence of children increases specialization within the household. This relative specialization strongly interacts with women's situation in the labor market: it often results in differences in wage rates (through part time work), in large differences in earned income (through less work duration, as well as through flatter careers), which, in turn, has several negative implications for women, especially in case of divorce. In this latter case, they are evidently more exposed to a risk of income cut or even of poverty.

At first sight, it can be thought that the division of labour within the household might be explained by usual economic variables, as wages, education, or other measurable variables. But, in fact, these variables are far from completely driving the phenomenon (Hersch & Stratton, 1994, Anxo & Kocoglu, 2002, Aronsson et al, 2001, Rapoport and Sofer, 2005, Kalenkoski, Ribar and Stratton, 2009, Sofer and Rizavi, 2010). According to Sofer and Rizavi (2010), who use French data from 1998-1999, woman's investment in career does increase her partner's household work and decreases hers. However, there is no role reversal, in the sense that these women still do the major part of household work even though they participate in the labour market with a strong intensity. These results challenge the assumption of Pareto-optimality of household decision making. In addition, several other studies (Udry, 1996, Duflo and Udry, 2004, Aguiar and Hurst, 2007) cast also some doubts about the efficiency assumption, especially on the production side of household decisions.

Of course, Pareto optimality in household decision-making could be restored under some auxiliary assumptions.

It could be that women are more productive than men in domestic production, with women's higher productivity more than compensating for wage differences when women's wage are higher. It is the assumption made by Becker (1981), based (besides "natural differences"?) on the different training received by girls and boys through "gendered" toys and games, for instance. But, today, in developed countries, at least, boys and girls are educated with the perspective that both genders in adulthood will participate in domestic tasks and work in the market. Moreover, though toys and games are still highly gendered, the skills necessary to perform domestic tasks are not really high any more, due to a large use of market substitutes to domestic goods, on the one hand (buying clothes has replaced sewing or knitting them) and household equipment in durable goods, on the other hand: it is not likely that women are better than men at pushing the button "on" of the washing machine! Moreover, most fathers are now involved in the caring of children of any age, including babies, so that, again, systematic productivity differences between genders do not seem likely to occur in the raising of children either, excluding the period, very limited in time, of pregnancy and, possibly, breastfeeding.

It could instead come from a difference in individual preferences, either in direct or indirect preferences. A direct difference in preferences would occur if women, on average, "liked" more than men performing domestic tasks. This would complicate the models above, as the production side of household decision-making would now have a consumption component. Non monetary costs (or advantages) should be added (or substracted) to monetary costs in the maximization of the profit from household production. In order to obtain the observed

division of labor, again, the difference between men and women in those non monetary costs should be high enough to compensate for any difference in wages when women's wages are higher. We do not find this ad hoc assumption convincing either, among other reasons because, again, the skills necessary to perform most of domestic tasks are not very high: women would like using a vacuum cleaner while men don't?
A more convincing candidate for the explanation of a gendered division of labor is a difference in indirect preferences: the gender division of labour could instead come from a social norm. Social norms represent rules of behavior imposed to individuals by society, from which it is costly to deviate. For example, a social norm could be that women must specialize in domestic production while men must work mainly in the labor market. Social norms can be modeled as adding to the utility function a "cost of deviating" from the norm. "Gender roles" would in that case impose or add a strong constraint leading households to deviate from the first best efficiency. Non cooperative household models including social norms have been developed by Carter and Katz (1997) and by Cudeville and Recoules (2009).

Rather than focusing on indirect preferences, the originality of our approach is to address the relevance of the production side in explaining gender differences. Indeed, we shall develop another approach, based on the existence of a stereotype about abilities within the society. Stereotypes are beliefs grounded in the society. For example, and this will be our main assumption here, people could - wrongly - believe that in average, women are more talented than men concerning domestic work and child care. A model of discrimination in the labour market involving stereotypes has been developed by Coate and Loury (1993), who assume a stereotype upon a difference in the respective productivity of black and white workers. Black workers are (wrongly) believed to be on average, less able than white workers in the labor market. The result is that white workers will more often occupy skilled jobs than black workers. Similarly, in the model developed below, we show that women will more often be in charge of domestic production than the observed wage difference between men and women in the labor market would justify.

The decision-making process described below is that of a collective model with domestic production (Apps and Rees, 1997, Chiappori, 1997, Aronsson, Daunfeldt and Wickstrom, 1999, Bourguignon F. and M.C. Chiuri, 2005, Rapoport, Sofer and Solaz, 2011), adding a stereotype about the relative ability of men and women in domestic production using a methodology inspired by Coate and Loury (1993). The stereotype considered is the belief that women are more talented than men in domestic production, while, in reality, the distribution of talents between women and men is assumed to be the same.

The model developed is the following: at the beginning of couple formation, a choice of relative specialization is made within the household. One of the two spouses will make an investment in domestic production, in order to improve his/her productivity. Therefore the first decision of the household consists in choosing which of the two spouses will invest. This decision depends on spouses' wages, which represent the costs of investment for each of them, the level of the specialization, and on their respective expected abilities to make the investment in domestic production. However, abilities are assumed not to be known nor immediately observable by the spouses. The couple can only observe noisy signals about them. They choose which of them will invest in domestic production as the result of a program of optimization (maximizing the expected profit from household production, or minimization of the costs for a given production), which depends on variables such as the ability signal emitted by each of them, on their wages, the level of specialization, but also on beliefs about the respective probabilities of abilities of each spouse. These beliefs depend on the signal which each spouse emits, but also on the stereotype running inside the society. Once the couple has chosen who invests, the investment is made and one spouse improves his/her productivity. Then they take daily household decisions (consumptions and labour supplies) in an optimal way, given that one spouse is more productive than the other. This implies that the couple maximizes a weighted sum of both couple members' preferences under a full income constraint which includes the maximized profit from household production.

Decision process assumed here appears quite similar to decision process assumed by Apps (1982): in a first stage, partners' specialization occurs: one member invests in order to specialize in the labor market, while the other invests in domestic production. Wage discrimination against women will bias the process. Then, in a second stage, labor supplies are determined according to this specialization (Apps, 1982). So the allocation of time is partly explained by wage discrimination, while in our model, specialization is partly determined by the stereotype.

We show that the stereotype is self-fulfilling, in the sense that at the end of the decision process, women become really more productive than men, given that women are more often than men chosen by couples to invest in domestic production. In addition, we show that even if a wife earns a higher wage than her husband, even though her husband has the same potential in domestic productivity, it is likely that the woman be chosen to invest in domestic production, though the first best optimal choice would have been to choose the husband in that case. Indeed, if the stereotype is strong in the society, the probability that the wife will be chosen to invest whatever her wage will be is high, and the wife will actually invest.

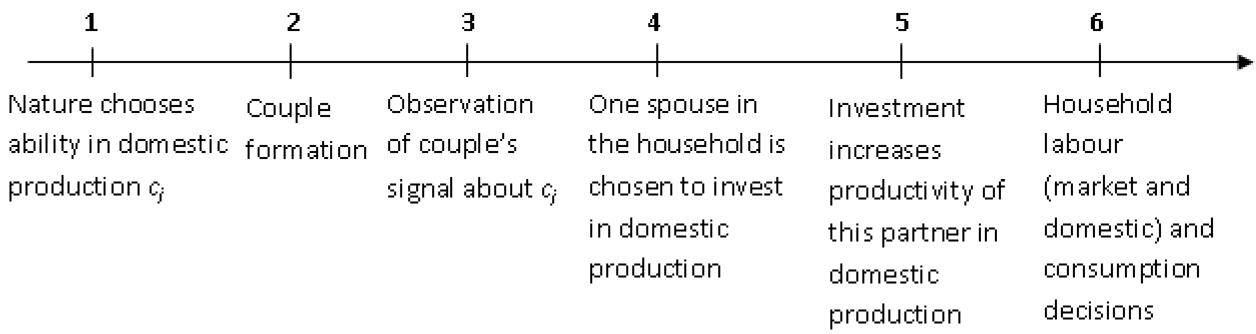
Then we lead simulations above our model, using the French Time Use survey of 2009-2010. First we aim at retrieving the level of the stereotype which matches with the observed sharing of time within couples. The true likeliness that a man is more able than a woman in the society is 50%. However, considering observed actual wages as exogeneous determinants of who invest, and given the actual gender hourly wage gap (around 2 euros by hours), we find that people believe that the likeliness that a man is more able than a woman is 19%. Now considering wages as endogenously determined by the possible investment in domestic production, the belief is a little weakened and is equal to 32%. Notes that we use an endogeneous switching regression model to predict wages that one partner would earned if the decision of who invest would have been the opposite in the household. Then in a public policy recommendation objective, we simulate the gender wage gap and the stereotype in order to analyse how the decision of who invest is impacted by both determinants. We show that the percentage of men chosen to invest is largely sensitive to the value of the belief about abilities, while the gender wage gap seems to exert a smaller effect. Thus strong political actions designed to weaken the stereotype would imply a larger share of men investing in domestic production. With a dynamic reasoning, considering wages as endogenously determined by the investment, such a political measure would consecutively help to reduce the gender wage gap.

Our analysis proceeds as follows. Section 2, first presents the sequence of actions in the household decision process and then the definition of the stereotype. Section 3 is devoted first to a brief presentation of the collective model with household production, and then to household choices of who invests in domestic production. Then, in Section 4, we develop a comparative-static analysis. Section 5 is devoted to the computation of the model above french data from 2009-2010 and simulations. We discuss the role of public policies. Finally, Section 6 concludes

4.2 The framework

4.2.1 Household Decision Process

Figure 4.1: Sequence of actions



Assume a population of couples, composed by a man and a woman. Men are indexed by $j = m$ and women by $j = f$. There are two productivity levels in household production: low and high. The timing of decisions is summarized in Figure 4.1. Each member of the household has a certain level of ability in domestic production c_j, which corresponds to the capacity to make an investment in domestic production and reach the high level of productivity. Thus c_j is different from productivity levels. Each individual in the population has a different level of ability c_j. The higher c_j, the more talented a priori the individual is to produce domestic goods, and the less his/her investment cost. We define by $(-c_j)$ the cost of investment in domestic production.

Then couples form, and household members do not observe their true ability to make an investment in domestic production, but only noisy signals about it. Indeed, it seems quite unexpected that people know and can measure exactly their own and partner levels of productivity, and it appears more likely that they only have a rough idea about it.
More specifically, the signal would correspond to the general idea people have about their own ability in domestic production, following the variety of daily domestic tasks they perform. Some individuals perform more quickly some domestic tasks than other individuals, or produce higher-quality domestic goods, and this signal exactly covers the general appreciation people have about their talent to produce these goods. Nevertheless, despite the multitude of signals people face days to days, it appears difficult to measure exactly the level of the skill, and especially when measuring the difference between the abilities of two people.

At the beginning of couple formation, a relative specialization occurs between spouses: one spouse specializes more in the labor market, and the other specializes more in domestic production. Except for very few couples, this specialization is not complete. The existence

of a relative specialization is consistent with the French Time Use Survey of 2009-2010, showing that in 91% of couples, one partner makes significantly more domestic work than his/her partner. Indeed, for only 9% of couples, domestic work time of one partner is less than 10% of domestic work of his/her partner, on the day of interview.
Note that the model does not exclude the possibility of experimentations for the signal. On the contrary, each individual entering in a couple already have an idea about his level of abilities, and the model does not exclude that there is a period of experimentation at the beginning of couple formation, for each individual to assess the level of his/her partner's ability before choosing who will invest in domestic production. What's most important is that the couple is never able to know exactly the difference of abilities between both partners, and even if signals are perfect, the couple is not aware that it represents the true skill. Note also that productivity related to childcare is rather difficult to evaluate if partners have never has children before, but nevertheless partners know well each other, and we assume that they are able to have a idea about their perceived ability in caring for children.

In order to proceed to this relative specialization, one of the two household members is chosen to make an investment in domestic production, and this investment allows him/her to increase his/her productivity in domestic production. So finally, one spouse becomes more productive than the other. This investment may be thought as spending more time in household production and developing habits. We assume that there exist two levels of productivity to produce domestic goods among all the population: a high level and a low level. The high level is the level of productivity of the household member who has invested in domestic production, and the low level is the level of productivity of the spouse who has not invested. All spouses in the society who have invested have the same high productivity, and all partners in the population who have not invested have the same lower productivity. What differs between all individuals is the ability (c_j) to reach the high level of productivity. The higher the initial individual ability, the lower the investment costs in order to reach the post-investment productivity.

The choice of which partner invests will be made on the basis of the configuration allowing to bring the highest profit from household production, or similarly the lowest cost at a given production. Profit depends on wages, the degree of time specialization between partners, and the cost of investment. As household members do not observe their true ability to make this investment, but only signals about it, these signals, wages, time specialization and beliefs about abilities help them to determine who invests.

The framework used here is a household general equilibrium model, in which the household profit from household production is maximized. Hence, the model below can be part of a Collective Model with household production (Apps and Rees 1997, Chiappori 1997, Aronsson, Daunfeldt and Wikstrom 2001, Bourguignon F. and M.C. Chiuri 2005, Rapoport, Sofer and Solaz 2011), or of a Nash bargaining model (Mc Elroy et Horney, 1981, Manser and Brown, 1980, Lunberg and Pollak, 1993), adding household production.

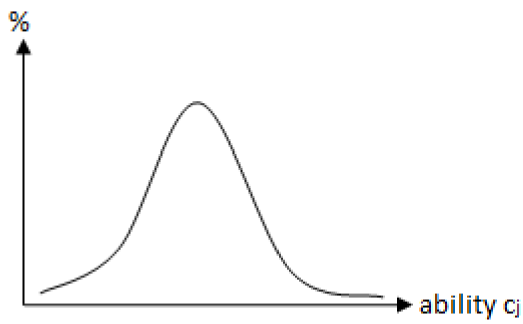
Once the choice of which partner invests and once the investment made, individual domestic times, leisure and consumption decisions are taken optimally, according to a household model with domestic production, given that one partner has increased his/her productivity.

4.2.2 The stereotype

A key assumption here is that before the investment made, all people, men as well as women, have the same distribution of ability in domestic production. This assumption is actually the null hypothesis.

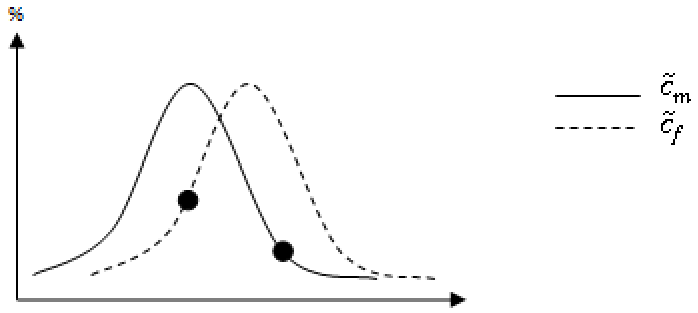
However, nobody knows and can measure exactly one's own ability, nor that of one's spouse. Moreover, nobody knows that initially, the distribution of abilities is the same for men and for women. People (women as men) believe instead that, on average in the population, women are more able than men for domestic production. This is the stereotype. For simplicity, we shall assume that the stereotype shifts to the right the distribution of women abilities. We call c_f and c_m, true abilities in domestic production, and $\tilde{c_f}$ and $\tilde{c_m}$, the abilities imputed to the woman and to the man respectively, according to the belief in the society.

Figure 4.2: True distribution of ability in domestic production for men and for women, in the whole population



Hence, on average, people believe that women are more able than men, but in a given household, the couple can (rightly) believe that the man is more able than the woman (cf the two points in Figure 4.3). All individuals believe that women's distribution of abilities

Figure 4.3: Imputed distribution of ability $\tilde{c_f}$ and $\tilde{c_m}$, according to the stereotype



is moved to the right in this way, that is why this belief can be called a stereotype. Finally, the model starts with the null hypothesis, in order to show how, with the presence of the stereotype, we achieve the current observed distribution of domestic tasks.

4.3 Household choices

4.3.1 General Household Behaviour

The general model, according to a Collective Model extended to household production (Apps and Rees 1997, Chiappori 1997, Rapoport, Sofer and Solaz 2011), can be written in the following way, in which the household maximizes a generalized weighted utilitarian household welfare function:

$$\max_{L_f,C_f,Y_f,L_m,C_m,Y_m} \mu_f(.)\, U_f(L_f,C_f,Y_f,\mathbf{z}) + \mu_m(.)\, U_m(L_m,C_m,Y_m,\mathbf{z})$$

$$\textit{subject to} \qquad C_f + C_m + pY_f + pY_m \leq H_f w_f + H_m w_m + y + \pi(w_f,w_m,p)$$

L_j represents leisure of individual j ($j = m$ for the man and $j = f$ for the woman),

C_j, the consumption of private goods, and Y_j the consumption of domestic goods (domestic production is assumed to be privately consummed), with $Y = h(t_f, t_m; \mathbf{z})$. t_j is member j's household work devoted to household production, H_j is member j's total working time (domestic work + market labour supply), $\mathbf{z}$ represents part of the individual heterogeneity, y the household's non-labour income, w_m and w_f are the wage rates, and $\mu_j = \mu_j(w_f, w_m, y, \mathbf{z})$ are weighting factors contained in [0,1], with $\mu_m + \mu_f = 1$. $\pi(w_f, w_m, p)$ is the profit function from the household production. p is the price for domestic goods, assumed to be the same for all households.

The household maximization program could be thought of as decentralized in three steps. In a first stage, the household would maximize the profit from household production:

$$\max_{t_f, t_m} \pi = pY - w_f t_f - w_m t_m$$

This allows to determine t_f^* and t_m^*, domestic work times. In a second stage, spouses agree on the sharing of an income which contains household non-labour income and profit from household production. Each spouse receives the share Ψ_j.

In the third stage, the man and the woman separately maximizes their own utility function, under their own budget constraint, in order to determine quantities of leisure L_j and consumption C_j.

$$\max_{L_j, C_j, Y_j} U_j(L_j, C_j, Y_j, \mathbf{z})$$

$$C_j + pY_j \leq \Psi_j + w_j H_j$$

$$L_j + H_j = T$$

where T is total time available for each individual.

In what follows, we concentrate only on the first step: profit maximization from household production. The other steps are straightforward from the standard model. Here, the uncertainty about abilities c_j and hence, the beliefs about the difference between men and women in that respect prevail in the first step of the household decision process. Rather than maximizing the known profit from household production by choosing adequate domestic times, the household will maximize an expected profit, given that nobody knows true spouses' abilities. Once the investment in domestic production is made by one partner accordingly, the chosen partner becomes more productive than the other. This has direct consequences on the determination of t_f^* and t_m^* in stage 1, and hence on subsequent stages.

4.3.2 Which of the two partners will invest ?

Each household must choose the man or the woman, in order to make an investment in domestic production. The objective of the household is to choose the partner who will bring the highest profit from household production. The error would be to choose one partner, while the other would have allowed to obtain a higher profit. However, the couple cannot measure correctly levels of abilities.

The profit if the man invests in domestic production is the following:

$$r_m = p^* h(t_f^{ni}, \rho t_m^i) - w_f t_f^{ni} - w_m t_m^i - (-c_m)$$

The profit if the woman invests in domestic production is the following:

$$r_f = p^* h(\rho t_f^i, t_m^{ni}) - w_f t_f^i - w_m t_m^{ni} - (-c_f)$$

w_f and w_m are respective wages of f and m, and p^*, the implicit price of domestic production. c_j is the measure of j's initial ability in domestic production. $(-c_j)$ represents the cost of investment in domestic production. The higher c_j, the less costly it is for an individual to acquire the high level of productivity. We index t_j by t_j^{ni} for the partner who has not invested in domestic production (*ni: no investment*), and t_j^i for the spouse who have invested in domestic production (*i: investment*). $h(\rho t^i, t^{ni})$ is the household production function. Domestic time spent by the spouse who has invested is multiplicated by $\rho > 1$, corresponding to the productivity gain resulting from the investment. ρ is the same across all households.

In the following, we assume for simplicity that the level of domestic production $h(\rho t^i, t^{ni})$ is the same for households of the same type. The type of household is defined on the number children present in the household according to their age. Particularly we consider the number of very young children (below 3 years old) and the number of older children (between 3 and 18). Indeed, the level of household production largely varies according to the composition of the family. Literature on domestic work shows that the number of children according to the age is a strong predictor of the amount of parents' domestic work

(Sofer and Rizavi, 2010 or Bloemen and Stancanelli, 2014, for instance). This level could be perceived as a standard level of domestic production, corresponding to an adequate cleanliness and storage level in the house, usual shopping, childcare etc. Certainly couples have different standards in this area, but this level could be seen as an average, a threshold to reach. Consequently, with m the number of children below 3, and n the number of children between 3 and 18, $h^{m,n}(\rho t^i, t^{ni})$ is the same across all households with the same composition $\{m, n\}$, whoever was chosen to invest. We also assume that p^* is the same for all couples. Hence, what differs among couples are wages w_f and w_m, abilities c_f and c_m, and domestic work times t_m and t_f.

The objective of the household is to obtain the highest profit from household production. So household's choice should be made by comparing r_m and r_f. If r_m is higher than r_f, the net benefit from household production is higher when the man invest rather than when the woman invests, hence the man should be chosen to invest.

The man should be chosen if and only if

$$
\begin{aligned}
& r_m > r_f \\
\Leftrightarrow \quad & p^* h^{m,n}(t_f^{ni}, \rho t_m^i) - w_f t_f^{ni} - w_m t_m^i - (-c_m) > p^* h^{m,n}(\rho t_f^i, t_m^{ni}) - w_f t_f^i - w_m t_m^{ni} - (-c_f)
\end{aligned}
$$

As $p^* h^{m,n}(t_f^{ni}, \rho t_m^i) = p^* h^{m,n}(\rho t_f^i, t_m^{ni})$,

$$\begin{aligned}
& r_m > r_f \\
\Leftrightarrow \quad & -w_f t_f^{ni} - w_m t_m^i - (-c_m) > -w_f t_f^i - w_m t_m^{ni} - (-c_f) \\
\Leftrightarrow \quad & c_m - c_f > w_m(t_m^i - t_m^{ni}) - w_f(t_f^i - t_f^{ni})
\end{aligned}$$

In order for the man to be chosen to invest, the difference $c_m - c_f$ should be larger than $w_m(t_m^i - t_m^{ni}) - w_f(t_f^i - t_f^{ni})$. However, the couple does not know the true values of c_m and c_f. They only observe noisy signals about c_m and c_f: θ_f and θ_m. Note that the distribution of $\theta_m - \theta_f$ depends on the true distribution $c_m - c_f$, and not on the stereotype. The stereotype acts through the perceived distribution of abilities, $\tilde{c_f}$ and $\tilde{c_m}$. Intuitively, the stereotype, by moving the distribution of capacities of women to the right, leads to a decrease of $c_m - c_f$, according to the belief of couples. Hence, the inequality $c_m - c_f > w_m(t_m^i - t_m^{ni}) - w_f(t_f^i - t_f^{ni})$ is less likely to be satisfied.

Before developing the formal decision process, what would happen if the model ended at this point, that is without taking into account signals about abilities ? The decision of who invests would be only based on the probability that $c_m - c_f > w_m(t_m^i - t_m^{ni}) - w_f(t_f^i - t_f^{ni})$. Consequently the decision would be based on what people believe about $c_m - c_f$, for the whole population, and there would be no individual variation across abilities. All the households in the population would take their decision using this unique stereotype (in addition to wages and time differential). However, considering that partners only rely on the stereotype to decide who will invest seems to be problematic and incomplete. It is very difficult to identify the stereotype from signals, but considering only a very specific situation in which partners do not take into account their appreciation about abilities in domestic production to make their choice represents a limited case, especially as we will see it later, varying the variance of the signal really impacts results. We can add that the objective of simulations is not so much to know the extent of the reliability of the signal and the degree of the corresponding stereotype, as to make vary each of these variables to better understand how reacts the proportion of men chosen to invest.

4.3.3 The formal decision process

We formally define the couple decision process below.

In the following, we denote the couple (true) ability differential $c_m - c_f$ by C, the signal differential $\theta_m - \theta_f$ by θ and the time differential $t_m^i - t_m^{ni}$ by T_m and $t_f^i - t_f^{ni}$ by T_f. The correct inequality for an investment by the man becomes: $C > w_m T_m - w_f T_f$.

Let $F_q(\theta)$ $[F_u(\theta)]$ be the probability that signal differential of the couple does not exceed θ, given that $C > w_m T_m - w_f T_f$ $[C < w_m T_m - w_f T_f]$ and let $f_q(\theta)$ and $f_u(\theta)$ be the related density functions. Define $\varphi(\theta) \equiv f_u(\theta)/f_q(\theta)$, to be the likelihood ratio at θ. We assume that $\varphi(\theta)$ is nonincreasing, which implies $F_q(\theta) \leq F_u(\theta)$ for all θ. So higher values of signals θ are more likely if $C > w_m T_m - w_f T_f$, and for a given prior, the posterior likelihood that $C > w_m T_m - w_f T_f$ is larger if couple signal θ takes a higher value.

We define $\Phi \in (0, 1)$, the probability that in a representative couple $\tilde{C} > w_m T_m - w_f T_f$,

according to the belief in the population about C, and before the observation of signals. The true probability that $C > w_m T_m - w_f T_f$ is $P\ (C > w_m T_m - w_f T_f)$.
This probability distorted by the stereotype is $\Phi = P(\tilde{C} > w_m T_m - w_f T_f)$. In other words, Φ is the prior probability that the profit is higher when the man invests, so that the man be chosen to invest, in a representative household, and according to the belief. This probability depends on six distributions: the distributions of w_m, w_f, T_m, T_f and the distributions of $\tilde{c_m}$ and $\tilde{c_f}$, in the whole population.

Note that couples do not kown t^i, t^{ni}, as domestic work times will be decided later through profit maximisation, once the investment will be made. However, when choosing who will invest, we assume that couples have in mind the average value of time specialization $t^i - t^{ni}$ within the society according with the composition $\{m, n\}$ of the family, whoever the man or the woman invests. Thus in the following, considering that couples have in mind an average value of $t^i - t^{ni}$ which does not depends on whether the man or the woman invests, we drop the subscript f or m for the variable $T = t^i - t^{ni}$, and the condition $C > w_m T_m - w_f T_f$ becomes $C > T(w_m - w_f)$.

Finally, Φ is a distribution of probability, and not a parameter, because it depends on specific wage values of the household, and their idea about time specialization. But all people have the same belief about the gap between c_m and c_f (the stereotype). So the stereotype intervenes through this probability Φ. Signals do not act on this probability, because Φ is defined anterior to signals observation.

The stereotype is defined by the shift in the distribution of abilities of women compared to men. To make it clear on an example, considering that $w_m = w_f$, and given our assumption, the true probability that $C > T(w_m - w_f)$ is equal to $\frac{1}{2}$.

$$
\begin{aligned}
& P(C > (w_m - w_f)T \mid w_m = w_m) \\
= & P(C > 0) \\
= & P(c_m > c_f) \\
= & 0,5
\end{aligned}
$$

Now, according to the stereotype (measured by S), this probability becomes lower, as instance 0,3.

$$
\begin{aligned}
1 - S &= P(\tilde{C} > (w_m - w_f)T \mid w_m = w_m) \\
&= P(\tilde{c}_m > \tilde{c}_f) \\
&= 0,3
\end{aligned}
$$

In this example, everybody in the society believes that the likeliness that a man randomly drawn in the population is more able than any woman drawn randomly is only 30%. A probability of 0,2 corresponds to a stronger stereotype, while a probability of 0,4 corresponds to a weaker stereotype.

The stereotype is defined on beliefs about abilities, $\tilde{c}_m$ and $\tilde{c}_f$, but the couple decision is based not only on both imputed abilities $\tilde{C}$, but also on wage differential $w_m - w_f$, and on the level of specialization, T.

Let's formally define how couples choose which partner will invest in domestic production. For a given couple, if it "emits" the signal $\theta = \theta_m - \theta_f$ then, using Bayes' Rule, the couple's posterior probability that $C > T(w_m - w_f)$ is the number $\xi(\Phi, \theta_m - \theta_f)$ given by

$$\begin{aligned}
\xi(\Phi, \theta_m - \theta_f) &= P\left(\tilde{C} > T(w_m - w_f) \mid \theta_m - \theta_f\right) \\
&\equiv \frac{\Phi f_q(\theta_m - \theta_f)}{\Phi f_q(\theta_m - \theta_f) + (1 - \Phi) f_u(\theta_m - \theta_f)} \\
&= \frac{1}{1 + \frac{1-\Phi}{\Phi}\varphi(\theta_m - \theta_f)}
\end{aligned}$$

This posterior probability (posterior to the observation of signals) depends on prior probability Φ and on couple's signal.

Now, how does a household decide which partner is the most appropriate to make this investment? We denote $\Phi_{W,T}$, the probability Φ for a given couple, hence for a given $W = w_m - w_f$ and for the value of T they have in mind. $\Phi_{W,T}$ is a scalar.

The man will be chosen to invest if and only if $\xi(\Phi_{W,T}, \theta_m - \theta_f) > \frac{1}{2}$, because it means that the posterior probability that the profit is higher when the man invests $\xi(\Phi_{W,T}, \theta_m - \theta_f)$, is superior in that case to the posterior probability that the profit is higher if the woman invests $(1 - \xi(\Phi_{W,T}, \theta_m - \theta_f))$.

$$\begin{aligned}
&\xi(\Phi_{W,T}, \theta_m - \theta_f) > \frac{1}{2} \\
\Leftrightarrow\ &\frac{1}{1 + \frac{1-\Phi_{W,T}}{\Phi_{W,T}}\varphi(\theta_m - \theta_f)} > \frac{1}{2} \\
\Leftrightarrow\ &1 > \frac{1-\Phi_{W,T}}{\Phi_{W,T}}\varphi(\theta_m - \theta_f) \\
\Leftrightarrow\ &\frac{\Phi_{W,T}}{1-\Phi_{W,T}} > \varphi(\theta_m - \theta_f) \qquad (4.1)
\end{aligned}$$

So the decision process of the household is the following: the couple assigns the man to invest if and only if signals differential is no less than the standard $t^*(\Phi_{W,T})$, where

$$t^*(\Phi_{W,T}) \equiv min\left\{\theta \mid \varphi(\theta) < \frac{\Phi_{W,T}}{1-\Phi_{W,T}}\right\} \qquad (4.2)$$

If prior to observing any signal, one couple believes that the probability is $\Phi_{W,T}$ that the man is "better" to invest, the couple will set the threshold $t^* = t^*(\Phi_{W,T})$. More optimistic beliefs will be reflected in easier thresholds, since t^* is decreasing in $\Phi_{W,T}$.

As a result, the household combines the stereotype, signals, wages and the level of specialization in order to take its decision.

4.3.4 Endogeneous wages

Until now, we have considered wages as exogeneous. However, it seems likely that making an investment in domestic production or not, at the beginning of couple formation, is not without consequences on future earned wage. Such a link has been theorized in

Becker's model of 1985, in which individual effort is limited and must be allocated across all activities. Effort expended on housework necessarily reduces the amount of effort available for market work. If work effort and wages are positively correlated, the wages of workers bearing greater household responsibilities will be lower than the wages of their less burdened counterparts, even if their human capital characteristics and labor market experience are identical. Thus Becker's effort model shows the presence of a housework effect that directly lowers wages.

Consequently, in our case, individual's hourly wage should depend whether he/she has invested or not, and this expected difference in wages is likely to be taken into account by partners when making their decision.

Considering now w_f^i [w_m^i] the wage of the woman [the man] if she [he] has invested, and w_f^{ni} [w_m^{ni}] the wage of the woman [the man] if she [he] has not invested, household profit if the man has invested becomes:

$$r_m = p^* h^{m,n}(t_f^{ni}, \rho t_m^i) - w_f^{ni} t_f^{ni} - w_m^i t_m^i - (-c_m)$$

In the same way, the profit if the woman invests in domestic production becomes:

$$r_f = p^* h^{m,n}(\rho t_f^i, t_m^{ni}) - w_f^i t_f^i - w_m^{ni} t_m^{ni} - (-c_f)$$

The condition in order the man is chosen to invest becomes:

$$
\begin{aligned}
& r_m > r_f \\
\Leftrightarrow\quad & p^* h^{m,n}(t_f^{ni}, \rho t_m^i) - w_f^{ni} t_f^{ni} - w_m^i t_m^i - (-c_m) > p^* h^{m,n}(\rho t_f^i, t_m^{ni}) - w_f^i t_f^i - w_m^{ni} t_m^{ni} - (-c_f) \\
\Leftrightarrow\quad & c_m - c_f > w_f^{ni} t_f^{ni} + w_m^i t_m^i - w_f^i t_f^i - w_m^{ni} t_m^{ni}
\end{aligned}
$$

Considering that when making their decision, people have in mind an average value of the time necessary to spend on domestic production according to the number of children in the household, independently of who invests, we can drop the subscript f and m for domestic times t^i and t^{ni}. The condition becomes:

$$c_m - c_f > t^i(w_m^i - w_f^i) - t^{ni}(w_m^{ni} - w_f^{ni}) \tag{4.3}$$

Hence the formal decision process remains the same as in the exogeneous case, but prior and posterior probabilities that the profit is higher when the man invests are now based on this new condition 4.3 in which wages are dependant on the investment in domestic production.

4.4 The results

4.4.1 Comparative-Static Analysis

– **For a given couple:**

Table 4.1: **Comparative-static analysis**

	$\frac{\Phi_{W,T}}{1-\Phi_{W,T}}$	$\varphi(\theta)$	**Investment of the man**
$\Phi_{W,T}$	+	$\varnothing$	more likely
θ_f	$\varnothing$	+	less likely
θ_m	$\varnothing$	-	more likely
Exogeneous wages			
w_f	+	$\varnothing$	more likely
w_m	-	$\varnothing$	less likely
$T = t^i - t^{ni}$	- for W>0 + for W<0	$\varnothing$	less likely more likely
Endogeneous wages			
If $w_m^i - w_f^i$ increases If $w_m^{ni} - w_f^{ni}$ increases	- +	$\varnothing$ $\varnothing$	less likely more liekly
If t^i increases	- for $w_m^i - w_f^i$>0 + for $w_m^i - w_f^i$<0	$\varnothing$ $\varnothing$	less likely more likely
If t^{ni} decreases	- for $w_m^{ni} - w_f^{ni}$>0 + for $w_m^{ni} - w_f^{ni}$<0	$\varnothing$ $\varnothing$	less likely more likely

It can be seen from Table 4.1 theoretical expected effects of different variables on the likeliness that men are chosen to invest.

What's the impact of a lightening of the stereotype, and consequently an increase in $\Phi_{W,T}$? $\frac{\Phi_{W,T}}{1-\Phi_{W,T}}$ increases, so the left hand of inequality 4.1 increases. Consequently, inequality 4.1 is easier to be satisfied, and the man will be more likely to be chosen. Considering now signals, if the signal of the man increases, $\varphi(\theta_m - \theta_f)$ decreases because $\varphi_{W,T}(\theta_m - \theta_f)$ is decreasing with $\theta_m - \theta_f$. Inequality 4.1 logically becomes easier to be satisfied. We conclude that if the stereotype is strong inside the society, for a couple who emits the signal $\theta_m - \theta_f$, it will be more difficult that condition 4.1 be realized, and as a result, the woman will invest more often. The stereotype decreases the left hand of condition 4.1, or in other words, increases the threshold t^*. Hence, in order for the man to be chosen, $\varphi(\theta_m - \theta_f)$

must be weak. Since $\varphi_{W,T}(\theta_m - \theta_f)$ is a decreasing function of $\theta_m - \theta_f$, the couple will need to observe a θ_m sufficiently high relative to θ_f in order to believe that the man is really as, or more able than his wife and is the right person for the investment which will be made.

Expected effects of wages and the degree of specialization in domestic production $T = t^i - t^{ni}$ depend on whether wages are assumed exogeneous or endogeneous from the investmeent in domestic production.

Considering wages as exogeneous, if the woman's wage w_f increases, it leads to a decrease of $w_m - w_f$, hence the probability $\Phi_{W,T}$ that $\tilde{C} > T(w_m - w_f)$ is higher. Consequently, inequality 4.1 becomes easier to be satisfied (or the threshold t^* in equation 4.2 becomes lower) and the man is more likely to be chosen. The opposite stands if the man's wage increases. Finally, the impact of the level of specialization, $T = t^i - t^{ni}$ depends on the sign of W. When $w_m - w_f > 0$, a higher level of specialization (a higher difference $t^i - t^{ni}$) decreases the likeliness that the man will be chosen. The opposite stands if $w_m - w_f < 0$. As in all societies, on average, men's wages are higher, more often, a high level of specialization tends to further decrease the chances that men will be chosen for household production.

Wages and specialization level effects are less straightforward if wages are treated as endogeneous. First, if for any reason, the gender wage gap is increasing for people who have made an investment in domestic production (if $w^i_m - w^i_f$ increases), the model predicts that men will be less often chosen to invest. This could occur if the wage penality for people having invested becomes higher for women, or lower for men. On the opposite, the model predicts that an increase in the wage gap for people who did not made the investment increases the number of men chosen to invest.

Finally, if the amount of domestic work time when people has invested increases (thus the degree of specialization between partners is increasing), in the case where the gender wage gap for people having invested is positive, the model shows that the probability that the man be chosen to invest decreases. We find the opposite if this specific gender wage gap is negative. In addition, if domestic work time for people who do not invest decreases, thus if the specialization between partners increases again, men will invest in a lower extent when the gender wage gap for people who have not invested is positive.

Results about time specialisation with exogeneous wages, and findings with endogeneous wages constitute testable implications of our model. [*Forthcoming*]

– **For the whole population:**

In a given household, the beliefs about difference of abilities between men and women, together with market wages, the degree of specialization they have in mind and signals, determine which partner will be chosen to invest in domestic production. Considering now all couples in the society, this will, in turn, determines the fraction of men who become qualified, and, hence, who specialize in domestic production. On average, according to empirical evidence on aggregate data, women earn lower wages than men. So on average, wage differences and stereotype effects reinforce each other to finally result in much more women than men be chosen to invest in the population.

The stereotype is defined by the deformation of distribution about abilities and can be measured by the probability: $1 - P(\tilde{C} > WT \mid w_m = w_f) = 1 - P(\tilde{c}_m > \tilde{c}_f) = S$.

Let us note $G(W, T, \theta, S)$ the proportion of men in the society who are chosen to invest.

Assuming a society in which $w_m = w_f$ on average in the population, $G(W, T, \theta, S) = P(\tilde{C} > WT \mid w_m = w_f) = 1 - S$. According to the definition of the stereotype S, the case where $w_m = w_f$ on average in the population, corresponds to a situation in which the stereotype is self-fulfilling: a belief of households members about the difference of abilities between men and women will be self-confirmed as households will induce men to invest at precisely the rate postulated by the beliefs. This is precisely the case when W is 0 in average in the population, hence if wages have no effect in the decision process. In this case, $1 - S = P(\tilde{C} > WT \mid w_m = w_f) = (\%\ of\ men\ who\ invest)/100$.

An important result can be drawn from there. Given that in average, women earn lower wages than men (according to empirical evidence on aggregate data), efficiency implies that a majority of women are chosen to invest in domestic production. The stereotype reinforces this effect, so that furthermore, even if a woman earns a higher wage than her husband, and true abilities of the two partners are equal, the couple will very often choose the wife to invest in domestic production, though efficiency would have implied to choose the husband. If a strong stereotype prevails in the society, in order the man to be chosen to invest, he has to earn a very low wage compared to his partner, or his signal has to be really higher compared to his partner's signal.

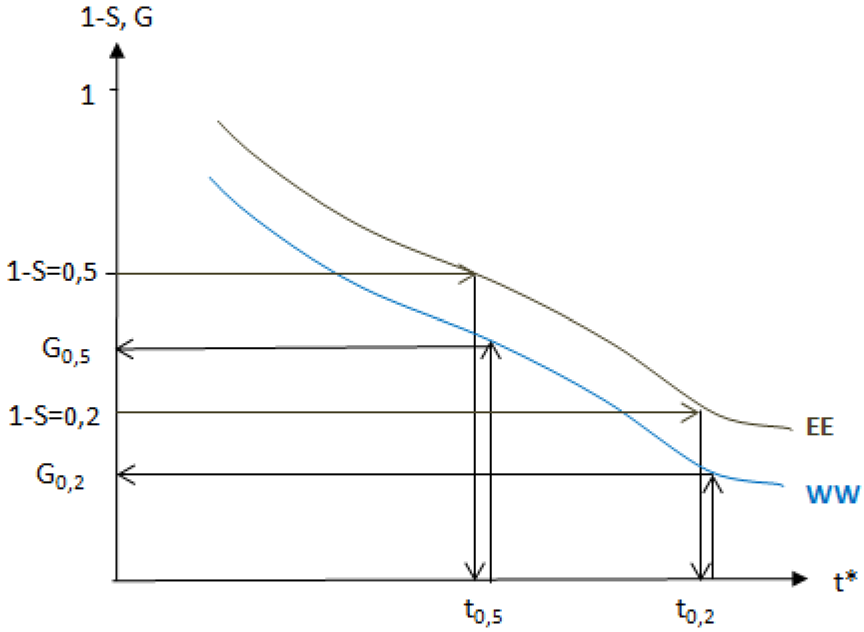
Finally, very few men are chosen to invest in domestic production, and the resulting resource allocation is Pareto inefficient. By introducing inertia in household decisions, the stereotype creates a second best Pareto inefficiency. Negative prior beliefs about ability of men will bias the assignment process.

4.4.2 A graphic analysis

Figure 4.4 below illustrates the analysis graphically, in the whole population. The horizontal axis measures the average value of the thresholds t^* in the population, while the vertical axis measures the opposite of the stereotype $1 - S = P(\tilde{c}_m > \tilde{c}_f)$, as well as the proportion of men who finally invest in the whole population, $G(t^*)$. The downward-sloping curve EE is the graph $\{t^*, 1 - S\}$, depicting standard t^*-stereotype pairs consistent with optimal household behaviour. Indeed, when the stereotype is strong in the society (1-S decreases), t^* increases. The downward-sloping curve WW is the graph $\{G(t^*)\}$, which represents 'standards t^*-proportions of men investing' pairs consistent with optimal household behaviour. Indeed, when t^* is high, few men invest in domestic production. The figure assumes $G(.)$ to be continuous. Wages are not represented in the graph, but they are incorporating in the determination of the standards t^*.

In figure 4.4, $w_m > w_f$, on average. Hence EE is above WW, which implies that the proportion of men investing (given by WW) is lower than the proportion of men believed to be more able than their wife in domestic production, namely $P(\tilde{c}_m > \tilde{c}_f) = 1 - S$.
Figure 4.4 shows different situations, according to the prevalence of the stereotype. Two levels of the stereotype are represented here. In the first situation, the stereotype is strong because people think that only 20 % of men have a higher ability than the average women ($S = 0,8$), while in the second situation, the stereotype disappears since half of the men

Figure 4.4: Different levels of the stereotype, for $w_m > w_f$, on average



are believed more talented than the average woman ($S = 0,5$). On average, $t_{0,2}$ is higher than $t_{0,5}$, and more men are chosen to invest when $S = 0,5$. In addition, 1-S is always superior to G. If, women's wages and men's wages were equal on average, curves EE and WW would merge and the stereotype would be self-fulfilling for any value of S.

4.5 Simulations and public policies implications

The objective of this part is to simulate the model above French data, allowing us to compute the level of the stereotype, and to analyse effects of different public policies.

4.5.1 Data and Calibration

The computation of the model is based on the French Time Use Survey of 2009-2010. This survey consists in collecting very precise information about daily activities of both the man and the woman in a couple. Interviewed household members write down their activities in a booklet during one day or two in this survey, indicating the time spent on each activity, according to a time slots of 10 minutes, during one day. The survey contains also many information about the family and its caracteristics. 12069 households and 18521 individuals are interviewed.

We select people living in a couple, married or not, with or without children, reporting a professional activity (full time or not). We drop 214 couples in which at least one of the spouses did not report a monthly wage or hours of work per week, and two couples in which the monthly wage was excessively high. Finally, we drop 23 couples in which at least one partner did not report daily activities in the booklet. In all, our final sample contains 2402 couples, so 4804 individuals. Note that interviewed people indicated their activities during one or two days (according to whether or not they filled in an extra-module about decision-making within couples). We use the first booklet here, for which the filling day was randomly selected.

Next tables show variables we extract from the survey to lead simulations. In Table 4.2, we observe that male hourly wage is on average 2.1 euros higher than female hourly wage, and that women devote on average 90.2 minutes more than men to domestic work during one day. In this empirical section, the partner qualified as the investor is the one who spends more time in domestic work during the day of the interview. If both partners spend exactly the same amount of time, we set the woman as the investor, as we mainly aim at studying the decision of choosing the man to invest, given than few men invest compared to women. According to this definition, we find that in 27.9 % of couples, the man is chosen to invest. In only 93 couples, both partners report the same amount of domestic work time. If we focus on couples in which one partner makes significantly more domestic work than the other, let's say 10% more, we find that 25.2 % of men are chosen to invest, 65.4 % of women, and 9.4 % have a similar level of domestic work. For the simulations, we consider that the man has invested in domestic production if he strictly spends more time making domestic work compared to his partner, thus we choose the first measure.

Table 4.2: General Descriptive statistics

	Men	**Women**
Hourly wage	12.90	10.82
	(13.33)	(10.15)
Age	41.55	39.70
	(9.70)	(9.63)
Domestic time (min/day)	140.9	231.1
	(145.8)	(159.7)
Who invests ?		
% of men who spend more time		27.98 %
% of women who spend more time		68.15 %
Exactly equal time		3.87 %
% of men who spend 10% more time than partner		25.19 %
% of women who spend 10% more time than partner		65.36 %
% of couples whose time diff is less than 10%		9.45 %

Number of couples: 2402

Values in (.) are standard errors.

As we have seen in last section, couples use the average level of time specialization $t^i - t^{ni}$ within the society to choose who invests in domestic production. Table 4.3 shows the composition of our sample according to the number of children per age in families, and Table 4.4 presents the amount of domestic work time spent by men and women. In all configurations, we observe that women spend more time than men in domestic production, and the time devoted to domestic work vary largely according with the number of children and their age. Indeed, both for the man and the woman, partners spend really more time to household work when they have at least one very young children compared to a situation in which they have only older children (between 3 and 18 years old). Domestic time of both partners increases as the number of older children increases, if they have no very young children. Then we observe different patterns for men and women if they have at least one very young children. In this case, having one other child above 3 years old increases domestic work time of the man by 61 minutes. Domestic work time of the woman decreases a little (by 10 minutes) in this situation. Now, adding a second child above 3 years old increases domestic work of the woman by 120 minutes compared to a woman with at least one child below three and 1 older child. However, domestic work time of the man decreases by 74.9 minutes in this configuration. Thus these simple means seem to suggest that the allocation of time between partners strongly depends on the number of children according to the age, and that the relation is not linear. In all, our assumption that the level of domestic production is largely influenced by the composition of the family is validated by our data.

Now what about the level of time specialization between partners according with family

Table 4.3: **Number of couples according to the number of children**

		3-18 years old					
		0	**1**	**2**	**3**	**>4**	**Total**
below 3 years old	**0**	920	477	544	153	12	2106
	1	138	107	35	8	2	290
	2	5	0	1	0	0	6
	Total	1063	584	580	161	14	2402

Table 4.4: **Mean of domestic work time (min/day), according to the number of children:**

		Men			
		3 -18 years old			
		0	**1**	**2**	**≥3**
below 3	**0**	115.5	133.2	147.3	146.5
	≥1	200.1	261.4	186.5	165.0
		Women			
		3 -18 years old			
		0	**1**	**2**	**≥3**
below 3	**0**	184.9	236.1	244.7	279.5
	≥1	309.6	298.7	418.8	317.8

composition ? Table 4.5 displays average levels of $t^i - t^{ni}$, that is the difference of domestic work time between the partner who has invested in domestic production and the partner who has not invested. We observe that the degree of specialization is higher when there is at least one very young children within the family, meaning that the partners who has invested spends really more time than the other, compared to a situation in which the couple does not have very young children. We can add that if the couple does not have very young children, the degree of specialization is increasing as the number of children above 3 increases. This effect does not persist as the family has at least one children below 3. But globally, the more the couple has children, and especially young children, the more time specialization is high, meaning that the partner who has invested devote really more time than the other. This could be due to the fact that as the amount of domestic work, including childcare, increases a lot when the couple has children, the surplus of domestic work due to the presence of children is mainly made by the partner who has invested, given that he/she became more productive in that work.

Table 4.5: **Time specialization $t^i - t^{ni}$ (min/day), according to the number of children:**

		3 -18 years old			
		0	**1**	**2**	**≥3**
below 3	**0**	130.6	154.7	168.6	198.5
	≥1	207.8	189.0	283.0	217.1

Our sample shows that in 36.41% of couples, the woman earns a higher hourly wage than her partner. Thus at this stage, assuming a simplified decision process only based on wage difference and assuming hourly wages as exogeneous, we would conclude that 36.41% of couples should have chosen the man to invest, while only 27.98% made this choice.

We adopt a Normal distribution for the abilities to make the investment in domestic production (c_m and c_f) which matches with the global mean and standard deviation of wages in our sample (men and women together) multiplicated with the average time specialisation. Indeed, both have to be comparable in amplitude, as they represent a cost due to the investment: $w_jT = w_j(t^i - t^{ni})$ represents the increase in the opportunity cost of doing domestic work due to the investment, and $(-c_j)$ represents the direct cost of doing the investment. The average hourly wage in the population (men and women together) is equal to 11.8 euros, and the average of time specialization (whoever the man or the woman invests) is equal to 158.1 minutes per day. In all, c_m and c_f follow a Normal distribution with a the same mean and standard deviation than $w_j \times 158.1$.

Signals are derived from true abilities plus a disturbance, following a standard Normal distribution. Figure 4.5 shows the Kernel density of signals difference $\theta = \theta_m - \theta_f$ given that it is more efficient that the man invests ($C > TW$), which corresponds to the density function f_q, and given that it is more efficient that the woman invests ($C < TW$), which corresponds to the density function f_u. Higher values of signals difference θ are actually more likely if it is efficient that the man makes the investment. Finally, $\varphi(\theta)$, the likelihood ratio at θ, is indeed a decreasing function (Figure 4.6 on the left). Figure 4.6 on the right shows the distribution of prior probabilities Φ_{WT}, which corresponds to prior beliefs of each couple that $C < TW$, for two values of the stereotype. The blue line corresponds to a situation in which people believe that $P(c_m > c_f) = 50\%$ (thus no stereotype because true belief), and the red line a situation in which people believe that $P(c_m > c_f) = 20\%$. Note also that Φ_{WT} depends on the value of wage difference W in the couple, and on the value of T the couple has in mind, and which depends on the number of children according to the age. As expected, the distribution of Φ_{WT} when the opposite of the stereotype is 20% is shifted towards the left compared to the situation with true belief about C, meaning that indeed, couples' beliefs about the probality the man should be chosen to invest $P(C > WT)$ are really lower in this case. Once couples have received signals about abilities, they formulate a posterior probability which help them to decide who is more able to make the investment. We have shown that they will choose the man to invest if and only if $\frac{\Phi_{W,T}}{1-\Phi_{W,T}} > \varphi(\theta_m - \theta_f)$. If there is no stereotype, our model shows that 47.2% of couples have chosen the man to invest, while with a stereotype of 80% (thus 1-S=20%), we find that 28.2% of men invests.

Figure 4.5: Kernel density of $\theta = \theta_m - \theta_f$ given that $C > TW$ (f_q) or that $C < TW$ (f_u).

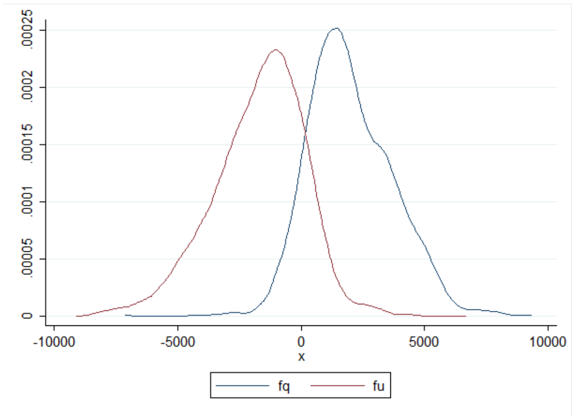
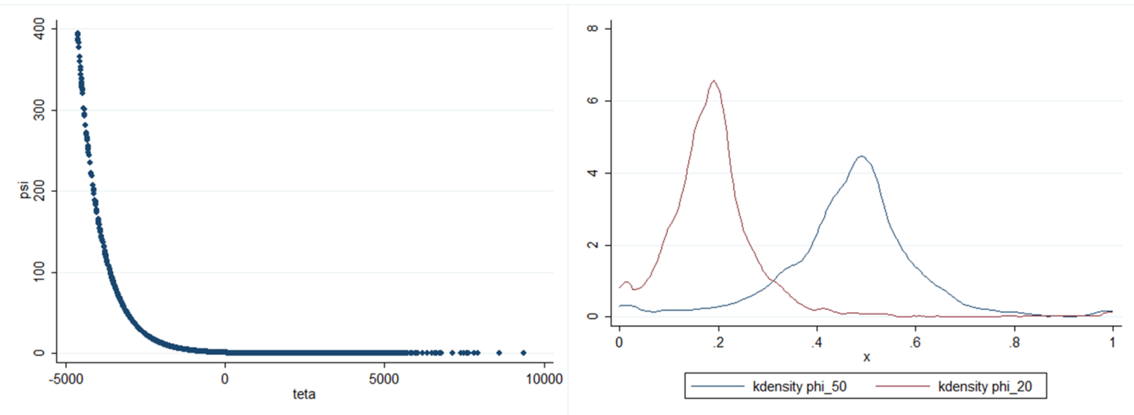


Figure 4.6: $\varphi(\theta)$ [left] and Φ_{WT} for no stereotype (50%) and a stereotype of 20% [right]



4.5.2 Measuring the impact of the stereotype

In this section, the value of the stereotype is changed in order to study how the stereotype impacts the proportion of men who invests in domestic production, and determine which value of the stereotype fits with the present sharing of time observed in our database.

Figure 4.7 shows the percentage of men who invest, and the value of the prior probability Φ_{WT}, according to the value of the stereotype $1 - P(c_m > c_f)$. In our survey, we observe that the man is chosen to invest in 27.98% of couples. According to our simulation results, this corresponds to a stereotype of 81%. The true probability that a representative woman has a higher ability c_f than a representative man is 0.50, but people believe that this probability has a value of 0.81.

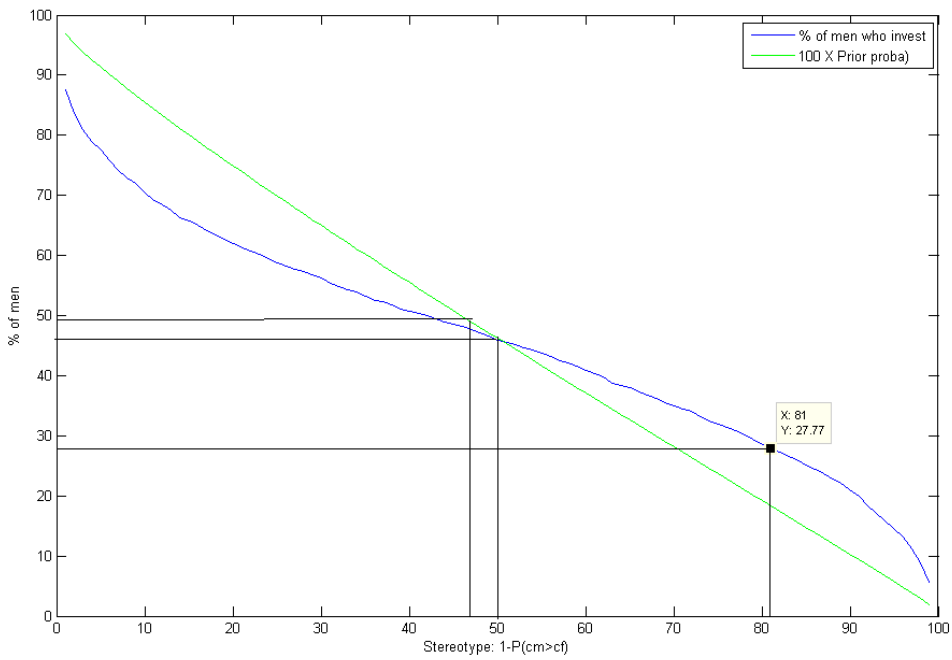
If the stereotype would have a value of 50%, thus "no stereotype" because true belief, we observe that 47.5% of men would invest. This is less than 50% because of the wage gap. In addition, given the actual wage gap, getting 50% of men chosen to invest would be reached for a stereotype of 45%, so that women would believed a little less able than men on average. As much as the stereotype is more than 50%, the posterior probability (or the % of men who actually invest) is always superior to the prior probability, meaning that signals help couples to revise their belief in the right sense, although without compensating the stereotype. If the stereotype is below 50%, we logically find the opposite direction.

4.5.3 Introducing a variation in the gender wage gap

In our survey we observe that on average, men's hourly wage is 2.08 euros higher than women's hourly wage. In this part, the gender wage gap is going to vary, to study how the stereotype and wage gap influence together the number of men who specialize in domestic production.

Figure 4.8 shows different curves representing the percentage of men who invest, according to different values of the wage gap. As expected, for any value of the stereotype, the number of men who invest is higher as the gender wage gap decreases. The red line curve corresponds to the same curve represented in the previous figure (4.7), and corresponds to

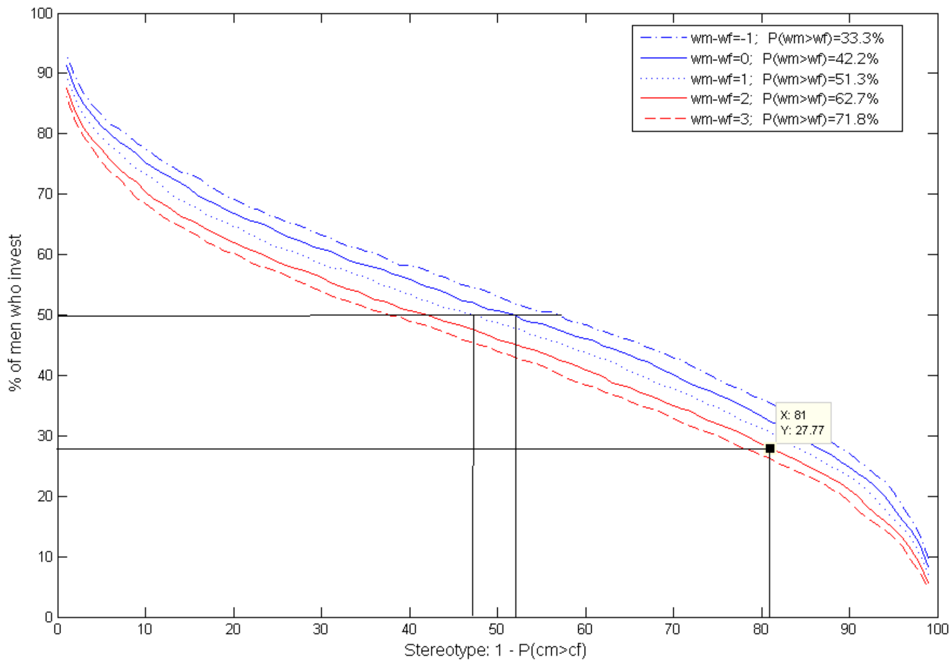
Figure 4.7: % of men who invest if $w_m - w_f = 2$ on average (actual wage gap)



the actual wage gap of 2. Based on the actual value of the stereotype, that is 81%, we observe that moving from a wage gap of 2 to a wage gap of 0 (solid blue line) allows to increase the number of men who invest by 4.58% (32.3% of men instead of 27.9%). Such a reduction of the gender wage gap would be a really strong phenomenon, but we remark that the associated evolution of the number of men who invest is quite weak. Indeed, the probability that in a couple, the man earns a higher wage than his wife decreases from 62.7% to 42.2% (thus a decreasing by 20.5%) following this reduction of the gender wage gap, while the probability that the man is chosen to invest increases only by 4.58%.

In addition, this simulation work shows that in order to reach 50% of men chosen to invest, the stereotype should be of 46% with the actual gender wage gap, of 51% with a gender wage gap of 1 euro, and of 56% with no gender wage gap. Finally, getting 50% of

Figure 4.8: % of men who invest, for different values of the wage gap

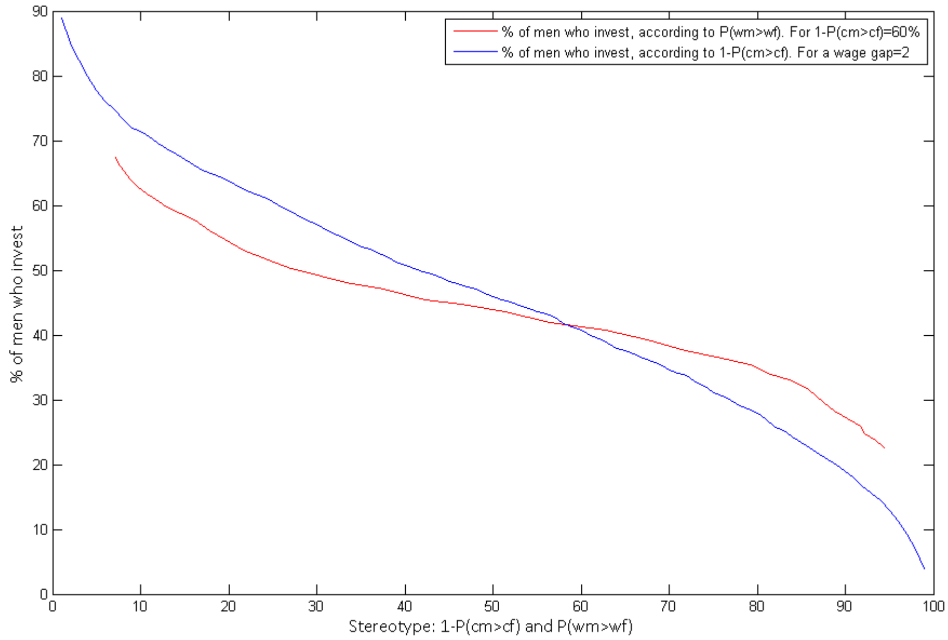


men chosen to invest imply a strong decreasing of the stereotype, even if the gender wage gap is reduced a lot. Note also that getting 50% of men chosen to invest, while staying with the actual level of the stereotype, would imply that on average, women earns 6 euros more than men per hour, which is disproportionate.

Finally, this simulation study shows that a reduction of the gender wage gap helps couples to choose the man to invest in a more efficient way, but the effect is quite low if the stereotype is not weakened in a high extent.

Graphic 4.9 shows the effects of the stereotype on the number of men who invests (given the actual wage gap of 2 euros) with the blue curve, and the effects of the wage gap on the number of men who invests (given a stereotype of 60%) with the red curve. Indeed, we see that the blue line is more sloping than the red curve, so that a variation of the stereotype has an higher effect on the % of men who invest.

Figure 4.9: % of men who invest, for different values of the stereotype (wage gap=2) and for different values of the wage gap (Stereotype of 60%)



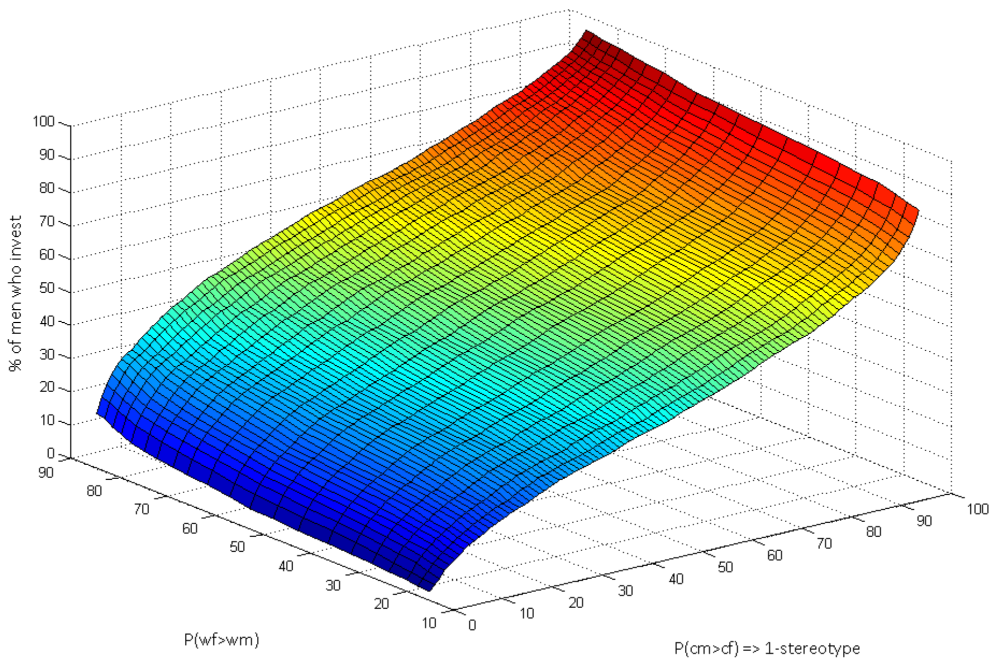
The figure 4.10 summaries these results by showing in an unique 3D graph the simultaneous impact of a variation of the wage gap and the stereotype. The vertical axis measures the percentage of men chosen to invest in domestic production. The x-axis represents $P(c_m > c_f)$, thus the opposite of the stereotype, and the y-axis represent the probability in the society that a women earns a higher wage than her partner.

This figure shows that as expected, the number of men who invest is always higher as the wage gap is reducing, for any value of the stereotype. In the same way, for any value of the gender wage gap, the number of men who invest is higher as the stereotype decreasing (or in other words as $P(c_m > c_f)$ is increasing). As expected too, getting 50% of men chosen to invest implies a fewer decreasing of the stereotype if the gender wage gap is in favor of women, and a fewer decreasing of the gender wage gap if the stereotype is in favor of women. In addition, we observe that the figure is more sloping toward the stereotype than the gender wage gap, which confirms that the % of men investing is more sensitive to the stereotype than the difference in wages between men and women.

In addition, if we place at the left end of the graphic, for a stereotype by 99% (thus $P(c_m > c_f)= 1$), we observe that moving $P(w_f > w_m)$ from 13% to 85,5% allows to increase the number of men who invest from 1.6% to 15.5%, thus an increase in 14%. However, if we consider the gender wage gap at the left end of the graphic, by 16%, we observe that moving $P(c_m > c_f)$ from 1% to 99% leads to increase the number of men investing from 1.6% to 81%, thus an increase in 80 percentage points. Finally, the contrast in the influence of the gender wage gap and in the influence of the stereotype is unambiguous: the number of men who invest is really more sensitive to a variation in the stereotype than a reduction of the gender wage gap.

Finally, a policy which only aims at reducing the gender wage gap, without willingness to weaken beliefs grounded in the society, seems be problematic as it may result in few real changes in the number of men who invest in domestic work. A reduction of the gender wage gap won't lead couples to share household work in a more efficient way if the stereotype still strongly prevails in the society. It even appears that weaker stereotypes may contribute to reduce gender wage gap as it may result in higher women's attachment to the labour market, and in turn to increase the number of men who invest in next periods. Thus a policy which strongly focuses on reducing the stereotype, for instance through campaigns

Figure 4.10: % of men who invest, for different values of the stereotype and the wage gap



to raise public awareness about the stereotype, in media or at schools, together with an objective of reduction of the gender wage gap, seem to produce quite strong (immediate ?) effects, with expected persistent and long-run impacts by increasing female investment in the labour market. Such a policy may also favour wage equality in the long run.

The next section investigates whether these effects persist when wages are considered as endogeneous.

4.5.4 Introducing a variation in the variance of the signal

We make vary here the variance of the signal, so its quality, in order to study the impact on decisions. We expect that a very informative signal on the true ability (people are not aware about the quality of the signal) leads to a strong stereotype in order to achieve the actual allocation of time within partners. Indeed, signals bring an information very closed to the true distribution of abilities which is the same for men than for women, and the stereotype has to be very strong to lead to the inegalitarian observed situation. On the contrary, very noisy signals will confuse the information, and the stereotype do not need to be too strong to achieve the actual proportion of men chosen to invest. Simple simulations making vary the variance of the signal confirm this supposition: the more the signal is noisy, the more the stereotype weakens.

4.5.5 Endogeneous wages

In this part, we lead the same type of simulation work, but considering wages as endogeneous, and particularly dependant on whether or not the individual has invested in domestic production. Indeed, wages are likely to depend on labour attachment to the labour market, and making an investment in domestic production leads to less time devoted to work in the labour market (Becker, 1985). In this part, we will consider that when choosing who will invest in domestic production, partners take into account the impact of this investment on the wage they may expect. We lead a switching model in order to predict the wage each partner would have earned if the opposite choice had been made. In other words, we will predict the wage the partner who has invested in domestic production would have earned if he/she had not invested, and the opposite for the partner who has not invested.

4.5.5.1 Estimation of wages

Considering wages as endogeneous amounts to define two type of wages for each individual: the wage he may expect if he invests in domestic production, and the wage he may expect if he does not invest. However, only wages in one situation are known, and we aim at estimating the wage each partner would have earned if the choice of the investor in the household would have been inversed. We use an endogeneous swtiching regression model (Lee (1978), Maddala (1983), Lokshin and Sajaia (2004) [1]) to proceed to these estimations, through a full-information Maximum Likelihood method (FIML) which simultaneously fits binary and continuous parts of the model in order to yield consistent standard errors. In this model, a switching equation sorts partners over two different states; he/she has invested in domestic production or not, and only one regime is observed.

Consider the following specification:

$$ln(w_j^i) = X_j\beta_1 + \epsilon_{1j} \tag{4.4}$$

$$ln(w_j^{ni}) = X_j\beta_2 + \epsilon_{2j} \tag{4.5}$$

$$I_j^* = \delta(w_j^i - w_j^{ni}) + Z_j\gamma + u_j \tag{4.6}$$

I_j^* is the criterion function, that determines which regime the agent faces. This is a latent variable that determines if the individual j has invested or not in domestic production. w_j^i is the wage of individual j if he has invested, w_j^{ni} the wage if individual j has not invested; Z_j is a vector of characteristics that influences the decision regarding which partner invests in domestic production. X_i is a vector of individual characteristics that is thought to

1. We use the `movestay` Stata command developped by Lokshin and Sajaia (2004)

influence individual wage. β_1, β_2 and γ are vectors of parameters, and u_j, ϵ_1, and ϵ_2 are the disturbance terms. The observed dichotomous realization I_j of latent vairable I_j^* of whether the individual j is chosen to invest or not has the following form:

$$\begin{aligned} I_j = 1 \qquad & if\ I_j^* > 0 \\ I_j = 0 \qquad & otherwise \end{aligned} \tag{4.7}$$

We assume here that the choice of who invests in domestic production is endogeneous to wages. Indeed, as seen in the theoretical part, the choice of the investor is dependent on expected wages of each partner if they have invested or not. In addition, some unobserved characteristics that influence the probability to choose the man to invest could also influence the wages the partners receive once the choice is made. Neglecting these selectivity effects is likely to give a false picture of the relative earning positions in both a situation in which the partner has invested and a situation in which he/she has not invested. The simultaneous ML estimation corrects for the selection bias in each regime.

This system is estimated separately for men and for women. The choice indicator in 4.7 take a value 1 if the man is chosen to invest and 0 if the woman is chosen, both in the man and the woman system. The wage equations (4.4 - 4.5) estimate log of individual hourly wages. Note that the selection equation contains exactly the same variables for the estimation for the man and the woman system. The exogeneous variables in the wage regressions include such individual characteristics as age, age^2, the number of children below 3 years old, and the number of children between 3 and 18, education, geographical area: living in a small town or in the countryside, as opposed to living in a big town (in which wages are higher on average), dummies indicating whether or not the workers are foreign-born (to capture some possible discrimination on the labour market), and the employment sector (public sector, private sector or self-employed).

In order to identify δ, some variables have to be excluded from the wage equations. Thus in addition to these variables, the investment selection equation includes specific variables to improve identification. In order to find variables that likely influence the choice of the man as the investor but do not affect wages, we include variables related to the partner, or relative variables between partners. For instance, when estimating the system for the man, we include as exclusion variable the level of education of the woman, her employment sector, a dummy variable indicating whether or not she is foreign-born, her age, and a dummy indicating whether the woman achieves a better occupational status than her partner (with the following order: worker/employee; technician/supervisor; self-employed; manager/executive). We also include a dummy indicating whether the diary booklet was filled in during a week-day compared to a week-end day, that may influence the choice given that the way we identify the investor.

In addition, we include specific non-economic variables, that may partly capture sociological or psychological variables affecting the choice. These non-monetary variables are included in the "Couples decision-making module" of the French Time Use survey (2009-2010). The sample of household who answered this module is lower (940 couples using the same selection critera than for the whole sample, in place of 2402 couples). However, we believe that these non-monetary variables are highly important to estimate the choice of who invest in domestic proudction in the household, and then to provide good predictions of wages in both regimes. Many variables has been tested, and we have selected those showing a significant impact on the choice of the man as the investor in domestic production. These new variables are the following:

- A dummy variable indicating whether or not each partner has already lived in a couple before, for at least one year.

- Dummy indicators for the first housing in which they moved together: they moved in the woman's housing / in the man's housing / in a new housing for both partners.

- A dummy about whether each partner was brought up by his both parents in a couple, compared to any other situation.

- The repartition of personal assets between partners (though a monetary variable). We use the ratio of the logarithm of female assets on the logarithm of male assets.

Table 4.6 presents main descriptive statistics to compare this new sample with the previous one, and descriptive statistics about new additional variables. Women earn a little higher wage in the narrow sample compared to the first one (39 cents more), leading to a wage gap of 1.59 euros (2.08 in the large sample). They are a little older in the narrow sample, but the difference is really small. As for domestic work time, they are quite similar between the two samples. The percentage of men chosen to invest is a little lower in the narrow sample, but only 1% less.

Tables 4.7 and 4.8 show estimation results of the switching model, respectively for men and for women. Then we use estimated parameters in log-wage equations to predict the counterfactual for each partner.

We observe that the probability that the man is chosen to invest is negatively impacted by

Table 4.6: Descriptive statistics about both samples

	Narrow sample *940 couples*		**Large sample** *2402 couples*	
	Men	**Women**	**Men**	**Women**
Hourly wage	12.80 (10.28)	11.21 (12.09)	12.90 (13.33)	10.82 (10.15)
Age	41.88 (9.48)	40.02 (9.56)	41.55 (9.70)	39.70 (9.63)
Domestic time (min/day)	136.3 (137.4)	239.3 (160.8)	140.9 (145.8)	231.1 (159.7)
	Who invests ?			
% of men who spend more time	26.91%		27.98%	
% of women who spend more time	69.15%		68.15%	
Exactly equal time	3.94%		3.87%	
	Additional variables			
Age diff (f-m)	-1.85 (4.19)			
Ratio educ, in years (f/m)	1.058 (0.302)			
Statut>partner	13.77 %			
$\frac{ln(female\ assets)}{ln(male\ assets)}$	1.16 (1.79)			
	Men	**Women**		
Couple before	20.01%	18.44%		
Both parents	84.88%	85.07%		
First housing: woman	21.82%			
First housing: man	23.65%			
First housing: new	54.53%			

Values in (.) are standard errors.

the fact he is self-employed. If the woman is working in the public sector, she is more likely to invest, but if she has a diploma with a level Bac+5 or more, her partner is more likely to invest (significant only in the man estimation for both). If the man was brought up by his both parents in a couple, he will invest in a higher extent in domestic production, compared with another man without this characteristic. This is significant only in the man estimation again, and there is no effect of this same variable for the woman. If the woman reaches a higher status than her husband, the probability he invests is higher. This effect is significant in both estimations, but the effect is stronger in the woman estimation. The more the assets of the wife are higher compared to those of her husband, the lower is the probability he invests. As for the first housing where partners lived together, if the man moved in the woman's housing, he has a higher probability to invest rather than a situation in which partners moved in a new housing. This effect appears significant only in the man system estimation. However, in the woman system estimation, we find that the man invests significantly more when the woman moved to man's housing, compared with moving in a new housing. Thus globally, when the first housing was a new place for both partners, the woman is more likely to invest rather than any other situation.

Table 4.7: **Man's log wage-equations and investment selection function**

	Wage: He has invested	Wage: He has not invested	Selection function: he has invested	
			Male variables	Female and couple variables
Age	0.034 (0.035)	0.053 (0.023)**	0.102 (0.083)	-0.117 (0.084)
Age^2	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)	0.001 (0.001)
Child<3	-0.020 (0.139)	0.082 (0.066)	0.225 (0.168)	
Child 3-18	0.012 (0.052)	0.016 (0.025)	0.048 (0.062)	
CAP-BEP	-0.181 (0.187)	0.070 (0.060)	-0.172 (0.173)	-0.001 (0.349)
Bac	0.127 (0.156)	0.320 (0.093)***	-0.346 (0.229)	0.166 (0.352)
Bac +2	-0.007 (0.270)	0.340 (0.070)***	0.016 (0.201)	0.076 (0.282)
Bac +3 or +4	0.129 (0.280)	0.465 (0.101)***	-0.247 (0.277)	0.371 (0.236)
Bac +5 or PhD	0.351 (0.229)	0.750 (0.095)***	0.112 (0.273)	0.499 (0.295)*
Public sector	-0.045 (0.129)	0.003 (0.044)	0.191 (0.128)	-0.272 (0.113)**
Self-employed	-0.291 (0.370)	-0.405 (0.107)***	-1.003 (0.372)***	-0.128 (0.226)
French	-0.090 (0.110)	-0.348 (0.085)***	-0.349 (0.249)	-0.101 (0.243)
Rural	-0.014 (0.130)	-0.033 (0.049)	-0.009 (0.122)	
Little town	-0.320 (0.095)***	-0.098 (0.062)	-0.110 (0.158)	
Constant	1.612 (1.056)	0.988 (0.436)**	-0.334 (1.344)	
Couple before			-0.216 (0.140)	0.199 (0.175)
Both parents			0.279 (0.136)**	-0.265 (0.221)
Status woman>man				0.324 (0.167)*
Ratio assets (f/m)				-0.105 (0.042)**
Weekday				-0.219 (0.176)
Man moved to woman's housing				0.360 (0.131)***
Woman moved to man's housing				0.204 (0.247)

Observations: 940, Std err in (), * significant at 10%; ** at 5%; *** at 1%

Table 4.8: **Woman's log wage-equations and investment selection function**

	Wage: She has not invested	Wage: She has invested	Selection function: he has invested	
			Female variables	Male and couple variables
Age	0.052 (0.034)	0.017 (0.024)	-0.016 (0.069)	0.013 (0.083)
Age^2	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.001)
Child<3	0.038 (0.101)	0.105 (0.086)	0.088 (0.165)	
Child 3-18	-0.002 (0.032)	0.018 (0.034)	0.021 (0.064)	
CAP-BEP	0.032 (0.086)	0.199 (0.068)***	-0.030 (0.172)	-0.069 (0.153)
Bac	0.066 (0.113)	0.267 (0.111)**	0.161 (0.220)	-0.122 (0.384)
Bac +2	0.378 (0.110)***	0.301 (0.079)***	-0.143 (0.227)	-0.029 (0.186)
Bac +3 or +4	0.213 (0.105)**	0.306 (0.093)***	0.295 (0.218)	0.174 (0.260)
Bac +5 or PhD	0.516 (0.144)***	0.615 (0.130)***	0.131 (0.330)	0.123 (0.464)
Public sector	0.053 (0.117)	0.114 (0.052)**	-0.141 (0.184)	0.165 (0.159)
Self-employed	-0.197 (0.371)	-0.712 (0.144)***	-0.317 (0.330)	-0.494 (0.282)*
French	0.232 (0.164)	-0.094 (0.112)	-0.031 (0.225)	-0.493 (0.238)**
Rural	0.017 (0.110)	0.010 (0.056)	-0.069 (0.118)	
Little town	-0.063 (0.080)	-0.043 (0.069)	-0.073 (0.162)	
Constant	1.261 (1.169)	1.138 (0.463)**	-0.538 (1.357)	
Couple before			-0.070 (0.158)	0.165 (0.115)
Both parents			0.330 (0.216)	-0.101 (0.109)
Status woman>man				0.404 (0.152)***
Ratio assets (f/m)				-0.046 (0.040)
Weekday				-0.235 (0.176)
Man moved to woman's housing				0.241 (0.163)
Woman moved to man's housing				0.179 (0.108)*

Observations: 940, Std err in (), * significant at 10%; ** at 5%; *** at 1%

4.5.5.2 Simulation results with endogeneous wages

Considering wages as endogeneous, simulations predict a quite strong weakening of the stereotype, as it is now equal to 68%, while we found 81% considering wages as exogeneous.

Figure 4.11: % of men who invest if $w_m - w_f = 1.5$ on average (actual wage gap). Endogeneous wages

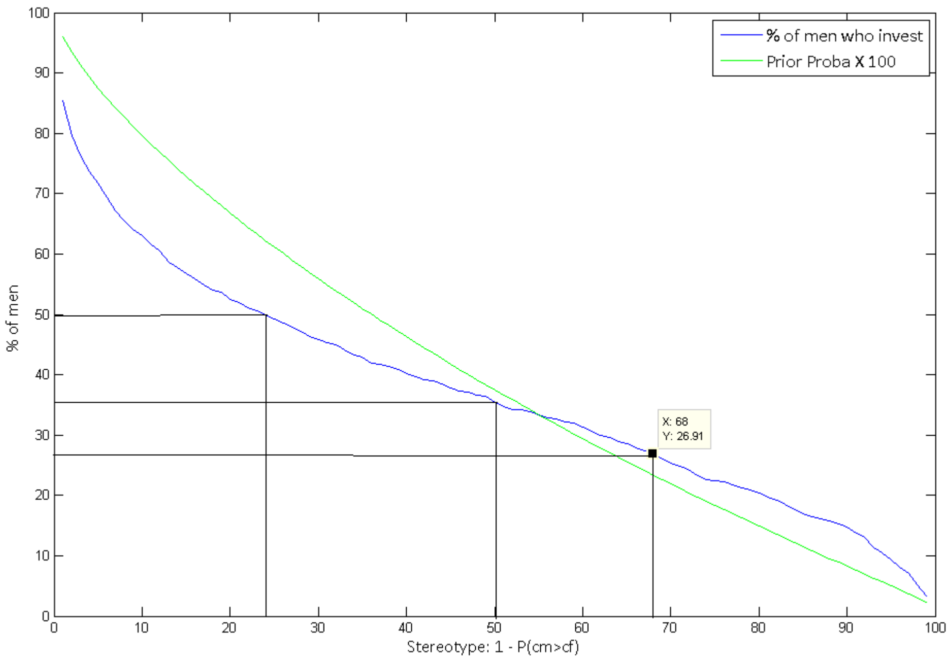
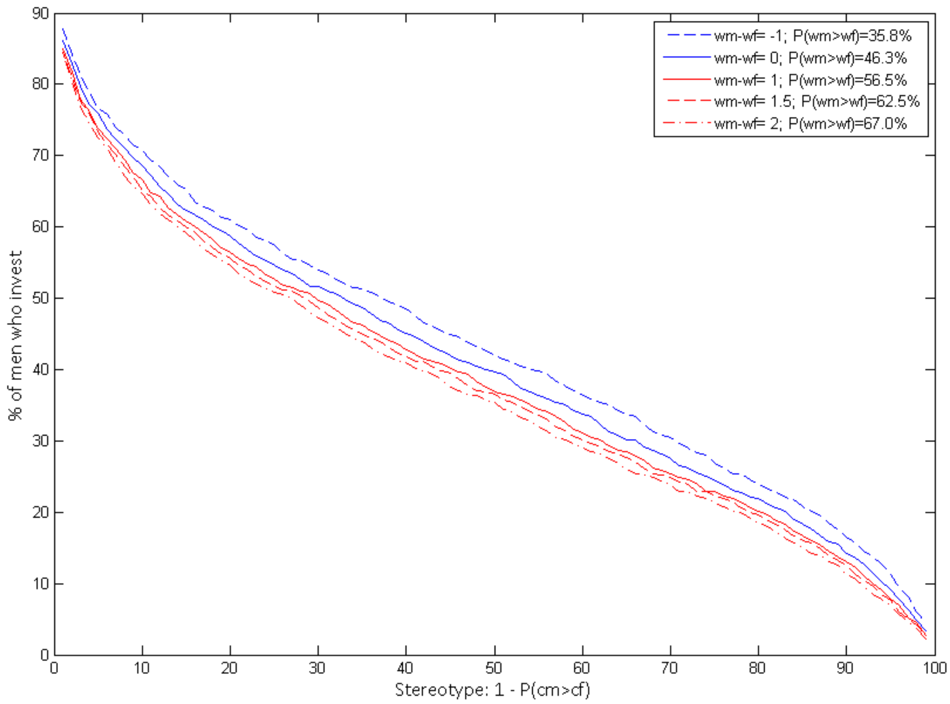


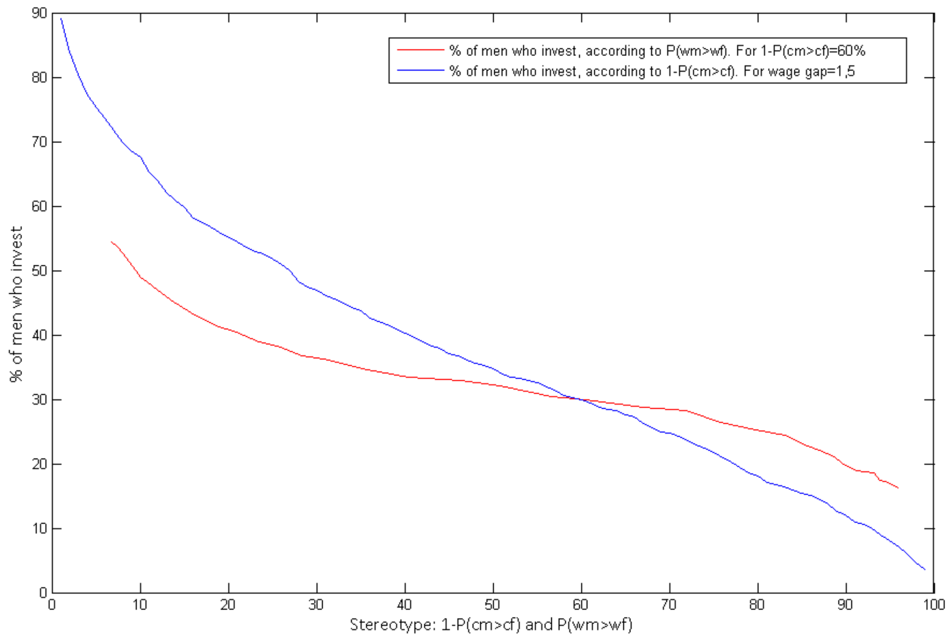
Figure 4.11 shows that a belief of 50%, thus no stereotype actually, leads to a percentage of men chosen to invest by 35.4 %, which is very low compared with such a reduction of the stereotype, and compared to results using wages as exogeneous. In addition, in order to get 50% of men chosen to invest, the stereotype has to take the value of 24%, leading to a complete reversal of the belief. Thus it appears that the gender wage gap introduces now a larger inertia in the way the stereotype influences the number of men who invest,

Figure 4.12: % of men who invest, for different values of the wage gap. Endogeneous wages



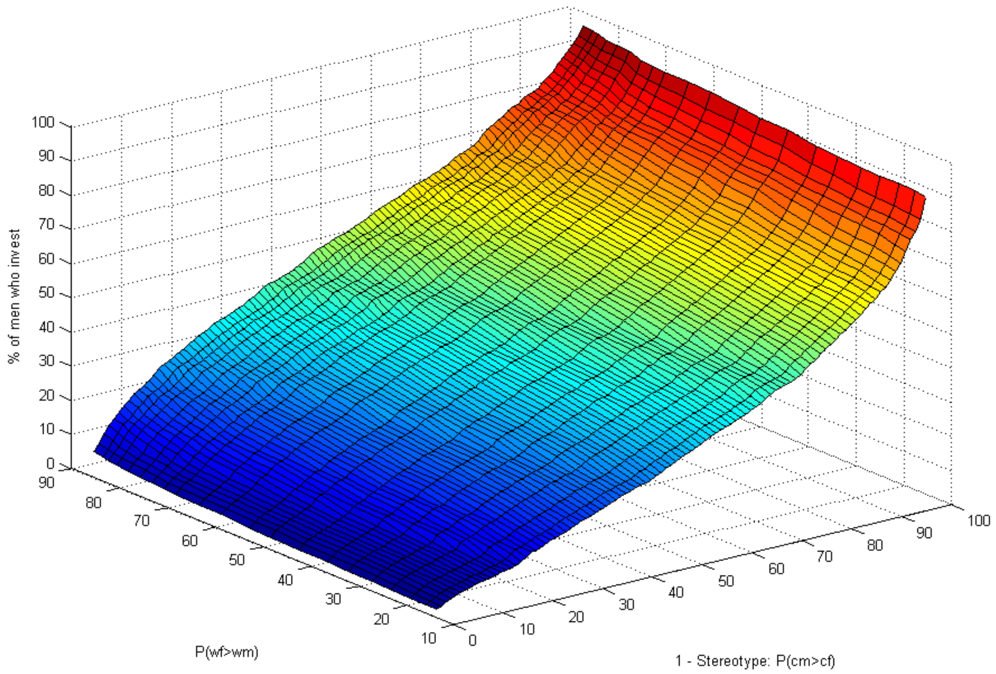
particularly when the stereotype is strong. Indeed, if we compare the graphic 4.7 (exogeneous wages) with the graphic 4.11, we observe that the blue and green lines in the second graphic are below the same curves in the case of exogeneous wages. Particularly, with endogeneous wages, the blue line is more sloping compared with exogeneous wages, for a reversed stereotype. We find the contrary for large values of the stereotype. Thus for a strong stereotype, even if it is decreasing, the number of men chosen to invest increases, but in a lower extent compared with exogeneous wages. Certainly the gender wage gap is more marked with endogeneous wages, preventing the % of men investing to ajust as well as the situation with exogenous wages.

Figure 4.13: % of men who invest, for different values of the stereotype (wage gap=1.5) and for different values of the wage gap (Stereotype of 60%). Endogeneous wages



Considering wages as endogeneous reduces the elasticity of the number of men investing with the value of the stereotype. But do wages impact now in a higher extent the number of men chosen to invest ? Figure 4.12 shows that based on the actual value of the stereotype, that is 68%, we observe that moving from a wage gap by 1.5 (dotted red line) to a wage gap of 0 (blue line) allows to increase the number of men who invest from 26.9% to 29.6%, thus an increase in 2.7 percentage points, and moving from a wage gap from 2 (the lower dotted red line) to 0 increases the number of men by 3.7 percentage points (with exogeneous wages, we found an increase in the number of men chosen to invest by 4.58 percentage points for the same decrease in the gender wage gap). Thus considering wages as endogeneous reduces a little the effect of a change in the gender wage gap.

Figure 4.14: % of men who invest, for different values of the stereotype and the wage gap. Endogeneous wages



By comparing graphics 4.13 (endogeneous wages) and 4.9 (exogeneous wages), we observe that the two curves in the first case are below the two curves in the second case, showing that both the effect of the wages and the stereotype are lower in the endogeneous case. For a belief above 50%, we observe that the two curves are less slopping in this situation than in the exogeneous case.

Finally, the 3D graph 4.14 reflects well the lower effet of wages on the % of men chosen to invest, as it is less sloping on the side of $P(w_f > w_m)$ compared with the same graph considering wages as exogeneous. In addition, the effect of the belief about $P(c_m > c_f)$, thus the opposite of the stereotype, appears less sloping for $P(c_m > c_f) < 50\%$ compared with exogeneous wages.

Even if both effects are smaller, a change in the value of the stereotype always exerts a higher effect than a change in the gender wage gap.

4.6 Conclusion

We show through a theoretical model that, even if men and women are equally endowed ex ante, a negative stereotype upon the capacity of men in reaching a high productivity level in household production can result in a situation in which households (correctly) perceive the groups to be unequally productive, ex post. The stereotype reinforces the effect of wage differences in the labor market, leading only a very small minority of men to (partly) specialize in domestic production while efficiency, as well as equity, would have implied less segregation in gender roles. We also show that this effect is still stronger, the higher the specialization level.

We empirically measure the model through simulations. The true probability that a man is more able than a woman to make an investment in domestic production is 50%. However, we find that a stereotype bias people belief about this probability, as the society believe that 19% of men may be more able than woman, considering exogeneous wages, and 32% considering wages as endogenously determined. Then we simulate variations in the value of the stereotype and in the gender wage gap, to investigate the role of policy measures to restore efficiency and equity. We show that the percentage of men chosen to invest is largely sensitive to the value of the stereotype, while the gender wage gap seems to exert a smaller effect. Sensitivity to both variables are a little smaller considering wages as endogeneous.

It appears that trying to improve women's situation only through a gender wage gap reducing objective may results in few changes in the allocation of time within couples, if a stereotype about abilities in domestic production prevails in the society. Besides policies targeting wage equality between men and women, policies directly targeting beliefs should have a larger positive impact. In addition, an unequal division of labor within the family strongly interacts with women's situation in the labor market: it is very unlikely that wage and income equality can be attained without an equal sharing of household production. Thus in a dynamic perspective, a larger share of men investing in domestic production would imply a larger investment of women in the labour market, leading them to earn higher wages, and reducing the gender wage gap in turn.

For instance, the objective of public policies could be to increase the revealing of true abilities: paternity leaves, as well as strong incentives for a sharing of parental leave between mother and father (as in some Northern countries, for example) would result in decreasing the strength of the stereotype by showing to both parents that, in fact, their abilities in household production are much often more similar than what they initially believed. At the same time, this would decrease $(-c_m)$, the cost of investment in domestic production for men.

Another types of political measure could directly act on the stereotype, as broadcasting advertisements promoting a better sharing of tasks between partners (advertisements showing

men performing domestic tasks for instance), or encouraging little boys to play with the usual toys for girls connected with domestic tasks (dolls, dolls' tea sets, etc.).
Finally, firms could also be encouraged to recognize and promote fathers' role by family friendly policies addressing men (no meeting late in the evening, tolerating sick leave in case of a child's illness, etc...)

Finally, such policies which aim at strongly reducing the stereotype, together with an objective of decreasing the gender wage gap, seem to produce strong immediate impacts, and vertuous effects on the long run. They might restore the first best optimum and promote gender equality at the same time.

Further research may contribute to better understand the dynamic of process, particularly by investigating how long time needs the society to achieve the first best optimum. Actually, the effects of the gender wage gap and the stereotype may also differ in the time they take to produce changes in the proportion of men investing in domestic production. Such an analysis may help to design at best public policies.

4.7 Database

Emploi du temps - 2010 - (2010), INSEE, Centre Maurice Halbwachs (CMH)

Conclusion Générale

L'ensemble de cette thèse fut consacrée à l'étude de la prise de décision au sein des couples ainsi que l'analyse des choix éducatifs selon le genre.

Jusqu'à présent, les modèles économiques offrent une meilleure compréhension des décisions prises au sein des ménages et des choix d'orientation scolaire des élèves, mais ne parviennent pas à expliquer les différences de genre dans leur globalité.

En effet, les variables économiques traditionnelles (salaires, revenu, niveau d'éducation) ne permettent pas de représenter entièrement l'allocation du temps entre les partenaires, et plus spécifiquement pourquoi les femmes continuent de prendre en charge la majorité des tâches domestiques, même si leur niveau d'éducation et leur participation au marché du travail a fortement augmenté durant la seconde moitié du 20$^{\text{ième}}$ siècle.

De manière similaire, les modèles de capital humain ne parviennent pas à expliquer pourquoi les filles et les garçons effectuent des choix éducatifs différents, et plus particulièrement

pourquoi les filles choisissent des filières conduisant à des carrières moins prestigieuses et moins rémunératrices, alors qu'elles réussissent aussi bien que les garçons à l'école.
Ainsi, il s'avère nécessaire de chercher à représenter un optimum de second rang, intégrant des contraintes telles que des représentations sociales dans l'analyse.

Le premier chapitre composant cette thèse a donc cherché à mieux comprendre les déterminants de "qui obient quoi" dans le couple, en terme de ressources monétaires et de temps. L'idée générale consistait à confronter une règle de partage empirique, directement calculée à partir de la nouvelle Enquête Emploi du Temps française de 2009-2010, à une règle de partage théorique, estimée dans le cadre du modèle collectif.
Le calcul de la règle de partage empirique fut permis grâce à la richesse de cette nouvelle enquête, qui offre l'avantage considérable de fournir à la fois des informations sur les dépenses personnelles de chacun des partenaires, en plus de données précises sur leur emploi du temps. Il est ainsi possible de calculer, pour chaque couple, la part du revenu complet reçue par chaque conjoint, en prenant en compte à la fois les dépenses personnelles et le temps de loisir, évalué au salaire horaire. Il s'avère que les femmes reçoivent en moyenne 45 % du revenu complet du ménage.
Le "challenge" consistait alors précisément à développer une règle de partage théorique, dérivée du modèle collectif, et directement comparable à la règle de partage empirique. Cela fut possible en considérant une règle de partage théorique basée sur le revenu complet du ménage (et pas uniquement sur le revenu hors travail du ménage), et en avançant l'hypothèse de biens domestiques marketable et d'une séparabilité entre les biens exclusifs et l'ensemble des autres biens (biens publics et biens communs pour la famille). Ainsi,

une règle de partage théorique est définie conditionnellement aux dépenses consacrées aux autres types de biens (biens publics et biens communs), et qui s'avère ainsi être directement comparable à la règle de partage empirique, en niveau et dans ses dérivées.

Un troisième volet de ce chapitre a consisté à introduire et tester de nouveaux facteurs de distribution, non-économiques, afin d'analyser dans quelle mesure introduire davantage d'information sur le processus de décision au sein des couples aide à améliorer la convergence entre le modèle collectif et les données. Ces nouveaux facteurs de distribution ont trait à la situation professionnelle de la mère de chaque partenaire quand ils avaient 16 ans, leur propre situation professionnelle lorsqu'ils se sont rencontré pour la première fois (s'ils avaient un emploi ou non), la présence d'enfants d'une union précédente, et le nombre d'années depuis qu'ils vivent ensemble.

Ce chapitre montre que l'impact du salaire horaire de la femme sur la part qu'elle reçoit est estimé de manière très proche selon que l'on se base sur la règle de partage théorique ou empirique. L'influence du revenu hors travail apparaît quand à lui assez différent selon les deux cas. Les résultats sont très éloignés en ce qui concerne l'impact du salaire de l'homme et du sex ratio (le facteur de distribution habituellement utilisé). Ajouter de nouveaux facteurs de distribution quand au contexte biographique des partenaires ne permet pas d'améliorer la convergence entre la règle de partage théorique et empirique. Néanmoins, ces facteurs non-économiques expliquent les parts empiriques reçues par chacun, et jouent donc un rôle effectif dans le processus de décision des couples. Ces variables pourraient en fait capturer en partie la présence de normes sociales dans la société, influançant les pouvoirs de décision, bien que non observables. Globalement, ces divergences mises en évidence entre la règle de partage théorique et empirique conduisent à questionner l'hypothèse d'efficience sur laquelle le modèle collectif repose.

Le second chapitre de cette thèse s'est quand à lui penché sur la sphère production du ménage, en confrontant l'hypothèse d'efficience aux choix d'allocation du temps dans les couples. La nouvelle enquête Emploi du Temps de 2009 fut également employée à cet objectif, mais également l'enquête précedente de 1998-99. Ce chapitre s'intéresse aux couples où la femme investit de manière intensive dans sa carrière, et analyse comment les conjoints adaptent leur temps à la situation professionnelle de la femme. Selon l'hypothèse d'efficience, ou de minimisation des coûts, les conjoints de ces femmes devraient prendre en charge de manière plus importante les tâches domestiques par rapport aux autres hommes, ou même en faire davantage que leur partenaire.
Les femmes se consacrant de manière intensive à leur carrière ont été identifiées en développant plusieurs indicateurs, se définissant chacun par rapport à différents groupes de référence. Le premier grand groupe de référence correspond aux autres femmes, ayant soit le même niveau d'éducation, ou bien le même statut professinonel. Nous identifions ainsi les femmes travaillant beaucoup, ou gagnant un salaire élevé, dans chacun des sous-groupes de référence. Le second grand ensemble d'indicateurs se définit par rapport au conjoint, en identifiant successivement les femmes qui gagnent un salaire supérieur à leur partenaire, ou totalisent un niveau d'éducation plus élevé, ou encore atteignent un statut plus élevé.
Même si la femme diminue fortement son temps de travail domestique lorsqu'elle investit beaucoup dans sa carrière, et que son conjoint a tendance à en faire un peu plus dans ce cas, cette hausse du temps de travail domestique de l'homme n'est significative que dans un nombre limité de cas, ce qui semble en contradition avec l'hypothèse d'efficience. En se

concentrant plus particulièrement sur le temps consacré aux enfants, nous trouvons que les femmes adaptent ces activités à leur investissement professionnel, mais dans une moindre mesure par rapport au travail domestique global. Le temps parental de l'homme est très insensible à la situation professionnelle de sa partenaire. Ainsi, le partage des activités liées aux enfants semble encore plus éloigné de l'efficience, en comparaison au partage des tâches domestiques globales.

Finalement, le chapitre se termine par un test de l'hypothèse de substituabilité entre le temps de travail domestique de l'homme et de la femme, dont l'issue pourrait conduire à relativiser les résultats précédents d'inefficience. Il apparaît que ces deux facteurs ont un degré de substituabilité plutôt faible, plus faible encore en ce qui concerne le temps de travail domestique qu'en ce qui concerne les soins aux enfants. Ce résultat apparaît plutôt paradoxal si on se réfère aux justifications "naturalistes" de la division traditionnelle du travail entre hommes et femmes qui s'appuient sur l'hypothèse d'une relation privilégiée mère/enfant.

Ce dernier résultat mérite d'être approfondi, car d'une part il repose sur des hypothèses très précises quand à la fonction de production, et d'autre part l'exogénéité stricte du caractère substituable ou complémentaire des temps de travail domestique de l'homme et de la femme semble inexacte. En effet, des investissements préalables effectués par les conjoints dans le domaine de la production domestique, et dépendents du genre, pourraient impacter les niveaux de productivité et avoir une influence sur le degré de substituabilité observé des temps de l'homme et de la femme.

Une autre extension de ce chapitre consiste aussi à développer un unique indicateur de l'investissement des femmes dans leur carrière, qui regrouperait l'ensemble des différentes 'dummies' décrivant l'attachement des femmes au marché du travail. Cela aurait l'avantage d'offrir un unique indicateur général, mais aussi à affiner le degré d'investissement.

Ainsi, ces deux chapitres ont conduit à la conclusion que l'hypothèse d'efficience semble remise en cause au niveau du processus de production au sein des ménages, et également au niveau des choix de consommation. Comment représenter alors les comportements ? Une voix de recherche pourrait consister à représenter un optimum de second rang, intégrant des contraintes ou des représentations sociales. Plus particulièrement, dans la sphère production, les stéréotypes de genre, ou jugements sur les compétences des individus basés sur leur appartenance à un groupe social, pourraient conduire les individus à dévier de l'efficience dans leur prise de décision. Les deux derniers chapitres de cette thèse ont alors tenté de dépasser l'hypothèse d'efficience, en particulier en s'intéressant à l'influence de stéréotypes de genre (ou croyances) relatifs aux compétences. Cela a été appliqué à la fois à la sphère production du ménage, mais également à l'étude des choix éducatifs, où ce type de croyance pourrait très largement impacter les choix effectués.

Le chapitre 3 a donc cherché à mieux comprendre pourquoi les filles et les garçons effectuent des choix d'orientation scolaire différents, et particulièrement pourquoi les filles semblent choisir des filières préjudiciables en terme de salaires. Une analyse basée sur les compétences et les résultats scolaires dans les différentes disciplines est suggérée. Plus précisément, ce chapitre consiste à étudier dans quelle mesure les filles et les garçons réagissent différemment à leurs notes dans les différentes disciplines lorsqu'ils effectuent leurs choix de filières éducatives. Un tel phénomène pourrait être la conséquence de l'existence d'un stéréotype sur les compétences, qui conduirait les filles et les garçons à sur-estimer ou sous-estimer leurs compétences dans les différents domaines. Le panel d'élèves du second degré (1995-2011) a ainsi été employé dans cet objectif.

Les principaux résultats se dégageant de cette étude sont les suivants. Des différences de genre apparaissent moins sur les choix de sujets (sciences versus lettres), mais davantage sur le choix d'un type de filière, en terme de sélection à l'entrée et de durée d'études envisageables, au lycée tout comme dans les études supérieures. En effet, les filles "moyennes" mais ayant un avantage comparatif en mathématiques comparé au français choisissent davantage un baccalauréat général littéraire ou économique, alors que le choix d'un baccalauréat technique orienté en sciences auraient pu leur permettre de valoriser au mieux leur compétence en mathématiques. Le stéréotype ne semble pas jouer sur les meilleurs élèves, qui choisissent un baccalauréat scientique de tout façon, mais davantage sur les filles obtenant des résultats globaux moyens mais meilleures en math. Concernant les choix d'études supérieures, ce chapitre a mis en évidence que les filles réagissent moins que les garçons à leurs résultats scolaires pour faire leur choix de filière. Nous pouvons également remarquer que les filles utilisent davantage leurs notes en sciences humaines que leurs notes en sciences, par rapport aux garçons. Cela se verifie particulièrement lorsqu'il s'agit du choix de la filière la plus sélective, les classes préparatoires.

Finalement, en termes de politiques publiques, ce chapitre montre que malgré l'introduction d'une mesure du salaire espéré, les filles et les garçons évaluent différemment leurs notes. Ainsi, chercher à réduire l'écart salarial après un diplôme donné pourrait ne pas être suffisant pour changer les choix éducatifs. Y adjoindre des campagnes d'information, à l'école ou dans les médias par exemple, pourrait s'avérer efficace afin d'affaiblir le stéréotype, et notamment limiter la perception négative des filles concernant les filière techniques, et les encourager à s'orienter davantage vers des classes préparatoires.

Le chapitre 4 va quant à lui s'intéresser de nouveau à l'allocation du temps eu sein des couples, et analyser l'impact de stéréotypes de genre cette fois-ci portant sur les compétences des hommes et des femmes pour produire des biens domestiques.
Ce chapitre présente un modèle théorique de division des tâches domestiques entre les conjoints. Nous considérons qu'une spécialisation relative a lieu au sein du couple, dans le sens où l'un des deux partenaires va effectuer un investissement dans la production domestique, lui permettant d'améliorer sa productivité dans ce domaine. Le modèle consiste alors à modéliser lequel des deux conjoints sera choisi pour investir. Dans cet objectif, le couple maximise le profit espéré issu de la production domestique, et le "bon choix" consiste à choisir le conjoint permettant d'atteindre le profit le plus élevé. L'hypothèse "nulle" est la suivante: avant que l'investissement ne soit effectué, les hommes et les femmes ont la même compétence pour effectuer cet investissement, en moyenne. Cependant, les vraies compétences ne sont pas connues, et les conjoints observent uniquement des signaux bruités. De plus, il est supposé qu'il existe un stéréotype dans la société, selon lequel les gens croient que les femmes sont plus compétentes pour produire des biens domestiques par rapport aux hommes, en moyenne. Précisément, la vraie probabilité qu'une femme soit plus compétente que son partenaire est de 50%, mais selon le stéréotype, les gens croient que cette probabilité est de 70%. Un modèle bayesien est alors développé. Les croyances "a priori" des individus sur le fait qu'il soit efficient que l'homme investisse et le signal sur les compétences permettent de définir une probabilité "a posteriori", qui servira de base à la

décision finale de qui investit.

Finalement, il en ressort que le niveau de salaire de chacun, le degré de spécialisation, et le niveau de la croyance vont impacter le choix, et des restritions testables spécifiques sont déduites du modèle, selon que l'on considère les niveaux de salaires comme exogènes ou endogènes. Au niveau de la société dans son ensemble, les effets du stéréotype et de l'écart salarial entre les hommes et les femmes se renforcent l'un l'autre pour finalement amener à une proportion de femmes désignée pour investir bien plus importante que la proportion d'hommes. Ainsi, même si une femme gagne un salaire plus élevé que son partenaire, et que le vraies compétences des deux conjoints sont égales, le couple choisira plus souvent la femme pour investir, bien que l'efficience aurait conduit à choisir l'homme. Autrement dit, afin que l'homme soit choisi pour investir, il doit gagner un salaire bien plus faible que sa partenaire, ou bien son signal sur sa capacité dans la production domestique doit être bien plus élevé que le signal de la femme.

La seconde partie de ce dernier chapitre est consacrée à des simulations du modèle, à partir de la nouvelle Enquête Emploi du Temps française de 2009-2010. L'homme est considéré comme ayant investi dans la production domestique s'il passe plus de temps à effectuer du travail domestique que sa partenaire, le jour de remplissage du carnet journalier. Les compétences sont simulées, tout comme les signaux (à partir de ces compétences). Ainsi, la vraie probabilité qu'une femme soit plus compétente que son conjoint pour les tâches domestiques est de 50%. Cependant, lorsque les salaires sont considérés comme exogènes, les simulations montrent que la société croit que cette probabilité est de 81%. Lorsque le salaire est endogénéisé, cette probabilité est affaiblie et atteint 68%. De plus, il est montré que l'investissement des hommes dans les tâches domestiques est plus sensible à l'affaiblissement du stéréotype qu'à une réduction de l'écart salarial, même quand cet écart salarial diminue très fortement. Finalement, chercher à réduire uniquement l'écart salarial entre les hommes et les femmes, sans volonté de réduire les croyances, provoque un faible impact sur le nombre d'hommes investissant dans la sphère domestique. De plus, à long terme, agir sur la prévalence du stéréotype dans la société crée un cercle vertueux, dans lequel les femmes investissent de manière plus intensive la sphère professionnelle, les amenant à recevoir des salaires plus élevés, et donc à réduire leur investissement dans la sphère domestique, et ainsi de suite.

Ce chapitre sera complété en cherchant dans un premier temps à tester spécifiquement le modèle à partir des restrictions testables. De plus, la détermination de qui investit dans le couple sera approfondie. Finalement, les simulations seront enrichies en faisant varier le degré de précision du signal.

Ainsi, les deux derniers chapitres de cette thèse ont permis de mettre en évidence un mécanisme de croyances auto-réalisatrices qui joue sur les décisions des agents économiques. Les implications de politiques publiques résultantes sont donc très fortes, puisqu'il semble que des incitations monétaires ne permettent pas d'infléchir à elles-seules la tendance. Il apparaît qu'agir sur les croyances et les représentations sociales représente un vecteur clé pour inciter les comportements à s'approcher de l'efficience, et favoriser ainsi l'équité et l'égalité entre les hommes et les femmes. Faire évoluer des croyances sociales peut se révéler être un processus très long, mais il semblerait qu'une certaine évolution s'amorce, qu'une prise de conscience de l'existence de ces stéréotypes se développe, tout comme de fortes résistances.

La difficulté majeure qui ressort de ces travaux repose sur le problème d'identification des mécanismes à l'oeuvre. Les chapitres 3 et 4 de cette thèse s'intéressent au stéréotype et à la manière dont il influence les décisions, mais il est certain que la présence de normes sociales agissant sur les préférences pourraient également exercer un impact fort, conduisant aux différences de genre observées. Vraisemblablement, normes et stéréotypes coexistent et s'entretiennent l'un l'autre. Chercher à identifier quel mécanisme est le plus prégnant par rapport à l'autre serait finalement vain, puisque la conjonction des deux effets est forte, et qu'en cherchant à affaiblir les stéréotypes, on affaiblit également les prescriptions de genre et inversement. Néanmoins, étudier les différents canaux de transmission apparaît fondamental pour mieux comprendre les mécanismes sous-jacents et mener des politiques optimales.

Une seconde difficulté sous-jacente à ce type d'étude repose sur l'inobservabilité des compétences intrinsèques de chaque individu. Si l'on peut observer des signaux sur les compétences actuelles (par les résultats scolaires à l'école, bien plus difficilement mesurables quant à la productivité domestique), ceux-ci sont la résultante d'un processus long intégrant des compétences "innées", l'effet de l'environnement familial et scolaire, les efforts et apprentissages de l'individu à chaque période, des normes sociales et des stéréotypes ... Néanmoins, le recours à des modèles structurels de plus en plus élaborés ainsi que les bases de données très récentes cherchant à entrer de plus en plus dans la boîte noire du ménage et la psychologie des enfants et des adolescents permettront d'apporter des éléments de compréhension nouveaux et des réponses à ces questions, dans les prochaines années.

Plusieurs projets se dessinent alors. Un première étude, constituant la suite naturelle du chapitre 3 portant sur les choix éducatifs, aurait pour objectif de développer et estimer un modèle structurel de choix éducatifs comportant des croyances 'a priori' sur les compétences. Ce modèle viserait à caractériser le stéréotype et décrire les différentes étapes par lesquelles il se véhicule, au travers de choix d'effort et de filières éducatives. L'élève ne connait pas ses compétences réelles dans les différentes disciplines, mais il a une certaine idée de ses talents que l'on nomme les croyances 'prior'. Ces 'prior' sont révisées à chaque étape, selon une révision bayésienne, par le biais de signaux (les notes) reçues tout au long du processus. Le modèle serait estimé avec l'objectif principal de tester si les 'prior' diffèrent entre les garçons et les filles [2].

Une seconde étude pourrait avoir pour objectif d'analyser l'importance de facteurs psychologiques directement mesurables comme déterminants des résultats scolaires et des choix éducatifs des adolescents. Il s'agirait d'examiner comment s'articulent différentes mesures de la confiance en soi, de l'image physique de soi et des perceptions relatives aux relations sociales, sur la réussite scolaire. Cela permettrait d'étudier si ces facteurs jouent de façon différente sur la réussite selon le genre et l'origine sociale, afin de déterminer s'ils constituent des facteurs sur lesquels il est possible de peser afin d'améliorer la réussite scolaire de certaines fractions de la population [3].

Enfin, un troisième projet aurait pour objectif de relier deux des thèmes fondamentaux de cette thèse, à savoir l'allocation du temps entre les conjoints et l'éducation, en

2. Il s'agit d'un projet mené avec Benoît Rapoport
3. Cette étude serait développée en collaboration avec Benoît Rapoport

s'intéressant à l'influence que pourraient exercer les différentes activités des parents sur les résultats scolaires de leurs enfants.

Ces nouveaux projets ne sont finalement pas nécessairement indépendants, dans le sens où le degré d'implication des parents génère différents contextes émotionnels influençant les choix éducatifs et la réussite. De plus, le degré de prévalance du stéréotype pourrait en partie provenir des parents, qui véhiculent plus ou moins fortement ces croyances à leurs enfants. Par ailleurs, certains traits psychologiques, tels que la confiance en soi par exemple, pourraient atténuer les effets du stéréotype pour une certaine fraction de la population. Ces projets de recherche apporteraient ainsi une compréhension plus fine de la question, à savoir comment le stéréotype peut être modulé en fonction des caractéristiques des individus, et tracent ainsi de nouvelles perspectives afin de mieux comprendre les décisions prises au sein des familles ainsi que les choix éducatifs des jeunes.

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