CAHIER DE RECHERCHE

MAI 1994 ■ N°62

ARTICLES DE MICRO-ECONOMIE APPLIQUEE

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CRÉDOC
L'ENTREPRISE DE RECHERCHE

Centre de Recherche pour l'Étude et l'Observation des Conditions de Vie

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Pauvreté absolue ou pauvreté relative ?

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(1981 - 1992)

Secréraria t : Lucette Laurent

François Gardes

Mai 1994

Avant-propos

Le système d'enquêtes *"Aspirations et Conditions de vie des Français"*, système contractuel, présente l'originalité de répondre à un double mode d'approche : l'enquête fournit à la fois une description des situations (les faits) et une perception subjective de ces situations par les personnes qui les vivent (les opinions et les aspirations).

Elle enregistre ainsi, sur un grand nombre de thèmes, des informations aussi bien objectives que subjectives, qui peuvent être analysées simultanément. C'est de la mise en relation de ces indicateurs objectifs et subjectifs que naît l'essentiel de ses enseignements.

Cette recherche a été accomplie dans le cadre de la subvention "recherche" du Commissariat Général du Plan. Nous remercions Georges Hatchuel, Directeur adjoint du CREDOC, de nous avoir utilement conseillé dans l'élaboration des objectifs de cette recherche.

Introduction

L'instauration d'un Revenu Minimum d'Insertion pose des problèmes difficiles de mesure du revenu minimum nécessaire pour donner un mode de vie décent au ménage qui le reçoit. Ce revenu minimum dépend évidemment des caractéristiques socio-économiques du ménage, en particulier de sa structure démographique (âge du chef de famille, taille du ménage), mais également de son lieu de résidence (du fait des différentiels de coût du logement et de diverses consommations, qui peuvent atteindre 20 à 30 % entre deux villes différentes) et de sa classe sociale d'appartenance.

Ce dernier point se réfère plutôt à la théorie de la **pauvreté relative**, alors que les premiers peuvent être considérés comme des coûts absolus, dont la somme correspondrait à un seuil de **pauvreté absolue.** On connaît l'ampleur des débats suscités par cette distinction (dont font partie les polémiques autour des travaux de Townsend), qui ne peuvent être éclairés aujourd'hui que par des arguments quantitatifs. C'est une telle analyse quantitative que l'on propose ici.

Une dimension essentielle de ce débat peut se formuler par la question **de la représentation de la pauvreté** que se font les divers types de ménages et qu'on se fait au niveau national, à diverses époques. Il s'agit donc d'étudier **l'évolution d'un seuil quantitatif de pauvreté** (poverty line) et ses divers déterminants transversaux : revenu par unité de consommation (u.c) des ménages, variables de positionnement social, structure démographique, position dans le cycle de vie, variables patrimoniales (de capital immobilier, financier ou humain), variables d'attitude et d'aspiration.

On a pu montrer certains de ces effets dans deux rapports précédents (Gardes - Combis, 1992, 1994 ; Gardes - Volatier, 1993) à partir de l'analyse d'enquêtes transversales de Budgets de Famille (INSEE, 1989) ou des enquêtes "Aspirations" (1989-91). D'une enquête à l'autre, certains déterminants communs apparaissent très solidement : on en rappellera l'influence dans la première section de ce rapport. Mais l'analyse **dynamique** de ces déterminations n'était pas possible avec ce type de statistique purement transversale. On a donc cherché à construire un matériau statistique (nouveau, semble-t-il, dans ce type d'étude), qui combine les deux dimensions transversale et temporelle, pour comparer ces deux causalités.

Qu'elle puisse différer a été montré par l'article pionnier de Kilpatrick (1974) qui estime l'élasticité-revenu **temporelle** (estimée sur une série temporelle agrégée des enquêtes Gallup) du revenu minimum à 0.6 pour les Etats-Unis sur la période 1957-1971, alors que les élasticités-revenus transversales semblent ne pas dépasser 0.5, avec une valeur médiane de 0.2 à 0.3. Seule une statistique combinant les deux dimensions pourra permettre de juger de la réalité de cette différence, et d'en chercher les raisons.

Nous remercions Georges Hatchuel de nous avoir permis de construire un pseudo-panel[1] des enquêtes "Aspirations" du CREDOC (décrit précisément en section 1.1.3 et en annexe I), et Ariane Dufour et Con Tam Le d'avoir réalisé le travail informatique de regroupement des données individuelles des douze enquêtes utilisées.

Après une présentation critique des principaux résultats empiriques antérieurs et du pseudo-panel des enquête "Aspirations", en première partie, on présentera en seconde partie les premiers résultats de nos analyses qui seront complétées dans un rapport ultérieur.

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[1] Un pseudo-panel, ou panel synthétique, est constitué des moyennes des variables d'une même enquête pour différentes périodes. La population enquêtée changeant d'une période à l'autre, les réponses moyennes sont entâchées d'erreurs, qu'il faut corriger en effectuant ces moyennes sur des sous-populations assez importantes (au moins 100 individus statistiques), ou par d'autres méthodes correctives (on trouvera une discussion détaillée de ce problème dans Gardes - Langlois, 1994).

PREMIERE PARTIE

Présentation des travaux antérieurs et des données statistiques

1.1 - Etat de la question

On utilise dans ce type de travaux des enquêtes d'opinion comme les enquêtes Gallup (Kilpatrick, 1974), les enquêtes "Conditions de vie et Aspirations des Français" du CREDOC (Gardes, Volatier, 1993), ou des questions d'opinion incluses dans diverses enquêtes socio-économiques, par exemple dans les enquêtes de Budgets de Famille de l'INSEE (Gardes-Combris, 1992, 1994). Les questions posées aux ménages concernent le revenu minimum, par exemple : *"Quel est le plus petit montant monétaire dont une famille de quatre personnes - mari, femme et deux enfants - a besoin chaque semaine pour vivre décemment dans cette société" ?*[1], dans les enquêtes Gallup de l'American Institute of Public Opinion, ce qui correspond à un **revenu de confort** plutôt qu'à un revenu minimum. Dans les enquêtes "Aspirations" du CREDOC, la question concerne *"Le revenu mensuel paraissant minimum, dans votre localité, pour une famille ayant deux (ou trois) enfants de moins de dix ans"*, ou la dépense alimentaire minimale pour une personne seule ou un couple avec deux enfants (voir le détail des questions en Annexe I). Dans l'enquête Budgets de Famille de l'INSEE, les questions concernent à la fois *"le revenu minimum pour une famille comme la vôtre"* et *"les niveaux de revenu correspondant à divers états d'aisance"*. Pour de telles enquêtes, on peut discuter la nature subjective de ces questions, mais on observe une grande stabilité statistique des réponses et de leur détermination par divers facteurs socio-économiques. Par ailleurs, on peut négliger dans une analyse transversale tous les facteurs perturbants de type conjoncturel, en supposant qu'ils s'exercent de manière homogène dans la population (une telle hypothèse est justifiée si l'on pouvait prendre en compte les contraintes de liquidité qui pèsent sur les ménages et leurs caractéristiques démographiques et d'éducation) : dans ce cas, on pourra prévoir que le niveau du revenu minimum déclaré changera d'une période à l'autre, mais non la loi qui le relie à ses divers déterminants transversaux. Une analyse temporelle des séries temporelles agrégées sera moins facile à justifier en raison des biais classiques d'agrégation (liés en particulier à la non-linéarité des lois) et de l'instabilité temporelle de ces lois.

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[1] "To get along in this community".

Trois voies de recherche peuvent permettre de mieux estimer ces difficultés :

(i) On peut **comparer les lois transversales** obtenues à partir d'enquêtes différentes dans l'espace et dans le temps. L'identité des lois estimées sur ces diverses statistiques constituerait une indication probante de la force et de la stabilité des causalités transversales indiquées par les lois estimées sur données d'enquête.

(ii) La constitution de données groupées temporelles à partir d'une même enquête périodique permettrait de mieux juger **de la stabilité des lois transversales** (à partir d'une statistique dont le protocole d'enquête est invariant d'une période à l'autre), comme de comparer lois transversales et lois temporelles reliant les mêmes variables, mais dans les deux dimensions.

(iii) On peut enfin comparer les résultats obtenus à partir de ces questions subjectives à des analyses statistiques effectuées à partir **de variables objectives** (telles, par exemple, que les consommations effectuées par divers types de ménages pour mesurer la dépense minimale alimentaire ou non-alimentaire).

On propose, dans ce rapport, une première analyse (nouvelle à notre connaissance) selon les deux premières méthodes.

1.2 Travaux antérieurs

Les premiers travaux quantitatifs américains sur les seuils de pauvreté ont prouvé qu'on pouvait estimer, à partir de ces réponses subjectives, des élasticités-revenus du seuil de pauvreté de l'ordre de 0.2 à 1 qui indiquent une indexation plutôt infra-unitaire du revenu minimum subjectif au niveau de revenu du ménage. Ceci constitue un test négatif de l'hypothèse de seuil de pauvreté absolue (au moins pour ce qui concerne la perception de ce seuil par les ménages). Néanmoins, une différence significative apparaît entre les estimations transversales et les estimations de séries temporelles agrégées. Danziger et al. (1984) et Gardes et al. (1992, 1993, 1994), calculent les élasticités transversales, très proches l'une de l'autre, pour des enquêtes américaines et françaises : de l'ordre de 0.3 pour l'ensemble de la population, elles varient de manière systématique en fonction du revenu relatif des ménages (0 pour les bas revenus, 0.5 pour les moyens revenus, 0.2 pour les hauts revenus) et de l'âge du chef de famille (l'élasticité est maximale pour la classe d'âge médiane)[1]. Kilpatrick a estimé la même loi logarithmique du revenu minimum par rapport au revenu moyen courant per capita des ménages - ou à leur revenu permanent disponible per capita (calculé selon la méthode de Friedman et aux mêmes types de revenu médian) - sur une série temporelle agrégée des enquêtes Gallup (1937-54, puis 1957-71)[1] : une différence structurelle apparaît dans ces estimations entre les périodes 1937-54 et 1957-71.

Pour la première période, l'hypothèse de pauvreté absolue semble prévaloir (coefficient du revenu non significativement différent de 0), ce qui peut être expliqué par la crise qui a ramené une partie de la population au minimum physiologique, mais également par des incertitudes relatives au questionnaire (voir l'article de Kilpatrick, pp. 328-9).

Dans la seconde période, l'élasticité-revenu du revenu minimum s'établit, dans les différentes spécifications, entre 0.55 et 0.66. Kilpatrick (p. 331) note que les élasticités transversales obtenues sur des données groupées par classe de revenu sont nettement inférieures : de l'ordre de 0.10 à 0.15, bien que significativement supérieures à 0.

Ces résultats remettent en cause les méthodes classiques de dénombrement des familles pauvres : entre 1951 et 1971, un seuil de pauvreté absolu diminuerait de 22% à 12% leur proportion, alors qu'un seuil relatif calculé à partir d'une élasticité-revenu de 0.6 ne la diminuerait que de 22 à 18% (un seuil entièrement relatif, correspondant à une élasticité unitaire, maintiendrait la pauvreté à 22% de la population). Par ailleurs, le dénombrement des pauvres, à l'aide du revenu médian (par exemple en comptant comme pauvre une famille ayant un revenu inférieur à la moitié du revenu médian), peut être critiqué de la même manière, puisque le ratio du revenu minimum au revenu médian diminue (l'élasticité-revenu médian du revenu minimum étant inférieur à un). Ceci remet donc en cause une méthode classique de mesure de la pauvreté (du moins de la pauvreté subjective telle que la considèrent les individus).

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[1] Ces deux derniers résultats dans l'article de Gardes-Combris (1994), qui fait également apparaître l'effet significatif du patrimoine immobilier des ménages, de leurs anticipations de revenu et des restrictions monétaires.

[1] La taille de la famille n'apparaît pas comme significative dans ses estimations.

Kilpatrick cite (p. 331-2) les estimations obtenues par d'autres auteurs à partir de budgets de famille répétés, qui fournissent des élasticités de 0.75 à 1, ainsi que l'élasticité-revenu obtenue en comparant les moyennes de quatre régions des Etats-Unis : elle s'avère également proche de 1, mais plutôt plus forte que celle qu'il calcule à partir des enquêtes Gallup, ce qu'il attribue à l'existence de variables perturbantes non prises en compte (on peut penser plutôt que les classes sociales de référence, et donc le revenu minimum qui indique l'une d'entre elles, sont plus corrélées, d'un état à l'autre, au revenu moyen de l'Etat, que ce n'est le cas entre les ménages d'une population homogène).

On notera deux phénomènes importants que Kilpatrick ne semble pas remarquer : **les élasticités-revenu semblent augmenter avec le niveau d'éducation économique des individus enquêtés, ainsi qu'avec le niveau de référence** (de subsistance ou de confort minimum) correspondant au revenu minimum étudié, **comme si revenu relatif et revenu absolu étaient plus proches pour les hauts niveaux d'utilité.**

Les travaux antérieurs permettent donc de poser plusieurs questions empiriques importantes auxquelles on ne peut répondre qu'à l'aide d'un pseudo-panel :

1 - Sur un même ensemble de données statistiques, le revenu minimum dépend-il des mêmes variables explicatives en cross-section et en time-series ?

2 - L'élasticité-revenu du revenu minimum est-elle significativement plus faible en cross-section qu'en time-series ? Sont-elles comprises toutes deux entre 0 et 1 ?

3 - Les élasticités-revenu augmentent-elles, pour toutes les périodes et tout type de population, avec le niveau d'éducation des individus interrogés et avec la situation de référence du revenu minimum (subsistance physiologique, bien-être minimal, situation de confort ou d'aisance, ...) ?

1.3 - Explications théoriques

Ces changements des élasticité-revenus du revenu minimum ont été interprétées de deux manières différentes dans un article antérieur (Gardes-Combris, 1994), auxquels nous renvoyons.

Dans un premier modèle, on explique la courbe en U renversé de cette élasticité-revenu le long de l'échelle des revenus (après contrôle des effets du cyle de vie et du patrimoine immobilier, qu'on peut supposer fortement corrélés au revenu relatif des ménages) par une extension des ensembles de consommation lorsque le ménage se déplace sur l'échelle des revenus relatifs, en particulier au milieu de la distribution des revenus. Cet élargissement des possibilités de choix du consommateur est lié à la recherche d'informations au fur et à mesure que ses besoins élémentaires se saturent, à la disposition de certaines contraintes financières (meilleur accès au marché financier), à une hiérarchie naturelle des besoins qui apparaissent et se saturent de manière successive.

On peut également expliquer cette modification de la pression des besoins (et donc de l'utilité marginale du revenu) par un changement des anticipations de revenu le long de la distribution du revenu relatif (chaque position sur cette échelle correspondant à un rapport revenu futur/revenu antérieur spécifique, du fait en particulier de sa corrélation avec la position du ménage dans son cycle de vie).

Ces deux explications ont été partiellement testées dans l'article précité.

1.4 -Les données de pseudo-panel

On a regroupé les populations enquêtées annuellement de 1981 à 1992 (comprenant en moyenne 1 500 ménages) en 60 cellules, dont l'effectif varie fortement (de 1 à 60 ménages, l'effectif moyen étant de 26 ménages). Cette variation de l'effectif des cellules (transversalement et temporellement) entraîne une hétéroscélasticité des erreurs, puisque l'agrégation d'une loi individuelle, écrite pour un ménage h et la période t :

$$y_{ht} = x_{ht}.b + u_{ht}$$

en une loi agrégée au niveau des cellules C_i d'effectif Card $C_i = N_i$:

$$y_{ci,t} = \frac{1}{N_i} \sum_{h \varepsilon C_i} y_{ht} = \left(\frac{1}{N_i} \sum_{h \varepsilon C_i} x_{ht}.b \right) + \frac{1}{N_i} \sum_{h \varepsilon C_i} u_{ht}$$

fournit une variance de l'erreur :

$$V\left(\frac{1}{N_i} \Sigma u_{ht}\right) = \frac{1}{(N_i)^2} \Sigma V(u_{ht}) = \frac{\sigma^2}{N_i}$$

sous hypothèse d'homoscélasticité et d'indépendance des erreurs individuelles :

$$V(u_{ht}) = \sigma^2, \forall h,t ; Cov(u_{ht}, u_{h't'}) = 0 \text{ si } (h,t) \neq (h',t')$$

On corrigera cette hétéroscélasticité systématique en effectuant une transformation

préalable des données : $Z'_{ht} = \sqrt{N_i}\, Z_{ht}$ pour $h \varepsilon C_i$

Le cellulage a été effectué pour chaque enquête en fonction de trois critères discriminants.

1. Le revenu par unité de consommation, regroupé par décile.
2. L'âge du chef de famille (trois tranches d'âge limitées par 35 et 55 ans).
3. La taille de la famille (trois modalités : adulte seul, couple sans enfants, couple avec enfants.

Vingt variables ont été calculées sur ces fichiers cellulés : le revenu minimum moyen pour une famille de deux ou trois enfants, le revenu par unité de consommation, leurs logarithmes et des variables de contrôle socio-démographiques : répartition des adultes et des enfants dans la cellule, existence de restrictions financières, évolution du niveau de vie depuis dix ans (trois modalités), anticipation de conditions de vie dans les cinq ans à venir (trois modalités), classe de revenu, d'âge et de structure familiale.

Les enquêtes et les données cellulées sont présentées plus en détail en annexe I.

DEUXIEME PARTIE

Elasticités transversales et temporelles du revenu minimum

2.1 - Spécification

Les élasticités-revenus ont été calculées sur des spécifications logarithmiques du revenu minimum déclaré en fonction du revenu disponible par unité de consommation des ménages[1]. La déflation de ces deux variables a été opéré par un indice général des prix à la consommation.

Les variables de contrôle suivantes ont été introduites en plus de la constante :

(i) **Variables démographiques** : la proportion d'enfants de moins de six ans, d'enfants de six à seize ans et d'adultes ; des variables muettes indiquant la classe d'âge et de taille du ménage.

(ii) **Variables de revenu relatif** : neuf variables muettes pour indiquer le positionnement du ménage dans les déciles de la distribution du revenu disponible par unité de consommation.

(iii) **Variables financières** :
- une variable muette indiquant la présence de restrictions financières ;
- les proportions de ménages dont le niveau de vie personnel a évolué à la hausse, ou est resté stable depuis dix ans ;
- la proportion des ménages anticipant des conditions de vie dans les cinq ans à venir en amélioration ou en stabilité.

Pour chaque variable muette, une des modalités a été omise. On obtient donc au total 22 variables explicatives, soit 698 degrés de liberté sur l'ensemble du fichier.

Pour estimer les élasticités transversales, on a opéré une transformation des données[2] qui élimine les effets fixes entre deux cellules dont les caractéristiques d'âge, de taille et de période sont identiques, et qui appartiennent à deux classes de revenu relatif adjacentes : si l'on note $Y_{i,j,k,t}$ le revenu minimum déclaré par la cellule (i,j,k,t), dont le revenu relatif se situe au ième décile pour l'enquête de la période t, et qui

[1] Tous les ajustements sont faits sur les moyennes (calculées pour chaque cellule) logarithmiques (c'est-à-dire le logarithme d'une moyenne géométrique) des revenus individuels par unité de consommation des ménages composant une cellule.

[2] Cette différenciation s'applique aux données pré-multipliées par $\sqrt{\text{Card } C_i}$

appartient à la classe d'âge j et de taille k (j,k, = 1 à 3), on considèrera les différences transversales :

$$d_{cs}\ y_{i,j,k,t} = y_{i+1,j,k,t} - y_{i,j,k,t}$$

qui éliminent les effets fixes individuels additifs a (donc multiplicatifs avec la transformation logarithmique) :

$$y_{i,j,k,t} = y^*_{i,j,k,t} + a_{j,k,t}$$

Une transformation semblable est opérée entre deux enquêtes successives pour obtenir une estimation en différence première (dite aussi en time-series) :

$$d_{TS}\ y_{i,j,k,t} = y_{i,j,k,t} - y_{i,j,k,t-1}$$

qui élimine les effets fixes individuels liés aux trois critères de cellulages entre deux enquêtes.

Ces deux transformations permettent des estimations par les MCO sous certaines hypothèses relatives aux erreurs de l'équation de départ, mais sont difficilement comparables dans la mesure où ces hypothèses ne sont pas identiques pour les deux transformations.

On a donc effectué, pour comparer les estimations transversales et temporelles, des estimations Between et Within, dont on sait qu'elles sont orthogonales, qu'elles éliminent également les effets fixes transversaux ou temporelles, et qu'elles s'agrègent en une estimation des MCG efficient. Le test d'Haussman permet alors d'effectuer une comparaison statistique des deux types d'élasticité.

Transformation Between :

$$BZ_{i,j,k,t} = \frac{1}{12} \sum_{t=1981}^{1992} Z_{i,j,k,t}$$

Transformation Within :

$$WZ_{i,j,k,t} = Z_{i,j,k,t} - BZ_{i,j,k,t}$$

2.2 - Estimations

Le tableau 1 et l'annexe II (résultats détaillés) indiquent les résultats suivants.

(i) Toutes les estimations sont très significatives, en terme de R^2 et de significativité des paramètres, comme en terme de stabilité des estimations quand on modifie marginalement l'ensemble des régressions[1].

(ii) Les élasticités-revenus sont très proches, pour les deux définitions, du revenu minimum (pour une famille comprenant deux ou trois enfants)[2] et pour les deux techniques d'estimation dans chaque dimension.

(iii) La suppression des ménages dont le revenu est en deçà du premier décile augmente significativement les élasticités pour les deux types d'estimation.

(iv) Les élasticités temporelles s'établissent autour de 0.6 pour toute la population (autour de 0.9 sans le premier décile), alors que les élasticités transversales sont estimées entre 0.1 et 0.3 (la seule élasticité en cross-section sans le premier décile atteignant 0.6).

(v) Les élasticités tendent à augmenter dans les deux dimensions avec le revenu relatif jusqu'au septième décile, puis diminuent légèrement : cette évolution en U renversé, observée transversalement dans les travaux antérieurs (Gardes-Combris, Gardes-Volatier) est donc également vérifiée dans la dimension temporelle.

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[1] On a par exemple retiré une variable muette de taille de la famille dans l'ajustement en Between, sans modifier beaucoup l'éladticité estimée ; pour les autres estimations, l'abandon des variables à $t < 1$ - donc n'augmentant pas le R^2 ajusté - ne modifie que très légèrement les paramètres estimés.

[2] L'élasticité d'un revenu minimum pour trois enfants semble légèrement plus élevée pour les estimations temporelles (de l'ordre de 10%).

Tableau 1

Elasticités-revenus transversales et temporelles du Revenu Minimum

Population	Type d'élasticité	Elasticités-revenu temporelles								Elasticité-revenu transversales					
		Différence première (Time series)				Within				Cross section		Between			
		(1)		(2)		(1)		(2)		(1)		(1)		(2)	
		a	R^2	a	R^2	a	R^2	a	R^2	a	R^2	a	R^2	a	R^2
Revenu minimum pour une famille avec 2 enfants :	Toute population	0.597 (14.5)	0.9158	0.595 (14.4)	0.9160	0.498 (12.4)	0.9160	0.547 (12.0)	0.9176	0.277 (13.9)	0.9185	0.085 (16.4)	0.9994	0.123 (18.6)	0.9996
	Sans le premier décile	0.867 (17,4)	0.9258	0.871 (17.3)	0.9263	0.734 (15.7)	0.9279	0.846 (16.4)	0.9314	0.626 (25.53)	0.9470	(3) 0.246 (18.1)	0.9993	-	-
Revenu minimum pour une famille avec 3 enfants :	Toute polulation	0.612 (18.2)	0.9466	0.611 (18.0)	0.9467	0.606 (18.6)	0.9484	0.684 (18.7)	0.9506	0.276 (13.3)	0.9179	0.070 (13.9)	0.9994	0.107 (17.2)	0.9996
	Sans le premier décile	0.943 (26,6)	0.9640	0.944 (26.3)	0.9641	0.871 (24.9)	0.9624	0.993 (26.4)	0.9660	0.645 (25.32)	0.9464	(3) 0.215 (17.0)	0.9994	-	-

(1) - Sans les variables muettes de revenu relatif.
(2) - Avec les variables muettes de revenu relatif.
(3) - Sans la variable muette indiquant les célibataires, apparemment multicolinéaire aux autres variables explicatives (les élasticités sont de : 0.916 (15.6) et 0.176 (14.5) avec cette variable)

Source statistique : Enquête "Aspirations et Conditions de vie des Français", 1981 - 1992, pseudo-Panel CREDOC.
Les résultats détaillés sont présentés en annexe II.
t de Student entre parenthèses.

2.3 Comparaison des élasticités transversales et temporelles

Le test d'Hausman permet de juger de la significativité de la différence dans les estimations Between et Within. Il peut être opéré par un test sur la différence des estimations Between et Within (voir Dormont, 1987, p. 101), ou, de manière équivalente en jugeant de la validité globale, par un test de Fisher, des régresseurs Between ajoutés à une estimation en moindres carrés ordinaires de l'équation initiale (avant transformation Between ou Within).

La différence des deux estimateurs est très significative dans les ajustements sans les variables muettes de revenu relative (qui interfèrent avec l'effet-revenu dans les estimations transversales et n'indiquent donc sans doute pas seulement les effets individuels).

Tableau 2

Test d'Hausman (F. de Fisher)

	Avec toutes les variables explicatives		Sans les variables muettes de revenu relatif	
	(1)	(2)	(1)	(2)
Revenu minimum, famille de deux enfants ..	2.68	1.91	57.54	13.67
Revenu minimum, famille de trois enfants...	3.64	3.49	22.13	32.32
F limite				

(1) Population totale
(2) Sans le premier décile.

On peut donc conclure que l'indexation du revenu minimum au revenu disponible des ménages est entière temporellement, mais largement infra-unitaire transversalement. Notons que les estimations temporelles concernent des populations dont le revenu relatif est stable d'une période à l'autre : la progression des ménages dans l'échelle des revenus relatifs au cours du temps correspondra donc à une indexation infra-unitaire intermédiaire entre ces deux élasticités de 0.3 et 1.

2.4 Autres variables déterminantes

On observe des effets prévisibles (dans les deux types d'estimation) des autres déterminants du revenu minimum qui augmente avec le nombre d'enfants, l'anticipation favorable du niveau de vie, l'évolution passée positive du niveau de vie et l'existence de restrictions financières. La jeunesse semble également augmenter (une fois contrôlée l'influence du revenu) l'exigence de revenu minimum, ce qui peut s'interpréter par l'existence de besoins mieux diffusés dans les classes jeunes.

On notera que les paramètres des variables muettes mesurent l'augmentation en pourcentage du revenu minimum : + 5 % par exemple pour l'existence de restrictions financières dans l'estimation Between, + 6 et + 2% dans le passage des trois classes d'âge, + 13 % du premier au dernier décile (avec un saut de 6% entre le quatrième et le cinquième.

Conclusion

Les premiers résultats de cette étude permettent de répondre aux deux premières questions que nous avons posées :

1) Le revenu minimum demandé par les ménages dépend fortement d'un certain nombre de variables/revenu du ménage, structure familiale, âge du chef de famille, anticipations de revenu, situation financière), d'une manière incomparable quand on étudie ces déterminations sur enquêtes ou sur données individuelles temporelles.

2) L'élasticité-revenu de ce revenu minimum, qui mesure la pression des besoins ressentis par le ménage, est nettement plus faible dans les estimations transversales que sur séries temporelles. **Il y a donc une moindre diffusion sociale des besoins que sa diffusion temporelle** (qui est l'évolution des conditions de vie et de la technologie de consommation) : on mesure donc là précisément l'extension dynamique des besoins opérée par l'ensemble du système social sur toutes les classes sociales (sauf les ménages pauvres, dont l'élasticité-revenu est nulle) qui excède sa diffusion sociale "naturelle" (liée à un positionnement différent des ménages dans l'échelle du revenu relatif et des divers types de patrimoine).

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A N N E X E I

Statistiques descriptives du pseudo-panel des enquêtes "Conditions de vie et Aspirations des Français"

Tableau I.1

Taille des enquêtes

Années	Nombre de réponses utilisables
1981	1434
1982	1561
1983	1543
1984	1373
1985	1483
1986	1424
1987	1497
1988	1641
1989	1649
1990	1684
1991	1670
1992	1668

Questions du sous-fichier

N° Codes 1991 : intitulé

1	D3	Statut d'occupation du logement.
2	D4	Les dépenses de logement représentent-elles une lourde charge ?
3	G10	Préférence temps libre/pouvoir d'achat.
4	J13	Peut boucler son budget sans les prestations familiales ?
5	J14	Restrictions ressenties.
6	J19	Evolution du niveau de vie personnel dans les dix dernières années.
7	J20	Conditions de vie personnelles dans les cinq ans à venir.
8	J24	Revenu mensuel paraissant minimum, dans votre localité, pour une famille ayant deux enfants de moins de dix ans.
9	J25	Revenu mensuel paraissant minimum, dans votre localité, pour une famille ayant trois enfants de moins de dix ans.
10	R1	Selon vous, pour ne pas être considéré comme pauvre, de combien doit disposer chaque mois pour la nourriture un couple avec deux enfants ?
11	R2	Selon vous, pour ne pas être considérée comme pauvre, de combien doit disposer chaque mois pour la nourriture une personne seule ?
12	P4	Revenu du foyer en classes.
13	-	Revenu mensuel global du foyer.
14	-	Indicateur de patrimoine (logement principal, valeurs mobilières, biens fonciers, biens immobiliers).
15	-	Indicateur d'équipements (parmi 8 items : lave-vaisselle, téléviseur couleur, magnétoscope, piano, voiture, ordinateur domestique, four à micro-ondes, minitel).
16	-	Nombre d'enfants de 0 à 16 ans.
17	-	Nombre d'adultes.
18	-	Nombre d'actifs.
19	-	Taille d'agglomération (deux postes : Paris-grandes villes et autres)
20	-	Age (moins de 35 ans, 35-55 ans, 55 ans et plus).
21	-	Catégorie socio-professionnelle (6 postes).

Source : Gardes - Volatier, 1993, p.33

Description des données utilisées

Les données de cette étude proviennent de l'enquête "Aspirations et Conditions de vie des Français", réalisée chaque année en novembre-décembre auprés d'un échantillon de 2000 individus de nationalité française âgés de 18 ans et plus. La méthode d'échantillonnage est celle des quotas (âge, sexe, PCS individuelle) établis au niveau régional avec une stratification selon la région et la taille d'agglomération.

Les trois années d'enquêtes les plus récentes (1989, 1990, 1991) ont été utilisées pour cette première étude transversale. Les données monétaires ont été actualisées sur la base de novembre 1991, en utilisant le mois et l'année d'enquête. Les revenus par unité de consommation ont été calculés selon une échelle proche de celle d'Oxford (une u. c. pour le premier adulte, 0,7 pour les autres, 0,5 pour les enfants de 16 ans et moins).

Sur les 6000 enquêtés, 4800 se sont avérés avoir répondu à **l'ensemble** des questions factuelles ou d'opinion utiles au cellulage, soit 80%. Le taux de réponse est assez stable entre les différentes catégories socio-démographiques (Tableau I.2).

Tableau I.2
Taux de réponse (en %)

(en %)

Catégories	Taux de réponse
agglomération de moins de 200 000 habitants	79
agglomération de 200 000 habitants et plus	83
moins de 35 ans	85
de 35 à 55 ans	84
plus de 55 ans	70
s'impose régulièrement des restrictions	83
ne s'impose pas régulièrement des restrictions	76
Ensemble	80

Tableau I.3

Moyennes des données continues selon la réponse à l'ensemble des questions

	Répondants à l'ensemble des questions utilisées pour le cellulage	Non répondants à l'une des questions utilisées pour le cellulage
Nombre moyen d'unités de consommation	2,13	2,26
Revenu par UC moyen[1]	5059	5779
Revenu minimum subjectif pour une famille avec deux enfants	9560	9863
Revenu minimum subjectif pour une famille avec trois enfants	11509	11768

Source : Gardes - Volatier, 1993, p. 35-6

[1] Données brutes non actualisées.

Présentation des fichiers cellulés

N° Colonnes	Contenu
1-2	Tranches de revenu/UC (déciles)
3	Tranche d'âge (<=35, 36-55, >=56 ans)
4	Taille de la famille (1=adulte seul, couple, 2=plus de 2 personnes)
6-7	Effectif de la cellule
9-12	Nombre de personnes dans le foyer
14-17	Nombre d'enfants de moins de 16 ans
19-22	Nombre d'UC
24-31	Revenu/UC
33-40	Estimation du revenu minimum pour une famille avec 2 enfants
42-49	Estimation du revenu minimum pour une famille avec 3 enfants
51-54	Log(RUC)
56-59	Log(revmin2)
61-64	Log(revmin3)
66-67	Niveau de vie personnel depuis 10 ans mieux
69-70	Niveau de vie personnel depuis 10 ans pareil
72-73	Niveau de vie personnel depuis 10 ans moins bien
75-76	Conditions de vie dans les 5 ans vont s'améliorer
78-79	Conditions de vie dans les 5 ans vont rester semblables
81-82	Conditions de vie dans les 5 ans vont se détériorer
84-85	S'impose des restrictions
87-88	Nombre d'enfants de moins de 6 ans
90-91	Nombre d'enfants de 6 à moins de 16 ans
92-94	Nombre d'adultes

ANNEXE II

Résultats économétriques détaillés

Toutes les variables sont prémultipliées par $\sqrt{N_i}$

LYM2RN	Logarithme du revenu minimum pour une famille avec deux enfants
CYM2RN	Logarithme du revenu minimum pour une famille avec trois enfants
LYRN	Revenu disponible du ménage par unité de consommation
N(6,616,ADU)AN	Nombre (d'enfants de moins de 6 ans, de 6 à 16 ans, d'adulte)
DYjN	Variable muette indiquant le positionnement du ménage sur la jième classe de revenu (repérée par deux déciles successifs)
D âge jN	Variable muette par classe d'âge (modalité j)
D size 1N	Variable muette par taille de la famille (1 = adulte seul)
RN	$\sqrt{N_i}$
CVieAjN	Nombre de ménages répondant j à la question sur les conditions de vie anticipées à 5 ans
RESTRN	Nombre de ménages soumis à des restrictions financières
NIV10jN	Nombre de ménages répondant j à la question sur l'évolution du niveau de vie depuis 10 ans
BZ	Transformation Between de la variable Z
WZ	Transformation Within de la variable Z
CSZ	Transformation Cross-section de la variable Z
DZ	Différence première de Z entre deux enquêtes successives

I Estimation BETWEEN:
1.1 Toute la population:

LS // Dependent Variable is BLYM2RN
Date: 4-27-1994 / Time: 9:53
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.1231956	0.0066311	18.578323	0.0000
BN6ANN	3.6814007	0.6195321	5.9422272	0.0000
BN616ANN	4.3309428	0.6307440	6.8664038	0.0000
BNADUN	4.3577913	0.6215172	7.0115382	0.0000
BDY2N	-0.0741170	0.0083939	-8.8298394	0.0000
BDY3N	-0.0653828	0.0084348	-7.7515854	0.0000
BDY4N	-0.0604141	0.0075740	-7.9765090	0.0000
BDY5N	-0.0108739	0.0074287	-1.4637699	0.1437
BDY6N	-0.0066741	0.0068361	-0.9762984	0.3293
BDY7N	-0.0098823	0.0056597	-1.7460798	0.0812
BDY8N	-0.0025946	0.0053727	-0.4829286	0.6293
BDY9N	0.0107066	0.0052543	2.0376783	0.0420
BDAGE1N	0.1720110	0.0204886	8.3954504	0.0000
BDAGE2N	0.0807162	0.0117890	6.8467504	0.0000
BDSIZE1N	-0.1034015	0.0096977	-10.662528	0.0000
BNIV101N	1.0583328	0.1345500	7.8657195	0.0000
BNIV102N	1.0656984	0.1564717	6.8108054	0.0000
BNIV103N	0.9578660	0.1401064	6.8367043	0.0000
BCVIEA1N	0.1985449	0.1167001	1.7013258	0.0893
BCVIEA2N	0.0246287	0.1173651	0.2098466	0.8338
BCVIEA3N	0.1460974	0.1328104	1.1000454	0.2717
BRESTRN	-0.2057213	0.0374718	-5.4900362	0.0000
BRN	-1.7932430	0.6602314	-2.7160827	0.0068

R-squared	0.999566	Mean of dependent var	18.65082
Adjusted R-squared	0.999552	S.D. of dependent var	6.687038
S.E. of regression	0.141489	Sum of squared resid	13.95329
Log likelihood	398.0373	F-statistic	72969.54
Durbin-Watson stat	2.384377	Prob(F-statistic)	0.000000

LS // Dependent Variable is BLYM3RN
Date: 4-27-1994 / Time: 9:55
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.1077466	0.0062528	17.231777	0.0000
BN6ANN	2.8735433	0.5841826	4.9189130	0.0000
BN616ANN	3.3822287	0.5947547	5.6867626	0.0000
BNADUN	3.4805064	0.5860544	5.9388798	0.0000
BDY2N	-0.0761403	0.0079150	-9.6197675	0.0000
BDY3N	-0.0687311	0.0079535	-8.6416210	0.0000
BDY4N	-0.0664857	0.0071418	-9.3093117	0.0000
BDY5N	-0.0128198	0.0070048	-1.8301362	0.0677
BDY6N	-0.0038059	0.0064461	-0.5904228	0.5551
BDY7N	-0.0107894	0.0053368	-2.0217160	0.0436
BDY8N	-0.0083884	0.0050661	-1.6557670	0.0982
BDY9N	-0.0026103	0.0049545	-0.5268410	0.5985
BDAGE1N	0.1081793	0.0193196	5.5994744	0.0000
BDAGE2N	0.0478791	0.0111163	4.3071031	0.0000
BDSIZE1N	-0.0720455	0.0091443	-7.8787125	0.0000
BNIV101N	1.0716195	0.1268728	8.4464078	0.0000
BNIV102N	1.0245669	0.1475437	6.9441605	0.0000
BNIV103N	0.8721767	0.1321121	6.6017906	0.0000
BCVIEA1N	0.4691823	0.1100414	4.2636898	0.0000
BCVIEA2N	0.2128573	0.1106684	1.9233783	0.0548
BCVIEA3N	0.2930219	0.1252324	2.3398251	0.0196
BRESTRN	-0.1353894	0.0353337	-3.8317391	0.0001
BRN	-0.8945916	0.6225596	-1.4369574	0.1512

R-squared	0.999637	Mean of dependent var	19.31828
Adjusted R-squared	0.999626	S.D. of dependent var	6.895520
S.E. of regression	0.133416	Sum of squared resid	12.40641
Log likelihood	440.3380	F-statistic	87270.89
Durbin-Watson stat	2.401097	Prob(F-statistic)	0.000000

LS // Dependent Variable is BLYM2RN
Date: 4-27-1994 / Time: 10:02
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.0852534	0.0052079	16.370129	0.0000
BN6ANN	5.2567699	0.6756404	7.7804252	0.0000
BN616ANN	5.9284549	0.6913721	8.5749124	0.0000
BNADUN	6.1433890	0.6795166	9.0408227	0.0000
BDAGE1N	0.2695830	0.0204636	13.173779	0.0000
BDAGE2N	0.1636406	0.0106965	15.298560	0.0000
BDSIZE1N	-0.1520618	0.0103440	-14.700526	0.0000
BNIV101N	1.2003818	0.1542171	7.7837119	0.0000
BNIV102N	1.3106739	0.1763441	7.4324791	0.0000
BNIV103N	0.9121503	0.1575015	5.7913738	0.0000
BCVIEA1N	0.2795619	0.1250432	2.2357229	0.0257
BCVIEA2N	0.1432762	0.1286269	1.1138902	0.2657
BCVIEA3N	0.4559994	0.1421151	3.2086622	0.0014
BRESTRN	-0.3913003	0.0256033	-15.283218	0.0000
BRN	-3.6248388	0.7313577	-4.9563148	0.0000

-squared	0.999375	Mean of dependent var	18.65082
djusted R-squared	0.999362	S.D. of dependent var	6.687038
.E. of regression	0.168870	Sum of squared resid	20.10452
og likelihood	266.5545	F-statistic	80480.77
urbin-Watson stat	1.720313	Prob(F-statistic)	0.000000

LS // Dependent Variable is BLYM3RN
Date: 4-27-1994 / Time: 10:08
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.0703252	0.0050646	13.885703	0.0000
BN6ANN	4.6335453	0.6570516	7.0520271	0.0000
BN616ANN	5.1821225	0.6723503	7.7074735	0.0000
BNADUN	5.4537566	0.6608211	8.2530007	0.0000
BDAGE1N	0.2071492	0.0199006	10.409200	0.0000
BDAGE2N	0.1304875	0.0104022	12.544251	0.0000
BDSIZE1N	-0.1210475	0.0100594	-12.033301	0.0000
BNIV101N	1.1497050	0.1499742	7.6660204	0.0000
BNIV102N	1.2106931	0.1714924	7.0597498	0.0000
BNIV103N	0.7718309	0.1531682	5.0391063	0.0000
BCVIEA1N	0.4441629	0.1216029	3.6525694	0.0003
BCVIEA2N	0.2340134	0.1250880	1.8707899	0.0618
BCVIEA3N	0.5028088	0.1382051	3.6381348	0.0003
BRESTRN	-0.3269970	0.0248988	-13.133017	0.0000
BRN	-2.7623722	0.7112358	-3.8839048	0.0001

R-squared	0.999444	Mean of dependent var	19.31828
Adjusted R-squared	0.999433	S.D. of dependent var	6.895520
S.E. of regression	0.164224	Sum of squared resid	19.01347
Log likelihood	286.6415	F-statistic	90494.26
Durbin-Watson stat	1.729978	Prob(F-statistic)	0.000000

1.2. Sans le premier décile:

LS // Dependent Variable is BLYM2RN
Date: 4-27-1994 / Time: 10:18
SMPL range: 7 - 60 67 - 120 127 - 180 187 - 24
0 247 - 300 307 - 360 367 - 420 427 - 480
487 - 540 547 - 600 607 - 660 667 - 720
Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.1964942	0.0125869	15.610969	0.0000
BN6ANN	3.8777537	0.6507329	5.9590555	0.0000
BN616ANN	4.3768849	0.6654239	6.5775891	0.0000
BNADUN	4.5652014	0.6566553	6.9522039	0.0000
BDAGE1N	0.1665062	0.0228109	7.2994106	0.0000
BDAGE2N	0.0927342	0.0136663	6.7856131	0.0000
BDSIZE1N	-0.1438641	0.0108655	-13.240446	0.0000
BNIV101N	0.8724739	0.1541262	5.6607773	0.0000
BNIV102N	1.0280487	0.1735035	5.9252332	0.0000
BNIV103N	0.7586831	0.1556940	4.8729122	0.0000
BCVIEA1N	0.3219725	0.1226263	2.6256404	0.0089
BCVIEA2N	0.2209924	0.1298583	1.7017967	0.0893
BCVIEA3N	0.1731682	0.1390694	1.2451925	0.2135
BRESTRN	-0.1118975	0.0411282	-2.7206997	0.0067
BRN	-2.2567756	0.7019080	-3.2152013	0.0014

R-squared	0.999429	Mean of dependent var	18.79701
Adjusted R-squared	0.999416	S.D. of dependent var	6.527534
S.E. of regression	0.157736	Sum of squared resid	15.74938
Log likelihood	284.8649	F-statistic	79098.19
Durbin-Watson stat	1.923550	Prob(F-statistic)	0.000000

LS // Dependent Variable is BLYM3RN
Date: 4-27-1994 / Time: 10:16
SMPL range: 7 - 60 67 - 120 127 - 180 187 - 24
0 247 - 300 307 - 360 367 - 420 427 - 480
487 - 540 547 - 600 607 - 660 667 - 720
Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
BLYRN	0.1759632	0.0121468	14.486389	0.0000
BN6ANN	3.4594435	0.6279784	5.5088576	0.0000
BN616ANN	3.8459643	0.6421556	5.9891466	0.0000
BNADUN	4.0923697	0.6336937	6.4579623	0.0000
BDAGE1N	0.1197781	0.0220133	5.4411770	0.0000
BDAGE2N	0.0718830	0.0131884	5.4504638	0.0000
BDSIZE1N	-0.1141318	0.0104856	-10.884668	0.0000
BNIV101N	0.9279384	0.1487367	6.2387971	0.0000
BNIV102N	1.0860023	0.1674365	6.4860543	0.0000
BNIV103N	0.7340433	0.1502498	4.8854874	0.0000
BCVIEA1N	0.3504243	0.1183383	2.9612072	0.0032
BCVIEA2N	0.1509473	0.1253175	1.2045197	0.2288
BCVIEA3N	0.1012475	0.1342065	0.7544161	0.4509
BRESTRN	-0.0794576	0.0396901	-2.0019519	0.0457
BRN	-1.5707653	0.6773640	-2.3189382	0.0207

R-squared	0.999500	Mean of dependent var	19.45909
Adjusted R-squared	0.999489	S.D. of dependent var	6.731814
S.E. of regression	0.152220	Sum of squared resid	14.66720
Log likelihood	307.9295	F-statistic	90339.89
Durbin-Watson stat	2.044880	Prob(F-statistic)	0.000000

II. Estimation CROSS-SECTION:

2.2. Toute la population:

LS // Dependent Variable is CSLYM2RN
Date: 4-25-1994 / Time: 22:11
SMPL range: 7 - 60 67 - 120 127 - 180 187 - 24
0 247 - 300 307 - 360 367 - 420 427 - 480
487 - 540 547 - 600 607 - 660 667 - 720
Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
CSLYRN	0.2768123	0.0198687	13.932051	0.0000
CSAGE1N	0.3320745	0.1115579	2.9767005	0.0030
CSAGE2N	0.0629311	0.1114445	0.5646856	0.5725
CSSIZE1N	-0.2256771	0.1012183	-2.2296089	0.0261
CSN6ANN	0.4899835	0.6498300	0.7540180	0.4511
CSN616AN	1.8459768	0.7485311	2.4661325	0.0139
CSNADUN	1.4539418	0.6780646	2.1442527	0.0324
CSNIV1N	0.0326830	0.0667524	0.4896150	0.6246
CSNIV2N	0.0237212	0.0696704	0.3404779	0.7336
CSCVIEA1	-0.1005295	0.0689382	-1.4582542	0.1453
CSCVIEA2	-0.0923039	0.0650674	-1.4185898	0.1565
CSRESTRN	-0.0254096	0.0537499	-0.4727379	0.6366
CSRN	1.4908922	0.6878820	2.1673662	0.0306

R-squared	0.918537	Mean of dependent var	0.297288
Adjusted R-squared	0.916998	S.D. of dependent var	3.334978
S.E. of regression	0.960812	Sum of squared resid	586.2065
Log likelihood	-887.0014	F-statistic	596.6624
Durbin-Watson stat	1.993462	Prob(F-statistic)	0.000000

LS // Dependent Variable is CSLYM3RN
Date: 4-25-1994 / Time: 22:12
SMPL range: 7 - 60 67 - 120 127 - 180 187 - 24
0 247 - 300 307 - 360 367 - 420 427 - 480
487 - 540 547 - 600 607 - 660 667 - 720
Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
CSLYRN	0.2755779	0.0206175	13.366245	0.0000
CSAGE1N	0.3231659	0.1157617	2.7916464	0.0054
CSAGE2N	0.0742041	0.1156440	0.6416597	0.5213
CSSIZE1N	-0.1767220	0.1050325	-1.6825464	0.0930
CSN6ANN	0.2302644	0.6743175	0.3414778	0.7329
CSN616AN	1.6977936	0.7767379	2.1858000	0.0292
CSNADUN	1.2210592	0.7036160	1.7354058	0.0832
CSNIV1N	0.0326803	0.0692678	0.4717966	0.6372
CSNIV2N	0.0408498	0.0722958	0.5650362	0.5722
CSCVIEA1	-0.0478351	0.0715360	-0.6686858	0.5039
CSCVIEA2	-0.0573940	0.0675193	-0.8500388	0.3956
CSRESTRN	-0.0266334	0.0557754	-0.4775116	0.6332
CSRN	1.7883609	0.7138034	2.5053972	0.0125

R-squared	0.917874	Mean of dependent var	0.286197
Adjusted R-squared	0.916322	S.D. of dependent var	3.446661
S.E. of regression	0.997018	Sum of squared resid	631.2188
Log likelihood	-910.9710	F-statistic	591.4215
Durbin-Watson stat	1.972686	Prob(F-statistic)	0.000000

2.2. Sans le premier décile:

LS // Dependent Variable is CSLYM2RN
Date: 4-25-1994 / Time: 22:10
SMPL range: 13 - 60 73 - 120 133 - 180 193 - 2
40 253 - 300 313 - 360 373 - 420 433 - 480
493 - 540 553 - 600 613 - 660 673 - 720
Number of observations: 576

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
CSLYRN	0.6260917	0.0245254	25.528271	0.0000
CSAGE1N	0.1800347	0.0973161	1.8499983	0.0648
CSAGE2N	-0.0904228	0.0961910	-0.9400341	0.3476
CSSIZE1N	-0.2354048	0.0865812	-2.7188890	0.0068
CSN6ANN	0.2998547	0.5467071	0.5484742	0.5836
CSN616AN	0.6054088	0.6435242	0.9407709	0.3472
CSNADUN	0.2123025	0.5897084	0.3600126	0.7190
CSNIV1N	-0.1331739	0.0567423	-2.3469956	0.0193
CSNIV2N	-0.0185243	0.0592849	-0.3124622	0.7548
CSCVIEA1	-0.0270588	0.0594413	-0.4552196	0.6491
CSCVIEA2	-0.0128628	0.0547053	-0.2351287	0.8142
CSRESTRN	0.2194907	0.0466225	4.7078247	0.0000
CSRN	1.4812029	0.5931529	2.4971686	0.0128

R-squared	0.946956	Mean of dependent var	0.311182
Adjusted R-squared	0.945826	S.D. of dependent var	3.303622
S.E. of regression	0.768930	Sum of squared resid	332.8759
Log likelihood	-659.3873	F-statistic	837.5742
Durbin-Watson stat	1.769042	Prob(F-statistic)	0.000000

LS // Dependent Variable is CSLYM3RN
Date: 4-25-1994 / Time: 22:08
SMPL range: 13 - 60 73 - 120 133 - 180 193 - 2
40 253 - 300 313 - 360 373 - 420 433 - 480
493 - 540 553 - 600 613 - 660 673 - 720
Number of observations: 576

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
CSLYRN	0.6448704	0.0254713	25.317560	0.0000
CSAGE1N	0.1706877	0.1010692	1.6888200	0.0918
CSAGE2N	-0.0954712	0.0999006	-0.9556615	0.3397
CSSIZE1N	-0.1933176	0.0899203	-2.1498770	0.0320
CSN6ANN	0.0318125	0.5677914	0.0560285	0.9553
CSN616AN	0.3922748	0.6683422	0.5869370	0.5575
CSNADUN	-0.0723010	0.6124511	-0.1180518	0.9061
CSNIV1N	-0.1492343	0.0589306	-2.5323731	0.0116
CSNIV2N	-0.0080630	0.0615713	-0.1309537	0.8959
CSCVIEA1	0.0259946	0.0617337	0.4210757	0.6739
CSCVIEA2	0.0161967	0.0568150	0.2850786	0.7757
CSRESTRN	0.2305896	0.0484206	4.7622225	0.0000
CSRN	1.7732170	0.6160284	2.8784663	0.0041

R-squared	0.946391	Mean of dependent var	0.303406
Adjusted R-squared	0.945248	S.D. of dependent var	3.412893
S.E. of regression	0.798585	Sum of squared resid	359.0464
Log likelihood	-681.1836	F-statistic	828.2479
Durbin-Watson stat	1.686551	Prob(F-statistic)	0.000000

III. Estimation WITHIN:

3.1. Toute la population:

LS // Dependent Variable is WLYM2RN
Date: 4-27-1994 / Time: 10:57
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.5473262	0.0454742	12.035960	0.0000
WN6ANN	-0.5674251	0.2421740	-2.3430475	0.0194
WN616ANN	0.4059053	0.2153004	1.8852977	0.0598
WDAGE1N	0.4186782	0.1176525	3.5585995	0.0004
WDAGE2N	0.3545688	0.1100626	3.2215195	0.0013
WDSIZE1N	0.4419999	0.0982824	4.4972411	0.0000
WRESTRN	0.2041276	0.0566244	3.6049416	0.0003
WCVIEA1N	-0.0124698	0.0564568	-0.2208724	0.8253
WCVIEA2N	-0.0132286	0.0640269	-0.2066108	0.8364
WNIV101N	0.4055352	0.0629478	6.4424009	0.0000
WNIV102N	0.1972466	0.0688998	2.8628032	0.0043
WDY1N	0.5306647	0.2204009	2.4077244	0.0163
WDY2N	0.3713202	0.1979338	1.8759815	0.0611
WDY3N	0.3957056	0.2172244	1.8216438	0.0689
WDY4N	0.6543144	0.2093977	3.1247449	0.0019
WDY5N	0.2811727	0.1955531	1.4378331	0.1509
WDY6N	0.4980356	0.1789888	2.7824963	0.0055
WDY7N	0.3464963	0.1898848	1.8247706	0.0685
WDY8N	0.4189618	0.1969361	2.1273999	0.0337
WDY9N	0.2542969	0.1711547	1.4857723	0.1378
WRN	0.8631921	0.2149619	4.0155582	0.0001

R-squared	0.917582	Mean of dependent var	-0.019130
Adjusted R-squared	0.915223	S.D. of dependent var	2.438902
S.E. of regression	0.710121	Sum of squared resid	352.4863
Log likelihood	-764.5095	F-statistic	389.1053
Durbin-Watson stat	1.668030	Prob(F-statistic)	0.000000

LS // Dependent Variable is WLYM2RN
Date: 4-27-1994 / Time: 11:05
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.4980896	0.0400736	12.429366	0.0000
WN6ANN	-0.5147660	0.2406097	-2.1394233	0.0327
WN616ANN	0.4853570	0.2116781	2.2929012	0.0221
WDAGE1N	0.3788486	0.1146628	3.3040226	0.0010
WDAGE2N	0.3359404	0.1083494	3.1005280	0.0020
WDSIZE1N	0.4763903	0.0962285	4.9506138	0.0000
WRESTRN	0.2207993	0.0561614	3.9315112	0.0001
WCVIEA1N	0.0013342	0.0563102	0.0236930	0.9811
WCVIEA2N	-0.0207564	0.0637693	-0.3254927	0.7449
WNIV101N	0.4054832	0.0629112	6.4453296	0.0000
WNIV102N	0.2086705	0.0687872	3.0335641	0.0025
WRN	1.3577689	0.1339626	10.135431	0.0000

R-squared	0.915976	Mean of dependent var	-0.019130
Adjusted R-squared	0.914671	S.D. of dependent var	2.438902
S.E. of regression	0.712432	Sum of squared resid	359.3516
Log likelihood	-771.4537	F-statistic	701.6537
Durbin-Watson stat	1.682702	Prob(F-statistic)	0.000000

LS // Dependent Variable is WLYM3RN
Date: 4-27-1994 / Time: 11:00
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.6835213	0.0365835	18.683846	0.0000
WN6ANN	0.1633493	0.1948263	0.8384354	0.4021
WN616ANN	0.1025547	0.1732068	0.5920939	0.5540
WDAGE1N	0.4585654	0.0946502	4.8448443	0.0000
WDAGE2N	0.5393627	0.0885442	6.0914535	0.0000
WDSIZE1N	0.2914596	0.0790672	3.6862276	0.0002
WRESTRN	0.0661384	0.0455537	1.4518777	0.1470
WCVIEA1N	0.0879500	0.0454189	1.9364172	0.0532
WCVIEA2N	0.1736991	0.0515089	3.3722126	0.0008
WNIV101N	-0.0009272	0.0506409	-0.0183098	0.9854
WNIV102N	0.0376749	0.0554292	0.6796947	0.4969
WDY1N	0.8645786	0.1773102	4.8760801	0.0000
WDY2N	0.4731919	0.1592356	2.9716455	0.0031
WDY3N	0.5271442	0.1747547	3.0164804	0.0027
WDY4N	0.4341780	0.1684582	2.5773633	0.0102
WDY5N	0.5003472	0.1573204	3.1804348	0.0015
WDY6N	0.5616346	0.1439946	3.9003879	0.0001
WDY7N	0.2952690	0.1527603	1.9328909	0.0537
WDY8N	0.4029705	0.1584330	2.5434761	0.0112
WDY9N	0.2168193	0.1376921	1.5746677	0.1158
WRN	0.6803546	0.1729346	3.9341740	0.0001

R-squared	0.950624	Mean of dependent var	-0.019357
Adjusted R-squared	0.949211	S.D. of dependent var	2.534943
S.E. of regression	0.571285	Sum of squared resid	228.1301
Log likelihood	-607.8752	F-statistic	672.8812
Durbin-Watson stat	1.487527	Prob(F-statistic)	0.000000

LS // Dependent Variable is WLYM3RN
Date: 4-27-1994 / Time: 11:03
SMPL range: 1 - 720
Number of observations: 720

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.6057697	0.0326560	18.550032	0.0000
WN6ANN	0.2456082	0.1960729	1.2526370	0.2108
WN616ANN	0.1859762	0.1724966	1.0781446	0.2813
WDAGE1N	0.4236369	0.0934388	4.5338446	0.0000
WDAGE2N	0.5381395	0.0882940	6.0948614	0.0000
WDSIZE1N	0.3556689	0.0784167	4.5356296	0.0000
WRESTRN	0.0812156	0.0457660	1.7745847	0.0764
WCVIEA1N	0.1079427	0.0458872	2.3523505	0.0189
WCVIEA2N	0.1635206	0.0519656	3.1467079	0.0017
WNIV101N	-0.0067766	0.0512663	-0.1321851	0.8949
WNIV102N	0.0455999	0.0560547	0.8134882	0.4162
WRN	1.2906250	0.1091662	11.822572	0.0000

R-squared	0.948351	Mean of dependent var	-0.019357
Adjusted R-squared	0.947548	S.D. of dependent var	2.534943
S.E. of regression	0.580561	Sum of squared resid	238.6319
Log likelihood	-624.0773	F-statistic	1181.806
Durbin-Watson stat	1.567340	Prob(F-statistic)	0.000000

3.2. Sans le premier décile:

LS // Dependent Variable is WLYM2RN
Date: 4-27-1994 / Time: 11:07
SMPL range: 7 - 60 , 67 - 120 , 127 - 180 , 187 - 240 , 247 - 300 , 307 - 360 , 367 - 420 , 427 - 480 , 487 - 540 , 547 - 600 , 607 - 660 , 667 - 720
Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.8458555	0.0515839	16.397655	0.0000
WN6ANN	-0.5783133	0.2377880	-2.4320541	0.0153
WN616ANN	0.3736428	0.2106727	1.7735699	0.0766
WDAGE1N	0.3378946	0.1139327	2.9657390	0.0031
WDAGE2N	0.1171439	0.1092978	1.0717869	0.2842
WDSIZE1N	0.2605432	0.0957937	2.7198369	0.0067
WRESTRN	0.2251970	0.0551950	4.0800221	0.0001
WCVIEA1N	0.0199145	0.0559376	0.3560131	0.7220
WCVIEA2N	-0.0436338	0.0630059	-0.6925357	0.4889
WNIV101N	0.2873074	0.0618868	4.6424640	0.0000
WNIV102N	0.0606174	0.0678968	0.8927880	0.3723
WDY2N	0.7923092	0.1893887	4.1835077	0.0000
WDY3N	0.7176357	0.2057470	3.4879517	0.0005
WDY4N	0.9715799	0.1983255	4.8989149	0.0000
WDY5N	0.5130024	0.1844055	2.7819262	0.0056
WDY6N	0.6531668	0.1679849	3.8882471	0.0001
WDY7N	0.5605167	0.1787150	3.1363718	0.0018
WDY8N	0.5981900	0.1848140	3.2367133	0.0013
WDY9N	0.3589064	0.1603996	2.2375767	0.0256
WRN	-0.0798027	0.2231553	-0.3576107	0.7208

R-squared	0.931363	Mean of dependent var	-0.007537
Adjusted R-squared	0.929286	S.D. of dependent var	2.492765
S.E. of regression	0.662877	Sum of squared resid	275.9466
Log likelihood	-642.8788	F-statistic	448.5048
Durbin-Watson stat	1.621021	Prob(F-statistic)	0.000000

LS // Dependent Variable is WLYM3RN
Date: 4-27-1994 / Time: 11:08
SMPL range: 7 - 60 67 - 120 127 - 180 187 - 24
0 247 - 300 307 - 360 367 - 420 427 - 480
487 - 540 547 - 600 607 - 660 667 - 720

Number of observations: 648

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
WLYRN	0.9927719	0.0376032	26.401295	0.0000
WN6ANN	0.1875419	0.1733404	1.0819285	0.2797
WN616ANN	0.0015942	0.1535742	0.0103809	0.9917
WDAGE1N	0.3446613	0.0830535	4.1498686	0.0000
WDAGE2N	0.2847058	0.0796748	3.5733464	0.0004
WDSIZE1N	0.1409465	0.0698308	2.0184014	0.0440
WRESTRN	0.0986880	0.0402355	2.4527562	0.0144
WCVIEA1N	0.1279982	0.0407769	3.1389894	0.0018
WCVIEA2N	0.1297200	0.0459294	2.8243337	0.0049
WNIV101N	-0.1212047	0.0451137	-2.6866531	0.0074
WNIV102N	-0.0938725	0.0494947	-1.8966156	0.0583
WDY2N	0.8980765	0.1380588	6.5050310	0.0000
WDY3N	0.8504368	0.1499835	5.6702040	0.0000
WDY4N	0.7598161	0.1445734	5.2555730	0.0000
WDY5N	0.7305996	0.1344261	5.4349530	0.0000
WDY6N	0.7065987	0.1224560	5.7702262	0.0000
WDY7N	0.5123873	0.1302779	3.9330322	0.0001
WDY8N	0.5843494	0.1347239	4.3373841	0.0000
WDY9N	0.3243466	0.1169265	2.7739349	0.0057
WRN	-0.2991078	0.1626736	-1.8386996	0.0664

R-squared	0.965980	Mean of dependent var	-0.007481
Adjusted R-squared	0.964951	S.D. of dependent var	2.581096
S.E. of regression	0.483217	Sum of squared resid	146.6374
Log likelihood	-438.0315	F-statistic	938.5169
Durbin-Watson stat	1.552963	Prob(F-statistic)	0.000000

IV. Estimation en différence première:

4.1.;Toute la population:

LS // Dependent Variable is DLYM2RN
Date: 4-27-1994 / Time: 10:27
SMPL range: 61 - 720
Number of observations: 660

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
DLYRN	0.5953631	0.0413963	14.382036	0.0000
DN6ANN	0.2743343	0.5874705	0.4669754	0.6407
DN616ANN	1.4762980	0.6789195	2.1744816	0.0300
DNADUN	1.2279152	0.6289842	1.9522194	0.0513
DDY2N	-0.0012491	0.0228881	-0.0545753	0.9565
DDY3N	0.0217961	0.0229671	0.9490158	0.3430
DDY4N	0.0111463	0.0229244	0.4862177	0.6270
DDY5N	0.0095879	0.0228023	0.4204823	0.6743
DDY6N	0.0054044	0.0226718	0.2383750	0.8117
DDY7N	-0.0030010	0.0230097	-0.1304219	0.8963
DDY8N	0.0083901	0.0230590	0.3638540	0.7161
DDY9N	-0.0076586	0.0229001	-0.3344361	0.7382
DDAGE1N	-0.0372486	0.0138730	-2.6849799	0.0074
DDAGE2N	-0.0493569	0.0148570	-3.3221256	0.0009
DDSIZE1N	-0.1005755	0.1018768	-0.9872263	0.3239
DNIV101N	0.0706153	0.1917415	0.3682837	0.7128
DNIV102N	-0.0211674	0.1987785	-0.1064873	0.9152
DNIV103N	-0.0159338	0.1932822	-0.0824378	0.9343
DCVIEA1N	-0.0404578	0.1153353	-0.3507840	0.7259
DCVIEA2N	-0.1956068	0.1159448	-1.6870682	0.0921
DCVIEA3N	-0.2024616	0.1151590	-1.7581051	0.0792
DRESTRN	-0.0246894	0.0537916	-0.4589818	0.6464
DRN	0.9193081	0.6906870	1.3310054	0.1837

R-squared	0.916007	Mean of dependent var	0.033726
Adjusted R-squared	0.913106	S.D. of dependent var	2.944250
S.E. of regression	0.867898	Sum of squared resid	479.8180
Log likelihood	-831.2845	F-statistic	315.7724
Durbin-Watson stat	1.659357	Prob(F-statistic)	0.000000

4.2. Sans le premier décile:

LS // Dependent Variable is DLYM2RN
Date: 4-27-1994 / Time: 10:42
SMPL range: 67 - 120 127 - 180 187 - 240 247 - 3
00 307 - 360 367 - 420 427 - 480 487 - 540
547 - 600 607 - 660 667 - 720
Number of observations: 594

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
DLYRN	0.8714656	0.0503996	17.291117	0.0000
DN6ANN	0.2096296	0.5904746	0.3550188	0.7227
DN616ANN	1.2203046	0.6887823	1.7716840	0.0770
DNADUN	1.0051764	0.6400240	1.5705293	0.1168
DDY2N	-0.0058538	0.0230974	-0.2534401	0.8000
DDY3N	0.0117277	0.0231405	0.5068061	0.6125
DDY4N	-0.0010797	0.0231578	-0.0466253	0.9628
DDY5N	0.0048197	0.0230641	0.2089676	0.8345
DDY6N	-0.0046791	0.0229231	-0.2041214	0.8383
DDY7N	-0.0090783	0.0232161	-0.3910338	0.6959
DDY8N	-0.0026342	0.0233344	-0.1128906	0.9102
DDY9N	-0.0186133	0.0230718	-0.8067564	0.4201
DDY10N	-0.0359128	0.0228775	-1.5697891	0.1170
DDAGE1N	-0.0265620	0.0168175	-1.5794311	0.1148
DDAGE2N	-0.0403644	0.0177747	-2.2708896	0.0235
DDSIZE1N	-0.1013626	0.1012428	-1.0011832	0.3172
DNIV101N	0.1446982	0.1939366	0.7461109	0.4559
DNIV102N	0.0486406	0.1994998	0.2438126	0.8075
DNIV103N	0.1172809	0.1953511	0.6003593	0.5485
DCVIEA1N	0.0363510	0.1223458	0.2971171	0.7665
DCVIEA2N	-0.1591224	0.1222344	-1.3017809	0.1935
DCVIEA3N	-0.1377077	0.1215540	-1.1328929	0.2577
DRESTRN	0.0506861	0.0539565	0.9393878	0.3479
DRN	0.0064433	0.7001219	0.0092031	0.9927

R-squared	0.926293	Mean of dependent var	0.018011
Adjusted R-squared	0.923319	S.D. of dependent var	2.967974
S.E. of regression	0.821870	Sum of squared resid	385.0180
Log likelihood	-714.0735	F-statistic	311.4509
Durbin-Watson stat	1.689468	Prob(F-statistic)	0.000000

THE INCREASING MARGINAL UTILITY OF RELATIVE INCOME : EMPIRICAL FINDINGS ON FRENCH INDIVIDUAL DATA (*)

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May 1994

Abstract

Two empirical proofs are given of an increase of the marginal utility of relative income in a central zone of the income distribution: one uses the poverty lines declared by households, and the other relies on estimates of marginal utility derived from subjective measures of well-being. An economic interpretation is suggested either in terms of rapidly increasing needs throughout this zone, or in terms of the dependency of satisfaction on expectations of future income position, both of which are related to the life cycle position of the household.

Introduction

Friedman and Savage (1948) have proposed a non classical shape of the utility of money, characterised by a general concavity over the whole income distribution with a central convex zone corresponding to risk preference. Few tests of this hypothesis have been performed: some empirical works concern game behaviour in various civilisations classified according to their living standards (Pryor, 1976), other papers deal with the comparison of various types of households in industrial countries (Bailey, Olson and Wonnacott, 1980), or present simple tests based on questions on the *happiness of the household* (Bradburn and Caplovitz, 1965; Bradburn, 1969; AIPO poll cited in Easterlin 1974), their *perceived satisfaction* (Centers and Cantril, 1946), their *past income variation* (CERC, 1973), their *expected well-being* (Segal and Felson, 1973). We present here a direct test based on individual answers to questions related to the household's satisfaction.

If interpreted in terms of behaviour towards risk, the central convexity of these utility curves may come from a risk preference behaviour at the micro level as well as from the aggregation of concave individual utilities which may shift as relative income rises. But it seems difficult to relate the variations of marginal satisfactions towards life or well-being to behaviour towards risk, as the argument of theses satisfaction functions is not precisely a current income, which may vary through time, but some indicator of the relative social status of the household

(*) We are grateful to the Insee for giving us the possibility to use the individual data of the Family Expenditure Survey and of the Survey of Households' expectations and to J.L. Madre for processing the latter. We acknowledge remarks and helpful suggestions by F. Bourguignon, P.A. Chiappori, B. Fortin, J.M. Hourriez, S. Langlois, L. Lévy Garboua, C. Meidinger, C. Montmarquette, and M. Sollogoub in seminars at Universities of Paris I and Laval (Quebec), at the Credoc, at the Annual Meeting of the European Economic Association (Dublin, 1992) and at the Meeting of Applied Microeconomics (Strasbourg, 1992).

(as can be shown by the identity of the curves mapped over relative income for various countries or sub-populations with very different absolute incomes)[1].

On the contrary, recent works by Easterlin, Wachtel and Blatt, show the relative nature of welfare judgements. Easterlin (1973) remarks that what people perceive as their needs is socially determined: thus what one "needs" as he reaches adulthood typically depends on the impressions he has formed on "how to live" from observing life around him and in his society while growing up. Wachtel and Blatt (1990) show some empirical evidence that "once middle-class income levels are reached the increase in satisfaction brought by further increases in income is minimum". Moreover they note that "the phenomenon of expecting to need more than one earns is evident through the range of anticipated incomes and needs", especially for the middle class.

In the first section, we present the data and some empirical evidence of the existence of a central zone characterised by a rise of the marginal utility of relative income. The second section presents two explanations of such a non classical evolution of the marginal utility of income

1. Some empirical evidence

1.1. The data

In the 1989 INSEE Family Expenditure Survey, 7 827 French households have given full answers to questions related to their income and to four questions about their evaluation of well-being. The first question evaluates their own subjective welfare level using five alternative modalities ("You are well off", "you are okay", "you have to be careful", "you hardly make ends meet", "you have to borrow to make ends meet"); question 2, evaluates the minimum income (*YMIN*) they consider necessary to satisfy the essential needs; question 3 assesses the evolution of the household's well-being since one or five years (*NIVI 1*, *NIVI 5*); question 4 relates to the monthly income needed to reach different welfare levels, using six modalities ($RICH_j$), those used in the first question plus "frankly rich".

The results have been compared to those obtained on similar data sets: three "Aspirations and Living Conditions" surveys carried out by the CREDOC in 1989, 1990, 1991, which were aggregated to obtain 4 800 full answers, and the Canadian OPC surveys for 1977 and 1988 (around 2 500 answers). The data are presented more completely in appendix I.

1.2. Income elasticity of the subjective minimum income

A first statistical evidence relies on the income elasticity of the subjective minimum income *YMIN* (or the levels $RICH_j$ given in question 4): if this elasticity is unitary, the subjective minimum income is completely indexed on household income, so that it corresponds to the theory of relative poverty ; when null, it corresponds to the absolute poverty hypothesis. This elasticity can also be interpreted as an index of the pressure of needs felt by the

[1] Note that the mathematical equivalence between the utility measured on lotteries and the certain income utility relies upon the much discussed assumption of independance of irrelevant alternatives.

households: it may increase with the development of new needs for median income classes (i.e. if needs increase more rapidly than income for median income households).

Danziger's method (1984) consists in regressing in logarithmic form the subjective minimum income on household's actual income and other socio-economic variables such as the age or the sex of the respondent. His estimates on 2671 American households give rise to a correct explanation ($R^2 = 0.48$) and an income elasticity of minimum income of 0.33.

We apply the same specification[1] to estimate this elasticity for different levels of the income distribution in the 1989 INSEE family budget survey. We choose as explanatory variable, the per capita income (Y), the age of the head of household, the family size (number of adults and number of children under 16), and in addition three dummy variables indicating the status of the household in his dwelling. Regressions for the whole population (table 1) give an income elasticity of the subjective minimum income of 0.26 ($t = 43.2$; $R^2 = 0.33$) which is comparable to Danziger's results[2]. A more detailed analysis revealed estimation biases, related to possible measurement errors, which were discussed previously (Kapteyn *et al.*, 1988; Tammers, 1991) but not fully taken into account by previous studies. Close examination of the data shows that the minimum income and the disposable income declared by the household may both be measured with errors.

Instrumentation is a first method to correct for the possible inconsistency of the estimates. We have instrumented the disposable income by the total expenses and its powers, the age and the profession of household's head, the status of its dwelling, and the household composition. The instrumented income is much less variable than income, and gives rises to a much greater elasticity for the whole population (0.56 vs. 0.26).

A second method consist in eliminating households with a too important discrepancy between income and total expenditure. In order to discard households which may have badly reported their income, we have eliminated the 14 % of the population whose reported income pertains to a percentile in the income distribution which differs by more than 30 classes from the percentile class of its total expenditure. Then the income elasticity amounts to 0.38 for the selected sub-sample[3], but discarding households could entail a selection bias. An estimation using Heckman's selection model leads to an estimate of 0.39 for the whole population and shows that the selection bias is negligible.

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[1] A test of the linear versus logarithmic specification clearly shows that the second one performs much better.

[2] Danziger considers that his estimate falls in the range of previous studies, though in the low side. Morisette, Poulin (1991) obtain similar results for four canadian surveys of consumer finance (1983, 1986, 1987, 1988) containing 16199 to 37602 households: elasticities are between 0.37 and 0.41. On the Canadian OPC 1977 survey: Gardes-Langlois (1993) obtain an elasticity of 0.32 ($R^2 = 0.39$) for the whole population, rising from 0.2 to 0.45 from poors to middle class households (between first and fourth quintiles), thus declining to 0.2 for rich households. Similar results are drawn from the Credoc Aspiration surveys of 1989 and 1991 (Gardes-Volatier, 1993).

[3] The interest of this selection is shown by the fact that, for the 1291 housholds suppressed, the estimated elasticity is only 0.02 (t=1.3) and the correlation between minimal and disposable incomes amount to 6.4% only compared to 58% for the selected population.

Table 1: Income elasticity of minimum income (*YMIN*)

Population (1)	ln(*Y*)	ln(age)	nbr adults	nbr children < 16	dwelling (*dummy*) owners	buying	free renters	intercept	N	R2
Whole population	0.261 (0.006)	- 0.062 (0.014)	- 0.130 (0.005)	- 0.115 (0.005)	- 0.029 (0.011)	0.116 (0.011)	0.019 (0.017)	6.691 (0.078)	8545	0.334
Whole population *IV* (2)	0.557 (0.010)	- 0.012 (0.013)	- 0.102 (0.004)	- 0.070 (0.005)	- 0.036 (0.010)	0.043 (0.011)	- 0.018 (0.016)	3.915 (0.105)	8545	0.412
Whole population *|exp-inc|<=30*	0.378 (0.007)	- 0.042 (0.014)	- 0.119 (0.005)	- 0.096 (0.005)	- 0.030 (0.011)	0.072 (0.011)	- 0.005 (0.018)	5.586 (0.086)	7352	0.427
Whole population *|exp-inc|<=30* (3)	0.389 (0.008)	- 0.045 (0.014)	- 0.117 (0.005)	- 0.093 (0.005)	- 0.037 (0.012)	0.071 (0.011)	- 0.012 (0.018)	5.475 (0.096)	8545	
Whole population *IV, |exp-inc|<=30*	0.494 (0.008)	-0.012 (0.014)	- 0.107 (0.005)	- 0.076 (0.005)	- 0.040 (0.011)	0.035 (0.011)	- 0.006 (0.018)	4.450 (0.098)	7352	0.450
income>5th percentile										
Whole population	0.442 (0.008)	- 0.026 (0.013)	- 0.119 (0.004)	- 0.088 (0.004)	- 0.042 (0.010)	0.062 (0.010)	- 0.017 (0.016)	4.963 (0.090)	8137	0.418
Whole population *|exp-inc|<=30*	0.472 (0.008)	- 0.024 (0.014)	- 0.115 (0.005)	- 0.083 (0.005)	- 0.038 (0.011)	0.051 (0.011)	- 0.006 (0.017)	4.693 (0.095)	7103	0.454
Whole population *IV, |exp-inc|<=30*	0.523 (0.010)	- 0.014 (0.014)	- 0.111 (0.005)	- 0.074 (0.005)	- 0.037 (0.011)	0.040 (0.011)	- 0.000 (0.018)	4.204 (0.108)	7103	0.431
|exp-inc|<=30 (4)										
Quintile 1	0.026 (0.018)	0.051 (0.034)	- 0.112 (0.009)	- 0.060 (0.009)	- 0.087 (0.027)	0.026 (0.032)	0.001 (0.037)	7.852 (0.184)	1331	0.150
Quintile 2	0.489 (0.087)	0.001 (0.029)	- 0.115 (0.009)	- 0.074 (0.010)	- 0.024 (0.022)	0.058 (0.024)	- 0.012 (0.034)	4.430 (0.735)	1496	0.171
Quintile 3	0.642 (0.102)	- 0.017 (0.028)	- 0.107 (0.010)	- 0.063 (0.010)	- 0.044 (0.023)	0.026 (0.022)	0.004 (0.040)	3.205 (0.887)	1447	0.130
Quintile 4	0.401 (0.092)	- 0.018 (0.029)	- 0.141 (0.011)	- 0.109 (0.011)	- 0.049 (0.025)	0.076 (0.023)	0.010 (0.040)	5.385 (0.819)	1506	0.166
Quintile 5	0.349 (0.030)	0.010 (0.036)	- 0.119 (0.013)	- 0.119 (0.015)	- 0.025 (0.028)	0.058 (0.026)	0.040 (0.048)	5.711 (0.306)	1572	0.171

Values in parenthesis are standard errors.

(1) For all estimations the five highest income households have been omitted because of outlying values.
(2) Instrument for income : total expenditure and its powers, age and profession of household's head, status of its dwelling, and household composition.
(3) Maximum Likelihood estimation of Heckman's selection model.
(4) Two-step estimation of Heckman's selection model leads to a similar pattern of income elasticities along the income distribution : 0.069, 0.451, 0.708, 0.310, 0.280.

By both methods, used separatly or jointly (an estimate of 0.49 is obtained in this latter case), we obtain greater, and maybe more consisitent, estimates than Danziger (between 0.4 and 0.5 rather than 0.3). The indexation of minimum income on disposable income is still less than unity, but closer to the relative concept of poverty. An explanation of this result may be that by eliminating households with a large gap between declared income and observed total expenditure, we have selected a sub-population for which disposable income is closer to the permanent income definition, for households which have total expenses much greater or smaller than their income are probably in a transitory situation with important negative or positive windfall incomes. Instrumenting declared income by observed total expenditure and household characteristics leads as well to a predicted income which is closer to the permanent income. As we can consider that the minimum income declared by households relates to a permanent income concept, it is more pertinent to compute the permanent income elasticities of this minimum income. This permanent elasticity is greater than the current income one computed by Danziger *et al.* because the declared minimum income does not depend on windfall income received by the household.

But this mean estimates hides a very important heterogeneity. For instance the elasticity is close to zero for the poorest households (first five percentiles), revealing an absolute concept of poverty. When excluding these very poor households, the elasticity grows up to 0.44 for the remaining 95% of the population which are closer to the relative concept of poverty.

More interestingly, there is a systematic variation of the minimum income elasticity all along the income distribution. All the regressions on five sub-populations defined by quintiles of disposable income are significant (R^2 over 13 %) and give elasticity estimates rising from 0.03 to 0.64 in the third quintile, then declining till 0.35 in the last zone. Thus, the subjective needs measured by the minimum income *varies mostly in the central zone* and has only half of its income elasticity in the extreme zones compared to the central one. Moreover, as in the following analysis of risk aversion, *the adjustments are worse in the central zone,* thus indicating more complex behaviour than for the two extreme zones.

When parting the population into three cohorts (defined by ages 35 and 55 years), the same pattern is obtained for each cohort, but with a maximal elasticity obtained for a greater income as age increases, as if new needs appeared later (i.e. for higher incomes) for older households (see figures in appendix II). For the third cohort, elasticity grows up until almost the end of the distribution . According to our first explanation, this pattern can be justified by the satiation of basic needs, which appear soon in the life cycle, and the development of more luxury needs (or needs involved by age effects) during the last period of the life cycle, which cannot be afforded by low incomes.

Another interesting finding (table 2) concerns the dependency of the subjective income elasticity to the previous income changes : when the household has been affected by a sharp decrease of its economic conditions during the five past years, its subjective minimum income is greater by 13 % and its elasticity grows from 0.25 to 0.33, compared to the case of a small previous increase or a decrease of its income: this fact can be interpreted as *a ratchet effect of income variations on needs* (needs do not disappear when income decreases, and thus become more stringent).

Table 2: Income elasticity of minimum income according to age and past income variations

	Income			Dummies					
Quintiles	Y	Y1	Y2	DY1	DY2	DY3	DY4	N	R2
Whole population	0.270 (0.008)	-	-	0.120 (0.020)	0.060 (0.020)	0 (0.020)	0.025 (0.020)	8360	37.8
Whole population *lexp-incl<=30*	0.361 (0.007)	-	-	0.190 (0.020)	0.114 (0.020)	0.049 (0.020)	0.056 (0.020)	6585	35.0
Whole population	-	0.334 (0.015)	0.259 (0.007)	-0.508 (0.140)	0.057 (0.020)	0.000 (0.020)	0.023 (0.020)	8360	37.7
Whole population *lexp-incl<=30*	-	0.405 (0.180)	0.354 (0.008)	-0.245 (0.170)	0.112 (0.020)	0.047 (0.020)	0.055 (0.020)	6585	35.0
Quintile 3 (1)	-	0.788 (0.255)	0.496 (0.105)	-2.297 (2.350)	0.137 (0.030)	0.061 (0.040)	0.067 (0.040)	1696	31.5
AGE									
till 35 years	0.341 (0.014)	-	-	-	-	-	-	2088	23.0
36 to 55 years	0.306 (0.011)	-	-	-	-	-	-	3030	21.7
more than 55 years	0.314 (0.011)	-	-	-	-	-	-	2709	23.6

Values in parenthesis are standard errors.

Equation: $\ln(YMIN) = a\ln(Y) + bZ + cDY$

with $Z = \ln(age), \ln(size), X_1, X_2, X_3$

DY five dummies for changes in the households standard of living during the past five years (DY1 = sharp decrease,..., DY5 = sharp increase the coefficient of which is constrained to 0)

Y1 (Y2) = income for households with decreasing (increasing) income during the past five years.

(1) For the four other quintiles, the income elasticities are:
1st quintile: eY1 = -0.081 (0.014), eY2 = -0.07 (0.036); 2nd quintile: 0.528 (0.090), 0.132 (0.177); 4th quintile: 0.427 (0.093), 0.446 (0.220); 5th quintile: 0.351 (0.032), 0.370 (0.088).

1.3. The shape of cardinal utility indexes

The first question on the own subjective welfare level can be used as a ordinal index of utility. Discrete total and marginal utilities can also be computed from cardinal indexes, such as:

$$U_1(Y_i) = Y_i - YMIN_i$$

$$U_2(Y_i) = Y_i - RICH_3$$

$$UM_3(RICH_j) = k\,/\,(RICH_{j+1} - RICH_j)$$

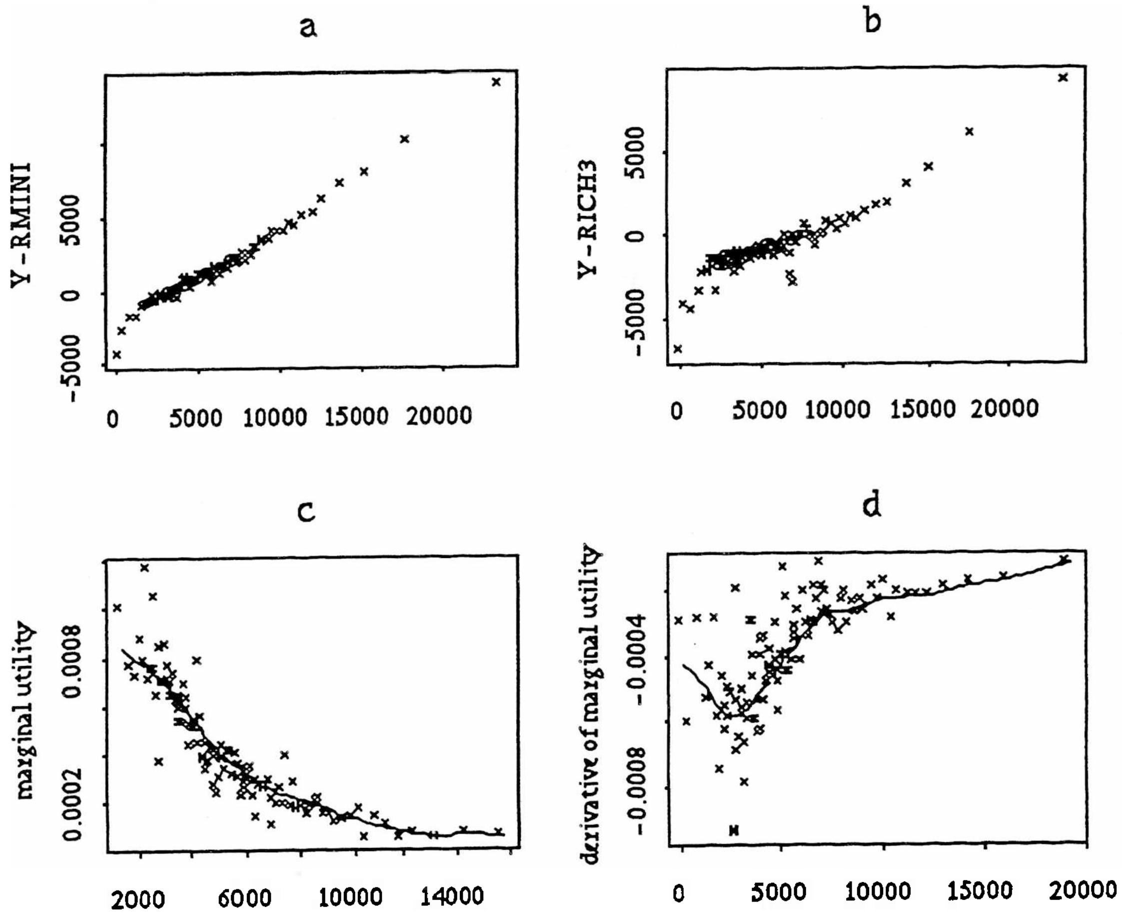
The first two are total utility indexes which simply assert that the distance between the household's actual income position and his subjective minimum income (or the income corresponding to the welfare level *$RICH_3$*) is correlated with his satisfaction for his present economic conditions. Figure 1 (a and b) shows the Friedman-Savage shape of the utility indexes U_1 and U_2 computed on cells defined by the percentiles of the income distribution, which increases with income but with variable rates along the income distribution.

The third index corresponds to a marginal utility which is founded on the hypothesis that answers to question 4 on "the total amount of income you consider as necessary to be frankly rich, well off,..." are equally distributed in terms of utility :

$$U_3(RICH_{i+1}) - U_3(RICH_i) = k$$

The interest of this last utility index relies on the quantification of the marginal utility by the individual himself, through his ranking of the different $RICH_j$. Moreover it is possible to compute the variation of this marginal utility *dUM₃ for the same individual* (between two adjacent $RICH_j$ given by this individual) thus avoiding problems of interpersonal comparisons. Figure 1 (b and c) shows the shape of these utilities computed on cells defined by the percentiles of the income distribution : the marginal utility is positive and decreasing (except for the first decile), but three different variations of theses marginal utilities appear along the income distribution. The second derivative dUM_3 remains negative but increases sharply between the second and the seventh decile, thus indicating a loosening of the satiation law in the middle of the income distribution.

Figure 1: Shape of utility indexes according to income



1.4. Estimation of the risk aversion by relative income zone

These utility indexes can be functionally related to the household's income so that the usual Arrow-Pratt absolute and relative risk aversion measures (ARA, RRA) can be computed from these functions. Montmarquette-Blais (1987) use the usual functional form to estimate the relative risk aversion :

$$U(i) = a_0 + a_1\left(\frac{Y_i^{\lambda} - 1}{\lambda}\right) + a_2 Z_i + u_i \quad (1)$$

with $U(i)$ = utility index for household i
Y_i = i th household's income
Z_i = vector of other explanatory variables
u_i = random error term,

which allows to compute the $RRA = -\dfrac{\frac{\partial^2 U}{\partial Y^2}}{\frac{\partial U}{\partial Y}} Y = 1 - \lambda$

Risk neutrality corresponds to $\lambda = 1$, risk aversion to $\lambda < 1$, risk preference to $\lambda > 1$. Szpiro (1986) estimates it to be between 1 and 2 for 15 countries, using property/liability insurance data for the period 1950-1980.

The utility indexes can be either a quantitative measure as previously defined, or the qualitative answer to the question concerning the subjective perception of its financial situation by the household. In this latter case, the fitting of equation (1) may be performed by a multinomial logit. In the former case the Box-Cox transformation concerns the first explanatory variable and not the utility index, so that a priori using least squares does not involve problems of non normality of the residuals.

1.4.1. Quantitative welfare indexes

Such an adjustment on income and on five explanatory variables has been made for two quantitative indicators : $U_2 = Y - RICH_3$ and $U_{2'} = (Y - RICH_3) / Y$ for the whole population (7 820 households without the 7 last households) and for three income zones : I till the second decile (1 565 households), II between deciles 2 and 6 (3 013 households), III after the sixth decile (2 349 households). By a grid search one obtains (table 3):

(i) U_2 : three sub-population parted by the 20th and 70th percentiles, with RRA = 1 - λ = + 0.6 , - 0.1 and - 0.3. Thus, *risk-aversion is detected in the first zone and risk-neutrality in the two others.* Another interesting feature in the *dramatic decrease of the coefficient of correlation R^2 in the central zone* : it seems that *there exists in this zone a plurality of behaviours* caused by the multiplicity of new needs which appear for the different types of households. This heterogeneity is a strong indication of a change of the conditions of choice in this central zone.

(ii) $U_{2'}$: shows risk aversion in the first and third zones (RRA = 1.8 and 1.2) and risk neutrality in the second one (RRA = 0.2). Another definition of the sub-populations by the 2nd and 6th deciles leads to similar results. Non-linear estimations on sub-populations of three consecutive deciles have been performed by taking as starting values a rough estimation by grid search. The RRA index seems to be low or negative in the middle-class (- 0.2 to + 0.2) and are significantly different from those obtained for poor (RRA = 1.8) and rich households (RRA = 1.2 to 1.5).

Table 3: Estimation of relative risk aversion (1 - λ)

	Zone 1	Zone A	Zone 2	Zone B	Zone 3	Whole population
1 - Quantitative indexes (1)						
$U_2 = Y - RICH_3$	0.6		- 0.1		- 0.3	
$U_{2'} = (Y - RICH_3)/Y$	1.8		0.2		1.2	
2 - Quantification of subjective welfare on grouped data (2)		- 1.6		1.4		0.8
3 - Qualitative answers on subjective welfare (logit)	0.5/0.6		0.4 (3)	2.0		0.5
4 - Multinomial logit on grouped data	1.2	-3.4	- 4.0	1.8	1.8	0.2
5 - Canadian deprivation indexes						
1977		- 1.4		0		0.4/0.5
1988						0.6

Zone A: up to the 50th percentile, zone B: from the 50th percentile on.

Zone 1: up to the 20th percentile,
Zone 2: from the 20th percentile to the 70th percentile,
Zone 3: from the 70th percentile on.

(1) Equation: $U(i) = a_0 + a_1\left(\frac{Y_i^\lambda - 1}{\lambda}\right) + A_2 Z_i + u_i$, with Z = age.

(2) Subjective welfare = 1 $\Leftrightarrow$ P = probability of being well-off = 1
Subjective welfare = 5 $\Leftrightarrow$ P = probability of being well-off = 0

Equation: $\ln\left(\frac{P_i}{1 - P_i}\right) = a\left(\frac{Y_i^\lambda - 1}{\lambda}\right) + b$ on grouped data (100 groups defined by the percentiles).

(3) Maximum likelihood estimation not very significant.

1.4.2. Qualitative welfare indexes

The same specification has been estimated by binomial and multinomial logit on the first question on subjective welfare (*SW*). First, a rough estimate of the probability of being well-off is computed on grouped data (100 groups of 73 individuals defined by the percentiles of the income distribution) by the formula : $P_i = \frac{5 - SW}{4}$ as *SW* takes its values on an arithmetic scale between 1 (well-off) and 5 (have to borrow to make ends meet). A logit model estimated on these data shows risk aversion for the whole population (RRA= 0.8, $R^2 = 0.95$), but risk loving before the 50th percentile (RRA = - 1.6, $R^2 = 0.84$) and risk aversion after (RRA = + 1.4, $R^2 = 0.94$)

Second, a binomial logit has been performed by grouping the first two items (well off, okay) and the three last ones. For the whole population the maximal score is obtain by grid search for RRA = 0.5. The three sub-populations (defined by the first and the third quintile) are characterised by risk aversion, and the RRA index does not change much : between 0.4 and 0.8 for poor households, between 0.4 and 1.4 for the middle class and around 2.0 for richer households.

Third, a multinominal logit have been performed by simultaneous equation on grouped data by percentile, for four items of answers (by grouping the two last items). The coefficient is obtained by grid search by minimising the determinant of the residuals covariance matrix. For the whole population, risk aversion appears, as small (RRA = 0.2), but its division by the first quintile and the median income shows stronger risk aversion for the first and the third population (RRA = 1.2 and 1.9), and clear risk preference for the central zone (RRA = - 3.5 to - 4.4)

One can conclude from these various estimations that *relative risk aversion seems to change as relative income increases, just in the way predicted by Friedman-Savage.* Nevertheless, these estimations are very sensitive to changes in the definition of sub-populations: the results obtained are less precise than those on the income elasticity of the subjective minimum income, but give rise to the same distinction between middle class households and poor or rich ones.

2. Two possible explanations of the rise in marginal utility

2.1. Increasing needs

We can first assume that *the consumer's wants increase sharply in a central zone, by the discovering of new goods* (information effect), *or the acquisition of human capital and financial facilities which make the consumption of certain goods* (cultural goods, travels, bequests, access to the financial markets, socially valued sports...) *easier and more attractive*, as they represent an identification to the status of the richest part of the population. If the appearance of new wants is concentrated in the central zone, each income increase becomes more important and useful for consumers who need it to satisfy new wants which have not yet reached their level of saturation, so that the marginal utility of income is increasing until the disappearance of the discovering of new consumption opportunities.

The appearance of some specific needs as income increases can be directly shown by the analysis of the *subjective needs declared by the individuals*. In the INSEE survey of households' expectations conducted three times a year for about 6 000 households interviewed (see Gardes-Madre, 1990, 1991), a question concerns the use of an income increase : "In case of an important increase of your income, what would you prefer to do first ?

1. Buy or build a dwelling ;
2. Make important expenses for durables ;
3. Use this income mainly for a better daily life ;
4. Make a saving by buying land or dwellings ;
5. Make a saving by buying bonds or other financial goods ;
6. Keep your money in cash or in a bank deposit ;
7. Invest your money in your enterprise or your farm ;
8. Other uses ;
9. Do not know.

The hypothesis of increasing needs for the middle income classes gives rise to precise assumptions which concerns each of these expenses :

- expenses 3, 6, 8 and the no-answer 9 may be dominant for poorer households and then decrease when new needs appear,
- expenses 1 and 2 may diffuse in the beginning of the central income zone,
- expenses 4, 5, 7 may increase in the end of the central zone and for higher incomes.

The percentages of answers for each income class for the cumulated population of three recent surveys (about 8 000 households)[1] shows exactly these patterns through the income distribution, as it is clear from table 4 and figure 2.

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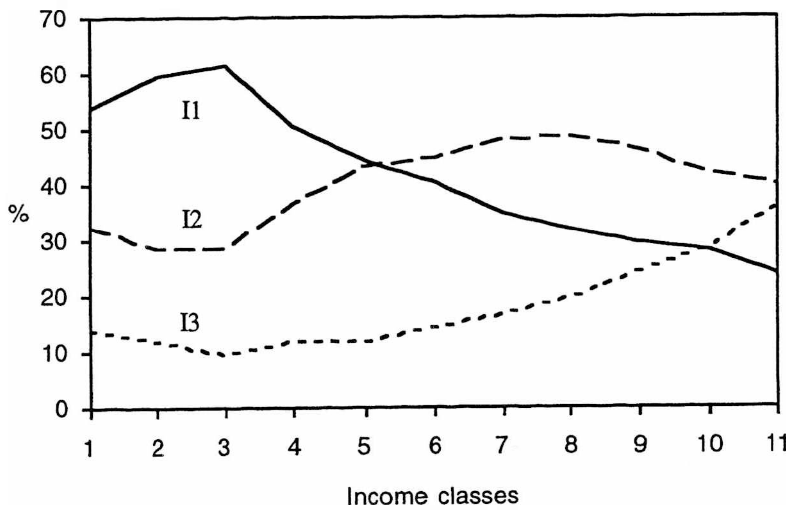
[1] All the computations have been performed on tables prepared by J.L. Madre (INRETS) who has built the whole dataset of these INSEE surveys.

Table 4: Answers to the question: "In case of an important increase of your income, what would you prefer to do first?"
(% of the whole population having answered)

	Income classes										
Questions	1	2	3	4	5	6	7	8	9	10	11
I1: uses 3+6+8+9 (better daily life)	53.8	59.5	61.4	50.8	44.3	40.4	35.1	31.9	29.5	28.3	23.7
I2: uses 1+2 (durables and housing)	32.4	28.7	28.8	36.9	43.4	45.1	48.2	48.5	46.5	41.8	39.9
I3: uses 4+5+7 (investment)	13.9	11.9	9.8	12.2	12.2	14.5	16.8	19.5	24.4	28.8	36.4
% population	1.7	3.3	8.1	11.4	14.6	14.2	12.8	18.4	8.8	3.7	3.0
deciles			D1	D2	D3 D4	D5	D6	D7 D8			

Figure 2 : Percentage of uses according to income classes



Another indirect indication of increasing needs can be found in *the variation of spontaneous purchases* (not anticipated by a willingness to buy in the previous period). This behaviour concerns more than one half of French households (and 86% of the younger ones), especially for small purchases, and can be shown to be related to unexpected income (Gardes, Madre, 1990). CREDOC Aspirations Surveys (Beaudoin, 1993) show a striking dependency of the percentage of this impulsive behaviour on relative income, especially for households the head of which is from 18 to 49 years old: this percentage first decreases with income, then increases after an income level which diminishes as age increases. Normally, budgetary constrains may impede spontaneous purchases for the poorest households, and this type of consumption may increase with income, as it does for older households. The explanation may lie in the appearance of new basic needs which constrains the household to depart from habits of irrational purchases. In the same surveys, a question concerns the number of consumption desires and the number of declared restrictions : both appear to reach a maximum for middle-aged households (around 48 years old) and for middle-income classes, as shown in table 5. The pressure of needs can explain this increase of consumption desires and restrictions, as well as the decline of spontaneous purchases in the middle of the income distribution.

Table 5: Percentage of spontaneous purchases according to income classes and age

Annual income per head	less than 25 000 F	from 25 000 F to 40 000 F	from 40 000 F to 60 000 F	from 60 000 F to 100 000 F	more than 100 000 F
age 18 to 24	98.6	92.9	86.8	80.9	94.7
age 25 to 49	65.3	59.1	52.5	63.4	69.1
age 50 and more	20.9	31.0	36.7	40.4	58.9
Whole population	61.2	57.9	51.2	56.5	69.1

2.2. Expectations of future income change

Another explanation of the central convexity of the utility function relies on the shape of the expectations of future income changes[1]. Consider an individual living two periods, whose utility, $u(W)$, of a certain wealth W is concave all over the wealth distribution, and who expects its wealth to increase in the future by an amount $O(dW^2)\ dW > 0$, with a subjective probability p depending on its present wealth W, his age, his human capital, etc...., or to decrease by the same amount with a probability (1-p). The individual can compute his expected utility as :

$$U(W) = E_{t=0}U(W,p) = u(W) + e^{-\rho}\left[pu(W+dW) + (1-p)u(W-dW)\right] \quad (1)$$

with a fixed subjective discount rate ρ. The second order derivative of expected utility $U(W)$ can be written as :

$$\frac{\partial^2 U}{\partial W^2} = u''(1+e^{-\rho}) + 2e^{-\rho}\left[2u''p'(W) + u'p''(W) + (p-\frac{1}{2})u'''\right]dW + O(dW^2)$$

with $u''(W) < 0$, and $O(dW^2)$ a second order residual. The second term of this expression can change the convexity of expected utility even if $u(W)$ remains uniformly concave as soon as

$$RPA\ /\ RRA > (\text{or} <) - 2 - \frac{1}{p'(W)} \quad \text{if } p' > (\text{or} <) 0$$

$$\text{with } RPA = -\frac{p''}{p'}Y \ , \ RRA = -\frac{u''}{u'}Y \ , \ dW = 1 \ \text{ and } \left(p - \frac{1}{2}\right)u''' \approx 0$$

We obtain estimates of these income expectations in French conjuncture surveys[2] which include a question on households' expectations of their future financial situation. Five items of

[1] See Gregory, 1980, for an amusing example of non linearity in utility due to uncertain wealth change.
[2] The data has been prepared by J.L. Madre; see Gardes-Madre, 1990, 1992.

answers are proposed which are grouped in three items (increase, stability, decrease), the frequencies of which are noted p_1, p_2, p_3. A first order approximation on

$$U(W) = u(W) + e^{-\rho}\left[p_1 u(W + dW) + p_2 u(W) + p_3 u(W - dW)\right]$$

leads to :

$$\left(1 + e^{-\rho}\right)u(W) - U(W) = \left(1 + e^{-\rho}\right)\left(p_1 - p_3\right)u'(W)dW$$

so that the discrepancy between the concave certain utility function $u(W)$ and the expected utility $U(W)$ depends on $(p_1 - p_3)$. Table 6 shows that this difference increases sharply between the median and the ninth decile of the income distribution and decreases for higher income classes. Thus, the increase of marginal utility of an uncertain wealth can be thought of as more probable for middle-aged households and the middle income class.

Table 6: Households' expectations of their financial situation

	Income classes							
Population	1	2	3	4	5	6	7	8
All households								
p_1	14.7	14.4	17.6	18.9	21.6	22.4	22.8	20.1
p_3	10.9	10.9	10.9	11.4	9.9	10.3	8.0	9.8
$(p_1 - p_3)$	3.8	3.5	6.6	7.5	11.6	12.1	14.8	10.3
I	4.1	3.1	6.7	7.4	12.0	13.3	17.3	12.6
$(p_1 - p_3)$								
age <= 34 years	33,7		25.6		28.8		35.8	
34< age< 55	5.4		8.8		9.6		16.3	
55 <= age	- 6.1		- 6.1		- 3.0		- 0.6	

Source : Enquêtes INSEE de Conjoncture auprès des ménages, 1988-89-90 (around 5000 households each year)

I = weighted frequency of 5 items of answers by weight +2, + 1, 0, - 1, - 2.

p_1 = weighted frequency by 1, 1, 0, 0, 0.
p_3 = weighted frequency by 0, 0, 0, 1, 1.

Question : "Do you think that your financial situation will in the next months sharply increase/ increase a little/ remain stable/ decrease a little/ sharply decrease".

Conclusion

The analysis of utility indicators based on subjective answers given by households to questions on their standard of living gives rise to a positive test of the Friedman-Savage hypothesis of an increase of the marginal utility of income in a central zone of the income distribution. This surprising behaviour can be explained by the widening consumers ' choice set as income increases or by changes of households ' expectations about their future position in the income distribution.

Finally, one can make the hypothesis that the central zone characterised by an increasing marginal utility has widened as the mean households' income grew during the last thirty years, and that it was probably narrower in the fifties or the sixties (as is suggested by the aggregate data from the surveys quoted in section 1). Thus the central zone where the usual hypothesis on marginal utility is refuted takes now an important place over the income distribution.

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Appendix I: Subjective questions about the evaluation of well-being in the French INSEE 1989 Family Expenditure Survey

1. Questions

Variable AISE : Concerning your budget, can you tell me which of the followings suits better your own situation ?

- You are well off
- You are okay
- You have to be careful
- You hardly make ends meet
- You have to borrow to make ends meet
- Don't know or don't want to answer

Variable RMINI : According to you what is the smallest amount of money a family like yours must have just to meet its needs ?

(In francs by month)

Variable $RICH_j$: For a family like yours what is the total amount of income you consider necessary to be said ...

- frankly rich
- well off
- okay
- to have to be careful
- to hardly make ends met
- to have to borrow to make ends met.

2. Missing answers

Among the 9038 responding households, some have given incomplete answers to the question on the evaluation of well-being, and some gave no indication about their own income (REVTOT variable).

The following table indicates the total of missing answers for the different questions we have used in this paper :

REVTOT	209
AISE	26
RMINI	308
$RICH_j$	990

Globally 1211 households have given incomplete answers to at least one of the first four questions (variables REVTOT, AISE, RMINI, RICHJ). These households have not been taken into account for the analysis, which finally bears on 7827 households. For some computations the number of households is slightly less important due to households who assessed consecutive levels of well-being at the same monetary amount.

3. Means of answers for the 7827 households with full answers to the first four questions

REVTOT : 6028.96 F per Consumption Unit (Oxford equivalent scale)

AISE : (distribution of households)

well off	okay	careful	hard	borrow
556	2463	3456	1204	148

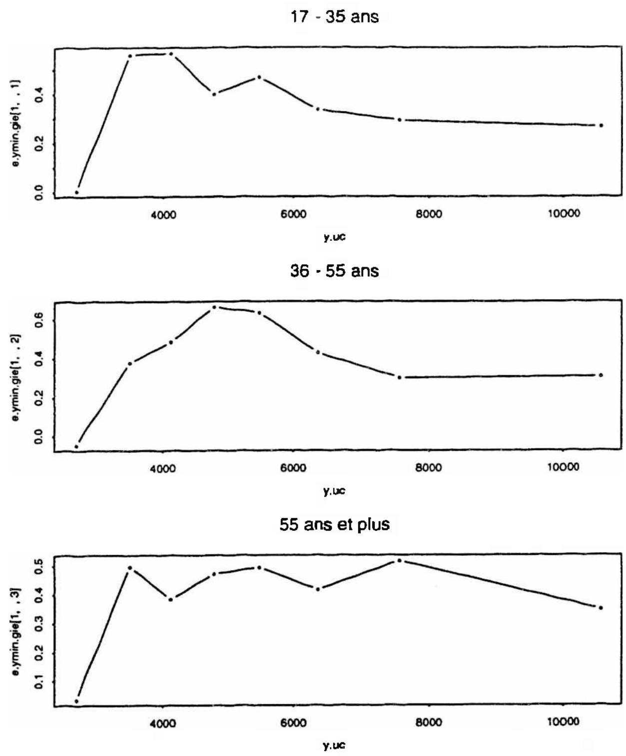
RMINI : 4680.60 F per Consumption Unit

$RICH_j$ (monthly income per consumption unit to be ...)

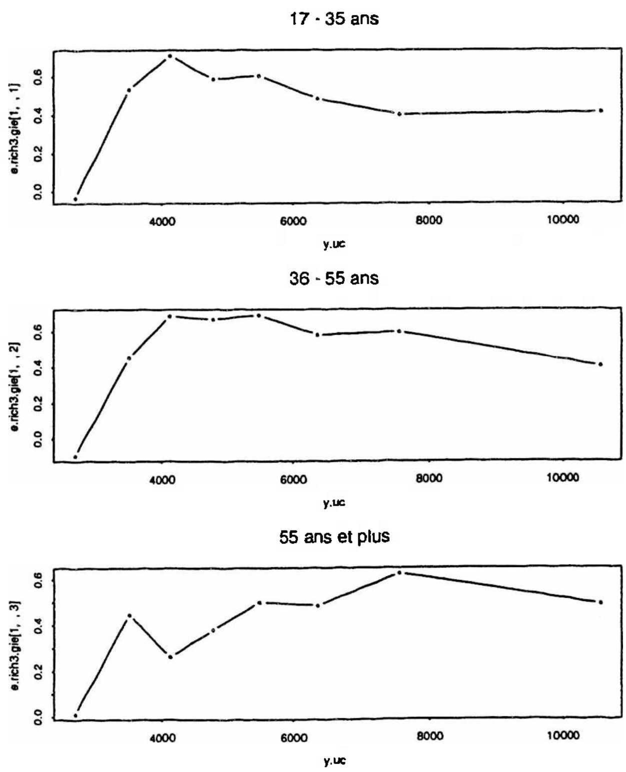
rich	well off	okay	careful	hard	borrow
23561.79	10340.17	6677.97	4576.81	3450.03	2663.56

Appendix II

Elasticity of minimum income according to age and income



Elasticity of RICH3 according to age and income



HEDONIC PRICES FOR ENVIRONMENTAL CHARACTERISTICS IN THE FRENCH CAR MARKET

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INTRODUCTION

The hedonic approach has been often used for the analysis of cars'demand, because of the measurability of the characteristics of these durable goods and because it allows to analyse the structure and the price policy of the industry (see, for instance, Cubbin, 1975, Ohta, 1987, Becuwe-Mathieu (1991), Bresson-Mathieu, 1992).

This paper concerns the environmental characteristics of cars (catalytic converter and airbag) and shows that they are positively valued by the market. Moreover, the hedonic price, evaluated on individual panel data[1] for three periods of time and eighty models, is proved to be much correlated to the market price. The difference between these two prices seeems to be correlated to the perceived quality by the consumer, thus proving the existence of an Akerlof effect.

Section 1 presents the data and the estimation of hedonic prices. Sections 2 and 3 give the demand-price elasticity and the proof of the Akerlof effect.

SECTION 1 : ESTIMATION OF THE HEDONIC PRICE FUNCTION

According to the Lancaster model (1966) and to the Griliches approach (1961), the cars'prices reflect the valorization of the characteristics embodied in the different models, through the optimization of consumers choices in the market. Apart from technical characteristics (engine type, engine power, environmental characteristics, outside area, reliability), other variables are included in the regression to reflect the influence on market

1 *: Thanks are due to M. Linard and J.L. Madre for supplying part of the data set.*

prices of the origine of the vehicule and its market category (B : supermninis, M1 : small family cars, M2 : large family cars, H : executive cars).

The hedonic price function is estimated in an usual semi-logarithmic form :

$$\text{Log } P_{it} = a_0 + a_1.X_{1it} + \ldots + a_n.X_{nit} + u_{it}$$

on each period separetly or a poling of the three periods.

Data :

The data contains 180 points : 53 models[2] are present the second half-year 1991 and the first half-year 1992 ; 63 models for 1992.1 and 1992.2. The details of the variables are presented in appendix 1.

Over the period, the main change concerns the generalization of the catalytic converter and the appearance of the airbag, the valorization of which shown in the hedonic price function.

The hedonic price function :

Table 1 presents the estimated coefficients of the hedonic price function[3]. The estimation is quite good (R^2 around 0.97) and the coefficients are generally signicative and with correct signs. The four technical characteristics are positively related to the price : diesel engine cars are more valuated by 25 %[4], each kiloWatt of power increases the price by 0.7 % (about 0.5 % for each bhp), and each supplementary square meter of outside surface increases it by 18 %. Each unit of reliability gives rise to much weaker hedonic price increase of 3 %. The french and german origin of the car increases, as expected, the hedonic price by around 10 %. The french origin is a little more appreciated for the whole data set, and this appreciation increases sharply over the period. Perhaps, the market price choosen by french makers was too much increased in this period relatively to the hedonic price of the national origin of the car, thus explaining the market failure of french cars in the beginning of 1993.

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2 : *Accurately, we worked by homologated type.*

3 : *As the panel is not calibrated (models change from one period to another) and as the characteristics of each models do not change from one period to another, it was not possible to compute panel estimation.*

4 : *This important difference, ""all thing being equal, corresponds, in fact, to the difference of price between petrol models and turbo-diesel models. Only, such an engine can get comparable power.*

The environmental characteristics are hightly significative in the estimations : the presence of an airbag increases the hedonic price by 7 % in average and the catalytic converter by 9 % (this hedonic price of the catalytic converter was increasing significantly aver the period, which would imply an increased demand of this equipment by the end of 1992).

The increase in the constant of the regression (all other coefficient remaining the same) indicates the small inflation of quality adjusted cars price of 0.9 % and 0.4 % over the two half-years.

SECTION 2 : PRICE ELASTICITIES OF CARS'PURCHASES

Table 2 presents the estimation of a demand function where half-year sales are explained by cars'characteristics. It shows clearly that all characteristics, and particulary the regressor for the loyalty of customers[5], are significant with stable coefficients and correct sign (from an economic point of view) from one period to another, except for the catalytic converter, the coefficient of which varies and is not significant, except perhaps for the last period. This result will be more thoroughly discussed later.

The last equation of this table contains the mark or the national origin of vehicules as supplementary regressors : it shows the pre-eminence, over this period, of Renault on Peugeot SA or german and japanese cars (of this last type it is established a quota for 3 % of the market, which explains probably its negative coefficient). By adding the same variables to the hedonic price equation (last line of table 1), one obtains the same hierarchy of the coefficients of these origins, thus revealing that Renault had choosen, during this period, to take advantage of the increased demand of its cars to increase their relative price (or the converse of its concurrents).

In table 3, the demand function is estimated[6] on prices, market categories, french origin, engine type, number of doors and the existence of catalytic converter in two succeeding periods, by differencing the panel data between two periods. The own price-

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5 *: Thanks due to J.L. Madre for computing loyalty index on individual answers of the INSEE survey on households expectations (Enquetes de Conjoncture auprès des Menages). See Gardes-Madre (1990), for a description of these data.*

6 *: In linear term, a better specification than the logarithmic equation.*

elasticity is between - 3.0 (t = 1.4) and - 1.2 (t = 0.8) on six or 12 months[7], and the dummies for the existence of a catalytic converter show that its effect does not appear immediatly when the converter is added to a car : this may explain its insignificance in the equation of sales over characteristics (table 2).

Point price-elasticities computed for each car between two periods (table 4) are generally negative, but Giffen effects appear mainly for ancient models (62 % of positive price-elasticity, versus only 29 % for a new or middle-aged models) with petrol engines, and diesel engines which are characterised by an increasing demand and increasing prices during this period. On the contrary, these ancient cars have decreasing prices and demand, perhaps because they are in the end of their diffusion phases.

SECTION 3 : AKERLOF EFFECTS

We use in this section perceived quality indexes : Q_1 is the proportion of owners of a mark who declare they will buy the same mark in the future, Q_2 the proportion of satisfied and very satisfied users of their cars.

These indexes can be explained by cars'characteristics[8] and, eventually, through an Akerlof effect[9], by the market price or, better, the difference between the market and the hedonic price of vehicules (this difference measuring the unexplained part of the market price). Table 5 shows that both relations are well estimated (thus proving the existence of an Akerlof type effect) and that the second index perform better than the first one for this Akerlof Effect. Moreover, this effect is much stronger for the second regression on the explained part of the market price, which is normally more in accordance with the Akerlof model (the price coefficient is much greater, as its statistical significance). This Akerlof

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7 : *Between 1992.1 and 92.2, or 1991.2 and 1992.2. Note the same hierarchy between own price-elasticities in the short and in the long one, as the one generally obtained between income elasticities.*

8 : *Note that the characteristics used in this equation are not the same as those used in the hedonic price function : these characteristics are choosen to be more known by the consumer than those more technical characteristics (outside area, engine power), because the equation concerns directly the quality perceived by the consumer (and not the characteristics valuation by the two sides of the market in the hedonic price).*

9 : *The Akerlof effect can be thus defined : "all things being equal (i.e. for quality adjusted prices) and in the case of asymetric information between buyers and dealers, higher prices are an indicator of the quality of goods for the consumer".*

effect proves the existence an asymetry of information between buyers and dealers on the cars'market.

CONCLUSION

The computation of hedonic prices for the french car market in 1991 and 1992 shows the positive influence of environmental characteristics of cars and the necessary delay for the consumers to perceive theses characteristics. Moreover, Akerlof effect of a perception of quality through unexplained prices is directly proved by statistics of the perceived cars'quality by consumers.

ABSTRACT

In this paper, the computation of hedonic prices on individual panel data shows the positive valorization of environmental characteristics by the market and gives some evidence of an Akerlof effect between perceived quality and the part of the market price which is not explained by cars'characteristics.

Key words : hedonic prices, environmental characteristics, cars demand.

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APPENDIX 1 : DATA SOURCES AND VARIABLES

PRICE : P_{ijt}, market price for a model i of the mark j in period t, supplied by L'argus, le Moniteur Automobile, makers data.

SALES : S_{ijt}, monthly sales by model i (in fact, by homologated type), supplied by Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME).

ORIGIN : O_{ijt}, origin of construction (dummie variable, France or Germany).

ENGINE TYPE : E_{ijt} (dummie variable : 0 = diesel ; 1 = gazoline), supplied by makers data and ADEME panel data.

ENGINE POWER : P_{ijt} in kW, supplied by makers data and ADEME panel data.

FISCAL POWER : FP_{ijt} in cv, supplied by makers data and ADEME panel data.

OUTSIDE AREA : A_{ijt} in m^2, supplied by makers data and ADEME panel data.

OVERALL CONSUMPTION : C_{ijt} in liters of petrol (or diesel) per 100 km, computed and supplied by ADEME.

NUMBER OF DOORS : D_{ijt} (dummy variable : 0 = 2 or 3 doors ; 1 = 4 or 5 doors), supplied by ADEME panel data.

RELIABILITY : R_{jt}, for the mark j at the period t, reported from 1 (worse than average of cars) to 5 (better than average of cars), from Which (Car bying guide, United Kingdom, 1993) and Test-Achats (Belgique, 12/1993 and 01/1994).

CATALYTIC CONVERTER : CC_{ijt} (dummy variable), standard equipment on the model i of the mark j, supplied by ADEME from makers data.

AIRBAG : AB_{ijt} (dummy variable), optional equipment proposed on the model i by the mark j, data supplied by makers data and Le Moniteur Automobile.

LOYALTY OF CUSTOMERS : L_{jt}, percent of owners of the mark j who bought the same mark in the period t, supplied by J.L. MADRE from the individual answers (for 1991-1992) of the INSEE surveys on household conjonctural expectations.

MARKET CATEGORY : MC_{ijt} (dummy variable), superminis = B, small family cars = M1, large family cars = M2, executive cars = H.

PERCEIVED QUALITY : Q_{1jt} = percent of owners of the mark j who declared, in the period t, they would buy in the future a car of the same mark, Q_{2jt} = percent of owners of the mark j satisfied and very satisfied, in the period t, with the mark they own, data supplied by M. LINARD (Test-Achats, Belgique) from the 1992 European consumers unions survey on the reliability of cars (data for France, collected during the first half-year 1993).

HEDONIC PRICE	CONSTANT	ORIGIN (FRANCE)	ORIGIN (GERMANY)	ENGINE (TYPE)	ENGINE POWER (kW)	AIRBAG D1	AIRBAG D2	AIRBAG D3	CATALYTIC CONVERTER D1	CATALYTIC CONVERTER D2	CATALYTIC CONVERTER D3	OUTSIDE AREA (m2)	MARKET CATEGORY H	RELIABILITY	R square
ALL POINTS :															
a) without diff. coeff.															
1) unweighted by sales	9,463	0,117	0,081	-0,251	0,0069		0,067			0,085		0,18	0,173	0,032	0,9709
	(0,081)	(0,018)	(0,017)	(0,016)	(0,0005)		(0,02)			(0,015)		(0,012)	(0,021)	(0,007)	
2) weighted by sales	9,74	0,1	0,061	-0,235	0,0092		0,067			0,048		0,115	0,29	0,03	0,999
	(0,051)	(0,035)	(0,041)	(0,009)	(0,0007)		(0,032)			(0,016)		(0,007)	(0,018)	(0,007)	
b) with diff. coeff.															
1) unweighted by sales	9,487	0,115	0,085	-0,256	0,0069	0,081	0,012	0,048	0,041	0,078	0,104	0,18	0,18	0,037	0,972
	(0,076)	(0,018)	(0,018)	(0,016)	(0,0005)	(0,037)	(0,09)	(0,023)	(0,023)	(0,03)	(0,018)	(0,012)	(0,021)	(0,007)	
2) weighted by sales	9,742	0,099	0,078	-0,235	0,0115	-0,113	-0,14	0,099	-0,035	0,078	0,046	0,115	0,3	0,032	0,999
	(0,053)	(0,035)	(0,041)	(0,009)	(0,0007)	(0,09)	(0,184)	(0,032)	(0,046)	(0,046)	(0,016)	(0,007)	(0,018)	(0,007)	
BY PERIOD :															
2nd HALF-YEAR 1991															
1) unweighted by sales	9,498	0,117	0,097	-0,26	0,0069		0,092			0,051		0,173	0,168	0,032	0,973
	(0,145)	(0,032)	(0,032)	(0,03)	(0,0009)		(0,046)			(0,035)		(0,023)	(0,041)	(0,014)	
2) weighted by sales	9,687	0,097	0,108	-0,239	0,0115		-0,037			-0,039		0,127	0,283	0,021	0,999
	(0,092)	(0,062)	(0,085)	(0,018)	(0,0012)		(0,129)			(0,064)		(0,016)	(0,035)	(0,016)	
1st HALF-YEAR 1992															
1) unweighted by sales	9,404	0,127	0,094	-0,235	0,069		0,039			0,076		0,184	0,175	0,035	0,974
	(0,131)	(0,03)	(0,028)	(0,025)	(0,0007)		(0,039)			(0,028)		(0,021)	(0,039)	(0,014)	
2) weighted by sales	9,758	0,113	0,143	-0,223	0,0115		-0,256			0,016		0,092	0,366	0,035	0,999
	(0,081)	(0,053)	(0,074)	(0,013)	(0,0009)		(0,103)			(0,046)		(0,012)	(0,03)	(0,012)	
2nd HALF-YEAR 1992															
1) unweighted by sales	9,556	0,097	0,058	-0,274	0,0069		0,044			0,111		0,17	0,184	0,039	0,97
	(0,138)	(0 032)	(0,037)	(0,03)	(0,0009)		(0,037)			(0,028)		(0,021)	(0,046)	(0,014)	
2) weighted by sales	9,797	0,09	0,012	-0,235	0,0092		0,129			0,055		0,111	0,276	0,053	0,999
	(0,085)	(0,06)	(0,067)	(0,016)	(0,0009)		(0,035)			(0,023)		(0,012)	(0,046)	(0,012)	

a) : without differenciation of the coeficients by period
b) : airbag and catalytic converter differentiated by period dummies (D1 = 1991-2 ; D2 = 1992-1 ; D3 = 1992-2)

TABLE 1 : HEDONIC PRICE ESTIMATION

data sources and variables : see appendix 1
standard errors of the estimators in brackets

Equation : Log Pijt = X0 + X1.Oijt + X2.Eijt + X3.Pijt + X4.ABijt + X5.CCijt + X6.Aijt + X7.MCijt(H) + X8.Rjt + Uit

(Log P : neperian logarithm of market price)

SALES	CONSTANT D1	CONSTANT D2	CONSTANT D3	LOYALTY	ORIGIN FRANCE	ENGINE TYPE	CATALYTIC CONVERTER D1	CATALYTIC CONVERTER D2	CATALYTIC CONVERTER D3	Number of DOORS	MARKET CAT. M1	MARKET CAT. M2	MARKET CAT. H	R square
ALL POINTS :														
a)	6,199 (0,502)	6,019 (0,504)	5,809 (0,497)	4,274 (0,83)	0,88 0,182	-0,502 (0,191)	-0,136 (0,325)	-0,371 (0,265)	0,203 (0,253)	1,112 (0,302)	-0,735 (0,313)	-1,414 (0,322)	-2,321 (0,338)	0,644
BY PERIOD :														
2sd HALF-YEAR 1991		6,205 (0,937)		3,742 (1,458)	1,112 (0,334)	-0,412 (0,336)		-0,205 (0,348)		0,679 (0,502)	-0,504 (0,534)	-1,126 (0,553)	-1,916 (0,589)	0,681
1st HALF-YEAR 1992		5,816 (1,059)		4,304 (1,499)	1,094 (0,343)	-0,306 (0,345)		-0,286 (0,318)		1,253 (0,555)	-0,916 (0,583)	-1,547 (0,606)	-2,62 (0,624)	0,66
2sd HALF-YEAR 1992		5,987 (0,979)		4,683 (1,504)	0,541 (0,309)	-0,764 (0,35)		0,237 (0,283)		1,165 (0,336)	-0,76 (0,576)	-1,547 (0,573)	-2,42 (0,603)	0,609

a) : catalytic converter differenciated by period dummies (D1 = 1991-2 ; D2 = 1992-1 ; D3 = 1992-2)

TABLE 2 : DEMAND FUNCTION ESTIMATION

data sources and variables : see appendix 1
standard errors of the estimators in brackets

Equation : Log Vijt = X0t + X1.Ljt + X2.Oijt + X3.Eijt + X4.CCijt + X5.Dijt + X(6..8).MCijt + Uit

(Log V : neperian logarithm of sales)

PERIOD	CONSTANT	PRICE DIFFERENCE	ORIGIN FRANCE	ENGINE TYPE	MARKET CAT. M1	MARKET CAT. M2	MARKET CAT. H	Dummy cat-cat	Dummy cat-no cat	PRICE ELASTICITY	R square
1992-2/1992-1	3,328 (3,414)	-0,136 (0,096)	-3,01 (1,003)	-2,56 (1,128)	-2,396 (1,368)	-3,131 (1,294)	-2,274 (1,381)	3,224 (1,139)	-1,108 (1,358)	3,009	0,412
1992-2/1992-1	5,108 (4,852)	-0,0735 (0,0968)	-5,404 (1,46)	-3,693 (1,7)	-2,304 (1,97)	-3,055 (1,859)	-2,13 (2,238)	2,094 (2,048)	1,819 (1,77)	1,18	0,268

TABLE 3 : ADJUSTMENT ELASTICITIES

data sources and variables : see appendix 1
standanrd errors of the estimators in brackets

Vijt = A0 + A1.Pijt + A2.Oijt(F) + A3.Eijt + A(4...6).MCijt + A(7..8).CCijt + Uit

model age	Ep > 0 (DP, dV < 0)	Ep > 0 (dP, dV > 0)	Ep < 0
old	19	2	12
new	0	7 (3 diesel)	11
other	12	14 (8 diesel)	44

TABLE 4 : POINT ELASTICITIES

PERCEIVED QUALITY	CONSTANT D1	CONSTANT D2	CONSTANT D3	ACTUAL PRICE	ORIGIN FRANCE	ORIGIN GERMANY	ENGINE TYPE	FISCAL POWER	OVERALL CONSUMPTION	AIRBAG	CATALYTIC CONVERTER	RELIABILITY	R square
1)	0, 416 (0, 039)	0, 416 (0, 039)	0, 406 (0, 037)	0, 0009 (0, 0002)	0, 115 (0, 01)	0, 08 (0, 01)	0, 063 (0, 014)	−0, 008 (0, 004)	−0, 013 (0, 0065)	0, 04 (0, 012)	0, 017 (0, 009)	0, 075 (0, 004)	0, 842
2)	0, 656 (0, 024)	0, 657 (0, 024)	0, 652 (0, 023)	0, 00025 (0, 00011)	0, 087 (0, 006)	0, 045 (0, 006)	0, 021 (0, 009)	−0, 001 (0, 002)	−0, 003 (0, 004)	−0, 001 (0, 007)	0, 022 (0, 005)	0, 055 (0, 002)	0, 856

PERCEIVED QUALITY	CONSTANT 1	CONSTANT 2	CONSTANT 3	ACTUAL PRICE – HEDONIC PRICE	ORIGIN FRANCE	ORIGIN GERMANY	ENGINE TYPE	FISCAL POWER	OVERALL CONSUMPTION	AIRBAG	CATALYTIC CONVERTER	RELIABILITY	R square
1)	0, 643 (0, 023)	0, 645 (0, 023)	0, 64 (0, 022)	0, 00018 (0, 00026)	0, 089 (0, 006)	0, 046 (0, 006)	0, 009 (0, 007)	0, 0008 (0, 002)	−8E−05 (0, 004)	0, 004 (0, 007)	0, 023 (0, 005)	0, 056 (0, 002)	0, 852
2)	0, 373 (0, 04)	0, 375 (0, 039)	0, 364 (0, 038)	0, 0013 (0, 0004)	0, 122 (0, 011)	0, 084 (0, 011)	0, 018 (0, 011)	−0, 0004 (0, 0036)	−0, 0035 (0, 006)	0, 062 (0, 012)	0, 018 (0, 009)	0, 077 (0, 004)	0, 825

1) : Perceived quality = percent of owners of the mark j who declared, in the period t, they would buy, in the future, a car of the same mark
2) : Perceived quality = percent of owners of the mark j satisfied and very satisfied, in period t, with the mark they own

TABLE 5 : AKERLOF EFFECT ESTIMATION

data sources and variables : see appendix 1
standard errors of the estimators in brackets

Equation :

$$A) : Qijt = A0 + A1.Pijt + A2.Oijt + A3.Eijt + A4.FPijt + A5.Cijt + A6.ABijt + A7.CCijt + A8.Rjt + Uijt$$

$$B) : Qijt = A'0 + A'1.\ \ Pijt + A'2.Oijt + A'3.Eijt + A'4.FPijt + A'5.Cijt + A'6.ABijt + A'7.CCijt + A'8.Rjt + Uijt$$

CROSS-SECTION VERSUS TIME-SERIES INCOME ELASTICITIES : AN ESTIMATION ON A PSEUDO-PANEL OF CANADIAN SURVEYS (1969-1990)[1]

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1 This analysis has been made on the microdata of Statistics Canada *"Economic households-Income, 1969, 1978, 1982, 1986, 1990"* which contains statistics from the surveys on households' expenditures. All the computations made with these data are under the responsibility of Institut Québecois de Recherche sur la Culture, their use and interpretation being under the sole responsibility of the authors.
Thanks are due to Johanne Bujold and P. Gaubert for their participation to the computation of pseudo-panel data, to D. Richaudeau who made the principal work of the estimation and to N. Cardoso (who is currently making the same work on French pseudo-panel in collaboration with F. Gardes and J.M. Houriez). We acknowledge a grant from the Canadian government for the beginning of the research in 1991 and from the French Ministry of Education, and financial help from CREDOC and INRS-Culture et Société.
Thanks are due for useful remarks from François Bourguignon, Greg Duncan, François Legendre, Y. Lemel, Jacques Mairesse, Patrick Sevestre, Alain Trognon in workshop Polish Panel (Warsaw, 1992), European Economic Association Congress (Helsinki, 1993), and seminars in University Paris I, CRÉDOC and ENSAE.

ABSTRACT

Cross section and time series income elasticities are computed on a pseudo-panel of five Canadian surveys and compared to aggregate time-series estimates. The analysis shows that 1) the procedure affords good estimates from an econometric point of view; 2) these two types of elasticity differ significantly; 3) the order between them seem to be related to the value of the income elasticity (cross-section elasticities tend to be greater than time-series ones for luxury goods); 4) the evolution of both elasticities through the income distribution is similar, contrary to their levels.[2]

[2] KEY WORDS:
Consumption, pseudo-panel, cross-section, time-series, income elaticities.

INTRODUCTION

1 - Economic and social statistics may be cross-sections or time series, the first type of data being commonly used to estimate models the causality of which is fact temporal, because of the availability of such cross-sections and their span (size and variability of data).

For consumption analysis, the observed differences between cross-sections and time-series elasticities have been attributed to specific dynamic factors (such as relative prices, demographic evolutions or technological changes), to aggregation biases or to the size of transitory income for the lowest and highest income classes in households' expenditures surveys (see Friedman, 1957).

The remarkable stability of transverse income elasticities observed in consumption analysis (Gardes, 1984) as well as for other economic statistics (for instance in international trade analysis, see Phan, 1967) allows us to consider them as showing the distance between the dynamic consumption laws of stable sub-populations ; in contrast, the variability of temporal elasticities refers to the blending of transitory and permanent effects of income variations (Gardes, 1984, 1985), as well as to the blending of transverse effects of income redistribution between households and temporal income effects of each of the income classes.

We can then make the hypothesis that transversal and temporal income effects differ completely, the former indicates the behavioural change due to an evolution of the socio-economic status of the household, and the later the mixing of the global effects of these changes and of the approximately parallel evolutions of incomes for individuals pertaining to the different socio-economic groups. Noting Z and Z' two relative income classes and Y_c, Y_r the current and relative households incomes, the two types of incomes elasticities can be written e^{z}_{yc}, $e^{z'}_{yc}$ and $e^{z/z'}_{yr}$ (supposed to be symmetrical), with no a-priori identity between these three parameters[1] (the change of the current income elasticity being probably related to the relative income elasticity). The cross-section elasticities e_{yr} can be estimated from surveys ; they vary through the income distribution but seem to be very stable from one survey to another. The

[1] The equality between these elasticities is more probable for aggregates group of commodities, all income elasticities tending to unity.
It can be noted that the keynesian consumption function C = aY + b implies the identity of transversal and temporal laws. Because the agents who borrow in low income classes must be able to refund their debt when arriving, later in their life cycle, in the upper classes.
In fact, the difference between transversal and temporal laws is due to the influence of variables taken into account in one estimation and not in the other. The important point is that the variables which imply a difference between behaviours of different sub-populations are not supposed to vary through time : their effect cannot be indicated by the influence of a dynamic variable.
Symmetrically, some dynamic variables have no transversal corresponding variable.

temporal elasticities e_{yc} must be estimated from panel data which are very rare and generally short, longer panels giving rise to well known problems.

2 - Estimations of these temporal elasticities have been obtained (Gardes, 1984, 1985) from a very rough pseudo-panel (1959-1980) built on aggregate British data published annually in the Family Expenditure Surveys. These data are very aggregate (in some ten to twenty income classes, with a second possible level of desaggregation by the age of the household's head or its social category), but, moreover, they are aggregated by the total family income and not according to the per capita income, so that there exists an aggregation systematic bias.

The dynamic laws that we have adjusted on British time series of six populations (the relative income of which is limited by the two extreme deciles and the terciles of the income distribution[1]) show a wide and systematic variation of income and price elasticities, both for the long term and the short-term effects of income or price changes. Three conclusions have been drawn from this analysis:

- time series and cross-section elasticities are often different,

- long-term income elasticities vary continuously for the whole span of relative income distribution for all groups of goods except one ;

- these evolutions differ from those indicated by national time series or transverse data : for example, food in home is characterized by a strong decrease of its transverse income-elasticity, while temporal elasticities are slightly increasing.

The differences between the levels of cross-section and time-series income elasticities and between their variations as relative income increases will be analysed in this paper with pseudo-panel of 360 cells obtained by aggregating individual data from remote Canadian surveys (1969, 1978, 1982, 1986 and 1990) : these data are more parsimonious for the time scale (so that the estimation of price effects is more difficult) and must be estimated by special econometric methods as Deaton (1985) showed the specific problems associated with pseudo-panel data.

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1 These six zones are grouped by two in order to make the broad zones containing each the third of the whole population.

I. THE DATA

I - 11. Estimation on pseudo-panel data: a survey

In many countries there are no panel data. However a series of independent cross-section is available over time. Consumer expenditures true panel data may be scarce, while repeated cross sections can be established more easily. Beside, the included households are much more variable than for other types of panel. Recently, many authors point out the fact that genuine panel data are not essential in the estimation of parameters of interest in the context of linear models. A. Deaton (1985) suggested a way to estimate cluster fixed effects regression model from a series of cross sections. Since it's not possible to track individual households over time, he proposes to track a group of "similar individuals" or cohorts through such data, and treat averages within the cohorts as observations in synthetic panel data. These aggregate data on cohort averages can be used to formulate the covariance model with cohort fixed effects in the econometric analysis of behaviour pattern. Moreover, the observed cohort aggregates are considered as error-ridden measurements of the true cohort population values, and errors-in-variables techniques are used by the authors which yield consistent estimators. Verbeek M. and Th. E. Nijman (1992) show that when cohort size are fairly large (100 to 200 individuals) it's tempting to ignore the measurement error problem and use standard within estimator on the synthetic panel as if it were a genuine panel[1] (1). Generally, grouping individuals in homogeneous groups is motivated by empirical considerations. Examples of grouping characteristics would include geographic location, age (date of birth), industry, etc. Such cohorts are considered as group of individuals sharing some common characteristics.

An alternative way to approach the problem is to take into account of the grouping procedure in the stochastic structure of the residual[2].

In practice, we assume there that the regression errors are often correlated within groups and propose GLS estimators of systems of regression equations with grouped synthetic panel data by treating implicitly the intra group error correlation using an original structure of the disturbance covariance matrix.

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1 This has been done in several practical situations, see for example Browning. M.A. Deaton and M. Irish (1985) or Blundell R.M. Browning, and C. Meghir (1989).

2 Some recent papers in economics which do consider random effect models for grouped data include A. Packes (1983), B.R. Moulton (1986), and W.T. Dickens (1990).

I - 12. Pseudo-panel on Canadian surveys

The microdata of the Canadian households expenditures surveys contain 14 994 households in 1969, 9 351 in 1978, 10 936 households in 1982, 10 075 in 1986, and only 4 225 in 1990 (data corresponding to great cities). We have aggregated the expenses in 23 functional groups and four groups defined by their durability: Durable goods, semi-durable goods, non-durable goods and services which we use for this study.

The households have been aggregated in 360 cells defined by four discriminate variables:

1. Per capita relative income, with a classical equivalent scale (1: first adult ; 0.8: other adults ; 0.8, 0.5, 0.4: children according to their age): 20 relative income classes have been obtained, each totalizing 5 % of the whole population ;

2. Age of the head of household: three classes until 35 years old, between 36 and 55, beyond for 1982 survey (age limits are defined of the other surveys in order to group households in cohorts) ;

3. Human Capital in two classes: primary and secondary level, post-secondary level ;

4. Size of the household: one adult, two adults, three persons or more.

In 1986, only two cells have no household, and 8 % of the 360 cells have less than 5 households, the mean size being 29 households. The two or three empty cells in each survey have been filled for all variables by the means between the two income adjacent cells (other discriminate variables constant) and a weight of one household, so that it does not change anything in the estimations but allows us to obtain the same structure of the data for the three surveys ; thus, by comparing, in cross-section data, not two income adjacent cells but two cells which have the same value for the three last characteristics and which belong to adjacent income classes, we are able to take into account all the common effects due to these three characteristics. For the same reason, the estimations of income and price effects between two surveys will be made directly on the differences between two corresponding cells.

I - 13. Pseudo-panel on French surveys[1]

The Household Expenditure Survey (BDF) was first carried out in France by Institut National de la Statistique et des Etudes Economiques in the 50's. Naturally, since then a lot of modifications have been introduced in each of its versions. The last three of them —1979, 1984 and 1989— were made compatible among themselves by N. Cardoso in 1993. The starting number of available households in each of them is respectively 10 645, 11 976 and 9 038.

Three a priori invariant criteria were employed to construct cells:
1. Age of the household head (11 items) ;
2. The highest acquired degree of the household head (6 items) ;
3. The household geographic localisation (2 items: Paris + elsewhere).

After some regrouping for having quite large cells, 56 cells were obtained. Next table presents some description statistics about the cells for each available version of BDF.

BDF version	Number of cells	Percentage of cells with			Mean cell size	Min. cell size	Max. cell size
		less than 50 hh's	between 50 and 100 hh's	more than 100 hh's			
1979	56	7 %	27 %	66 %	166.30	18	506
1984	56	3 %	18 %	79 %	191.89	27	549
1989	56	11 %	36 %	53 %	137.89	24	529

Two other groupings will be performed:
- Firstly, by a similar method as the one used for the Canadian survey;
- Secondly, by filtering the data according to the working states of the different adults of the family, so that biases are due to the non-separability of the labour supply and the consumption demand functions are taken into account.

The same grouping methods will also be applied later to the Canadian statistics.

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[1] This section was prepared by N. Cardoso.

II - ESTIMATION OF CROSS-SECTION ELASTICITIES

II - 1. Estimation procedure for cross-sections

Several problems are encountered in the estimation of Engel curves on individual or aggregate transversal data: estimation of *functional forms* gives rise to specification problems, especially problems related to the choice of the main regress (income or total expense) and the verification of theoretical constraints ; the computation of Engel curves by concentration curves (such as Lorenz curves, see Sreenivasa Lyengab, 1960, Blaylock-Smallwood, 1982) brings, as does the first method, special forms of curves, which do not reveal the true curvatures of the relation between income and partial expenses although it takes into account the whole information to determine the elasticities on each point (see Gardes, 1985, pp. 751-808 for details).

The computation of elasticities between two adjacent points allows us to follow continuously the curvature of the Engel curves, but errors of measurement as well as exogenous variations of consumption lead to an erratic pattern of these elasticities, even on aggregate data (for instance twenty income classes containing 500 households each), as is shown in Gardes-Levy (1992) where elasticities are calculated for the Canadian consumption survey of 1986, on 20 relative income classes or 360 cells determined as indicated before. Thus, prior to the computation of point elasticities, it is necessary to smooth the data: we have used for this purpose a modified Whittaker-Henderson filter (often referred as Hodrick-Prescott) which is presented in Gardes-Levy (1992). This filter is the ideal candidate to smooth the consumption, for other non parametric smoothing methods are not as powerful as concerns the smoothing of the first derivative which is our main goal. To adapt it to our purpose, one must change the objective to minimize by taking into account the weights corresponding to the size of the cells of the survey, and by modifying its second term where the variation in the first differences of the filtered series (measuring the first derivative on time) is replaced by the variation of the marginal propensities of consumption on income or total expense. The detail of this minimization and the resulting matrix to inverse are presented in Gardes, Levy (1991). Results of this prior filtering are shown in Appendix 2.
A second type of estimation (which gives rise to similar patterns) has been computed quadratic and cubic Gorman generic forms (Deaton, 1986, p. 1 799-1 801):

$$w_{hk} = a_k + b_k Log Y_h + d_k \sum_{m=1}^{M} c_m (Log Y_h)^m + e_k S_h \quad \text{for good k.} \quad (1).$$

with $w_{hk} = \dfrac{p_{hk} q_{hk}}{y_h}$ for household h

Y_h : total expenses of household h by U.C.

S_h : demographic variables (number of adults and number of children in the households).

M = 1, 2 or 3.

under the restriction: $\Sigma a_k = 1$; $\Sigma b_k = \Sigma d_k = 0$ (which are automatically verified by OLS). The cubic form has been estimated on the whole distribution and it indicates the global evolution of elasticities. The quadratic form is estimated on sub population containing one fifth of the whole survey, and this affords the continuous variation of elasticities over 15 points (see Banks-Blundell-Lewbel, 1992, for a discussion of quadratic AIDS).

Heteroscedasticity may exist because of the grouping of data: from (1), we obtain by grouping the households of cell I and weighting by income shares: $\gamma_h = \frac{y_h}{\sum_{h \in H} y_h}$

$$w_{hk} = \sum_{h \in H} \gamma_h w_{h_k} = b_k \sum_{h \ni H} (\gamma_h Log y_h) + d_k \sum_h \left(\gamma_h (Log y_h)^2\right) + ... + e_k \sum_h (\gamma_h Log S_h) + \sum_h \gamma_h \varepsilon_{h_k} + a_k \quad (2)$$

one obtains the geometric means $\sum_h LogY_h^{\gamma_h}$ and $\sum LogS_h^{\gamma_h}$ as regressors, with $\sum_{\gamma_h} = 1$

These means are replaced here by the logarithms of arithmetic means of income and size S for each cell. The estimation of the means of powers of $LogY_h$ by $(Log\bar{Y})^m$ are less easily justified[1].

The variance of the error term is: $V\left(\sum \gamma_h \varepsilon_h\right) = \sigma^2 \sum_{h \in H} \gamma_h^2$ under the homoscedasticity assumption on individuals. The coefficient of σ^2 varies between 1 (if $\gamma_h = 0$ for $h \neq h_0$) and (for $\frac{1}{N_1}$ (for $\gamma_h = \gamma_j, \forall_{h,j}, \in H$).

This last case is the more probable because of the grouping of cells by income per capita, so that we correct the heteroscedasticity by premultiplying equation (2) by $\sqrt{N}$.

These estimations are computed for the differences between comparable cells in two adjacent income classes H and (H + 1):

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1 Estimation by linear Engel curves, which are well aggregated, lead to similar estimations.

$$\Delta W = b \Delta L \overline{Y} + \sum_{m} D_m \Delta (L \overline{Y})^m + e \Delta L S + \eta \tag{3}$$

with

$$\Delta X = \sqrt{N_{H+1}} X_{H+1} - \sqrt{N_H} X_H$$

$$\eta = \sum_{h \in H+1} \gamma_h \sqrt{N_{H+1}} \varepsilon_h - \sum_{h \in H} \gamma_h \sqrt{N_H} \varepsilon_h$$

Another type of cross-section estimations is obtained by a prior between transformation of the data, and thus an estimation of equation (2) on between data is made.

A correction of partial heteroscedasticity by Dickens' method (1990) was not proved to be efficient here.

II - 2. Estimation procedure for aggregate time-series

AIDS and quadratic AIDS (QAIDS) are estimated as in equation (1) with logarithmic prices and for the two nomenclatures (by durability and by functions). To correct for multicolinearity between total expenses and prices, and for the first order autoregressive autocorrelation that appears with a coefficient around 0.8 for most equations, the estimation is made in first difference (the AR (1) autocorrelation seems to be corrected by this procedure).

The non-separability, proves empirically, of consumption demand and labour supply, will be corrected later by a filtering of the population according to the number of workers in the family.

The estimation is performed by seemingly unrelated regressions under additivity, homogeneity and symmetry constraints (which are tested). Separate estimations of each equation were also made where only the direct price is taken into account (to minimize multicolinearity problems): in this case, only the homogeneity constraint is considered.

Income and price elasticities are computed by the formulas:

$$e_{ci/y} = 1 + \frac{b_i}{w_i} \tag{4}$$

$$e^{NC}_{ci/p_j} = -\delta_{ij} + \frac{c_{ij}}{w_i} - b_i \frac{w_j}{w_i} + b_i b_j \frac{\log\left(\frac{y}{p}\right)}{w_i}$$ (5) non compensated

δ_{ij} Kronecker delta

$$e^{c}_{c_i/p_j} = e^{NC}_{c_i/p_j} + w_j\left(1+\frac{b_i}{w_i}\right) \qquad \text{(5') compensated}$$

For the non compensated price elasticities, the last term is generally considered as negligible.

To estimate long term and short term elasticities, a partial adjustment process of households' income was integrated to the AIDS equation with logarithmic permanent and transitory incomes (as in Seater, 1982 and Gardes-Pouchain, 1989):

$$w_{it} = \alpha_i + \beta_i LYP_t + \gamma_i LYC_t + \sum_j \delta_{ij} \log P_{jt} + u_{it} \qquad (6)$$

$$LYP_t = E_{t-1}LYP_t + \lambda\left[LY_t - E_{t-1}LYP_t\right]$$

with:

LYP_t = permanent log income expected in period (t-1) for period t

$E_{t-1}LYP_t = LYP_{t-1} + c$ with c a constant expected rate for growth of real disponible income.

This integration affords an autoregressive equation which allows us to compute long term and short term elasticities:

$$w^k_{it} = \left[\alpha_i\lambda + (\beta_i - \gamma_i)(1-\lambda)c\right] + \left[\gamma_i + (\beta_i - \gamma_i)\lambda\right]LY_t - \gamma_i(1-\lambda)LY_{t-1}$$
$$+(1-\lambda)w^k_{t-1} + \sum_j\left[\delta_{ij}Lp_{jt} - \delta_{ij}(1-\beta)Lp_{jt-1}\right] + u_{it} - (1-\lambda)u_{it-1}$$

(8)

long term income elasticity:

$$1+\left(\frac{\beta_i}{w_i}\right)$$

short term income elasticity:

$$1+\left(\frac{\gamma_i}{w_i}\right)$$

II - 3. Estimation procedure for pseudo-panel data

Consider the set of n linear equations with grouped data :

$\overline{Y}_{ict} = \overline{X}_{ict}\beta_i + \varepsilon_{ict}$ (2) i : 1, ... n ; c = 1, ...C ; t = 1, ... T ; h : 1, ... N_c

where Y^h_{ict} is the dependent variable of equation i for household h belonging to cluster c, observed at period t. X^h_{ict} is a k_i by one vector of unknown parameters ; ε^h_{ict} is a random disturbance ; and N_c is equal to the total number of individuals in cluster c[1].

Now let us consider an aggregated form over h of the micro system :

$\overline{Y}_{ict} = \overline{X}_{ict}\beta_i + \overline{\varepsilon}_{ict}$ (2) i = 1, ... N ; c = 1, ... C ; t = 1, ... T

where $\overline{Y}_{ict}$,, $\overline{X}_{ict}$ and $\overline{\varepsilon}_{ict}$ constitute group means. If the groups are very different in size, this induce that each observation be weighted by the square root of the cohort size as for cross section estimation.

We estimate AIDS and QAIDS equations with the usual restrictions and after a within transformation to eliminate the fixed effect and the individual component u_{ic} of the composite error: $\overline{\varepsilon}_{icr} = u_{ic} + v_{it}$. Within and between estimates will be compared by Haussmann's test, in order to test the difference between cross section and time-series estimations of the pseudo-panel data.

Another estimation of dynamic laws is made by taking the first difference of all variables between t and in (t-1) This estimation may double the variance of the error term, as

$$V(d\overline{v}_i) \cong 2\left[V(\overline{v}_i) + Cov(\overline{v}_{it}, \overline{v}_{it-1})\right],$$

thus diminish the precision of the estimated parameters, but it eliminates also the fixed effect and $\overline{u}_{ic}$.

Within and between transforms of the first differences (the between one corresponding to the "long distance estimator", the within one perhaps to short term effects) were also used for the same equations.

For all these estimations, we take into account the conjunctural particularities of each survey (for instance the recession affecting the data in 1990) by dummies which were also transformed by within, between or long difference methods. The relative prices were also integrated in the equation, but as they do not vary across cells of the same survey, it was not possible to use more than one price (while eliminating one period dummy). The decomposition of the

1 Ideally, since we are dealing from the same underlying groups through time, we would expect to get the same size samples from each survey. However this does not happen for many reasons. For more details, see Browning and al (1985).

household's size between the number of adults and children is also taken into account, and dummies indicating education levels and cohorts are added among the regressors.

There exists an error in variable problem discussed by Deaton (1985): as identical cells of two different surveys do not contain the same households (as in true panel data), the variation of consumption between the corresponding cells of the two surveys is affected by measurement errors, compared to the true variations for the households contained in the cell of the first survey (or, alternatively, of the second one). This can be taken into account, either by Deaton' s method which necessitate to come back to the individual data to compute covariances, and which has been used only one time in a Yale working paper), or by instrumenting total expenses (as the econometric bias comes from the correlation between total expenses and the measurement error in partial consumption, which is a part of the error term equation). This second method is much more simple and will be subsequently used.

Finally, efficient estimation on first differences will be performed first by the panel GLS method, and secondly, by the Goaïed's model based on a multiplicative composition of errors which takes into account the multiplicative heteroscedatiscity of the grouped data (see Appendix 1 for details).

III. Results

III - 2. Aggregate time-series

Tables IIIA, B, C present the estimations, for aggregate time-series of durables and functions (6 and 13), of the AIDS specification under the additivity, homogeneity and symmetry constraints. Additivity is automatically verified; the homogeneity test $\sum_{j=1}^{n} c_{ij} = 0$ is performed as a Fisher test F(1,T-(n+2)) for each equation between the constraint and the unconstrainted specifications (i.e., with logarithmic relative or absolute prices); the symmetry is tested, under homogeneity or not, by a likehood ratio test which is distributed as a

$$X^2\left(\frac{(n-1)(n-2)}{2}\right) \text{ or } X^2\left(\frac{n(n-1)}{2}\right).$$

All the tests have been performed for estimations in levels or in differences. For this second estimation, tables in Appendix 3 show that the homogeneity is refused (for 5 %) for

2 equations over 4 for durability groups, for 3 over 6 for 6 functions and for 4 over 13 for 13 functions (only 2 at 1 %): thus it seems to be more probable for a more complete desaggregation of the consumption.

Without homogeneity, symmetry is refused for the three groupings of commodities, while it is accepted under homogeneity: overall, it seems possible to estimate the systems under the three restrictions. The estimation in differences suppresses first order autocorrelation, except for a few cases.

For 6 functions, the income and direct price elasticities seem to be more plausible when estimated in system under the constraints, than by estimating each equation independently (i.e., under the sole additivity constraint). For the first estimation procedure, all direct price elasticities are negative and their hierarchy is close to the order of the income elasticities. Ten over 15 cross-price elasticities seem to be symmetric.

For 13 functions, the estimation in system or equation by equation are closer for income elasticity (except for two groups: fuel and power, and clothing), and better estimated than for 6 functions, but it is not the case for direct price elasticities: private transport, furniture, entertainment and food outside are luxury goods; housing is the only inferior good.

For durability, the two estimations are not too different for income effects, but the direct own price elasticities are more plausible for independent estimations equation by equation.

The income elasticities are clearly ordered: 3.8 for durables, 1 for services, 0.4 to 0.8 for semi-durables, 0 for non-durables.

The price elasticities show the same order: -2.2, -0.6, -0.7, -0.4. Cross price elasticities indicate the complementarity of services and non-durables to the other groups (as they are not dynamic for income or own price changes, a rise in their price implies an increase of these expenses, so that other expenses must decrease because of the budget constraint), and the substituability between durables and semi-durables.

It seems important to test the *stability* of these estimations over a period characterized by important macroeconomical changes, and to integrate *income expectation* in order to estimate short and lon term income elasticities.

III - 2. Pseudo-panel data

III - 2.1. Estimation

The AIDS and QAIDS are estimated with five survey-dummies which are introduced to take into account the cyclic particularities of each period (for instance the depression in 1982), as well as the particularity of the 1990 survey. Another estimation will be performed with the own relative price, which takes only 5 values over the whole sample (so that the price effect may be difficult to estimate).

To obtain sufficiently numerous cells, we have grouped the data in 30 cells for each survey by taking only income fifth, age and education as discriminant variables: dropping a too precise income definition and the household's size demographic variable lead to a more correct pseudo-panel (i.e., with cells that may contain the same cohorts in two periods).

The estimations are quite good: R^2 around 0.9 estimations in first differences, within and between, around 0.7 for cross-section (only one equation non significative for cross-section estimation of cars' purchase).

Within and between estimates are shown to be significantly different by Hausman test (see Appendix 5), especially for the more desaggregated functions. Thus, the social diffusion of consumption differs from the dynamic diffusion, and cross-section consumption functions estimated on survey data cannot, for more than the half of the functions, indicate the dynamic laws of consumption.

III - 2.2. Comparison between cross-section and time series income elasticities

Tables III D and E show that, for the whole population of the five surveys,

1) Within estimates are very close to first difference ones, and cross-section close to between estimates;

2) The difference between within and between estimates or cross-section and time-series ones is greater for the 13 functions nomenclature than for 6 functions on 4 groups defined by durability

3) A majority of functions (8 versus 2) are characterized by *a greater social diffusion than their dynamic evolution*, a fact that corresponds to the intuition that microeconomic conditions (which are imposed equally to all households, such as the changes in the price structure or in the rate of interest), tend to equalize their responses to income variations. It indicates that *the convergence between social classes is not complete*, as time variations of income imply changes in consumption which are less important than those which correspond to a similar change in relative income.

4) Pseudo-panel estimates of income elasticities are often different of aggregate time-series ones, as for durables (1.3 for the first, 3.8 for the second), non-durables (0.7 versus 0.0), clothing (1.3 versus 0.5), cars'purchases (1.5 versus 3.7), food at home (0.6 versus 1.1), housing (0.8 versus -0.4), furniture (1.2 versus 2.2). These differences affect one half of all commodities groups; they can be related to conjunctural determinants of consumption laws (case of durables), to price effects, to the neglect of expectation processes.

5) *The hierarchy between cross-section and time-series income elasticities seems to be correlated with the value of the income elasticities*: luxury goods (durables and services, levels 1, 2, 3, for functions in column (4) of Table 1) have greater cross-section elasticities, while low income elasticities or inferior goods (semi and non-durables, levels 6, 7, 8) have greater time-series elasticities. For the first type of goods, the mean difference between cross-section and time series estimates is 0.09, while it is -0.05 for the second type (and -0.02 for the levels 4-5).

Table 1: Comparison of different income elasticities

	(1)	(2)	(3)	(4)	(5)
Durables	3.81	1.34	1.27	1	≥
Semi-durables	0.82	1.21	1.35	3	<
Non-durables	0.02	0.66	0.74	4	<
Services	0.90/1.07	1.12	1.05	2	≥
Clothing	0.53	1.21	1.34	6	<
Leisure	1.59	1.40	1.35	2	≥
Health	-0.16	0.85	0.91	7	?
Public transport	0.73	0.87	0.80	5	>
Private transport	1.39	1.27	1.11	3	>
Cars' purchase	3.71	1.58	1.37	1	>
Food at home	1.06	0.48	0.72	4	<
Food outside	1.50	1.32	1.18	2	>
Alcohol, tobacco	0.86	1.07	0.99	5	>
Housing	-0.45	0.81	0.77	8	≥
Charges	1.28	0.32	0.46	3	<
Furniture	2.18	1.23	1.11	2	>
Other goods	0.76	1.05	1.03	5	=

(1): AIDS estimation on aggregate time-series, 1947-90.

(2): Cross-section income elasticities: average of between and cross-section estimates by AIDS and QAIDS.

(3): Time series income elasticities: average of within and first difference estimates by AIDS and QAIDS.

(4): Order of aggregate time-series income elasticities.

(5): Cross-section elasticities compared to time-series elasticities.

When the social diffusion of a consumption is greater than its time diffusion, this consumption is generally a social-luxury good (the cross-section of which is greater than one: this is always the case except for housing and public transport, for which the difference between the two elasticities is small). The remarkable correspondence between the income dynamism of the good and the hierarchy between cross-section and time series income elasticities can be due to the fact that the growth of the households' relative income during their life-cycle increases the budget share of social luxury goods, more than by the time variation corresponding to its time-series income elasticity: if the two elasticities were equal, the budget share could not change between two relative income classes. Thus the diffusion of luxury goods is caused by the increase of this consumtion during the households' life cycle or because of another change in their relative income.

III - 2.3. Change of income elasticity from one income class to another

Tables and the related figures of Appendix 7 present pseudo-panel income elasticities for five income classes defined by the quintiles of the income distribution, or for four moving income classes containing two quintiles.

The changes of the two types of elasticities are similar for durables and semi-durables, but not for services and non-durables. The increase of the times-series' income elasticities of services and durables, and the decrease of the non-durables one, at the end of the income distribution corresponds to the diffusion of new services and of the need for a second car or TV. The changes of the two types of elasticities are much more similar for the functions: this correspondence concerns 9 functions over 13 (versus one inverse evolution and 3 uncertain cases). This similarity is an important fact which contrast with the differences between the levels of these two types of elasticities.

Some correspondence appears also between the hierarchy of cross-section and times-series elasticities and their evolution: greater cross-section elasticities tend to be characterized by a decrease over the income distribution, as if rich households had a more stable consumption structure (elasticities closer to one) than poor households.

Table 2: Peuso-panel estimations for 6 functions and for durability groups

	type	Habillement	Loisirs	Transport	Alimentation	Logement	Divers
Within :	1	1, 379	1, 327	1, 060	0, 862	0, 845	1, 044
	2	1, 391	1, 418	1, 129	0, 803	0, 782	1, 106
Between :	1	1, 160	1, 218	1, 145	0, 994	1, 013	0, 710
	2	1, 186	1, 209	1, 193	0, 641	0, 766	1, 458

	type	Services	Durables	Semi-durables	Non-durables
Within :	1	1, 01954	1, 20284	1, 32222	0, 80681
	2	1, 11286	1, 27749	1, 37379	0, 63604
Time-series :	1	0, 98301	1, 27166	1, 33279	0, 83399
	2	1, 07797	1, 34091	1, 37321	0, 66617
Between :	1	1, 104	1, 35179	1, 23585	0, 67063
	2	1, 10679	1, 19619	1, 22383	0, 71773
Cross-section :	1	1, 08679	1, 3756	1, 21193	0, 69538
	2	1, 17039	1, 43939	1, 17381	0, 57062

Table 3: Peuso-panel estimations for 13 functions

Estimation of income elasticities by a system under additivity and homogeneity constraints.

	Type	Clothing	Leisure	Health	Public Transport	Private Transport	Cars' Purchases	Food at home	Food Outside	Alcohol tobacco	Housing	Charges	Furniture	Other go
Within	1	1,291	1,362	0,940	0,806	1,186	1,160	0,761	1,041	1,036	0,896	0,375	1,048	0,946
		43,2	23,9	21,9	11,7	35,7	11,8	17,1	12,7	22,1	20,8	6,9	21,7	30,2
	2	1,387	1,426	0,877	0,914	1,082	1,579	0,532	1,596	1,053	0,722	0,330	1,094	1,037
		34,6	16,0	16,4	9,6	24,2	12,3	9,5	16,9	16,0	12,7	4,4	16,3	24,5
Time-series	1	1,323	1,293	0,849	0,710	1,148	1,171	0,893	0,869	0,928	0,765	0,597	1,037	1,036
		34,5	16,5	13,4	7,5	24,7	7,5	16,0	8,1	12,7	17,7	9,5	16,5	24,4
	2	1,350	1,328	0,882	0,758	1,036	1,558	0,682	1,215	0,934	0,699	0,543	1,099	1,111
		27,7	13,2	10,9	6,3	18,2	8,2	10,6	9,5	10,0	12,8	6,6	13,8	20,9
Between	1	1,253	1,401	0,740	0,652	1,240	1,484	0,534	1,412	1,149	0,850	0,304	1,262	0,959
		160,8	66,8	50,3	46,7	96,6	94,6	43,6	97,8	106,6	125,3	15,7	132,5	74,1
	2	1,260	1,425	0,662	0,666	1,181	1,488	0,452	1,459	1,150	0,843	0,179	1,266	1,043
		129,1	54,4	43,6	39,6	84,1	75,5	42,3	85,7	84,8	99,5	10,2	105,8	89,4
Cross-section	1	1,184	1,356	1,006	0,835	1,388	1,565	0,540	1,082	1,029	0,794	0,370	1,179	1,038
		52,1	27,8	25,2	13,3	40,7	17,7	17,7	20,4	23,8	30,0	10,7	31,3	37,5
	2	1,147	1,398	0,965	0,811	1,280	1,798	0,387	1,323	0,959	0,741	0,416	1,212	1,157
		30,0	21,8	18,8	11,1	30,3	16,9	11,4	21,7	17,1	21,8	9,2	24,6	35,7

Type 1: Estimation by the linear form of the AIDS.

Type 2: Estimation by the quadratic form of the AIDS

Table 4: Evolution of the income elasticities estimated for two moving fifth of income

	Type	Services	Durable goods	Semi-durabl goods	Non-durable goods
Within	3	1,007	1,271	1,385	0,839
		26,8	9,0	36,7	19,1
		0,929	1,236	1,378	0,910
		18,6	6,3	18,6	13,4
		1,131	0,823	1,299	0,755
		29,0	5,6	19,8	13,1
		1,102	1,297	1,185	0,607
		33,9	9,3	18,3	11,7
	4	1,061	1,797	1,496	0,639
		14,4	6,8	21,0	8,0
		1,073	1,290	1,475	0,677
		11,9	3,5	10,7	5,6
		1,145	1,099	1,425	0,592
		30,6	8,4	23,6	11,5
		1,144	1,493	1,293	0,399
		25,8	7,9	14,8	6,9
Time-series	3	0,985	1,249	1,338	0,880
		20,5	5,8	26,3	15,0
		0,881	1,272	1,470	0,935
		12,7	4,6	18,2	10,4
		1,131	0,860	1,260	0,756
		21,1	4,2	14,0	9,6
		1,070	1,528	1,238	0,545
		21,8	6,9	14,1	7,3
	4	1,052	2,014	1,355	0,636
		12,6	5,8	15,1	7,0
		1,048	1,316	1,574	0,672
		93,0	2,8	11,6	4,7
		1,178	0,975	1,277	0,630
		19,2	4,1	12,3	7,6
		1,129	1,714	1,326	0,321
		18,7	6,2	12,2	4,4
Cross-section	3	1,135	1,513	1,235	0,647
		46,9	22,6	40,8	22,8
		1,077	1,297	1,202	0,731
		36,1	14,7	30,1	16,1
		1,031	1,161	1,106	0,845
		27,1	8,5	19,1	14,3
	4	1,206	1,538	1,212	0,562
		58,0	19,6	34,6	23,6
		1,176	1,410	1,207	0,553
		42,1	13,3	24,3	15,4
		1,177	1,147	1,031	0,636
		31,7	6,5	14,0	10,4

Type 3 : Estimation by the linear form of the AIDS.
Type 4 : Estimation by the quadratic form of the AIDS

Table 5: Evolution of the income elasticities estimated for two moving fifth of income

	Type	Clothing	Leisure	Transport	Food	Housing	Other goods
Within	3	1,283	1,278	1,135	0,889	0,795	1,164
		22,9	12,6	14,3	18,7	16,6	29,9
		1,374	1,425	0,984	0,935	0,889	0,925
		14,7	12,6	8,6	12,5	12,3	12,7
		1,358	1,285	0,812	0,862	0,892	1,196
		21,5	13,8	9,5	15,7	15,7	21,1
		1,238	1,523	0,974	0,719	0,878	1,140
		18,0	14,6	11,3	13,8	14,8	17,8
	4	1,138	1,088	1,350	0,799	0,725	1,368
		11,1	5,8	9,3	9,1	8,2	20,9
		1,415	1,286	1,078	1,026	0,565	1,184
		9,1	6,9	5,7	8,3	5,2	10,5
		1,390	1,152	0,905	0,856	0,732	1,359
		17,1	9,8	8,3	12,1	11,2	20,8
		1,340	1,460	0,902	0,684	0,882	1,217
		15,9	11,0	8,3	10,4	11,7	15,3
Time-series	3	1,249	1,234	1,023	0,944	0,808	1,181
		14,6	8,6	8,5	15,5	14,0	23,3
		1,353	1,209	1,024	0,983	0,790	1,047
		12,1	7,8	6,1	10,9	8,5	11,4
		1,351	1,166	0,928	0,868	0,836	1,208
		16,6	8,0	7,8	12,5	12,4	14,7
		1,326	1,485	1,024	0,691	0,862	1,125
		16,4	9,8	8,0	11,0	13,3	13,6
	4	0,999	0,988	1,418	0,761	0,798	1,357
		7,6	4,3	7,7	8,1	8,5	17,8
		1,339	1,279	1,044	0,962	0,606	1,284
		7,1	5,1	3,9	6,6	4,2	9,1
		1,374	0,930	0,980	0,812	0,749	1,425
		14,0	5,7	6,9	9,9	9,6	17,5
		1,333	1,486	0,872	0,687	0,881	1,234
		12,8	7,6	5,4	8,5	10,6	11,8
Cross-section	3	1,221	1,428	1,372	0,667	0,746	1,291
		47,0	30,4	41,7	32,1	40,1	47,0
		1,217	1,496	1,170	0,652	0,750	1,330
		32,5	27,2	28,3	26,7	26,8	36,4
		1,198	1,344	1,118	0,616	0,776	1,373
		23,8	13,0	14,3	12,7	18,5	18,1
	4	1,164	1,476	1,388	0,604	0,738	1,393
		39,3	25,8	34,2	27,8	32,2	54,4
		1,209	1,492	1,171	0,642	0,741	1,360
		32,1	26,7	27,8	27,0	26,8	45,1
		1,205	1,366	1,129	0,629	0,767	1,349
		24,7	14,2	14,8	14,4	19,6	21,4

Type 3 : Estimation by the linear form of the AIDS.
Type 4 : Estimation by the quadratic form of the AIDS.

Table 6: Evolution of the income elasticities estimated for two moving fifth of income

	Type	Clothing	Leisure	Health	Public Transport	Private Transport	Cars' Purchases	Food at Home	Food Outside	Alcohol & Tobacco	Housing	Charges	Furniture	Other goods
Within	3	1,235	1,327	0,821	0,580	1,352	1,341	0,875	0,842	1,212	0,818	0,381	1,271	0,858
		25,4	8,4	10,3	5,8	10,7	5,8	15,0	6,0	14,3	13,4	6,1	14,7	13,8
		1,283	1,464	0,858	0,527	1,004	1,038	0,878	0,842	1,074	0,903	0,429	1,208	0,823
		12,4	8,8	5,5	2,3	13,8	3,8	7,3	4,0	7,8	8,8	3,2	7,4	8,3
		1,281	1,297	0,893	0,774	0,968	0,906	0,785	1,244	0,741	1,042	0,403	1,011	1,000
		15,2	11,8	7,1	4,2	12,3	3,7	7,2	8,8	5,7	8,8	2,7	7,8	13,8
		1,234	1,371	0,854	0,808	1,047	1,210	0,588	1,224	1,027	0,818	0,831	0,848	1,225
		14,8	10,7	7,7	5,5	12,8	5,5	8,5	10,8	6,8	4,4	5,1	7,8	14,2
	4	1,110	1,150	1,222	0,109	1,548	2,484	0,833	1,204	1,056	0,643	0,320	1,065	0,837
		8,4	3,8	6,5	0,7	8,3	4,4	4,8	3,5	5,1	4,1	1,1	8,5	5,8
		1,203	1,577	0,687	0,985	0,849	1,481	0,887	1,500	1,341	0,864	0,081	1,237	0,752
		7,4	6,8	2,8	2,8	7,1	2,7	4,0	5,1	7,4	5,7	0,3	4,8	4,8
		1,294	1,354	0,810	0,589	0,844	1,108	0,838	1,485	0,910	0,909	0,140	1,174	1,037
		12,7	8,5	5,4	2,8	10,0	3,8	5,1	9,4	6,2	7,1	0,0	7,0	12,2
		1,271	1,332	0,823	0,888	0,846	1,291	0,581	1,281	0,937	0,667	0,821	0,904	1,240
		14,6	8,7	7,8	5,8	11,8	5,5	8,0	10,5	5,8	5,8	4,7	7,2	12,5
Time-series	3	1,198	1,268	0,772	0,473	1,325	0,124	0,901	0,788	1,180	0,785	0,541	1,333	1,004
		16,0	5,9	5,8	2,5	12,1	25	10,8	3,4	7,8	8,5	6,3	11,3	11,3
		1,259	1,303	0,852	0,570	1,040	1,308	0,848	0,750	1,098	0,881	0,443	1,098	0,889
		10,5	7,2	3,1	1,7	0,7	2,8	7,3	2,8	5,3	6,7	2,8	5,4	7,2
		1,317	1,256	1,022	0,836	0,837	1,305	0,882	1,050	0,804	0,851	0,666	0,862	1,069
		13,0	7,5	6,3	3,5	9,1	3,5	6,8	5,2	3,1	7,8	3,8	4,9	11,3
		1,307	1,401	0,646	0,663	0,907	1,318	0,641	1,054	0,782	0,702	0,817	1,138	1,182
		13,1	7,8	4,3	3,5	10,0	3,8	5,9	6,2	3,8	7,6	4,5	7,8	10,8
	4	0,848	1,053	0,780	0,234	1,323	3,202	0,345	1,138	0,948	0,648	0,497	1,021	1,159
		6,5	2,4	2,8	0,6	6,0	3,8	3,5	2,5	3,1	4,0	2,8	8,8	6,4
		1,129	1,462	0,538	0,748	0,861	1,573	0,138	1,450	1,450	0,843	0,048	1,108	0,839
		6,0	5,7	1,8	1,6	4,6	7,0	3,2	3,8	5,3	4,5	0,2	2,7	4,3
		1,313	1,138	0,963	0,648	0,870	1,523	0,730	1,183	0,883	0,841	0,444	0,849	1,179
		11,6	6,2	5,3	2,4	7,7	3,8	5,4	5,5	3,1	6,8	2,4	4,9	11,5
		1,278	1,388	0,824	0,704	0,897	1,355	0,818	1,098	0,784	0,710	0,588	1,147	1,223
		13,4	7,3	3,8	3,8	8,8	3,8	5,5	6,2	3,8	7,4	4,1	7,4	10,8
Cross-section	3	1,106	1,422	0,998	0,870	1,375	1,445	0,539	1,211	1,873	0,832	0,473	1,240	1,050
		41,3	18,0	18,8	10,4	40,8	12,8	10,9	10,7	20,4	23,8	13,0	27,7	20,2
		1,158	1,309	0,902	0,960	1,298	1,448	0,565	1,230	0,804	0,852	0,435	1,224	1,018
		29,8	17,0	12,7	6,8	27,4	8,7	11,5	11,7	11,4	17,7	7,8	20,8	22,8
		1,204	1,453	0,907	0,821	1,086	1,308	0,751	0,813	0,727	0,770	0,478	1,021	1,078
		10,2	12,7	8,9	6,8	15,0	6,8	11,8	7,5	6,0	14,7	5,7	10,5	14,3
	4	1,148	1,547	1,076	0,854	1,378	1,085	0,373	1,525	0,877	0,739	0,549	1,373	1,173
		27,3	13,8	14,3	7,0	29,8	10,6	5,8	16,7	12,8	13,8	11,3	18,3	24,2
		1,157	1,392	0,831	0,822	1,240	1,712	0,308	1,584	0,875	0,748	0,415	1,371	1,133
		23,8	14,8	8,8	6,0	22,3	10,1	3,7	15,4	10,3	14,1	6,1	17,8	23,9
		1,148	1,350	0,843	1,075	1,068	1,362	0,539	1,073	0,873	0,778	0,444	1,137	1,196
		16,8	11,8	8,4	7,8	13,2	6,3	10,1	8,4	5,0	13,3	4,8	10,8	15,8

Type 3: Estimation by the linear form of the AIDS.
Type 4: Estimation by the quadratic form of the AIDS.

Conclusion

These pseudo-panel data, although characterized by a limited span (five points) and strong macroeconomic evolutions during this period (1969-1990), allows us to obtain interesting results:

(i) the estimation procedure used for a time-series of repeated surveys time-series results in quite precise estimates for the income elasticities; in comparison, aggregated time-series elasticities are much less precise and quite different form pseudo-panel estimates;

(ii) the time-series elasticities are significantly different from the cross-section ones, as concerns their levels but have the same variation across the income distribution;

(iii) the order between cross-section and time-series elasticities is, for 9 cases versus 1 (3 cases not significant), similar to the order between short term and long term elasticities computed on aggregate time series. Thus, it seems that pseudo-panel data affords better estimations of long term income elasticities than both cross sections and aggregate time-series.

New estimation will be performed with another panel structure based on cohorts, education and localization (without relative income classes) which has been also built on French INSEE surveys (1979, 1984, 1989). An instrumentation of total expenses will be performed to take into account errors in consumption. Finally, an estimation by Goaïed's model is currently performed on first difference data to obtain consistent estimates of time-series income elasticities.

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Appendix 1

PANEL ESTIMATION WITH A MULTIPLICATIVE COMPOSITION OF ERROR

(Goaïd's model[1])

I. The model

Consider the micro system presented in section II3. Thereafter, we would suspect for the existence of a supplementary heteroscedasticity. In fact, when individuals are grouped with characteristics such as geographic location or industry, we would expect that these "homogeneous individuals" share common unobserved characteristics. So we would wish to model variation between groups assuming that the estimation of parameters of interests depends on inter group variation. Indeed, if people within a group share common unobserved factors this can be done by formulating an original structure of the variance of grouped residuals. Therefore, we assume further that:

$$E\left[\overline{\epsilon}_{ict}\,\overline{\epsilon}_{jps}\right] = \sigma_{ict,\,jps} = \sigma_{ij} \times w_{cp} \times \delta_{ts} \quad (3)$$

where δ_{ts} is kronecker delta.

σ_{ij} indicates correlation between residuals of two cohorts.

We assume that the individuals within each cohort should be as "homogeneous" as possible, while those from different cohorts should be as "heterogeneous" as possible. Hence, for the present, we also assumes that disturbances are uncorrelated across cohorts. Therefore, we have :

$$w_{cp} = 0 \text{ for } c \neq p \quad (4)$$

it follows that: $E\left[\overline{\epsilon}^{2}_{ict}\right] = \sigma_{ii} \times w_{cc}$

where w_{cc} reflects the intra-class correlation resulting from the effect of common unobserved characteristics within groups.

We will develop below a consistent GLS procedure for estimation of systems of regression equations for grouped synthetic panel data.

II. Consistent estimation procedure

Suppose that we want to estimate the system (2)

$$\overline{y}_{ict} = x_{ict}\,\beta_i + \overline{\epsilon}_{ict}\,(b) \quad i = 1, \ldots n\ ;\ c = 1, \ldots C \text{ and } t = 1, \ldots T$$

---

[1] A more complete account of this econometric procedure can be found in Goaïed (1991).

where $\overline{\in}_{ict}$ is a mean zero residual with variance equal to $\sigma_{ii}\, w_{cc}$ It's useful to view the formulation of the model (6) for each group c in blocks of T observations.

$$\overline{Y}_{ict} = \overline{X}_{ict}\, \beta_i + \overline{\in}_{ict} \qquad (7) \qquad i = 1,\dots n \; ; \; c = 1, \dots C$$

So that

$$\overline{Y}_i = \overline{X}_i\, \beta_i + \overline{\in}_i \qquad (8) \qquad i = 1,\dots n$$

where $\overline{Y}_i$ and $\overline{\in}_i$ are CT by 1 vectors, $\overline{X}_i$ id a CT by k_i matrix

From (3) and (4), it follows that:

$$E\left[\overline{\in}_i\, \overline{\in}_j\right] = \sigma_{ij}\, V_c \qquad (9)$$

where $V_c = \Omega_c \otimes I_T$ and $\underset{c \times c}{\Omega_c = [w_{cc}]}$

Ω_c is a diagonal matrix. In a more compact manner, we can stack the data in the pooled regression model (8). Then the generalized regression model applies to the stacked regression:

$$\overline{Y} = \overline{X}\, \beta + \overline{\in} \qquad (10)$$

where $\underset{ncT \times 1}{\overline{Y} = [\overline{Y}_i]}$; $\underset{ncT \times K}{\overline{X} = \mathrm{diag}\,(X_i)}$; $\underset{K \times 1}{\beta = [\beta_i]}$

with $K = \sum_{i=1}^{n} ki$

The covariance matric of the disturbance has a particularly convenient form:

$$E\left[\overline{\in}\, \overline{\in}'\right] = V = \Sigma_n \otimes B \qquad (11)$$

where $B = \Omega_c \otimes I_T$, with $\underset{n \times n}{\sum_n} = [\sigma_{ij}]$

We note that in a SUR model (10) with disturbance covariance matrix V, the fact that each equation has an identical set of explanatory variables (for e.g. in demand system analysis) is a sufficient condition for GLS performed on the whole system to be equivalent to GLS performed in each equation separately[1].

$$\text{IF } \overline{X}_1 = \overline{X}_2 = \overline{X}_3 \dots = \overline{X}_n = \overline{X}_* \text{ (say), then } \overline{X} = In \otimes \overline{X}_*$$

$$\text{so } \hat{\beta}_{GLS} = \left[In \otimes \left(\overline{X}_*' B^{-1} \overline{X}_*\right)^{-1} \overline{X}_*' B^{-1}\right] \overline{Y} \qquad (12)$$

$$= \hat{B}_{iGLS} = \left(\overline{X}_*' B^{-1} \overline{X}_*\right)^{-1} \overline{X}_*' B^{-1}\, \overline{Y}_i$$

---

[1] Moreover, in the context of demand analysis system the GLS estimates verify adding up automatically. See appendix 2.

Since $\sum_n$ and Ω_c are unknown matrix, the system (10) is estimated using GLS procedure. FGLS estimator of β may be computed using the standard estimator

$$\widehat{\beta}_{FGLS} = \left[\overline{X}' \widehat{V}^{-1} \overline{X}\right]^{-1} \overline{X}' \widehat{V}^{-1} \overline{Y} \quad (13)$$

where $\overline{X}$, $\overline{Y}$ are stacked data matrix. $\widehat{V}$ is a consistent estimator of V. In practical terms, this is a formidable computation. However, things are simpler than they appear. We develop a three stage Zellner estimator method. The estimator $\widehat{\beta}_{FGLS}$ is constructed by first obtaining a consistent estimate of using OLS estimation on each equation (8). Denoting the vector of residuals in equation i as $\widehat{\overline{\varepsilon}}$, a consistent estimate of Ω_c is obtained by constructing:

$$\Omega_c = \frac{1}{n} \sum_{i=1}^{n} \widehat{\Omega}_{ic} \quad (14)$$

$$\text{where } \widehat{\Omega}_{ic} = \left[\widehat{\omega}_{icc}\right]$$

$$\text{whith } \widehat{\omega}_{icc} = \frac{1}{T} \sum_{t=1}^{T} \widehat{\overline{\varepsilon}}_{ict}^{2} \quad (15)$$

since Ω_c is a diagonal matrix, it's easy to compute $\Omega_c^{-1/2}$ and premultiply the model in (8) by $\Omega_c^{-1/2} \otimes I_T$ to obtain:

$$\overline{Y}_i^* = \overline{X}_i^* \beta_i + \overline{\varepsilon}_i^* \quad (16)$$

where asterisks denote that each original vector or matrix is premultiplied by the matrix $\Omega_c^{-1/2} \otimes I_T$ It's easy to verity that:

$$E\left[\overrightarrow{\varepsilon}_i^* \, \overrightarrow{\varepsilon}_j^{*\prime}\right] = \sigma_{ij} I_{cT} \quad (17)$$

So the classical two stage (or iterative) Zellner procedure applies to the transformed model (16).

Finally, it's useful in this context to develop briefly the disturbance covariance matrix appropriate for the case where the model requires differencing prior to estimation. The extension of the estimation procedure to models in first differences form is straightforward.

Consider the model in the form[1]

$$\Delta \overline{Y}_{ict} = \Delta \overline{X}_{ict} \beta_i + \Delta \overline{\varepsilon}_{ict} \quad i = 1, ...n \; ; c = 1, ...c \; ; t = 1 \quad T \qquad (18)$$

where $\Delta \overline{Y}_{ict} = \overline{Y}_{ict} - \overline{Y}_{ict-1}$; $\Delta \overline{X}_{ict} = \overline{X}_{ict} - \overline{X}_{ict-1}$; $\overline{\varepsilon}_{ict} = \overline{\varepsilon}_{ict} - \overline{\varepsilon}_{ict-1}$

since we have $\varepsilon [\overline{\varepsilon}_{ict}] = 0$ for all i, c and t (19)

and $\varepsilon [\overline{\varepsilon}_{ict} \overline{\varepsilon}_{jpst}] = \sigma_{ij} \times \delta_{cp} \omega_{cc} \times \delta_{ts}$

where δ_{cp} and δ_{ts} are kronecker delta.

It's easy to verify that:

$$E[\Delta \overline{\varepsilon}_{ict}] = 0 \qquad (20)$$

$$E[\Delta \overline{\varepsilon}_{ict} \Delta \overline{\varepsilon}_{jps}] = 2_{\sigma ij} \times \delta_{cp} \omega_{cc} \times \delta_{ts}$$

So we have $E[\Delta \overline{\varepsilon}_{ict}{}^2] = 2 \sigma_{ii} \omega_{cc}$ (21)

Hence, the disturbance covariance matrix for the full nc (T-1) observation is

$$E[\Delta\overline{\varepsilon} \Delta\overline{\varepsilon}'] = 2 V = 2 (\Sigma n \otimes \Omega_c \otimes I_{T-t}) \qquad (22)$$

The double role of covariance matrix comes from the MA (1) errors $\Delta \varepsilon_{ict}$ in (18) .

[1] Note that this estimation on differences between two consecutive surveys differs from the within estimator (or estimator of the covariance) on panel data for our model (18) allows for varying individual effects from one couple of consecutive surveys to another, and the within estimator corresponds to a constant fixed effect X_{ici}

$$Y_{ict} = X_{ict} \beta_i + \alpha_{ic} + \varepsilon_{ict}$$

III. The adding-up property in demand system analysis: an econometric approach

Consider the linear demand system in the form :

$$\overline{Y}_{ict} = a_i + b_i\,\overline{Y}_{ct} + \sum_j cij\, P_{jt} + \sum_m d_{im}\,\overline{Z}_{Mct} + \overline{\varepsilon}_{ict} \quad (1) \quad i = 1, \dots n\,;\ c = 1, \dots C\,;\ t = 1, \dots T$$

where $\overline{Y}_{ict}$ is the expenditure of good i, by representative household in cluster c in period t, $\overline{Y}_{ct}$ is the representative total outlay, $\overline{Z}_{mct}$ are m socio-economic or demographic characteristics ; $\overline{\varepsilon}_{ict}$ represents an error term ; P_{jt} is a price index for good j in period t , a_i, b_i, c_{ij} and d_{im} are parameters.

Since $\sum_i \overline{Y}_{ict} = \overline{Y}_{ct}$ for all c and t, we have the adding-up restrictions on the above model :

$$\sum_i a_i = 0,\ \sum_i b_i = 1 \quad \sum_i c_ij = 0 \text{ and } \sum_i d_im = 0 \qquad (2).$$

Hence, the adding-up restrictions (2) may be formulated in matrix notation as :

$$\left[S'_n \otimes I_k\right]\beta = L$$

where S_n is the unit vector of order n, β the nk x 1 vector and L is a vector of the form[1] :

$$L = [O_{k-1}]$$

From (12) it follows that :

$$\begin{aligned}(S'_n \otimes I_k)\hat{\beta} &= (S'_n \otimes I_k)\left(I_n \otimes \left(\overline{X}'_* B^{-1}\,\overline{X}\right)^{-1} \overline{X}'_* B^{-1}\right)\overline{Y}\\ &= \left[S'_n \otimes \left(\overline{X}'_* B^{-1}\overline{X}_*\right)^{-1} \overline{X}'_* B^{-1}\right]\overline{Y}\\ &= \sum_{i=1}^{n} (\overline{X}'_* B^{-1}\,\overline{X}_*)^{-1}\,\overline{X}'_* B^{-1}\,\overline{Y}_i\\ &= \left(\overline{X}'_* B^{-1}\,\overline{X}_*\right)^{-1}\overline{X}'_* B^{-1}\sum_{i=1}^{n}\overline{Y}_i\end{aligned}$$

$\sum_i \overline{Y}_i$ may be replaced by the expression : $\sum_i \overline{Y}_i = \overline{X}_* L$

it follows that : $\sum_i \hat{\beta}_i = \left(\overline{X}'_* B^{-1}\,\overline{X}_*\right)^{-1}\overline{X}'_* B^{-1}\,\overline{X}_* L = L$

So GLS estimates satisfy adding up automatically. Similarly, the argument can be extended to models in budget share forms, such as AIDS of A. Deaton and J. Muellbauer (1980).

---

1 β_i is arranged to have β_i in the first row ; at the same time $\overline{X}_*$ is arranged to have $\overline{Y}_{ct}$ in the first column.

Appendix 2

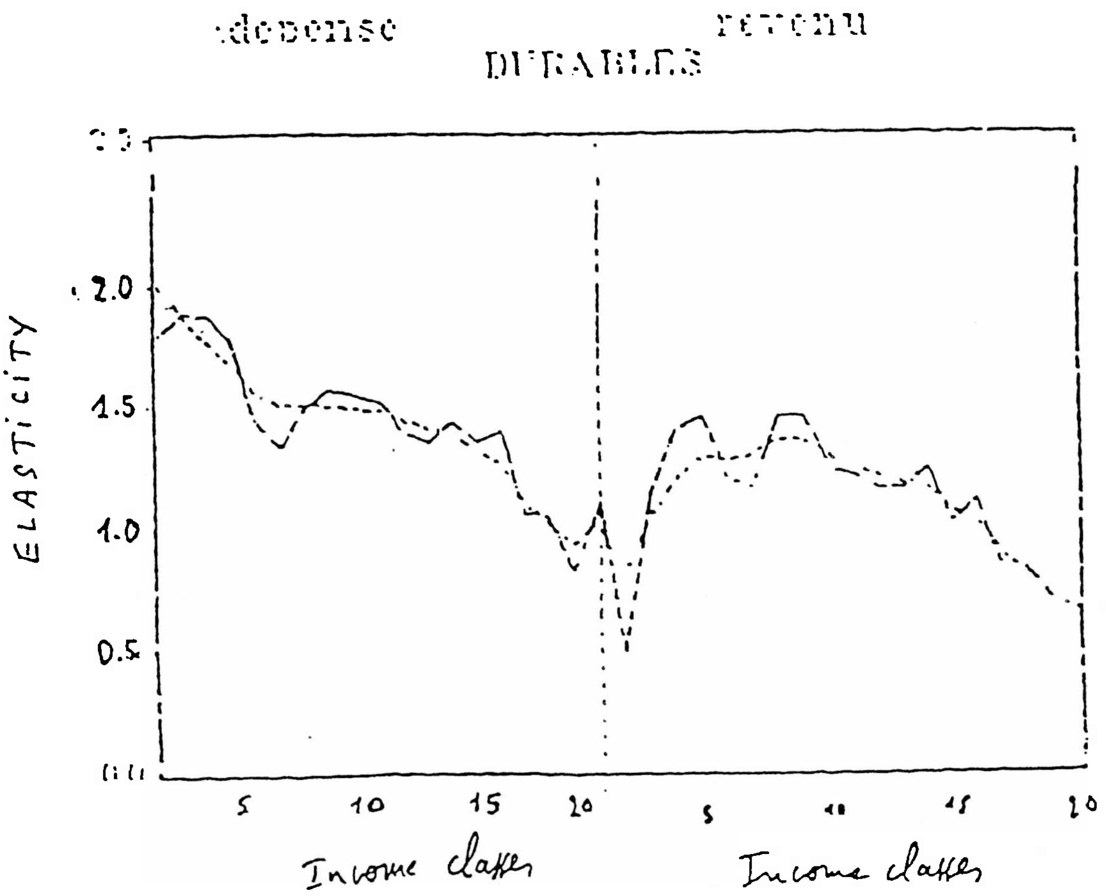
EMPIRICAL RESULTS ON SURVEYS

(Point elasticities)

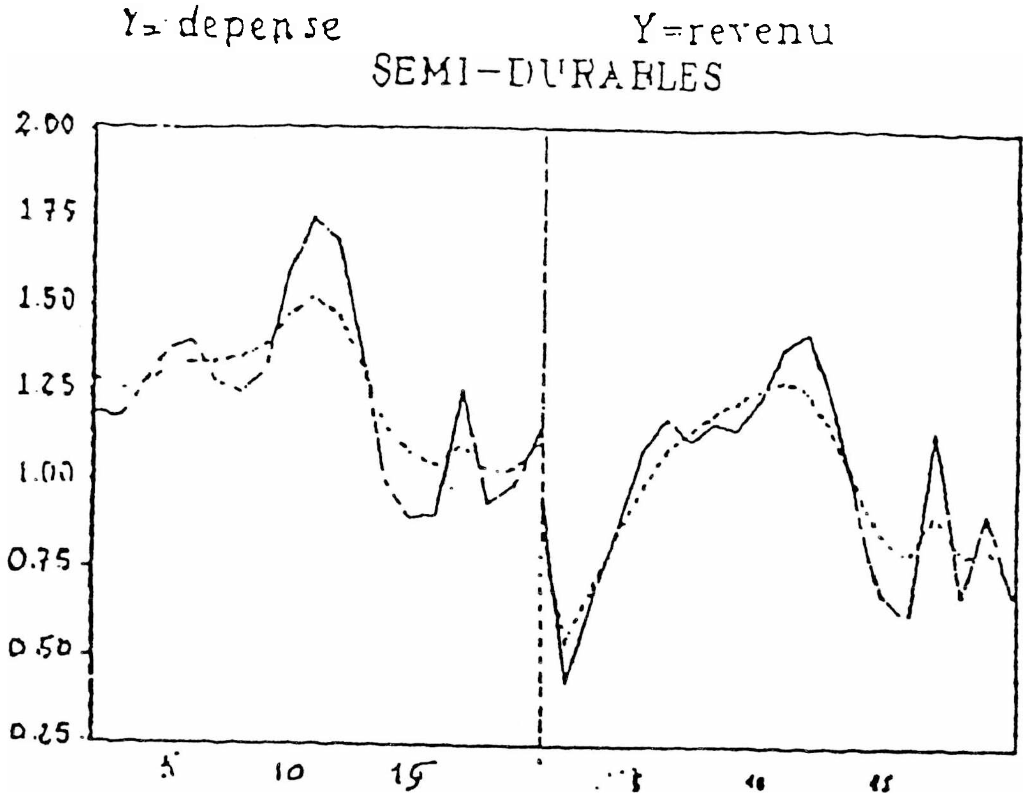
I . CROSS-SECTION ELASTICITIES(1986 Canadian Survey):

A. Arc elasticities on Filtered data :

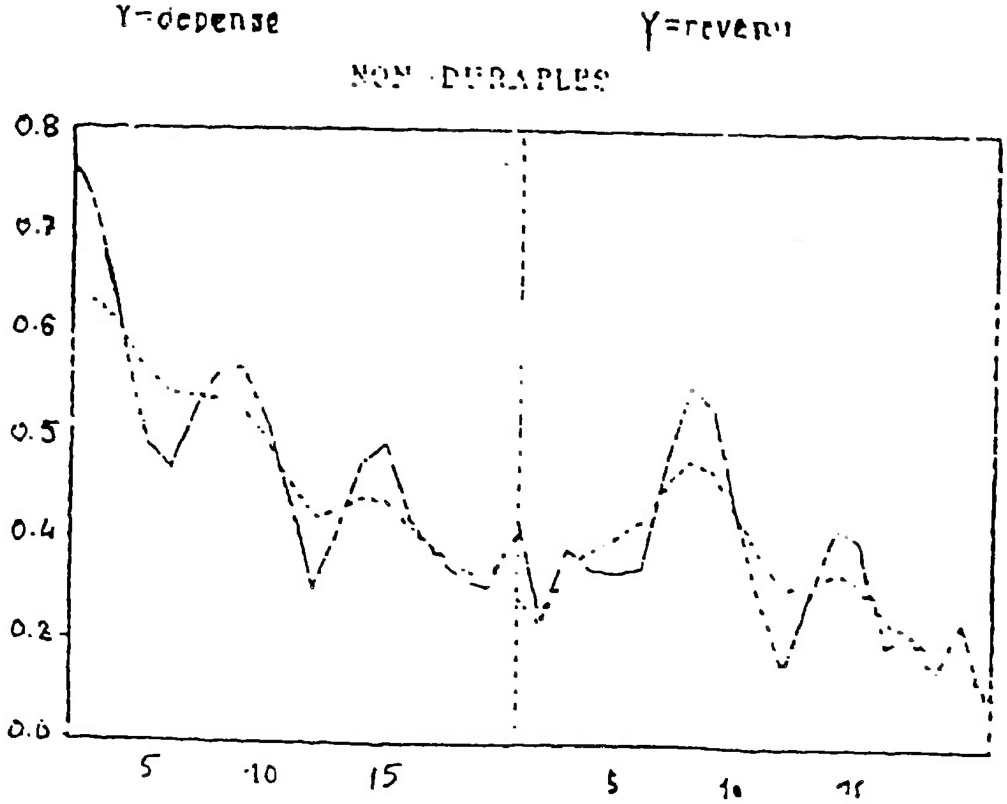
The elasticities are shown for two values of λ : $\lambda = 10^7$ and $\lambda = 5 \times 10^7$, and are computed on total expense and income.



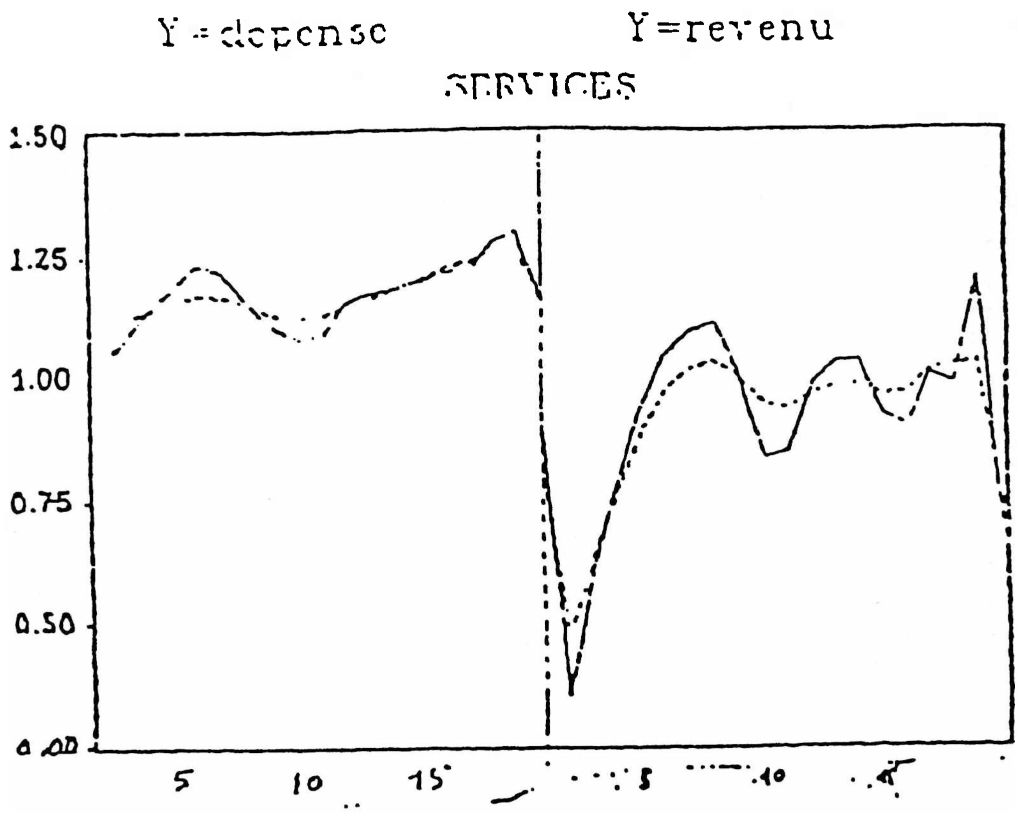
III . 1


Y= depense
Y=revenu
SEMI-DURABLES
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
5
10
15
5
10
15

III.2


Y=depense
Y=revenu
NON-DURABLES
0.8
0.7
0.6
0.5
0.4
0.2
0.0
5
10
15
5
10
15

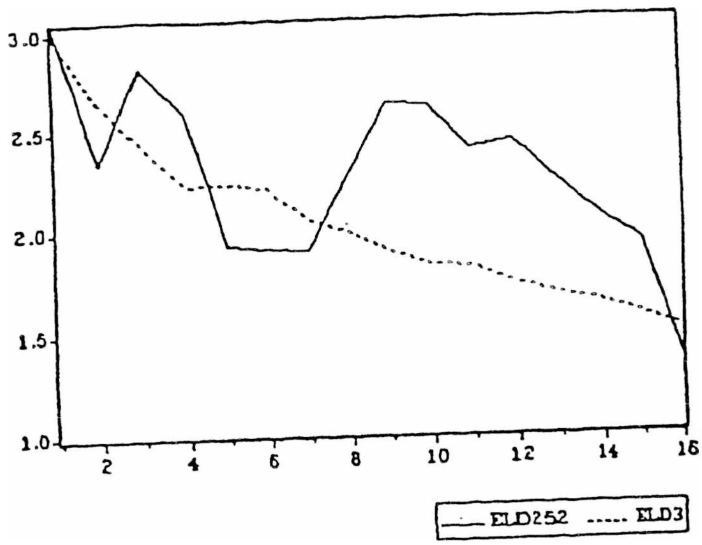
III.3



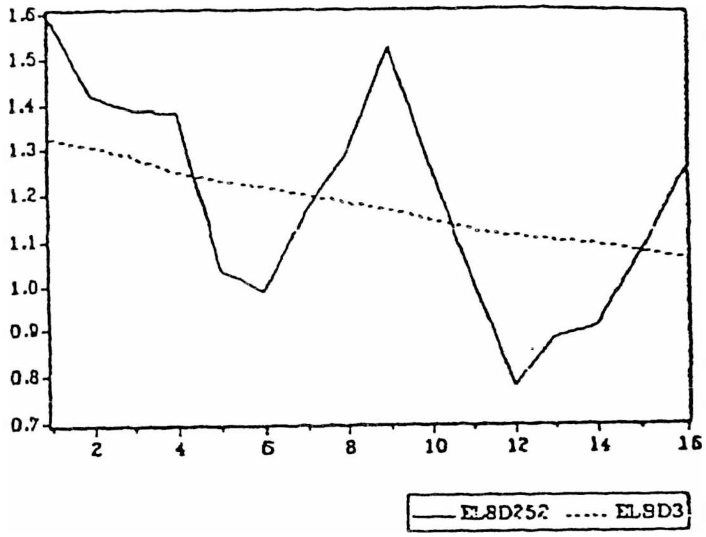
III. 4

B. Ajustment elasticities on 360 cells of 1986 survey:

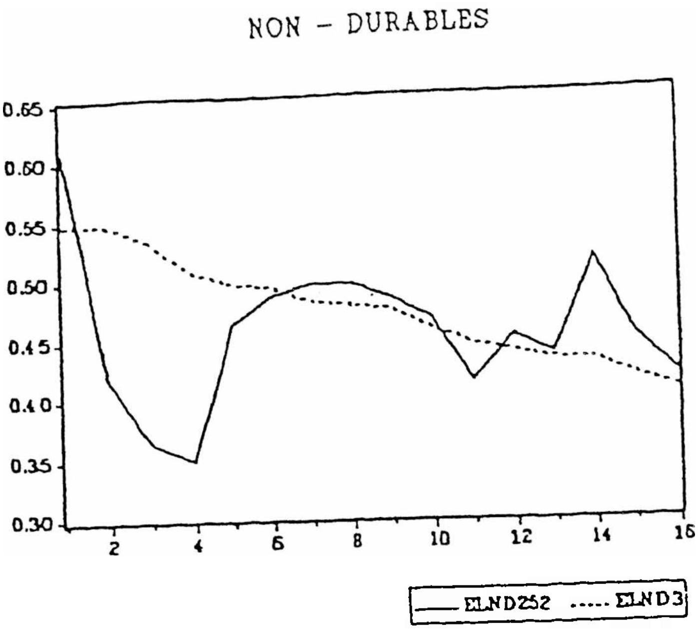
DURABLES

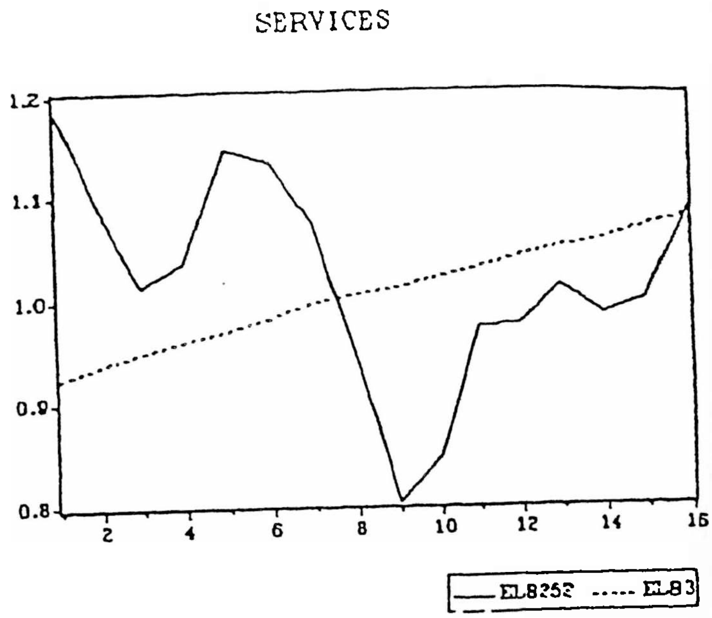


SEMI - DURABLES



obs	CELL	ELD3	ELD252	ELSD252	ELSD252
1	1.500000	2.995979	3.037295	1.585810	1.585810
2	2.600000	2.647696	2.346314	1.415067	1.415067
3	3.700000	2.429869	2.821154	1.383040	1.383040
4	4.800000	2.223848	2.592439	1.379230	1.379230
5	5.900000	2.237566	1.929854	1.033604	1.033604
6	6.100000	2.206957	1.915587	0.984672	0.984672
7	7.110000	2.053246	1.900396	1.163492	1.163492
8	8.120000	1.992447	2.265987	1.293896	1.293896
9	9.130000	1.895740	2.622408	1.521312	1.521312
10	10.14000	1.826461	2.608622	1.259054	1.259054
11	11.15000	1.817047	2.387063	1.013244	1.013244
12	12.16000	1.734126	2.426852	0.775244	0.775244
13	13.17000	1.681204	2.235931	0.878637	0.878637
14	14.18000	1.634931	2.055672	0.903042	0.903042
15	15.19000	1.568489	1.929301	1.062859	1.062859
16	16.20000	1.502432	1.363597	1.251660	1.251660





obs	CELL	ELND3	ELND252	ELS252	ELS252
1	1.500000	0.548391	0.608224	1.184434	1.184434
2	2.600000	0.547487	0.419424	1.089120	1.089120
3	3.700000	0.533441	0.364723	1.013275	1.013275
4	4.800000	0.507677	0.349232	1.035928	1.035928
5	5.900000	0.497361	0.463736	1.145927	1.145927
6	6.100000	0.493628	0.486130	1.132798	1.132798
7	7.110000	0.482011	0.496734	1.072400	1.072400
8	8.120000	0.478308	0.496399	0.943099	0.943099
9	9.130000	0.475455	0.485125	0.802479	0.802479
10	10.14000	0.458631	0.466869	0.845022	0.845022
11	11.15000	0.445895	0.413709	0.974312	0.974312
12	12.16000	0.438943	0.452655	0.976449	0.976449
13	13.17000	0.432666	0.435751	1.012349	1.012349
14	14.18000	0.430814	0.515275	0.985074	0.985074
15	15.19000	0.417544	0.451436	0.998441	0.998441
16	16.20000	0.405931	0.419492	1.086391	1.086391

Appendix 3
ESTIMATION OF AIDS ON AGGREGATE TIME-SERIES

Estimation par durabilité en différence première :

Tableau 1 : Estimation en système avec les contraintes d'additivité, d'homogénéité et de symétrie.

	ldep	lps	lpd	lpsd	lpnd	SCR	R²	DW
Services	-0.03688	0.416	-0.145	-0.0848	-0.185	0.001693	0.347	1.384
	-0.4	-0.1	-1.8	-1.8	-3			
Durables	0.388		0.14	0.0796	-0.0733	0.00126	0.376	1.535
	4.8		1.5	1.9	-1.3			
Semi-durables	-0.0248			0.038734	-0.0335	0.00039	0.237	1.423
	-0.6			1	-0.9			
Non-durables	-0.32645				0.292	0.000676	0.693	1.513
	-5.8				4.5			

Tableau 2 : Elasticités.

	Revenu	Prix			
		Services	Durables	Semi-durables	Non-durables
Services	0.906	0.0937	-0.358	-0.203	-0.439
	3.7	0.3	-1.9	-1.8	-2.7
Durables	3.812	-2.164	-0.376	0.196	-1.467
	6.5	-2.9	-0.6	0.7	-3
Semi-durables	0.816	-0.554	0.192	-1.102	-1.2
	2.5	-1.2	0.6	-3.9	-3.5
Non-durables	0.0189	-0.171	-0.085	0.0322	0.204
	0.1	-0.7	-0.5	0.3	1

Tableau 3 : Estimation équation par équation avec le seul prix direct.

	ldep	prix	SCR	R²	DW	Revenu	Prix
Services	0.0279	0.158	0.00175	0.325	1.324	1.07	-0.626
	0.3	3.4				4.9	-3.4
Durables	0.315	-0.125	0.00115	0.432	1.165	3.812	-2.219
	5.4	-3				6.5	-6.9
Semi-durables	-0.0853	0.0284	0.000429	0.16	1.381	0.371	-0.705
	-2.3	0.7				1.4	-2.5
Non-durables	-0.42	0.0712	0.000844	0.616	1.24	-0.262	-0.366
	-8.1	2.6				-1.7	-3.3

rem: non compensated price elasticities

Estimation pour six fonctions en différence première :

Tableau 1 : Estimation en système avec les contraintes d'additivité, d'homogénéité et de symétrie.

	ldep	lphabi	lplois	lptrans	lpalim	lplogt	lpdivers	SCR	R²	DW
Habillement	-0.00185	-0.0408	-0.0722	-0.0544	0.0517	0.101	0.0143	9.95E-05	0.172	1.545
	0.0'	-0.8	-2	-1.1	1.7	2.4	1.2			
Loisirs	0.00095		-0.0448	-0.00218	0.0582	0.0622	-0.0012	0.000289		1.144
	0.0		-0.8	0	1.5	1.3	-0.1			
Transport	0.0787			-0.0988	0.177	-0.0377	0.0159	0.000339	0.425	1.812
	2.1			-1.3	3.8	-0.7	0.9			
Alimentation	0.0204				-0.351	0.0124	0.0516	0.00047	0.578	1.613
	0.5				-5.9	0.4	2.6			
Logement	-0.161					-0.163	0.0246	0.000134	0.655	1.534
	-6.4					-2.5	2			
Divers	0.0622						-0.105	0.00084	0.340	1.152
	1.2						-3.8			

Tableau 2 : Elasticités.

	Revenu	Prix					
		Habi	Lois	Trans	Alim	Logt	Divers
Habillement	0.977	-1.496	-0.88	-0.661	0.637	1.245	0.178
	3.2	-2.3	-1.8	-1.2	1.8	2.4	1.3
Loisirs	0.976	-0.696	-1.431	-0.0176	0.568	0.607	-0.00816
	3	-1.8	-2.4	0	1.6	1.3	0
Transport	1.54	0.407	-0.0704	-1.741	1.047	-0.394	0.026
	6.1	-1.3	-0.2	-3.5	3.4	-1	0.2
Alimentation	1.0864	0.00688	0.00683	0.0318	-1.109	-0.0188	0.000808
	7	1.6	1.4	3.8	-10.1	0.2	2.3
Logement	0.392	0.432	0.298	-0.0513	0.2	-1.454	0.183
	4	2.7	1.6	-0.2	1.6	-5.9	3.9
Divers	1.421	0.3	0.0354	0.17	0.453	0.277	-1.645
	4.2	1.6	0.3	1.2	2.8	2.2	-1.4

Tableau 3 : Estimation équation par équation avec le seul prix direct.

	ldep	prix	SCR	R²	DW	Elasticités	
						revenu	Prix
Habillement	-0.0301	-0.0154	0.000115	0.0458	1.42	0.632	-1.158
	-1.1	-0.6				1.9	-3.7
Loisirs	0.0602	0.115	0.000173	0.451	1.97	1.582	0.0497
	1.9	4.6				5.2	0.2
Transport	0.187	0.089	0.000446	0.244	1.32	2.25	-0.593
	2.9	2				5.3	-2.3
Alimentation	-0.186	-0.226	0.000374	0.665	1.61	0.262	-1.71
	-4	-7.4				1.4	-17.6
Logement	-0.164	-0.0627	0.00024	0.38	0.9	0.38	-1.073
	-3.9	-2.1				2.4	-12.6
Divers	-0.0783	-0.16	0.000676	0.469	2.31	0.473	-1.999
	-1.5	-4.9				1.4	-9.9

Estimation pour treize fonctions en différence première :

Tableau 1 : Estimation en système avec les contraintes d'additivité, d'homogénéité et de symétrie.

	ldep	lphabi	lplois	lpsant	lptpub	lptpri	lpvehi	lpalid	lpalie	lpalct	lplogt	lpchar	lpmeub	lpdive	SCR	R²	DW
Habillement	-0.0339	0.0975	-0.053	-0.051	-0.012	-0.0023	-0.031	-0.00365	-0.086	-0.008	-0.006	-0.0225	0.0858	0.079	6E-05	0.552	1.78
	-1.4	2.2	-1.5	-1.5	-0.7	-0.1	-1.3	-0.2	-2.7	-0.5	0.2	-0.9	2.7	1.9			
Loisirs	0.055		0.0015	0.0351	0.0201	-0.024	-0.067	0.02	0.032	0.0044	0.0428	-0.0167	-0.664	0.0713	0.0002	0.384	1.89
	1.7		0	0.9	1.1	-1.1	-2.5	0.8	0.9	0.2	1.2	-0.7	-1.8	1.4			
Santé	-0.041			-0.201	0.0094	0.0375	0.141	-0.0634	0.092	0.0004	0.0709	-0.0171	0.00281	-0.056	0.0004	0.159	1.45
	-0.9			-2.9	0.5	1.7	4	-1.8	2.7	0	1.8	-0.6	0.1	-0.9			
Transport public	-0.005				-0.004	-0.0073	0.0052	0.00783	-0.022	-0.002	-0.011	0.0083	-0.0195	0.0269	1E-05	-0.105	2.08
	-0.4				-0.3	-0.7	0.4	0.7	-1.4	-0.2	-0.8	0.7	-1.1	1.2			
Transport privé	0.0231					0.0913	-0.033	0.0119	-0.04	-0.009	-0.039	0.0271	-0.0217	0.0094	4E-05	0.638	1.92
	1.4					5.3	-2.2	0.8	-2.2	-0.9	-2	2	-1.2	0.3			
Achats véhicules	0.143						0.044	0.0662	-0.01	0.0149	-0.101	0.0471	0.00934	-0.067	0.0004	0.443	1.91
	4.5						1.3	2.8	-0.4	0.9	-3.9	2.6	-0.4	-1.5			
Alim à domicile	0.00965							0.129	-0.006	-0.007	-0.083	-0.0126	0.0424	-0.103	0.0002	0.633	1.63
	0.3							4.3	-0.2	-0.5	-3.4	-0.7	2.1	-2.4			
Alim à l'extérieur	0.0305								0.007	-0.027	-0.01	0.0244	0.335	0.013	7E-05	0.371	1.83
	1.3								0.2	-1.7	-0.3	1.1	1.2	0.3			
Alcool et tabac	-0.00795									0.0131	0.006	-0.0107	0.0153	0.0098	6E-05	0.08	1.4
	-0.4									0.9	0.3	-0.9	1	0.3			
Logement	-0.229										0.18	-0.024	-0.0891	0.0515	0.0002	0.829	1.49
	-7.9										4.2	-1	-4.3	1			
Charges	0.101											0.0216	0.0518	-0.077	5E-05	0.263	2.13
	0.4											1.3	2.9	-2			
Meubles	0.0873												-0.0227	-0.003	7E-05	0.694	2.02
	3.7												-0.5	-0.1			
Divers	-0.0415													0.0444	0.0006	-0.028	2.17
	-0.7													0.4			

Tableau 2 : Elasticités.

		Prix												
	Revenu	Habi	Loisirs	Santé	Tpub	Tpriv	Vehi	Ali dom	Ali ext	Alc. tab	Logt	Charges	Meubles	Divers
Habillement	0.531	0.38	-0.716	-0.686	-0.15	-0.399	-0.003	0.019	-1.16	-0.081	0.159	-0.294	1.219	1.151
	1.5	0.6	-1.5	-1.4	-0.6	-1.2	0	0.1	-2.6	-0.4	0.4	-0.9	2.7	2
Loisirs	1.589	-0.61	-1.039	-0.569	0.205	-0.291	-0.753	0.127	0.307	0.0129	0.366	-0.2	0.755	0.688
	4.5	-1.6	-1.7	-1.5	1	-1.3	-2.6	0.5	0.8	0.1	1	-0.8	-1.9	1.3
Santé	-0.0507	-1.23	0.999	-6.11	0.261	1.023	3.669	-1.467	2.411	0.0701	1.981	-0.401	0.149	-1.305
	0	-1.3	0.9	-3.5	0.6	1.8	4	-1.7	2.7	0.1	2	-0.6	0.2	-0.8
Transport public	0.735	-0.589	1.092	0.509	-1.23	-0.368	0.288	0.454	-1.145	-0.081	-0.558	0.451	-1.015	1.458
	1.1	-0.6	1.1	0.6	-1.8	-0.7	0.5	0.8	-1.4	-0.2	-0.7	0.8	-1.1	1.2
Transport privé	1.386	-0.066	-0.435	0.611	-0.128	0.502	-0.578	0.142	-0.694	-0.179	-0.718	0.439	-0.39	0.108
	4.9	-0.2	-1.1	1.7	-0.7	1.8	-2.2	0.6	-2.2	-1	-2.2	1.9	-1.3	0.2
Achats véhicules	3.713	-0.778	-1.532	-2.572	0.0469	-0.796	-0.307	0.857	-0.359	0.126	-2.349	0.796	-0.378	-1.611
	6.2	-1.7	-2.9	-3.9	0.2	-2.8	-0.5	1.9	-0.8	0.4	-4.8	2.3	-0.9	-1.9
Alim à domicile	1.065	-0.025	0.129	-0.431	0.0517	0.0766	0.444	-0.135	-0.041	-0.051	-0.57	-0.0873	0.282	-0.704
	5.7	-0.2	0.7	-1.9	0.7	0.8	2.8	-0.7	-0.3	-0.4	-3.5	-0.7	2	-2.4
Alim à l'extérieur	1.497	-1.436	0.474	1.47	-0.366	-0.683	-0.19	-0.163	-0.924	-0.473	-0.239	0.378	0.509	0.147
	3.9	-2.7	0.8	2.6	-1.4	-2.3	-0.5	-0.4	-1.4	-1.8	-0.5	1.1	1.1	0.2
Alcool et tabac	0.863	-0.126	0.0885	0.0116	-0.029	-0.153	0.265	-0.0991	-0.463	-0.765	0.126	-0.18	0.274	0.187
	2.8	0.4	0.3	0	-0.2	-0.9	1	-0.4	-1.7	-2.9	0.4	-0.8	1	0.4
Logement	-0.448	0.144	0.405	0.504	-0.044	-0.162	-0.562	-0.309	0.021	0.122	0.367	-0.0988	-0.456	0.51
	-2.44	0.7	1.8	2.1	-0.5	-1.3	-3.4	-2	0.1	1.1	1.3	-0.7	-3.6	1.6
Charges	1.278	-0.637	-0.483	-0.481	0.223	0.726	1.277	-0.385	0.65	-0.31	-0.702	-0.419	1.398	-2.136
	1.9	-1	-0.7	-0.7	0.7	1.9	2.5	-0.8	1.1	-0.9	-1	-1	2.8	-2
Meubles	2.182	1.076	-1.01	-0.008	-0.287	-0.364	-0.189	0.399	0.381	0.139	-1.394	0.658	-1.395	-0.189
	6.8	2.4	-2	0	-1.2	-1.6	-0.7	1.5	1	0.7	-4.8	2.7	-2.3	-0.4
Divers	0.755	0.636	0.581	-0.43	0.215	0.0884	-0.508	-0.77	0.117	0.0912	0.442	-0.591	-0.0037	-0.021
	1.8	1.9	1.4	-0.9	1.2	0.4	1.5	-2.3	0.4	0.4	1.2	-2	0	-0.7

Tableau 3 : Estimation équation par équation avec le seul prix direct.

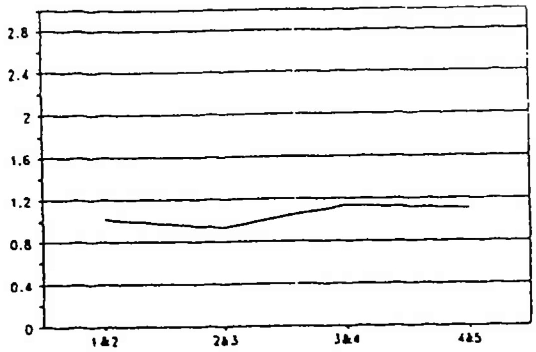
	Idep	prix	SCR	R²	DW	Elasticités	
						Revenu	Prix
Habillement	0.0102	-0.0311	0.00011	0.148	1.9	1.14	-1.44
	0.4	-1				2.9	-3.5
Loisirs	0.126	0.162	0.00012	0.537	1.84	2.35	0.613
	4.7	5.7				8.3	2.1
Santé	-0.0454	-0.0237	0.00051	0.0168	1.11	-0.164	-1.563
	-0.7	-0.6				-0.1	-1.5
Transport public	0.00103	0.00393	1.1E-05	0.0356	2.01	1.05	-0.793
	0.1	0.6				2.12	-2.5
Transport privé	0.0349	0.0491	7.1E-05	0.342	1.78	1.58	-0.215
	1.3	2.9				-3.5	-0.8
Achats véhicules	0.205	0.125	0.00031	0.394	1.66	4.88	1.177
	4.2	3.1				5.3	1.6
Alim à domicile	0.0688	0.00604	0.00047	0.108	1.64	1.46	-1.028
	1.4	0.2				4.5	-5
Alim à l'extérieur	0.0456	0.0296	9.2E-05	0.122	1.74	1.74	-0.564
	1.9	1.8				4.4	-2.3
Alcool et tabac	-0.022	-0.0232	5.6E-05	0.123	1.4	0.62	-1.378
	-1.2	-2				2	-7.2
Logement	-0.156	0.00605	0.00052	0.415	1.31	0.0162	-0.806
	-2.4	0.1				0	-3.2
Charges	-0.0332	-0.006	5.4E-05	0.143	1.8	0.0915	-1.13
	-1.5	-0.4				0	-3.3
Meubles	0.155	0.0895	8E-05	0.632	1.58	3.1	0.0583
	6.4	3.6				9.5	0.2
Divers	0.00158	0.0488	0.00048	0.108	2.28	1.012	-0.619
	0	1.2				2.3	-2.2

Appendix 4

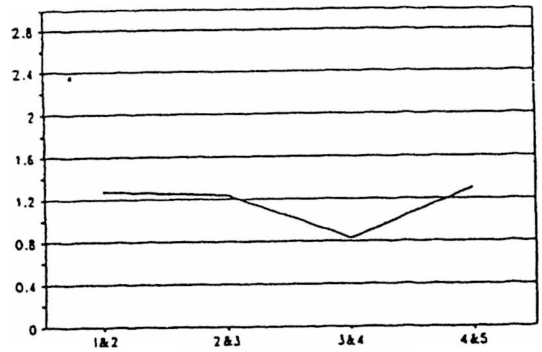
FIGURES ON PSEUDO-PANEL ELASTICITIES

Figures : Evolution of the income elasticities with within estimations of a linear AIDS on two moving fifth of income classes (x : number of the two fifth of income classes ; y : income elasticity).

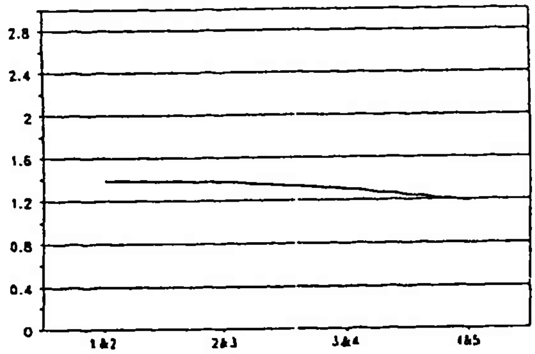
Services



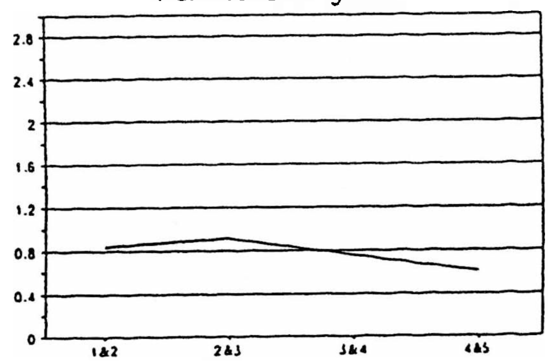
Durable goods



Semi-durable goods

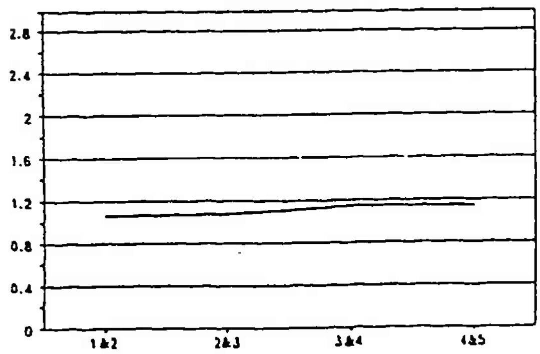


Non-durable goods

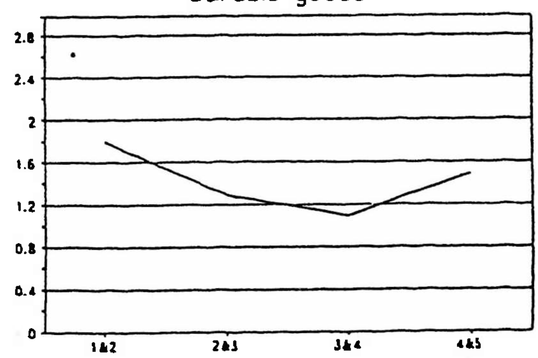


Figures : Evolution of the income elasticities with within estimations of a quadratic AIDS on two moving fifth of income classes (x : number of the two fifth of income classes ; y : income elasticity).

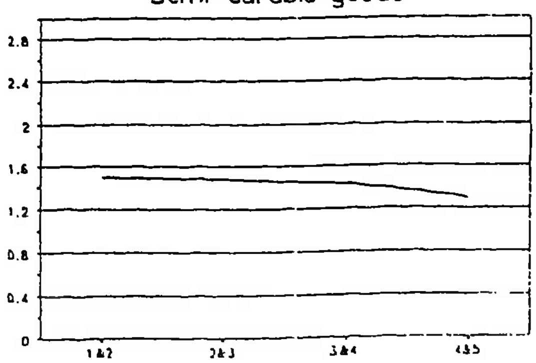
Services



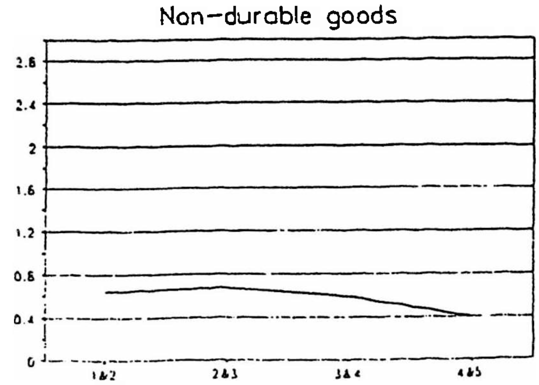
Durable goods



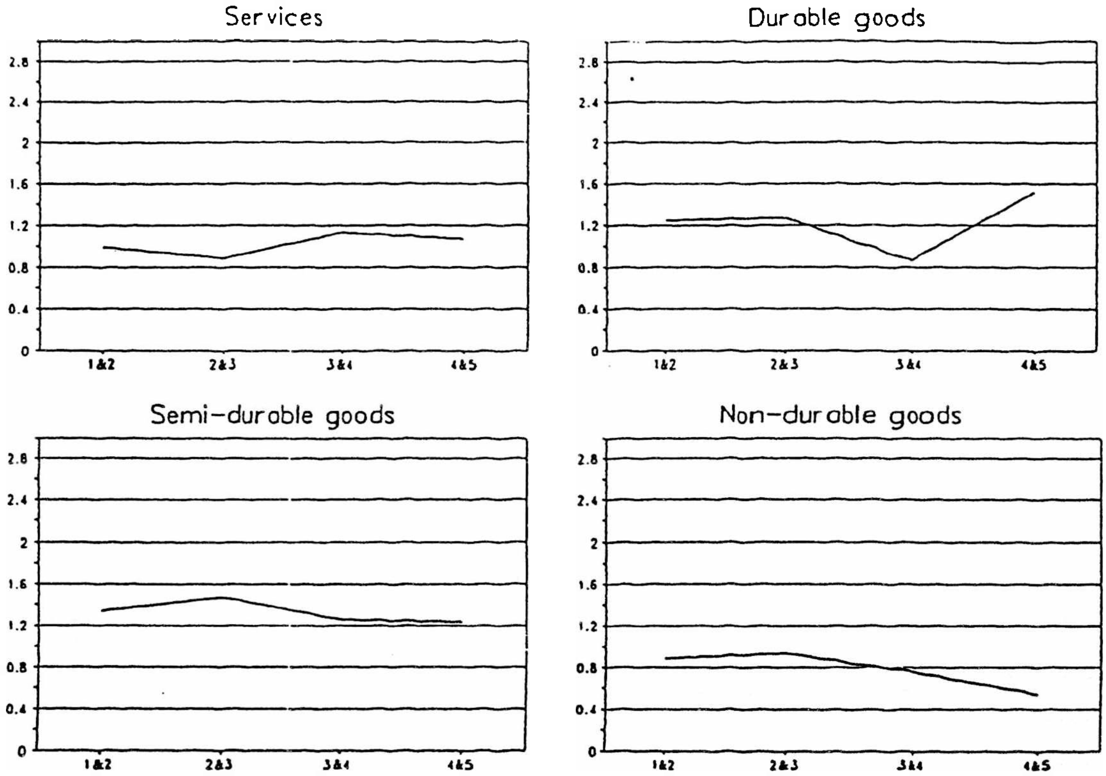
Semi-durable goods



Non-durable goods



Figures : Evolution of the income elasticities with time series estimations of a linear AIDS on two moving fifth of income classes (x : number of the two fifth of income classes ; y : income elasticity).



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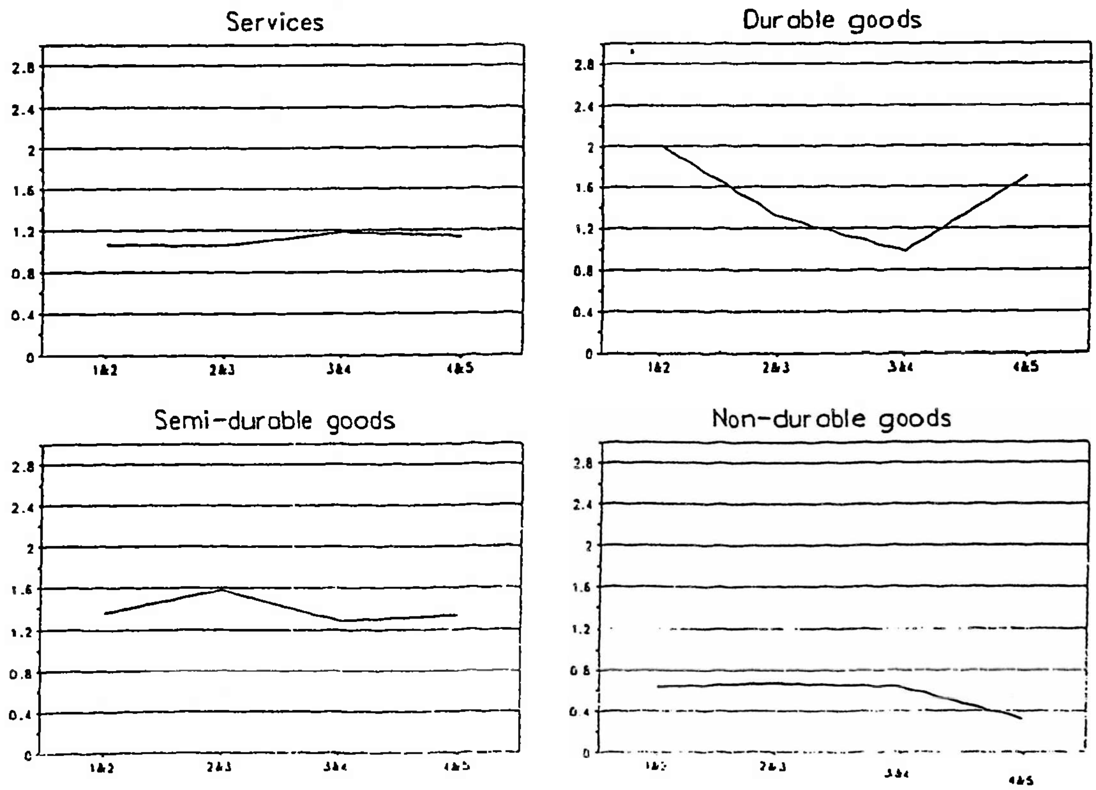

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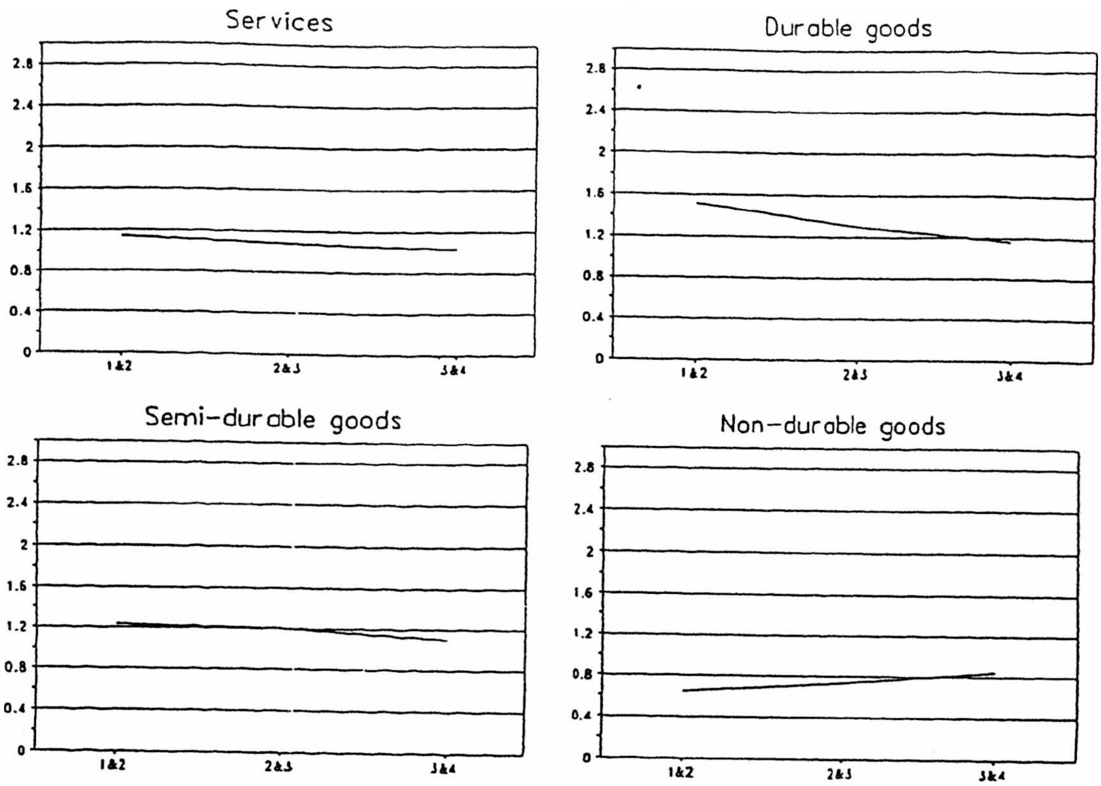

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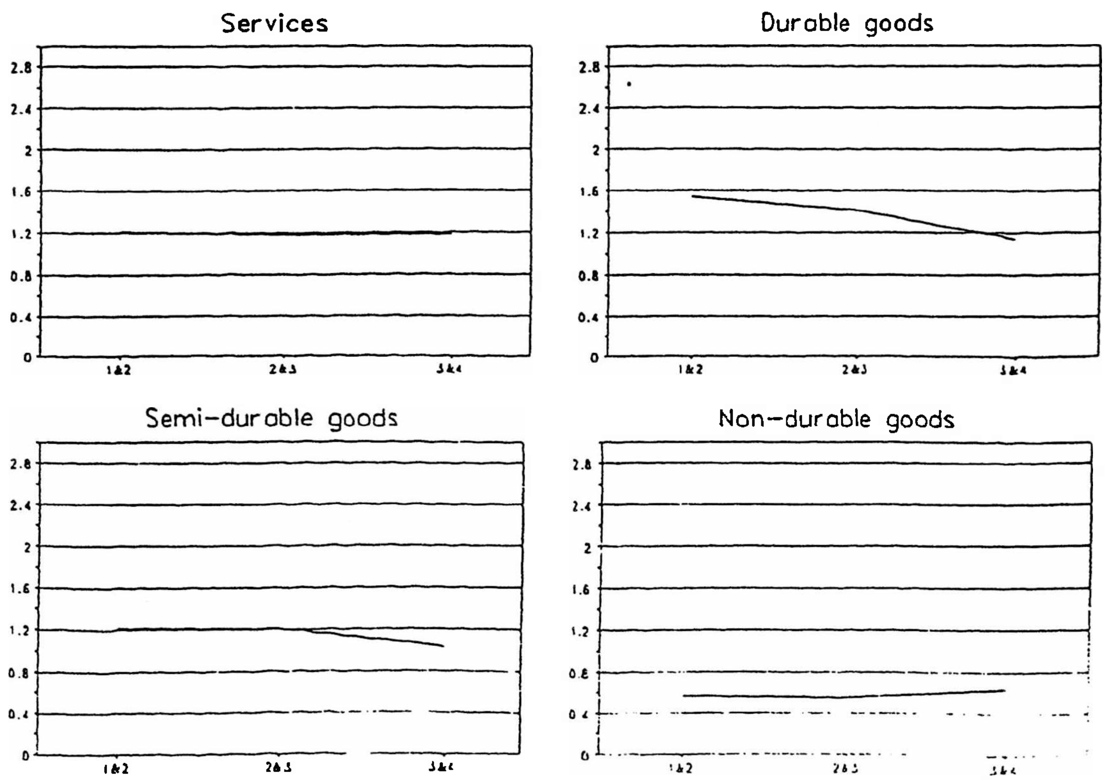

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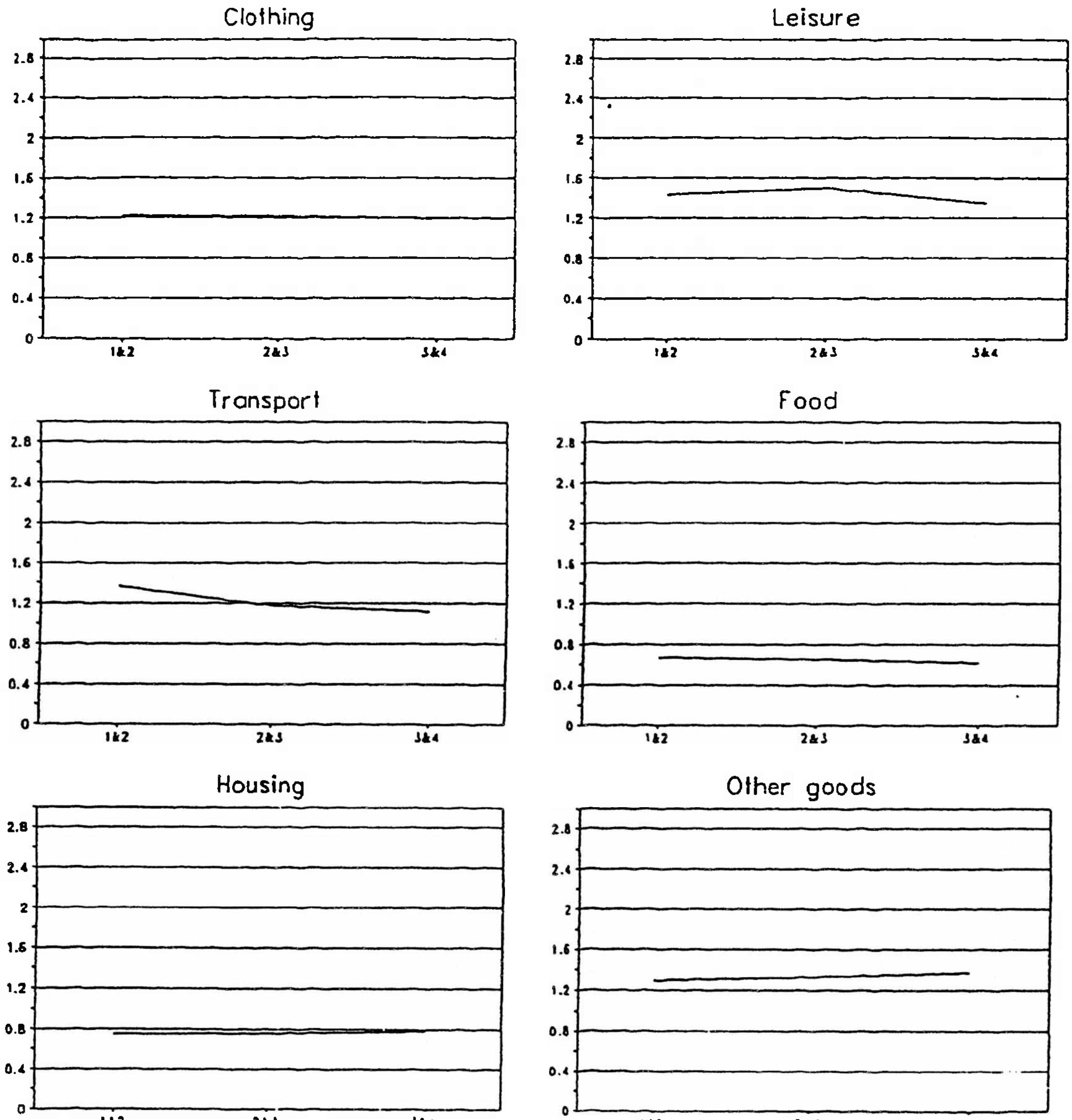

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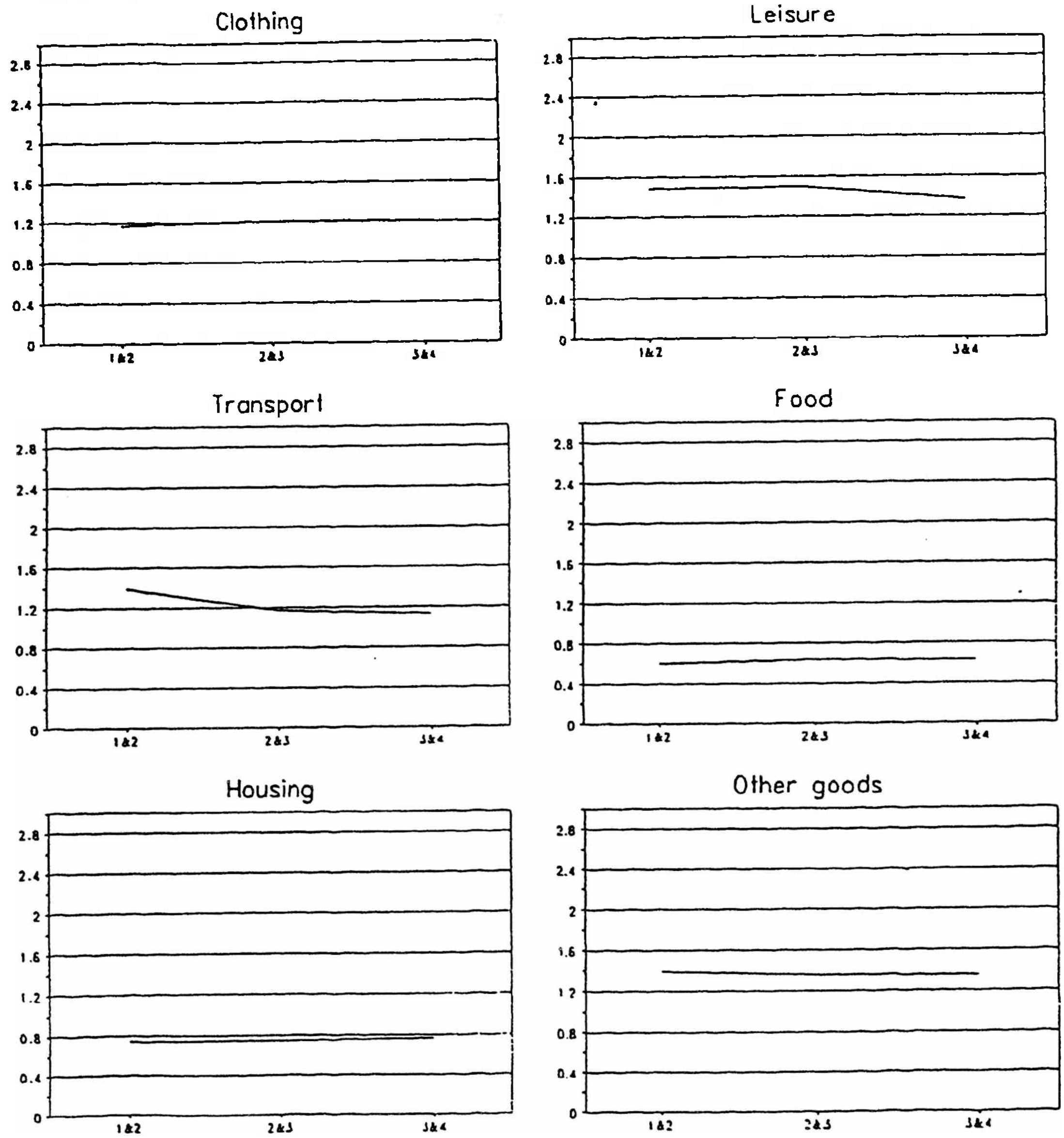

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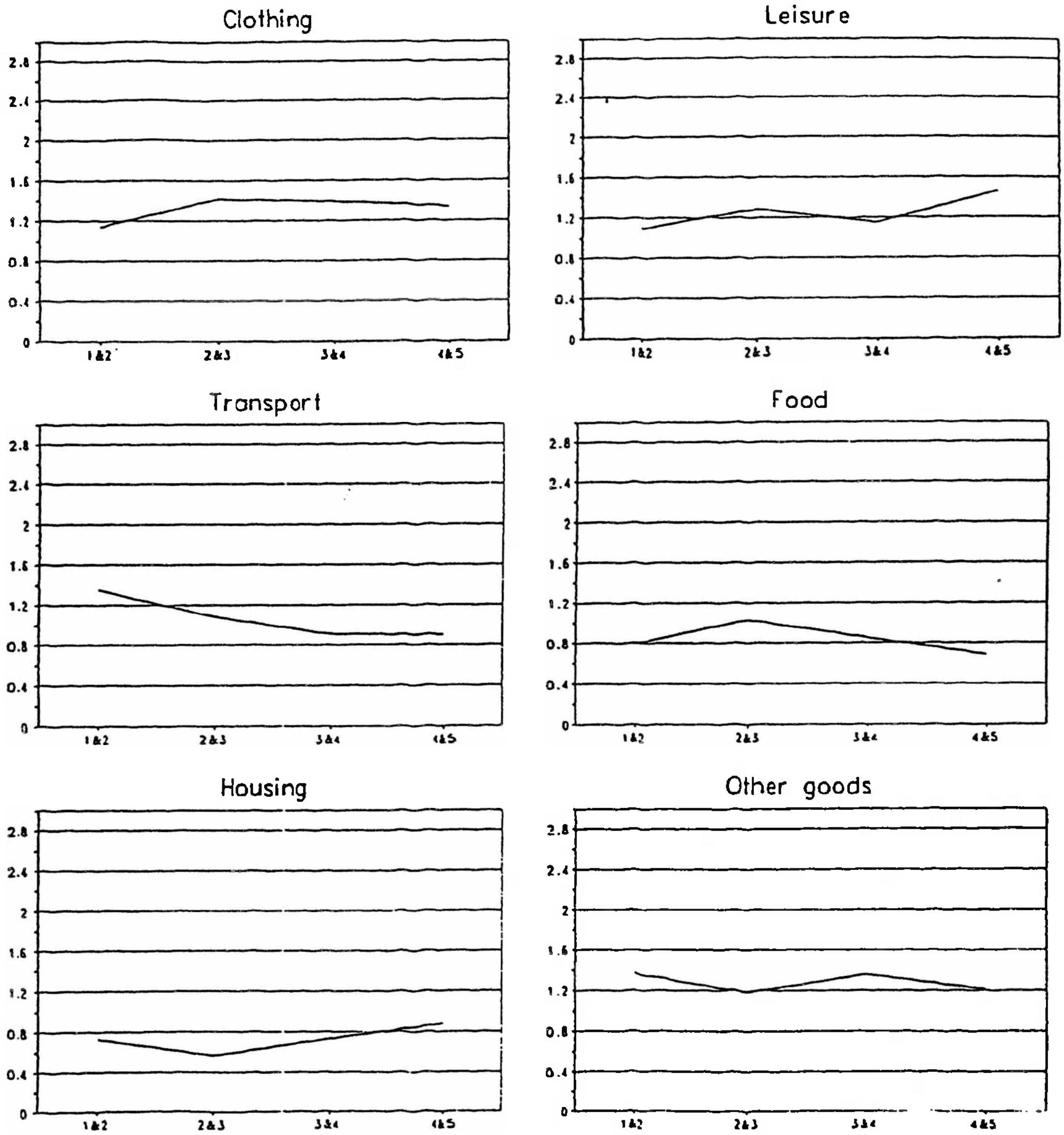

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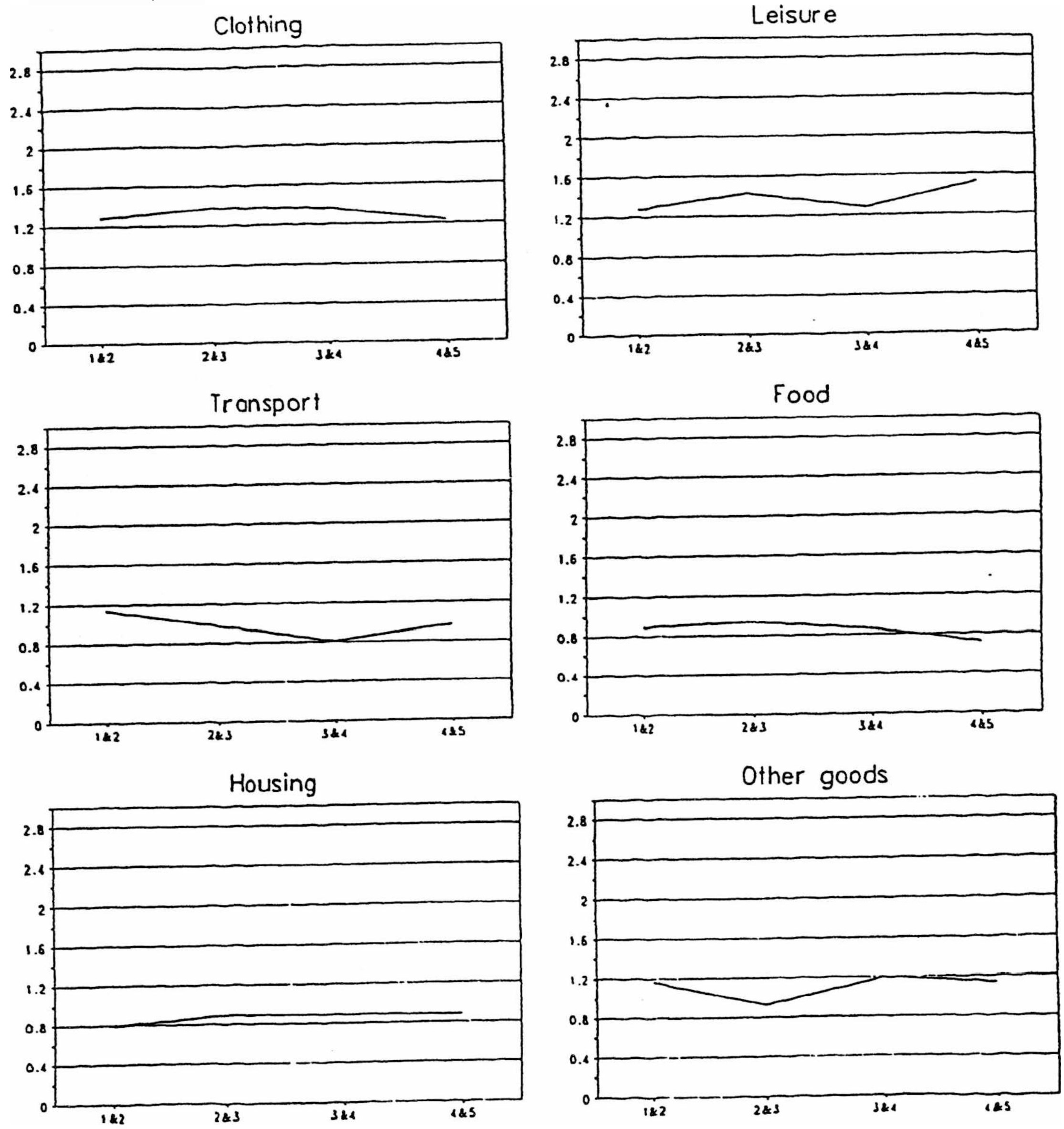

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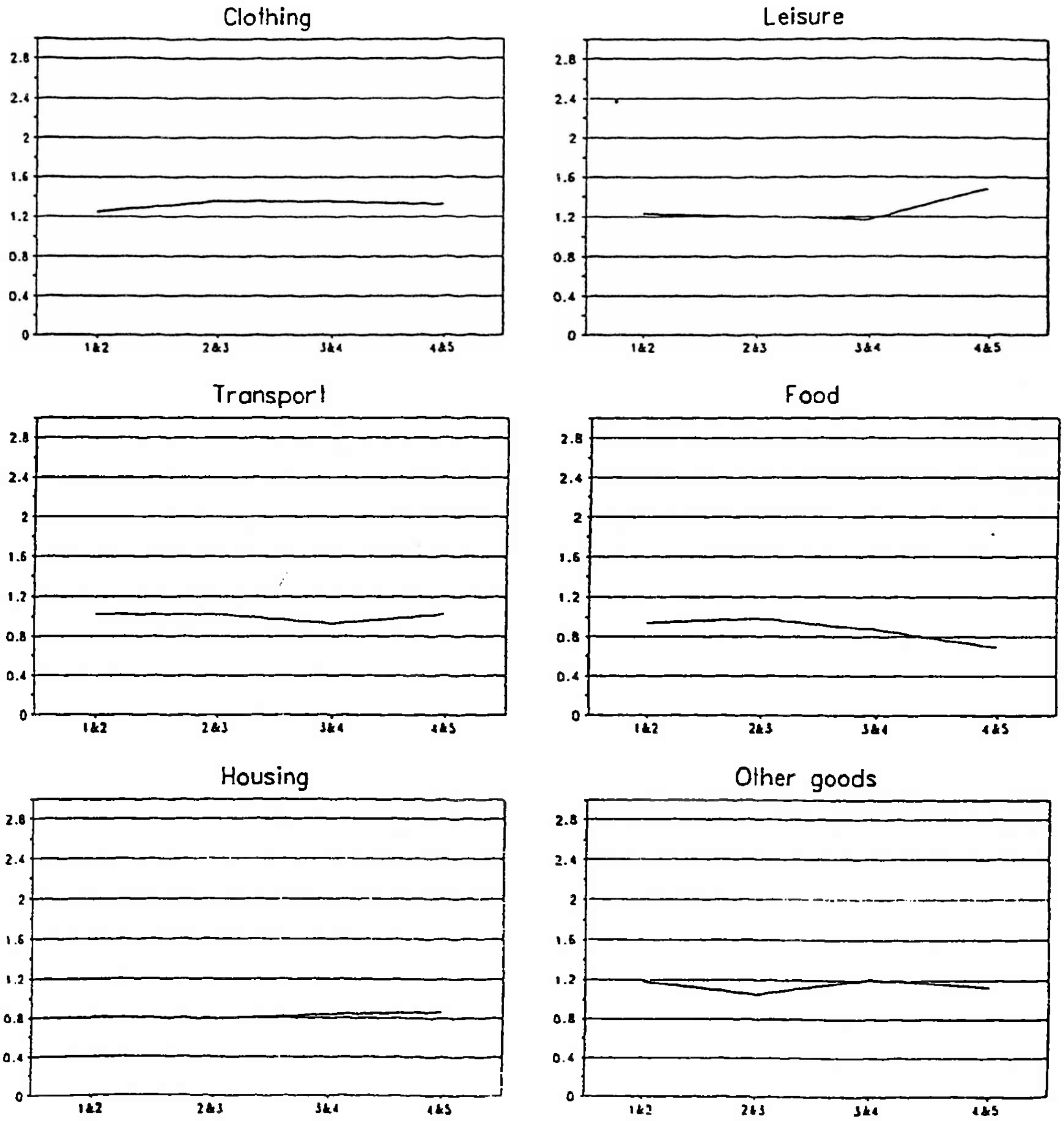

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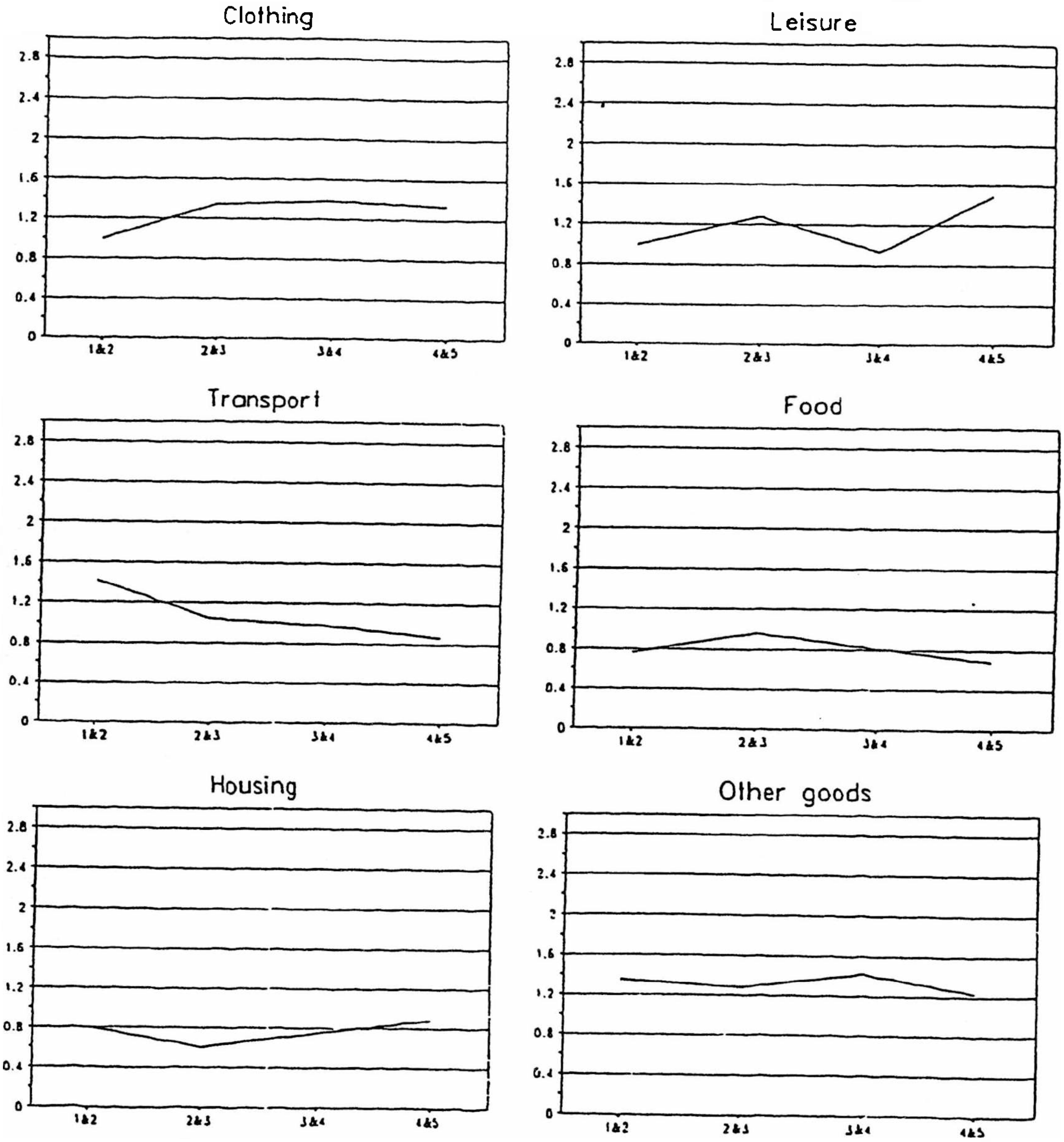

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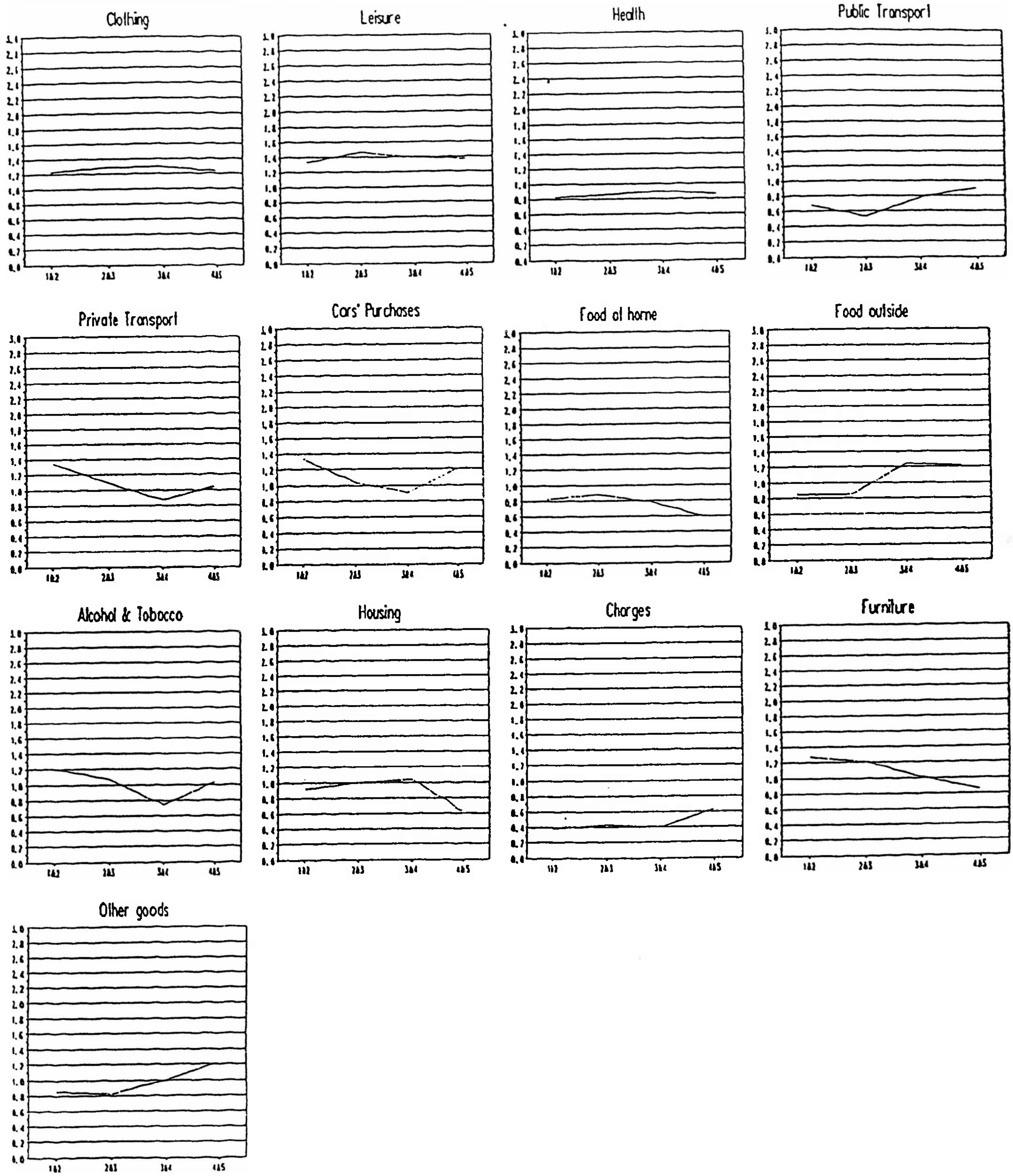

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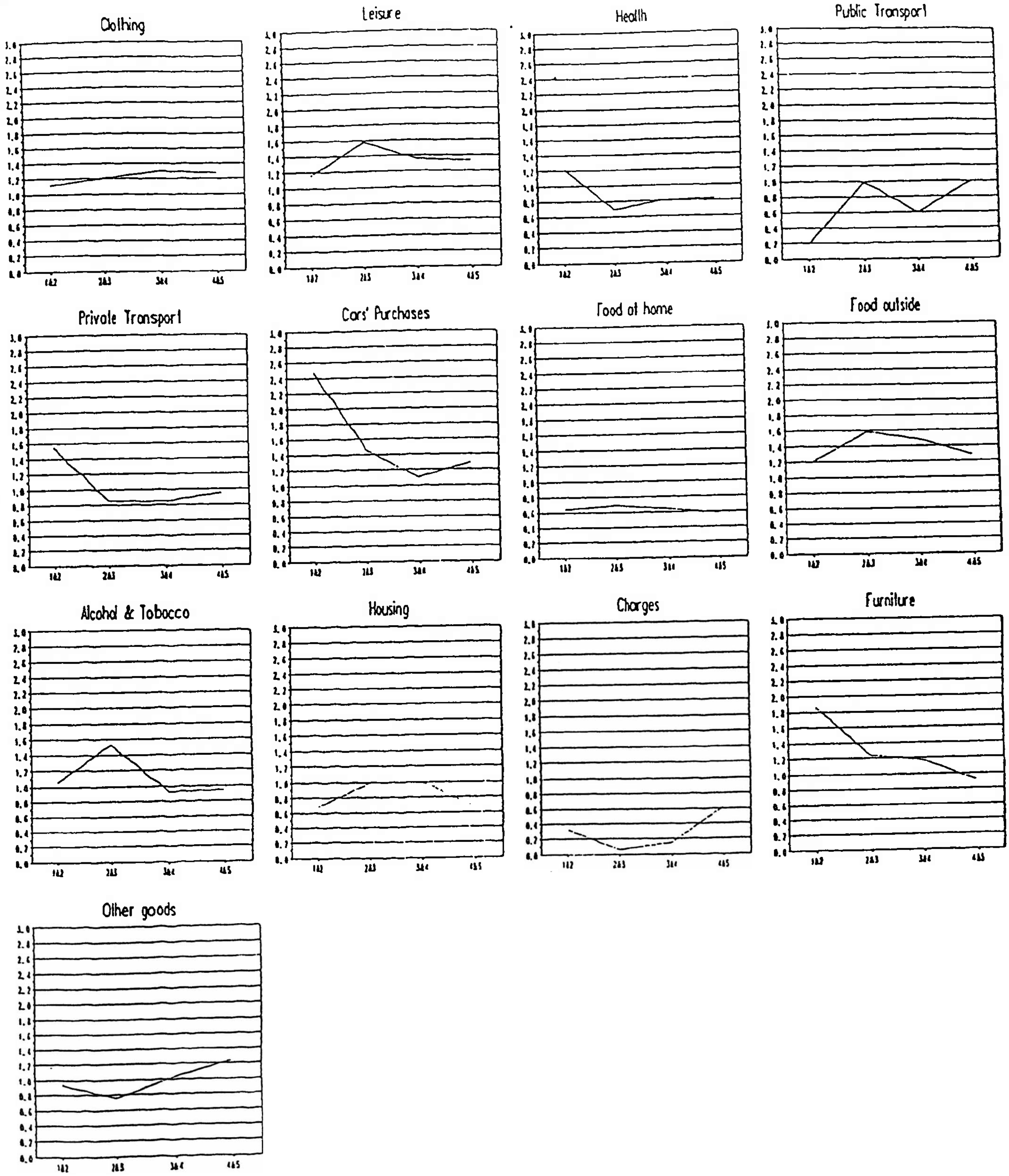

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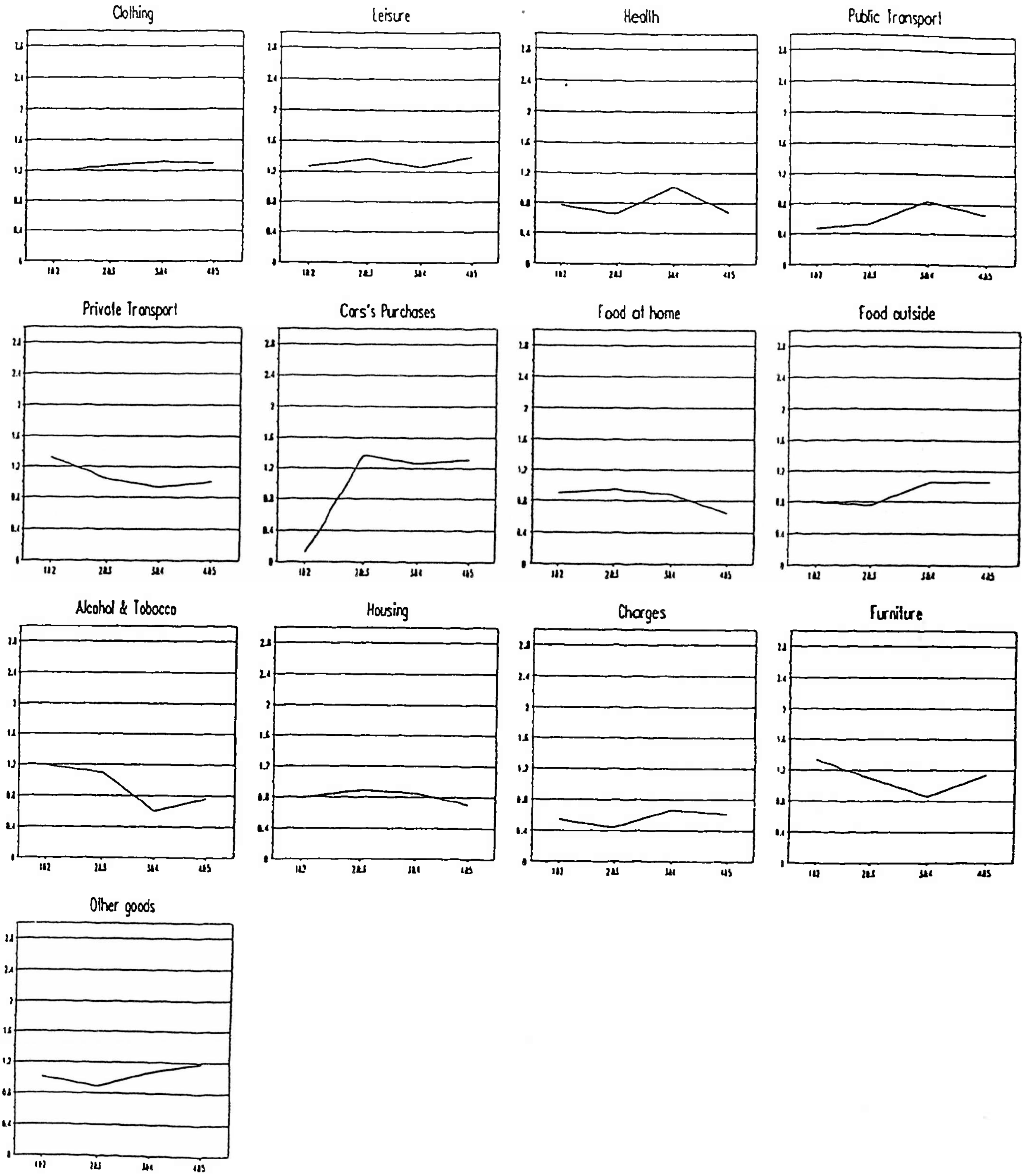

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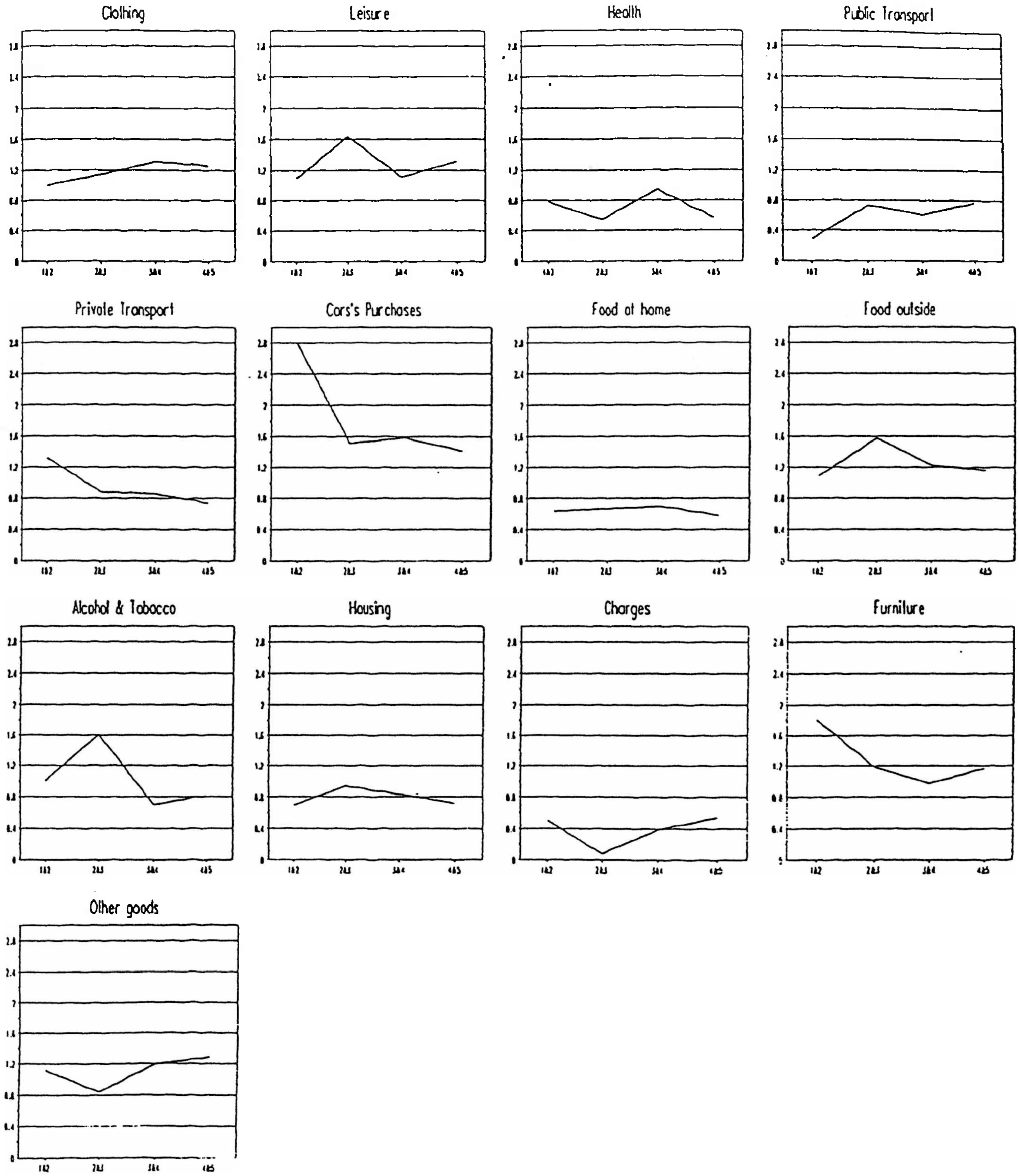

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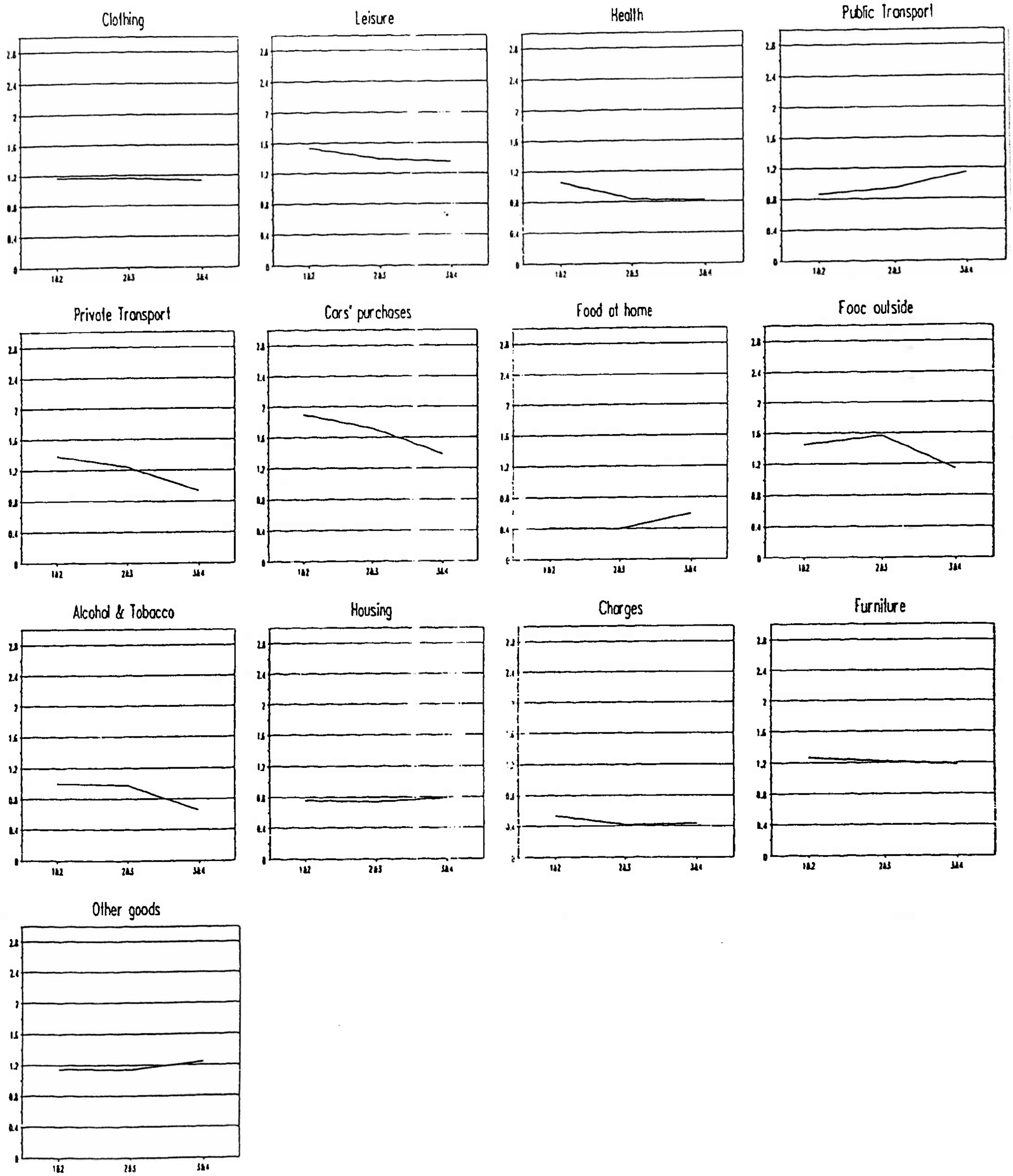

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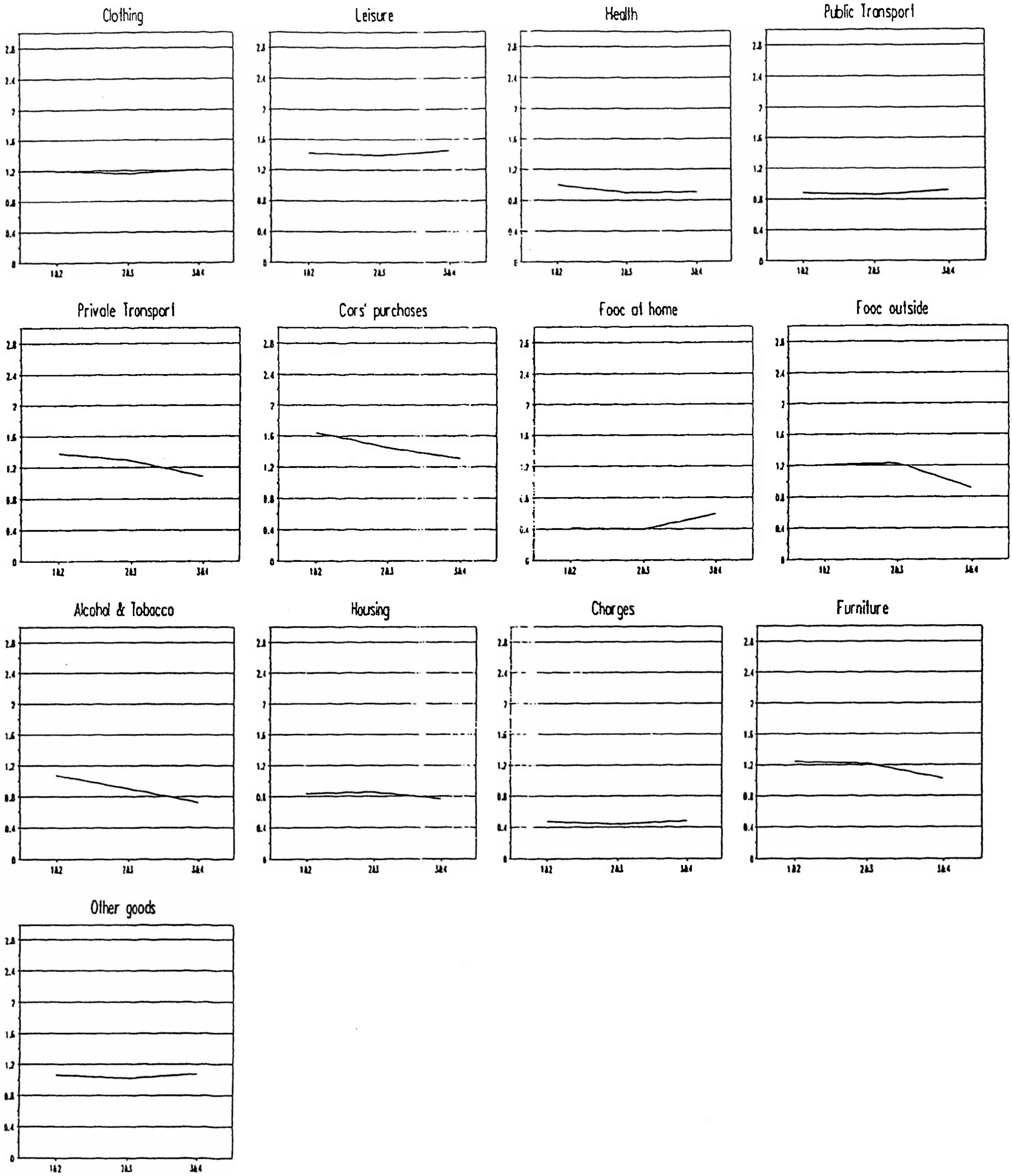

Appendix 5

HAUSMAN TEST FOR WITHIN AND BETWEEN ESTIMATES

The comparison between within and between estimates is performed for each commodity by a Fisher test between the constraints and unconstrained equations (which is equivalent to a χ^2 test on $\left(\hat{b}_w - \hat{b}_B\right) V\left(\hat{b}_w - \hat{b}_b\right)\left(\hat{b}_w - b_B\right)$):

(c) $\quad w_{kh} = a_k + b_k LogY + d_k (LogY)^2 + \delta_h e_k + \varepsilon_{hk}$

(u) $\quad w_{kh} = a_k + b_k LogY + d_k (LogY)^2 + \delta_h e_k + b_k^{'} BLogY + d_k^{'} B(LogY)^2 + BS_h e_k^{'} + \varepsilon_{hk}^{'}$

with BX the between transform of variable X.

Dépôt légal : Mai 1994

ISBN : 2-84104-009-7

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