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Estimating the cost of children in Poland using panel data

(preliminary version)

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Introduction

The object of this paper is to discuss the methodological problems when estimating the cost of children or, in more general case, the equivalence scales. We are using traditional Engel model estimated on cross-section and panel data¹. This tentative gives unexpected results showing very small or even negative cost of children. Several explanations could be given, but none of them are sufficient to explain the observed results. This conclusion is then discussed in a larger perspective of debate started by Deaton, Paxson article (1998) on the paradoxical negative relation between food consumption and the family size (Gardes, Starzec, 2000). We show that a part of paradoxical results can be explained when the change of the family structure over time is taken into account using the panel information.

Section I discusses methodological problems with estimation of the equivalence scales. Section II give classical estimation of child cost using Engel model applied to cross section and panel data. Section III analyzes the biases in the estimation on cross-sectional data, and Section IV evaluates the endogeneity biases on the Polish panel, Section V comments on substitution effect.

I. Methodological problems

The literature on child cost or more generally on the equivalence scale estimation issues is very rich and many authors contributed to the discussion (see for exemple Deaton, Muellbauer 1980, Browning, Lewbel, 1991). Let us resume in this section the main conclusions of this debate.

1.1 The equivalence scale is estimation of the cost necessary to achieve a certain level of well being for a given family structure. However, in order to measure an equivalence scale from the expenditure data a hypothesis identifying the well being is necessary. This kind of well being identifying hypothesis are not testable, so the estimated this way scales are not comparable from one individual to another. The reason is that it is impossible to be sure that the given consumption and income situations have the same utility for two different individuals. For exemple it is impossible to take into account the difference in utility of having a child for two different households.

This subjectivity of « objective » (because estimated on the really observed expenditures) equivalence scales was discussed by Pollack and Wales (1979). Blundell, Lewbel (1991) showed that it was possible to obtain any cost of child from a cross-section data in the frame of a theoretical model compatible both with arbitrary hypothesis and observed behaviour.

1.2 Different methods can be used to estimate the equivalence scales :

¹ The estimations on the Polish Consumption Panel (1987-1990) were possible thanks to collaboration of B. Gorecki, University of Warsaw. This data set is of good statistical quality and was used in a previous research on food consumption giving similar estimation results as those obtained using the Panel Study of Income Dynamics (PSID) (see Gardes et al. 1999).

- they can be based on the real, *objective* observations of households' budgets or on their *subjective* responses (where the asked questions are about their financial satisfaction, or minimum necessary income).
- they can take or not take into account the price substitution effects caused by the presence of children. Indeed, according to the Barten's model children modify the relative prices of goods : one liter of milk is more expensive for the family of three than for the family of one or two children.

Different estimation methods give different results : for exemple the subjective scales are usually much lower than objective ones. The explanation could be that the subjective approach takes better into account the utility of the child in well being or minimum income evaluation.

- 1.3 The choice of the functional specification of the demand functions and of the effects of family structure is crucial : presence or absence of economies of scale, non-linearity, treshold effects, identifying hypothesis to fix the *level* of the scale... (in the last case the most popular solutions are to fix arbitrary size elasticity of one of the expenditures – like zero for adult's clothing, or for alcohol and tobacco, like unit for total clothing expenditure or like satisfaction of elasticity additivity constraint .
- 1.4 Problems with income measures (measurement errors, permanent or current income, life cycle analysis).
- 1.5 Problem of intra-household allocation of income and consumption : the total household's consumption is distributed, for his individualisable part, among different family members and the residual is considered as a collective good . This allocation difficult to estimate, has an strong impact on the on the cost of child and economy of scale estimation. (for exemple : a lower relative price of a collective good will increase its consumption and will imply a substitution in detriment of of the individualisable goods consummes by adults and children modifyinf the cost of child.. To avoid a hypathesis of independence between intra-household allocation and family coposition is necessary.

Some other point have not been yet discussed in the litterature :

- 1.6 Anticipation effects which consist in purchasing good expecting some events – child birth for exemple : moving, changing home, car, clothes, holiday plans, schooling costs... All these anticipated expenditure will change considerably the cost of child.
- 1.7 New subsistence constraints : enlarging family can create new incompressible expenditures (food cloths) implying reduction of compressible expenditures (leisure, food away, durables ...). As it is not possible to distinguish these expenditures from those on children, the cost of child will be lower in this case then if it was computed on the fully income compensated budget.
- 1.8 Endogeneity bias : the parameter estimates based on the individual data are generally biased by endogeneity bias (see Gardes, Langlois, Richaudeau, 1996). This bias needs to be eliminated using panel or pseudo-panel data.

II. The cost of child and equivalence scale estimations.

2.1 The model

For testing child cost estimation we will use well known and frequently used Engel method based on the food budget share changes. The reason is its simplicity but also the fact that in Poland food budget shares are relatively high (see appendix).

Following the Engel law, the changes in food budget share is used as an indicator of household's standard of living. The food share should increase when a child arrives and this change is considered as a decrease in the well being. It is assumed that as far as the food consumption is concerned, households with children have the same behaviour as households without children having lower well being.

The estimation of the cost of children consists in regressing food share on income (or total expenditure) and family size and structure .

As a consumption function we will use the Almost Ideal Demand System proposed by Deaton and Muellbauer (1980). For the household i , the functional form of the budget share on food, w_f is:

$$w_f = \alpha + \beta \ln x + \gamma^* f(n) + \zeta \cdot v + u \quad (1)$$

with w_f the budget share for food, $f(n) = n$ or $\ln(n)$ or another function of the number of children and ζ various socio-economic variables.

Positive parameter b indicates luxuries and negative b 's necessities. This specification of the demand function has two main advantages:

1. It can be derived from a utility function
2. It falls into the class of flexible functional forms, in the way that it is sufficiently richly parameterized to allow independent estimations of the total expenditure elasticity and the matrix of own and cross price elasticity. Furthermore its quadratic form (QUAIDS) (Blundell and Lewbell) allows the relative cost of children to vary with income (Ekert-Jaffe and Trognon, 1994).

The equivalence scale (ES) for a couple with one child with respect to a childless couple is obtained by a formula:

$$ES = \exp(-\gamma^*/\beta).$$

The underlined hypothesis is that food is a necessity and that the budget share for food is growing with the number of children.

So, it is supposed that the method should produce **a positive estimate of the cost of children., based on a positive estimate for γ^* and a negative one for b .**

For estimations on cross sections, the coefficients correspond to the differences in food consumption between small and large families. These estimations can be biased by endogeneity biases if the family size is correlated with control variables which are not included in the regression equation (such as socio-cultural characteristics, household production...). These specific effects can be taken into account only with the panel data. Similarly, the modification of the family demographic structure due to such events as births or departures of children, divorce, marriage, grand parents arrivals etc... with important impact on food consumption, cannot be taken into account in the cross section estimation convention.

With panel data the the equation (1) becomes

$$w_{f,i,t} = \alpha + \beta \ln x_{it} + \gamma^* f(n_{it}) + \zeta \cdot v + m_i + e_{it} \quad (1')$$

with m_i unobserved heterogeneity term.

In order to overcome the estimation problem of m_i and to focus on the child birth effect we can introduce lagged effect of previous year states (lagged income and family characteristic in this first stage of the study), or, better, the « within » operator $X_{it} - X_i$. We build a system of T equations (t=1987,.....,1990), each household forming one observation.

We estimate the simplest functional form model, that usually provides the highest estimated values for the Equivalence Scale (ES) of a couple with one children compared with a couple without children.

2.2 Equivalence scale estimations results

The data used for estimation comes from Polish Panel data (1987-1990) (see appendix for description). The estimated results are presented in table 1.

Table 1
Equivalence scale estimations

	1987 cross section estimates	1990 cross section estimates	1987-1990 « within » panel estimates
β (t-ratio)	- 0.21454 (- 34.62)	- 0.16927 (- 27.39)	- 0.13467 (- 44.41)
γ^* (t-ratio)	0.023706 (9.07)	0.00477 (2.42)	0.00336 (1.78)
Equivalence scale	1.117	1.029	1.025

Both cross sections and within estimates provide a unusually low γ^* term and, consequently, a very low level of equivalence scale². All our attempts, with more sophisticated models produced negative values for both γ 's and equivalence scales.

With the same data, another attempt to calculate the cost of children, using the Rothbarth's method based on adult's clothing expenditures (Ekert- Jaffé and Starzec, 1997) gave the negative or zero cost for child birth.

In the next sections we try to discuss the possible reasons of these somewhat paradoxical results.

² Estimations of the analogous model for France and some other countries give a large range of values from 1.18 up to 1.40 in the case of France (Ekert-Jaffé, 1994).

III. Biases in the estimation on cross-sectional data

Difficulties in finding expected values of child cost come from unexpected estimation results of function (1). In particular very small or negative γ values implies low or negative cost of children. The paradoxical estimate of γ value was found and discussed in Deaton, Paxson (1998). We will try here to check to what extent this result depend on different specification and estimation biases by testing different variants of model and using the panel dimension.

The discussion is based an more general specification of the consumption function. We use, according to the Working-Leser consumption function, the food budget share w_f over the per capita total expenditure, the family size, the proportion of different types of individuals and various socio-economic variables \mathbf{v} :

$$w_f = \alpha + \beta \ln x/n + \gamma \ln n + \sum_{k=1}^{k-1} \eta_k n_k/n + \mathbf{z} \cdot \mathbf{v} + u \quad (2)$$

3.1 Economies of scale

The income variable controls for the level of well-being which is usually taken into account by income or total expenditures divided by an equivalence scale $\mathbf{j}(n)$ depending on the number of adults and children of different ages, and not by the log of per capita income.

$$w_f = \alpha' + \beta' \ln x/\mathbf{j}(n) + \gamma' \ln n + \sum_{k=1}^{k-1} \eta_k' n_k/n + \mathbf{z}' \cdot \mathbf{v} + u' \quad (2')$$

As $\mathbf{j}(n) < n$ for large households, the per capita income x/n underestimate the change in the level of being when n increases, so that it is normal that the food budget share decreases at constant x/n for greater n . Equation (2) can be reformulated according to this classic specification with $\ln x/\mathbf{j}(n)$ instead of $\ln x/n$ and $\ln n$ or $\ln \mathbf{j}(n)$ to measure the effect of family size changes³.

Table 2 shows that the estimations on the Polish *cross section* data are similar to those observed for various countries: $\gamma' = -0.128$ ($\sigma = 0.0027$) (see Deaton, Paxson, 1998). When computing the income per unit of consumption using a Prais-Houthakker equivalence scale, this coefficient increases significantly to -0.094 for $\ln n$ and -0.113 for $\ln \mathbf{j}(n)$. Thus, taking into account the non-linearity of the equivalence scale explains 40% of the negative value of the coefficient of household size on food consumption (γ), but this coefficient remains negative⁴.

³ Note that this specification amounts to add $\ln \mathbf{j}(n)/n$ as an explanatory variable to equation (2) if the level of being is measured by income per unit of consumption. Using $\ln \mathbf{j}(n)$ instead of $\ln n$ to estimate γ implies an artificial change of the family size when a child becomes adult (as it amounts for 0.35 as a child in the equivalence scale, while the other adults amount for 0.7), so that it seems preferable to keep $\ln n$ to measure family size (the estimations with $\ln \mathbf{j}(n)$ give smaller coefficients γ but the same qualitative results).

⁴ Note that for families with no demographic change, the coefficients correspond to the cross-section effects and are different from the coefficients estimated for families having either an increase or a decrease of the adult and children number. However, when restricted to families with no demographic change, γ remains significantly negative

Table 2

Regression coefficients on the logarithm of household size in food share regressions

	γ	γ	γ	γ	γ	γ
Specification	Whole population (3630)	Head aged 21-60 (2879)	No demographic change (2024)	Number of adults changes (1061)	Number of children changes (945)	Complete families:2ad + children (1040)
(2)	-0.136 (.0036)	-0.1517 (.0042)	-0.1070 (.0058)	-0.1659 (.0061)	-0.1701 (.0072)	-0.1086 (.0012)
(2')	-0.0908 (.0035)	-0.1082 (.0026)	-0.0536 (.0059)	-0.1300 (.0061)	-0.1264 (.0073)	-0.0108 (.0127)

Explanatory variables: log of head's age, location quarter dummies, log of food relative price, proportion of adults and children at different ages, dummies for education level.

All specifications use total expenditures as the income variable. No instrumentation of total expenditures is necessary to take into account errors of measurement (see Gardes et al., 1999).

Note that estimating γ on a Prais-Houthakker equivalence scale $\mathbf{j}(n)$ would give rise to an artificial increase of the weighted size when a child becomes an adult, as their weight are respectively 0.35 and 0.7.

3.2 Changes in numbers of adults or children:

In equation (2) we substitute the family size with the numbers of children and adults. Table 3 shows that the coefficient γ remains negative in all estimations for the whole observed population, with a slightly stronger adults' than children' effect.

Table 3

Estimation on the numbers of adults and children

Specification	Whole population (3630)		Head aged 21-60 (2879)	
	γ_a	γ_c	γ_a	γ_c
2b': (2') with number of adults (a) and children (c)	-0.0330 (.00086)	-0.0208 (.00178)	-0.0318 (.00087)	-0.0205 (.00173)

(2b) specification (2) with adults (a) and children (c) separated (in levels: multiply by 3.03 to compare to figures in Table 2):

$$w_t = \alpha + \beta \ln x/n + \gamma_a n_a + \gamma_c n_c + \sum_{k=1}^{k-1} \eta_k n_k/n + \mathbf{z} \cdot \mathbf{v} + u$$

IV. Correction of various biases using panel data

Using panel data can improve the estimation results eliminating several types of biases. Let us show now using a more general specification of equation (2) how the γ and β parameters can change eliminating different sources of biases.

For estimations on cross sections, the coefficients correspond to the differences in food consumption between small and large families. These estimations can be biased by endogeneity biases if the family size is correlated with control variables which are not included in the regression equation (such as socio-cultural characteristics, household production...). These specific effects can be taken into account only with the panel data. Similarly, the modification of the family demographic structure due to such events as births or departures of children, divorce, marriage, grand parents arrivals etc... with important impact on food consumption, cannot be taken into account in the cross section estimation convention.

4.1. Anticipated expenditures before a birth:

Some expenditures can be anticipated before a birth. Such expenditures may concern for instance purchases of durables, cars and houses. In this case, those expenditures which are substitutes for these durables (such as laundry services, collective transport expenditures, rent) will decrease after the birth, and other expenditures may be substituted (it is also possible that the expenditures made before the birth of the child diminishes the available income because of mortgage). Estimation of various expenditures changes before and after a birth are presented in table 4. It appears that overall, total expenditures are smaller one year before and in the year of a birth, and greater one year after (perhaps in Poland because of the income increase due to the endogeneity of work supply to the family composition which might exist during this period.). The food consumption is larger by 8 to 10 per cent when there is a birth while spending on durables are much increased one year before, as expected, and non-basic expenditures much decreased for the three years (perhaps to make possible the increase in basic consumption). As food consumption increases before and after a birth the coefficient of household size must be greater for families with a birth when compared to other families, but an estimation with a variable indicating expected or past births does not change much the effect of family size on food expenditures: γ varies between -0.122 to -0.131 for (2) and -0.085 to -0.098 for (2')⁵.

⁵ For the 519 families over 3630 which have a child over the four years, the total income decreases sharply (four times more than for other households). Thus when considering only cross-section estimations, the positive effect of a birth on the food budget share may be caused by the under-estimated effect on cross-section of this income decrease (as the income elasticity is under-estimated on cross-sections) which is compensated by an over-estimation of γ . But γ remains positive or not significantly different from 0 when estimated on time-series.

Table 4
Effects of a birth on the income coefficient

Expenditures	Income coefficient β	β when Birth in t-1	β when Birth in t	β when Birth in t+1
Food	0.469 (.037)	0.508 (+8%)	0.516 (+10%)	0.507 (+8%)
Housing	-0.055 (.227)	-0.051 (+7%)	-0.043 (+8%)	-0.061 (-10%)
Durables	0.486 (.074)	0.513 (+6%)	0.498 (+2%)	0.498 (+3%)
Alcohol-Tobacco	-1.750 (.930)	-1.750 (0%)	-1.740 (-1%)	-1.754 (+0.2%)
Other expenditures	0.311 (.0044)	0.240 (-23%)	0.219 (-30%)	0.270 (-13%)
Total	0.298	0.296 (-1%)	0.292 (-2%)	0.303 (+2%)

The total expenditures elasticity for commodity i can be computed as $1 + \beta/w_i$

4.2 Estimation on panel dimension:

When estimated on first differences between two periods, *the coefficient g is smaller than for cross-section estimates*: there exists a small positive endogeneity bias (cross-section parameter greater than the time-series estimate) which may indicate that food consumption decreases immediately when an adult arrives in the household and adjusts by increasing slightly in the long term.

But when considering complete families composed of two adults and a positive number of children in the first period (table 4), γ is not significantly different from zero. More precisely, γ is not different from zero for years 1988 and 89 and significantly positive for 1987 and 1990, two years when income constraints were particularly serious imposing important binding. When considering the population of households which may have children (as defined by an estimated probability greater or less than 0.5 or 0.75, see table 6), we obtain similar results. This indicates the presence of a specific effect for such complete families compared to households without children. This specific effect corresponds to a difference existing for these two types of families when confronted to market conditions, either due to the endogeneity of household income (in Poland, adults with children tend to increase more their participation to the labor market when the family size increases, to be able to satisfy new needs) or to some specific resources (taxes, allocations...) or through the existence of constraints for families with children. Such particularities may be related to the family size and should in this case induce an endogeneity bias on coefficient γ . From an economic point of view, these particularities can be considered as the dual of price differentiations between households (difference in non-monetary resources corresponding for instance to different complete prices, specific constraint corresponding to implicit prices) which impart prices effects on food consumption (the positive γ for nuclear families thus indicates that they are confronted to lower complete food prices, these complete prices including monetary, non monetary and implicit prices differences between households).

Thus, it is possible that families having the potential to increase or decrease during the life cycle (especially by a change in the number of children), have special conditions of choices (other non monetary resources, constraints) implying different complete and virtual prices which give rise to a different γ than the one computed between different families on cross-sections. These special conditions can change their behavior on the job market, their savings and their purchases of durable (both may be anticipated before the arrival of children). So the negative γ paradox does not apply to the normal evolution of families through the life cycle and depends on the comparison of different types of families which cannot change one into another through time, and are thus as if situated on different planets.

This result is confirmed when looking at the effect on food consumption of the arrival or departure of adults and children over three four years. A birth seems to increase slightly food expenditure, which is contrary to negative γ paradox can be considered as the normal effect for this type of increase of the family size. The departure of a child implies an increase of food expenditures as well as the departure of an adult: perhaps because public goods give rise to smaller economies of scale, so that food expenditures are substituted in quantity or quality to other expenditures⁶. The arrival of an adult has a symmetrical effect: the food budget share decreases by the same amount as for the departure of adults. Thus, the γ negative value is verified for all situations *except for births*, which is the more important event changing the family structure during the life-cycle.

⁶ The decrease of food consumption when the number of adults increases may also be due to a change in the quality of food purchased: bachelors may eat better food because they purchase it personally and have less budget constraints.

Table 5
Estimation in first differences for families with and without children

Parameter estimates	Families with at least one child in 1987		Families with no children in 1987		Whole population	
	Log(size)	Equivalence scale	Log(size)	Equivalence scale	Log(size)	Equivalence scale
β	-0.2464 (.0030)	-0.2531 (.0030)	-0.2640 (.0040)	-0.2641 (.0040)	-0.2533 (.0024)	-0.2573 (.0024)
γ	-0.1515 (.0051)	-0.1869 (.0055)	-0.1088 (.0067)	-0.1417 (.0085)	-0.1344 (.0041)	-0.1724 (.0047)
β	-0.2512 (.0030)	-0.2526 (.0030)	-0.2626 (.0040)	-0.2631 (.0040)	-0.2531 (.0024)	-0.2562 (.0024)
γ child arrives	0.0051 (.0214)	0.0110 (.0363)	-0.0043 (.0130)	-0.0097 (.0291)	-0.0034 (.0107)	-0.0048 (.0222)
γ child leaves	-0.0303 (.0106)	-0.0698 (.0207)	-0.0037 (.0532)	0.0051 (.1145)	-0.0298 (.0105)	-0.0757 (.0207)
γ adult arrives	-0.2249 (.0101)	-0.2122 (.0094)	-0.1547 (.0113)	-0.1840 (.0133)	-0.1883 (.0076)	-0.2015 (.0078)
γ adult leaves	-0.2121 (.0077)	-0.2006 (.0071)	-0.0971 (.0095)	-0.1221 (.0116)	-0.1588 (.0060)	-0.1578 (.0062)
N	2042	2042	1588	1588	3630	3630

Equation: $dw_i = \alpha' + \beta' \ln x/j(n) + \sum_i \gamma_i \ln(1+n_i/n) + \sum_{k=1}^{k-1} \eta_k' d(n_k/n) + z' \cdot dv + u'$ with $n_i = +1$ or -1

for the arrival or leaving of a member of the family and α' representing a fixed effect for the period (16 quarters). Estimation by Seemingly Unrelated Regressions on differences between two years: 1987-88, 1988-89 and 1989-90. Similar results when restricting to families the head of which is between 20 and 55 years old.

Table 6
Estimation in first differences according to
the probability to have children

	Families with probability greater than 0.75	Families with probability greater than 0.5 and less than 0.75	Families with probability less than 0.5
Parameter estimates	Log(size)	Log(size)	Log(size)
β	-0.2630 (.0037)	-0.2706 (.0050)	-0.2516 (.0043)
γ	-0.1518 (.0061)	-0.1282 (.0099)	-0.1072 (.0079)
β	-0.2642 (.0036)	-0.2437 (.0047)	-0.2493 (.0043)
γ child arrives	-0.0172 (.0226)	-0.0247 (.0210)	-0.0137 (.0253)
γ child leaves	-0.0451 (.0173)	-0.0297 (.0159)	-0.0052 (.0238)
γ adult arrives	-0.2168 (.0123)	-0.1956 (.0133)	-0.1490 (.0138)
γ adult leaves	-0.1965 (.0091)	-0.1736 (.0115)	-0.1040 (.0110)
N	1558	930	1142

Probabilities computed by probit estimations on age, total expenditure per consumption unit (cu), location, education and quarterly dummies.

V. Substitution Effect

Usually the income and substitution effects in food and non food consumption (including public goods) are considered by a family of a size n (Deaton, Paxson, 1998). Each commodity i is subject to economies of scale measured by the elasticity of the equivalence scale $\phi(n)$ on the size :

$$\sigma_i = 1 - (\partial \ln \phi_i(n) / \partial \ln n)$$

The demand functions for food per unit of consumption are written as:

$$q_f \phi_f(n) = g_f(x/n, p_f \phi_f(n)/n, p_h \phi_h(n)/n)$$

with per capita income x/n and prices p_f, p_h , for food and nonfood consumption. The differentiation of this zero degree homogenous function, with respect to n leads to condition (3) for an increase of per capita food consumption with n at constant per capita income:

$$\partial(q_f/n)/\partial n |_{x/n \text{ constant}} \Leftrightarrow \sigma_h(\epsilon_{fx} + \epsilon_{ff}) - \sigma_f(1 + \epsilon_{ff}) > 0 \quad (3)$$

where ϵ_{ff} and ϵ_{fx} the uncompensated own price and income elasticities for food. In terms of compensated price elasticities ϵ_{ff} we obtain:

$$\partial w_f \partial n |_{x/n \text{ constant}} > 0 \Leftrightarrow \epsilon_{ff} (1 - \sigma_f / \sigma_h) > -\epsilon_{fx} (1 - w_f) + \sigma_f / \sigma_h ((1 - w_f) \epsilon_{fx}) \quad (4)$$

which substitutes for equation (2)⁷ obtained when assuming that σ_f / σ_h is small because economies of scale are supposed to be much larger for public goods than for food consumption. We estimate an equivalence scale d^f on the Polish consumption panel to compute $\sigma_i = 1 - d_i$: d_f is estimated around 0.6, d_h around 0.9 so that σ_f / σ_h is much greater than 1⁸.

The compensated price elasticity for food ϵ_{ff} estimated by QAIDS is between -0.3 and -0.5. The income elasticity ϵ_{fx} can be estimated on cross section or on panel data. The two elasticities are very different $\epsilon_{fx}(cs) = 0.5$, $\epsilon_{fx}(ts) = 0.9$, because of an important endogeneity bias due to the correlation between the specific effect (the permanent component of unexplained heterogeneity) and the relative income position of the household (see Gardes et al. 1999). Thus 0.9 is the unbiased estimate. The average budget share of food is 0.437 for the four years. Finally, for cross-section estimates and $\sigma_f / \sigma_h = 3$, the right hand side of equation (4) divided by $|1 - \sigma_f / \sigma_h|$ to be compared with $|\epsilon_{ff}|$ amounts to 1.03 while for time-series estimates it is around 0.66⁹ (i.e w_f increases with family size if $|\epsilon_{ff}| > 1.03$ or 0.60).

The estimations of the price elasticity below 0.66 indicates that γ may be negative. In fact, the price elasticity depends, not only on monetary price changes, but on the changes of the complete prices. It can be supposed that this price increases with income, as the time price of food at home increases with the household's social status. This increase is empirically proved by the dominance of the time-series income elasticity of food consumption over the cross-section¹⁰. Thus, as soon as the food price elasticity decreases in absolute value with income (as it is often supposed that it varies in the same direction as its income elasticity), the generalized price elasticity is lower in absolute value than the monetary price elasticity, so that it is possible that it is below the critical value of 0.67 that makes possible a decline of food consumption when the household size increases¹¹.

Conclusion

The use of panel data gives theoretically more possibilities to eliminate various biases in cost of child or equivalence scale estimations. However the unexpected, very low or even negative value

⁷ Note a small error in equation (2) which needs a budget share w_f before the last income elasticity ϵ_{fx} .

⁸ By another method, using a linear equivalence scale estimated with usual identification hypotheses as $\phi_0(n) = 1 + 0.7(n_a - 1) + 0.35 n_c$ (with n_a and n_c the number of adults and children respectively), we obtain $d_f = 0.66$, $d_h = 0.87$ and $\sigma_f / \sigma_h = 2.6$.

⁹ For cross-section estimates of ϵ_{ff} (respectively for time-series ones), the lower limit for $|\epsilon_{ff}|$ decreases from 1.78 to 0.91 (respectively from 0.81 to 0.63) when σ_f / σ_h increases from 1 to 5.

¹⁰ If the complete price of food increases with relative income on cross-sections, food consumption decreases by a substitution effect over the income distribution, compared to its variation through time for a similar income increase (see Gardes, 1999).

¹¹ If so, the Frisch income flexibility (which is, under separability conditions, related to the ratio of the income elasticity over the compensated price elasticity) would be greater than one, which is conform to the Frisch conjecture. Thus, examining the DP condition for γ is a way to reveal the upper limit of the price elasticity and the lower limit of the Frisch income flexibility.

of this cost due to the negative relationship between food consumption and family size obliged us to reconsider some « commonly approved » relationships between income, consumption, family size and structure. Polish individual time-series allows to estimate the effect of family size, and shows that a small endogeneity bias exists between the cross-section and the time-series estimates, but with still negative relation between income and food consumption. This relation seems to be closely related to the different number of adults between families and disappears when considering *complete families* which contain or may contain children. Thus, this negative relation does not exist or is very weak when considering the « normal » changes of the family structure due to births or to the departure of children.

Estimation on panel data allows us to estimate correctly the parameters of the equation relating substitution and income effects on the elasticity of food consumption according to the family size. These two effects imply a negative effect, but small changes in the elasticities for sub-populations may give rise to the small positive relation which has been obtained when considering only complete families.

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Appendix

The Polish panel (1987-1990)

Household budget surveys have been conducted in Poland for many years. In the analyzed period, the annual total sample size was about 30 thousand households, which represent approximately 0.3% of all households in Poland. The data were collected by a rotation method on a quarterly basis. The master sample consists of households and persons living in randomly selected dwellings. To generate it, a two stage, and in the second stage, two phase sampling procedure was used. The full description of the master sample generating procedure is given by Kordos et al. (1991).

Master samples for each year contain data from four different sub-samples. Two sub-samples started to be surveyed in 1986 and ended the four years survey period in 1989. They were replaced by new sub-samples in 1990. Another two sub-samples of the same size were started in 1987 and followed through 1990.

Over this four year period on every annual sub-sample it is possible to identify households participating in the surveys during all four years. The checked and tested number of households is about 3707. The available information is as detailed as for the cross-sectional surveys: all typical socio-economic characteristics of households and individuals are present, as well as details on income and expenditures.

Table A1 presents descriptive information on the Polish data. The period 1987-1990 covered by the Polish panel is unusual even in Polish economic history. It represent the shift from a centrally planned, rationed economy (1987) to a relatively unconstrained fully liberal market economy (1990). GDP grew by 4.1% between 1987 and 1988, but fell by .2% between 1988 and 1989 and by 11.6% between 1989 and 1990. Price increases across these pairs of years were 60.2%, 251.1% and 585.7%, respectively. Thus, the transitory years 1988 and 1989 produced a period of a very high inflation and a mixture of free-market, shadow and administrated economy.

Table A1
Average budget shares

Budget shares	1987	1988	1989	1990
Food	0,432	0,400	0,435	0,483
Alcohol and tobacco	0,041	0,037	0,031	0,029
Clothes	0,129	0,141	0,145	0,096
Dwelling	0,110	0,112	0,125	0,097
Energy	0,033	0,039	0,022	0,039
Health and hygiene	0,026	0,024	0,020	0,026
Transp, and communic	0,050	0,062	0,063	0,066
Culture and entertain.	0,066	0,078	0,075	0,080
Other	0,028	0,025	0,020	0,031
Financial operations	0,087	0,081	0,057	0,050