The value of home production and returns to scale in families with children

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The aim of the analysis

- The estimation of Cobb-Douglas production function's parameters

- The Estimation of the average value of home production in selected families.

- The comparison of direct utility, which the spouses gain during the time of housework.

Home production

The consumption of the results of household production increases the utility of individuals ⟶ increased quality of life of household members.

There are justifiable doubts as to whether the standard measures of economic activity and welfare reflect the welfare of individuals in an adequate manner (Kuznets 1934; Juster 1970; Eisner 1988; Lützel 1989).

Theoretical foundation: a model developed by Gronau (1980) in the version supplemented by the phenomenon of the joint production (Graham and Green, 1984)

The data

- Micro-data from Polish time use survey in the year 2013 (28,209 households) (GUS, 2015).

- 36 kinds of activities in 4 main categories (R, H, L, S):

R - market work,

H - Household work, productive activities according to third person criterion (Goldschmidt-Clermont 1993; Hawrylyshyn 1977; Reid 1934),

L – leisure,

S - self-care.

The data

- Structure Of Wages And Salaries By Occupations (GUS)

  Three kinds of variables:
  a) using earnings declared by the TUS respondents themselves,

  b) wages assigned on the basis of the profession declared,

  c) **a variable that links both of these, with priority over the wages declared by the TUS respondents.**

- Household Budget Surveys in 2013 **(**GUS, 2014)

  Average monthly expenditures per 1 person in households for consumer goods and services, rounded to full euros: 210.

Household production function

$$Z = A(M_m^a H_m)^{\gamma_m} (M_w^b H_w)^{\gamma_w} X_z^{\beta}$$

where:

A – a general scale parameter,

M_i – a measure of the productivity (or human capital) of the man and woman, *i*= *m*, *w*,

H – domestic production time,

$\gamma_m, \gamma_w, \beta$ – returns-to-scale parameters

a, b – The positive parameters can be less than, equal to, or greater than 1.0 depending upon whether the individual is less productive, equally productive, or more productive at home than in market work,

X_z – average daily expenditures of household for consumption goods.

Joint production - Graham and Green (1984)

$$g_i(H_i) = H_i\left[1 - \frac{1}{1+\delta_i}\left(\frac{H_i}{T}\right)^{\delta_i}\right], \qquad i = m, w$$

where:

g_i – function describing the scale of joint production (the part of domestic worktime which turns into leisure),

T – total time of people,

δ_i – the parameters describing the scale of joint production of each of the spouses,

m – husband,

w – wife.

Utility maximization

The first-order conditions can be reduced to three:

$$\beta A (M_m^a H_m)^{\gamma_m} (M_w^b H_w)^{\gamma_w} X_z^{\beta-1} = 1$$

$$\gamma_m A M_m^{a\gamma_m} H_m^{\gamma_m - 1} (M_w^b H_w)^{\gamma_w} X_z^{\beta} = W_m (\frac{H_m}{T})^{\delta_m}$$

$$\gamma_w A (M_m^a H)^{\gamma_m} M_w^{b\gamma_w} H_w^{\gamma_w - 1} X_z^{\beta} = W_w (\frac{H_w}{T})^{\delta_w}$$

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Utility maximization

Solving the system (1-3) simultaneously for H_k and expressing the solution in log-linear form gives:

$$lnH_w$$
$$= c + \frac{1}{q} lnA + \frac{\frac{\gamma_m}{1+\delta_m} + \beta - 1}{q} lnW_w - \frac{\frac{\gamma_m}{1+\delta_m}}{q} lnW_m$$
$$+ \frac{b\gamma_w}{q} lnM_w + \frac{a\gamma_m}{q} lnM_m$$

And estimated with cross-sectional data:

$$lnH_w$$
$$= c + k \, ln \, A + l \, lnW_w + n \, lnW_m + o \, lnM_w + p \, lnM_m$$

Parameters of the regression function

H_w – time spent by women for housework in minutes per day
A1= number of children aged 0-2,
A2= number of children aged 3-6,
A3= number of children aged 7-12,
A4= number of children aged 13-18,
A5= number of persons in a family (spouses plus children),
A6= possession of dishwasher (0, 1),
A7= car ownership (0, 1),
Ww= market wage of woman (wife),
Wm= market wage of man (husband),
Mw_1= age of woman,
Mw_2= number of education years of woman,
Mm_2= number of education years of man.

Estimation of the function parameters

$$A = \prod_{i=1}^{7} A_i^{\alpha_i}, for \sum_{i=1}^{7} \alpha_i = 1$$

k = the sum of parameters describing the variables A1 to A7

l = W_w (wage of wife)

n = W_m (wage of husband)

o = the sum of parameters M_{w1} (wife's age) i M_{w2} (wife's years of education)

p = M_{m2} (husband's years of education)

Cases	γ_m	γ_w	β	a	b	δ_m	δ_w
1	$\dfrac{-m}{k}$	$\dfrac{1+l}{-k}$	$\dfrac{k+l+m}{k}$	$\dfrac{-o}{m}$	$\dfrac{-n}{1+l}$	0	0
2	$\dfrac{o}{k}$	$\dfrac{n}{k}$	$\dfrac{k+l+m}{k}$	1	1	$\dfrac{o+m}{-m}$	$\dfrac{1+n+l}{-l}$
3A	$\dfrac{-m}{k}$	$\dfrac{-l}{k}$	$\dfrac{k+l+m}{k}$	$\dfrac{-o}{m}$	$\dfrac{-n}{l}$	0	$\dfrac{-1}{l}$
3B	$\dfrac{1-m}{k}$	$\dfrac{1+l}{-k}$	$\dfrac{k+l+m}{k}$	$\dfrac{o}{1-m}$	$\dfrac{-n}{1+l}$	$\dfrac{-1}{m}$	0
3C	$\dfrac{o}{k}$	$\dfrac{l+m+o}{-k}$	$\dfrac{k+l+m}{k}$	1	$\dfrac{-n}{l+m+o}$	$\dfrac{o+m}{-m}$	$\dfrac{m+o-1}{l}$
3D	$\dfrac{l+m+n}{-k}$	$\dfrac{n}{k}$	$\dfrac{k+l+m}{k}$	$\dfrac{-o}{k+l+m}$	1	$\dfrac{l+n}{m}$	$\dfrac{1+n+l}{-l}$
3E	$\dfrac{-o(l+m)}{k(o+n)}$	$\dfrac{-n(l+m)}{k(o+n)}$	$\dfrac{k+l+m}{k}$	$-\dfrac{(o+n)}{l+m}$	$-\dfrac{(o+n)}{l+m}$	$\dfrac{ol-nm}{m(o+n)}$	$\dfrac{n(m-1)-o(l+1))}{l(o+n)}$
3F	$\dfrac{m(1-l-m)}{k(m+l)}$	$\dfrac{m+l(m+l)}{-k(m+l)}$	$\dfrac{k+l+m}{k}$	$\dfrac{o(m+l)}{n(1-l-m)}$	$\dfrac{-n(m=l)}{m+l(m+l)}$	$\dfrac{-1}{m+l}$	$\dfrac{-1}{m+l}$
4	$\dfrac{mo}{k(ol-nm)}$	$\dfrac{nm}{k(ol-nm}$	$\dfrac{k+l+m}{k}$	$\dfrac{ol-nm}{m}$	$\dfrac{ol-nm}{m}$	$\dfrac{o(l+1-nm)}{nm-ol}$	$\dfrac{o(l+1-nm)}{nm-ol}$

Special cases of the problem

1 – No Jointness ($\delta_m = \delta_w = 0$)

2 – Neutrality of human capital (a = b = 1). No difference in market and home productivity)

3 – Constant Returns to Scale

3A – No jointness of husband's time ($\delta_m = 0$)

3B – No jointness of wife's time ($\delta_w = 0$)

3C – Neutrality of husband's time (a = 1)

3D – Neutrality of wife's time (b = 1)

3E – Equality of relative marginal productivities at home and in the market for husband and wife (a = b)

3F – Equality of jointnes ($\delta_m = \delta_w$)

4 – simultaneous fulfillment of the conditions 3E and 3F

	γ_m	γ_w	β	a	b	δ_m	δ_w
1	-0.040	-0.032	0.844	4.199	-0.371	0	0
2	-0.166	0.357	0.844	1	1	3.199	6.739
3A	-0.040	0.196	0.844	4.199	1.822	0	5.917
3B	1.119	-0.963	0.844	-0.149	-0.371	-29.232	0
3C	-0.166	0.323	0.844	1	1.106	-1.144	6.564
3D	-0.201	0.357	0.844	0.197	1	4.063	6.739
3E	-0.136	0.293	0.844	1.219	1.219	0.066	0.173
3F	-0.334	0.490	0.844	0.499	0.729	7.418	7.418
4	-0.414	0.888	0.844	0.402	0.402	9.454	9.454

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Monetary valuation

	Value of production in euro	Value added in euro
1	87	-156
2	1301	1058
3A	964	722
3B	394	151
3C	1063	821
3D	1516	1273
3E	1039	797
3F	1210	968
4	8361	8118

Average time per day:

W: 359.66 min;

M: 166.04 min;

Market goods per day:

X: 7 eur/person

Summary

- In the cases 3A-3F (with assumption of constant returns to scale) the highest value added appeared for the neutral human capital of wife (3D), and the lowest when there was an absence of joint production in the case of woman (3B)

- The results indicate the possibility of increasing returns to scale in Polish households:

$$\gamma_m + \gamma_w + \beta > 1$$

Summary

- The imposition of the lack of joined production in the first case leads to the negative values of the γ_m and γ_w parameters. In addition, the erroneous assumption about jointness in this case is also evidenced by the negative value added

- In all the cases that allow for the freedom of parameters δ_i, in the case of women they are positive and exceed the same estimates for men

- The results indicate that it can be presumed that the scale of jointness is gender-related

Summary

- The (unreliable) results of estimation in the case 4 may indicate the differences in production technology between men and women

- After excluding extreme estimates, the average monthly value added in the production of Polish households was 873 eur