The Living Arrangements of Elderly Widows

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Preliminary

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More elderly widows lived alone in 1990 than in 1970

	1970	1990	Change
Alone	52.1	64.2	12.0
Children, with	31.9	21.0	-10.9
Others, with	10.6	10.3	-0.3
Institution, in	5.3	4.5	-0.9

Source: U.S. Bureau of the Census (IPUMs data files, 1970, 1990)

Income facts

- **Big gains in income for elderly widows (Hurd, 1990)**

	1967	1984
Poverty rate elderly widows	35.1	19.1
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Summarizing

- Average income (Household) grew: 54.2%
- Average income (Children household) grew: 47.9%
- Average income (Widows) grew: 110.6%

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2. **Then we substitute the incomes with those of 1990, compute the new equilibrium and report the implied changes in living arrangements decomposing the effects of the various types of income changes.**

3. **To explore richer models that take into account other characteristics of individuals. Please wait until after first model to consider marital status, age, sex and number of children.**

Other work

Cross-section (1970)

• Income: Borsch-Supan et al. (1992), and Schwartz, Danziger, and Smolensky (1984) (income not important). Kotlikoff and Morris (1990) (not too important). Hill and Hill (1974), McElroy (1985) Whittington and Peters (1996) income does matter for children to leave home.

• Other variables. Wolf and Soldo (1988) Dunn and Phillips (1998) look at other variables.

Over time using census

• Michael et al. (1980), Dora (1990) McGarry and Schoeni (2001) claim that social security did a lot.

Data

- 1970: we choose elderly widows 65–82, living alone and living with children. Widows are about half of all females, and 2/3 of female singles.

- 1990: we choose elderly widows 67–84, living alone and living with children (actually with a child since 88.3% live with only one) (to account for the increase in life expectancy: we count backwards)

Percentage of widows living	1970	1990
Alone	62.0	75.3
Children, with	38.0	24.7

- We have to look at the joint distribution of living arrangements and incomes. However,

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Data Problem: We cannot match mothers with children if they live independently using census data.

Good Luck: AHEAD 1993 matches mothers and children

- Crucial identifying assumption: the joint distribution of incomes of mothers and children is the same in the seventies as in the nineties. We then

- 1. From AHEAD compute the joint distribution of incomes of mothers and children. Sort them into four equal size groups. Obtain

	Mother				
Child	Lowest	Low	High	Highest	Marginal
Lowest	C_{11}	C_{12}	C_{13}	C_{14}	25.
Low	C_{21}	C_{22}	C_{23}	C_{24}	25.
High	C_{31}	C_{32}	C_{33}	C_{34}	25.
Highest	C_{41}	C_{42}	C_{43}	C_{44}	25.
Marginal	25.	25.	25.	25.	100.

$C_{i,j}$ % of mothers of income type j with children of income type i.

Matching Data II

- 2. Go to the 1970 and 1990 select a subsample of children living alone with the same size that the widows living alone.

- 3. Also in the Census select the the pairs of mothers and children that do live together.

- 4. Sort all the children and all the widows into four income groups of equal size (a fourth each). Obtain the fractions of those that live together and denote them $T_{i,j}$.

5. Use the AHEAD $C_{i,j}$ (we assume them constant) to obain

$$A_{i,j} = C_{i,j} - T_{i,j}$$

Results: Distribution of widows living alone 1970

$$\left\{ C_{i,j}, \frac{\mathrm{A_{i,j}}}{C_{i,j}} \right\}$$

	Mothers			
	0-25	25-50	50-75	75-100
0-25	49.4	50.1	57.6	48.8
	(9.13)	(6.27)	(5.61)	(3.99)
Ch 25-50	56.8	64.0	68.4	67.0
	(8,08)	(6.65)	(5.89)	(4.28)
50-75	31.7	68.1	69.2	84.7
	(3.90)	(7.22)	(5.70)	(8.27)
75-100	23.2	52.7	76.7	81.3
	(3.90)	(4.85)	(7.79)	(8.46)

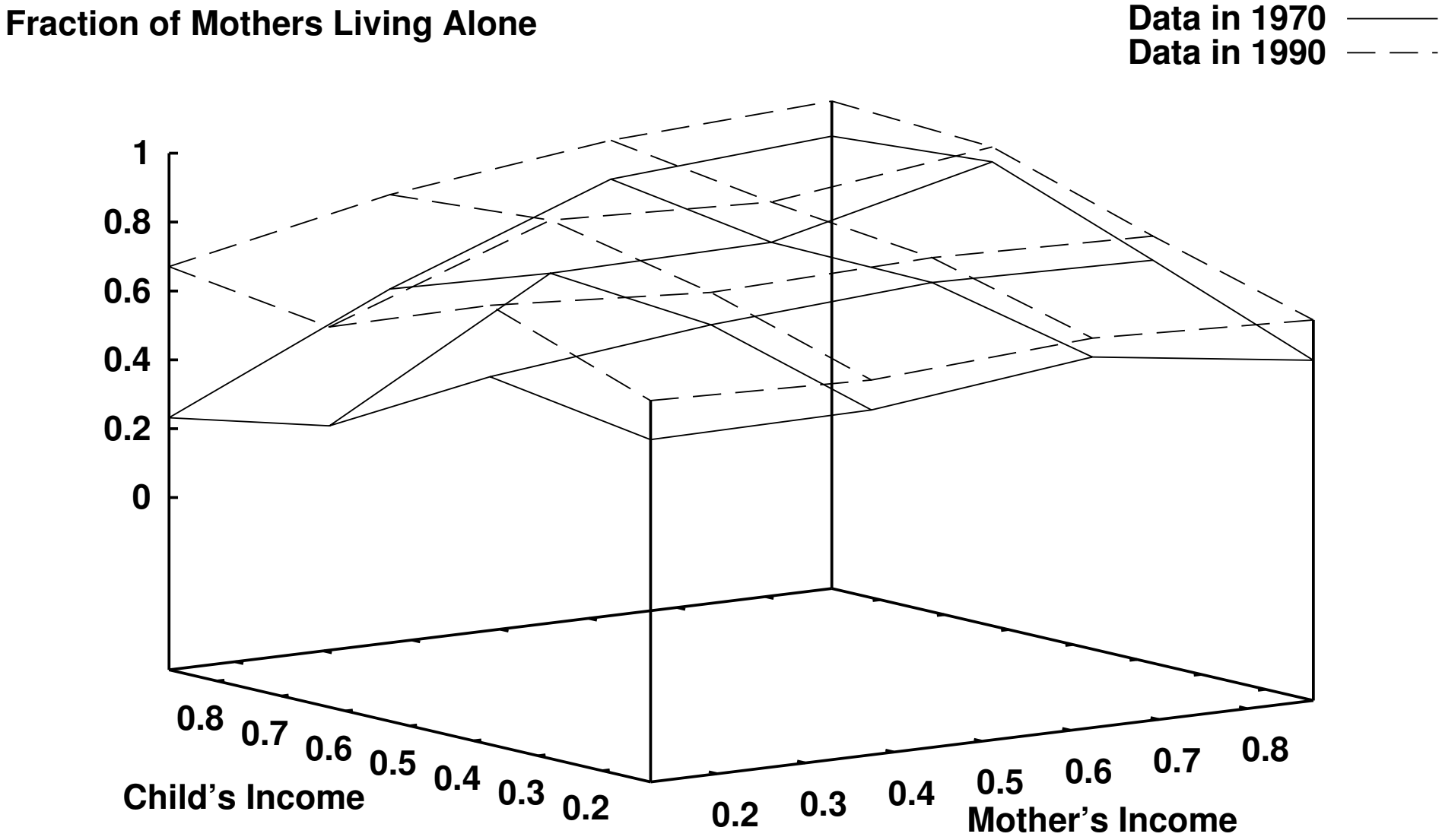
- Objective 1: Build a model and estimate it so that it replicates this Table.

Results: Distribution of widows living alone 1990

$$\left\{ C_{i,j}, \frac{\mathrm{A_{i,j}}}{C_{i,j}} \right\}$$

	Mothers			
	0-25	25-50	50-75	75-100
0-25	60.7 (9.13)	58.8 (6.27)	63.1 (5.61)	60.5 (3.99)
Ch 25-50	77.5 (8,08)	73.4 (6.65)	75.6 (5.89)	74.0 (4.28)
50-75	60.4 (3.90)	82.5 (7.22)	80.9 (5.70)	89.0 (8.27)
75-100	67.1 (3.90)	80.1 (4.85)	88.9 (7.79)	91.5 (8.46)

- Objective 2: Put in our model the incomes of the 1990's and see how similar it is to this one.


Fraction of Mothers Living Alone
Data in 1970
Data in 1990
1
0.8
0.6
0.4
0.2
0
0.8 0.7 0.6 0.5 0.4 0.3 0.2
Child's Income
0.2 0.3 0.4 0.5 0.6 0.7 0.8
Mother's Income

A visual aid

The Model

- One-period
- There are many mothers and children pairs, $t \in \{m, h\}$.
- Only one mother and one child that can either live alone or together $\ell \in \{A, T\}$.
- If they live alone they consume their income.
- If they live together they could enjoy economies of scales and they consume equally.
- Whether they live together is a stochastic outcome. The probabilities can be affected by undertaking costly investments. In fact, for a large enough effort, the desired outcome can be achieved with certainty.
- We model the undertaking of effort as a non cooperative game.

- **Consumption preferences are log beyond a type specific threshold. There may be intrinsic utility from living together. Effort is costly. Conditional on the living arrangement, their utility is**

$$u^{t,\ell} = \log\left(c^{t,\ell} - \overline{c}^{t}\right) + \eta^{t} \;\; 1_{\ell=T} - \alpha^{t} \;\; \left(e^{t}\right)^{2}$$

- **Both agents undertake effort, e^t to affect the outcome. The probability of living alone is given by**

$$p(e^{m}, e^{h}) = \frac{\exp\{e^{m} + e^{h}\}}{\exp\{e^{m} + e^{h}\} + \rho \;\; \exp - \{e^{m} + e^{h}\}}$$

- **So utility for $t \in \{m, h\}$ is given by**

$$u^{t} = p(e^{m}, e^{h}) \left[\log\left(c^{t,A} - \overline{c}^{t}\right)\right] + \left[1 - p\left(e^{m}, e^{h}\right)\right] \left[\log\left(c^{t,T} - \overline{c}^{t}\right) + \eta^{t}\right] - \alpha^{t} \;\; \left(e^{t}\right)^{2}$$

- If the mother is alone, she consumes her income, $c^{mA} = y^m$.

- If the child is alone, there are economies of scale

$$c^{hA} = \frac{y^h}{\gamma - 1}$$

- If together, both consume the same $c^{mT} = c^{hT} = \frac{y^h + y^m}{\gamma}$

- Equil: Agents within each pair play best response in effort.

- We assume for income levels for each type, the mean of the quartiles. This yields 16 cells to match.

Parameters

- Two: Subsistence consumptions, $\overline{c}^m$ and $\overline{c}^h$.
- Two: Effort costs, α^m, α^h.
- One: Parameter of the effort function, ρ.
- One: Parameter of economies of scale, γ.

Estimation Procedure

We minimize the weighted (by cell size) sum of the square of the residuals between the model and the data subject to the constraint that we get the correct aggregate number of widows living alone.

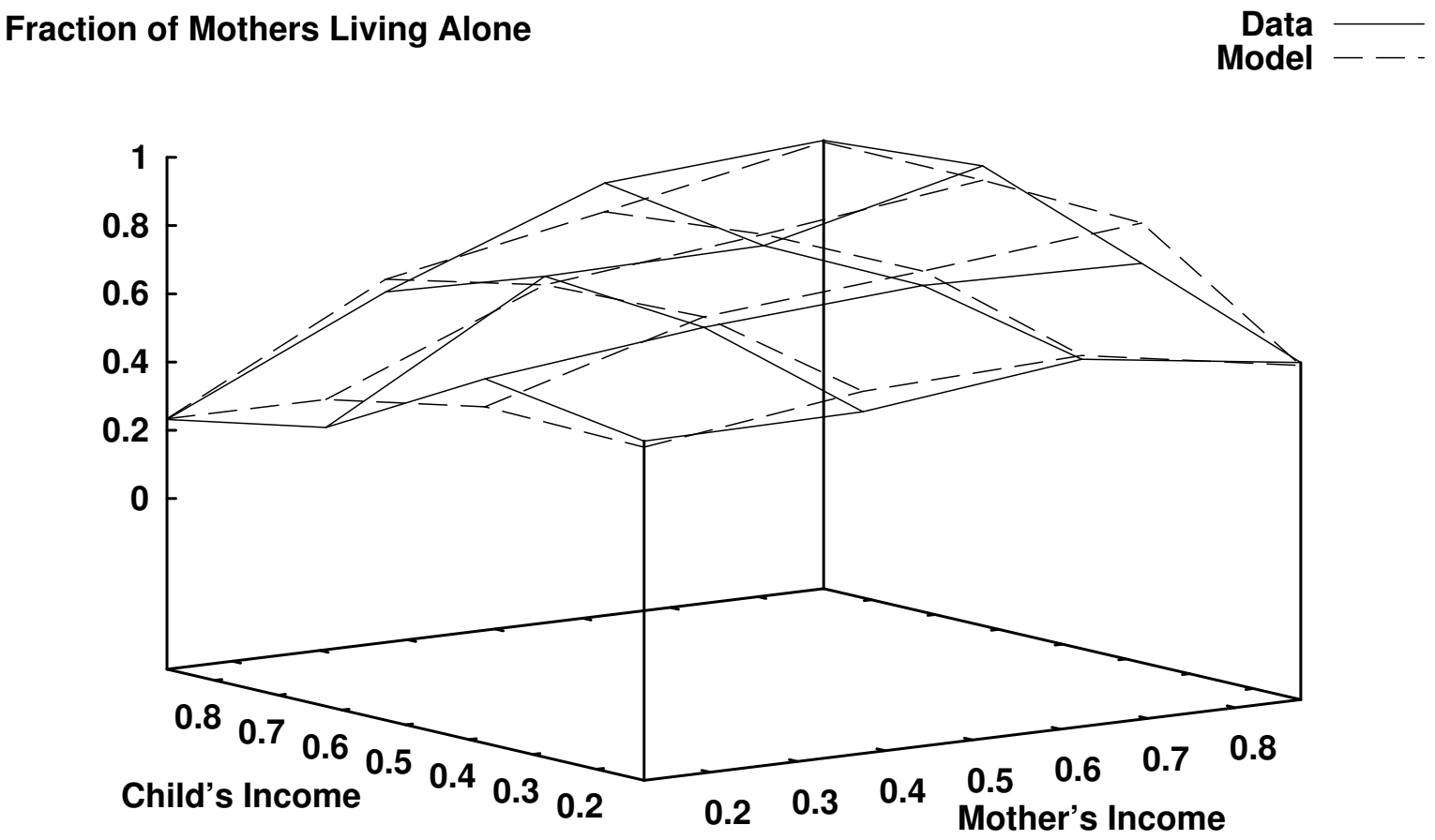
Estimates

Percentage of mothers living alone, model and (data) Total 62.0.

Accur. .00283		Mother 0-25		25-50		50-75		75-100	
	0-25	47.3	(49.4)	55.6	(50.1)	58.1	(57.6)	46.3	(48.8)
Child	25-50	48.9	(56.8)	67.3	(64.0)	72.6	(68.4)	78.8	(67.0)
	50-75	40.4	(31.7)	65.9	(68.1)	72.6	(69.2)	80.6	(84.7)
	75-100	23.8	(23.2)	56.9	(52.7)	68.6	(76.7)	80.9	(81.3)

Parameters	Estimates
$\overline{c}^m$	-725.36
$\overline{c}^h$	22.49
ρ	3.97
α^m	0.14
α^h	0.11
η^m	-0.20
γ	33.90

Another visual aid



Variations of the model

• We considered various alternatives to the model (adding children concerns for the arrangement, adding altruism both one and two-sided, and other functional forms for the probability of living alone. They all require more parameters with very small improvements in the estimation. We report the properties for the baseline with seven parameters.

What is the model prediction for 1990

- We use the incomes of 1990 (means of quartiles). We use a deflator of 2.55% per year, as corrected by The CPI Advisory Commission.

- The model predicts that the fraction of widows living alone is now 71.9 while the data is 75.3. The model predicts an increase of 75% of the size of the actual increase.

- We also construct another measure of accuracy of the prediction.

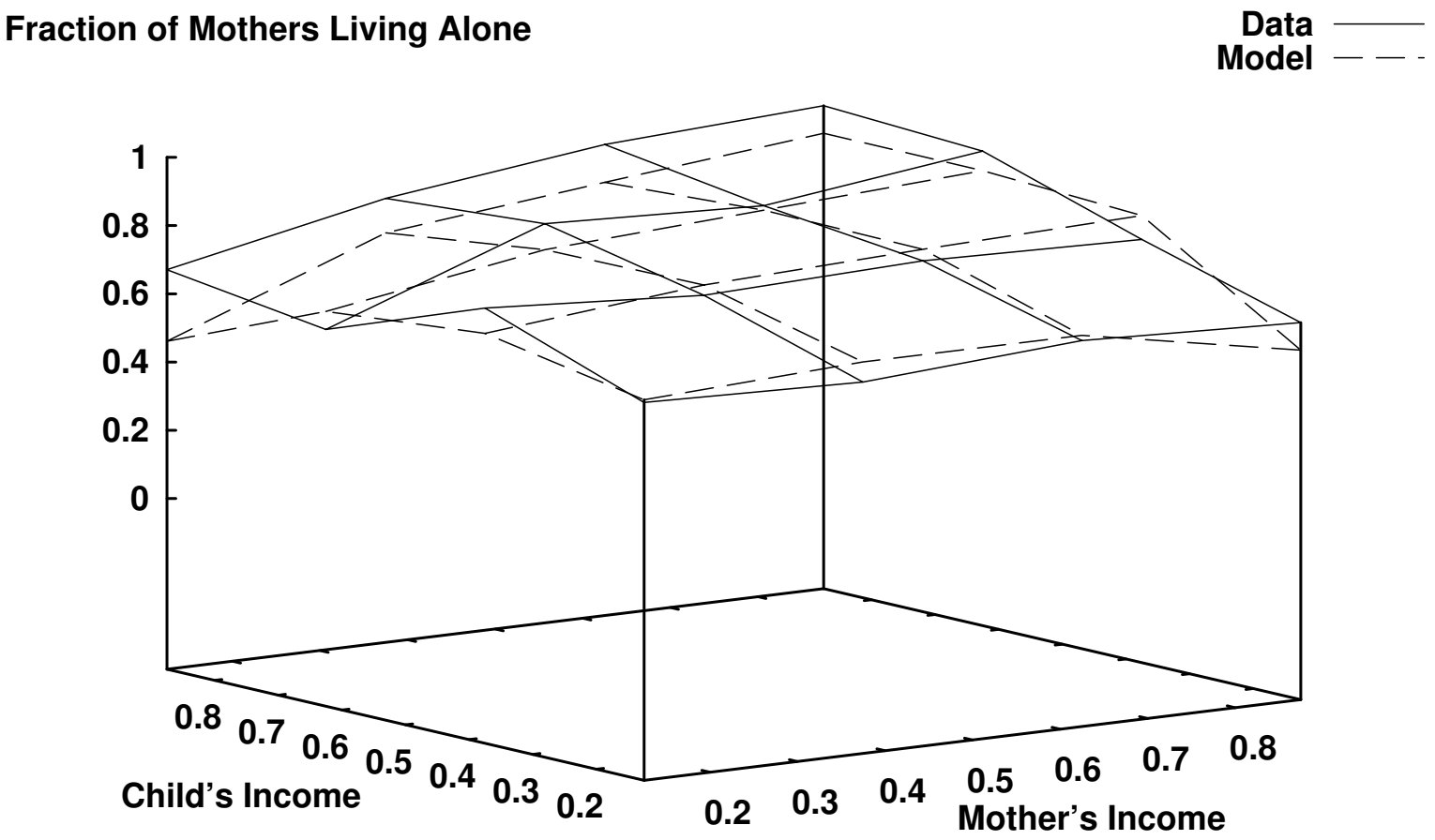
$$Acc = 1 - \frac{\sum_{ij} \left(x_{ij}^{d,90} - x_{ij}^{m,90} \right)^2 \mu_{ij}}{\sum_{ij} \left(x_{ij}^{d,70} - x_{ij}^{d,90} \right)^2 \mu_{ij}} = 77.3\%$$

The actual predictions for 1990 and the data

Percentage of mothers living alone for 1990, model and (data) Total 71.9 and 75.3.

Accur. .00707		Mother 0-25		25-50		50-75		75-100	
	0-25	61.5	(60.7)	64.7	(58.8)	64.6	(63.1)	52.4	(60.5)
Child	25-50	70.1	(77.5)	76.4	(73.4)	79.0	(75.6)	81.0	(74.0)
	50-75	65.7	(60.4)	75.9	(83.5)	79.6	(80.9)	83.3	(89.0)
	75-100	46.1	(67.1)	70.0	(80.1)	76.9	(88.0)	83.4	(91.5)

Yet another visual aid



Is it children's or mother's income: Decomposition

- If we increase only the income of mothers, the model predicts an increase of 63.9%

- If we increase only the income of the children, the model predicts a decrease of 1.6%.

- If we keep constant the income of children and increase the mothers so that relative income is as in 1990, the model preditcs an increase of 45%.

- If we increase the income of children to 1990 and keep the relative income as in 1970 the model predicts an increase of 27%.

- Very nonlinear but it seems that relative income is more important.

This is fine, but What about the other characteristics of the children?

In a nut shell

1. **Sex does not matter (49.4 of all children are males and 50.4 of children living with mothers are males).**

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2. **Marital status does matter (68.1 of all children are married and 20.7 of children living with mothers are married).**

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3. **Number of children matters a little (but not big change over time).**

4. **Age matters little (living alone increases with age).**

Living Arrangement distribution among selected characteristics of children

	0 Child	1 Child	2 Child.	3 Child.	More than 3
Total # of children		69.0	78.9	77.8	62.4
Total # of daughters	73.4	71.5	76.8	74.0	55.0
Total # of sons	73.5	75.7	71.7	67.3	56.5
Total # of married ch.	47.0	69.9	81.5	77.2	75.0
Total # of single ch.	91.5	62.6	53.7	50.0	6.4

Age of Average child	Percentage living alone
< 40	60.71
40-45	67.78
45-50	72.13
50-55	77.16
$55 >$	76.56

Let's distinguish by marital status

• It is now harder to impute the same joint distribution of income and characteristics.

Percentage of widows living alone in 1970 by income quartiles

With MARRIED child 70.7% average 57.3% of the total				With SINGLE child 50.2% average 42.7% of the total			
65.4	76.1	87.6	88.5	34.4	42.9	41.0	39.1
71.7	76.3	80.6	83.8	27.8	52.2	52.0	50.0
35.3	68.5	74.5	89.2	38.5	61.5	45.3	75.7
15.2	44.3	72.5	80.8	58.3	57.7	84.1	81.2

A model that distinguishes by marital status

$$p(e^m, e^h) = \frac{\exp\{e^m + e^h\}}{\exp\{e^m + e^h\} + \rho_z \ \exp -\{e^m + e^h\}}$$

$$\begin{aligned} U^m &= p \ \log\left(c^{mA} - \overline{c}^m\right) + (1-p)\left[\log\left(c^{mT} - \overline{c}^m\right) + \eta_z\right] \\ &\quad -\alpha_z^m \ e_m^2 \end{aligned}$$

$$U^h = p \log(c^{hA}) + (1-p)\left[\log\left(c^{hT}\right)\right] - \alpha_z^h \ e_h^2$$

$$c^{mA} = y^{mA}, \qquad c^{hmA} = \frac{y^{hmA}}{\gamma}, \qquad c^{hsA} = y^{hsA}$$

$$c^T = \chi_z \left(y^{mT} + y^{hT}\right)^{\theta_z} \quad c^{mT} = c^T \lambda_z, \quad c^{hmT} = \frac{c^T}{\gamma}(1 - \lambda_m)$$

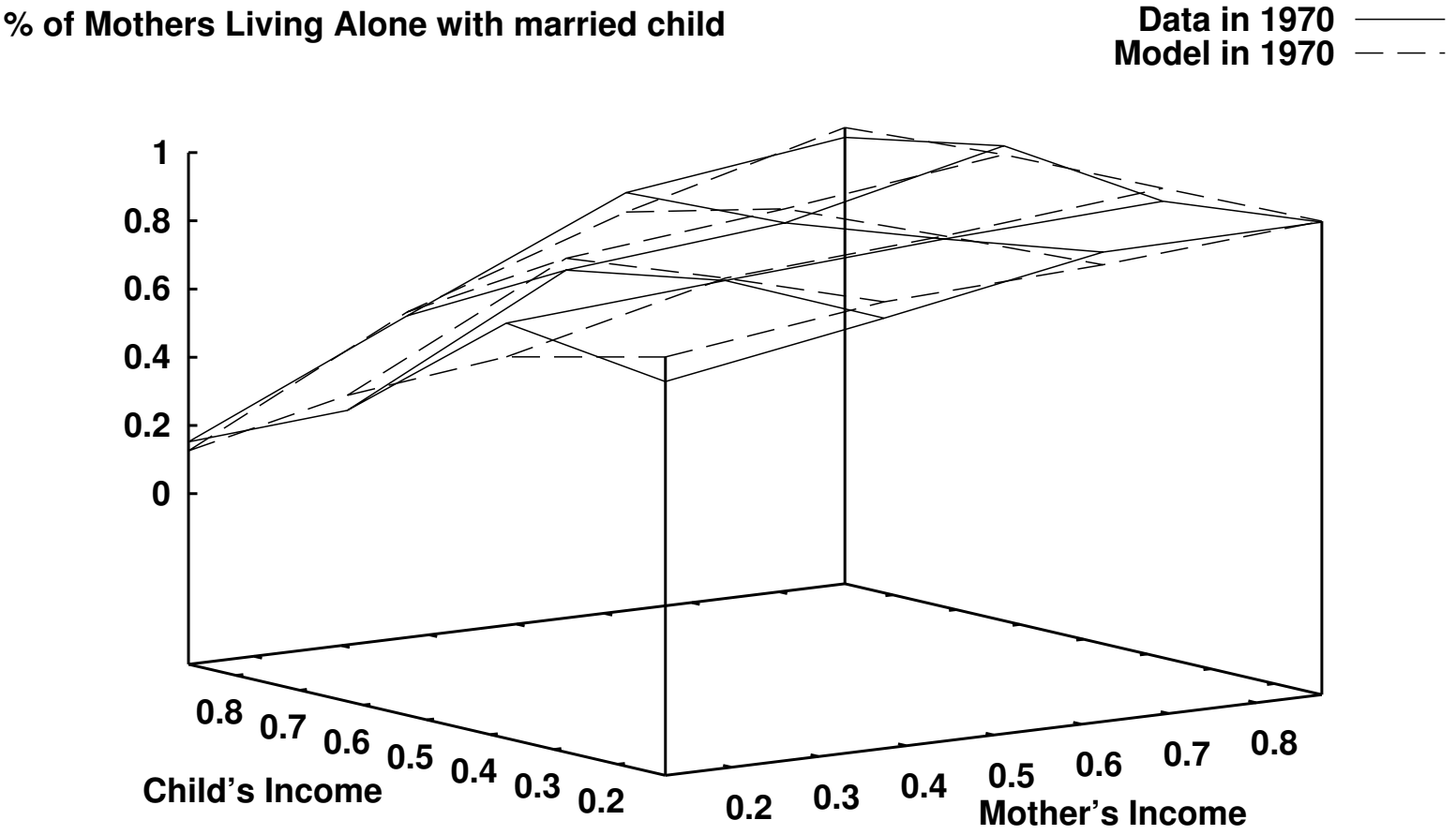
- There are 16 parameters for 32 targets.

Quality of estimation Accu=0.00689

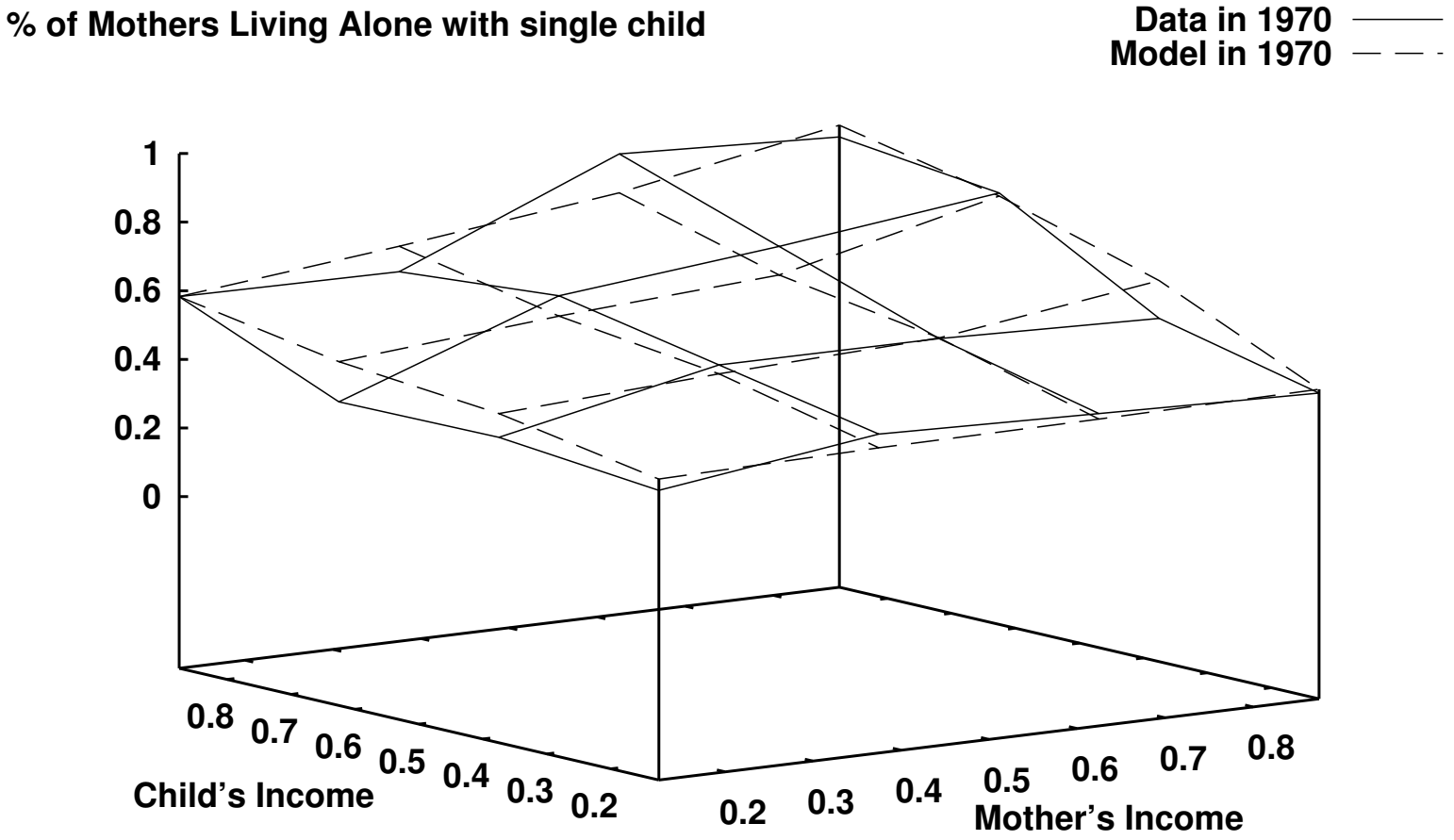
MARRIED DATA				SINGLE DATA			
65.4	76.1	87.6	88.5	34.4	42.9	41.0	39.1
71.7	76.3	80.6	83.8	27.8	52.2	52.0	50.0
35.3	68.5	74.5	89.2	38.5	61.5	45.3	75.7
15.2	44.3	72.5	80.8	58.3	57.7	84.1	81.2

MARRIED MODEL				SINGLE MODEL			
77.9	83.3	84.8	86.7	35.4	37.6	38.8	41.5
62.4	77.8	81.0	84.9	42.0	46.1	48.4	56.0
34.1	72.5	77.6	83.5	45.7	51.4	54.8	75.0
13.1	53.9	67.7	80.0	53.9	62.2	83.4	90.5

More Visual Aids for those with a married child



And for those with a single child



General Equilibrium? Recall that

- The model predicts that the fraction of widows living alone is now 71.9 while the data is 75.3. The model predicts an increase of 75% of the size of the actual increase.

- Absent other changes in fundamentals, we can specify the residual as what sociologists and others call culture, i.e. an externality.

$$u^t = p(e^m, e^h)\left[\log\left(c^{t,A} - \overline{c}^t\right)\right] + \left[1 - p\left(e^m, e^h\right)\right]\left[\log\left(c^{t,T} - \overline{c}^t\right) + \eta^t\right]$$

$$- \alpha^t \left(e^t\right)^2 + \psi(x_t^{\cdot,\cdot})$$

- With a time series we could measure the properties of function ψ and then we could talk about what other social scientists call cultural change.

What have we learned?

- Changes in incomes of mothers are very important.

- But changes in relative incomes are also quite important.

- Some Other characteristics such as marital status do matter and we do look into them.

So, ... What is next?

- Extend the model to include various children.

- Extend the model to account for age (and health): Dynamic model.

- Link the model with other changes in family composition.