



International Institute for Applied Systems Analysis (IIASA)

Effects of Household Age and Size on the Elasticity of Energy Consumption

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31st IAEE Conference, June 2008, Istanbul

elasticity of substitution

- between energy intensive and non-intensive goods
- for household types differing by age and size
- US households over 1986-2004

reasons

- important policy parameter
- hard to be found in energy context
- absent in demographic context

assumptions

- two consumption goods, energy intensive x_e , and non-intensive x_n
- each household has own utility parameters
- CES functional form

lead to

- system of demand equations

$$\ln(S_{nit}^{-1} - 1) = \alpha_i + \beta_i \ln(p_{et} / p_{nt}) + u_{it} \quad \text{where} \quad S_{nit} = x_{nit} p_{nt} / m_i$$

- 4 stage Aitken method $\hat{\sigma}_i = 1 - \hat{\beta}_i$

- **shares:** S_{nit} , S_{eit}
 - **US Consumer Expenditure Survey 1986-2004**
 - **mean household expenditure shares**
 - **for all household types**
 - **energy intensive goods: utilities and fuels**
- **prices:** P_{nt} , P_{et}
 - **corresponding CPIs**
 - **US Bureau of Labour statistics**

household types

- **4 age types**

- very young (<25)
- young (25-34)
- middle age (35-64)
- old (>65)

- **4 size types**

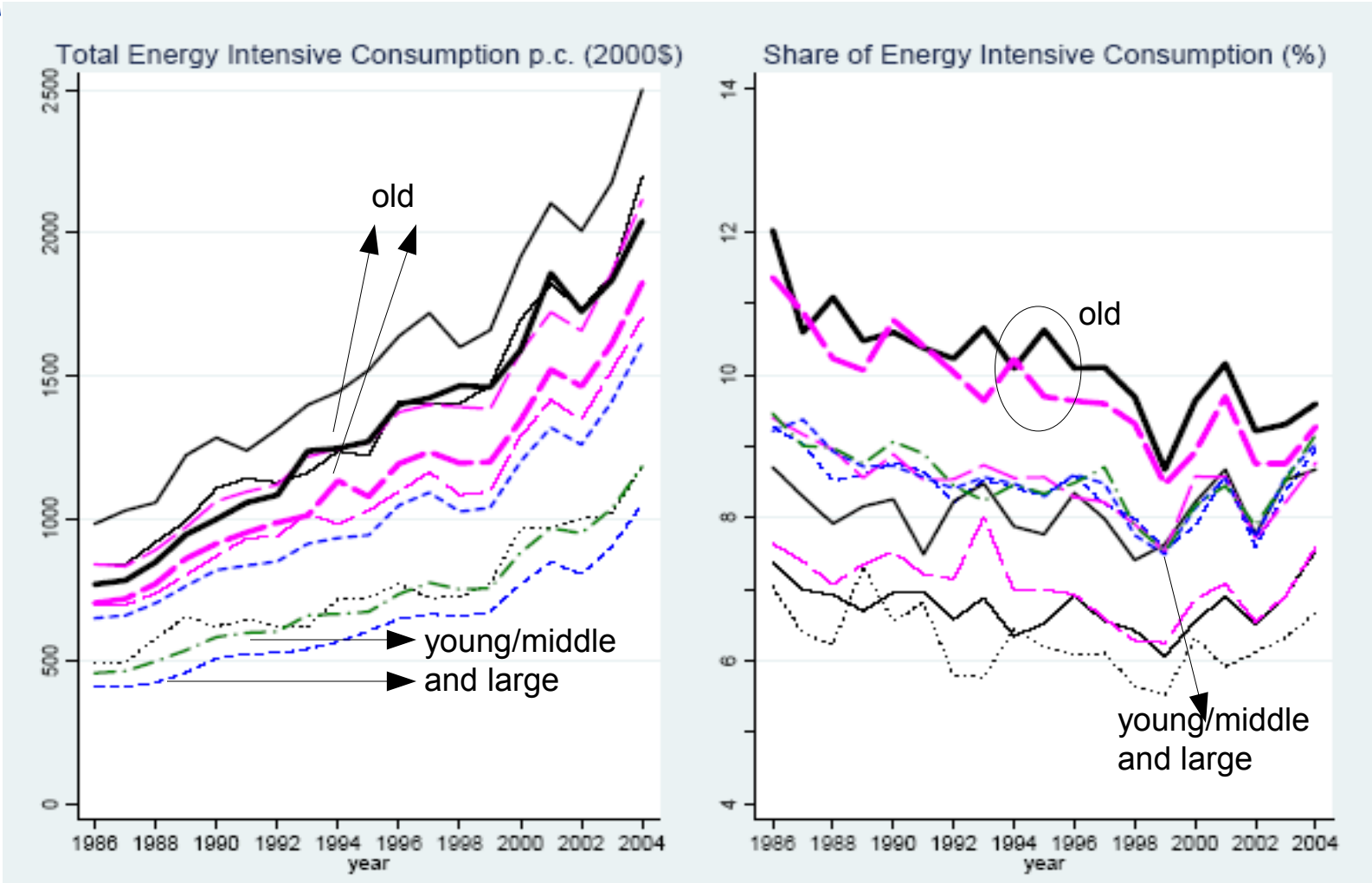
- 1, 2, 3, 4+



- **10 age-size types**

- very young: size 1
- young: size 1, 2, 3+
- middle aged: size 1, 2, 3, 4+
- old: size 1 and 2

household types cont.



■ **substitutable goods**

■ **notable range**

(0.227-0.615)

■ **Wald test**

$F(160,9)=4.7$

■ **significantly**

different

	σ	Std.Err	θ	γ
vyoung1	0.278*	0.143	0.054	-0.257
young1	0.380**	0.087	0.030	-0.146
young2	0.230	0.149	0.041	0.191
young3p	0.465**	0.093	0.034	0.077
mid1	0.479**	0.146	0.042	0.104
mid2	0.325**	0.112	0.030	0.387
mid3	0.227*	0.090	0.027	0.489
mid4p	0.243*	0.095	0.025	0.458
old1	0.615**	0.211	0.054	0.370
old2	0.545**	0.180	0.049	0.568

- **largest values: older households** (0.55-0.62)
- **lowest values: middle aged and large households** (~0.23)
- **middle values: young, middle aged and small household**
- **older households: highest tendency to substitute**

compare

- **Goulder et al. (1999): 0.85**
- **Cremer et al. (2003): 0.27**

- **elasticity of substitution estimate**
 - energy intensive vs. non-intensive
 - for a broad range of household types
 - US household data

- **significant differences across household types**
- **possible reasons: tastes and income**
- **future: use in energy economic growth models**