Health and Heterogeneity

Josep Pijoan-Mas
CEMFI

José-Víctor Ríos-Rull
UPenn, CAERP

January 25, 2005

Introduction

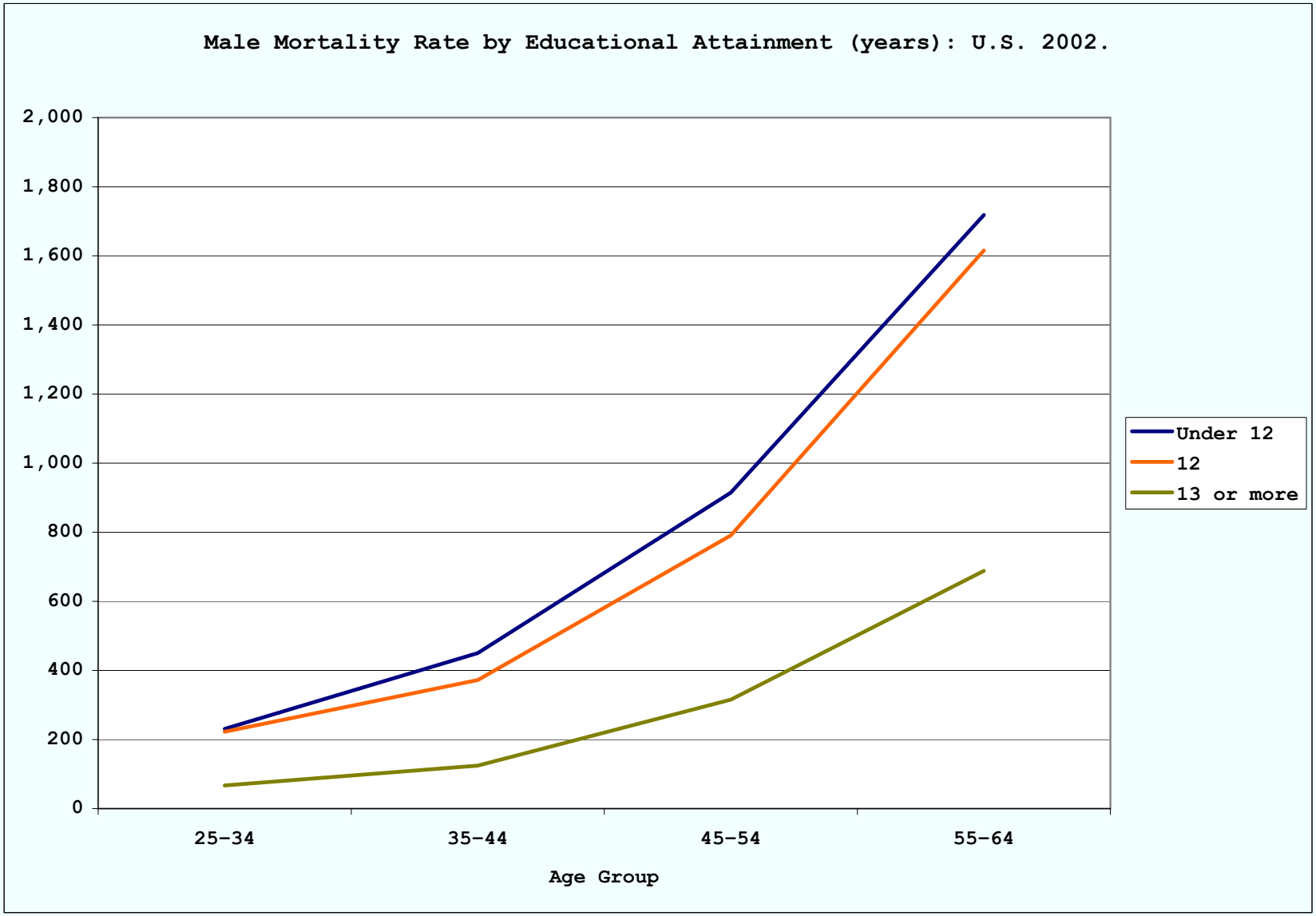
- People are different in many ways: Income and Wealth, Education and Marital Status, and Health Related Behavior and Survival.

- As economists, we want to know whether people differ in their decisions through life because different things happen to them or because they are intrinsically different?

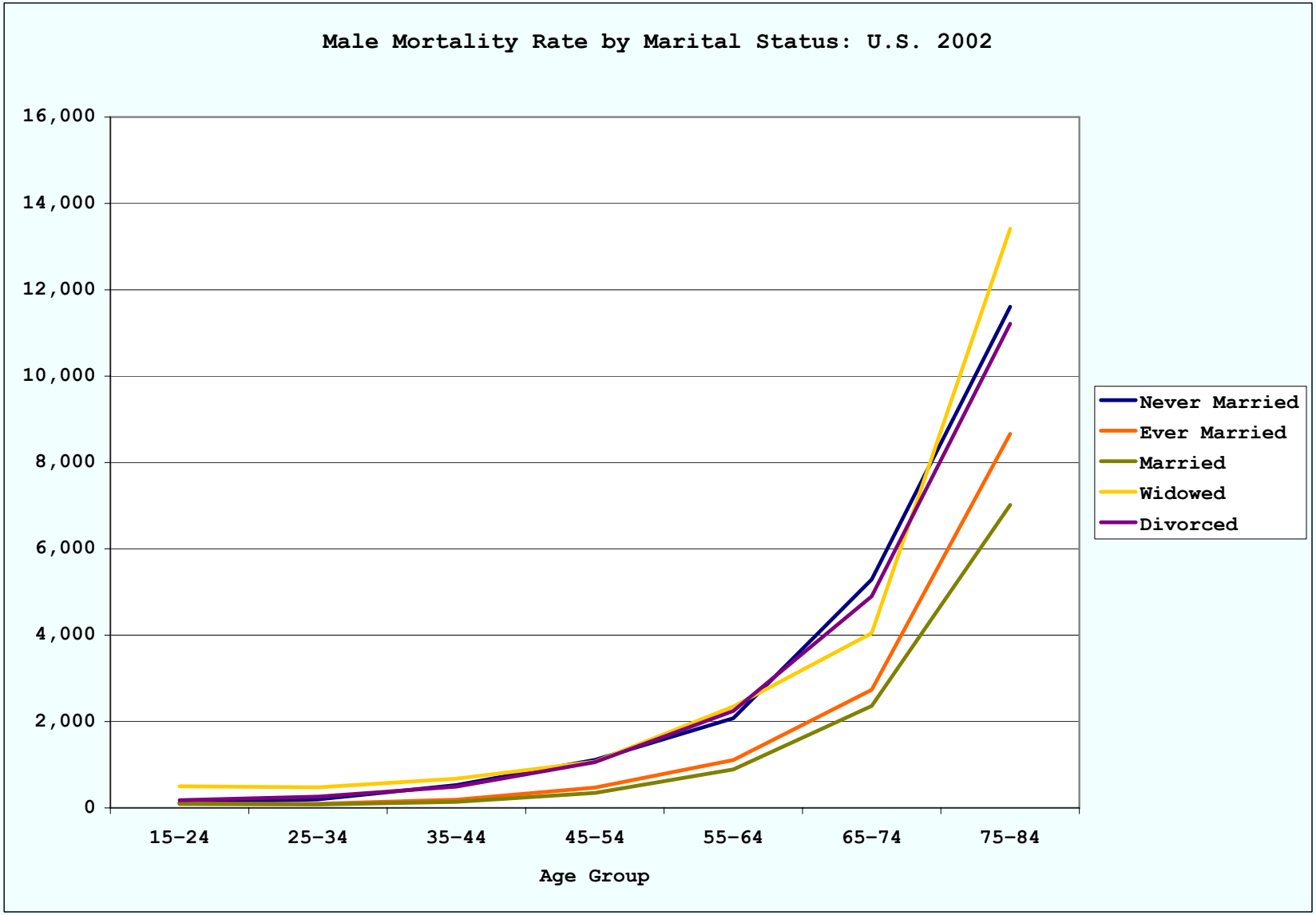
- If the latter, in which dimensions people are different?

- We will exploit data on health outcomes and health investment to find out.

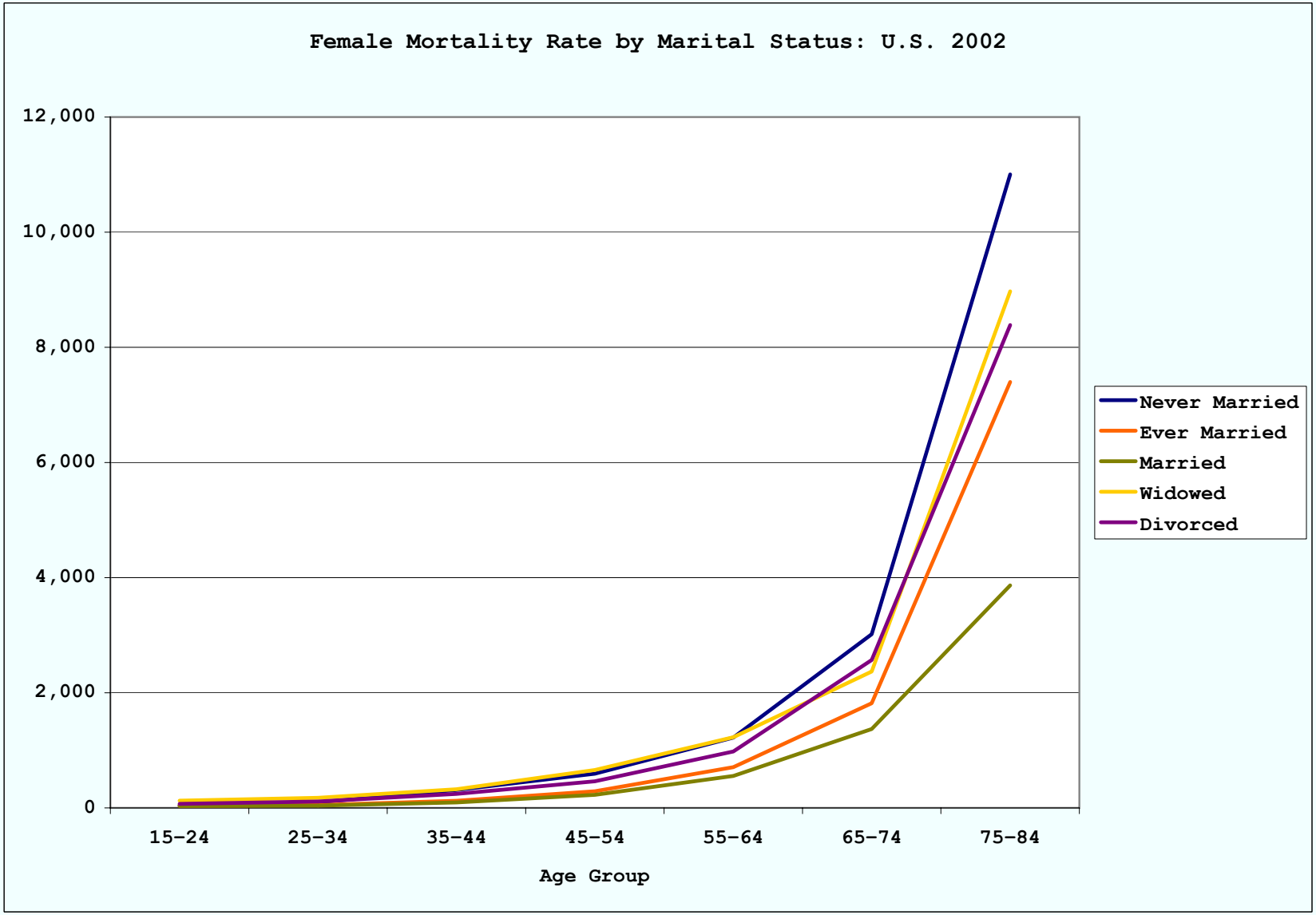
Health outcomes and economics (educ) are related



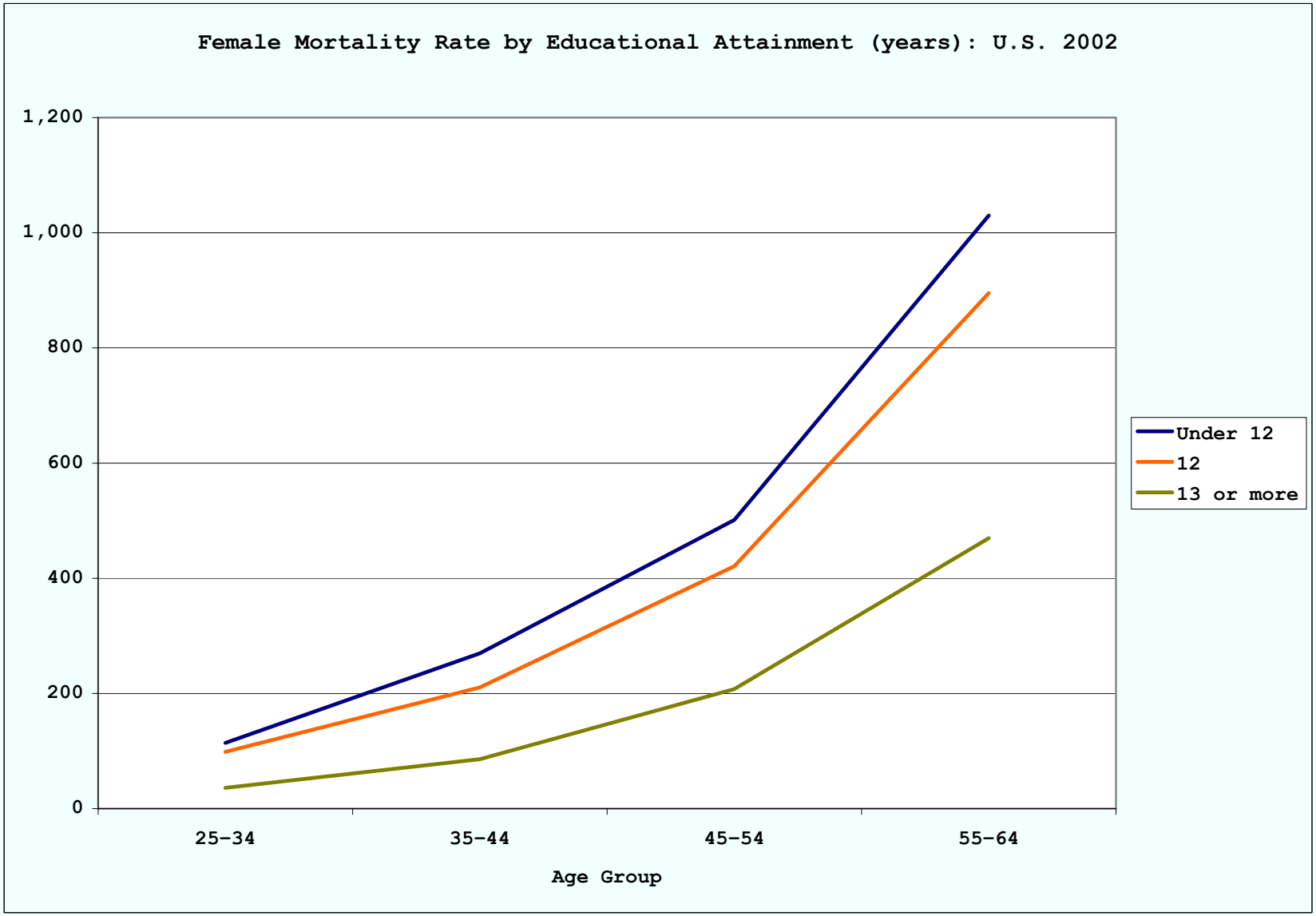
But Marital Stuff Also Matters



For Females, too



Health outcomes and economics (educ) are related



Income also matters (Rogot, Sorlie, Johnson (92))

- At age 25 the lowest income group for males has a life expectancy of 43.6 the highest, 53.6. For females 54.4 and 59.4.

- Throwing away the two extremes is also there. 46.1–52.4 and 56.0–57.8

- At age 65 is also there. 13.3–17.2 and 20.0–21.1.

- The interesting thing is that this is family income (so the man earns is, ... typically).

- We do not know right now how separated these things are. We will pursue this more.

Health outcomes and economics (educ) are related

Various possibilities of why

1. **Better education $\rightarrow$ more income $\rightarrow$ you buy better health.**
2. **Schooling develops different tastes and attitudes.**
3. **Schooling allows to have better health.**
4. **Old age is relatively more enjoyable with more educ/money.**
5. **There is a (are) third variables(s) that influence both schooling and health choices.**

Facts

- The relationship between health and schooling persists once we control for income and other socio-economic variables Grossman (1973). Therefore, hypo 1, insufficient.

- A gradient of smoking behavior with years of schooling persists (and is very strong) when smoking is measured at age 17, before the later years of schooling are completed Farrell and Fuchs (1982). Therefore, hypo 2 seems to be rejected.

- Kenkel (1991) shows that the relationship between smoking, drinking and exercise habits and educ persists once we control for individuals knowledge of their effects on health. Hence, hypo 3 bad.

- Hypos 4 and 5 point to health like earnings capability as human capital. Their respective investments maybe complimentary.

- We will try to exploit individual level data on health outcomes, wealth and education levels to learn about how to think about types of people.

Some related work

- **A model of career and educational choice.** Keane and Wolpin (1997) **(90% of diff in utils exist at 16).**

- **Heterogeneous time discount factors.** Belzil and Hansen (1999) **claim that diff in β is important to explain observed years of education, wages and unemployment, and that discount rates are correlated with ability (more able are more patient).**

- **Using the NLSY,** Munasinghe and Sicherman (2000) **show that non-smokers self select into professions with higher wage growth.**

NLSY data

Yearly panel of (14-22 in 1979). There are complete data on schooling, mental skills (different tests), labor market behavior (hours and hourly wages), income and wealth (including study loans and scholarships), and demographic and family variables.

- Health at age 40. A series of questions on health (bmi, self rated health, time spent in health care activities) after 40.
- Exercise habits (year 2000)
- Drug use: quantity and age of first consumption.
- Smoking.
- Sex and Criminal behavior.
- Use of time (1981). TV vs homework, work, etc.
- Data on wealth.

HRS data

Panel since 1992 of born between 1931-41 and their spouses regardless of age.

- **Health status measures: there is an array of questions for households to assess their health, from self rated health status to perceived survival probabilities.**

- **Health investment: individuals are asked about their use of medical services plus several questions on preventive behavior such as prostate or breast cancer checks, preventive flu shots or cholesterol checks. They are also asked about smoking and drinking behavior.**

- **Finally, there are the usual demographic and economic indicators: age, sex, education, family structure, wealth and income.**

The Model: Exogenous Variables

First the types, constant for each type.

- **Taste for health-related behavior $z \in Z$**
- **Patience β**
- **Ability to earn η**
- **Ability to learn θ (maybe also the Hugget-Ventura-Yaron ability to learn).**

Let $\tau = \{z, \beta, \eta\}$ denote a subset of types.

Next the shocks

- **Labor Earnings Shock ϵ with transition $\Gamma_{\epsilon,\epsilon'}$.**
- **Shock to health ζ that affects (deteroriates) health, it is i.i.d.**

The Model: Preferences and Endogenous States

- Individuals live for a maximum of I periods.
- Within period ut fn, $u^z(c, y)$ (health investments).
- Health h evolves stochastically $h' = \phi_i(z, h, y)$
- Health improves survival odds $\gamma^i i = \gamma^i(h)$ (only need one $_i$).

Education is chosen only in the first period. Health and Wealth are updated. The endogenous state variables are

- Education $e \in E \equiv \{e_1, e_2, ...e_{n_e}\}$ Chosen when young.
- Wealth $a \in A \equiv [\underline{a}, \infty)$ updated every period.
- Health $h \in H \subset \mathbb{R}_+$ updated every period.

Agent's problem

$$V^{\tau,e,i}(\epsilon,\zeta,a,h) = \max_{a',y} \; u^z(c,y) + \beta\,\gamma^i(h)\;\; E\left\{V^{\tau,e,i+1}(\epsilon',\zeta',a',h')\right\}$$

with

$$c + a' = R\,a + w\,e\,\eta\,\epsilon$$
$$h' = \psi(\zeta,h,y)$$

Notice that the problem is not indexed by θ.

At $i=0$, $youth$, individuals choose their education level e.

$$\max_{a',y,e} \quad W^{\tau,\theta}(a,a',e,\epsilon,y) + \beta\gamma^1(h)\,E\left\{V^{\tau,e,1}(\epsilon',\zeta',a',\psi(\zeta,h,y))\right\}$$

with a yet to be determined current return $W(.)$

Issues

MARRIAGE

Solution

We solve the model to find the policy functions,

$$c = c^{\tau}_{e,i}(\epsilon, \zeta, a, h) \qquad y = y^{\tau}_{e,i}(\epsilon, \zeta, a, h).$$

The first order conditions are given by:

$$\begin{aligned} u^z_c(c,y) &= \beta\gamma^i(h)\, E\left\{V^{\tau,e,i+1}_a(\epsilon',\zeta',a',h')\right\} \\ -u^z_y(c,y) &= \beta\gamma^i(h)\ \psi_y(\zeta,h,y)\ E\left\{V^{\tau,e,i+1}_h(\epsilon',\zeta',a',h')\right\} \end{aligned}$$

The envelope conditions are $V^{\tau,e,i}_a(\epsilon,\zeta,a,h) = R\, u^z_c(c,y)$

$$\begin{aligned} V^{\tau,e,i}_h(\epsilon,\zeta,a,h) = \beta\gamma^i_h(h)\ E\left\{V^{\tau,e,i+1}(\epsilon',\zeta',a',h')\right\} + \\ + \beta\ \psi_h(h,y)\ \gamma^i(h)\, E\left\{V^{\tau,e,i+1}_h(\epsilon',\zeta',a',h')\right\} \end{aligned}$$

The Cons Euler

The first Euler Eq is standard

$$u_c(c,z) = u_c(c) = R\,\beta\,\gamma^i(h)\;E\{u_c(c')\}$$

- **If $u_c = u_c(c)$, then age profiles of c only differ due to $\{h, \epsilon, \beta\}$.**

- **If h is observable, with an estimation of the earnings process, the age-profiles for c shows differebces ub time preferences, β. We need a data set containing at the same time health status, income and consumption (or wealth instead on cons).**

The Health Euler

Under separability:

$$-u_y^z(y) = \beta\,\gamma^i(h)\;\psi_y(\zeta,h,y)\,E\left\{V_h^{\tau,e,i+1}(\epsilon',\zeta',a',h')\right\}$$

- **It is crucial to identify**

1. **the relationship between health investment and health stock**
2. **the predictive power of health stocks for survival probabilities.**

With information on these two elements, differences in observed y within individuals with same assets a, education e, earnings categories ϵ and η and patience β will be accounted for differences in z.

The Educational Choice

Finally, the optimality condition at $youth$ that sorts out people in different educational categories will give us information on the ability to learn or utility cost of education θ once we have already inferred values for β, z and η.

Mapping the Model to Data

We needed to know (Possibly only one of them age dependent)

1. **the relationship between health and harmful behavior, $\psi^i(h, y)$**
2. **the survival probabilities at different health levels $\gamma^i(h)$.**

HRS reports (self-rated health) and various measures of health behavior. We use switching health category for those with good health behavior and for those with bad health behavior.

Targets for Identification of Types

1. We can use earnings analysis directly to get η).
2. The positive correlation between education and health.
3. The Education Distribution given wage levels per generation. (helps with θ).
4. Consumption Growth Rates (for β).

These variables have to be jointly observed.

There are more targets to use

- After retirement earnings do not matter anymore, so conditional on education, wealth and health (observables), variation in health investment can only be due to variation in z (tolerance for care) or variation in β (patience). Alternatively, we can estimate jointly β and z for retirees by looking at the variation in health investment and in savings.

- Changes in assets a or earnings position ϵ should lead to changes in health related behavior. Within an educational category, we can look at changes in health related behavior y for those who experience a change in either a or ϵ compared to those who do not experience it.

- In a model including marriage there are many more sources of data to exploit (although we may need go to PSID in this case). For example, exogenous changes in fortune can be those of the spouse.

Some descriptive statistics: preventive behavior

The HRS asks some questions that cover what we may call preventive behavior: those actions or activities that the individual can take to prevent mortal diseases. In what follows, I show data on the following:

- **The respondent currently smokes, table 1.**
- **the respondent has checked his/her cholesterol level in the last two years, table 2,**
- **the respondent has got a preventive flu shot in the last two years, table 3 ,**
- **the respondent has made preventive checkings on gender-specific cancer risks, prostate for men and breast for women, in the last two years, table 4**
- **the respondent does heavy physical activity (aerobics, running, swimming, etc ... and heavy housework) at least three times per week, table 5.**

Smoking behavior

Table 1 shows the proportion of smokers, men and women separately, conditional on age education and marital status. Old people smoke less which can also be used.

Table 1: Conditional means: currently smokes.

	mar m	sing m	mar f	sing f
edu=d	0.32	0.46	0.27	0.32
edu=h	0.21	0.36	0.18	0.27
edu=c	0.12	0.22	0.08	0.13

Preventive cholesterol tests

The picture for cholesterol tests is the same as for smoking behavior. More educated, married and women are more likely to take preventive cholesterol tests. Age does not seem to be a significative factor.

Table 2: Conditional means: cholesterol checks in the last two years.

	mar m	sing m	mar f	sing f
edu=d	0.58	0.47	0.68	0.65
edu=h	0.71	0.59	0.73	0.69
edu=c	0.79	0.68	0.80	0.73

Preventive flu shot

Again, we observe the same pattern in both the conditional means but marital status does not seem to be significative.

Table 3: Conditional means: flu shot.

	mar m	sing m	mar f	sing f
edu=d	0.29	0.28	0.36	0.37
edu=h	0.35	0.33	0.42	0.36
edu=c	0.44	0.42	0.50	0.40

Preventive tests for gender specific cancer

Man are asked about prostrate checks in the last two years and women about both mammogram in the last two years and regulars self-checks on breasts.

Table 4: Conditional means: gender specific cancer.

	mar m	sing m	mar f	sing f
edu=d	0.50	0.47	0.82	0.48
edu=h	0.67	0.58	0.89	0.52
edu=c	0.80	0.64	0.94	0.62

Physical activity

This is the case were the standard pattern of preventive behavior is not fully apparent. In particular, it is not true that college educated individuals do more physical activity. However, the question is not very good since it mixes sports activity with heavy housework.

Table 5: Conditional means: heavy physical activity.

	mar m	sing m	mar f	sing f
edu=d	0.54	0.44	0.46	0.36
edu=h	0.61	0.55	0.50	0.43
edu=c	0.55	0.47	0.55	0.48

Conclusions

- We are after using the joint determination of earnings, education, wealth and health to learn about ex ante heterogeneity of peoples.

- We have to think a lot more about of the details of the moments of the data that we are using to restrict the model. We like to think that we will work in the mold of Gustavo and Amir (and Huggett).

- We will extend this to account for marriage formation and sex. We do not know yet how. We have done similar things before.

References

Belzil, C. and J. Hansen (1999, October). Subjective discount rates, intergenerational transfers and the return to schooling. IZA Discussion Paper, 60.

Farrell, P. and V. Fuchs (1982). Schooling and health: the cigarette connection. *1*, 217–230.

Grossman, M. (1973). The correlation between health and schooling. NBER Working Paper, 22.

Keane, M. and K. Wolpin (1997). The career decisions of young men. *Journal of Political Economy 105*(3), 473–522.

Kenkel, D. S. (1991). Health behavior, health knowledge, and schooling. *Journal of Political Economy 99*(2), 287–305.

Munasinghe, L. and N. Sicherman (2000). Why do dancers smoke? time preference, occupational choice and wage growth. NBER Working Paper, 7542.