Health and (other) Asset Holdings

Julien Hugonnier Florian Pelgrin Pascal St-Amour

Discussion by Grigory Vilkov

18-29 July 2011

European Summer Symposium in Financial Markets in Gerzensee

Summary

1. Fact: health and income are correlated. Casual link in both directions
   - Higher income $\rightarrow$ better quality of life $\rightarrow$ better health
   - Better health $\rightarrow$ higher productivity, better education, higher investments in physical capital, "demographic dividend."
2. Consequence: health and investment-consumption decisions are linked
3. This model:
   - Introduce morbidity and mortality (exogenous or linked to health)
   - Link labor income to health status directly
   - Let agent's utility be affected by expected health status change (sickness or death)
   - Give agent health technology to improve his/her health status
   - Give agent tools to hedge against morbidity ($\rightarrow$ labor income shocks)
   - Solve and calibrate to PSID data on wealth and health

Components of the Analysis I

1. Partial Equilibrium: consumption (c)—investment (π, x, I) analysis:

$$\sup_{(c,\pi,x,I)} U_t(c)$$

   Investments: financial market, health insurance, health investment

2. Labor income: increasing function of the current health status H_{t-}

$$Y_t = Y(H_{t-}) = y_0 + \beta H_{t-}, \ y_0, \beta > 0$$

where health status can be improved, but is risky:

$$dH_t/H_{t-} = \underbrace{(I_t/H_{t-})^{\alpha} dt}_{\text{decreasing returns to scale}} - \delta dt - \phi \underbrace{dQ_{st}}_{\text{jump}}$$

$\Rightarrow$ labor income inherits health (morbidity) risk

Components of the Analysis II

3. Preferences

   EZ with source-dependent RA for consumption, morbidity, mortality

   Penalty for "bad health" = higher exposure to mortality and morbidity

$$U_t = 1_{\{T_m > t\}} E_t \int_t^{T_m} \Big(\underbrace{f(c_\tau, U_{\tau-}) - \ldots}_{Kreps-Porteus} - \sum_{k=m}^{s} \underbrace{F_k(U_{\tau-}, H_{\tau-}, \Delta_k U_\tau)}_{penalty\ \ for\ \ health\ \ risks} \Big) d\tau$$

   T_m — first occurrence of the "mortal" jump dQ_m

4. Traded assets:

   Financial – a risky (driven by a priced BM) and a riskless assets

   Health – instantaneous health insurance traded at "fair" price

5. Health risk modeling:

   Mortality and morbidity driven by jumps

   Jump intensities are (i) exogenous, (ii) health-dependent

Components of the Analysis III

Rewrite

$$V_t = E_t \int_t^{\infty} e^{-\int_t^{\tau} \nu_{m(H_v-)}dv} \left(f(c_\tau, U_{\tau-}) - \ldots - \sum_{k=m}^{s} F_k(U_{\tau-}, H_{\tau-}, \Delta_k U_\tau) \right) d\tau$$

where $\nu_m(H) = \lambda_m(H)/(1-\gamma_m)$

Two channels for Health entering the optimization problem:

1. Durable good generating service flow $Y(H)$ net of insurance premium: budget constraint channel
2. Health determines the "discount rate" $\nu_m(H)$ for future consumption and continuation utility: risk channel

Major Results I

1. Exogenous health shocks: jump intensity not related to health status
   - Objective function does not depend on H_{t-} directly $\rightarrow$ Health – other decisions separation $\rightarrow$ easier (closed form) solution
   - Morbidity parameters affect marginal value of health $\rightarrow$ total wealth
   - Mortality parameters affect sensitivity of optimal rules to changes in resources; the effect is similar to the rate effect (depending on EIS)
   - **Model:** health and wealth $\rightarrow$ perfect substitutes, while **evidence** suggests that marginal utility of wealth is positively affected by health
   - **Model:** health investment and insurance $\rightarrow$ independent of agent's wealth and increase in health, while **evidence** suggests that both are increasing in wealth and non-increasing in health.

Major Results II

2. Endogenous health shocks: jump intensity related to health status
   - Objective function depends on H_{t-} directly via ν_m and $F(\ldots) \rightarrow$ Health investment–optimal portfolio link $\rightarrow$ approximate solution (perturbation)
   - Separating financial and health-related decisions is optimal iff mortality remains exogenous
   - Mortality does not have the first-order effect on the optimal portfolio
   - Full model potentially fixes all the shortcomings of the restricted model: optimal health investment increases with financial wealth and the marginal utility of wealth is increasing with wealth

Comments: Model I

- New and intuitive approach to quantify health and health risks
- Labor income shock $\propto$ health status shock: priced source of risk, especially with the EZ preferences?
  `If not -- insurance is too cheap, and agent definitely buys into it to hedge labor income shock`
- General equilibrium extension:
  `Price for health risk/ health insurance premium`
- Health-related penalty $F_k(U_{\tau-}, H_{\tau-}, \Delta_k U_\tau) =$

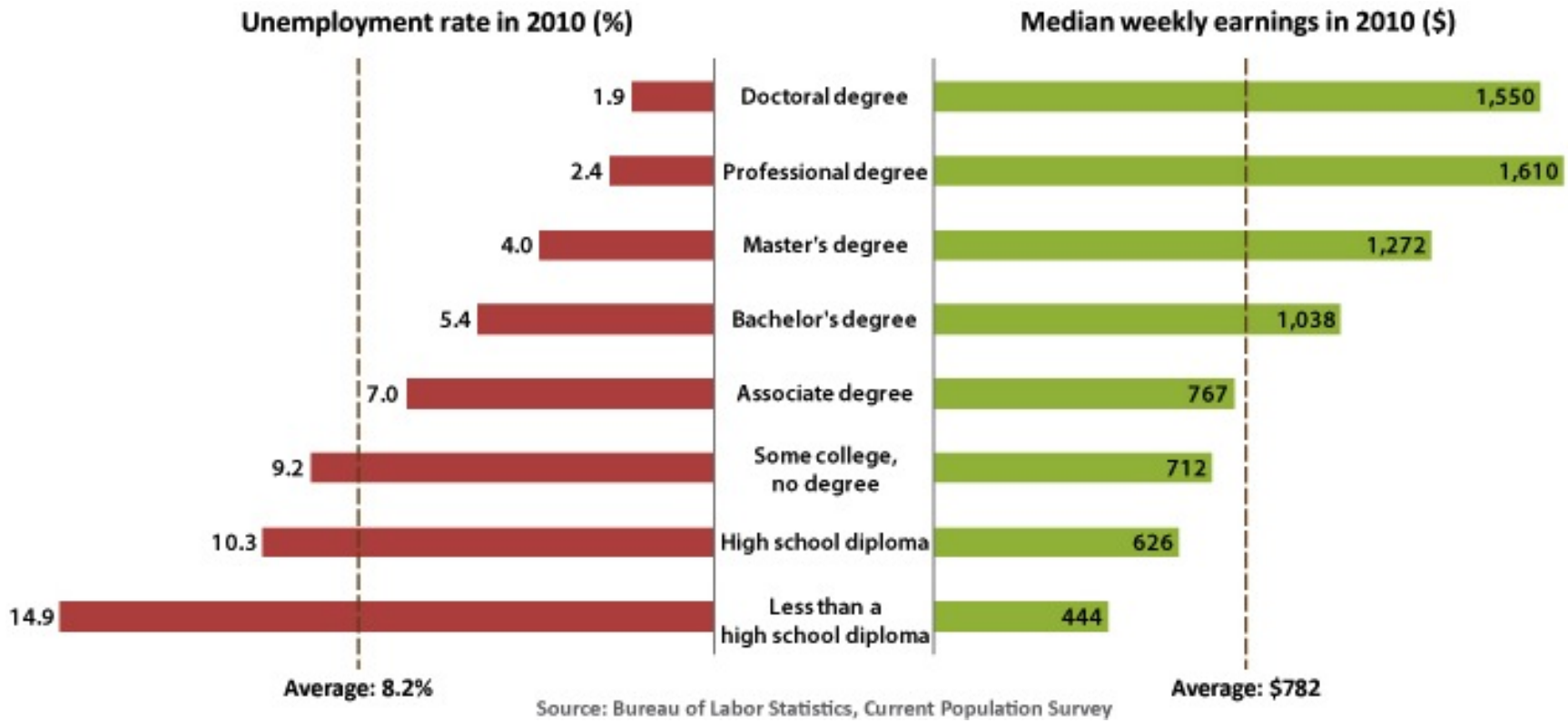
$$U_{\tau-}\lambda_k(H_{\tau-})\Big[\frac{\Delta}{U_{\tau-}} + u(1;\gamma_k) - u(1+\frac{\Delta}{U_{\tau-}},\gamma_k)\Big]$$

`depends on the shocks to health, and not on health status directly.`
`How to interpret risk aversion to health risks?`

Comments: Model II

- Education vs. health:

  Empirically (authors' estimation as well) health beta in labor income is about 2%; for education > 10%



Are we missing a factor?

Comments: Model III

- Results depend a lot on mortality risk aversion $\gamma_m < 1$
- Endogenous morbidity...
  ...seems to play a more important role in the final results, but endogenous mortality complicates the solution big time
- Results depend a lot on EIS $\varepsilon < 1$
  Agent trades quantity vs. quality of life: having bad health, an agent will get into an ‘‘eating spiral’’
- Is wealthier always healthier?
  Not supported by the data
- Can health investments be consumed? What medical expenses are not covered by insurance?
  Having a vacation, more healthy diet, etc.

Comments: Empirical Perfromance

- Extensive calibration exercise $\rightarrow$ hard to understand its stability `though all estimates are significant and most of them make perfect sense`
- Is the main goal to explain the health-related investments, or joint consumption-financial markets-health related investments?
  - `Health insurance and health expenditures --perfect fit!`
  - `Consumption and stock holdings -- far from data`
- Very interesting way to quantify "non-monetary matter" `the model performance in predicting the value of health, remaining expected lifetime and the value of one year of additional life expectancy is very interesting`
- Fits well for PSID (US) data. Any chance with European data?

Bottom Line

1. Impressive theoretical and empirical work adding important dimension to the agent's consumption-investment problem
2. Solution may be useful for production economies with manageable stochastic default
3. Good luck in publishing the paper!