Discussion:

“Personality, Education, and Health-Related Outcomes of High Ability Individuals”
by Peter Savelyev and Kegon T.K. Tan

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University College London, IFS and NBER

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What this paper is about

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- Uses factor-analytic methods to account for measurement error in the proxies for unobserved traits.
- Uses the Romano and Wolf stepdown procedure to account for multiple hypothesis testing.
- Find strong effects of personality (mostly Conscientiousness and Neuroticism) and education on health-related outcomes, mostly for males, and with effects differing by outcome.
General Comments

Broken Promises?

- **Theoretical Model**: useful to interpret the results – why not disentangling the various channels?
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► Style: (too) many remainders to Savelyev + 30 (!) keywords
Relationship with Literatures

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Personality psychology and economics (Almlund et al., *HEE*, 2011), more sophisticated approach than health psychology.

**Table 4: Description of Big–Five Personality Skills**

<table>
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<tr>
<th>Trait</th>
<th>Definition</th>
<th>Notes: *(a)*Description taken from John and Srivastava (1999).</th>
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<tbody>
<tr>
<td>1. Openness to Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Intelect)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Conscientiousness</td>
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<td>3. Extraversion</td>
<td>An energetic approach to the social and material world, which includes traits such as sociability, activity, assertiveness, and positive emotionality</td>
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<td>4. Agreeableness</td>
<td>A prosocial and communal orientation towards others (as opposed to antagonism), which includes traits such altruism, tender-mindedness, trust, and modesty</td>
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<td>5. Neuroticism</td>
<td>An emotional stability and even-temperedness as opposed to negative emotionality, such as feeling anxious, nervous, sad, and tense</td>
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- Personality traits or mental health? (Goodman, Smith et al., PNAS 2011).


- "A number of these papers are at odds with each other even though they use the same identification strategy." Why?
- Different instruments/margins/countries/levels of education. Consistent that education has bigger effects at higher levels.
- Key is to understand the mechanisms.
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Gabriella Conti (UCL, IFS & NBER) 
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- How does this compare with the general population?
- How does this compare with today prevalence for high IQ individuals?
Theoretical Model

Simple two-period model: an individual makes decision about college education, health investment, and consumption over the lifecycle.

- Lifetime utility:
  \[ u_1(C_1^N, C_1^H, H_1) + B(\theta) \cdot S(H_2) \cdot u_2(C_2^N, C_2^H, H_2, C_1^H), \]

- Health production:
  \[ H_2 = f(I, D, \theta) + (1 - \delta(C_1^H)H_1). \]

- Budget constraint:
  \[
  C_1^N + p^H C_1^H + g(D, H_1, \theta) + p^I I + \frac{S(H_2)}{1 + r}(C_2^N + p^H C_2^H) = \\
  A + Y_1(H_1, \theta) + \frac{S(H_2)}{1 + r} Y_2(D, H_2, \theta).
  \]
FOC wrt health-related consumption:

\[
\frac{\partial u_1}{\partial C_1^H} = \left[-B(\theta)S'(H_2)\delta'(C_1^H)H_1u_2\right] \text{cons. benefit} \\
+ \left[B(\theta)S(H_2)\frac{\partial u_2}{\partial H_2}\delta'(C_1^H)H_1\right] \text{morbidity benefit} \\
+ \left[B(\theta)S(H_2)\frac{\partial u_2}{\partial C_1^H}\right] \text{addiction benefit} \\
+ \left[\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial H_2}\delta'(C_1^H)H_1\right] \text{health productivity} \\
= \lambda\left(p^H\right) + \frac{S'(H_2)\delta'(C_1^H)H_1}{1+r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \theta)).
\]

FOC wrt health investment (why the difference?):

\[
B(\theta)S'(H_2)\frac{\partial f}{\partial I}u_2 + B(\theta)S(H_2)\frac{\partial u_2}{\partial H_2}\frac{\partial f}{\partial I} + \lambda\left[\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial H_2}\frac{\partial f}{\partial I}\right] \\
= \lambda\left(p^I\right) + \frac{S'(H_2)\partial f/\partial I}{1+r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \theta)).
\]
FOC for education:

\[
B(\theta)S'(H_2)\frac{\partial f}{\partial D}u_2 + -B(\theta)S(H_2)\frac{\partial u_2}{\partial H_2}\frac{\partial f}{\partial D} + \lambda \frac{S(H_2)}{1 + r}\frac{\partial Y_2}{\partial D} + \lambda \frac{S(H_2)}{1 + r}\frac{\partial f}{\partial H_2}\frac{\partial f}{\partial D}
\]

\[
= \lambda \left( \frac{\partial g(D, H_1, \theta)}{\partial D} + \frac{S'(H_2)\partial f / \partial D}{1 + r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \theta)) \right)
\]

Strengthen the link between theory and empirics.
Econometric model

- Linear model for health-related outcomes:

\[ h^k = \gamma^k D + \rho^k \theta + \mu^k X + \epsilon^k, \]

- Augmented by system of measurement equations (also linear) for the personality traits:

\[
\begin{align*}
M^1 &= \alpha_1 + \beta_1 \theta + \gamma_1 A + \delta_1 X + \eta_1 \\
&\vdots \\
M^j &= \alpha_j + \beta_j \theta + \gamma_j A + \delta_j X + \eta_j \\
&\vdots \\
M^J &= \alpha_J + \beta_J \theta + \gamma_J A + \delta_J X + \eta_J,
\end{align*}
\]

- Standard assumptions made to ensure identification in factor models with cross-loadings and correlated factors.

- Model estimated using maximum likelihood (EM algorithm).
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a. Measurements for Conscientiousness, Openness and Extraversion are averages of parents’ and teachers’ ratings taken in 1922.
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b. Measurements for Agreeableness and Neuroticism are self-reports taken in 1940.
   ▶ Error structure in measurement system should reflect this.
   ▶ Contemporaneous with several outcomes.
   → Could adjust for schooling at the time of the test like in Hansen, Heckman and Mullen (JoE, 2004).
   ▶ What is the signal-noise ratio for the various measurements?
   ▶ Why not a health factor?
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Comments on the factor model - Factor Structure

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More comments

- Linearity of the outcome equation.
More comments

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- Comparison with two-step method (regression on factor scores).
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- Mediating role of education (rather than estimating models with only and without personality).
More comments

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- **Mediating role of education (rather than estimating models with only and without personality).**
  - Also: goodness-of-fit measures in binary choice models (e.g. Windmeijer, *ER* 1995)
Results
Figure 1: Survival by Health Behaviors\(^{(a)}\)

\(\text{(a) Heavy Drinking, Males} \quad \text{(b) Heavy Drinking, Females} \quad \text{(c) Physical Activity, Males} \quad \text{(d) Physical Activity, Females}\)

Notes: \(^{(a)}\)Health behaviors refer to heavy drinking and physical activity. Heavy drinking in this graph is an indicator variable which is 1 if subject ever reported drinking heavily over the period of 1940–1960 and 0 otherwise. Physical activity indicates whether or not the subject engaged in physical activity frequently in 1982. Survival graphs are based on lifetable calculations, standard errors above and below are represented by the thinner lines. Survival curves are conditional on survival to an age by which we know the answer to the behavior in question.
Figure 2: Survival by Health Measures

(a) Mental Difficulty, Males

(b) Mental Difficulty, Females

(c) General Health, Males

(d) General Health, Females

(e) BMI, Males

(f) BMI, Females

Notes:

(a) Health measures refer to mental health, general health, and body mass index (BMI). Mental difficulty indicates whether or not the subject experienced any mental difficulty over the years 1950–1960. General health is an index constructed from various self-reported health measures including “energy level”, “vitality”, and “physical health”. It indicates whether the subject experienced poor or fair health over the years 1940–1960. Lastly, BMI indicates whether or not the subject had abnormal BMI in 1940, where abnormal means underweight or overweight. Overweight refers to subjects who had a BMI above 25. Underweight subjects had a BMI below 18.5. Survival graphs are based on life-table calculations, standard errors above and below are represented by the thinner lines. Survival curves are conditional on survival to an age by which we know the answer to the health measure in question.
Figure 4: Survival by Age 50 Earnings, Non-discounted

(a) Above Median, Males

(b) Above Median, Females

Notes:
“High wage” refers to earnings above the median, “low wage” refers to earnings at or below the median. For females, the median wage is zero. Survival by earnings quintiles are also presented. Survival graphs are based on lifetable calculations, standard errors above and below are represented by the thinner lines. Survival curves are conditional on survival to an age by which we have the earnings observation in question.
**Figure 3:** Survival by Lifestyle Choices - Social and Family

(a) Group Membership, Males

(b) Group Membership, Females

(c) Ever Divorced, Males

(d) Ever Divorced, Females

**Notes:**

(a) Lifestyle choices refer to group membership in 1950 and marriage status. ‘High’ membership refers to subjects having a greater number of organization memberships than the median. ‘Low’ membership refers to subjects at or below the median number of organization memberships. “Ever divorced” indicates whether the subject was divorced at least once. Survival graphs are based on lifetable calculations, standard errors above and below are represented by the thinner lines. Survival curves are conditional on survival to an age by which we know the answer to the lifestyle choice in question.
Table 6: Personality Skills Factor Structure

<table>
<thead>
<tr>
<th>Openness</th>
<th>Conscientiousness</th>
<th>Extraversion</th>
<th>Agreeableness</th>
<th>Neuroticism</th>
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<tbody>
<tr>
<td>Desire to know</td>
<td>Prudence</td>
<td>Fondness for large groups</td>
<td>Easy to get along</td>
<td>Miserable</td>
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<tr>
<td>Originality</td>
<td>Conscientiousness</td>
<td>Leadership</td>
<td>Avoid arguments</td>
<td>Touchy</td>
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<tr>
<td>Intelligence</td>
<td>Truthfulness</td>
<td>Popularity</td>
<td>Critical</td>
<td>Periods of Loneliness</td>
</tr>
<tr>
<td>Prudence</td>
<td>Desire to know</td>
<td>Truthfulness</td>
<td>Tactful</td>
<td>Lonely when with others</td>
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<tr>
<td>Leadership</td>
<td>Popularity</td>
<td>Desire to Know</td>
<td>Unfeeling</td>
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<tr>
<td>Popularity</td>
<td>Fondness for large groups</td>
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<td>Domineering</td>
<td>Lack self confidence</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Inflated self-opinion</td>
<td>Worry about humiliation</td>
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<td></td>
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<td></td>
<td>Lack self confidence</td>
<td>Emotionally unstable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Worry about humiliation</td>
<td>Easily hurt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Easily hurt</td>
<td>Hard to be serene</td>
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<td>Moody</td>
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Notes: Personality measures in bold are strongly associated with the corresponding personality skill, and measures not in bold weakly relate to the corresponding personality skill. Factor structure is determined by theoretical considerations and empirical EFA.
## Drinking

### Males

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<td>1940 - 1960 Ever Drank Heavily</td>
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<td>.061 **</td>
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<td>-.109 **</td>
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<tr>
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<td>.044</td>
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### Females

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# Overweight, Exercise, Smoking

### Table 8: Health-Related Outcomes, Females

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<td>1982 Physical Activity, Freq.</td>
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<td></td>
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<td>-.066 **</td>
<td></td>
<td>.108 *</td>
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<td>1991 Ever Smoked</td>
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<td>-.107 **</td>
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### Table 7: Physical Health Outcomes, Males

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## Mental Health

### Table 8: Health-Related Outcomes, Females

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### Table 7: Summary of Effects on Health-Related Outcomes, Males

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## General Health

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<td>1940 General Health</td>
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<td>-.279 ***</td>
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<td>.135 **</td>
<td>-.152 **</td>
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### Earnings

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# Social Capital

## Summary

### Males

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### Females

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<th>N</th>
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*Statistical significance represented by stars, where ∗ ∗ ∗ indicates p < 0.01, 0.05, 0.10 respectively.*
# Marital Status

## Males

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<td>.050 ***</td>
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## Females

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## Alternative Stepdown Blocks

### Males

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<th>A</th>
<th>N</th>
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Some comments on the results

- Complementarities/substitutabilities
Some comments on the results

- Complementarities/substitutabilities
  - Among the traits
Some comments on the results

- Complementarities/substitutabilities
  - Among the traits
  - Between the traits and education
Some comments on the results

- Complementarities/substitutabilities
  - Among the traits
  - Between the traits and education
- How much does measurement error in the traits matter?
Some comments on the results

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  - Between the traits and education
- How much does measurement error in the traits matter?
- How misleading is it not to account for multiple hypothesis testing?
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- Lots of emphasis on statistical significance: what about public health significance?
Some comments on the results

- Complementarities/substitutabilities
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  - Between the traits and education
- How much does measurement error in the traits matter?
- How misleading is it not to account for multiple hypothesis testing?
- Lots of emphasis on statistical significance: what about public health significance?
- Which interventions are able to shift Conscientiousness and Neuroticism (by 1SD)? How much would those cost?
Conclusions

Nice paper which uses a high-ability sample to examine the relationship between personality, education and health-related outcomes.
Conclusions

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- Useful attempt to understand the mechanisms and pathways through which different investments over the lifecourse affect health.
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- Could be more developed in more than one direction:
Conclusions

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- Could be more developed in more than one direction:
  - exploit the richness of the data;
Conclusions

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  - disentangle the mechanisms implied by the model;
Conclusions

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  - disentangle the mediating role of education and healthy behaviors;
Conclusions

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- Could be more developed in more than one direction:
  - exploit the richness of the data;
  - disentangle the mechanisms implied by the model;
  - disentangle the mediating role of education and healthy behaviors;
  - understand why there are gender differences.


Figure 5: Coefficient of Determination ($R^2$) Comparison

(a) Females

(b) Males

Notes: Calculations are based on the Terman data. For each health-related outcome, $R^2$ is reported for the full model, the model based on only personality skills, and the model omitting personality skills. Due to correlations between latent personality skills and observable regressors the $R^2$ for the full model can be somewhat smaller than the sum of $R^2$ for the partial models.