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

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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.

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▶ <u>Style</u>: (too) many remainders to Savelyev + 30 (!) keywords

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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[a]

Trait	Definition
1. Openness to Experience (Intellect)	The breadth, depth, originality, and complexity of individual's mental and experimental life
2. Conscientiousness	A propensity to follow socially prescribed norms for impulse control, to be task- and goal- directed, to be planfull, to delay gratification, and to follow norms and rules
3. Extraversion	An energetic approach to the social and material world, which includes traits such as sociability, activity, assertiveness, and positive emotionality
4. Agreeableness	A prosocial and communal orientation towards others (as opposed to antagonism), which includs traits such altruism, tender-mindedness, trust, and modesty
5. Neuroticism (Emotional Stability)	An emotional stability and even-temperedness as opposed to negative emotionality, such as feeling anxious, nervous, sad, and tense

Notes: [a]Description taken from John and Srivastava (1999).

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   - ▶ Key is to understand the mechanisms.

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- Sample selection criteria (e.g. high school dropout are excluded) leave 70% of men and 79% of women.
  - How does the final sample differ from the original one?

Outcome	Year	Mean F	Mean M
Ever drank heavily	1940-1960	0.205	0.394
Physical activity, freq.	1982	0.173	0.176
Ever poor/fair mental well-being	1940-1960	0.463	0.415
Ever poor/fair general health	1940-1960	0.127	0.074
Abnormal BMI	1940	0.160	0.225
Ever divorced	1922-1986	0.253	0.267
# of organizations	1950	1.565	2.714
Wages at age 50	1955-1967	16.083	71.503

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▶ 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:

$$u_1(C_1^N, C_1^H, H_1) + B(\boldsymbol{\theta}) \cdot S(H_2) \cdot u_2(C_2^N, C_2^H, H_2, C_1^H),$$

▶ Health production:

$$H_2 = f(I, D, \boldsymbol{\theta}) + (1 - \delta(C_1^H)H_1),$$

▶ Budget constraint:

$$C_1^N + p^H C_1^H + g(D, H_1, \boldsymbol{\theta}) + p^I I + \frac{S(H_2)}{1+r}(C_2^N + p^H C_2^H) =$$
$$A + Y_1(H_1, \boldsymbol{\theta}) + \frac{S(H_2)}{1+r}Y_2(D, H_2, \boldsymbol{\theta}).$$

▶ FOC wrt health-related consumption:

$$\underbrace{\frac{\partial u_1}{\partial C_1^H}}_{\text{cons. benefit}} \underbrace{-B(\boldsymbol{\theta})S'(H_2)\delta'(C_1^H)H_1 u_2}_{\text{longevity benefit}} \underbrace{-B(\boldsymbol{\theta})S(H_2)\frac{\partial u_2}{\partial H_2}\delta'(C_1^H)H_1}_{\text{morbidity benefit}}$$

$$+ \underbrace{B(\boldsymbol{\theta})S(H_2)\frac{\partial u_2}{\partial C_1^H}}_{\text{addiction benefit}} + \lambda \underbrace{\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial H_2}\delta'(C_1^H)H_1}_{\text{health productivity}}$$

$$= \lambda(\underbrace{p^H}_{\text{price}} + \underbrace{\frac{S'(H_2)\delta'(C_1^H)H_1}{1+r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \boldsymbol{\theta})))}_{\text{budget deficit}}.$$

▶ FOC wrt health investment (why the difference?):

$$\underbrace{B(\boldsymbol{\theta})S'(H_2)\frac{\partial f}{\partial I}u_2}_{\text{longevity benefit}} + \underbrace{B(\boldsymbol{\theta})S(H_2)\frac{\partial u_2}{\partial H_2}\frac{\partial f}{\partial I}}_{\text{morbidity benefit}} + \lambda\underbrace{\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial H_2}\frac{\partial f}{\partial I}}_{\text{health productivity}}$$

$$= \lambda(\underbrace{p^I}_{\text{price}} + \underbrace{\frac{S'(H_2)\partial f/\partial I}{1+r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \boldsymbol{\theta}))}_{\text{budget deficit}}).$$

▶ FOC for education:

$$\underbrace{B(\boldsymbol{\theta})S'(H_2)\frac{\partial f}{\partial D}u_2}_{\text{longevity benefit}} + \underbrace{-B(\boldsymbol{\theta})S(H_2)\frac{\partial u_2}{\partial H_2}\frac{\partial f}{\partial D}}_{\text{morbidity benefit}} + \lambda\underbrace{\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial D}}_{\text{skill productivity}} + \lambda\underbrace{\frac{S(H_2)}{1+r}\frac{\partial Y_2}{\partial H_2}\frac{\partial f}{\partial D}}_{\text{health productivity}}$$

$$= \lambda(\underbrace{\frac{\partial g(D, H_1, \boldsymbol{\theta})}{\partial D}}_{\text{direct cost}} + \underbrace{\frac{S'(H_2)\partial f/\partial D}{1+r}(C_2^N + p^H C_2^H - Y_2(D, H_2, \boldsymbol{\theta}))}_{\text{budget deficit}}))$$

▶ Strengthen the link between theory and empirics.

Econometric model

▶ Linear model for health-related outcomes:

$$h^k = \gamma^k D + \boldsymbol{\rho}^k \boldsymbol{\theta} + \boldsymbol{\mu}^k \boldsymbol{X} + \epsilon^k,$$

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

$$
\begin{aligned}
M^1 &= \alpha_1 + \beta_1 \boldsymbol{\theta} + \gamma_1 A + \boldsymbol{\delta}_1 \boldsymbol{X} + \eta_1 \\
&\vdots \\
M^j &= \alpha_j + \beta_j \boldsymbol{\theta} + \gamma_j A + \boldsymbol{\delta}_j \boldsymbol{X} + \eta_j \\
&\vdots \\
M^J &= \alpha_J + \beta_J \boldsymbol{\theta} + \gamma_J A + \boldsymbol{\delta}_J \boldsymbol{X} + \eta_J,
\end{aligned}
$$

▶ 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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▶ Why not searching for a latent structure underlying *all* measurements?

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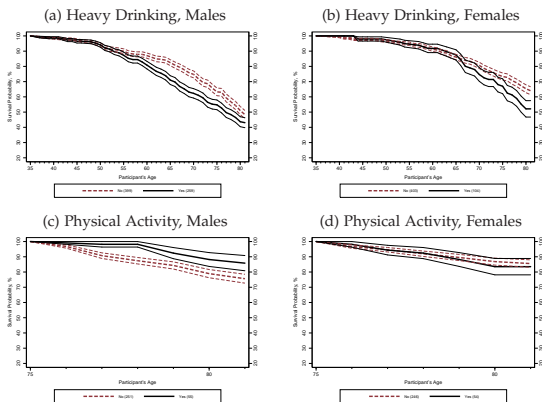▶ Mediating role of education (rather than estimating models with only and without personality).

    ▶ Also: goodness-of-fit measures in binary choice models (e.g. Windmeijer, *ER* 1995)

Results

Figure 1: Survival by Health Behaviors[a]

(a) Heavy Drinking, Males

(b) Heavy Drinking, Females

(c) Physical Activity, Males

(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]
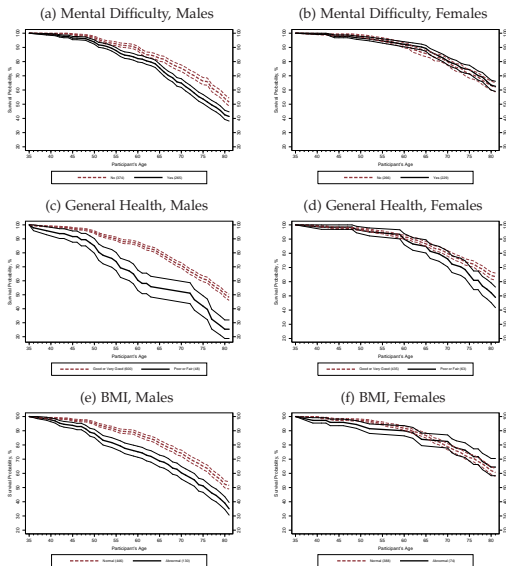
Figure 4: Survival by Age 50 Earnings, Non-discounted

(a) Above Median, Males

(b) Above Median, Females
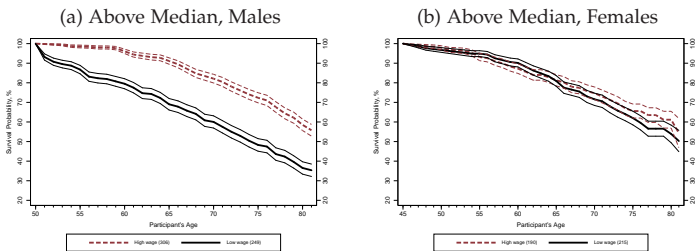
Figure 3: Survival by Lifestyle Choices - Social and Family
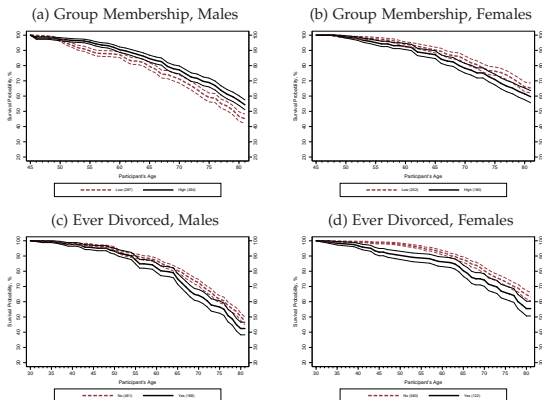
Notes: [a]Lifestyle choices refer to group membership in 1950 and marriage status. 'High' membership refers to subjects having a greater number of organization memberships than the median. 'Low' membership refers to subjects at or below the median number of organization memberships. "Ever divorced" indicates 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

Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Desire to know	**Prudence**	**Fondness for large groups**	**Easy to get along**	**Miserable**
Originality	**Conscientiousness**	**Leadership**	**Avoid arguments**	**Touchy**
Intelligence	**Truthfulness**	**Popularity**	**Critical**	**Periods of Loneliness**
Prudence	Desire to know	Truthfulness	**Tactful**	**Lonely when with others**
Leadership	Popularity	Desire to Know	**Unfeeling**	**Remorseful**
Popularity	Fondness for large groups		**Domineering**	**Lack self confidence**
			Inflated self-opinion	**Worry about humiliation**
			Lack self confidence	**Emotionally unstable**
			Worry about humiliation	**Easily hurt**
			Easily hurt	**Hard to be serene**
			Hard to be serene	**Moody**
			Sensitive	**Sensitive**
			Conscientiousness	Easy to get along
				Critical

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

	C	O	E	A	N	IQ	Edu
Males							
1940 - 1960 Ever Drank Heavily	-.055 **		.061 **				-.109 **
1940 Heavy Drinking	-.046 *		.044			.057 **	-.086
1950 Heavy Drinking			.040 **		.039 *		-.090 **
1960 Heavy Drinking	-.072 **	.056	.044 *				-.077

	C	O	E	A	N	IQ	Edu
Females							
1940 - 1960 Ever Drank Heavily		-.073 **	.054 *				
1940 Heavy Drinking				-.041 *			
1950 Heavy Drinking							
1960 Heavy Drinking		-.060 *	.049				

Overweight, Exercise, Smoking

	Males						
	C	O	E	A	N	IQ	Edu
1940 Overweight				-.034		-.023	
1982 Physical Activity, Freq.		-.044 *			-.066 **		.108 *
1991 Ever Smoked	-.107 **						

	Females						
	C	O	E	A	N	IQ	Edu
1940 Overweight					-.037 *		-.074 *
1982 Physical Activity, Freq.							
1991 Ever Smoked							

Mental Health

	Males						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
Mental Health (MH)							
Ever Poor/Fair MH	-.071 ***	.085 ***	-.051 *		.134 ***		
1940 Mental Difficulty	-.078 ***	.086 ***	-.077 ***		.120 ***		
1950 Mental Difficulty	-.040 *				.111 ***		
1960 Menatl Difficulty	-.080 ***	.091 ***	-.101 ***		.120 ***		

	Females						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
Mental Health (MH)							
Ever Poor/Fair MH					.152 ***		
1940 Mental Difficulty					.137 ***		
1950 Mental Difficulty					.134 ***		
1960 Menatl Difficulty					.123 ***		

General Health

	Males						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
General Health (GH)							
Never Poor/Fair GH		-.032 *			-.021		
1940 General Health					-.279 ***		
1950 General Health	.135 **	-.152 **	.096		-.242 ***		
1960 General Health					-.211 ***		

	Females						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
General Health (GH)							
Never Poor/Fair GH					-.044 ***		.116 ***
1940 General Health				-.133 *	-.318 ***		.283 **
1950 General Health				-.094	-.267 ***		.172
1960 General Health					-.241 ***		

Earnings

	C	O	E	A	N	IQ	Edu
Males							

	C	O	E	A	N	IQ	Edu
Earnings							
Lifetime earnings, 3%			79.908 **	-94.713 **		44.431	44.431 ***
Earnings at age 40				-6.556 ***		3.280	3.280 ***
Earnings at age 50			4.122	-6.787 **	-6.553 **	4.758 *	4.758 ***
Earnings at age 60			5.814 *		-7.466 **		

	C	O	E	A	N	IQ	Edu
Females							

	C	O	E	A	N	IQ	Edu
Earnings							
Lifetime earnings, 3%							
Earnings at age 40							3.946 *
Earnings at age 50							
Earnings at age 60					-4.650		

Social Capital

	Males						
	C	O	E	A	N	IQ	Edu
1940 - 1960 Any Organization							
1940 Number of Organizations						-.175 *	-.175
1950 Number of Organizations				.258 *			
1960 Number of Organizations						.327 **	.327 ***

	Females						
	C	O	E	A	N	IQ	Edu
1940 - 1960 Any Organization							.066 **
1940 Number of Organizations							.789 ***
1950 Number of Organizations							.877 ***
1960 Number of Organizations						-.352 **	1.213 ***

Marital Status

	Males						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
Never Married	.023				.024		
Married Once and Still Married	.056 *						.120 **
Ended up Divorced	-.023 *	.050 ***			.024		
Ever Divorced	-.055 *						-.137 **
Divorced at least Twice	-.044 **	.031 *			.025		

	Females						
	C	**O**	**E**	**A**	**N**	**IQ**	**Edu**
Never Married							.074 ***
Married Once and Still Married							.129 *
Ended up Divorced							
Ever Divorced							-.111 **
Divorced at least Twice							-.054 *

Alternative Stepdown Blocks

| | **Males** | | | | | | |
	C	O	E	A	N	IQ	Edu
Lifecycle Outcomes and Proxies							
1940 - 1960 Ever Drank Heavily	-.055						-.109 *
1940 Overweight							
1982 Physical Activity, Freq.					-.066 *		
1991 Ever Smoked	-.107 **						
1940 - 1960 Any Organization							.084 ***
Ever Divorced	-.055						-.137 ***
Lifetime earnings, 3%			79.908 *	-94.713 *			209.191 ***
Ever Poor/Fair MH	-.071 *	.085 ***			.134 ***		
Never Poor/Fair GH							

| | **Females** | | | | | | |
	C	O	E	A	N	IQ	Edu
Lifecycle Outcomes and Proxies							
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1991 Ever Smoked							
1940 - 1960 Any Organization							
Ever Divorced							-.111
Lifetime earnings, 3%							
Ever Poor/Fair MH					.152 ***		
Never Poor/Fair GH					-.044		.116 **

Some comments on the results

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- ▶ 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?

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  ▶ understand why there are gender differences.

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

(a) Females

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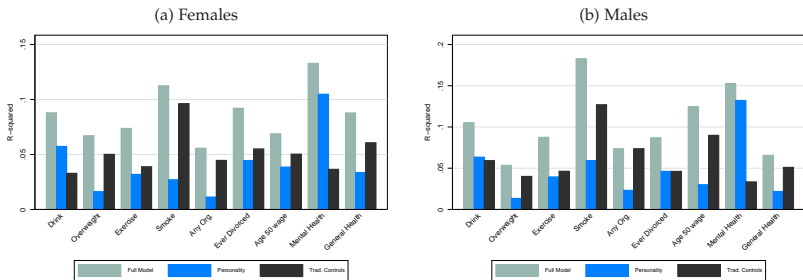
Notes: Calculations are based on the Terman data. For each helath-related outcome, R^2 is reported for the full model, the model based on only personality skills, and the model omitting personality skills. Due to correlations between latent personality skills and observable regressors the R^2 for the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