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Time-preference, Non-cognitive Skills and Well-being across the Life Course: Do Non-cognitive Skills Encourage Healthy Behavior?

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A number of prominent diseases are influenced by health behaviors. For example, it is well-known that the decision to smoke comes with considerable risks of developing smoking-related ailments such as lung cancer, emphysema, and heart disease. Obesity is another health condition that can be costly. It is associated with increased risk for diseases such as coronary heart disease and diabetes (Centers for Disease Control 2009). Nationally, it is estimated that about one-third of the U.S. population is obese, and estimates suggest that obesity costs society anywhere from $27 to $47 billion in health care expenditures annually (Centers for Disease Control 2009, National Center for Health Statistics 2008). Research suggests that changing individuals' diets and getting them to exercise would help to reduce the prevalence of obesity in society (Melayne McInnes and Judith Shinogle, 2009).

Smoking and obesity provide just two examples of cases in which the nation's burden of disease is influence by behaviors that its citizens engage in. Because the United States spends a large share of GDP on health care each year, understanding the determinants of health behaviors is important, as it may allow scholars to identify ways to reduce these costs. This paper examines the relationship between individuals' health behaviors and the "non-cognitive" skills that individuals possess. In the past decade the economics discipline has seen a burst of interest in human capabilities that contribute to labor market productivity beyond the usual foci of attention—levels of education and learning by doing. The collection of personality traits, soft-skills, incentive-enhancing preferences, and socio-emotional factors that economists are now studying has been loosely grouped together under the heading "non-cognitive" skills.1 While the term may be something of a misnomer because many of the worker attributes that the authors writing in this subfield are interested in require reasoning or cognition, the skills of interest have been found to be important

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[1]See Bowles, Gintis and Osborne (2001), Heckman (2007) and Farkas (2003) for types of non-cognitive skills and further discussion of this terminology. Examples of non-cognitive skills that have been provided in the literature include: personal efficacy, time-preference or orientation toward future, self-esteem, locus of control, level of application, ability to pay attention, ability to work with others, organizational skills, self-regulation, motivation, adventurousness, self-control, and conscientiousness.

determinants of labor market success (James Heckman, Jora Stixrud, and Sergio Urzua 2006; Samuel Bowles, Herbert Gintis, and Melissa Osborne 2001).2James Heckman (2007) has stated that these socio-emotional attributes--as non-cognitive skills are sometimes called--are also likely to affect health behaviors. This paper tests this hypothesis. It provides a theoretical and an empirical analysis of the connection between socio-emotional attributes and the choices that individuals make about health. It uses data from a large, nationally representative dataset to analyze the relationships.

I. Theoretical analysis

We start with the model of Michael Grossman (1972, 2000) and modify it to analyze ways that socio-emotional attributes could affect health. The Grossman model is a multi-period model that demonstrates how changes in health affect individual well-being. In the model health affects utility directly and also has implications for individuals' earnings because it determines the amount of healthy time that an individual has available to devote to the labor market. An individual's health status at any point in time is determined by his initial stock of health capital, depreciation, and investments to health that the individual makes through a household production process that combines market-purchased inputs such as medical care with time spent within the household producing health. The Grossman model specifies a role for cognitive skills via its analysis of the effect of education on health. We argue that the claims made about education levels are applicable to non-cognitive skills as well. Socio-emotional attributes may raise the efficiency of household production just as education does in the standard Grossman model.

Let increases in the health stock be generated according to the following household production function:

$$I_t=I_t(M_t,TH_t;E_t,S_t). \quad (1)$$

I represents gross investment, M the amount of medical care the household purchases, TH the amount of time the household devotes to the production of health, and E represents education and is taken to be exogenous in the model. In addition to these variables, which are each present in Grossman (2000), we use S to represent socio-emotional attributes that are relevant for the production of health.

Household production of health affects the stock of health capital (H) as follows:

$$H_{t+1}=H_t-\delta_t H_t+I_t \quad (2)$$

where δ gives the depreciation rate of the health capital stock.

Individuals choose optimal H, along with desired levels of the other choice variables by maximizing lifetime utility,

[2]Heckman (2007) uses the term "socio-emotional skills" interchangeably with "non-cognitive" skills.

$$\text{Lifetime utility}=U_0(h_0,Z_0)+\beta U_1(h_1,Z_1)+\beta^2 U_2(h_2,Z_2)+\ldots..\beta^n U_n(h_n,Z_n) \quad (3)$$

where "*h*" represents the service flow from the health stock, i.e. $h_t = \acute{\emptyset}_t H_t$, and Z is a consumption good.[3] While Grossman's original formulation of the model did not explicitly include discounting, our modified version of the model introduces a discount factor β because allowing individuals to discount the future provides a way of capturing the effect that future-orientation has on health behavior; and, as noted earlier, the literature covering non-cognitive skills identifies being future-oriented as an example of a non-cognitive skill.

As in Grossman (2000) households maximize utility subject to a time constraint and a budget constraint.

$$TH_t+TW_t=\Omega - TL_t \quad (4)$$

and

$$\sum_0^n\left(\frac{P^z Z_t+P^m M_t}{(1+r)^t}\right)=\sum_0^n\frac{TW_t w_t}{(1+r)^t} \quad (5)$$

Equation (4) indicates that time spent working in the labor market (*TW*) and time spent in the household production of health (*TH*) are constrained by the amount of time an individual has available, which is equal to the individual's time endowment (Ω) minus the amount of time that the individual is sick ("*TL*"). *TL* is influenced by health: $\partial TL_t/\partial H_t < 0$. Equation (5) stipulates that the sum of expenditures cannot exceed total earnings from the labor market. P^z gives the price of the consumption good Z, and P^m represents the price of medical inputs (M). The variable "w" denotes the market wage, and "r" denotes the market interest rate.

In addition to incorporating a new term in the household production function and introducing a discount factor into the specification of the utility function, our modified model makes one additional change to the Grossman framework. We modify it to allow the possibility that consumption of certain goods may have adversely affect health. This allows us to analyze adverse health behaviors such as smoking or drinking. Let $\partial_t = \partial_t(Z_t)$ where $\partial\delta_t/\partial Z_t > 0$. This allows consumption goods that are bad for one's health, such as cigarettes or alcohol, to contribute to deterioration of the health capital stock.

The Lagrangean for the individual's optimization exercise can be written as,

[3] $\acute{\emptyset}$ is the service flow per unit of stock and is assumed to be constant in the Grossman model.

$$L=[\sum_{0}^{n}B^{t}u_{t}(h_{t},Z_{t})]+\lambda[A_{0}+\frac{\sum w_{t}\Omega}{(1+r)^{t}}-\frac{\sum w_{t}TH_{t}}{(1+r)^{t}}-\frac{\sum w_{t}TL_{t}}{(1+r)^{t}}-\frac{\sum P^{m}M_{t}+P^{z}Z_{t}}{(1+r)^{t}}] \quad (6)$$

Maximizing (6) with respect to *TH, Z, H* and *M* yields a series of first order conditions. These can be used to draw insights about the effects that non-cognitive skills have on health behavior.

II. Empirical research

This paper's empirical research analyzes data from the Panel Study of Income Dynamics (PSID) to ascertain the relationship between a number of different socio-emotional attributes and drinking and exercising.4 Our dataset consists of individuals who were household heads in 1972.5 The health behaviors that we analyze are measured at a number of different points in time, however. For instances in which a health behavior is measured in a year other than 1972, we impose a restriction requiring the individual to be head of household in both years under observation.6 Alcohol consumption represents an example of an instance in which an individual chooses a *Z* variable that raises his health stock depreciation rate. Exercising provides an example of a way that health can be produced in the household; it therefore serves as our measure of the use of *TH* to generate improvements in the health capital stock. Data on drinking were collected in the 1968 and 1972 waves. Information about exercising is available in 1986 and 1999.7 Due to space limitations we report results for only one year for each variable.8

The non-cognitive skills that we analyze in this paper are the degree to which an individual is future-oriented, and self-efficacy. There is already limited research linking each of these personality dispositions to specific disease outcomes, although most of this literature relies on small samples. Because our two traits of interest are unlikely to represent biological causes of disease, we argue that their effect would obtain through the behaviors that individuals engage in.

What do we see in terms of evidence for or against the proposition that non-cognitive skills have an effect on health behavior if we use data from the PSID? We estimate an equation from the modified Grossman model for each dependent variable in order to test the model's predictions that the choice of *Z* and *TH* will be influenced by the exogenous variables of the

[4]For a description of the PSID see http://psidonline.isr.umich.edu/

[5]The PSID asked its questions about socio-emotional attributes in its early waves only (from 1968–1972). In these early years, most of the PSID's questions were asked solely of household heads. Accordingly, the data for our socio-emotional attributes are not available for wives. We focus on individuals present in 1972 because that is the year from which our self-efficacy measure is obtained. The measure of future-orientation comes from a question that the PSID asked about the length of the individual's time horizon, and our self-efficacy variable corresponds to the self-efficacy index in the 1972 PSID. As noted in the psychology literature, self-efficacy refers to the evaluation of one's ability to be effective performing tasks that are necessary to realize an outcome.

[6]Detailed information about the number of samples this produces and the characteristics of each sample are available from the author upon request.

[7]With the exception of the socio-emotional attributes, all variables used in the regressions are measured in the same year as the dependent variable.

[8]Results for other years were qualitatively similar in most instances and are available from the author upon request.

system: the price of medical inputs (P^m), the individual's level of education (E), the current wage, expected future earnings, and non-cognitive skills.9 The basic regression equation is,

$$y_i = b_0 + b_1\, current\ wage_i + b_2\, future\ earnings_i + b_3\, P^m{}_i + b_4\, E_i + b_5\, future-orientation_i + b_6\, self-efficacy_i + \varepsilon_i \quad (7)$$

where "y" represents a health behavior, and i indexes individuals. All regressions were estimated using logistic regressions. Table 1 reports the estimated coefficients, standard errors and odds ratios. All data are weighted using the PSID's statistical weights.

As shown in the table, the current wage is positively associated with drinking. This is consistent with an income effect. As predicted by the Grossman model, the sign for the future earnings term is negative.10 A rise in future earnings reduces the odds of engaging in unhealthy behavior because future earnings represent a cost of consuming consumption goods that are bad for one's health (because they lower the future health stock, subsequently increasing sick days and time lost at work in future periods). We use health insurance as a proxy for P^m in our regressions because an individual with health insurance will have lower out-of-pocket costs for medical care than an individual with no health insurance. The positive sign for the coefficient on the health insurance variable is consistent with the modified Grossman model, which predicts that one would expect a rise in unhealthy behaviors as the price of medical care falls, but the variable is not statistically significant. Contrarily, our future-oriented variable is statistically significant and it is negatively associated with drinking, as expected. An increase in β raises the marginal benefit from investment (I) and the marginal efficiency of the health capital stock, causing the individual to choose higher levels of H and I. The results in Table 1 indicate that individuals who are future-oriented have about a 7 percent lower odds of drinking than individuals who are not. Self-efficacy is also negatively associated with drinking.

For exercising, the coefficient for future earnings is positive and statistically significant. A rise in future earnings represents a payoff to producing health because production of health yields a higher stock of H and more time available in the future to spend in the labor market earning income as a result. The coefficient for the health insurance variable is negative, suggesting that exercise is negatively associated with having health insurance. This is consistent with the model's prediction that a fall in the price of medical care can induce individuals to devote less time to exercising. It represents a standard substitution effect in production: If the cost of one input rises, one expects a shift into the second input. We also

9We ignore P^Z in the regressions because the price of a consumption good should not vary across individuals.

10The Grossman framework predicts a relationship between health behavior and expected future earnings. Because the PSID does not contain a direct measure of individuals' expectations about their earnings, we use a measure constructed from the occupation that the individual works in instead. Specifically, we combine the PSID's information about the respondent's occupation with data about average wages in different occupations taken from the Bureau of Labor Statistics, and we use the average earnings for each individual's occupation as a proxy for her expected future earnings. This allows us to capture variation across occupations in the earnings an individual can reasonably expect. For example, individuals in occupations with steep earnings profiles will have different expectations about future wages than those who are in occupations where wages do not rise much over the life cycle.

find that being future-oriented is positively associated with exercise. Future-oriented individuals have a higher odds of exercising than individuals who are not future-oriented (17 percent greater). Finally, self-efficacy is associated with a greater odds of exercising. This is consistent with the hypothesis that having well-developed non-cognitive skills could have effects that are similar to education. A rise in self-efficacy may increase the marginal productivity of TH if efficacious individuals are better at using time to produce health than non-efficacious individuals are. This would cause the optimal TH to rise.

III. Conclusion

Because the financial costs to society of treating disease can be daunting, it is important for researchers and policymakers to understand the determinants of health behaviors. The economics literature recently has begun to address the relationship between socio-emotional attributes and economic well-being across the life course. Much has been done to examine the way that non-cognitive skills are produced and the effects that they have on labor market outcomes. Less has been done within economics to assess their likely effects on health. This paper finds that these skills are positively associated with good health behaviors and negatively associated with bad behavior. These results are early results. Future research is needed to investigate the possibility that our results are affected by unobserved heterogeneity.

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Table 1

Testing the modified Grossman model

	Drinking (yes/no)	Exercising (yes/no)
current wage	0.0317*** [0.00538] OR=1.032	0.00892*** [0.00107] OR=1.009
future earnings	−0.00004** [0.000012] OR=1.00	0.000455*** [0.000110] OR=1.00
health insurance	0.0600 [0.0502] OR=1.062	−0.6642*** [0.1208] OR=0.516
education	0.0312** [0.00975] OR=1.032	0.0545*** [0.00822] OR=1.056
future-orientation	−0.0709*** [0.0144] OR=0.932	0.1574*** [0.0179] OR=1.17
self-efficacy	−0.2063*** [0.00997] OR=0.814	0.0685** [0.0131] OR=1.071
Likelihood ratio χ^2	513 (df = 6)	469 (df = 6)
pr > Chi-squ	.0001	.0001
N	2911	525

Notes: (1)

*** Significant at the 1 percent level;

** Significant at the 5 percent level;

* Significant at the 10 percent level. (2) All regressions include a constant. (3) Standard errors in parenthesis. (4) “OR” denotes the odds ratio. (5) The above results are for drinking measured in 1972 and exercise measured by the PSID’s heavy physical activity question in 1999.