Web Appendix
The Relevance of Personality Psychology for Economics

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This appendix supports material in main text of the paper. We organize it by section. Amanda Agan and Pietro Biroli contributed to Appendix A7 on crime and health, respectively.

Contents

A1. **Introduction**

Section Contents

Table A1. Validities from the National Longitudinal Survey of Youth, 1979 by Gender

NLSY79 Partial Correlation Table (tests and school performance)
controlling for family background measures listed at the base of the table

	Males			Females		
Outcomes	IQ	GPA (10th grade)	AFQT	IQ	GPA (10th grade)	AFQT
Hourly Wage Age 25	0.13***	0.13***	0.18***	0.07**	0.17***	0.19***
Hours Worked Age 25	0.02	-0.02	0.03*	0.11***	0.16***	0.21***
Wage Income Age 25	0.15***	0.13***	0.19***	0.14***	0.22***	0.28***
Weeks Worked Age 25	0.04	0.01	0.05***	0.12***	0.17***	0.21***
Weeks Unemployed Age 25	-0.11***	-0.07***	-0.11***	-0.06**	-0.08***	-0.06***
Weeks Out of Labor Force Age 25	0.02	0.04**	0.03*	-0.10***	-0.14***	-0.20***
Total Jobs by Age 25	-0.01	-0.11***	-0.01	0.03	-0.03**	0.11***
Num. of Spouses/Partners by Age 25	-0.05*	-0.09***	-0.06***	-0.05	-0.11***	-0.09***
Any Welfare Age 25	-0.06**	-0.09***	-0.14***	-0.11***	-0.16***	-0.20***
Hourly Wage Age 35	0.00	0.03*	0.03*	0.07**	0.09***	0.14***
Hours Worked Age 35	0.03	0.11***	0.12***	0.07*	0.10***	0.16***
Wage Income Age 35	0.14***	0.17***	0.21***	0.06**	0.14***	0.21***
Weeks Worked Age 35	0.03	0.13***	0.15***	0.12***	0.12***	0.17***
Weeks Unemployed Age 35	-0.08**	-0.10***	-0.09***	-0.12***	-0.07***	-0.08***
Weeks Out of Labor Force Age 35	-0.02	-0.11***	-0.15***	-0.06	-0.12***	-0.15***
Total Jobs by Age 35	-0.05	-0.15***	-0.06***	-0.02	-0.08***	0.07***
Num. of Spouses/Partners by Age 35	-0.04	-0.11***	-0.03*	-0.01	-0.12***	-0.08***
Any Welfare Age 35	-0.02	-0.10***	-0.16***	-0.08**	-0.16***	-0.19***

Notes: AFQT was administered in 1979. IQ is a percentile score obtained by equating IQ across different IQ tests from NLSY79 transcript data following the procedure in Borghans, Golsteyn, Heckman et al. [2010]. Tenth grade GPA is reported because after this grade attrition losses are substantial. (* $p<0.10$, ** $p<0.05$, *** $p<0.01$)
Source: National Longitudinal Survey of Youth 1979 (NLSY79). These estimates are taken from Heckman and Humphries [2010].

A2. **Personality and Personality Traits: Definitions and a Brief History of Personality**

Section Contents

(There is no appendix material for this section.)

A3. **An Economic Framework of Personality**

Section Contents

This section discusses alternative economic models of personality from those introduce in Section 3 of the text. We draw on the research of Borghans, Duckworth, Heckman et al. [2008]. We use their notation to facilitate comparison with their paper. As noted in Section 6 of this paper, preference anomalies have attracted a lot of attention in the recent literature in behavioral economics.[1] However, choice is generated by preferences, expectations, and constraints, and psychology has something to say about each of these aspects of agent decision making.

We show how psychological variables, which define capacities and constraints, can enter standard choice models. Some traits can be enhanced through investment and experience. Traits may be divisible so that more of a trait used in one activity may reduce the supply of traits to other activities. Some traits may be public goods, available at the same level to all tasks. We create a taxonomy of traits to motivate future research on the economics of personality.

Bowles and Gintis [1976], Mueser [1979], Bowles, Gintis and Osborne [2001], Hartog [2001], and Mueller and Plug [2006]) consider how specific traits affect earnings capacities. Our discussion is more comprehensive than theirs because we consider how traits affect performance in many distinct areas of economic and social life. We also speculate about the relationship of the Big Five personality factors to conventional economic preference parameters. As yet, no tight link has been established. Cognition and personality likely both affect conventional preference parameters. Despite a hundred years of intelligence testing, IQ remains to be systematically integrated into economic theory apart from its direct effect on earnings.

A3.A. Psychological Variables as Constraints

Capacities may be physical (beauty and strength, for example), cognitive (abstract reasoning) and those related to personality. Capacities determine, for example, how effectively

[1] See Camerer and Loewenstein [2004] for a good introduction to behavioral economics and the papers in Camerer, Loewenstein and Rabin [2004]. Fudenberg [2006] presents a critical review of the literature.

persons process information, cope with uncertainty, adjust to setbacks, envision counterfactual states, project into the future as well as their sense of pride in their work. These capacities affect learning, social engagement and even the definition of self. They are in part acquired, and there is evidence that aspects of these capacities are heritable.

The conventional neoclassical model of economics postulates quasiconcave preferences embedded in a model with uncertainty and constraints. A large literature analyzes this model under a variety of constraints, market arrangements and expectation schemes (see Mas-Colell, Whinston and Green [1995] for an example). Versions of the model emphasize how information revelation in different market settings affects agent choices. Preferences postulated a priori play a central role in this theory as they do in most research in behavioral economics.

However, individual differences in personality and cognition shape the constraints of individuals and hence their choices. To show how far one can go in developing models that recognize the centrality of constraints to economic choice theory, it is instructive to consider a simple model without standard preferences where constraints alone (including expectations of feasible states) shape choices. A constraint-driven model need not produce a unique choice outcome for all persons with the same constraints.[2] In this framework, agents have no preferences and act like molecules in a Brownian motion constrained only by choice sets. As the choice sets change, the constrained molecules must change their choices to respect the boundaries created by the constraints. As emphasized by Becker [1962] and Sanderson [1974], with sufficient generality in the specification of the constraint set, one can generate all of the predictions of neoclassical choice theory from constraints and not preferences.

[2] Thurstone [1927], Block and Marschak [1960], Marschak [1960], Becker [1962], Bock and Jones [1968], McFadden [1974],McFadden [1981], and Falmagne [1985] develop models that recognized that constraints (choice sets) may largely determine behavior. Becker's random consumer model and the extension of Sanderson [1974] extension of it are the most radical versions of this approach. List [2004] is a recent application of this model.

Thurstone [1927], Block and Marschak [1960], Bock and Jones [1968], McFadden [1974],and McFadden [1981]write the utility of agent i for choice l as $U_{i,l}$. In terms of the literature in psychology, $U_{i,l}$ is the motivation for choice (goal) l by agent i. There is a distribution of utilities across consumers. Choice sets, B_i, differ among persons depending on their capacities. These capacities are determined by agent cognitive and personality traits as well as the usual time and material constraints. In models with uncertainty, agents form expectations of constraint sets. Agent i chooses $\hat{l}_i$ as the maximal element in the choice set B_i:

$$\hat{l}_i = \underset{l \in B_i}{\operatorname{argmax}} \{U_{i,l}\}.$$

Consider a familiar model which writes $U_{i,l} = \overline{v}_l + \varepsilon_{i,l}$, where $\overline{v}_l$ is the mean valuation for l and $\varepsilon_{i,l}$ is a random "taste" shock. When $\varepsilon_{i,l}$ is iid extreme value type 1, the probability that l is selected from choice set B_i is

$$\Pr(l \mid B_i) = \begin{cases} \dfrac{\exp(\overline{v}_l)}{\sum_{j \in B_i} \exp(\overline{v}_j)} & \text{for } l \in B_i, \\ 0 & \text{for } l \notin B_i. \end{cases} \tag{A.1}$$

If agents have zero mean scale preference among the choices ($\overline{v}_l$=0) so that all choices (goals) have the same mean utility, we obtain a version of the Becker [1962] model of rational random behavior as extended by Sanderson [1974]where choices are generated by random shocks and the budget set determines choice behavior. Under an iid assumption for preference shocks, all possible choices are equally likely.[3]

Depending on how the constraints are determined, one can capture a variety of aspects of choice behavior. Thus a shy person may limit her options in a way an extravert does not. An

[3] The "taste" shock may be interpreted as either a utility (preference) or as a random element that determines which bundle of B_i is selected by agent i.

intelligent person may have a much richer choice set not only because of greater earnings capacity but also because of much greater imagination. Much like greater pixel resolution in imaging machines, those with higher IQ may resolve reality in a more fine-grained and less biased way. The negative relationship between IQ and risk aversion noted in Section 6 may be due, in part, to the greater resolution of reality (removal of components of uncertainty) by the more intelligent.[4] We capture the effect of these traits on the choice sets, which may also depend on material endowments. Applied to intertemporal settings, this framework captures the phenomenon of high time preference as an inability of an agent to imagine future states or as an inability to accurately measure future states.[5]

A3.B. Incorporating Personality and Cognitive Ability into Conventional Economic Models: A Simple Framework for Organizing the Evidence

How should one incorporate psychological traits into conventional economic models? One could think of them as public goods, freely available to all activities or tasks undertaken by agents. This is the approach implicitly adopted by most personality psychologists. One could also think of psychological traits as excludable private goods. More of a trait used in one activity means less of the trait available for use in other activities.

In addition, one might augment, complement or override the supply of a trait to any activity by supplying more time, or energy, to the activity in which the trait is used. Thus a trait that is a public good may be more evident in a given activity if more time or energy is allocated to the activity. On the other hand, "energy," e, which can be vector valued, may be used to moderate the manifestation of the trait (for example, energy may be spent controlling anger in a

[4] Allowing personality traits to determine, or screen out certain elements of possible choice sets is reminiscent of Tversky's elimination by aspects (EBA) model (see Tversky [1972a] Tversky [1972b]). McFadden [1981] discusses this model and its relationship to other random utility choice models. In our setup, psychological constraints eliminate certain components of choice.

[5] Frederick, Loewenstein and O'Donoghue [2002] review the classical literature in economics relating time preference to a failure of imagination.

given activity). Individuals differ in their endowment vector of the trait $\bar{f}$ or in terms of the energy (possibly including time) denoted $\bar{e}$. Thus there may be a time constraint as in Becker (1965) or, more generally, there may be energy constraints (constraints on effort capacity).

To develop these concepts and their consequences, we sketch a simple one-period model of consumer choice under certainty. We consider models with uncertainty in the next subsection. The framework developed in this subsection is rich enough to make some useful distinctions. Following Becker [1965], assume that there are $J+1$ activities with outputs $Z_j, j=1,...,J+1$ undertaken by the agent. We add one activity to account for market earnings. Z_j is produced by combining tasks, T_j with purchased market goods, X_j. We allow the task functions to include levels of energy, and time, in vector e^j:

(A.2) $$T_j = h_j(f^j, e^j), \qquad j=1,...,J+1.$$

f^j is to be distinguished from f_j, the j^{th} component of vector f. f^j is the vector of f used in task j. There is a parallel notation for e^j which may also be vector valued (for example, time and energy may be separate components). Thus the first component of e, e_1, could be time; the second component effort, and so on. e^1 is the amount of the vector e allocated to the first task. The more time or energy devoted to a task, the greater the output from the task. For a fixed input of psychological traits, higher levels of e^j may raise the output of the task. It may also happen that unless a minimum amount of time or energy is devoted to a task, there is no productivity in the task. Thus if $e^j = 0$, the trait vector f^j may be switched off. However, if some traits have negative productivity in some tasks, more energy may be allocated to those tasks to offset the negative trait. The effect of a trait in a task will depend on the bundle of other inputs used in the task. It is necessary to identify these other inputs to identify the traits used in any activity.

Output in activity Z_j is

(A.3) $$Z_j = \varphi_j(T_j, X_j), \qquad j = 1,...,J+1.$$

The outputs in activity *j* depend on the task output T_j and the goods input X_j. Agents have preferences over Z_j and e^j. The effort expended in an activity may have psychic costs or benefits. There may be psychic costs in using e^j to suppress the expression of a trait. Allowing for full generality, we allow each e^j to have potentially different effects on utility. Preferences may also depend on f as well as other variables which we keep implicit. The utility function is

(A.4) $$U = U(Z_1,...,Z_J, e^1,...,e^{J+1}, f).$$

It captures the motivation of the agents for the outputs and "energy." As previously noted, personality psychologists do not typically study motivation.[6] As embodied in utility functions, motivation is central to most economic models of choice. Income is return on asset flow Y plus labor earnings which we denote $Z_{J+1} = \varphi_{J+1}(T_{J+1}, X_{J+1})$. The budget constraint for goods is thus

(A.5) $$\sum_{j=1}^{J+1} P_j X_j = Y + Z_{J+1}.$$

Z_{J+1} is a hedonic earnings function which prices out traits and energy in the market, and produces a flow of income.[7]

It is possible to distinguish two different cases for *f*. For psychological traits, we can distinguish the case where f is a public good, $f^j = \bar{f}$ for all $j = 1,...,J+1$, from the case where it is a private good, $\sum_{j=1}^{J+1} f^j = \bar{f}$. In the former case, the same psychological traits enter as inputs

[6] But see McAdams [2006] and McAdams and Pals [2006].
[7] See Sattinger [1993] for a discussion of hedonic models of earnings. This specification subsumes the conventional labor-leisure model as a special case where e^{J+1} is time allocated to market and $Z_{J+1}=we^{J+1}$, where *w* is the wage rate which may be person specific.

into all tasks and activities. In the latter case, the traits applied to different tasks are excludable and rivalrous. More traits applied in one activity means fewer traits in other activities. People are not stuck with their personality in all activities. Some components of f may be public and others private. Thus extraversion and conscientiousness may be private goods that are more productive in some activities than others and the limited and divisible supply of these traits will be allocated according to preferences and productivity. Openness to experience may be a public good. One can classify all traits by this schema. One could consider all possible combinations of public and private good possibilities for all of the traits. For simplicity, we consider the pure private goods case and the pure public goods case. A similar distinction could be made for the energy inputs, but this seems less natural. To focus on main cases, we assume that e is a private good. Thus we analyze the two cases displayed in the table:

		f	
		Public	Private
e	Private	I	II

In case I, the additional constraint operating on the consumer beyond the budget constraint (A.5) is

(I) $$f^j = \overline{f}, \quad \sum_{j=1}^{J+1} e^j = \overline{e}, \quad \text{for all } j = 1,...,J+1.$$

In case II, the operative constraints are

(II) $$\sum_{j=1}^{J+1} f^j = \overline{f}, \quad \sum_{j=1}^{J+1} e^j = \overline{e}.$$

A3.B.i. Case I: Traits as Public Goods

In case I, different bundles of $\bar{f}$ across persons create comparative advantages for agents in different tasks and thus produce comparative advantages in different activities. These endowments affect consumption patterns of agents and the derived demand for X_j through scale and complementary effects in the production of activities and through demand effects in preferences. Case I is a version of the model in Michael [1973] of environmental variables in a household production framework.[8]

For analytical simplicity, suppose that Z_j and T_j, $j = 1,...,J+1$, display constant returns to scale in non-public inputs. The assumption of constant returns neutralizes any scale effects in the determination of the shadow prices of tasks and activities. Traits may have negative productivities. Persons with higher levels of traits with negative productivity require the allocation of more energy and time to produce any given task. Thus hot tempered people exert greater effort in controlling themselves in some activities.

In terms of the technologies expressed in (A.2), when f is a public good, we assume constant returns to scale in e^j but that $f^j = \bar{f}$ is a fixed, environmental variable. Different levels of $\bar{f}$ produce different productivities in different tasks. Feeding $\bar{f}$ into the activity functions (A.3), which are also assumed to be constant returns to scale, we can analyze the agent's problem of allocating effort among tasks and goods among activities using the analysis of Michael [1973]. Financial and energy resources are not changed by $\bar{f}$ except for its effect on Z_{J+1}. Holding energy and money resources fixed, changes in $\bar{f}$ produce reallocations across budget categories.

[8] Michael [1973] analyzes a scalar environmental variable (education) that plays the role of public goods in our analysis. The environmental variable is not chosen but affects the productivity of the other inputs.

Thus if $\bar{f}$ raises the productivity of inputs in task *j,* it reduces the shadow price of activity *j*. This has the usual income and substitution effects. The income effects produce a greater demand for all normal activities and sets in motion an increase in the derived demand for the inputs used in the activities. Since in general $\bar{f}$ appears as an input in multiple activities, increases in $\bar{f}$ will set off a chain of substitution effects among the activities. Depending on the preferences (motivations) over the Z_j, j=1,..., J+1, demands for inputs may increase or decrease.

It is instructive to reason through several cases. Consider an increase in conscientiousness. This will likely increase earnings (via Z_{J+1}), and will enhance productivity in some tasks intensive in conscientiousness and activities based on those tasks more than other tasks and activities. The increased income will support more of all activities. The differential shift in productivity across tasks and activities will reduce the prices of activities that are more intensive in the use of conscientiousness. If the demands for those activities are price elastic compared to the demands for the less conscientiousness-intensive activities, the demand for the inputs used in those activities will increase. If the demands are relatively inelastic, the demands will decrease because of the greater productivity for the inputs.

If a trait reduces productivity, the chain of logic just presented runs in reverse. With increases in, for example, neuroticism, shadow prices of activities intensive in that trait will increase. Labor earnings will tend to decrease. In the price-elastic case, consumers will tend to substitute away from activities intensive in the trait and the demand for inputs will decrease. In the inelastic case, input demands will increase as agents substitute goods and energy inputs into the activities that are inelastically demanded.

The same level of the traits is found in all activities, but in general, energy or time will be allocated differentially among activities. A person who allocates more energy or time to a task

will manifest more of the trait.[9] If inputs are complementary, at the same scale of output more of the task will be demanded. Unless one controls for these inputs, one may fail to capture the uniformity of traits across tasks and activities. In all of these cases, purchase patterns of market goods will provide information on endowments and allocation of energy and traits.[10]

A3.B.ii. Case II: Traits as Private Goods

The case when traits are private goods produces the possibility of different levels of traits being used in different tasks and activities. Responses of activity levels to changes in rewards across activities will be more price-elastic when traits can be allocated across activities than when traits are fixed. Equiproportionate expansions in $(\overline{f},\overline{e})$ differentially expand the consumption possibility set for activities differentially intensive in (f,e) and reduce their shadow prices, producing substitution effects in task production and activity consumption that promote consumption in activities intensive in the traits. Because of the ability of agents to reallocate traits across tasks and activities, an increase in endowment produces a stronger effect on consumption of *f*-intensive activities than in the public goods case. This greater elasticity of response to endowment is a consequence of the LeChatelier Principle (Samuelson [1947]). The public goods case imposes more constraints on the system than the private goods case.

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[9] One specification of the task functions writes, in the case of scalar *e*, $T^j = h_j(f^j e^j)$ so that the task depends on the product of f^j and e^j. In the case of public goods for traits $(f^j = \overline{f})$, the level of energy applied to a task augments or reduces the output of the traits. Thus, if $e^j = 0$, the trait is effectively not allocated to the task. For example, agreeable people could decide not to be agreeable in certain situations. Borghans, ter Weel and Weinberg [2008] argue that suppressing certain psychological traits is harder for some people than others. In our framework, the utility cost of e^j is higher for such persons.

[10] Baumeister has recently proposed that the trait of self-control be conceived of as a limited resource, the finite capacity of which varies from individual to individual. Self-control entails overriding lower-level processes (for example, impulses and emotions) by higher-level processes (that is, processes that are mediated by frontal areas and therefore are classified as executive functions). All brain functions rely on glucose and are metabolically expensive, but higher-level processes are particularly impaired by decreases in available glucose. (SeeBaumeister, Bratslavsky, Muraven et al. [1998]; Gailliot, Baumeister, DeWall et al. [2007]). Their analysis corresponds to a public goods case with glucose as a component of *e,* with *f* a public good and with $\overline{f}$ differing among people.

Compared to the case of public goods for traits, agents will reduce their allocation of the trait from activities where their productivity is negative and will spend less effort (*e*) in overriding the effects of negative traits in productivity.[11] The trait will be shifted into less costly activities and less energy will be spent controlling it.[12] In this case, in different tasks and activities, different traits will in general be observed. This will produce a low correlation in traits across activities.

The evidence summarized in Sections 6 and 7 of the main text would seem to favor case II, since different levels of traits are often found in different activities. However, since most of the estimates reviewed in this paper do not adjust for the inputs that affect the manifestation of the traits, one must be cautious in reaching this conclusion. Such adjustments are indicated by the theory but are not yet standard in economics or psychology.

The roles of time and energy in amplifying or reducing the effects of the traits in activities needs to be systematically explored to make the theory empirically operational as are the effects of traits on the purchase of related goods (for example, shy people may seek to live in secluded areas, have houses with high walls and seek jobs with little human contact). In the private goods specification of the model (case II), the motivation for the supply of traits to different activities depends on preferences (utility rewards *U*), on productivity in Z_j, and in productivity in the tasks T_j. In this framework, it is possible to formalize many of the currently disparate concepts of personality psychology. However, much more empirical research is required to make the framework just sketched operational. It would be very informative to estimate both versions of the model and to test between them.

[11] In both cases, as emphasized by Pollak and Wachter [1975], non-constant returns to scale produce additional substitution effects. Our public goods case captures one aspect of their analysis of jointness in production.
[12] Thus an angry person may transfer his or her anger to the home sector and thus avoid the costs of overriding his or her anger on the job. Alternatively, in a public goods case, the person would allocate more effort to controlling anger on the job than in controlling it at home.

We now turn to more general economic models with risk aversion, intertemporal choice, and investment. For simplicity, we assume that personality, other psychological traits and energy are public goods. The private goods version of the models follows from a direct application of analysis of this section.

A3.C. Integrating Psychology into More General Economic Models

Economic theory at the single agent level separates two distinct aspects of behavior and decision making: preferences and constraints. Included among the constraints are (a) information acquisition constraints; (b) static budget constraints and endowments that affect the flow of resources available for consumption in any period; and (c) dynamic constraints connected with asset, skill and trait formation. The constraints facing agents are also determined by available market arrangements and trading opportunities. Psychology is potentially informative about all aspects of agent decision making.

Preferences are central to conventional economic choice models. In their most general form, we may write utility for an agent with decision horizon $\mathcal{T}$ over bundles of goods (attributes), X_τ, $\tau = 1,...,\mathcal{T}$, in an environment of perfect certainty with cognitive and personality attributes f as

$$U(X_1,...,X_{\mathcal{T}};f), \tag{A.6}$$

where it is assumed that U is neoclassical.[13] At this level of generality, cognitive and personality traits can affect all aspects of choice for all goods including the valuation of leisure, the intertemporal tradeoffs among goods, and risk aversion. A general non-separable intertemporal preference function is consistent with substantial departures from standard utility theory such as hyperbolic discounting (Ainslie [1991]; Laibson [1998]; Phelps and Pollak [1968]) and a variety

[13] That is, increasing in its arguments and twice differentiable. Henderson and Quandt [1958] formulate such a general model.

of "exotic" or nonstandard preferences as discussed in, for example, Backus, Routledge and Zin [2005] and Hansen [2005]. Preference specifications as in (A.6) are consistent with different rates of time preference for different goods and across different periods as is found in the literature reviewed in Section 6.[14]

Few economists would embrace the high level of generality of specification (A.6). Fruitful economic models are more tightly structured. Specification (A.6) can characterize a one-shot model of lifetime decision making under certainty. Agents choose their lifetime consumption bundles at the beginning of life and are fully committed to those choices.

A basic problem with these specifications is time inconsistency.[15] In open markets, persons are not committed to their initial desired choices. After period 1, there is ambiguity about the appropriate representation of the remaining lifecycle utility function. One possibility is expressed in (A.6) with the first period choices as fixed arguments. Then, agents will stick to the lifetime program they initially select. Such an approach seems artificial because each period, people start anew and are free to make new decisions from a fresh time perspective. However, compulsive personality types may stick to the same plans no matter what, as long as they are feasible.

More generally, agents may look at future decisions differently in period 2 than they did in period 1. Let U^{τ} be the utility of the agent at stage τ for the remainder of life $U^{\tau} = G^{\tau}\left(X_{\tau},...,X_{T};f\right)$. Without further restrictions, there is no reason why in period τ, the agent is compelled to value the utilities of previous period consumption bundles or account for past consumption behavior in the way done prior to period τ in evaluating future consumption

[14] We note, however, that the evidence on differences in discount rates across goods is sensitive to the role of markets in intertemporal arbitrage. In the absence of transaction costs, market and personal rates of time preference must be in agreement.
[15] See Samuelson [1937] and Strotz [1955].

streams. The problem of preferences changing over time is distinct from the problem of revised information sets although both produce possible departures from initial decisions based on (A.6).[16] In both cases, decisions made in early periods affect resources available to later periods and, retrospectively, there may be regret about initial consumption choices. Economists have traditionally addressed this problem by specializing (A.6). The conventional specification of the general preference function assumes a constant rate of discount ρ for utility across periods:

$$U(X_1,...,X_T,f)=\sum_{\tau=1}^{T}\frac{1}{(1+\rho)^{\tau-1}}U(X_\tau,f)\,. \tag{A.7}$$

Specification (A.7) is not required to achieve time consistency of choices.[17] This is an important point, because there is a lot of evidence that speaks against (A.7), as previously noted in Section 6. Notice that (A.7) is just a special case of equation (A.6), which is also a standard model of economic preferences. Discounting is implicit in specification (A.6), which generates goods-specific discounting that depends on future and past consumption choices, a phenomenon ruled out by (A.7). A more general form of discounting than specification (A.7) that is consistent with (A.6) is

$$U(X_1,...,X_T,f)=\sum_{\tau=1}^{T}\prod_{j=2}^{\tau}\left(\frac{1}{1+\rho_j}\right)U(X_\tau,f)\,, \tag{A.8}$$

where discount rates may vary with age. Even more generally, both preferences and discount rates may vary with time-dependent variables (for example, children, health, mood, personality

[16] We consider uncertainty below.
[17] See Johnsen and Donaldson [1985]. The model of Becker and Murphy [1988] is an example of a non-separable model that is time consistent.

variables, and cognition).[18] Following our analysis in Section 3 and 8, factor f can evolve over time.

Let f_τ denote personality and cognitive traits at age τ. We can use $U_\tau(X_\tau, f_\tau)$ in place of $U(X_\tau, f)$, allowing for personal traits to evolve over time, and we can allow for utility in period τ itself to change, even after controlling for f_τ and X_τ. The analysis of Becker and Mulligan [1997] and Mulligan [1997] models the evolution of the discount rate through investment decisions. Becker and Murphy [1988] model the evolution of preferences for addiction where f_τ is a stock of addictive capital.

A wide variety of special cases of lifetime preferences are subsumed in specification (A.6). Personality factors like deliberation, future time perspective, and the capacity to inhibit impulses likely determine discount factors or preferences more generally. So may aspects of cognitive ability. Loewenstein, Weber, Hsee et al. [2001] discuss how decisions are affected by moods and emotions, which are influenced by personality variables. There is some evidence that higher-IQ persons have lower discount rates (see Frederick [2005] and Dohmen, Falk, Huffman et al. [2010]).

The standard model of social interaction in economics is interaction through markets (see Arrow and Hahn [1971]). More recently, economists have begun to analyze interactions in more general settings. They consider interactions in learning, in workplace productivity and in consumption.[19]

This aspect of human interaction is not captured by specifications (A.6)-(A.8) unless the X_τ include outcomes, choices or utilities of other persons. As noted previously in Section 6, a

[18] See the evidence on age dependent preferences in Browning and Meghir [1991] and the survey of the evidence presented in Browning, Hansen and Heckman [1999].
[19] Durlauf and Fafchamps [2005] and Durlauf and Young [2001] survey this literature.

large literature in economics discusses the implications of altruism (see Becker [1981]; Laferrère and Wolff [2006], for a survey). Fehr and Gächter [2000] discuss the consequences of social preferences for economic decisions. Models of social preferences have been developed by Fehr and Schmidt [1999] and Falk and Fischbacher [2006]. See the surveys by Fehr and Schmidt [1999] and Meier [2007]. One of the major findings of personality psychology noted in Section 7 is that sociability, empathy, and the capacity to get along with others are important predictors of success in some activities. These traits are not the same as altruism or social preferences, but they are facets related to Big Five agreeableness and extraversion. It would be useful to clarify the relationships among these measurements.

Sociability and empathy may affect preferences for group activity which may be a source of pleasure (or displeasure) for some and which may also affect productivity in group activities in the workplace or in learning environments. Dohmen, Falk, Huffman et al. [2008] present evidence on how trust, positive reciprocity, and negative reciprocity relate to Big Five personality traits. These and other personality traits play dual roles. They are a source of pleasure and they can also be a source of productivity in certain contexts. Agents making choices under any of the standard preference schemes, including those that recognize social interactions, are constrained in their information, the resources required to support consumption and in their ability to accumulate financial assets and skills.

Uncertainty and risk are essential aspects of life. Economists have devoted much attention to the specification of the preferences of agents and the effect of uncertainty on choice (see Mas-Colell, Whinston and Green [1995]). Revisions of information sets over time are another reason why agents may deviate from initial choices apart from time inconsistency.

Alternative specifications of information and preference are used in the literature. Individuals who are more intelligent or more open to experience (that is, more intellectually curious and motivated to learn) may acquire information more cheaply. Other personality traits may affect the basic attribute spaces perceived by agents.

The conventional model of uncertainty in economics is the expected utility model. Break X into values that occur in different states s=1,..., S_τ, at different times $\tau = 1,..., \mathcal{T}$, ($X_{\tau,s}$). Expected utility represents preferences by

$$U(X) = \sum_{\tau=1}^{\mathcal{T}} \sum_{s=1}^{S_\tau} P_{\tau,s} U(X_{\tau,s}), \text{ where } \sum_{s=1}^{S_\tau} P_{\tau,s} = 1, \ \tau = 1,..., \mathcal{T}$$

where $X_{\tau,s}$ is a state s, time τ -specific bundle of traits and $P_{\tau,s}$ is the probability that state s occurs in period τ.

There is considerable empirical evidence against this model. Many departures from it have been proposed to rationalize the available evidence.[20] Some departures break the additive separability assumption and assume a variety of alternative preference structures. A more general specification is based on (A.6) or its "exotic preference" specializations augmented to include as arguments different states of nature at each time period ($X_{\tau,s}$) and probability distributions over these states of nature. These models allow for much richer specifications of the information sets on which agents act than is permitted in the expected utility model.

Personality factors may affect the arrival and processing of information and vice versa. People not open to experience fail to learn from it. Impulsive people who do not act with deliberation may process information inefficiently (Frederick [2005]). Persons with greater ability to imagine the future or imagine outcomes reduce the intrinsic uncertainty in their

[20] See the survey in Starmer [2000].

environments and may be less risk averse, or more risk averse, depending on whether the imagined outcome is more favorable or less favorable. Personality traits affect openness to experience (willingness to learn), risk aversion (anxiety), and imagination about future states not yet experienced (creativity). Persons with higher IQs appear to be more willing to take risks and are more patient (Dohmen, Falk, Huffman et al. [2010]), perhaps because they are better able to envision future consequences.

There are far richer models of decision making under uncertainty in economics than the standard expected utility model or models based on decision making under uncertainty generated from objective distributions. These specifications allow for preferences over the temporal resolution of uncertainty about states of the world (Epstein and Zin [1991]; Kreps and Porteus [1978]), uncertainty about distributions over states of the world (ambiguity) and different types of risk and uncertainty aversion in preferences (see Starmer [2000]). These models enrich conventional economic theory by taking into consideration how agents react to uncertain events and how they process information.[21] These richer theories of decision making under uncertainty expand the scope for introducing personality variables into economics.[22]

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[21] See Hansen [2007]and the references contained therein.

[22] There is some confusion in the literature about the role of additive separability in models of dynamic consistency of decision making under uncertainty. Johnsen and Donaldson [1985] establish that dynamic consistency requires weak separability of intertemporal preferences but not the strong separability used in standard models of consumer decision making. Consider a two period model of agent decision making. X is current consumption. Y_s is future consumption in state s, which occurs with P_s. Under a certain interest rate r, the standard expected utility theory postulates that agents maximize for a three-possible-outcome-second-period-model,
$U(X)+P_1U(Y_1)+P_2U(Y_2)+P_3U(Y_3)$
subject to $A=X+\sum_{s=1}^{3}\frac{P_s}{1+r}Y_s$. This produces time consistent preferences for the usual reasons. However, keeping probabilities implicit, the following non-expected model of utility maximization
$U(X,Y_1,Y_2,Y_3)=[X+\log(X+Y_1)+(X^{1/2}Y_2^{1/2})^{1/3}(XY_3)]^{1/2}$
also produces time consistent preferences. Note that in this specification even if $P_1=P_2=P_3$, discount rates differ for different second period goods.

Personality traits are likely to prove useful in economic models of decision making under ambiguity.[23] Individuals may differ in their capacities to deal with poorly defined situations. Greater intelligence may help define situations, but persons with greater self-control, openness to experience, lower levels of anxiety, and those who seek excitement may also cope better with ambiguity.

Personality traits may also affect the resources available to agents. As emphasized by Bowles, Gintis and Osborne [2001], certain personality and character traits may be more highly valued than others in the labor market (trustworthiness, perseverance, outgoingness, for example). Borghans, ter Weel and Weinberg [2008] show that technological and organizational changes have increased the importance of people skills in the workplace. They present evidence for Germany and the United States that the increased importance of people skills has affected the labor-market outcomes of blacks and women. They find that the relative employment of women is higher in occupations in which people tasks are more important in Britain, Germany and the United States. The reverse is true for racial, ethnic, cultural, and linguistic minorities in the United States. They also show that the rapid increase in the importance of people tasks over this time period helps explain the increase in women's wages relative to men and the stagnation in wages of black workers relative to white workers. Diligent or trustworthy employees require less supervision. More generally, different personality and cognitive traits may be more highly valued in some activities than in others. In any activity, whether it is learning, information processing or performance of a workplace task, those who exert higher levels of effort will be more productive.

[23] See Epstein and Le Breton [1993], Gilboa and Schmeidler [1993], Siniscalchi [2006], and Hansen and Sargent [2008]for analyses of decision making under ambiguity. Ellsberg [1961] is the classic reference.

Comparative advantage in the labor market is analyzed in the models of Roy [1951], Mandelbrot [1961], Mandelbrot [1962],Tinbergen [1956], Rosen [1974], Sattinger [1979], Sattinger [1993], Willis and Rosen [1979], Heckman and Sedlacek [1985], Teulings [1995], and Teulings [2005. {Borghans, 2008 #7831]develop a model in which personality traits are included in an assignment model. Write the productivity of a person in occupation (pursuit) *j* at time τ as $Y_{j,\tau} = \alpha_{j,\tau}(f_\tau^j, e_\tau^j)$, j=1,...,J_τ, where we adjoin τ subscripts to the trait and energy levels. Different occupations or tasks require (or weight) different traits differently. (See Hogan [2005]; Hogan and Hogan [2007].) Thus, for example, extraversion is an essential trait for a salesman but not a lighthouse keeper or a truck driver. An individual who tries harder at any task will typically be more productive, although in certain workplace norms that enforce effort standards, the loner who makes more effort may be less productive, at least in terms of group cohesiveness.[24]

In Subsection B, we analyzed specifications of market productivity functions that are used in the efficiency wage literature (see Weiss [1991]). Market output depends on psychological traits plus effort and energy. Agents operating under different incentive schemes will manifest different effort. More generally, as noted in Subsection B and Section 6, the expression or manifestation of personality traits will depend, in part, on the context in which the individual is placed. At issue is the situational specificity of personality traits.

If agents choose or are assigned to tasks on the basis of maximal output $Y_{j,\tau}$ and pursuit of one occupation precludes pursuit of other occupations, the occupation (task) selected at time τ among the J_τ possible assignments at time τ is j_τ^*, defined as

[24] Borghans, ter Weel and Weinberg [2008]provide evidence of assignment based on "people skills" in the labor market using British and German data. Krueger and Schkade [2008]provide similar evidence for gregarious workers in the United States.

(A.9) $$j_\tau^* = \arg\max_j \left\{ Y_{j,\tau} \right\}_{j=1}^{J_\tau}.$$

In this case, Y_{i,j_τ^*} corresponds to $Z_{J+1,\tau}$ for the period τ as introduced in Subsection C. This framework captures the notion of comparative advantage in the labor market where agents sort into sectors based on their comparative productivity. Productivity determined by skills and personality traits affects the bundle of goods that the agent can buy. The phenomena of comparative advantage and differential skill requirements in different tasks helps to explain why some personality traits are predictive in certain activities but not in others (for evidence see Hogan, Hogan and Roberts [1996]). Hogan [2005] and Hogan and Hogan [2007] show the predictive power of personality traits in different occupations. Different employers may place different weights on different characteristics, and they may have different values in different settings.[25]

Over time, persons may also accumulate assets and skills, and may change their personality characteristics and cognitive traits. Preference parameters affect asset and skill accumulation. In Section 8, we presented evidence that cognitive and personality traits can be changed (see Cunha and Heckman [2007]and Fraley and Roberts [2005]). Both are influenced by experience and current stocks of the characteristics and other determinants. To formalize these notions, define C_τ as a capacity vector that includes f_τ and e_τ but encompasses a wider notion of capacities. Motivation can be affected by intelligence and other capacities of human beings (see Cunha and Heckman [2008]). Interventions can affect preferences, information, opportunity sets, and the formation of skills and preferences. Personality and cognitive ability evolve over

[25] There is a subliterature in psychology on "*g*" that pits "*g*" against personality characteristics in terms of their predictive power (see Gottfredson [2002]). This literature creates a false dichotomy. While "*g*" is predictive in a much wider variety of settings, in particular settings, as noted in Section 7, certain personality traits are more predictive than "*g*".

time through investment, through learning by doing or through other life experiences (see Cunha and Heckman [2007]; Cunha, Heckman and Schennach [2010]). Among the characteristics or capacities C_τ can be health, motivation, personality traits and ability (Heckman [2007]). Using the technology of skill formation developed by Cunha and Heckman [2007] and Cunha and Heckman [2008], capacities evolve via the following recursive technology

$$C_{\tau+1} = \varphi(C_\tau, IN_\tau), \ \tau = 1, \ldots, \mathcal{T}-1, \ C_0 = c_0 \tag{A.10}$$

where c_0 is an initial condition for capacities and IN_τ is investment at stage τ and where φ is concave in IN_τ, and is assumed to be differentiable in C_τ and IN_τ. In one version of this theory, $f_\tau = C_\tau$ and cognitive and personality skills can evolve over time. Characteristics may be self-productive $\left(\frac{\partial \varphi(C_\tau, IN_\tau)}{\partial C_\tau} > 0 \right)$. Investment, which can include experience and other inputs, may affect the evolution of abilities and personality, that is, $\left(\frac{\partial \varphi(C_\tau, IN_\tau)}{\partial IN_\tau} > 0 \right)$.

A3.D. Linking Preference and Constraint Parameters to Psychological Variables

We previously cited evidence relating IQ to risk preference and time preference. In this subsection, we speculate about the relationship between personality measures and conventional preference parameters. It is an area ripe for future research and our comments are designed to foster it.

The Big Five captures traits that seem relevant but are not exclusive determinants of economic preference parameters. Moreover, a single agent economic model cannot fully capture the operation of traits that foster social interactions. Positive social interactions can produce benefits in terms of learning and information processing. Participation in social groups provides a form of insurance and may promote risk-taking (through insurance), even if it does not change

risk aversion. Many economic models of contracting emphasize unobserved effort (a component of e), as an important dimension of economic transactions in the presence of imperfect information (Salanié [1997]). Empirical work in contract theory would be facilitated if preference parameters could be extracted from psychological questionnaires that predict effort.

For the same time input, some individuals may put in more effort in a task (a component of T_j, $j=1,...,J+1$) and will be more productive than other individuals at the task whether the task is a job, learning in school or acquiring information. Persons for whom the utility cost of effort is low, and hence exert more effort, will be more productive in a variety of activities. Moreover, effort or energy levels (and other personality traits) can be affected by incentives confronting agents. Thus, behavior is affected by incentives and is not necessarily constant across settings.

In Table 4 of the text, "warmth" (a facet under extraversion) may be a productive trait in some settings, but it may be unproductive in certain settings (for example, an assembly line, on the battlefield or in a seminar). Fantasy (under Openness) can be counterproductive in routine tasks but very productive in creative work, providing that the person is also self-disciplined and open to criticism. There is wisdom in considering traits that have domain-specific productivities. Such productivities are associated with comparative advantage in the labor market. In addition, different incentives and monitoring schemes can produce different behaviors (the measures in equation (A.9) for the same person placed in different settings, for example).

Do the traits discussed by personality psychology cause us to rethink the standard economic model? The evidence on the predictive power of sociability, effort and conscientiousness and the evidence on altruism and other pro-social preferences should lead to a reemphasis of traditional theory. Social interactions tend to be neglected in standard economic

theory, although there is a lot of recent research on this topic (see Durlauf and Young [2001], Brock and Durlauf [2001], and the evidence in Fehr and Schmidt [2006]).

Is it possible that conventional economic preference parameters fully explain all of the personality traits uncovered by psychologists? It seems implausible that conventional leisure preference, risk aversion, and time preference parameters explain all of the personality traits. For one thing, it is likely that these parameters are produced both by cognition and personality as we have previously noted. However, certain traits associated with Big Five conscientiousness might be rationalized by basic preference parameters. A low taste for leisure and a low discount rate would contribute to making persons more conscientious. However, the Big Five traits alone cannot explain diligence unless the person has some goal (or goals) or preferences motivating effort and self-discipline in a particular situation. Conventional economic models do not explain the origin of motives (goals).

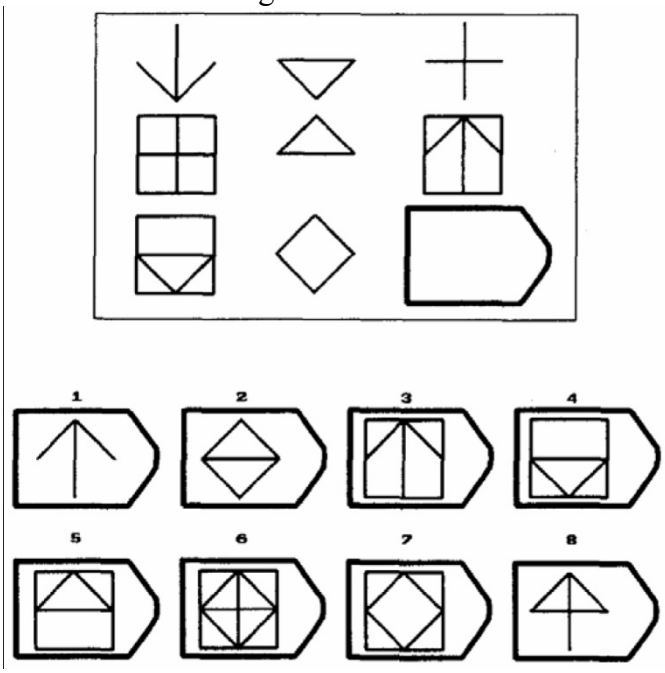
A4. **Measuring Personality**

Section Contents

A5. **Implementing the Measurement Systems**

Section Contents

Figure A1.Problem Similar to Raven's Progressive Matrices Test Item



Note: Note: The bottom right entry of this 3x3 matrix of figures is missing and must be selected from among 8 alternatives. Looking across the rows and down the columns, the test taker attempts to determine the underlying pattern and then pick the appropriate missing piece. The correct answer to this problem is 5.
Source: Figure taken from Carpenter, Just and Shell [1990], used with permission of the publisher, copyright American Psychological Association.

A6. **Personality and Preference Parameters**

Section Contents

Figure A2. Correlations of Personality Traits, Preferences, and Cognitive Skills

Males (N=1135)

	Big Five: Openness Factor	Big Five: Conscientiousness Factor	Big Five: Extraversion Factor	Big Five: Agreeableness Factor	Big Five: Neuroticism	Locus of Control Factor	Risk Aversion Factor	Trust Factor	Positive Reciprocity Factor	Negative Reciprocity Factor	Impatience	Cognitive skills Crystallized	Cognitive Skills, fluid
Big Five: Openness Factor													
Big Five: Conscientiousness Factor	0.249 0.00												
Big Five: Extraversion Factor	0.306 0.00	0.452 0.00											
Big Five: Agreeableness Factor	0.324 0.00	0.156 0.00	0.210 0.00										
Big Five: Neuroticism	-0.114 0.00	-0.039 0.18	-0.124 0.00	-0.113 0.00									
Locus of Control Factor	0.255 0.00	0.149 0.00	0.221 0.00	0.167 0.00	-0.288 0.00								
Risk Aversion Factor	-0.081 0.01	-0.129 0.00	-0.188 0.00	-0.141 0.00	0.049 0.10	-0.077 0.01							
Trust Factor	-0.060 0.04	0.063 0.03	0.024 0.41	0.008 0.78	-0.077 0.01	0.128 0.00	0.016 0.58						
Positive Reciprocity Factor	0.303 0.00	0.146 0.00	0.185 0.00	0.302 0.00	-0.009 0.76	0.082 0.01	-0.137 0.00	−0.048 0.11					
Negative Reciprocity Factor	-0.086 0.00	0.002 0.94	-0.060 0.04	-0.274 0.00	0.196 0.00	-0.208 0.00	0.074 0.01	−0.120 0.00	−0.049 0.10				
Impatience	-0.129 0.00	-0.020 0.94	-0.007 0.82	-0.195 0.00	0.209 0.00	-0.103 0.00	0.041 0.17	−0.060 0.04	−0.038 0.20	0.179 0.00			
Cognitive skills Crystallized	0.007 0.82	0.111 0.00	0.077 0.01	-0.024 0.41	-0.032 0.27	0.085 0.00	-0.020 0.50	0.100 0.00	−0.020 0.51	−0.021 0.48	−0.007 0.82		
Cognitive Skills, fluid	0.000 1.00	0.089 0.00	0.057 0.05	0.012 0.69	-0.085 0.00	0.051 0.08	-0.039 0.18	0.107 0.00	−0.028 0.35	−0.060 0.04	−0.007 0.80	0.405 0.00	

Females (N=1228)

	Big Five: Openness Factor	Big Five: Conscientiousness Factor	Big Five: Extraversion Factor	Big Five: Agreeableness Factor	Big Five: Neuroticism	Locus of Control Factor	Risk Aversion Factor	Trust Factor	Positive Reciprocity Factor	Negative Reciprocity Factor	Impatience	Cognitive skills Crystallized	Cognitive Skills, fluid
Big Five: Openness Factor													
Big Five: Conscientiousness Factor	0.207 0.00												
Big Five: Extraversion Factor	0.245 0.00	0.462 0.00											
Big Five: Agreeableness Factor	0.378 0.00	0.101 0.00	0.182 0.00										
Big Five: Neuroticism	−0.044 0.13	−0.069 0.02	−0.142 0.00	−0.081 0.00									
Locus of Control Factor	0.197 0.00	0.124 0.00	0.273 0.00	0.186 0.00	−0.300 0.00								
Risk Aversion Factor	−0.084 0.00	−0.054 0.06	−0.102 0.00	−0.143 0.00	0.049 0.08	−0.067 0.02							
Trust Factor	−0.085 0.00	0.046 0.11	−0.013 0.65	0.034 0.24	−0.146 0.00	0.158 0.00	0.054 0.06						
Positive Reciprocity Factor	0.270 0.00	0.122 0.00	0.147 0.00	0.315 0.00	−0.008 0.7	0.057 0.04	−0.044 0.12	−0.030 0.29					
Negative Reciprocity Factor	−0.124 0.00	0.008 0.78	−0.050 0.08	−0.342 0.00	0.115 0.00	−0.202 0.00	0.042 0.14	−0.126 0.00	−0.031 0.28				
Impatience	−0.118 0.00	0.022 0.44	−0.020 0.49	−0.234 0.00	0.203 0.00	−0.078 0.01	0.060 0.04	−0.055 0.05	−0.114 0.00	0.127 0.00			
Cognitive skills Crystallized	−0.039 0.17	0.101 0.00	0.046 0.11	−0.068 0.02	−0.083 0.00	0.054 0.06	0.034 0.24	0.100 0.00	−0.003 0.93	−0.032 0.26	0.029 0.31		
Cognitive Skills, fluid	0.010 0.72	0.094 0.00	0.041 0.15	−0.046 0.11	−0.013 0.64	0.009 0.76	0.041 0.15	0.048 0.09	−0.027 0.34	0.030 0.29	0.049 0.09	0.435 0.00	

Notes: In the graph, larger correlations are displayed using a larger font size. Correlations larger than .3 (in absolute terms) are grey. Sample includes all individuals with non-missings for personality measures, preferences measures and cognitive skill measures as well as a battery of control and outcome variables. Factors are predicted using the Bartlett method. Source: GSOEP, waves 2004-2008, authors' calculations.

Table A2. Personality Traits as Outcomes of Other Variables

	Males						Females					
	O	C	E	A	N	Loc	O	C	E	A	N	Loc
Christalized intelligence	-.018	.035	.063*	-.014	.027	.037	-.065**	.034	.001	-.065**	-.039	-.008
	(.033)	(.033)	(.036)	(.032)	(.034)	(.035)	(.03)	(.036)	(.034)	(.029)	(.032)	(.033)
Fluid intelligence	.038	.013	-.002	.028	-.029	-.03	.059*	.02	.031	.017	.019	-.033
	(.039)	(.034)	(.037)	(.034)	(.037)	(.037)	(.033)	(.037)	(.037)	(.03)	(.035)	(.034)
Age	.044***	-.003	-.014	-.024**	.002	-.016	.044***	.003	.008	-.01	.033***	-.022*
	(.014)	(.013)	(.013)	(.012)	(.013)	(.014)	(.012)	(.012)	(.013)	(.011)	(.012)	(.012)
Age^2	-.0004***	5.15e-06	.00007	.0002**	.00004	.0001	-.0004***	-.0001	-.00006	.0001	-.0003***	.0002*
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Height	.001	.012***	.005	-.005	-.002	.0001	-.003	.013**	.013***	-.0009	-.003	.003
	(.004)	(.005)	(.005)	(.004)	(.005)	(.005)	(.005)	(.005)	(.005)	(.004)	(.005)	(.005)
Ln(income)	.036**	.025	-.01	-.002	-.013	.025	.009	.0009	.024	.006	-.041***	.051***
	(.018)	(.016)	(.015)	(.014)	(.017)	(.016)	(.017)	(.016)	(.016)	(.015)	(.015)	(.017)
Ln(income from assets)	-.011	-.002	-.002	-.035***	-.025*	.045***	.001	.006	-.001	-.02	.018	-.005
	(.014)	(.014)	(.015)	(.013)	(.014)	(.014)	(.014)	(.015)	(.014)	(.012)	(.014)	(.015)
Ln(income from pubtrans)	.008	-.011	-.007	-.005	.0005	-.006	-.019**	-.0003	.014	-.014*	-.012	-.005
	(.01)	(.009)	(.009)	(.009)	(.009)	(.009)	(.01)	(.01)	(.009)	(.008)	(.01)	(.009)
Yrs of Edu	.004	.07***	.016	.005	-.009	.026**	.011	.045***	.031**	.004	-.039***	.04***
	(.012)	(.012)	(.013)	(.011)	(.013)	(.012)	(.013)	(.014)	(.012)	(.011)	(.013)	(.013)
Number of children	-.024	-.094**	-.036	.037	.06	.031	.018	-.126***	-.073	.002	.067	.085**
	(.048)	(.042)	(.045)	(.041)	(.049)	(.046)	(.045)	(.042)	(.045)	(.038)	(.042)	(.04)
Risk aversion (f)	-.036	-.088***	-.144***	-.071**	.032	-.069**	-.061**	-.063**	-.11***	-.094***	.044	-.083***
	(.033)	(.033)	(.034)	(.028)	(.033)	(.032)	(.028)	(.031)	(.03)	(.026)	(.03)	(.031)
Trust (f)	-.081**	.023	.021	.012	-.023	.055	-.086***	.008	-.056*	.036	-.089***	.093***
	(.034)	(.033)	(.034)	(.032)	(.034)	(.035)	(.031)	(.033)	(.032)	(.028)	(.032)	(.034)
Positive Reciprocity (f)	.296***	.148***	.181***	.287***	.003	.052*	.262***	.126***	.139***	.288***	.016	.046
	(.037)	(.03)	(.032)	(.03)	(.03)	(.031)	(.036)	(.033)	(.035)	(.033)	(.03)	(.031)
Negative Reciprocity (f)	-.057*	.038	-.056*	-.223***	.156***	-.183***	-.114***	.003	-.037	-.305***	.066**	-.182***
	(.031)	(.033)	(.033)	(.032)	(.033)	(.033)	(.03)	(.032)	(.031)	(.027)	(.033)	(.032)
Impatience	-.1***	-.013	.022	-.139***	.185***	-.063**	-.067**	.007	-.017	-.129***	.193***	-.056*
	(.03)	(.032)	(.033)	(.029)	(.034)	(.032)	(.03)	(.031)	(.03)	(.026)	(.032)	(.032)
N	1011	1011	1011	1011	1011	1011	1085	1085	1085	1085	1085	1085
R-squared	.123	.097	.069	.193	.074	.096	.112	.055	.044	.251	.076	.087

Notes: O=Openness to Experience, C=Conscientiousness, E=Extraversion, A=Agreeableness, N=Neuroticism. The table displays regression coefficients of factor scores on covariates. Height is a person's body height, Ln(income), Ln(income from assets) and Ln(income from pubtrans) denote total yearly gross household income, total yearly gross household income from assets and total yearly gross household income from public transfers respectively. Source: GSOEP, waves 2004-2008, own calculations.

A7. **The Predictive Power of Personality Traits**

Section Contents

Table A3. The Predictive Power of Personality for Males (GSOEP)

	Males							
	Married	Divorced	Higher edu	Yrs of edu	Employed	Ln(earnings)	Hospitalized	Poor health
Openness (f)	.048***	.004	.005	.028	.032***	.068***	.01**	-.024***
	(.006)	(.003)	(.005)	(.037)	(.006)	(.017)	(.004)	(.005)
Conscientiousness (f)	-.02***	.007**	.061***	.573***	.023***	.041***	-.0002	-.008
	(.006)	(.003)	(.006)	(.04)	(.006)	(.015)	(.005)	(.005)
Extraversion (f)	-.027***	.014***	-.001	.142***	.031***	.015	-.009**	-.014***
	(.006)	(.003)	(.006)	(.036)	(.006)	(.014)	(.004)	(.005)
Agreeableness (f)	.001	-.002	.003	.016	-.009	-.002	.0007	.001
	(.006)	(.004)	(.006)	(.039)	(.006)	(.017)	(.005)	(.005)
Neuroticism (f)	.003	.00005	-.011*	-.089**	-.013*	-.036**	.003	.012***
	(.007)	(.003)	(.006)	(.041)	(.007)	(.018)	(.005)	(.005)
Locus of control (f)	.002	-.0008	.005	.057***	.007**	.019**	-.002	-.005*
	(.004)	(.002)	(.003)	(.02)	(.003)	(.009)	(.002)	(.002)
Risk Aversion (f)	.005	.001	.001	.004	.0005	.011	-.001	-.0008
	(.003)	(.002)	(.003)	(.021)	(.004)	(.009)	(.002)	(.003)
Trust (f)	-.003	-.005	.047***	.379***	.017***	.068***	-.01**	-.019***
	(.006)	(.003)	(.006)	(.034)	(.006)	(.017)	(.004)	(.005)
Positive reciprocity (f)	.001	.002	.003	.035	.007	-.002	-.004	-.002
	(.006)	(.003)	(.006)	(.033)	(.006)	(.013)	(.004)	(.005)
Negative reciprocity (f)	-.014***	.005	-.04***	-.244***	.014***	-.022*	-.004	.004
	(.005)	(.003)	(.005)	(.032)	(.005)	(.013)	(.004)	(.004)
Impatience (s)	.007	-.01	.012	.06	.005	.044	-.011	.02*
	(.014)	(.007)	(.013)	(.088)	(.013)	(.035)	(.009)	(.011)
Crystalized intelligence (s)	.001	.004	.08***	.741***	.088***	.111***	-.03***	-.041***
	(.014)	(.007)	(.013)	(.083)	(.013)	(.035)	(.009)	(.011)
Fluid intelligence (s)	-.028**	-.007	.045***	.508***	.125***	.097**	-.037***	-.05***
	(.014)	(.008)	(.012)	(.081)	(.013)	(.041)	(.01)	(.011)
N	1153	1153	1153	1153	1153	1153	1153	1153

Note: The table displays regression coefficients from bivariate regressions of outcomes on traits. Coefficients on factor scores (f) are corrected for attenuation bias. Coefficients can be interpreted in terms of standard deviations. Standard errors are bootstrapped using 500 bootstrap replications. Married and Divorced are binary indicators indicating the marital status of an individual, higher edu is binary and indicates post-high school education, employed indicates the current (2008) employment status, Ln(earnings) refers to the logarithm of yearly labor earnings, hospitalized is a binary indicator of whether there was at least one hospital stay in the past year, poor health indicates whether the current self-rated health status is 'bad' or 'poor' (as opposed to 'good' or 'very good'). Source: GSOEP, waves 2004-2008, own calculations.

Table A4. The Predictive Power of Personality for Females (GSOEP)

	Females							
	Married	Divorced	Higher edu	Yrs of edu	Employed	Ln(earnings)	Hospitalized	Poor health
Openness (f)	.027***	-.009**	-.018***	-.078**	.011*	.067***	-.0008	-.021***
	(.006)	(.004)	(.005)	(.035)	(.007)	(.019)	(.005)	(.005)
Conscientiousness (f)	-.011*	.014***	.03***	.331***	.03***	.051***	-.013***	-.014***
	(.006)	(.004)	(.005)	(.031)	(.006)	(.017)	(.004)	(.005)
Extraversion (f)	-.023***	.017***	.03***	.261***	.042***	.064***	-.01**	-.015***
	(.006)	(.003)	(.005)	(.03)	(.007)	(.016)	(.005)	(.005)
Agreeableness (f)	-.0005	-.002	-.003	-.034	-.014**	-.003	-.004	-.002
	(.007)	(.004)	(.006)	(.038)	(.007)	(.018)	(.004)	(.005)
Neuroticism (f)	.008	.002	-.012**	-.097***	-.009	-.04**	.004	.016***
	(.006)	(.004)	(.005)	(.036)	(.006)	(.018)	(.004)	(.005)
Locus of control (f)	-.0003	-.002	.006*	.051***	.005	.014	-.001	-.006**
	(.004)	(.002)	(.003)	(.018)	(.004)	(.01)	(.002)	(.003)
Risk Aversion (f)	.003	-8.26e-07	.002	.027*	.013***	.0001	-.003	-.0003
	(.003)	(.002)	(.002)	(.015)	(.003)	(.01)	(.002)	(.003)
Trust (f)	.003	-.011***	.046***	.411***	.028***	.067***	-.014***	-.038***
	(.006)	(.004)	(.005)	(.033)	(.006)	(.018)	(.004)	(.005)
Positive reciprocity (f)	-.006	.004	-.007	-.017	.002	.03*	-.003	-.001
	(.006)	(.004)	(.005)	(.036)	(.006)	(.016)	(.004)	(.005)
Negative reciprocity (f)	-.015**	.007*	-.028***	-.144***	.023***	-.027*	.004	.002
	(.006)	(.004)	(.004)	(.031)	(.006)	(.016)	(.004)	(.005)
Impatience (s)	.019	-.02**	.004	.174**	.024*	.0005	-.009	.011
	(.014)	(.009)	(.012)	(.078)	(.014)	(.04)	(.01)	(.011)
Crystalized intelligence (s)	.002	-.001	.073***	.693***	.104***	.013	-.023**	-.031***
	(.014)	(.009)	(.012)	(.075)	(.013)	(.04)	(.009)	(.011)
Fluid intelligence (s)	-.011	.001	.04***	.552***	.128***	-.023	-.004	-.032***
	(.014)	(.007)	(.011)	(.074)	(.013)	(.042)	(.01)	(.011)
N	1228	1228	1228	1228	1228	1228	1228	1228

Note: The table displays regression coefficients from bivariate regressions of outcomes on traits. Coefficients on factor scores (f) are corrected for attenuation bias. Coefficients can be interpreted in terms of standard deviations. Standard errors are bootstrapped using 500 bootstrap replications. Married and Divorced are binary indicators indicating the marital status of an individual, higher edu is binary and indicates post-high school education, employed indicates the current (2008) employment status, Ln(earnings) refers to the logarithm of yearly labor earnings, hospitalized is a binary indicator of whether there was at least one hospital stay in the past year, poor health indicates whether the current self-rated health status is 'bad' or 'poor' (as opposed to 'good' or 'very good'). Source: GSOEP, waves 2004-2008, own calculations.

Table A5. The Predictive Power of the Big Five and Intelligence for Total Years of Education

	Years of Education					
	Females		Males		All	
Male					.297***	.277***
					(.109)	(.106)
Age	.044*	.026	.119***	.096***	.079***	.058***
	(.026)	(.026)	(.034)	(.034)	(.022)	(.021)
Age^2	-.0007***	-.0005*	-.001***	-.0007**	-.0009***	-.0006***
	(.0002)	(.0002)	(.0003)	(.0003)	(.0002)	(.0002)
Openness (f)	-.102	-.086	-.098	-.076	-.103*	-.085
	(.083)	(.081)	(.089)	(.085)	(.061)	(.059)
Conscientiousness (f)	.319***	.275***	.746***	.675***	.542***	.485***
	(.083)	(.081)	(.089)	(.086)	(.062)	(.061)
Extraversion (f)	.062	.057	-.128	-.154*	-.044	-.058
	(.079)	(.076)	(.091)	(.088)	(.061)	(.059)
Agreeableness (f)	-.097	-.078	-.068	-.065	-.087	-.073
	(.083)	(.081)	(.083)	(.078)	(.059)	(.057)
Neuroticism (f)	-.345***	-.299***	-.214***	-.183**	-.274**	-.235***
	(.073)	(.071)	(.081)	(.079)	(.056)	(.053)
Crystalized intelligence (s)		.48***		.555***		.526***
		(.083)		(.089)		(.061)
Fluid intelligence (s)		.176**		.334***		.251***
		(.087)		(.093)		(.064)
N	1197	1197	1129	1129	2326	2326
R-squared	.078	.12	.068	.132	.06	.115

Note: The table displays regression coefficients of years of education on covariates.
Source: GSOEP, waves 2004-2008, own calculations.

Table A6. The Predictive Power of the Big Five and Intelligence for High School Graduation

	High School Graduation (Linear Probability Model)					
	Females		Males		All	
Male					.064***	.062***
					(.014)	(.014)
Age	.017***	.015***	.017***	.016***	.017***	.015***
	(.004)	(.004)	(.004)	(.004)	(.003)	(.003)
Age^2	-.0002***	-.0002***	-.0002***	-.0001***	-.0002***	-.0002***
	(.00004)	(.00004)	(.00004)	(.00004)	(.00003)	(.00003)
Openness (f)	.007	.008	.015	.016	.01	.012
	(.012)	(.012)	(.011)	(.011)	(.008)	(.008)
Conscientiousness (f)	.035***	.03**	.044***	.04***	.042***	.037***
	(.013)	(.012)	(.011)	(.01)	(.008)	(.008)
Extraversion (f)	.012	.012	.011	.009	.01	.009
	(.012)	(.011)	(.011)	(.01)	(.008)	(.008)
Agreeableness (f)	.012	.015	-.011	-.011	-.0004	.0006
	(.012)	(.012)	(.009)	(.009)	(.007)	(.007)
Neuroticism (f)	-.033***	-.028***	-.019**	-.016*	-.025***	-.021***
	(.011)	(.01)	(.009)	(.009)	(.007)	(.007)
Crystalized intelligence (s)		.051***		.027***		.041***
		(.011)		(.008)		(.007)
Fluid intelligence (s)		.025**		.035***		.028***
		(.012)		(.011)		(.008)
N	1207	1207	1138	1138	2345	2345
R-squared	.077	.104	.055	.079	.061	.087

Note: The table displays regression coefficients of the probability of graduating from high school on covariates.
Source: GSOEP, waves 2004-2008, own calculations.

Table A7. The Effect of Personality on Educational Attainment and Achievement

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Baron and Cobb-Clark [2010]	Outcome(s): *educational attainment* – secondary school completion, university rank qualification (based on a test), and university ranking Explanatory Variable(s): *locus of control* – factor based on 7 survey questions	Data: Youth in Focus (YIF) Project; 2,065 Australians born in 1987 or 1988 Methods: factor models, probit, parametric censored regression, IV	Controls: welfare receipts, family structure, sex, parental education, parental immigration status, indigenous background, and born early for their grade Timing of Measurements: The measures are contemporaneous. Theory: People with an internal locus of control might perceive they have a higher return to education because they can affect their educational outcomes.	Moving from the 25th to the 75th percentile of the internal locus of control scale is associated with an increased probability of completing secondary school of 6.1 percentage points ($p<0.10$), an increased probability of qualifying for a university ranking at graduation of 7.1 percentage points ($p<0.05$), and an increased university ranking of 1.31 percentiles ($p<0.10$).
Behncke [2009]	Outcome(s): *cognitive ability* – performance on a diagnostic math test for a college economics class Explanatory Variable(s): *noncognitive skill shock* – verbal encouragement before the test	Data: Collected by author; 440 students from a Swiss University Methods: RCT, randomization inference	Controls: n/a (RCT) Timing of Measurements: The noncognitive skill shock directly proceeded test. Theory: Verbal encouragement boosts self-esteem.	Verbal encouragement raised test scores by 2.5% amongst all students ($p<0.05$) and by 8.0% amongst students who reported difficulties with math ($p<0.01$).

Borghans, Meijers and ter Weel [2008]	Outcome(s): *cognitive ability* – number of correct answers on an IQ test; *effort* – time spent on each question Explanatory Variable(s): *risk aversion* – survey response to lotteries; *time preference* – survey response to time trade – offs ; *leisure preference* – survey response; *experiment incentives* – payment for correct answers; *personality* – self-reported Big Five and others	Data: Collected by authors; 128 university students from a Dutch University Methods: probit model	Controls: type of cognitive test, the amount of incentive pay, and time constraints Timing of Measurements: They measured IQ both before and after providing incentives. Theory: People with different personalities and preferences might be willing to expend different amounts of mental effort during a test.	Performance motivation, fear of failure, internal locus of control, curiosity, low discount rates, and risk aversion are positively associated with more correct answers ($p<0.05$). Extroversion, openness, and agreeableness are negatively associated with answering the question correctly ($p<0.05$). Performance motivation, positive fear of failure, resilience, enjoyment of success, lower risk-aversion and higher discount rates are positively associated with time spent on questions ($p<0.05$). Preference for leisure is negatively associated with time spent on questions ($p<0.05$). Incentives did not affect the number of questions answered. Intrinsic motivation, curiosity, internal locus of control, emotional stability, and conscientiousness are associated with low responsiveness to incentives ($p<0.05$). Low discount rates and low risk aversion are associated with high responsiveness to incentives ($p<0.05$).
Goldberg, Sweeney, Merenda et al. [1998]	Outcome(s): *educational attainment*– years of education Explanatory Variable(s): *personality* – self-reported Big Five	Data: 3,629 adults aged 18-75 in year 2000 Methods: OLS	Controls: gender, age, and ethnicity Timing of Measurements: The measures are contemporaneous. Theory: People with different personalities and preferences might be willing to expend different amounts of mental effort during a test.	Openness to Experience (r = .31) was most strongly associated with years of education. Associations with Conscientiousness (r = .12), Agreeableness (r = .08), Extraversion (r = -.04), and Emotional Stability (r = .03) were more modest.

Holmlund and Silva [2009]	Outcome(s): *academic performance* – average of standardized test scores in English, Math, and Science Explanatory Variable(s): *non-cognitive skill intervention* – participation in the "xl programme"	Data: "xl club programme," National Pupil Database (NPD), Pupil Level Annual Schools Census (PLASC) ; 2,333 and 259,189 treated and control students aged 14 in England (2004) Methods: logit, propensity score matching, OLS, difference-in-difference, double differences, "random-growth" model	Controls: sex, language, eligibility for school meals, special needs status, and race Timing of Measurements: The data contains test scores from age 11, age 14 (both before the program), and age 16 (after the program). Theory: People who participated in the program designed to boost noncognitive skills might perform better at school.	Unconditional on observables, the performance of the students in the xl club is 1.2 to 1.4 standard deviations lower than the control subjects ($p<0.01$). Using OLS , the effect is -0.17. The propensity score estimates are -.13 and -.15. For the difference-in-difference models estimated using OLS and propensity score matching, there is no longer a significant effect of the program in either direction.
Koning, Webbink, Vujić et al. [2010]	Outcome(s): *academic performance* – high school grades (below average, average, above average) , years of schooling, high school graduation; *negative human capital* – physically attacking others, being arrested since 18, spent time in jail Explanatory Variable(s): *conduct disorder* – meeting the requirements for the APA definition based on survey questions before the age of 18	Data: Australian Twins Register (ATR), Alcohol Cohort 2, TWIN89; 2,220 twins born in Australia between 1964 and 1971 Methods: OLS	Controls: (1) age, age squared, gender, birth weight, and parental education (2) controls in (1), and fixed effects for all twins (3) controls in (1), and fixed effects for identical twins Timing of Measurements: The conduct disorder measures are based on interviews when the twins were 24-39 years old that asked them to reflect on their behavior before age 18. Some of the questions pertain to earlier ages, such as the first onset of conduct disorder. The outcome variables potentially span many ages, some of them before age 18 and some of them after. Theory: Early-life behavior predicts later life behavior.	APA classified conduct disorder reduces the marks in high school ($p<0.01$;(1)), ($p<0.01$;(2)); years of education by 0.82 ($p<0.01$;(1)) ,0.34 ($p<0.01$;(2)) ; the probability of graduating high school by 13.6 ($p<0.01$;(1)) and 5.4 ($p<0.01$;(2)) percentage points. APA classified conduct disorder increases the probability of attacking others by 17.9 ($p<0.01$;(1)), 14.6 ($p<0.01$;(2)), 16.2 ($p<0.01$;(3)); being arrested since age 18 by 12.4 ($p<0.01$;(1)), 7.6 ($p<0.01$;(2)), and 6.7 ($p<0.01$;(3)) percentage points; and the probability of spending time in jail by 4.8 ($p<0.01$;(1)), 2.0 ($p<0.05$;(2)) and 2.2 ($p<0.10$;(3)). Conduct disorder most affects high school graduation rates when the disorder beings between ages 13 and 16 and arrests between ages 10 and 16.

Rodríguez-Planas [2010]	Outcome(s): *educational attainment* – high-school completion and post-secondary eduction; *academic achievement* – math test score percentile, reading test score percentile , GPA; *labor market success* – earnings during the last year of the program, three years after the program, and five years after the program Explanatory Variable(s): *mentoring, educational services, and incentives* – participation in the Quantum Opportunity Program (QOP)	Data: Quantum Opportunity Program (QOP); 1,069 students from seven large US cities Methods: RCT	Controls: n/a (RCT) Timing of Measurements: The program was offered for a cohort of ninth graders and was available for five years. Follow-up interviews were conducted during the last year of the program, three years after the program, and five years after the program. Theory: Mentoring can boost non-cognitive skills that would help in academic achievement. Educational services can boost cognitive ability. Incentives can increase study effort.	During last year of the program: Participation in the program was associated with a 7 percentage point increase in the probability of graduating high school ($p<0.10$) and 6 percentage point increase in the probability of attending college ($p<0.10$). There were no differences in academic achievement. Three years after the program: Participation in the program was associated with a 7 percentage point increase in the probability of ever attending college ($p<0.10$), 9 percentage point increase in the probability of attending college ($p<0.05$), and a 7 percentage point decrease in the probability of having a job ($p<0.10$). Five years after the program: There are no significant differences five years after the program. Findings for sub-populations: The program benefited people who were 14 or less upon entering high school significantly more than older students. It also tended to benefit girls more than boys.
Van Eijck and de Graaf [2004]	Outcome(s): *educational attainment* – years of education Explanatory Variable(s): *personality* – self-reported Big Five	Data: 1998 Family Survey Dutch Population; 2,029 adults aged 18 to 70 living in Holland in 1998 Methods: OLS	Controls: n/a (RCT) Timing of Measurements: The program was offered for a cohort of ninth graders and was available for five years. Follow-up interviews were conducted during the last year of the program, three years after the program, and five years after the program. Theory: Mentoring can boost non-cognitive skills that would help in academic achievement. Educational services can boost cognitive ability. Incentives can increase study effort.	Openness to Experience ($\beta = .14$). Associations with Emotional Stability ($\beta = .09$), Extraversion ($\beta = -.07$), Agreeableness ($\beta = -.07$) and Conscientiousness ($\beta = .05$) were more modest.

Table A8. The Effect of Personality and Preferences on Labor Market Outcomes

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Antecol and Cobb-Clark [2010]	Outcome(s): *vertical integration in field of study* – percent of males in field of study; male dominance in occupation – percent of males in occupation; percent of Explanatory Variable(s): *personality* – seven factors based on survey response that load on male traits, self-esteem, analytical problem solving approach, willingness to work hard, impulsiveness, problem avoidance, and self-assessed intelligence	Data: National Longitudinal Study of Adolescent Health, *Integrated Public Use Microdata Series* (IPUMS), Integrated Postsecondary Education Data System (IPEDS); 8,594 respondents Methods: OLS	Controls: age, sex, race, immigrant, Add Health Picture Vocabulary Test Score, marital status, children Timing of Measurements: The non-cognitive skills were measured in high school and the outcomes were measured after high school (18-28 years old) Theory: People pick occupations based on expectations of future income and employers accept people above a particular threshold.	Percent male in field of study: a one standard deviation increase in "male traits" for men is associated with choosing an occupation with 3.3% more males ($p<0.05$), a one standard deviation increase in self-perceived intelligence for men is associated with choosing an occupation with 3.0% fewer males.
Barrick and Mount [1991]	Outcome(s): *job proficiency* – performance ratings, productivity; *training proficiency* - training performance rating, productivity; *personnel data* – salary level, turnover, status change, tenure Explanatory Variable(s): *personality* -- Big Five classifications based on professional rater's assessment of other personality questionnaires	Data: 162 samples from 117 studies; 23,994 combined participants Methods: meta-analysis, corrections for artifactual variance, range restriction, and measurement error	Controls: n/a Timing of Measurements: The measures were contemporaneous. Theory: n/a	Conscientiousness is correlated with job proficiency ($r=0.23$, $p<0.10$), training proficiency ($r=0.23$, $p<0.10$), and personnel data ($r=0.20$, $p<0.10$). Extraversion is correlated with training proficiency ($r=0.26$, $p<0.10$). Openness to experience is associated with training proficiency ($r=0.25$, $p<0.10$). All other correlations were less than 0.20. They also found some evidence that conscientiousness predicted choice of occupation.

Caliendo, Fossen and Kritikos [2008]	Outcome(s): *entrepreneurial survival* – leaving self-employment as reported in a longitudinal survey Explanatory Variable(s): *risk preference* – a self-reported measure of willingness to take occupational risks on an 11-point scale, choices over a hypothetical lotteries on a survey	Data: German Socio-Economic Panel (SOEP);7,325 person-year observations of self-employed people aged 18-65 and living in Germany (2000-2005) Methods: logistic hazard rate model with duration dependence	Controls: sex, education, age, age squared, work experience, work experience squared, past unemployment experience, unemployment experience squared, living in East Germany, disability, German, children, marital status, capital income, and father's self-employment status Timing of Measurements: They use risk measurements from 2004, but self-employment status from 2000-2005 Theory: Assuming that the marginal return to risk-taking decreases after some point, there will be a u-shaped pattern in leaving self-employment versus risk-taking.	There is a u-shaped pattern of the probability of leaving self-employment and risk aversion. People who report a value of 5 or 6 on an 11-point occupational risk scale are less likely to leave self-employment by 5 percentage points relative to those who report a value of 0 ($p<0.01$; adjusted analysis).
Caliendo, Cobb-Clark and Uhlendorff [2010]	Outcome(s): *search effort* – number of applications submitted; *subjective belief of gaining employment*– self-reported belief of finding a "very good" job; *reservation wage*– log of self-reported reservation wage Explanatory Variable(s): *locus of control* – an average of two factors based on survey questions	Data: IZA Evaluation Data Set; 7,900 people aged 16 to 54 living in Germany who became unemployed between 2007 and 2008. Methods: probit, OLS, propensity score matching	Controls: openness to experience, conscientiousness, extraversion, neuroticism, sex, age, origin, marital status, children, schooling, employment history, log of wage, father's , living situation, and means of communication Timing of Measurements: All respondents were interviewed near when they became unemployed, diminishing the role of reverse-causality. Theory: People with an internal locus of control believe that they their search effort has a bigger effect, leading them to expend more effort, have a higher subjective probability of employment, and have a higher reservation wage.	A one standard deviation increase in internal locus of control is associated with a 0.2 percentage point increase in the perceived marginal effect of submitting one additional application ($p<0.01$, conditioning on personality, not conditioning on personality), 1.3-1.9 percentage point increase in the reservation wage ($p<0.01$conditioning on personality, not conditioning on personality) and with submitting 0.8 additional job applications ($p<0.01$; not conditioning on personality). The last result is not significant when conditioning on personality.

Cobb-Clark and Tan [2009]	Outcome(s): *occupation* – survey reports of 18 aggregated occupational categories; *wage* – survey report Explanatory Variable(s): *personality* – survey responses to 36 questions measuring the Big Five and 7 questions measuring locus of control	Data: Household Income and Labour Dynamics in Australia (HILDA); 5397 people aged 25-65 living in Australia (2001-2006) Methods: multinomial logit	Controls: years in paid employment, educational attainment, marital status, the presence of children under the age of 14 years, and measures of parental occupation Timing of Measurements: Locus of control was measured in the 3rd and 4th waves of the survey and the Big Five were measured in the 5th (of 6 total waves). Theory: Different personality traits might predispose people to select into different occupations and might be able to explain some of the male-female wage gap.	Men: A standard deviation increase in agreeableness is associated with a 2.8 percentage point decrease in being a manager ($p<0.01$) and 2.9 percentage point decrease in being a business professional ($p<0.01$). A standard deviation increase in internal locus of control is associated with a 2.8 percentage point increase in being a manager ($p<0.01$). Women: A standard deviation increase in openness to experience is associated with a 2.5 percentage point increase in the probability of being a manager ($p<0.01$). Occupational attainment is not linked to their locus of control. Wage Gap: 96.5% of the wage gap stems from differences in wages for men and women in the same occupations. Nearly 3/4 of the wage gap stem from differences in the return to human capital, demographic characteristics, and noncognitive skills of the within occupations.
Dohmen and Falk [2010]	Outcome(s): *baseline productivity* – the number of multiplication exercises a participant completes facing piece rate incentive in five minutes; *compensation scheme* – how the participant chooses to be compensated for future multiplication exercises (fixed payment, piece rate, tournament or revenue-sharing), has a performance evaluation at their job (survey data only) Explanatory Variable(s): risk *aversion* – elicited through a real-stakes experiment, survey questions matching the GSOEP; *trust* – elicited through a real-stakes, two-player trust game	Data: Experiment conducted by the authors, German Socio-Economic Panel (SOEP) ; 360 students from the University of Bonn, 8,159 people living in Germany Methods: Wilcoxon rank-sum tests, probit, Spearman rank correlations	Controls: (1) Big-Five, and gender (2) years of schooling, experience, experience squared, part-time experience, part-time experience squared, tenure, age, risk attitude, trust in strangers, reciprocity, and sex (3) controls in (2), employed in public sector, living in East Germany, firm size, occupation, and industry Timing of Measurements: The measures are contemporaneous. Theory: More productive people will select into variable compensation schemes. People in variable schemes will work at least as much as those in fixed schemes. People with higher willingness to take risks will sort into variable pay jobs more. Social preferences could be linked to selection.	Experimental Results: Participants in a piece-rate contract solved an average of 60.59 problems compared to 29.51 in the fixed rate payment ($p<0.0001$). Selection into the piece rate scheme was positively associated with productivity and willingness to take risks($p<0.01$). Trust, reciprocity and relative self-assessment had little significant effect on sorting. Survey Results: Risk preference is associated with having a job with a performance evaluation ($p<0.01$, (1), (2)). Reciprocity is negative associated with having a performance evaluation ($p<0.01$; (1)).

Dohmen, Falk, Huffman et al. [2009a]	Outcome(s): *long-term unemployment* – unemployed for over a year; *overdrawn account* – account overdrawn at the time of the interview Explanatory Variable(s): *education* – self-reported years of schooling; *processing speed* – perceptual speed test; *gambler's fallacy* – belief that a streak of coin tosses will be more likely to end; *hot hand fallacy* – belief that a streak of coin tosses will persist	Data: Collected by TNS Infratest; 1,012 nationally representative adults in Germany (2005) Methods: probit	Controls: (1) age, sex, word fluency, and symbol-digit score (2) age, sex, years of schooling, and wealth Timing of Measurements: The measures are contemporaneous. Theory: People who subscribe to the gambler's fallacy will be more likely to overdraw their bank account because they believe negative income shocks will not persist. People who subscribe to the hot hand fallacy are likely to face long-term unemployment because they will give up more easily in the face of rejections.	(1)An additional year of schooling is associated with a 4.2–4.6 pp higher chance of correctly answering the probability questions ($p<0.01$). (2) Subscribing to the "hot hand" fallacy increases the probability of long-term unemployment by 8.9 pp. ($p<0.01$). Significance falls to 10% when conditioning on education and wealth. Subscribing to the "hot hand" fallacy increases the probability of long-term unemployment by 8.8 pp. ($p<0.01$). Significance falls to 5% when conditioning on education and wealth.

Dohmen, Falk, Huffman et al. [2009b]	Outcome(s): *worker effort* – worked over time during the last month; labor market success – monthly income, employment status; overall welfare – overall self-reported life satisfaction, number of friends Explanatory Variable(s): *positive reciprocity (the tendency to reward kindness)* – factor based on 3 survey questions; *negative reciprocity (the tendency to punish unkindness)* – factor based on 3 survey questions	Data: German Socio-Economic Panel Study (SOEP), 20,744 individuals living in Germany Methods: probit, interval regression	Controls: (1) sex, education, experience, tenure, part-time status, age, firm size, sector, and occupational status (2) sex, education, experience, tenure, part-time status, age, firm size, sector, and occupational status (3) sex, age, residence in 1989, German nationality, region dummies, marital status, children, and religion (4) education, sex, age, residence in 1989, subjective health, income, employment status, trust, parental education, marital status, children, enrollment in school, religious background, social and national background, and month of interview Timing of Measurements: They have three years of outcome variables relative to the explanatory variables: contemporaneous, one year later, and two years later. Theory: Positively reciprocal workers will tend to work overtime more, even if they cannot be monitored.	Positive reciprocity is positively associated with the following: (1) overtime in the present, one year later and two years later ($p<0.01$;); (2) higher present monthly income ($p<0.05$), higher monthly income the next year ($p<0.01$), higher monthly income in two years ($p<0.10$); (3) being currently employed ($p<0.01$), being employed in the subsequent year ($p<0.10$), and being employed in two years ($p<0.10$); (4) the number of current friends ($p<0.01$), current overall life satisfaction ($p<0.01$), overall life satisfaction in the subsequent year ($p<0.01$) and overall life satisfaction in two years ($p<0.01$). Negative reciprocity is negatively associated with the following: (3) being currently employed ($p<0.01$), being employed in the subsequent year ($p<0.05$), and being employed in two years ($p<0.05$); (4) the number of current friends ($p<0.05$), current overall life satisfaction ($p<0.01$), overall life satisfaction in the subsequent year ($p<0.01$) and overall life satisfaction in two years ($p<0.01$).
Drago [2008]	Outcome(s): *wages* – log earnings based on a survey measure Explanatory Variable(s): *self-esteem* – index based on ten survey questions; *ability* – AFQT score	Data: National Longitudinal Survey of Youth (NLSY), 2250 white males living in the US Methods: IV	Controls: age, own education, parental education, and AFQT score Timing of Measurements: 1980 self-esteem serves as an instrument for 1987 self-esteem. Theory: If ability and effort are complements, then having higher self-esteem should lead to more effort and therefore higher wages.	The correlation between 1980 self-esteem and 1987 self-esteem is 0.42. A two standard deviation increase in self-esteem leads to a 18% ($p<0.10$; all controls) to 26% ($p<0.05$); just age) increase in log earnings.

Dur, Non and Roelfsema [2010]	Outcome(s): *bonus incentives* – whether employer offers bonuses based on appraisal; *promotional incentives* – whether employer offers promotions based on appraisal Explanatory Variable(s): *reciprocity* – average of 3, 7-point questions about willingness to return favors	Data: German Socio-Economic Panel Study (SOEP), 20,744 individuals living in Germany Methods: probit	Controls: sex, age, education, tenure, part-time status, lives in East-Germany, firm size, occupation, and industry Timing of Measurements: The measures are contemporaneous Theory: Firms with reciprocal workers should be more likely to offer promotional incentives and reciprocal workers should be less likely to receive bonuses.	Reciprocity is positively associated with receiving promotional incentives ($p<0.01$). Reciprocity is not associated with bonus pay.
Ham, Junankar and Wells [2009]	Outcome(s): *occupation* – whether an employee works in "blue collar" job that requires manual labor or a "white collar" job Explanatory Variable(s): *personality* – self-reported measures of the Big Five on a 7-point scale	Data: Household Income and Labour Dynamics in Australia (HILDA), 25,638 observations of people living in Australia Methods: probit	Controls: age, age squared, and the parent's ANU4 index Timing of Measurements: The Big Five were measured in the 5th of 6 waves. Theory: Personality could have different effects on occupational choice based on gender.	People with the highest levels of conscientiousness (on the seven point scale) are 10.8% more likely to have a white collar profession ($p<0.01$). Open-minded men are 14.6% more likely to have a white-collar job, whereas open-minded women are not ($p<0.01$). Emotional stability (the opposite of neuroticism) is also associated with having a white-collar job ($p<0.01$) .

Störmer and Fahr [2010]	Outcome(s): *absenteeism* – annual absent days Explanatory Variable(s): *cognitive ability* – performance on a test similar to AFQT measured on a 9-point scale; *noncognitive ability* – result of an interview with a psychologist measured on a 9-point scale; *physical capacity* – maximum resistance on stationary bike	Data: German Socio-Economic Panel Study (SOEP), 4,901 people living in Germany Methods: linear exponential specification with a Negbin II model, logit	Controls: health, education, firm size, industry, measures of job satisfaction, age, age squared, marital status, children, wage, white collar worker, contractual working hours, tenure, tenure squared, and job history Timing of Measurements: Personality and absenteeism are measured contemporaneously. Theory: Extroverts value leisure more so will be absent more. Neurotic employees might be overly anxious or depressed so will be absent more. Conscientious workers are more responsible so will be absent less. Agreeable employees will be absent less out of a sense of loyalty.	A one standard deviation increase in neuroticism is associated with an 11.9% more absent days for men ($p<0.01$). A one standard deviation increase in agreeableness is associated with 9.0% fewer days absent for men ($p<0.01$). A one standard deviation increase in openness for women is associated with 13.4% more absent days for women.

A7.A. Personality and Health by Pietro Biroli

The idea of ties between personality and health has received particular attention in the last decades but it dates back thousands of years: Hippocrates is believed to be among the first to connect medicine and Humoralism, the doctrine of the four temperaments, whose imbalance would affect both personality and physical health[26]. In this section, we review some evidence on the interconnections between personality and well being, considered not only as longevity and absence of chronic conditions but also as healthy behaviors and lifestyles[27]. Tables A9-A12 complement the discussion and provides further details.

Initially researchers focused on the direct connections between longevity and cognitive and non-cognitive abilities; Roberts, Kuncel, Shiner et al. [2007]provides an extensive and organized review of this literature: typically studies would collect information on personality, socio economic and health status of a particular population and, controlling for those initial characteristics, follow their survival throughout old-age. Although the magnitude and the significance of the relation varied widely across different studies and not all results were replicable[28], the long-term association between personality traits and longevity has been convincingly demonstrated. Friedman, Tucker, Tomlinson-Keasey et al. [1993]analyze a cohort of mentally gifted children and find that conscientious people tend to lived longer, especially men, while women's longevity is negatively associated to their cheerfulness at young ages (one of the measures of Agreeableness). Later studies (Martin, Friedman and Schwartz [2007]and Kern and Friedman [2008]) find corroborating evidence of a positive relation between longevity and conscientiousness, even after controlling for mid-life health and economic outcomes and

[26] See Hampson and Friedman [2008] and Friedman [2007] for a brief literature.
[27] See Friedman, Kern and Reynolds [2010] for a more thorough definition of healthy living an aging
[28] See Weiss and Costa [2005] for a discussion

examining evidence from various countries. Among others, Weiss and Costa Jr [2005]as well as Mroczek and Spiro [2007] find that high Agreeableness and Neuroticism have a negative impact on longevity: individuals who are, or become more neurotic over time tend to die sooner. A similar impact can be attributed to high Hostility (Boyle, Williams, Mark et al. [2005]) and Pessimism (Schulz, Bookwala, Knapp et al. [1996]), while Kubzansky, Sparrow, Vokonas et al. [2001] evaluate mortality from coronary heart disease and find that Optimism decreases the probability of death. Results about Openness are more controversial: while many studies don't find a significant correlation with mortality, Taylor, L., Davey Smith et al. [2003] find that men who died before the follow-up study had lower Openness and Conscientiousness scores and higher Neuroticism; however they did not control for participants cognitive ability, which tends to be highly correlated with Openness and whose relationship with mortality has been extensively documented[29]. Aware of the potential composite effects of cognitive and noncognitive abilities on longevity, Wilson, Mendes de Leon, Bienias et al. [2004] control for participants IQ as well as initial medical conditions in their analysis and find that high Neuroticism and low Extraversion are associated with lower survival probability; following a similar approach, Weiss, Gale, Batty et al. [2009] find that high Neuroticism and low Cognitive ability are independent mortality risk factors, and particularly fatal once interacted with each other.

A significant shortcoming of this literature is that some of these studies, although controlling for possible cofounding socioeconomic and health factors associated with mortality, focus mostly on a particular facet of personality and fail to control for the correlation among different individual traits; furthermore they often neglect the possible indirect effects that

[29] See Roberts, Kuncel, Shiner et al. [2007] and Batty, Deary and Gottfredson [2007]for systematic reviews

personality has on longevity via education[30] or healthier life-style. Moreover, most do not directly address the causal mechanism through which personality influences longevity: they simply document that individuals living longer have different traits than the original sample group. A more recent strand of psychological and economic literature addresses these problems and evaluates the effect that initial endowment of individual skills and physical conditions have on mid-life outcomes, which in turn can influence health and longevity in the long run. Looking at the genetic endowment of individuals as possible explanation for differences in personality and health, Luciano, Houlihan, Harris et al. [2010] confirm the existing finding that certain Single-Nucleotide Polymorphisms (SNPs) of the human DNA are associated with Extraversion, Emotional stability, Agreeableness, Conscientiousness and Intellect, which in turn are related to anxiety and depression of people in their 80s; however they fail to find a direct strong connection between the selected SNPs and old age health outcomes. Taking a different approach, Hampson, Tildesley, Andrews et al. [2010] follow a cohort of young children while in school and find that both the initial level and the growth in hostility over the years of elementary school are associated to substance abuse[31] in high school; furthermore their level of sociability is correlated with drinking but not smoking. Using data from the National Longitudinal Study of Youth-1979, Kaestner [2009] finds that adolescent measures of cognitive ability and self-esteem are positively associated with self-reported measures of physical and mental health at age 41, even after controlling for education and socioeconomic outcomes. Focusing on Locus of Control and IQ, Gale, Batty and Deary [2008] find strong correlations between these two personality traits measured in children and better health outcomes at age 30, such as low BMI, blood-pressure or psychological distress and higher self-rated health status; furthermore they show that these

[30] For a more thorough discussion of the education and health gradient, see Cutler and Lleras-Muney [2008;[2010] or Conti, Heckman and Urzua [2010b]
[31] Cigarette, alcohol and marijuana consumption

associations vary by gender and are attenuated once taking into account educational attainment and social class. A similar comprehensive approach is pursued by Friedman, Kern and Reynolds [2010]who assess the life-time evolution of personality and health traits of a cohort of intellectually gifted students born in the 1910s; they find that low Neuroticism and high scores of Agreeableness, Conscientiousness and Extraversion are connected to better physical health and social interactions when 70 years old, as well as longevity, with sizeable gender differences.

An approach more attentive to causality and the presence of indirect effects is pursued by Hampson, Goldberg, Vogt et al. [2007] who, using a structural model, find that high scores of Extraversion, Agreeableness and Conscientiousness are associated with an overall better health status when middle age (less smoking, more exercise, better self-rated health) and also have significant indirect effects via educational attainment and improved eating habits. Using a structural dynamic model of skill formation, Conti, Heckman and Urzua [2010a]estimate the causal relationship between personality traits, initial health endowments and endogenous choices about schooling and post-schooling outcomes; they find a strong sorting into secondary education based on higher cognitive and noncognitive skills (both men and women) and initial health endowment (only women); on top of it, more than half of the difference in poor health, depression and obesity at age 30 can be explained by variation in personality and health traits when young, with health returns to education varying strongly with unobserved skills even after controlling for standard socioeconomic conditions. Using an analogous technique but looking at a life-long time span, Savelyev [2010] finds that both child Conscientiousness and higher education causally increase survival through age 80, but these traits tend to substitute each other so that effects of education are only strong at low levels of Conscientiousness and vice versa.

Finally, a different branch of research focuses on the effects of physical health on personal traits. A fairly popular biological approach analyses the consequences of hindered development of the brain in utero and early life: Shenkin, Starr and Deary [2004]systematically review a strand of the literature that highlights small but consistent, positive associations between birth weight and childhood cognitive ability; a steep rise in IQ is associated to increases from severely low birth-weights but possibly a downward sloping relationship can exists at high weights. Similarly Pesonen, Räikkönen, Andersson et al. [2008]find that very low birth weight (below 1500gr) was linked to higher Conscientiousness and Agreeableness scores during childhood and lower Openness to experience, Hostility and Impulsivity.

Besides initial health conditions, also current physical conditions like appearance or the level of hormones in the body have been associated to certain facets of personality: Sapienza, Zingales and Maestripieri [2009] find an overall negative correlation between salivary testosterone concentrations and risk aversion, even if the effect is strongly gender specific and primarily driven by the fact that females tend to be less prone to risk and also have lower testosterone in circulation. Ryden, Sullivan, Torgerson et al. [2003]focus on physical appearance and study a sample of obese subjects who underwent surgical or conventional dietary treatment: they find that considerable weight-loss ameliorates patients' anxiety, extraversion and aggressiveness, with effects varying with gender and the amount of kilos lost. Concentrating on height, Hoffman, Fessler, Gneezy et al. [2010] find that taller individuals tend to be more competitive and estimate that each additional centimeter of height increases the probability of competing in a controlled experiment by 0.6%. Sell, Tooby and Cosmides [2009]corroborate this finding and put it in the perspective of evolutionary theory, reporting that taller and stronger men are more prone to anger in a controlled experiment and also reported a higher frequency of fights

since the age of 14; on the other side, they find that women's anger and success in conflicts is more associated with self-rated attractiveness.

Table A9. The Effect of Personality on Health Outcomes[32]

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Taylor, Whiteman, Fowkes et al. [2009]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – Big Five (NEO Five-Factor Inventory) *Health* – systolic blood pressure, BMI, smoking history (packs per year)	Data: Edinburgh Artery Study (N=1322) Methods: differences in mean; Cox proportional hazards model; EQS structural equation modeling program	Controls: sex (separate analysis); age, social class, systolic blood pressure, BMI, smoking (square root of packs per year) Timing of Measurements: Contemporaneous (aged 55 to 74) Theory: personality traits might spur healthy behaviors that reduce mortality	Men who died during follow-up had significantly lower **openness** and **conscientiousness** scores (-1/3 of a standard deviation, $p<.01$) as well as higher **neuroticism** (-0.3 of a sd, $p=0.3$); no significant difference in women. Results about openness and conscientiousness were confirmed by a Cox regression ($p<.05$). EQS structural equation model showed that both conscientiousness and openness were significantly ($p<.01$) affected by age and negatively ($p<.01$) influenced both blood pressure and all-cause mortality. **Openness** was also correlated with lower social status
Mroczek and Spiro [2007]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – growth-curve parameters of neuroticism and extraversion (EPI-Q scale) *health* – self-reported subjective and objective health (Seriousness of Illness Rating Scale) and depression (from the Symptom Check List-90);	Data: Normative Aging Study (Department of Veterans Affairs) 2,280 initially health men Methods: Cox proportional hazard model	Controls: neuroticism and extraversion separately; (1) Age (2) Age + health controls + interaction of level and growth of personality traits. (No gender, only men) Timing of Measurements: Health status and personality traits were assessed in 1987-88 (age 43 to 91); death certificates through 2005 Theory: neuroticism and its growth influence depression and poorer health	**Extraversion**: no significant impact on mortality ($p>.05$) **Neuroticism** level had no significant effect; neuroticism **growth**: (1) increase of 1/2 a standard deviation over a decade increased the risk of dying by 40% ($p<.01$) (2) controlling for health, effect grew to 67% ($p<.01$); significant ($p<.01$) effect of the interaction between level and growth: men with higher initial levels and greater increases in neuroticism over time died sooner

[32] Table A9 – Table A12 were created by Pietro Biroli.

Friedman, Tucker, Tomlinson-Keasey et al. [1993]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – six personality dimensions (Conscientiousness, Motivation, Cheerfulness, Sociability, Energy, Moods; parents and teacher assessment on 25 dimensions) *cognitive* – IQ (Rated general intelligence)	Data: Terman Life-Cycle study of Children (n=1,178) Methods: factor analysis; Cox proportional hazard models; logistic regression	Controls: (1) sex, year of birth and IQ (2) sex and all personal traits (3) sex; conscientiousness and cheerfulness squared (4) separate regression by gender Timing of Measurements: personal traits in 1922 (around age 11); survival up to 1986 Theory: biological (genetic / early environmental joint determinants); personal traits influence health behaviors or ability of coping with stress	(1) No effect of IQ or year of birth; only sex mattered (females live longer, $p<.0001$) (2) **conscientious** people tend to live longer (Relative Hazard $75^{th}/25^{th}$ percentile=.77; $p<.01$); **cheerful** ones tend to die earlier (RH = 1.23, $p<.05$); no effect of anything else than gender (3) concave effect of conscientiousness on mortality (square term has a RH=.15, $p<.05$) (4) conscientiousness has a significant effect for men ($p<.01$) but not women; women's longevity (but not men's) is influenced by cheerfulness
Kern and Friedman [2008]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – Conscientiousness (various measures: MMPI, NEO-Five factor; childhood/ parents/ teacher/ hospital ratings)	Data: several medical dataset about patients with different diseases (see results); Changing Lives of Older Couples Study; Terman Life Cycle Study; Cardiovascular Disease Project; Kansas high School Graduates (n=108); U.S. presidents (32); Medicare Demonstration study; Religious Orders Study; graduates from State University (155) Methods: literature review; Raw correlations and Random Effect moderator analysis	Controls: none Timing of Measurements: various. Some data assessed traits before onset of disease, some were contemporaneous Theory: conscientiousness induce better coping with stress, healthier behaviors; possible biological joint determinant of longevity and conscientiousness	Correlation coefficients ranged from 0.00 to 0.41: **conscientiousness** was never associated with higher mortality. Overall weighted and unweighted means and medians calculated following a random-effects approach showed a significant ($p<.05$) association between conscientiousness and longevity. Six different countries: the United States, Canada, Germany, Norway, Japan, and Sweden. Medical Datasets included patients with: coronary heart disease (n=40) angina pectoris patients (74) Stage 1 malignant melanoma patients (60) chronic renal insufficiency (174) anorexic (103) older community members (380 and 392) adolescent psychiatric patients (1095); cancer (819) leukemia (35); institutionalized elderly chronically ill patients (193)

Weiss and Costa [2005]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – Big Five (NEO-Five Factor Inventory 60-item questionnaire) *initial health*—presence of diabetes or cardiovascular disease (Health of Seniors Survey) or major depressive episode (dummies); functional limitations (Activities of Daily Living and Instrumental Activities of Daily Living scale); self-rated health; smoking (current, former, never)	Data: Medicare Primary and Consumer-Directed Care Demonstration (n=1076) Methods: Cox proportional hazard regression	Controls: sample: old age with no severe cognitive impairment; always control for gender, age, education, initial health variables. (1) continuous personality scores (2) trichotomized personality score (low-middle-high) Timing of Measurements: personality assessed at baseline and 23-year follow-up (age 65 to 100); mortality followed up to 5 years after baseline Theory: personal traits influence healthy behaviors/survival probability	(1) a SD increase in Neuroticism or **Agreeableness** related to 15.76% and 12.27% reduction in mortality risk ($p<.05$); other personal traits were non-significantly related to mortality (2) moving from average to high **conscientiousness** scores reduced mortality more than twice ($p<.05$); no other significant results
Christensen, Ehlers, Wiebe et al. [2002]	Outcome(s): *health* – longevity Explanatory Variable(s): *personality* – Big Five (NEO-Five Factor Inventory 60-item questionnaire) *Initial health* – clinical variables (dummy for presence of diabetes mellitus, comorbid cardiovascular disease; serum creatinine, blood urea nitrogen (BUN), albumin, potassium, and hemoglobin levels; blood pressure)	Data: Patients at the renal medicine clinic at the University of Iowa Hospitals and Clinics (n=174) Methods: Cox proportional hazard regression	Controls: sample selection: no severe cognitive impairment; chronic and progressive form of renal disease with a serum creatinine level above 3.0 mg/dl; no renal replacement intervention Controlling for age, gender, years of education, marital status and initial health Timing of Measurements: personality and initial health at baseline (average age 54.4) and follow-up; mortality followed for 4 years Theory: personal traits influence healthy behaviors/survival probability	High **neuroticism** scores and low conscientiousness decreased survival probability (37.5% and 36.4% respectively, $p<.05$)

Kubzansky, Sparrow, Vokonas et al. [2001],	Outcome(s): *health* – longevity (mortality from coronary heart disease) Explanatory Variable(s): *personality* – Optimism (revised Optimism-Pessimism Scale derived from Minnesota Multiphasic Personality Inventory) *health* – BMI, smoking status (never, former, or current), alcohol use (dummy for two or more drinks of alcohol per day) systolic and diastolic blood pressure (mm Hg), serum cholesterol (mg/dl), family history of heart disease (dummy)	Data: Veterans Affairs Normative Aging Study (n=1306) Methods: Cox proportional hazard regression	Controls: sample: men with no known chronic medical condition (1) Controlled for age, education (dummy for beyond high school studies) and health status; (2) also control for anxiety, anger/hostility, and depression (SCL-90 scale). Timing of Measurements: personality and health status checked at baseline (age 21 to 80); mortality followed for 10 year Theory: an optimistic explanatory style may protect against risk of coronary heart disease in older men	**Optimistic** men have few probabilities of dying from Coronary Heart Disease). Compared to pessimistic men, optimistic have a relative risk of death of .44 ($p<.05$); (2) controlling for negative emotions the relative risk increases to around .70
Chiteji [2010]	Outcome(s): *health behavior* -- Drinking and Exercising (dummies) Explanatory Variable(s): *personality* -- future oriented (question about length of individual's time horizon), self-efficacy (index in the 1972 PSID)	Data: PSID (2911 household heads in 1972 and 525 in 1999) Methods: logistic regression	Controls: current wage, future earnings, health insurance, education. No gender difference Timing of Measurements: contemporaneous Theory: psychological traits influence behavior that influences health outcomes	**Future oriented** people have roughly 7% ($p<.01$) lower probability of drinking and 15% ($p<.01$) higher probability of exercising; **self-efficacy** reduces by 20% ($p<.01$) the probability of drinking and increases by 7% ($p<.05$) the probability of exercising ($p<.01$).

Hampson, Tildesley, Andrews et al. [2010]	Outcome(s): *unhealthy behavior* – self-reported substance abuse, levels and growth (cigarettes, alcohol, and marijuana; 0 = Never, to 5 = "Some each day" in the past year) Explanatory Variable(s): *personality* – growth-curve parameters of hostility and sociability (annual teacher assessments of levels; growth over 4 years of childhood; questions taken from Walker-McConnell Test of Children's Social Skills, the Harter Social Acceptance subscale of the Perceived Competence Scale for Children, the Teacher Report Form and the pro-social subscales of the Children's Social Behavior Scale Teacher Form)	Data: Oregon Youth Substance Use Project (OYSUP); 1074 children from 15 elementary schools Methods: cohort sequential latent growth modeling; directed acyclic graphs	Controls: n/a. Separate analysis by gender Timing of Measurements: hostility and sociability assessed from 1st to 8th grade; unhealthy behaviors assessed from 9th to 12th grade Theory: Previous studies showed stable relations between sociability/hostility *levels* and substance abuse. Since children self-select into peer-groups with similar personality traits, *growth* of certain traits over time can predict involvement in risky behaviors	Initial level of **hostility** was significantly ($p<.01$) associated with initial level of cigarette, alcohol and marijuana use (effect stronger for girls ($p < .01$) than boys); hostility level also predicted ($p<.01$) growth in the use of cigarettes and marijuana (effect stronger for boys). Growth in hostility was associated ($p<.01$) with initial abuse of all 3 substances. Initial level of **sociability** was positively associated ($p<.01$) with initial level of alcohol abuse (no gender difference). Growth in sociability was never associated with substance use
Hampson, Goldberg, Vogt et al. [2007]	Outcome(s): *health status* -- Self-rated general health, functional status, BMI Explanatory Variable(s): *personality* – teacher assessment of Big Five (36 to 63 personality attributes from Cattell and Coan) *health behaviors* – eating habits (22-item version of the Food Habits Questionnaire) , smoking history (0 ="never smoked," to 3= "smokes half a pack a day or more."), physical activity (Godin Exercise Questionnaire)	Data: 1,054 members of the Hawaii Personality and Health cohort (40 years, childhood to mid-life) Methods: factor score; directed acyclic graphs	Controls: education, health behaviors. Pooled by gender and then separately Timing of Measurements: Childhood personality traits were obtained between 1959 and 1967 (1^{st} to 6^{th} grade); all other variables were obtained between 1999 and 2000 (age 41 to 50) Theory: Personality influences on health status are mediated by patterns of health-enhancing and health-damaging behaviors over the life course as well as educational attainment	**Extraversion** positively affected ($p<.10$) physical activity (.06) and smoking (.07); **Agreeableness** decreased smoking (-.10, $p<.01$) and increased educational attainment (.07; $p<.10$); **Conscientiousness** positively influenced both education (.16; $p<.01$) and final health status (.12; $p<.05$); **intellect/imagination** only influenced education (.17; $p<.01$). In turn, educational attainment improved eating habits (.38;$p<.01$) and smoking (-.32; $p<.01$) but decreased physical activity (-.15; $p<.01$). Physical activity and eating habits were positively associated with overall health status (.22; $p<.01$) while smoking decreased it (-.10; $p<.01$) Only gender difference was that women who were less **agreeable** as children were more likely to smoke (–.21, $p< .001$)

Luciano, Houlihan, Harris et al. [2010]	Outcome(s): *stress* – anxiety and depression (7 items each, Hospital Anxiety Depression Scale (HADS)) Explanatory Variable(s): *Personality* –Big-Five (IPIP 50-item inventory and NEO five-factor inventory) *genetic* -- Genomic DNA (single-nucleotide polymorphisms (SNPs) selected based on previous associations with personality, anxiety or depression)	Data: Lothian Birth Cohort 1936 (age 70, N = 1,091) and 1921 (age 80, N=550; age 87, N=229) Methods: regression with Bonferroni correction (association tests performed in PLINK)	Controls: sex and age Timing of Measurements: contemporaneous Theory: The genes influence personality traits and inflammatory markers, which in turn can induce depression	None of the selected SNPs in candidate genes for anxiety, depression and personality traits were significantly associated to negative health outcomes after a correction for multiple testing. Significant ($p<.01$) associations were found between NOS1 and **Extraversion**, and between PSEN1 and **depression/neuroticism**. Of the inflammatory marker genes, Transferrin (TF) was positively associated ($p<.05$) with **emotional stability**, **agreeableness** and **conscientiousness**; Glutathione peroxidase (GPX) with **extraversion**, **intellect**, **conscientiousness**
Friedman, Kern and Reynolds [2010]	Outcome(s): *healthy aging*– 5 measures of healthy aging (physical health, Subjective well being, Cognitive functioning, Social competence, Productivity); Explanatory Variable(s): *personality* – six personality dimensions (Conscientiousness, Motivation, Cheerfulness, Sociability, Energy, Moods; parents and teacher assessment on 25 dimensions) *cognitive* – IQ (Rated general intelligence)	Data: Terman Life-Cycle study of Children (n=1,312) Methods: factor analysis; hierarchical linear regression for the health aging;	Controls: sample selection: high ability children; Healthy aging: (1) only neuroticism, separate by sex (2) all personality traits separated by sex Timing of Measurements: personal traits in 1940 (age 29); health information in 1986 (age 75); death certificated throughout 2007 Theory: starting from a homogenous healthy sample, compare the health and personality evolution over the life-cycle	(1) Worse physical health and subjective well being were significantly ($p<.05$) associated with higher **neuroticism**, even more so for women ($p<.001$). Female scoring high on neuroticism in adulthood also were less social competent in later life. (2) **Agreeableness** was associated with higher subjective well being (men and women, $p<.05$) better physical health and social competence (men). **Extraversion** was associated with higher social competence (men and women) **Conscientious** men were more productive and social competent

Table A10. The Effect of Cognitive Ability on Health Outcomes

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Jokela, Batty, Deary et al. [2009]	Outcome(s): *health* – longevity Explanatory Variable(s): *cognitive* – IQ (40 verbal and 40 non verbal items) *health* -- psychosomatic symptoms (30-item Malaise Inventory), smoking (dummy), alcohol use (units of alcohol per week), BMI	Data: 1958 British Birth Cohort Study (N=10,620) Methods: discrete-time survival analysis	Controls: (1) sex interacted with IQ, childhood measures (father's occupation, family size, family difficulties, problematic behavior, height, mother's and father's investment); (2) add also adult measures (education, occupation, marital status, psychosomatic symptoms, smoking, alcohol use, BMI) Timing of Measurements: IQ, height and childhood risk factors at age 11; adult risk factors at age 23,33 and 42; mortality followed up to age 46 Theory: Not fully established. Possibly environmental (higher IQ, higher social status) possibly biological (higher IQ, better care oneself)	(1) 1sd increase in **IQ** decreased mortality probability (odds-ratio=.73, $p<.05$); (2) still significant but lower association between mortality and IQ (OR=.80, $p<.05$); Gender-IQ interaction never significant ($p>.80$); controlling for parents' investment in child reduced the association by 15% to 20%; education and psychosomatic symptoms attenuated association by 25%

Batty, Deary and Gottfredson [2007]	Outcome(s): *health* – longevity Explanatory Variable(s): *cognitive* – IQ (various measures)	Data: Swedish prospective cohort study (1938–1979); Australian retrospective cohort study (1965–1982); American retrospective cohort study (1931–1998); Scottish retrospective cohort study (1932–2001); Danish retrospective cohort study (1965–2002); UK prospective cohort study (1955–2001) Methods: literature review	Controls: (not all in same study) age, sex, birth date, birth weight, childhood illness, education, paternal socio-economic position, adult socio-economic position, smoking Timing of Measurements: Pre-morbid IQ, later life outcomes and mortality Theory: IQ might affect disease and psychiatric and injury prevention or management, increase socio-economic position	Positive relation between higher **IQ** and longevity; comparing groups from lowest to highest IQ, mortality risk decreased from 50% to 100%; some studies found a stepwise increase in mortality risk in successively lower quartiles of IQ; possible threshold effects; possible differences by sex (not common across all studies)
Batty, Deary, Schoon et al. [2007a]	Outcome(s): *healthy behavior* – eating habits (how often they ate a range of food); exercise (how often, how intense) Explanatory Variable(s): *cognitive* – IQ test (modified version of the British Ability Scales)	Data: 1970 British Cohort Study (N=8282) Methods: analysis of variance, logistic regression, Chi-square test	Controls: sex, childhood and current social class, education, annual earnings Timing of Measurements: Personal traits were measured at age 10, while health outcomes at age 30 Theory: not discussed	A sd increase in childhood v**erbal mental ability** significantly (p<,.05) increased the probability of eating fresh fruit (Odds Ratio = 1.09), cooked (OR=1.18) and raw (OR=1.09) vegetables; fish (OR=1.16); fewer French fries (OR=0.91); food fried in vegetable oil (vs hard fat; OR=1.11). Also increased the probability of getting out of breath/sweaty more frequently (OR=1.15), but had no significant impact on taking regular exercise or exercising more frequently (significant effect present when controlling only for sex)

Taylor, Whiteman, Fowkes et al. [2009]	Outcome(s): *healthy behavior* – smoking (never, past, current. Age of beginning) Explanatory Variable(s): *cognitive* – IQ (Moray House Test (MHT))	Data: Link of Scottish Mental Survey and Midspan prospective cohort studies (N=938) Methods: logistic regression; Cox's proportional hazards regression	Controls: (1) sex (2) sex and social class Timing of Measurements: Mental ability at age 11, smoking status at midlife Theory: not discussed	**IQ** and risk of ever smoking were not significantly correlated (p>.05) The relative rate of stopping smoking associated with one standard deviation increase in childhood IQ was 1.25 (p<.05) but not significant anymore once controlling for social class
Batty, Deary, Schoon et al. [2008]	Outcome(s): *health* – alcohol abuse (frequency, alcohol units consumed per week, problems drinking indexed by CAGE score) Explanatory Variable(s): *cognitive* -- IQ test (modified version of the British Ability Scales)	Data: British Cohort Study 1970 (n=8170) Methods: ANOVA, Chi-square test, ordinal logistic regression	Controls: Sex, current social class, adult alcohol outcomes Timing of Measurements: Personal traits were measured at age 10, while health outcomes at age 30 Theory: higher IQ induces a more responsible drinking behavior	Higher **mental ability** (childhood) linked with alcohol problems during adulthood (P for interaction term=.004) or drinking alcohol more frequently (0.043); for women, significant association between current social class and alcohol problems (P for interaction term=.44)
Batty, Deary, Schoon et al. [2007b]	Outcome(s): *health risk factor* – accidents (at work, at or around home, sports, others) Explanatory Variable(s): *cognitive* -- IQ test (modified version of the British Ability Scales at age 10; mental test abilities for 5 year olds: Human Figure Drawing Test, Copying Designs Test, English Picture Vocabulary Test, Profile Test)	Data: British Cohort Study 1970 (n=8203) Methods: ANOVA, logistic regression, odds ratios	Controls: Sex, childhood social class, current social class, academic/ vocational qualifications, annual net earnings, Timing of Measurements: mental test scores at age 5 and 10; risk factors at age 30 Theory: higher IQ induces a more responsible behavior	**IQ** scores positively related to level of educational qualifications (Spearman: 0.31); accident at work decreased with increasing IQ scores in unadjusted analysis (OR: 0.81; weakened when adjusted for parental social class or educational attainment; not significant for current social class), for sports (OR: 1.25), around the home (OR: 1.12), other circumstances (OR:1.15); in multivariate analysis, one SD increase in IQ score at age 10 years risk of accident in home rose by 19%, 29% in other locations (results weaker for women); results differed on sex and location; for women, positive relationship between IQ score and accidents and backwards for men

Gale, Batty, Cooper et al. [2009]	Outcome(s): *health risk*– self-reported health, obesity Explanatory Variable(s): *cognitive* -- IQ test (modified version of the British Ability Scales at age 10) *health* -- Psychomotor Coordination (Rutter Parental 'A' Scale of Behavior Disorder and Malaise Inventory)	Data: 1958 National Child Development Study and the British Cohort Study 1970 (N=6147) Methods: Correlation coefficients, logistic regression, odds ratios	Controls: Sex, educational attainment, earnings, parental social class, and current socioeconomic position Timing of Measurements: psychomotor coordination and intelligence at age 11 years and health outcomes at age 33 years Theory: higher IQ induces a more responsible behavior	Psychomotor coordination scores were higher in individuals with a higher **IQ** in both cohorts (r=-0.18 for 1958 cohort and r=-0.17 for 1970 cohorts); **nonverbal intelligence** strongly correlated with psychomotor coordination, more than **verbal intelligence** (r=0.20 and r=0.11, respectively); higher IQ and better coordination associated with lower risk of fair/poor health (OR=0.63 for 1958 cohort and OR=0.79 for 1970 cohort) and with lower risk of obesity (0.75 in 1958 cohort and 0.85 in 1970 cohort
Gale, Hatch, Batty et al. [2009]	Outcome(s): *health risk*– psychological distress (Malaise Inventory/BMI, and Rutter's Malaise Inventory) Explanatory Variable(s): *cognitive* -- IQ test (modified version of the British Ability Scales at age 10) *health* -- Psychomotor Coordination (Rutter Parental 'A' Scale of Behavior Disorder and Malaise Inventory)	Data: 1958 National Child Development Study and the British Cohort Study 1970 (N=6147) Methods: Spearman correlations, point bi-serial correlations, binary logistic regression, odds ratio	Controls: Sex, educational attainment, earnings, parental social class, and current socioeconomic position Timing of Measurements: psychomotor coordination and intelligence at age 11 years and health outcomes at age 33 years Theory: higher IQ induces a more responsible behavior	Higher **IQ** scores associated with lower total scores on Malaise Inventory in both cohorts (correlation coefficients: -0.18 for 1958 cohort and -0.11 for 1970 cohort); risk of psychological distress was greater in women for both cohorts; 1 SD increase in childhood IQ for psychological distress OR=0.61 for 1958 cohort and OR-0.77 for 1970 cohort; higher intelligence in childhood associated with reduced risk of psychological distress in both cohorts

Table A11. The Effect of Health on Personality

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Pesonen, Räikkönen, Andersson et al. [2008]	Outcome(s): *personality* – Big Five (NEO-Personality inventory) Explanatory Variable(s): *health* – very low birth weight (VLBW < 1500g)	Data: Helsinki Study of Very Low Birth Weight Adults (n=326) Methods: Univariate analyses of covariance (ANCOVA); matching and Bonferroni correction (next available singleton infant, same sex, born at term, not small for gestational age);	Controls: sex, age at assessment, parental educational attainment, individual school grade average; maternal preeclampsia and prenatal smoking; Timing of Measurements: weight at birth, maternal and gestational variables (1978-85); child age and education at follow up (2004) Theory: biological mechanism associated with prematurity; parents take better care of VLBW children;	VLBW adults scored significantly higher in **conscientiousness** (mean difference=1/5 of a standard deviation, $p < .03$), **agreeableness** (MD=1/2 of 1sd, $p < .001$), and lower in **openness** to experience (MD= –1/4 of 1sd, $p < .02$). They also showed lower **hostility** (-1/3 of 1sd, $p<.02$) and **impulsivity** (1/2 of 1sd, $p<.001$) however **neuroticism** overall was not significantly different; also displayed less **assertiveness** (1/2 of 1sd, $p < .05$) but no overall difference in **extraversion**. No significant interaction with gender No significant impact of excluding chronic disability (cerebral palsy (n = 12) or other developmental impairment (n = 5))
Ryden, Sullivan, Torgerson et al. [2003]	Outcome(s): *personality* -- Karolinska Scales of Personality (Somatic Anxiety, Muscular Tension, Psychasthenia, Psychic Anxiety, Monotony Avoidance, Impulsiveness, and Irritability) Explanatory Variable(s): *health* – obesity (2-year weight change due to surgery or diet)	Data: Swedish Obese Subjects reference study (1380 surgical treatment, 1241 conventional treatment) Methods: Matching (non-randomized controlled trial); Wilcoxon signed-ranks test; ANOVA with Bonferroni correction; effects sizes (ES) using Cohen's d	Controls: matching on 18 variables, 6 of which psychological. Analysis performed also separated by gender Timing of Measurements: BMI and personality trait assessed before treatment and 2 years after (age 37 to 60) Theory: obesity affects the way people relate to others	Due to non-randomization, personality traits significantly differed among the three groups (surgical treatment, conventional treatment, control). After treatment **anxiety**, **extraversion** and **aggression** significantly improved ($p<.01$) for both surgical and conventional treatment patients. Qualitatively, the greater the weight-loss the bigger the change in personality scores. Compared to the reference group, changes in traits were small or trivial: differences in Somatic Anxiety, Muscular Tension and Impulsiveness were significant and more than ½ a standard deviation for patients who loss <10kg. Also Psychic Anxiety and Irritability differed by roughly 1/4 of a standard deviation. Changes in all other psychological traits were less than 1/5 of a standard deviation Men and women differed significantly ($p<.01$) in personal traits (women scored higher in anxiety and lower in Monotony Avoidance); treatment effect significantly different across gender only regarding **Impulsiveness** (women=0.4 of a sd; men=0.6 of a sd)

Sapienza, Zingales and Maestripieri [2009]	Outcome(s): *personality* – financial risk aversion (willing to pay to avoid a 50/50 lottery $0/$200) Explanatory Variable(s): *health* – testosterone (salivary concentration and markers of prenatal exposure)	Data: 460 MBA students at Uchicago Methods: OLS (robust s.e.)	Controls: (1) none (2) sex (3) only low levels of testosterone Timing of Measurements: contemporaneous Theory: testosterone can affect brain formation (pre- and postnatal exposure) or its functioning (puberty)	(1) Overall negative correlation between salivary testosterone concentrations and **risk aversion** (r=-0.1793; p=.01); (2) effect goes away once controlling for sex (female are significantly more risk averse p<.05). (3)Focusing only on people with low levels of testosterone (n=225) higher levels of circulating testosterone were associated with lower risk aversion even after controlling for gender. Possible nonlinear effect of testosterone on risk aversion regardless of gender. Markers of prenatal exposure to testosterone had no significant effect on risk aversion
Shenkin, Starr and Deary [2004]	Outcome(s): *cognitive* – IQ measurement Explanatory Variable(s): *health* – birth weight	Data: 1946 and 1958 British birth cohort; 1950–1954 Birmingham study; National Collaborative Perinatal Project; Scottish Mental Survey; Newcastle Growth and Development Study and Performance Indicators in Primary Schools Method: Literature review	Controls: (not all in the same study) sex, gestational age, birth rank; maternal age; parental education; social class (parental occupation); deprivation; weight in infancy; race; Postnatal height and weight; breast fed Theory: Biological development of brain hinders IQ;	Small, consistent, positive association between birth weight and childhood **cognitive ability**, even after controlling for other variables. Possible concavity of the relation (steeper at low birth weights and possibly downward sloping at high weights) which varies across gender and as children age. However **IQ** variance was more related to parental social class than birth weight.
Hoffman, Fessler, Gneezy et al. [2010]	Outcome(s): *personality* – competitiveness (ball throwing task) Explanatory Variable(s): *physical health* – height	Data: 1296 residents of 8 villages in Meghalaya (India) Methods: randomized controlled experiment, matching on gender and village	Controls: (matching) gender and village Timing of Measurements: contemporaneous Theory: bigger individuals are more aggressive by nature since they are more likely to win a fight (especially men)	When asked to play a particular game either alone or against a randomly assigned partner, 38.1% of the men and 23.8% of women chose to compete. Each additional centimeter of height increased the probability of competing by 0.6% (p=.004). the tallest quartile is 1.5 times as likely to compete as the shortest quartile

Sell, Tooby and Cosmides [2009]	Outcome(s): *personality* – anger and aggression (proneness to anger, history of fighting, utility of personal and political aggression) entitlement (expectation of better treatment, e.g. "I deserve more than the average person") Explanatory Variable(s): *physical health* – height and strength (weight lifting machines, self-perception, chest/arm circumference); attractiveness (self-perception)	Data: (study 1) 62 men from UCSB gym; (study 2) 125 men and 156 women from UCSB study center Methods: Correlation (Pearson r)	Controls: (study 1) simple correlation (study 2) control for both strength and attractiveness Timing of Measurements: contemporaneous Theory: evolutionary biology	(1) In men, both lifting strength and self-perception of strength were positively ($p<.009$) correlated with **anger** and **aggression** measures ($0.27 < r < 0.47$) (2) The effect of strength on **aggressiveness** was significantly lower for women; attractiveness was positively ($p<.04$) correlated with all measures of anger and entitlement but not aggression; in men, strength and attractiveness are highly correlated with each other and with measures of anger and aggression

Table A12. The Effect of Personality on Cognitive Ability and Health

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Gale, Batty and Deary [2008]	Outcome(s): *health* -- BMI, blood pressure, self-rated health, psychological distress (Rutter's 24-item Malaise Inventory), smoking, exercising Explanatory Variable(s): *personality* -- locus of control (16-item CAROLOC scale) *cognitive* -- IQ test (modified version of the British Ability Scales)	Data: 1970 British Cohort Study; 10 year follow-up (14,875 children) and 30 year follow-up (7,551 children) Methods: logistic regression	Controls: (1) sex, locus of control and IQ (2) sequentially add parental social class, current social class, academic/vocational qualifications, annual earnings Timing of Measurements: Personal traits were measured at age 10, while health outcomes at age 30 Theory: Locus of control might affect health spurring healthy behaviors or via psychological influences (maintain homeostatic internal environment, lower stress responsiveness)	(1) **IQ** and **locus of control** are correlated among themselves (r=0.48) are positively (p<.01) correlated to health outcomes; adjusting for locus of control weakened the associations between IQ and lower health risk by 20% to 60%; (2) A standard deviation increase in the **locus of control** decreased significantly (p<.05) the risk of being overweight (BMI≥25) or obese (BMI≥30; stronger effect for women), the risk of fair or poor self-rated health and the risk of psychological distress. It had no significant impact (p≥.05) on blood pressure, smoking or exercising. Adjusting for childhood IQ attenuated the health risk estimates due to higher locus of control by 17% to 30% percent. Adjusting for education attainment further attenuated them by 25%-80%
Weiss, Gale, Batty et al. [2009]	Outcome(s): *health* -- longevity Explanatory Variable(s): *personality* – Neuroticism (Minnesota Multiphasic Personality Inventory) *cognitive* – IQ (Army General Technical Test) *health – physical*: hypertension, cancer, diabetes, or coronary heart disease; serum glucose levels, systolic (SBP) and diastolic blood pressure (DBP), physical activity (resting pulse rate), lung function, BMI; *behavioral*: use of cigarettes (never, current, former) or alcohol (never, seldom, or number of binge per month); *mental*: depression or anxiety	Data: Vietnam Experience Study (4200 Vietnam-era war veterans) Methods: differences in mean; Cox proportional hazards model; covariance structure modeling (MLE)	Controls: men only; (1) age, ethnicity, and marital status; (2) add education, income, 7 physical health measures, 2 mental health measures, drinking, and smoking to (1) Timing of Measurements: Explanatory variables assessed in 1985-1986 (age 30 to 48); death records censored in 2001 Theory: not discussed	(1) Independent mortality risk factors were high **neuroticism** (Hazard Ratio 1.296, p<.01) and low **cognitive ability** (HR 0.797, p=.006); there was significant interaction between the two (p<.01). (2) SES, physical and mental health variables attenuated the effect of cognitive ability but not that of neuroticism Covariance structure models allowing for correlation between factors showed that mortality is directly affected (p<.01) by **neuroticism**, lower income, and poor health as well as indirectly predicted by **cognitive ability** (paths from cognitive ability to higher income, more education, better health, and less neuroticism)

Savelyev [2010]	Outcome(s): *health* – longevity (survival through age 80 conditional on survival through age 30); *education* – the highest degree obtained in life. Explanatory Variable(s): *personality* – Conscientiousness, Openness, and Extraversion (averaged parents' and teachers' ratings from 1922), *cognitive* – IQ in 1922 (Stanford Binet and Terman Group Test), *initial health* – birth weight, whether birth was normal without complications, breastfeeding dummy	Data: Terman Life-Cycle study of Children (n=980) Methods: factor analysis; matching (observables and unobservables); Structural modeling with latent personality traits: discrete time proportional odds model of longevity with time-dependent effects, personality-education interactions; multinomial logit model of education level choice with latent factors; MLE; bootstrap inference	Controls: (1) separate analysis by gender; highest education level, IQ, father's and mother's education and occupation, parental origin, private tutoring by age 12, number of siblings, deceased mother, deceased father, divorced parents, World War II participation, World War II combat experience, cohort dummies (2) conscientiousness interacted with education Timing of Measurements: personality items and IQ, 1922 (around age 12); survival up to 1991; highest education level 1922-1986; private tutoring 1922-1928; World War participation information, 1945; all other variables, 1922. Theory: education creates skills that substitute Conscientiousness in producing health, since those skills act through the same mediators as Conscientiousness (healthy lifestyle, successful family, and others)	Male results: **Conscientiousness** and education increase survival and they substitute for each other (Education has stronger effects at low levels of Conscientiousness and vice-versa). **IQ**, **Openness**, **Extraversion** and other traits are not strong predictors of longer survival. The indirect effect of Conscientiousness on longevity acting through enhancing education is small. Females: effects of education and traits are generally not precisely determined. Doctorate degree is slightly associated to higher mortality ($p<.10$), which is possibly related to poor family outcomes. The result is likely specific to females born in the beginning on the 20th century

Conti, Heckman and Urzua [2010a]	Outcome(s): *healthy behavior* – ever used cannabis, daily smoking and regular exercise *health* -- BMI, self-rated health, psychological distress (Rutter's 24-item Malaise Inventory) Also: *schooling* and *labor market* outcomes Explanatory Variable(s): *personality* – locus of control (16-item CAROLOC scale) perseverance, cooperativeness, completeness, attentiveness and persistence (teachers' assessment) *cognitive* – IQ test (modified version of the British Ability Scales) *initial health* – height and head circumference conditional on weight (age 10); father's and mother's height	Data: 1970 British Cohort Study; (3,777 men and 3620 women) Methods: factor model (mixture of multivariate normals); matching (observable and unobservable); estimation of distribution of treatment effect conditional on endogenous schooling behavior using Bayesian Markov Chain Monte Carlo methods to compute likelihood	Controls: separate analysis for gender; mother's age at birth, mother's education at birth, father's high social class at birth, total gross family income at age 10, living with both parents since birth until age 10 (dummy), parity, number of children in the family at age 10. Timing of Measurements: Personal traits were measured at age 10, while health outcomes at age 30 Theory: technology of skill formation: personality and health traits grow and reinforce themselves over the life-cycle	Strong sorting into post-compulsory levels based on high **cognitive** and **personality skills** ($p<.01$) and also high health endowment (significant for females only) Conditional on education attained, cognitive ability matters for labor market outcomes and increases probability of cannabis use (both genders). Personality traits reduce probability of unhealthy outcome s (behaviors and overall health status at age 30). Initial health condition have a significant direct effect on health outcomes (both genders) but influence higher education only for women

Wilson, Mendes de Leon, Bienias et al. [2004]	Outcome(s): *health* – longevity (Annual clinical evaluation and brain autopsy) Explanatory Variable(s): *personality* – NEO Five-Factor Inventory (60 self-evaluated statements on a 5-point scale) *cognitive* – 19 individual tests (episodic memory, semantic memory, working memory, perceptual speed, visuospatial ability) *initial health* – clinical evaluation (medical history, complete neurological examination, assessment of motor abilities) ever smoker, alcohol (number of alcoholic drinks consumed in the past year), BMI	Data: Religious Orders Study (n=883) Methods: factor analysis; Cox proportional hazards models	Controls: Dementia patients were excluded; separate regression for each personal trait; (1) age, gender and education; (2) as (1) controlling also for global cognition and lower limb function; (3) add to (2) the number of medical conditions at baseline, alcohol use, smoker dummy, BMI; (4) interact personal traits with gender Timing of Measurements: Annual clinical evaluation from 1994 (75.1 years-old on average) to present Theory: personality influences healthy behaviors that increase longevity	(1) **Neuroticism** significantly ($p<.05$) decreases longevity (person at 90th percentile is 95% less likely to survive than person at the 10th percentile) while longevity increases with **extraversion** (90/10 percentile comparison: 75% increase in probability of survival) and **conscientiousness** (48%); when all traits are included in the regression, only neuroticism remains significant (2) controlling for **IQ** doesn't change substantially the results (same significance, similar levels) (3) only neuroticism and extraversion significantly affect longevity, in opposite direction and similar magnitudes as in (1) (4) Gender did not interact with any trait (all $p>.30$)

A7.B. The Effects of Personality and Cognitive Measures on Crime and Deviance by Amanda Agan

There is a large literature in criminology focusing on the effects of self-control on crime due to Gottfredson and Hirschi's seminal work in *A General Theory of Crime* (1990). In it they posit that a uni-dimensional factor they label as "self-control" is responsible for much of the variance in crime and deviance across individuals – although opportunity to commit crime interacts with self-control in important ways. If one has both opportunity and low self-control then crime is very likely, but without opportunity no crime occurs. They also argue that self-control is a stable trait that is unchanging over time, and thus advocate for cross-sectional tests of the theory, since longitudinal tests would be unnecessary (and more costly).

People with low self-control, as characterized by Gottfredson and Hirschi [1990], are "impulsive, insensitive, physical (as opposed to mental), risk-taking, short-sighted, and non-verbal" (1990:90). Criminal acts, they argue, are "likely to be engaged in by individuals unusually sensitive to immediate pleasure and insensitive to long-term consequences" (1990:2). Thus parts of Gottfredson and Hirshi's definition of self-control resembles the economists measure of the discount rate as well as the psychologists measure of impulsivity. There have been many studies in criminology and psychology that look at the correlations between self-control or impulsivity and criminal outcomes and deviance. However, there have been no studies linking common economic experimental measures of discount rates (or risk aversion) to criminal outcomes. This seems surprising particularly given that proliferation of research recently using these measures to predict outcomes such as education and migration (i.e. Jaeger, Dohmen, Falk et al. [2010]).

Two empirical measures of self-control have emerged in the literature. The first is a series of Likert-scale questions devised by Grasmick, Tittle, Bursik et al. [1993] – their original factor analysis on these questions determined that, as Gottfredson and Hirschi posited, this trait is unidimensional. The other empirical measure asks behavioral questions (Tittle, Ward and Grasmick [2003]) – these consists of questions about 10 forms of problem behavior such as smoking, drinking, overeating, using seatbelts etc..), and Benda [2005] includes questions like have you skipped school, have you had sex with more than one person without a condom, have you harassed someone in the past year, have you received a ticket for reckless driving, etc… The behavioral measures have been criticized as verging on tautological due to the fact that they essentially ask about participation in deviant behavior then use those responses to predict deviant behavior.

Given that the "analytic" self-control scales consist of Likert-type personality questions it is interesting to ask how it overlaps with the Big Five Personality traits. O'Gorman and Baxter [2002] test how the Grasmick, Tittle, Bursik et al. [1993] index correlates with the Conscientiousness scale of the NEO – which contains six subscales: dutifulness, self-discipline, deliberation, competence, achievement striving, and order. They find that low self-control is significantly negatively correlated with each of these subscales, with correlation coefficients ranging between 0.38 (competence) to 0.57 (order). Interestingly, when they regress self-reported deviant behavior on self-control and conscientiousness they find that self-control does not significantly add to the prediction once conscientiousness was entered.

Both the "analytic" and "behavioral" measures, and measures like them, have proven over and over again to consistently predict crime and deviance. Pratt and Cullen [2000] performed a meta-analysis of 21 empirical studies that consider the effects of self-control on

crime. They find consistently positive and significant standardized correlation coefficients between self-control measures and crime or deviance, though the correlations sizes are higher when a behavioral measure is used. Benda [2005] finds similarly that in an OLS regression of person or property offenses committed on low self-control that self-control significantly predicts offenses and this effect is higher when a behavioral rather than Grasmick, Tittle, Bursik et al. [1993] scale is used. Vazsonyi, Pickering, Junger et al. [2001], using the International Study of Adolescent Development (ISAD) finds that the Grasmick, Tittle, Bursik et al. [1993] scale explains a positive and significant amount of the variance in deviant acts (ranging from 10-16% depending on the type of act) across the four countries in the study (Hungary, the Netherlands, Switzerland, and the United States).

However, that is not to say that Gottfredson and Hirschi's theory is completely accepted. Although the main thrust of the theory is that self-control predicts much of the variance in criminal acts among people there are other facets of the theory that have not held up as robustly to empirical study. One is that once self-control is accounted for very little else should help predict crime differences. However, Pratt and Cullen [2000] find that across several studies that add in social learning variables the mean effect size of self-control on crime was unchanged but the social learning variables also had significant effects on crime. Gottfredson and Hirschi also argue that the self-control factor is uni-dimensional, however Tittle, Ward and Grasmick [2003] among others find evidence of multi-dimensionality in the scales measuring self-control.

In addition to self control other realms of personality or non-cognitive skills have been measured and analyzed in an attempt to determine their effects on crime. The studies mostly analyze deviance in children/adolescents and crime outcomes of undergraduates. Two of the studies use personality measures that load onto three main factors – constraint, positive

emotionality and negative emotionality. Across two studies – the Pittsburgh Youth Survey and the Dunedin Multidisciplinary Health and Development study – constraint was negatively correlated with self-reported delinquency while negative emotionality was positively correlated. Neither study found an effect of positive emotionality on delinquency. (Caspi, Moffit, Silva et al. [1994]). Similarly, Agnew, Brezina, Wright et al. [2002] found that their single factor measure of negative emotionality/constraint was significantly, positively associated with self-reports of delinquency amongst 12-16 year olds in the 2nd wave of the National Survey of Children. Sensation seeking and impulsivity have also been found to be positively associated with crime (Horvarth and Zuckerman [1993]), although one may argue that these traits are a subset of self-control and thus may also offer evidence in favor of Gottfredson and Hirschi's theory.

These studies in criminology and psychology, for the most part, use either correlations or OLS regression to talk about "effects" of various personality measures on crime. There has been little attempt to rigorously deal with causation in these studies.

In addition there is an emerging literature on the effects of education on crime. Lochner and Moretti [2004]using US data and Machin, Marie and Vujic [2010] using UK data find that increasing years of schooling is negatively associated with crime participation. Both papers use compulsory schooling laws as an instrument and find that these results hold up in a two stage least squares (2SLS) analysis. Lochner and Moretti [2004] posited several mechanisms through which education could causally impact criminal activity, including that education may change traits such as patience or risk aversion. Though neither paper attempts to differentiate amongst the various mechanism through which education could effect crime, that education changes ones non-cognitive skills seems like a particularly plausible argument. This is especially true in light

of findings by Cunha, Heckman and Schennach [2010]that criminal participation is more heavily loaded on noncognitive skills, thus any intervention that can change these (in a “positive” way) is likely to have effects on crime.

Table A13. The Effect of Personality on Crime[33]

	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Caspi, Moffit, Silva et al. [1994]	Outcome(s): *Delinquency* -- self-reports, teacher and parental reports, and official records Explanatory Variable(s): *personality* -- "Common language" version of California Child Q-sort (CCQ) for United States and Multidimensional Personality Questionnaire (MPQ) for New Zealand	Data**: US**: 430 12- and 13- year old boys from the Pittsburgh Youth Survey (PYS) **NZ**: Dunedin Multidisciplinary Health and Development Study (New Zealand) -862 18 year olds who took the MPQ Methods: correlations	Controls: **US:** Separate correlations computed for blacks and white, no controls **NZ:** separate correlations for men and women, but no controls Timing of Measurements: **US:** Reports were contemporaneous with test and were about delinquency at age 12 and 13. **NZ:** Self-reports are contemporaneous with MPQ test at age 18, though may have occurred in any of the previous years Theory: Personality can affect delinquent behavior	Both personality inventories were used to construct three "superfactors" – constraint (combines traditionalism, harm avoidance and control), negative emotionality (combines aggression, alienation, and stress reaction), and positive emotionality (combines achievement, social potency, well-being and social closeness) . **US:** *Constraint* is negatively correlated with self-reported delinquency for blacks and white (-0.17 and -.022 , $p<0.05$). *Negative emotionality* is positively correlated with self-reported delinquency for blacks and white (0.13 and 0.20, $p<0.05$). Positive emotionality is not significantly correlated with self-reported delinquency. Similar signs and significant for teacher- and parent-reported delinquency, except for positive emotionality which is negatively correlated with parent-reported delinquency for blacks and whites (-0.26 and -0.21 ($p<0.05$) **NZ:** *Constraint* is negatively correlated with self-reported crime for men and women (-0.44 ($p<.05$)), *negative emotionality* is positively correlated with self reported crime for men and women (0.48 and 0.34 ($p<.05$)), *positive emotionality* is not significantly correlated with self-reported crime. Signs of correlations were consistent across informant reports, police contact and court convictions, and for the most part similarly significant. Overall MPQ profile can explain 34% (25%) of variance in self-reported criminal activity for men (women).

[33] Table A13 - Table A15 were created by Amanda Agan.

Horvarth and Zuckerman [1993]	Outcome(s): *Crime* -- self reports of arrests for drugs, shoplifting, DUI, perjury, forgery, or vandalism Explanatory Variable(s): *Sensation Seeking* -- form V of the Sensation Seeking Scale (SSS). *Impulsivity* -- Narrow Impulsivity Scale of Eysenck and Eysenck (1978)	Data: Collected by authors; 447 undergraduates from an Introduction to Psychology course at the University of Delaware Methods: Correlations and multiple regression	Controls: Perceived proportion of peers participating in the specific criminal behavior, perceived risk of negative consequence from the specific criminal behavior Timing of Measurements: Personality measures and questions about crime were contemporaneous, though crime questions asked about criminal activity ever Theory: Sensation seeking, impulsivity and peer behaviors are likely important influences on criminal (and other risky) behavior	Sensation seeking and impulsivity are positively correlated with self-reported crime risk factor (0.53 and 0.36 respectively ($p<0.01$). In a multiple regression analysis with both sensation seeking and impulsivity included as well as the other controls, both sensation seeking and impulsivity are still positively associated with self-reported crime (with "Beta weights" of 0.27 and 0.13 - no p-values given but stated significant in the text). Note that perceived behavior by peers was the strongest predictor of criminal behavior.

Agnew, Brezina, Wright et al. [2002]	Outcome(s): *Juvenile Delinquency* -- self-reported five-item scale of how many times they had committed 5 acts of delinquency (hurt someone, stolen from store, damaged school property, skipped school, gotten drunk) Explanatory Variable(s): *Negative emotionality/constraint* -- factor derived from questions from teachers and parents about the child's behavior and personality	Data: 2nd wave of the National Survey of Children - 1423 children who completed the interviews, age 12-16 in 1981. Methods: Correlations and OLS	Controls: sociodemographic characteristics: total family income (8 categories), education of primary parent, family status (divorced, married), age of child, sex of child, race of child; measures of "strain" - including conflict with parents, school hatred, picked on by kids, family strain and neighborhood strain; measures of social control and social learning such - attachment to parents, parental firmness, school commitment, educational goals, time spend on homework, school attachment, troublesome friends Timing of Measurements: Contemporaneous self-reports of crime with questions to parents/teachers about behavior, although both could describe actions in the past Theory: Experiencing strain can increase an individuals likelihood of experiencing negative emotions which in turn create pressure to take action which may take the form of delinquency/crime. Personality traits, such as negative emotionality, may have a significant impact on this link.	Negative emotionality/low constraint is positively correlated with delinquency (0.22, $p<0.01$). In a regression of delinquency on all controls and negative emotionality/low constraint, an increase in the negative emotionality/low constraint scale increases delinquency ($p<0.01$). It is unclear how to interpret this magnitude. When negative emotionality/low constraint is interacted with strain, the main effect of negative emotionality/low constraint on delinquency remains positive and significant ($p<0.01$) and the coefficient on the interaction effect is positive and significant ($p<0.01$) – individuals are score higher on the negative emotionality/low constraint scale are more likely to react to strain with increased delinquency.

Table A14. The Effect of Self-Control on Crime

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Pratt and Cullen [2000]	Outcome(s): *crime and analogous behaviors* – measured in various ways in different studies Explanatory Variable(s): *self control* -- using Grasmick et al. (1993) inventory, other inventories, or behavioral questions	Data: Meta-analysis of 21 empirical studies testing the effects of self-control on crime Methods: Meta-analysis (mean effect sizes calculated)	Controls: Varies by study Timing of Measurements: Majority are contemporaneous, only two studies are longitudinal and thus have measures at different times Theory: Gottfredson and Hirschi (1990) *General Theory of Crime. A* uni-dimensional factor they label as "self-control" is responsible for much of the variance in crime and deviance across individuals	Mean effect size (standardized correlation coefficient) of self control on crime is 0.20 across the studies. When "behavioral" rather than "cognitive" or "attidunal" measures (i.e. Grasmick at al scale) are used the effect sizes are slightly higher. The effect of low self-control is significantly weaker in longitudinal studies as compared to cross-sectional studies. Self control has consistently large effects (minimum of 0.155) across different types of samples (juveniles vs. adults, racially homogenous or diverse, etc...). Variables that measure other criminal theories (i.e. social learning) do not effect the size of the effect of self-control but do tend to enter significantly in regressions on crime.
Nagin and Paternoster [1993]	Outcome(s): *criminal proclivity* -- students presented with crime scenarios were asked about whether they would participate and their probability of being caught if they do Explanatory Variable(s): *self control* -- using Grasmick et al. (1993) inventory	Data: Collected by authors; 699 undergraduates from the University of Maryland Methods: Tobit	Controls: gender, prior criminal behavior, sanctions present in the scenario, perceived utility from crime Timing of Measurements: The measures are contemporaneous Theory: Gottfredson and Hirschi (1990) *General Theory of Crime. A* uni-dimensional factor they label as "self-control" is responsible for much of the variance in crime and deviance across individuals	"Lack of self-control" as measured by the Grasmick et al. (1993) inventory is positively associated with the choice to commit crimes in all three scenarios (theft, drunk driving and sexual assault). Tobit regression was used because the modal response category for the dependent variables was 0 (i.e. no chance they would commit the crime). The lack of self-control measure was created by summing across 24 responses. An increase in 1 additional response associated with lack of self-control increases probability of intending to commit theft by 0.08 ($p<0.01$), drunk driving by 0.06 ($p<0.01$) and sexual assault by 0.11 ($p<0.01$).

Benda [2005]	Outcome(s): *Crime* -- self-reported property and person and offenses Explanatory Variable(s): *self control* -- using Grasmick et al. (1993) inventory and behavioral self-control scale where yes-no answers to questions about behavior (i.e. I regularly drive without a seatbelt) were combined to form an index	Data: Collected by authors; 3395 adolescents from a Midwestern state Methods: OLS	Controls: age, gender, race, rural/urban, family structure (two caregivers or not), caregiver years of education, annual family income, caregiver monitoring, Inventory of Parent and Peer Attachment (IPPA), Self-Efficacy Scale, 3 subscales from Childhood Trauma Questionnaire (CTQ), subscales from Multiple Problem Screening Inventory (MPSI) Timing of Measurements: Self-reports contemporaneous with personality measures but pertaining to offenses in the past Theory: Gottfredson and Hirschi (1990) *General Theory of Crime. A* uni-dimensional factor they label as "self-control" is responsible for much of the variance in crime and deviance across individuals	In an OLS regression of person and property offenses low behavioral self control is positively associated with both measures ($p<0.01$). These associations remain positive but shrink when the "cognitive" (Grasmick et al. (1993)) measure of self control is used instead.
Vazsonyi, Pickering, Junger et al. [2001]	Outcome(s): *Deviance* -- 55-item Normative Deviance Scale (NDS) - which contains 7 subscales relating to self-reported: vandalism, alcohol, drugs, school misconduct, general deviance, theft, and assault) Explanatory Variable(s): *self control* -- Grasmick et al. (1993) low self control scale	Data: International Study of Adolescent Development (ISAD), ~8500 subjects from Hungary, the Netherlands, Switzerland, and the United States. 6,085 15-19 year olds with no missing data were used in this present study Methods: Correlations, Hierarchical Regression Analysis	Controls: Sex, age, country Timing of Measurements: Contemporaneous self-repots about past deviance and self-control test. Reports given at ages 15-19 Theory: Gottfredson and Hirschi (1990) *General Theory of Crime. A* uni-dimensional factor they label as "self-control" is responsible for much of the variance in crime and deviance across individuals	All six sub-factors of self-control: impulsiveness, simple tasks, risk seeking, physical activity, self-centeredness, and temper were all positively correlated with deviance across all 7 deviance subscales. Risk seeking had the highest correlation with an average correlation of 0.320 across the 7 deviance subscales. Hierarchical regression was then used with each sub-factor of self-control entered in reverse order of correlation with deviance (age, sex, and country were entered first). Self control accounted for 18-24% of the variance in deviance across the 5 age groups (15-, 16-, 17-, 18-,19- year olds).Low self-control explains 10% of variance in theft, 12% in assault, 13% in alcohol use, 13% in drug use, 14% in school misbehavior, 15% in vandalism, and 16% in general deviance.

Table A15. The Effect of Education on Crime

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Fergusson, John Horwood and Ridder [2005]	Outcome(s): *crime* -- self reported criminal activity, self-reported arrests and convictions, and self-reported incarcerations Explanatory Variable(s): *IQ* -- Revised Wechsler Intelligence Scale for Chidren (WISC-R)	Data: Christchurch Health and Development (CHDS) study - 1,265 children in a birth cohort in New Zealand Methods: OLS	Controls: Conduct problems age 7-9, attentional problems age 7-9, anxiety/withdrawal score (age 7-9), socioeconomic disadvantage score, family instability score, parental adjustment problems score, child abuse score, and gender Timing: IQ test at age 8-9, crime outcomes from ages 17-25 Theory: Though some have found a relationship between IQ and crime, IQ is also linked to childhood behavioral and conduct problems which may explain the link.	IQ was measured in 5 categories ranging from <85 to >115, with 10 IQ point contained within each of the intervening categories. An increase from 1 category to the next is associated with -.28 self-reported offenses committed ($p<0.001$) and -0.23 self reported arrests/convictions. However, once covariates are added to the regression this relationship goes away almost completely, with a coefficient of 0.00($p=0.87$) on self-reported offenses and -0.11($p=0.11$) on arrests/convictions.
Lynam, Moffitt and Stouthamer-Loeber [1993]	Outcome(s): *Delinquency* -- self-reports, teacher and parental reports Explanatory Variable(s): *IQ* - Short form WISC-R	Data: 430 12- and 13-year old boys from the Pittsburgh Youth Survey (PYS) Methods: ANOVA, mean differences	Controls: Analysis separately by age and race, social class as a covariate, effort during test Timing of Measurements: Reports were contemporaneous with test and were about delinquency at age 12 and 13. Theory:	The authors find a significant main effect of delinquency on IQ ($p<0.001$). Adding in social class does not change the differences in mean IQ scores of delinquents and nondelinquents.

Lochner and Moretti [2004]	Outcome(s): *Imprisonment* -- reported as institutionalized in the US census Crime (census) self-reported criminal acts (NLSY) Explanatory Variable(s): *Education*--years of schooling	Data: 1960, 1970 and 1980 US Census Data on males age 20-60. National Longitudnal Survey of Youth (NLSY) 1979 cohort. Methods: OLS, IV	Controls: **Census** - separate regressions for race, cohort birth effects, state of residents x year effects, age, year, state of birth, state of residence **NLSY** - Age/cohort, area of residence, dummy for school enrollment, family background, AFQT score, SMSA status, local unemployment rate. Timing of Measurements: Theory: Education may have an important impact on criminal outcomes through several mechanisms: education increases wage which increases opportunity cost of crime, education may change non-cognitive skills which may in turn impact criminal activity.	**Census Data** - Using compulsory schooling laws as an instrument in a 2SLS estimate they find that one additional year of schooling reduces the probability of being in prison at the time of the census by 0.1 ($p<0.01$) percentage points for whites and 0.3-0.5 ($p<0.01$) percentage points for blacks (depending on controls included). OLS estimates were remarkably similar. **NLSY data** - Self-reported crime participation is reduced by around 1-3 percentage points for each additional year of schooling for white males.. For black males the effect is not significant (the purport this to be due to underreporting of criminal activity by black males.

Machin, Marie and Vujic [2010]	Outcome(s): *Crime* -- apprehended or charged for a crime; self-reports of crime *Imprisonment* -- individuals in a prison service establishment during the British Census Explanatory Variable(s): *Education*--years of schooling	Data: UK Census 2001; British Crime Survey (BCS) from 2001/2 to 2007/8. Offender Index Database aggregated and combined with education information from Labour Force Survey and wages from New Earnings Survey 1984-2002. Methods: OLS, IV	Controls: Age dummies, county of brith dummies, gender dummies, non-white dummy, marital status, dummy for never worked, current country of residence Timing of Measurements: Theory: Education may have an important impact on criminal outcomes through several mechanisms: education increases wage which increases opportunity cost of crime, education may change non-cognitive skills which may in turn impact criminal activity.	**Census Data** - From an OLS regression - individuals with no qualifications are four times more likely to be in prison at the time of the census as those with some qualifications ($p<0.01$). **BCS data** - From an OLS regression - Individuals with no qualifications report significantly more self-reported crimes than those with qualifications. **OID Cohort Data** - Using changes in compulsory schooling laws as an IV- these 2SLS results are larger in magnitude than the OLS results but cannot be rejected as significantly different from OLS.

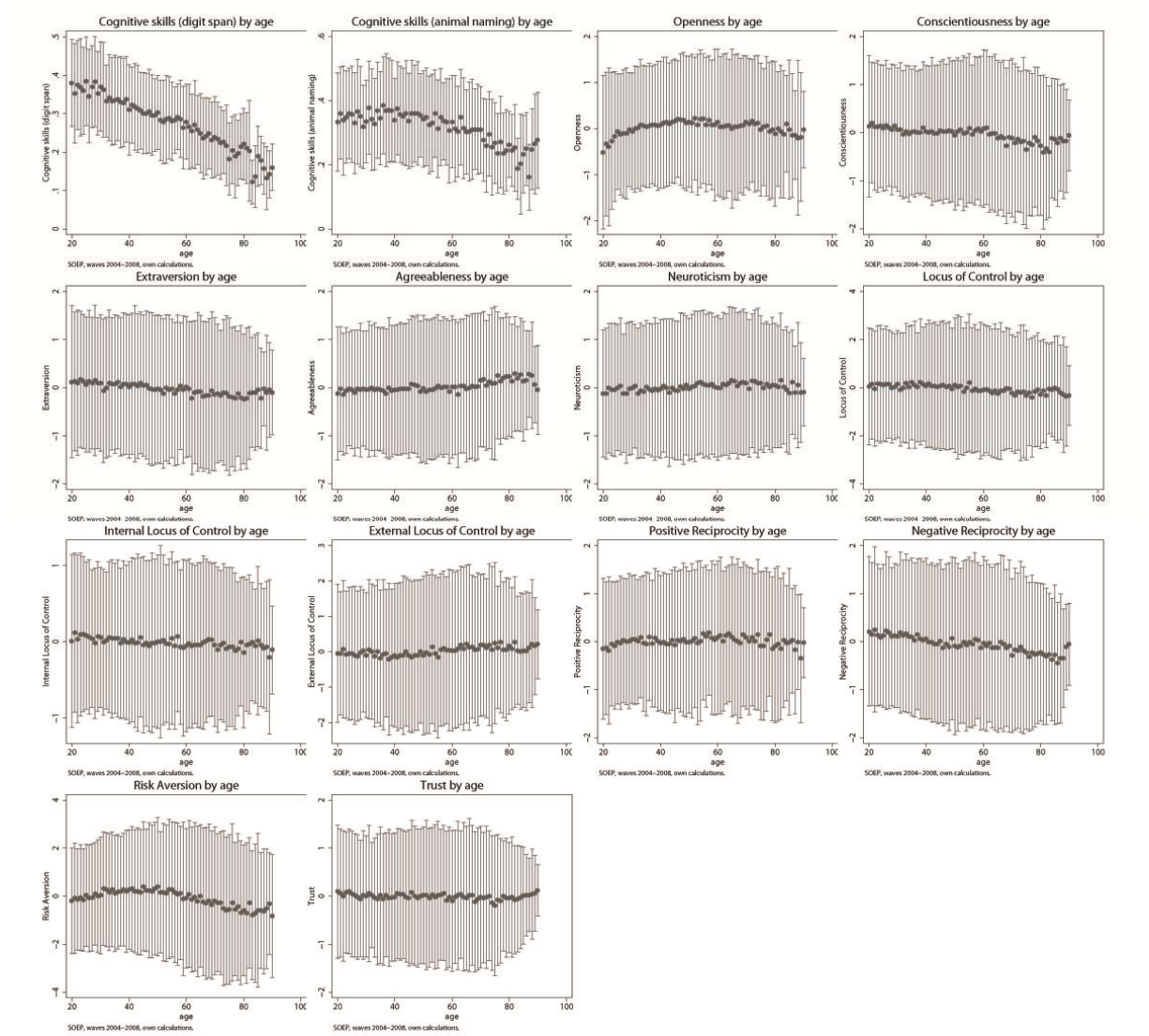
Table A16. The Effect of Personality and Preferences on Other Outcomes

Author(s)	Main Variable(s)	Data and Methods	Causal Evidence	Main Result(s)
Jaeger, Dohmen, Falk et al. [2010]	Outcome(s): *migration* – whether a person ever moved between regions in German between 2000 and 2006 Explanatory Variable(s): *risk preference* – the response to a survey question about general willingness to take risks, measured on a 10-point scale	Data: German Socio-Economic Panel (SOEP); 10,115 people aged 18-65 living in Germany (2000-2006) Methods: probit	Controls: (1) none (2) age and sex (3) age, sex, marital status, education, and place of origin Timing of Measurements: The risk question was asked in 2004 and 2006. A comparison of people who moved before and after 2004 suggested that migration did not affect risk preference. Theory: Migration is associated with uncertainty, so risk-preference should partially determine the propensity to move.	A one standard deviation increase in willingness to take risks is associated with a (1) 1.7 ($p<0.01$), (2) 1.1 ($p<0.01$), (3) 0.7 ($p<0.01$) percentage point increase in the probability of migrating, depending on specification (see controls). The average unconditional propensity was 5.8 percent.
Lundberg [2010]	Outcome(s): *marital status* – ever married by age 35, whether the first marriage ended in a divorce Explanatory Variable(s): *personality* – survey measures of The Big Five	Data: German Socio-Economic Panel (SOEP); 7,106 household heads, spouses, and partners aged 35-59 in Germany (2005) Methods: probit, Cox proportional hazard model	Controls: (1)education, German ethnicity, and living in East Germany (2) controls in (1), trust, risk aversion, locus of control, positive and negative reciprocity Timing of Measurements: The measures are contemporaneous. Theory: People match both positively and negatively on personality traits depending on whether they reflect preferences or specialization in production. Matching based on specialization will change as the labor market evolves.	Born before 1960: Extraversion increases the probability of marriage for both men and women ($p<0.05$); conscientiousness increases the probability for men ($p<0.05$); neuroticism increases the probability for women ($p<0.05$, (1) only); and agreeableness increases the probability for women ($p<0.05$; (1) only) but decreases the probability for men ($p<0.05$). Born after 1960: Openness to experience has a negative effect on marriage probabilities for men ($p<0.05$;(1)) and ($p<0.10$,(2)) and women ($p<0.05$;(2)) and conscientiousness has a strong positive effect for men and women ($p<0.05$;(2)).

A8. **Stability and Change in Personality Traits and Preference**

Section Contents

Figure A3. Cognitive Ability, Personality and Preferences by Age (GSOEP)



Note: The table displays means of traits by age in a cross-sectional data set. The bars represent standard errors.
Source: GSOEP, waves 2004-2008, own calculations.

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