The Economic Approach to Personality, Character and Virtue

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APPENDIX

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A Intertemporal decisions

All of the analysis so far is static. But the most interesting cases are dynamic and deal with uncertainty and evolution. We can write $X = (X^1, X^2, \ldots, \boldsymbol{X^A})$ and associate the superscript with age a. (This changes the notation, but in a fairly obvious way. Each X^a can be a vector itself.) Time preference is a weighting of early consumption (e.g., X) over later consumption. Thus, in a time-separable case letting V be lifetime preference at age 0,

$$V = \sum_{\boldsymbol{a=0}}^{\boldsymbol{A}} \left(\frac{1}{1+\rho} \right)^a U(X^a), \tag{1}$$

where ρ is the discount rate. $\rho > 0$ means you prefer early utility to later utility. Plato sees this as a defect (Protagoras). Koopmans (1960) and Koopmans et al. (1964) show that as $A \to \infty$, a positive ρ must occur or else the consumption pattern generated will be nonsensical; an extreme case is someone who never consumes, always deferring consumption at a because utility will be even higher at $a + 1$. The parameter ρ embeds the concept of patience into preferences. This is distinct from time consistency, which is discussed below.

One area where there appears to be disagreement concerns the relationship between self-control and the value of ρ. Economists would typically not relate ρ to self-control and rather regard it as a feature of preferences in the same way that a taste for apples versus oranges is a feature of preferences. The notion of a tradeoff between maximizing long run versus short run utility suggests a view that higher values of ρ leads to lower average utility over the lifetime. The reason an economist would object to this is that average utility does not represent a natural objective. Philosophers might possibly link ρ to self-control as well, based on the argument that a high value of ρ is not one an agent should wish to have for his preferences, Further discussion of relationship between ρ and self-control might help clarify disagreements and even lead to some convergence of perspectives.

Associated with these preferences is a constraint set

$$C(X^1, \ldots, X^{\boldsymbol{A}}) = Y. \tag{2}$$

This parallels the constraint set in the static case. However, one important difference is that the relative prices of goods will be date-specific. One reason why this will be so involves interest rates. Postponement of a unit of consumption today can, other things equal, lead to greater consumption in the future if the real interest rate on the savings associated with the postponement is positive.

One can think of $U(X^a)$ as the utility that the person gets from bundle X^a at time a. One way to think of conflict in choice–the self-control problem–is to think of the sub-utility $U(X^a)$ as the agent's period a preference for goods. If the agent only lived in period a they would consume all of Y in a. Since the agent lives A periods, consumption in a has consequences for other periods. It is the consequences of actions today for my actions tomorrow that is an essential feature of the self-control problem.

This utility is a special case of a more general utility:

$$V = (U^1(X^1), U^2(X^2), \ldots, U^t(\boldsymbol{X^A})). \tag{3}$$

Each $U^j(X^j)$ is the utility (valuation) in period j. In period j this is the agent's utility of bundle X^j. You can think of these as "short run" utilities, and the preference function may differ across periods (tastes may change with age, family responsibilities, etc.).

In a dynamic setting, new phenomena can arise. The agent has a bundle of resources Y to distribute over the lifetime. The agent uses up resources each period. (We consider creation of resources below.) What is consumed in period 1 will reduce the amount of Y for future periods. One can think of V as the master utility (the long-run self). If P^1 is the price vector in period 1, then $(P^1)'X^1$ is the consumption in 1. What is left over for future periods is $Y - (P^1)'X^1$.

This model provides a context for Fudenberg and Levine (1989). Think of U^j as the

utility of the short run person who only lives in period j. Left to their own devices, j takes everything. What stops them? The long-lived agent with preferences V has long-run preferences. But even with long-run preferences we have a problem. The master V can deal with each short run only if they remain the same master.

But suppose the master changes period by period. How can this be? One way is to have multiple masters, e.g., $V^1, V^2, \ldots, V^A$. Then they may reverse or try to reverse the plans made by the previous masters. If the "self" is associated with V, different selves can have different V^j in different periods. Self-control is a problem. This is a version of Jekyll and Hyde. One self resists the choices of another. Earlier selves have priority over later selves because they have access to the resources first. Their decisions affect the resources left to later selves. The later selves may regret the early selves, but they have no control until their time has come. Notice that earlier selves can have negative time preferences towards the later versions of themselves (the U^j). One can spice this up by using $U^{j,k}(X^k)$. Thus master 1 might value $U^{1,A}(X^A)$ a lot. They would leave a lot to master 2. Master 2 might not value the future and leave little to master 3.

Such a model produces regret. But it leaves open the question of why the selves change, or even what self-control means. Many strategies are available to take actions that permit earlier selves to restrict the set of actions that later selves can take (Pollak, 1968).

A central question is how V changes when we go from period 1 to period 2 (and obviously to higher periods). In the additively separable model, (10), the problem is simple:

$$V^0 = \sum_{a=0}^{A} \left(\frac{1}{1+\rho} \right)^t U^a(X^a). \tag{4}$$

$$V^1 = \sum_{a=1}^{A} \left(\frac{1}{1+\rho} \right)^{a-1} U^a(X^a). \tag{5}$$

These preferences are linked since

$$V^0 = U^0(X^0) + \left(\frac{1}{1+\rho}\right) V^1. \tag{6}$$

This is a theory of self and its evolution. What is nice about (4) and (5) is that the evolving self has no regret if $U^a(\cdot) = U^{a'}(\cdot)$ for all a and a'. That is, as the master changes from "0" to "1", they make the same decision about all future consumption decisions at "0" that they do at "1". This is called time consistency of consumption choices.

But suppose that $U^{a'}(\cdot) = g(a', a)U^a(\cdot)$ for a general $g(a', a)$ or more generally that $U^a(\cdot) = U(X^a, X^{a-1})$, etc. Then the person may have regret, i.e., the decisions made by one master do not accord with the decisions made by another. However, there is no guarantee that there will be regret. Becker and Murphy (1988) are an example of a model of this type without regret. (See general conditions in Johnsen and Donaldson (1985).)

The constraint set can have a dynamic aspect to it. Choices today might enhance capacities tomorrow as in Cunha and Heckman's (2007) technology of skill formation. My actions today might bolster resources for tomorrow. Thus, choices can be depleting or enhancing of resources tomorrow.

Temptation and salience are discussed in behavioral game theory. We present an example of a dynamic game, which is a minor modification of the discussion in Camerer (2003). Assume as before that long run utility at time 0 is $V^0 = \sum_{a=0}^{\infty} \left(\frac{1}{1+\rho}\right)^a U_a$. The rules of the game are as follows. At time 0, I choose to either act in a trustworthy way or in an untrustworthy way. At 0, the world assumes I am trustworthy. If I choose to be trustworthy, my utility at a is R; if I act in an untrustworthy way, my utility at a is $A > R$. However, if I act in an untrustworthy way at 0, the world will assume that I am untrustworthy in all future periods, and I receive utility $P < R$ in all future periods, regardless of what I do. It does not matter whether I am trustworthy or not in the future if I am untrustworthy today; there is no forgiveness. If I am untrustworthy today, my lifetime utility is

$$V^0 = A + \frac{1}{\rho}P. \tag{7}$$

If I am trustworthy today and in all future periods, my lifetime utility is,

$$V^0 = \frac{1+\rho}{\rho}R. \tag{8}$$

The infinite horizon assumption provides a mathematical simplification in the sense that if I elect to be trustworthy at t, I will be trustworthy in all future time periods; in other words, it allows us to ignore strategies of being honest today, and cheating tomorrow, etc.

Trustworthy behavior is chosen at a if

$$\frac{1+\rho}{\rho}R \leq A + \frac{1}{\rho}P. \tag{9}$$

Rearranging terms, trustworthy behavior requires that

$$\frac{A-R}{R-P} \geq \frac{1+\rho}{\rho}. \tag{10}$$

This makes intuitive sense. When $R-P$ is large relative to $A-R$, then I should forgo the short run gain to being untrustworthy for the long-term benefits.

When will I fail to make the optimal decision to be trustworthy? One possibility is that I make errors when $A-R$ is large. This would be an example of salience leading to nonoptimal decisions. Behavioral game theorists prefer to work with something like $\frac{A-R}{R-P}$ as a measure of temptation. The ideas of temptation and salience embedded in this example are interesting because they give a natural source of salience and temptation: location in time. The general issues of intertemporal consistency and akrasia are discussed in Robb (2022). There is no special reason to link the two. People may have multiple preferences and there is no reason to prefer one set of preferences to another. It's a a matter of the analyst's preferences and has no value in explaining choices.

B Uncertainty

Uncertainty can arise in two places: in preferences or in constraints. Future selves may be unknown, even for the same master (i.e., for master 1, $U^{1,j}(X^j)$ may be unknown for $j > 1$). Future costs may also be unknown. If I take an action under information set I_a, in period a the arrival of information in period $a+1$ may cause me to regret the decision I took in a. An agent can anticipate regret and still be perfectly self-controlled. It is just that nature has changed his world.

We can have "shocks" to preferences: $U^a(X^a, \theta^a)$ and prices $P^a(\omega_a)$. More generally, the cost function may shift in response to shocks. The *ex ante* wise decision may be the *ex post* unwise one. It is likely that this is always true.

Thus we can write $E(V^a(X^a)|\mathcal{I}_a)$ as the expected (anticipated) utility at time a given the information set I_a and the choice X^a. This is a complicated object since it implicitly requires that one calculates the probabilities of future choices given the current one and the constraint set. Regret at $a+1$ for a given choice $\tilde{X}^a$ is defined as

$$\max_{X^a \subset \Omega_a} E(V^a(X^a)|I_{a+1}) - (V^t(\tilde{X}^a)|\mathcal{I}_{a+1}). \tag{11}$$

Expected regret at time a is

$$\max_{X^a \subset \Omega_a} E((E(V^a(X^a)|\mathcal{I}_{a+1})) - E((V^a(\tilde{X}^a)|I_{a+1}))|\mathcal{I}_a). \tag{12}$$

This will equal 0 if $\tilde{X}^a$ solves $\max_{X^a \subset \Omega_a} E(V^a(X^a)|\mathcal{I}_a)$. But the latter means that the choice at a is optimal given available. This is what it means to say that expected regret is 0 for optimal choices, i.e., there is no anticipated regret in the sense in which we have defined the term.

To make this concrete, suppose that I do not know how much I will like my kid in future periods. This can give rise to regret, but I do the best I can with what I know $\mathcal{I}_a$. Note that the sub-components of U^a can have lexical arguments. So can the components of V^a. This

is an extreme case of time preference.

C Summary Tables of Economic Preference Development

Table C.1 Rationality of children's choices

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Harbaugh et al. (2001)	7 & 11	73	U.S.	Choice sets	With age number of violations decreases			
Brosig-Koch et al. (2015)	6–15	120	GER	Race game	With age performance increases	Young females perform worse		
Czermak et al. (2016)	10–17	191	AUT	Normal form games	With age elimination of dominated strategies	Females better at detecting dominated strategies		
Apesteguia et al. (2018)	8–10	82	AUT	Urn draw	With age rational imitation develops, learning curve gets steeper			Learning curve steeper for children with higher cognitive ability
Barash et al. (2018)	6–18	334	U.S.	Urn draw	Younger children use heuristics, older children (wrong) inferences			
Brocas and Carrillo (2018a)	4–5	72	U.S.	Tasks to elicit anticipatory reasoning and logical reasoning	With age increase in strategic thinking			
Brocas and Carrillo (2018b)	4–7	122	U.S.	Matching, fighting, tower, shape game	With age increase in strategic play	Females play equilibrium at higher rates		

Source: Sutter et al. (2019)

Table C.2 Time preferences

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Bettinger and Slonim (2007)	5–16	191	U.S.	Binary choice set	With age patience increases	Females more patient		
Castillo et al. (2011)	13–14	878	U.S.	Binary choice set		Females more patient	Black children less patient	Impatience correlates with disciplinary referrals
Kosse and Pfeiffer (2012)	Preschool age	213	GER	Choice task				Mother's and child's impatience are correlated
Golsteyn et al. (2014)	13	11,907	SWE	Choice task		Females less patient		Patience positively correlated with higher grades, attaining university diploma, higher earnings
Sutter et al. (2013b)	10–18	661	AUT	Binary choice set		Females more patient if high stakes and no up-front delay		Impatient children more likely to spend money on smoking, alcohol, have more conduct referrals, less likely to save money
Angerer et al. (2015b)	7–11	561	IT	Binary choice list & time investment exercise	With age patience increases	Females less patient in CL		Both measures yield similar results
Deckers et al. (2015)	7–10	732	GER	Piggy bank	With age patience increases	Females less patient	Low SES less patient	
Sutter et al. (2015)	3–6	336	AUT	Allocate tokens to envelopes	With age patience increases			Changing the default option increases patience
Deckers et al. (2017)	7–9	435	GER	Piggy bank			Low SES less patient	
Alan and Ertac (2018a)	9–10	1,921	TUR	Binary choice set & convex time budget				Students in intervention demanded 22-32% fewer presents for one week wait; treated students less likely to receive low "behavioral grade"
Castillo et al. (2018b)	13–15	878	U.S.	Binary choice set		Females more patient		More impatient children are less likley to graduate from high school
Lührmann et al. (2018)	13–15	914	GER	Convex time budget				Patience positively correlates with higher math grades and cognition scores

Source: Sutter et al. (2019)

Table C.3 Risk preferences

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Harbaugh et al. (2002)	5–20	187	U.S.	Safe option vs. gamble	With age less risk seeking			
Levin and Hart (2003)	5–8	102	U.S.	Safe option vs. gamble		Females more risk averse (only for losses)		Parent's total number of risky choices positively related to child's
Borghans et al. (2009)	15–16	347	NL	Ellsberg two-color choice task		Females more risk averse		
Moreira et al. (2010)	4–6	100	BRA	Safe option vs. gamble		Females more risk averse		
Booth and Nolen (2012b)	15	260	U.K.	Safe option vs. gamble		Females more risk averse		Females from same-sex schools just as likely to enter lottery as males; being in an all-girl-group makes females less risk averse
Cárdenas et al. (2012)	9–12	1,200	SWE & COL	Choice of six gambles and safe option		Females more risk averse		Competing and risk taking are correlated for Swedish children and Columbian males
Eckel et al. (2012)	14–15 & 16–17	490	U.S	Choice out of six gambles		Females more risk averse	Low income peers reduce risk tolerance	
Tymula et al. (2012)	12–17	33	U.S.	Safe option vs. gamble	Adolescents more risk averse than adults			
Sutter et al. (2013b)	10–18	661	AUT	Ellsberg two-color choice task		Females more risk averse		
Munro and Tanaka (2014)	12–18	412	UGA	Holt-Laury pair wise choice framework				71% of children have lower risk aversion than their parents
Alan et al. (2015)	7–9	746	TUR	Gneezy & Potters risk elicitation task	Older males invest more	Females more risk averse	Low SES females invest more	Child's risk taking correlates positively with mother's risk taking
Deckers et al. (2015)	7–10	732	GER	Safe option vs. gamble	With age less risk seeking	Females more risk averse	Low SES more risk seeking	
Glätzle-Rützler et al. (2015)	11–18	755	AUT	Investment in lottery	Increase in investments between 10^{th} and 12^{th} graders	Females invest less		No evidence of myopic loss aversion
Khachatryan et al. (2015)	7–16	824	ARM	Safe option vs. gamble	With age males become more risk seeking	Females more risk averse		
Castillo (2017)	5 & 8	2,000	PER	Choice of six gambles		Females more risk averse		Domestic violence correlates with risk averse decisions
Deckers et al. (2017)	7–9	435	GER	Safe option vs. gamble			Low SES more risk seeking	
Castillo et al. (2018a)	13–14	1,275	U.S.	Choice between two lotteries				Children who are more risk averse are less likely to receive disciplinary referrals, and more likely to complete high school

Source: Sutter et al. (2019)

Table C.4 Social preferences - Altruism and Egalitarianism

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Harbaugh et al. (2003b)	7–18	310	U.S.	UG, DG	Older children give more	Females give more		
Bettinger and Slonim (2006)	6–14	572	U.S.	DG	Older children give more	Females give more		Children give more to charity than peers
Fehr et al. (2008)	3–8	229	CH	DG, in/out-group	With age increase in egalitarian choices and parochialism	Females less parochial		
Houser and Schunk (2009)	8–10	151	GER	DG		Females give more		Competition decreases fairness in males but not females
Almås et al. (2010)	11–19	486	NOR	DG, spectator	With age increase in meritocratic and efficiency-based choices	Females less efficiency-based		
Gummerum et al. (2010)	3–5	77	U.K.	DG		Males more zero offers		
Eckel et al. (2011)	14–17	490	U.S.	DG				High norm conformance give and expect more
Martinsson et al. (2011)	10–15	650	AUT & SWE	DG	Older children less difference averse and more welfare concerned	Females more difference averse		Swedish children less difference averse and more social-welfare oriented compared to Austrian children
Fehr et al. (2013)	8–17	717	AUT	DG	Older children more pro-social, less envious, weakly altruistic type, more parochial	Females more egalitarian		
List and Samek (2013)	3–5	122	U.S.	DG		Females more altruistic		
Bauer et al. (2014)	4–12	275	CZE	DG	Older children more pro-social, more altruistic		Low SES less altruistic and more spiteful	
Angerer et al. (2015a)	7–11	1,070	IT	DG	Older children more altruistic	Females give more		
Ben-Ner et al. (2015)	3–6	147	U.S.	DG	Older children give more			Parent and child giving not correlated
Blake et al. (2015)	6–13	433	IT	DG	Older children give more			Social norm on giving increases giving
Deckers et al. (2015)	7–10	732	GER	DG	Older children more altruistic	Females more altruistic	Low SES do not become more altruistic with age	
John and Thomsen (2015)	10–16	895	GER	DG, PGG				Academic track children give more in DG

(*continued on next page*)

Source: Sutter et al. (2019)

Table C.5 Social preferences - Altruism and Egalitarianism-Continued

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Cappelen et al. (2016)	7–8	303	U.S.	DG				Majority of children found inequality fair if there was initial inequality
Chen et al. (2016)	6–12	231	IT	DG	Older children give more			Popularity promotes pro-social behavior when decisions are public
Maggian and Villeval (2016)	7–14	637	IT	DG, lying option	Older children less selfish, more efficiency concerned	Young females more egalitarian		
Almås et al. (2017)	14–15	524	NOR	DG, spectator			Low SES more egalitarian	
Angerer et al. (2017)	6–11	824	IT	Spectator		Females discriminate less		
Brocas et al. (2017)	6–18	334	U.S.	DG, PD	Increasing altruism until grade 4 then drops			
Deckers et al. (2017)	7–9	435	GER	DG			Low SES less altruistic	
Kosse et al. (2018)	7–8	607	GER	DG			Low SES less pro-social	Mentoring program increases pro-sociality, altruism, and trust
Sutter et al. (2018)	8–17	883	AUT	DG, spectator	Younger children more inequality averse, older children increasing efficiency concerns	Females primary motive maximin, males primary motive efficiency		

abbreviations: dictator game (DG); prisoner's dilemma (PD)

Source: Sutter et al. (2019)

Table C.6 Social preferences - Trust and Reciprocity

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Murnighan and Saxon (1998)	5–15	240	U.S.	UG	Younger children offer more and accept less	Females give more		
Harbaugh et al. (2003a)	7–18	310	U.S.	UG, DG	Older children give more	Females give more		
Harbaugh et al. (2007)	8–18	256	U.S.	UG	Older children make more consistent proposals			Observing larger proposals by others leads to larger own proposals
Sutter and Kocher (2007)	7–15	200	AUT	UG				Even when proposer has no choice, 46% of children reject unfair offers
Castelli et al. (2010)	5–10	177	IT	UG	Younger children accept unfair offers more often			Theory of mind reduces acceptance of unfair offers
Harbaugh et al. (2002)	8–17	153	U.S.	TG	Increase in trust until ninth grade, steep decrease for twelfth graders	Third grade: females less trusting		
Sutter and Kocher (2007)	8–16	662	AUT	TG	Older children make higher transfers	Eight year-olds: females return more		
Felfe et al. (2018)	15–16	4,077	GER	TG				Immigrant children (especially girls) discriminate against native children

abbreviations: ultimatum game (UG); trust game (TG)

Source: Sutter et al. (2019)

Table C.7 Social preferences - Cooperation

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Fan (2000)	6–11	196	TWN	PD	Older children cooperate more			Lecture on cooperation had a short term positive effect on cooperation levels
Harbaugh and Krause (2000)	6–12	208	U.S.	PGG	Older children cooperate more but learn to free-ride			
Peters et al. (2004)	9–16	68	U.S.	PGG, in/out-group				Parents give substantially more than children
Houser et al. (2012)	6–11	406	IT	Common pool resource game	Older children resist more in public condition			
Cipriani et al. (2013)	5–12	38	U.S.	PGG				Parent's contribution does not affect that of child
Cárdenas et al. (2014)	9–12	800	COL & SWE	PD				
Lergetporer et al. (2014)	7–11	1,120	IT	PD, TPP				TPP more than doubled cooperation rates
John and Thomsen (2015)	10–16	895	GER	DG, PGG				Academic track children give more in DG
Angerer et al. (2016)	6–11	828	IT	PD	Older children cooperate more, more parochial	Females cooperate more		Cooperation highest for children in same school-class who speak same language, lowest for other language
Brocas et al. (2017)	6–18	334	U.S.	DG, PD	Older children cooperate more			
Hermes et al. (2018)	6	129	GER	PGG				Children cooperate conditionally

Source: Sutter et al. (2019)

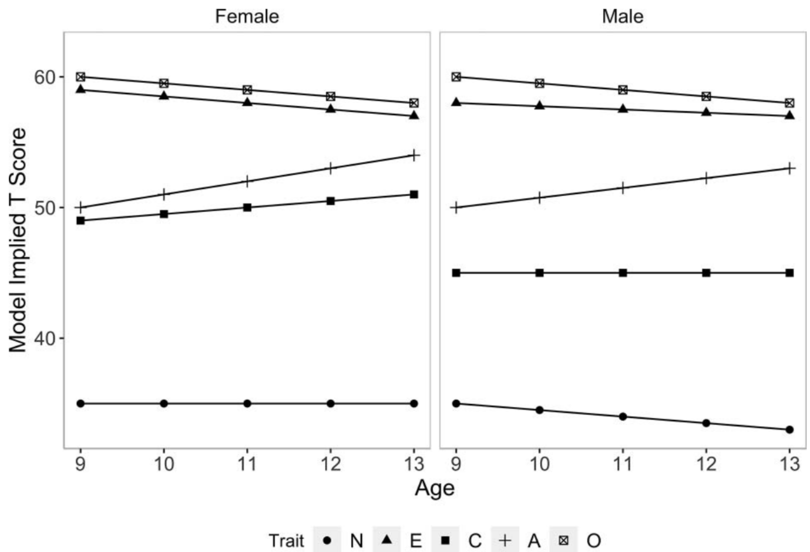
Table C.8 Competitive preferences

Authors	Subject Pool			Experimental Task	Results			
	Age	Sample size	Country		Age	Gender	SES	Other
Gneezy and Rustichini (2004)	9–10	140	ISR	Running task		Males improve performance in second round		Gender composition boy-boy: improved performance by large margin; girl-girl: worse performance
Zhang (2011)	11–15	544	CHN	Math task	Gender gap emerges in high school	Females less competitive only for ethnic minorities		
Bartling et al. (2012)	5–6	223	GER	Flipping toy frogs into pond			Low SES children with recent medical condition less competitive	
Booth and Nolen (2012a)	15	260	U.K.	Maze task		Females less competitive		Females in single-sex schools more competitive
Andersen et al. (2013)	7–15	318	IND	Throwing tennis ball into a bucket	Gender gap emerges at age 13	Females from patriarchal society less competitive		Older females in matrilineal societies more competitive
Samek (2013)	3–5	123	U.S.	Toy fishing task				
Buser et al. (2014)	14–15	362	NL	Math task		Females less competitive		Competitiveness can predict study track
Dreber et al. (2014)	15–19	216	SWE	Math and verbal task		Females less competitive in math task		
Khachtaryan et al. (2015)	7–16	824	ARM	Running, skipping rope, math, verbal task	Older children compete less in math task	No gender gap in tournament entry		
Sutter and Glätzle-Rützler (2015)	3–18	1,570	AUT	Running, sorting, math task		Females less competitive in all tasks		Competitiveness persists over two years
Almås et al. (2016)	14–15	523	NOR	Math task		Females less competitive	Low SES children less likely to choose competition (especially males)	
Sutter et al. (2016)	10–17	588	AUT	Math task	Older males more competitive	Females less competitive		Preferential treatment of females increases competitiveness
Alan and Ertac (2018b)	10	1,900	TUR	Math task		Females less competitive		Grit and role model interventions increase competitiveness
Khadjavi and Nicklisch (2018)	3–6	84	GER	Running task				If parents are highly ambitious even slow children opt for competition

Source: Sutter et al. (2019)

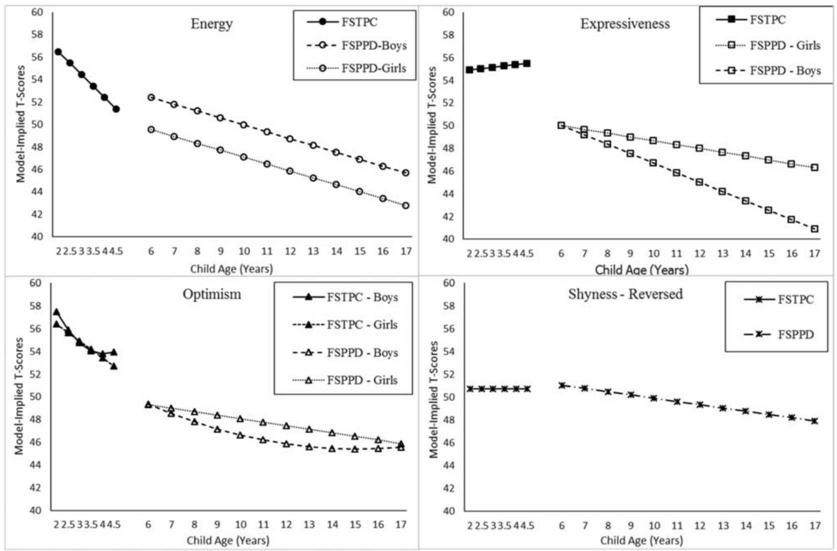
D Evidence of Personality Development from Longitudinal Studies

Figure D.1 Personality domain model-implied change by gender from age 9 to 13



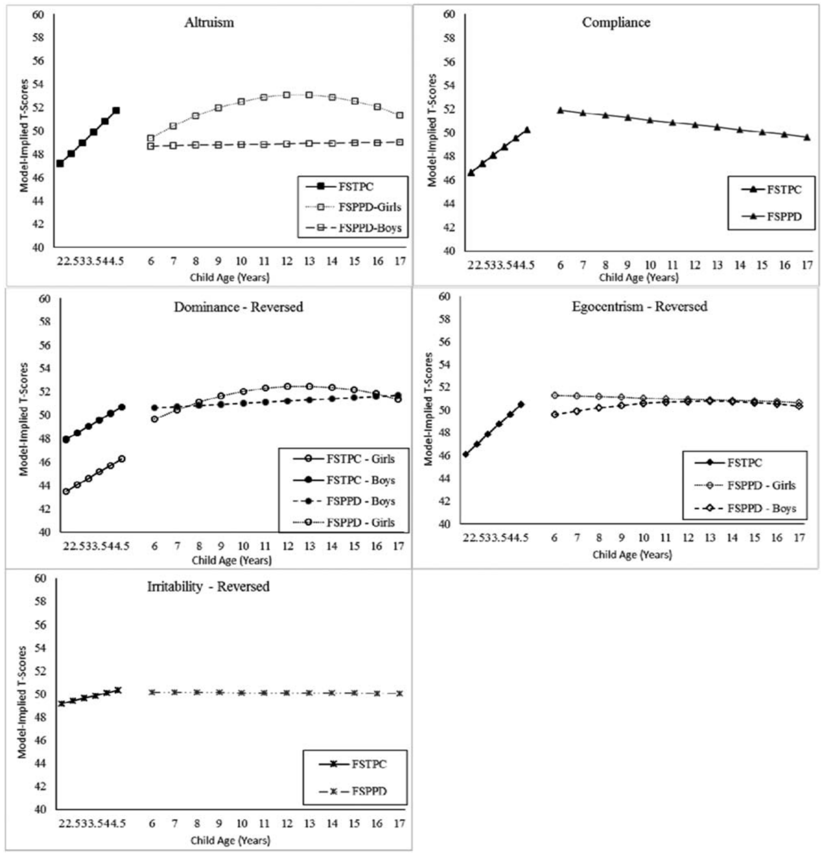
Notes: N = Neuroticism; E = Extraversion; C = Conscientiousness; A = Agreeableness; O = Openness to Experience. Source: Brandes et al. (2021)

Figure D.2 Model-implied changes for facets of Extraversion in early childhood (FSTPC) and childhood/adolescence (FSPPD)



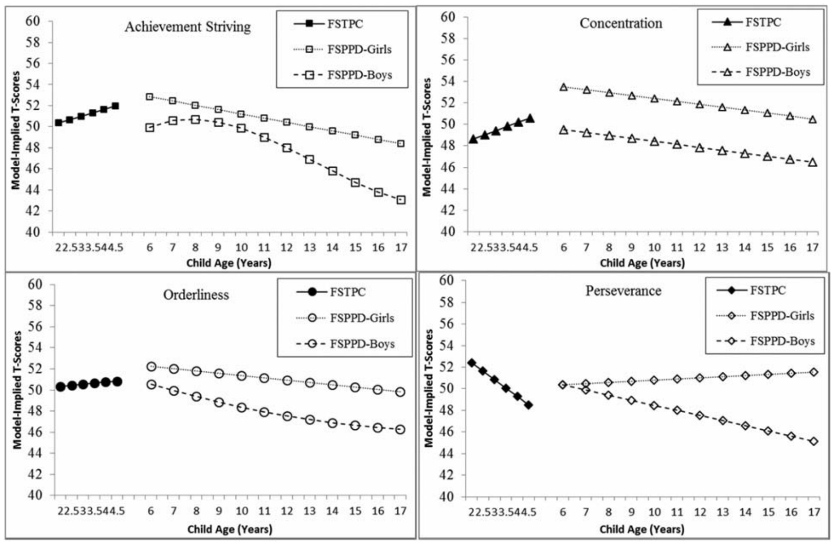
Notes: Shyness was reverse scored. Source: de Haan et al. (2017)

Figure D.3 Model-implied changes for facets of Agreeableness in early childhood (FSTPC) and childhood/adolescence (FSPPD)



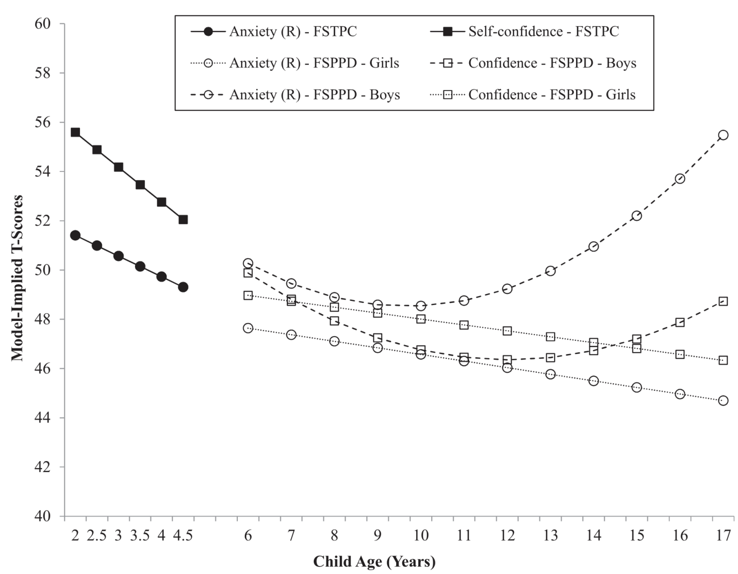
Notes: Dominance, Egocentrism, and Irritability were reverse scored. Source: de Haan et al. (2017)

Figure D.4 Model-implied changes for facets of Conscientiousness in early childhood (FSTPC) and childhood/adolescence (FSPPD)



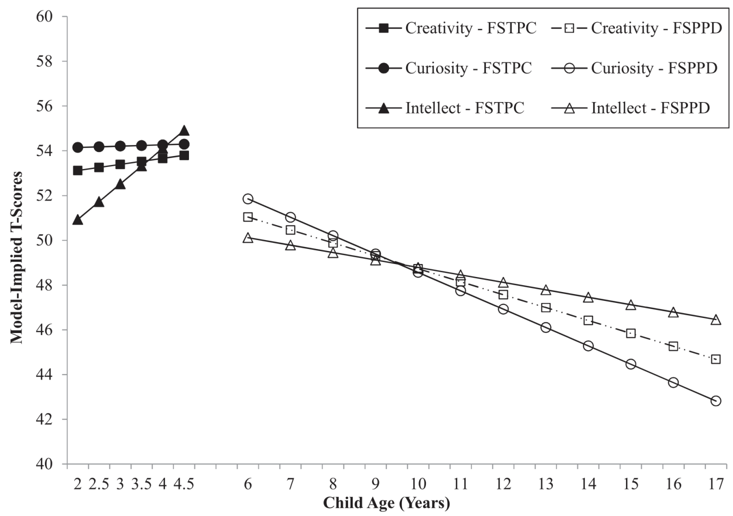
Source: de Haan et al. (2017)

Figure D.5 Model-implied changes for facets of Emotional Stability in early childhood (FSTPC) and childhood/adolescence (FSPPD)



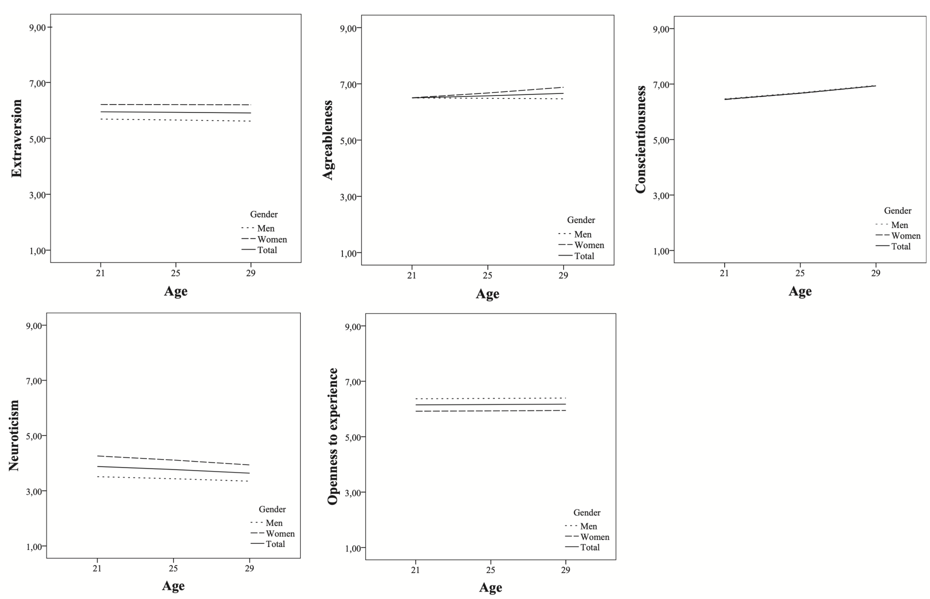
Notes: Anxiety was reverse scored. Source: de Haan et al. (2017)

Figure D.6 Model-implied changes for facets of Imagination in early childhood (FSTPC) and childhood/adolescence (FSPPD)



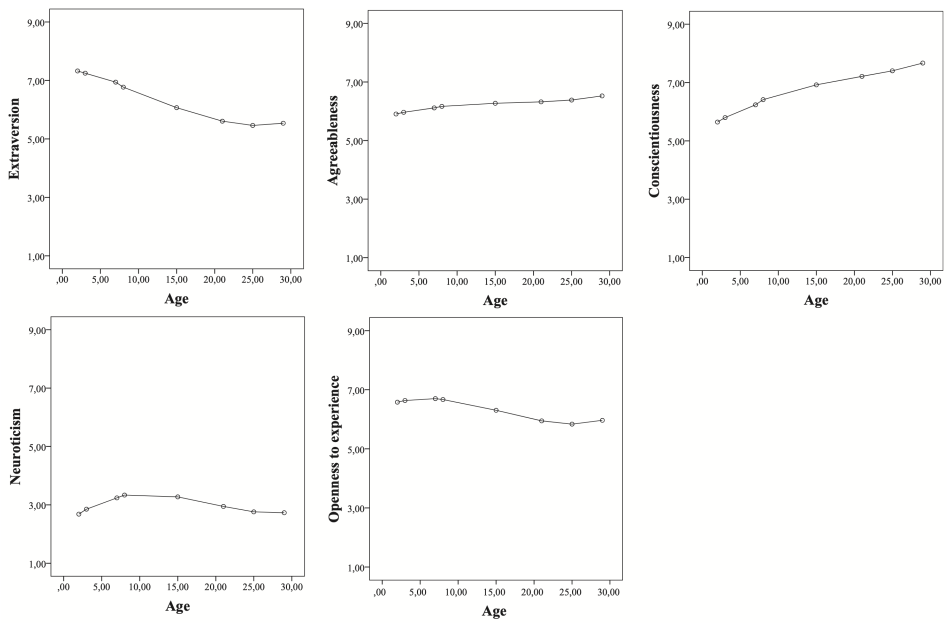
Source: de Haan et al. (2017)

Figure D.7 Estimated growth for the Big Five traits from ages 21 to 29 separate by gender



Notes: Age range is from 21 to 29 years old. Ages 21 to 29 were self-reported Big Five levels. Source: Wängqvist et al. (2015)

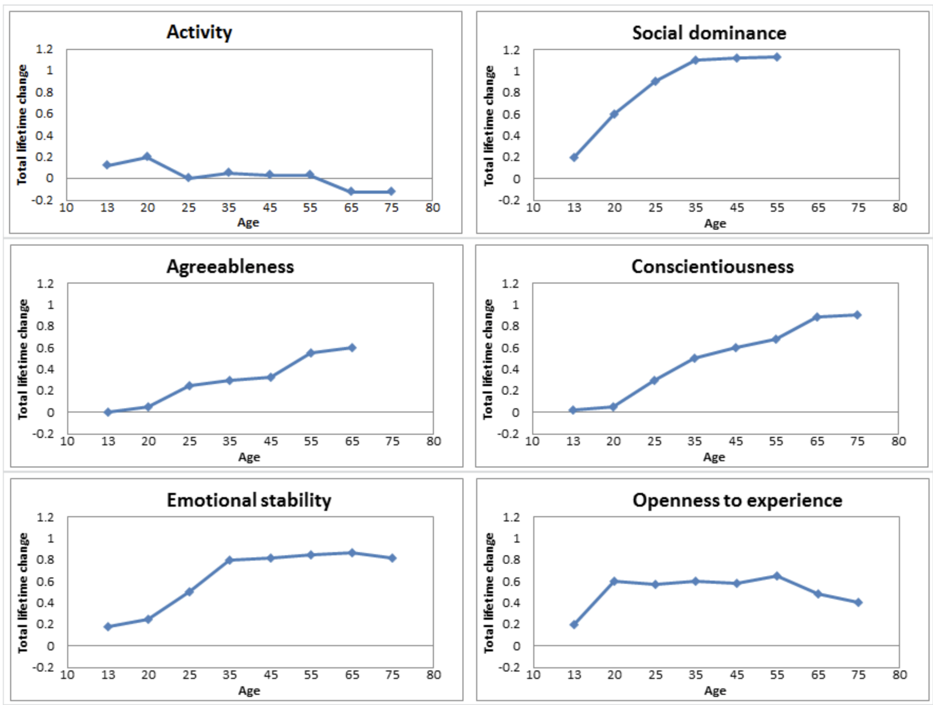
Figure D.8 Estimated growth for the Big Five domains from ages 2 to 29



Notes: Age range is from 2 to 29 years old. Ages 2 to 15 were mother-reported Big Five levels. Ages 21 to 29 were self-reported Big Five levels. Source: Wängqvist et al. (2015)

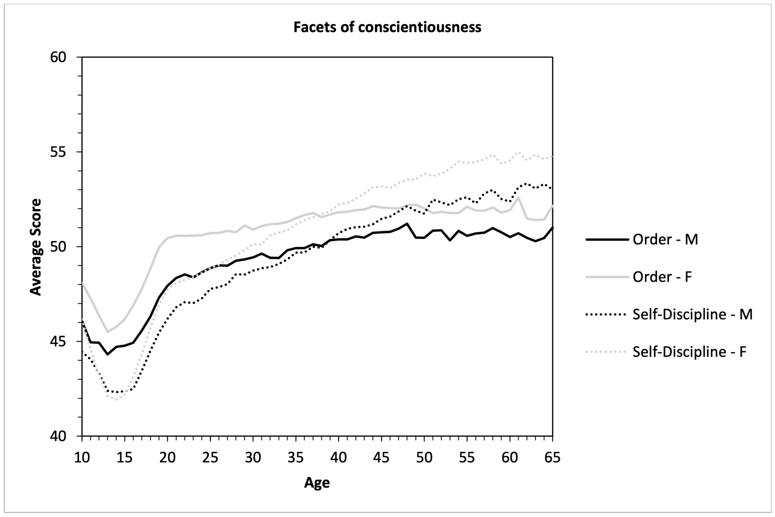
E Evidence of Personality Development from Cross-sectional Studies

Figure E.1 Cumulative average-level changes in personality throughout the life span



Notes: Total lifetime change represents cumulative size of change over life course (represented as standardized mean-level changes). Source: Chernyshenko et al. (2018) adapted from Roberts et al. (2006).

Figure E.2 Average levels of self-discipline and order across a lifetime

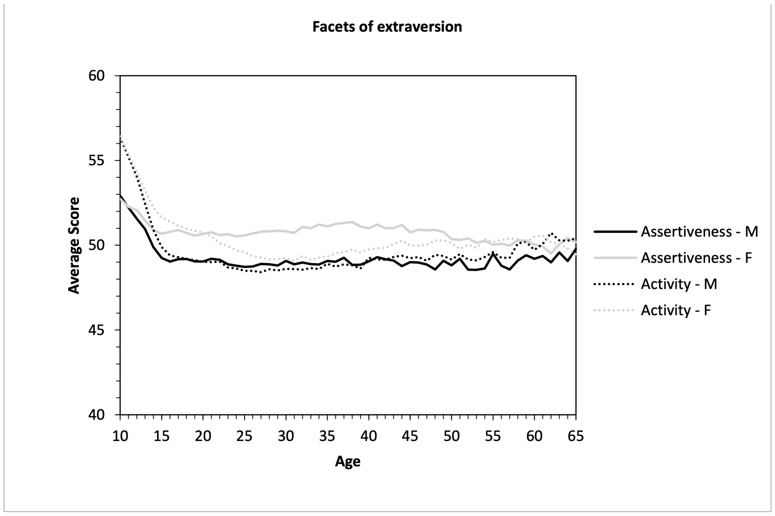


Source: Chernyshenko et al. (2018) adapted from Soto et al. (2011).

Figure E.3 Average levels of ideas and aesthetics across a lifetime

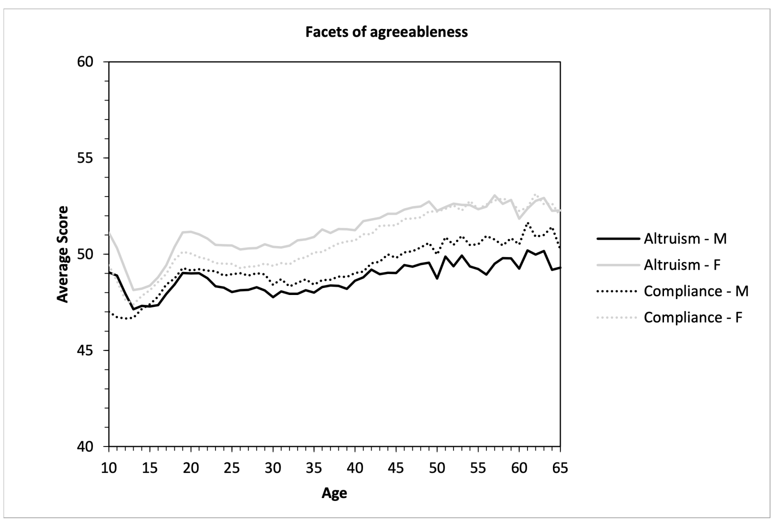
Source: Chernyshenko et al. (2018) adapted from Soto et al. (2011).

Figure E.4 Average levels of assertiveness and activity across a lifetime



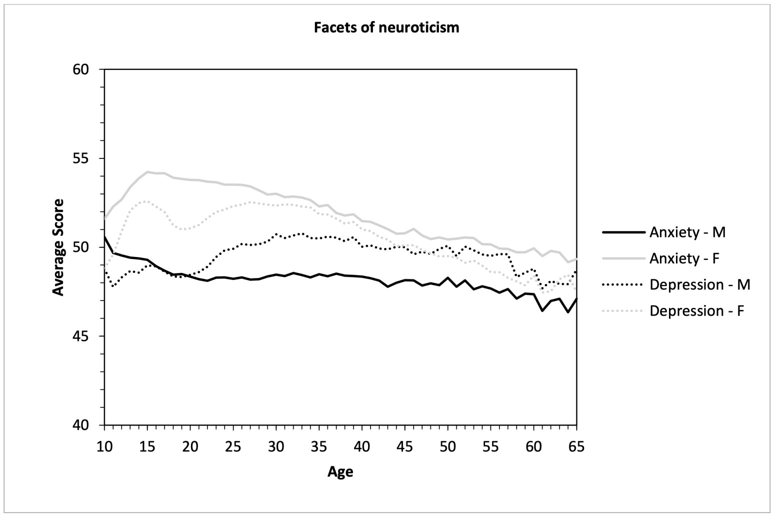
Source: Chernyshenko et al. (2018) adapted from Soto et al. (2011).

Figure E.5 Average levels of altruism and compliance across a lifetime



Source: Chernyshenko et al. (2018) adapted from Soto et al. (2011).

Figure E.6 Average levels of anxiety and depression across a lifetime



Source: Chernyshenko et al. (2018) adapted from Soto et al. (2011).

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