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Abstract

We use a large, nationally-representative sample of working-age adults to demonstrate that personality (as measured by the Big Five) is stable over a four-year period. Average personality changes are small and do not vary substantially across age groups. Intra-individual personality change is generally unrelated to experiencing adverse life events and is unlikely to be economically meaningful. Like other non-cognitive traits, personality can be modeled as a stable input into many economic decisions.

JEL classification: J24, C18

Keywords: Non-cognitive skills, Big-Five personality traits, stability

1 Introduction

Economists increasingly view personality as a type of non-cognitive skill that can have important consequences for the economic decisions that individuals make and the outcomes they achieve. This perspective has generated interest in the process of personality change. Almlund et al. (2011) argue that – in comparison to cognitive ability – personality traits are responsive to parental behavior, investments in education, and policy interventions making personality change a possibility well into adulthood. At the same time, empirical studies that attempt to quantify the economic returns to personality often assume that adults' personality traits are fixed (Heineck and Anger, 2010; Mueller and Plug, 2006; Nyhus and Pons, 2005). This assumption is convenient because it implies that personality traits are not driven by the economic outcome under consideration. However, simultaneity and reverse causality may bias our results if this assumption does not hold (Cobb-Clark and Schurer, 2011).

Surprisingly little evidence exists on the extent to which adult personality traits are stable and independent of the employment-, health-, and family-related events that people experience. In this note, we use data from a nationally-representative panel survey that includes measures of individuals' Big-Five personality traits in both 2005 and 2009 to answer the following questions: (1) Does the overall change in personality traits depend on age?; (2) Is adult personality change related to adverse life events?; and (3) Are changes in adult personality economically meaningful?

2 Data

Our data come from the Household, Income and Labour Dynamics in Australia (HILDA) survey which is a nationally-representative panel study of more than 7,600 Australian households (Summerfield, 2010). In the 2005 (wave 5) and 2009 (wave 9) self-completion questionnaires, HILDA respondents were administered a version of the Big-Five Personality Inventory based on Saucier (1994). Specifically, respondents were asked how well 36 different adjectives describe them. Factor analysis is then used to combine 28 of these 36 items into measures of five specific personality traits. The remaining eight items

are discarded because of their ambiguity in loading onto several factors simultaneously (Losoncz, 2009). These traits—extraversion, agreeableness, conscientiousness, emotional stability (the opposite of neuroticism), and openness to experience—represent personality at the broadest level of abstraction (see John and Srivastava, 2001). Each trait is scored from one to seven with higher scores indicating that the trait describes the individual better. Internal reliability coefficients (Cronbach's α) for these traits have been shown to be satisfactorily high in HILDA (> 0.7) in both waves 5 and 9 (see Wooden, Forthcoming).

Big-Five personality traits are available for 7,600 of the 8,466 individuals aged 25 - 64 interviewed in wave 5. Of these 8,466 individuals, 6,104 answered the battery of personality items again in wave 9. Our estimation sample consists of the 6,073 respondents aged 25 - 64 (2,789 men and 3,284 women) who also provided complete information on the other variables of interest. Means and standard deviations for the Big-Five traits are provided in columns 1 and 2 of Table 1. On average, individuals report slightly higher levels of agreeableness, emotional stability, and conscientiousness than of extraversion and openness to experience. Women report higher scores on each trait except for openness to experience (results provided upon request).

[Insert Table 1 here]

3 Results

Psychologists consider several alternative notions of "consistency" when assessing the extent to which personality traits are stable. Mean-level consistency reflects whether or not a population of individuals increases or decreases on some trait dimension over time. In contrast, intra-individual consistency assesses changes in the personality traits of each individual as he or she ages (see Roberts and DelVecchio, 2000). Both of these concepts are relevant for applied economists as they work to specify the best econometric model for estimating the returns to personality (see Cobb-Clark and Schurer, 2011). We consider each in turn.

3.1 Mean-level Consistency

We begin by constructing measures of the change in Big-Five personality traits. Specifically,

$$\Delta^j = T^j_{2009} - T^j_{2005} \tag{1}$$

where j $\in$\{extraversion, agreeableness, conscientiousness, emotional stability, openness to experience\}. Thus, the change in each trait ranges from -6 to 6. Negative values indicate that the trait is less salient in 2009 than in 2005; positive values indicate that the trait has become more pronounced over time.

Information about the mean-level change in Big-Five traits is provided in columns 3 - 10 of Table 1. These results indicate that changes in specific personality traits are approximately normally distributed with a mean of zero and a standard deviation of 0.80 (see Table 1). The median change in each trait is zero and 50 percent of individuals experience changes in their Big-Five traits of no more than half a point in either direction. At the extremes of the distribution (i.e. the bottom and top one percent of individuals), the mean-level change in personality traits is approximately two points on our seven-point scale.

Psychologists often equate mean-level consistency with the normative (i.e. common) personality change that occurs when the ageing process, social forces, or historical events confronting a population lead most individuals' personalities to change in much the same way (see Roberts, 1997). Given this, it is important to consider how changes in personality traits vary over the life-cycle. As the distribution of mean-level changes does not vary by gender except for agreeableness (p=0.083, Kolmogorove-Smirnov test), we conduct our mean-level analysis on the combined sample.

Mean-level changes (and 95-percent confidence intervals) across age groups are shown separately for each of the Big-Five traits in Figure 1. These figures indicate that average personality changes are relatively small. In particular, changes in Big-Five personality traits range only from -0.2 to 0.2 points on our seven-point scale irrespective of age. Moreover, tests of the equality of personality changes across age groups indicate significant age differences only for conscientiousness (p = 0.002) and agreeableness (p=0.066). In all other cases, we cannot reject the hypothesis that the change in Big-Five traits between

2005 and 2009 for the working-age population are independent of age.[1]

[Insert Figure 1 here]

3.2 Intra-Individual Consistency

Even though the above results indicate that on average changes in Big-Five personality traits are small and do not vary across age groups, there may still be substantial intra-individual change. Some individuals may be increasing in a particular trait dimension, while others are decreasing, producing offsetting changes (Roberts and DelVecchio, 2000; Roberts, 1997).

We investigate this issue by analyzing whether a range of adverse life events is linked to the change in individuals' personalities. Some of these events may be under individuals' control (e.g. divorce), however, others are not (e.g. death of a spouse).

Following Cobb-Clark and Schurer (2011), we create an adverse life-event measure by summing the total number of such events that individuals report between 2006 and 2009 across three separate domains: (i) family-related (death of a spouse, child, relative, or friend; being a victim of property crime); (ii) employment/income-related (worsening of finances; retiring; being fired; or unemployment); and (iii) health-related (serious illness or injury; physical violence; new health conditions). We then create six separate indicator variables – two for each domain – that take the value of 1 for individuals whose reported number of domain-specific events is more than two or three sample standard deviations, respectively, and 0 otherwise.

We construct standardized measures (i.e., mean = 0, standard deviation = 1) of intra-individual changes in our Big-Five traits. These five measures are then regressed sequentially on (i) one of these six indicators of adverse life events; and (ii) control for age, marital status, immigrant status, education, household income and employment status measured in 2005. All models are estimated separately for working-age men and women using OLS and the results can be interpreted in terms of standard deviation changes (see Table 2).

[1] Parallel analysis for the age 15 plus population shows that personality change is larger among the young (age 15 - 24) and the old (age 65 plus). For this population we reject the hypothesis that personality change is constant across age groups for all five personality traits. Results available upon request.

[Insert Table 2 here]

Adverse employment- or income-related events appear to be most closely associated with personality changes. Both men and women, for example, who experience five or more adverse employment or income events between 2006 and 2009 (i.e. more than three standard deviations (std)) become less emotionally stable (men -0.28 std, women -0.15 std), but also more open to experience (men 0.25 std, women 0.09 std). Women also become less conscientious (-0.25 std) and extraverted (-0.16 std), while men become more agreeable (0.12 std). Similarly, reporting eight or more (i.e. more than 3 std) adverse health-related events is associated with a small decrease in men's emotional stability (-0.14 std) and conscientiousness (-0.11 std). Finally, family-related events have little relationship to personality change. The exception is that men experiencing five or more family-related shocks become less conscientious (-0.15 std), but also more open (0.07 std), while women become less agreeable (-0.10 std).

Are these personality changes economically meaningful? We address this question in the context of the estimated wage returns to personality typically found in the literature. We take as our example intensive employment- and income-related shocks because these shocks have the strongest link with personality change. We benchmark these changes using Mueller and Plug (2006) who appear to have estimated the largest wage returns to personality in the literature. Specifically, Table 3 reports the wage returns to each Big-Five trait taken from Mueller and Plug (2006), the effect of reporting five or more (i.e. greater than 3 std) employment- or income-related shocks on changes in these traits (see Table 2), and the resulting wage-equivalent personality change expressed in US dollars per hour.

[Insert Table 3 here]

Experiencing a series of employment-related shocks that are greater than three sample standard deviations is associated with men's emotional stability falling by 0.28 standard deviations. Mueller and Plug (2006), however, find that the wage return to a one standard deviation increase in men's emotional stability is only \$0.002 US implying that the wage-equivalent of men's decline in emotional stability is only \$0.012 US. The estimated increase in men's agreeableness is equivalent to a larger fall in wages (\$0.093 US) because

the estimated wage penalty to agreeableness is larger. For women, the largest wage-equivalent personality change stems from a decline in their conscientiousness ($0.075 US) and emotional stability ($0.032 US). Overall, the estimated accumulative effect of intensive employment- and income-related shocks across all Big-Five traits is $ 0.136 US (0.6 percent) for men and $ 0.163 US (1.4 percent) for women.

4 Conclusion

Making continued progress in our effort to assess the role of personality in economic behavior relies heavily on understanding the way that our standard measures of personality evolve over time as people age and their lives unfold. Our results indicate that – while not literally fixed – personality traits do appear to be stable among working-age adults. Mean-level changes in Big-Five personality traits are small and do not vary substantially across age groups. Moreover, there is little evidence that economically-meaningful, intra-individual personality change can be linked to the adverse employment, health or family events that individuals experience. Finally, these results for the Big Five traits mirror previous results for locus of control (see Cobb-Clark and Schurer, 2011), suggesting that non-cognitive skills more generally may be seen as stable inputs into many economic decisions.

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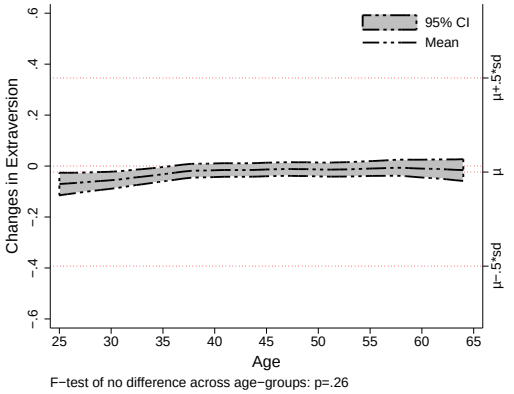
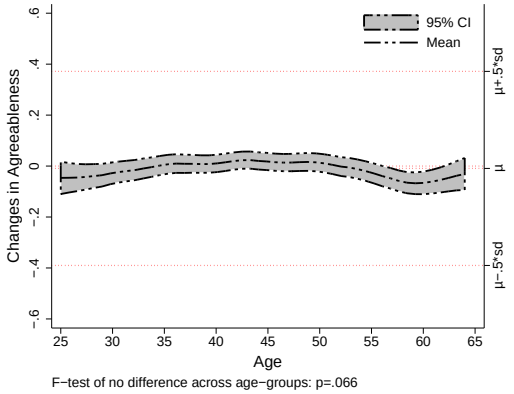
Table 1: Summary statistics of personality traits and their changes over time

	Level		Changes between 2005 and 2009 at						
	Mean	SD	Mean	SD	1^{st}	25^{th}	50^{th}	75^{th}	99^{th}
					percentile of distribution				
Extraversion	4.395	1.087	-0.024	0.739	-1.833	-0.500	0.000	0.500	1.833
Agreeableness	5.403	0.888	-0.009	0.762	-2.000	-0.500	0.000	0.500	2.000
Conscientiousness	5.152	1.005	0.011	0.758	-2.000	-0.500	0.000	0.500	2.000
Emotional stability	5.195	1.047	0.099	0.880	-2.167	-0.500	0.000	0.667	2.500
Openness to exp.	4.237	1.052	-0.074	0.774	-2.000	-0.500	0.000	0.333	1.833

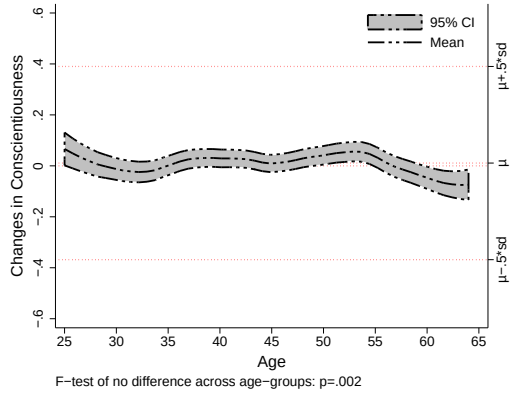
Data taken from HILDA wave 5 (2005) and 9 (2009). Pooled sample consists of 6,104 individual observations; distributions are equal between men and women.



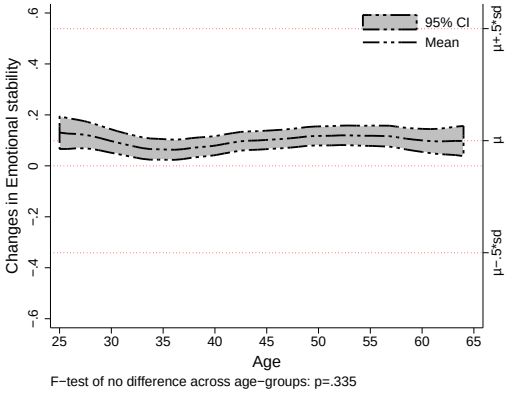
(a) Extraversion



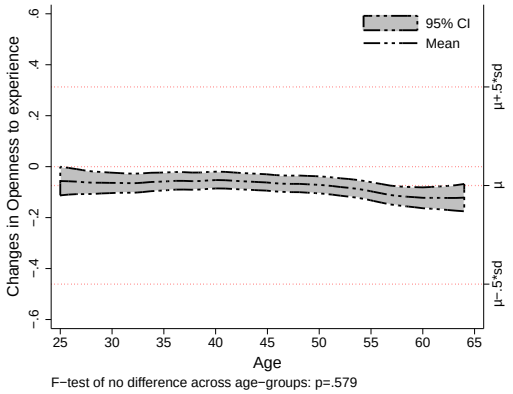
(b) Agreeableness



(c) Conscientiousness



(d) Emotional Stability



(e) Openness to Experience

Figure 1: Changes in Big Five personality over the life-cycle (HILDA 2005-2009)

Table 2: Relationship between intensity of domain-specific shocks and changes in Big-Five personality[a]

Domain	Size (Number)	Extra	Agree	Consc	E Stab	Open	N[b]
Men							
Health	$>$ 2 SD (6 +)	0.000	-0.044	-0.122*	-0.175**	0.060	235
Health	$>$ 3 SD (8 +)	-0.014	0.011	-0.105	-0.144^{+}	0.065	153
Employment	$>$ 2 SD (3 +)	0.058	-0.016	-0.130*	-0.098	0.013	386
Employment	$>$ 3 SD (5 +)	-0.026	0.118	-0.093	-0.279**	0.248**	96
Family	$>$ 2 SD (4 +)	0.013	0.046	-0.090	0.004	0.099^{+}	324
Family	$>$ 3 SD (5 +)	-0.034	0.015	-0.151*	-0.047	0.073	188
Women							
Health	$>$ 2 SD (6 +)	-0.063	-0.048	-0.062	-0.018	-0.044	319
Health	$>$ 3 SD (8 +)	-0.020	-0.024	-0.004	-0.006	0.027	213
Employment	$>$ 2 SD (3 +)	-0.032	-0.016	-0.105**	-0.035	-0.030	797
Employment	$>$ 3 SD (5 +)	-0.162*	0.058	-0.252**	-0.149	0.090	122
Family	$>$ 2 SD (4 +)	-0.057	-0.027	-0.050	0.024	0.011	462
Family	$>$ 3 SD (5 +)	-0.076	-0.108+	-0.056	0.058	-0.050	262

[a] OLS Coefficients are interpreted in terms of standard deviation change in personality trait (Adjusted R^2 in all models is less than 0.005.) [b] N refers to number of individuals for whom shock indicator is equal to 1. Analysis is based on sample of 2,789 men and 3,284 women aged between 25 and 64. *** 1%, ** 5%, * 10%, $^{+}$ just at 10% significance level.

Table 3: Wage equivalent of changes in Big-Five personality due to a sequence of employment- and finance related shocks

	M & P[a] wage eff. of Big 5	Est. effect of shock[b] on Δ Big 5	Wage equivalent by trait	$\sum$ Big 5 in |US$|
Men				
Extraversion	0.014	-0.026	0.008	
Agreeableness	-0.036***	0.118	0.093	
Conscientiousness	0.003	-0.093	0.006	0.136
Emotional stability	0.002**	-0.279**	0.012	
Openness to experience	0.003***	0.248**	0.016	
Women				
Extraversion	-0.004	-0.162*	0.008	
Agreeableness	-0.005	0.058	0.003	
Conscientiousness	0.025***	-0.252**	0.075	0.163
Emotional stability	0.018*	-0.149	0.032	
Openness to experience	0.043***	0.090	0.046	

[a] Wage effect of 1 SD increase in personality trait as reported in Mueller and Plug (2006), Table 3, Column (iii). In this study the average hourly wage is $US\$21.90$ for men and $US\$11.83$ for women. [b]: Employment and finance related shock takes the value 1 if individual experiences more than 3 SD of shocks experienced between 2006 and 2009, and 0 otherwise. *** 1%, ** 5%, * 10%, $^{+}$ close to significant.