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Brief report

The stability of self-control in a population-representative study ☆

Deborah A. Cobb-Clark [a,b,c], Nancy Kong [a,d,c,*], Hannah Schildberg-Hörisch [e,b,c]

[a] School of Economics, The University of Sydney, Australia
[b] ARC Centre of Excellence for Children and Families over the Life Course, Australia
[c] IZA Institute of Labor Economics, Germany
[d] ARC Life Course Centre, Australia
[e] Düsseldorf Institute for Competition Economics, Heinrich Heine University Düsseldorf, Germany

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ABSTRACT

We investigate the stability of self-control at the population level. Analyzing repeated Brief Self-Control Scale scores, we demonstrate that self-control exhibits a high degree of mean-level, rank-order, and individual-level stability over the medium term. Changes in self-control are not associated with major life events, nor are they economically important. The stability of self-control is particularly striking given that our study period (2017–2020) spans the onset of the COVID-19 pandemic.

"From our perspective, nearly every major personal and social problem affecting large numbers of modern citizens involves some kind of failure of self-regulation ... " (Baumeister & Vohs, 2004, p. 3).

1. Introduction

In their theory of crime, Gottfredson and Hirschi (1990) linked criminality to low self-control which they viewed as a stable personality trait resulting from ineffective child-rearing. Criminologists responded by launching a major research effort to understand whether – and if so why – some people exhibited consistently low self-control (see Beaver et al., 2008, for a review). Today, self-control is one of the most frequently studied concepts in social science (Duckworth & Kern, 2011). Despite this, we know surprisingly little about the degree of stability in self-control.

Reaching consensus on this issue has no doubt been made difficult by the plethora of strategies used to model and operationalize self-control. Dual-self models (e.g., Fudenberg & Levine, 2006, 2011, 2012; Fudenberg et al., 2014; Mukherjee, 2010), models of temporary fluctuations in self-control (Baumeister et al., 1998), experimental tests of the effects of temporary self-control depletion on time, risk, and social preferences (see, e.g., Achtziger, Alós-Ferrer et al., 2015; Achtziger et al., 2016, 2018; Gerhardt et al., 2017; Hoel et al., 2016), and quasi-hyperbolic discounting models (see, e.g., O'Donoghue & Rabin, 1999, 2001) along with related empirical approaches (Cobb-Clark et al., 2021; Incekara-Hafalir & Linardi, 2017; Mandel et al., 2017) coexist with models of trait self-control (see, e.g., Tangney et al., 2004), which is the focus of this paper. In the absence of psychometrically validated self-control

☆ Data access instructions and coding are available at https://doi.org/10.7910/DVN/ZCBQH8.

* Corresponding author at: School of Economics, The University of Sydney, Australia.
E-mail addresses: deborah.cobb-clark@sydney.edu.au (D.A. Cobb-Clark), nancy.kong@sydney.edu.au (N. Kong), schildberg-hoerisch@dice.hhu.de (H. Schildberg-Hörisch).

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measures, proxies are often derived from domain-specific measures of behavioral and attitudinal problems. Moreover, previous research has focused on children and adolescents (see Table A.1), implying that we know a great deal about self-control at some ages, and virtually nothing at others. This is perhaps understandable given that human development is characterized by a growing capacity for self-regulation in early childhood (see Pan & Zhu, 2018, for a review). Still, the existing evidence leaves us in the dark about the stability of self-control over much of the remaining life cycle. We are aware of only four studies that investigate the correlation in self-control over time in adults; each relies on a selected sample of young adults (two use university students, and two use offenders), see Table A.1.[1] We make a contribution by providing the first comprehensive, population-representative evidence on the stability of trait self-control in adults. Moving beyond simple correlations, we examine stability from multiple perspectives, including the possible effect of life events on self-control, and carefully considering the potential role of measurement error and the economic relevance of observed changes in self-control.

In particular, we use data from a population-representative panel survey to assess the stability in a well-established measure of self-control—the Brief Self-Control Scale (BSCS) (Tangney et al., 2004). Our data come from the German Socio-Economic Panel Innovation Sample (SOEP-IS) which, to our knowledge, is the only comprehensive, population-representative panel survey to provide repeated self-control measures. The BSCS is a domain-general measure of trait self-control with high internal consistency (Tangney et al., 2004), test-retest reliability over short time periods of three to seven weeks (Bertrams & Dickhäuser, 2009; Tangney et al., 2004), and predictive validity (de Ridder et al., 2012).[2] Importantly, people's BSCS scores are highly predictive of their physical, mental, and financial well-being in cross-sectional data (Cobb-Clark et al., 2022), making it important to understand how BSCS scores evolve over time.

Characterizing self-control as a stable personality trait does not necessarily imply that the capacity for self-control is either completely fixed or non-modifiable. Instead, in psychology the concept of stability accommodates some systematic changes while excluding others. For example, rank-order stability is a defining aspect of a personality trait, while mean-level stability within individuals over time is not (Golsteyn & Schildberg-Hörisch, 2017). For this reason, we center our analysis on three key facets of trait stability: (i) mean-level stability at the population level; (ii) rank-order stability; and (iii) individual-level stability (see Bleidorn et al., 2019). Our finding that self-control is stable across all three concepts is especially noteworthy given that our three-year study period – 2017 to 2020 – spans the onset of the COVID-19 pandemic. Importantly, any observed changes in self-control are not associated with major life events nor are they economically meaningful.

This is good news for economists who are increasingly modeling the behavioral consequences of personality traits, including self-control, on people's life outcomes (Almlund et al., 2011; Borghans et al., 2008; Heckman et al., 2021). Empirically, it is often convenient to assume that self-control is fixed over the relevant study period because this implies that self-control is exogenous to the outcome of interest, allowing an important threat to causal identification to be avoided. This fixed trait assumption is also particularly useful when self-control is measured contemporaneously, ex post, or perhaps years prior to the observed outcome since it allows the use of lead or lagged self-control measures. Estimation strategies relying on any stability assumption are, of course, likely to produce biased estimates if self-control is, in fact, not stable over the relevant time frame. Our results provide an empirical underpinning to the core identification assumption underlying many empirical analyses. Conceptually, our results are also important in highlighting that self-control, as captured in the BSCS, can be regarded as a stable personality trait. This provides an avenue for theoretical modeling and empirical evidence to be more closely integrated, and testable hypotheses about the role of self-control in economic decision making to be derived.

2. Data

The Self-Control Scale is the most widely used measure of trait self-control in psychological research on self-regulation and self-control (see Hoyle & Davisson, 2016). The 13-item brief scale (employed here) is highly correlated (0.92–0.93) with the full 36-item scale (Tangney et al., 2004), but is more suitable for large surveys. Widely applied in not only psychology, but also criminology and sociology (e.g., Duckworth & Kern, 2011; Hagger et al., 2021; Maloney et al., 2012), the BSCS includes 13 items related to resisting temptations, self-discipline, and acting without thinking. Responses ranging from "fully applies" (5) to "does not apply at all" (1) (see the Online Appendix) are then aggregated to construct a score, ranging from 13 to 65 points, increasing in self-control.

The innovation sample of the German Socio-Economic Panel Study was launched in 2012 with a target population of 5000 representative German households (Richter & Schupp, 2015). The goal was to construct a new sample, mirroring the core SOEP sample, to allow new, and innovative, survey questions to be trialed (Richter & Schupp, 2015). The BSCS was included in a representative subsample of the SOEP-IS in 2017, and again in 2020, providing the first opportunity to observe repeated measures of self-control in a sample that is representative of the entire adult (age > 16) population.

[1] Evidence on the stability of self-control in offender samples during their incarceration is not generalizable to other samples since (i) being incarcerated may affect an individual's level of self-control, and (ii) many offenders are subject to correctional measures including self-control training.

[2] See Duckworth and Kern (2011) who discuss the convergent validity of self-control measures derived from (i) executive function tasks; (ii) delay of gratification tasks; (iii) self-reports; and (iv) informant reports.

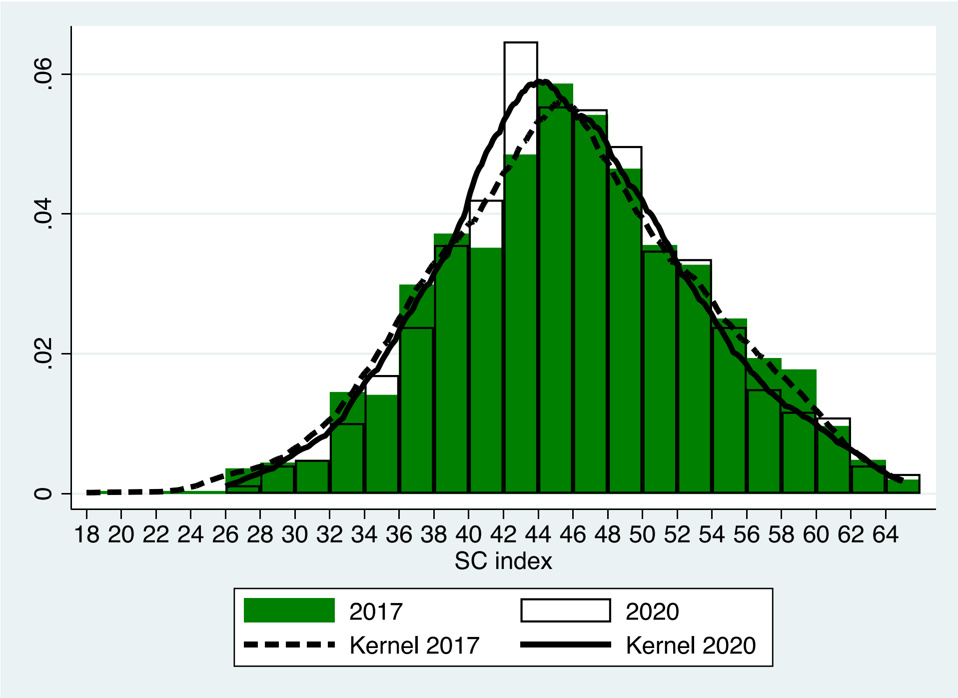

Fig. 1. Distribution of self-control raw score in 2017 and 2020. *Source:* SOEP 2017- and 2020-waves innovation sample. N = 1237. BSCS histogram and kernel density plot.

Our analysis sample consists of 1237 individuals who answered all self-control items in both 2017 and 2020.[3] Our sample is evenly split between men (48 percent) and women (52 percent). On average, respondents are aged 55 (minimum age is 17), have 13 years of education, and have a gross monthly income of 3027 euro.

3. The stability of self-control

3.1. Mean-level stability

Mean-level stability characterizes the extent to which the average traits of a population (or sub-population) remain the same over time (see Roberts & DelVecchio, 2000). In contrast, mean-level change – also referred to as normative change – occurs when aging, social forces, or macro events, lead most people's personalities to change in largely the same way (Little, 2020). Given this, we first assess the mean-level stability in self-control by comparing mean population-level BSCS scores across time. In 2017, the mean BSCS score is 45.56 ($S.D. = 7.59$); in 2020, the mean BSCS score is 45.55 ($S.D. = 7.10$). The inter-temporal difference is -0.01 ($p = 0.924$), indicating that there is no statistically significant mean-level change in self-control between 2017 and 2020. Nor is there evidence of a change in the distribution of self-control over time; a Kolmogorov–Smirnov test fails to reject the null hypothesis that the two distributions are the same ($p = 0.505$) (see Fig. 1).

Stability can also be assessed by considering the inter-temporal correlation in measured self-control. The Pearson correlation (raw score) in our BSCS measures taken three years apart is 0.68. This estimate may be attenuated by measurement error, however (see Saccenti et al., 2020). If we assume that measurement errors in the two periods are independent and additive, the true correlation (ρ_0) is the estimated correlation (ρ) times a function of the noise-to-signal ratio (Adolph & Hardin, 2007; Saccenti et al., 2020). The

[3] In 2017, 2090 respondents answered at least one item, with 1961 answering all items. In 2020, 1375 respondents provided responses to all 13 items. Attrition between 2017 and 2020 is mainly the result of respondents dropping out of the SOEP Innovation Sample, rather than item non-response in the self-control questions. Specifically, the year-to-year attrition rate in the full SOEP sample is 12 percent, while in the innovation sample it is approximately 15 percent. The reduction in the sample over our three-year study period (36 percent) is consistent with this. We show evidence in favor of non-selective attrition with regard to age, gender, years of education, marital status, and employment status in the Online Appendix Table A.2. We do see that a one-point increase in the BSCS score is associated with a 1.1-percent decrease in the probability of staying in the sample. We account for this using inverse probability weights that are based on all variables in Table A.2.

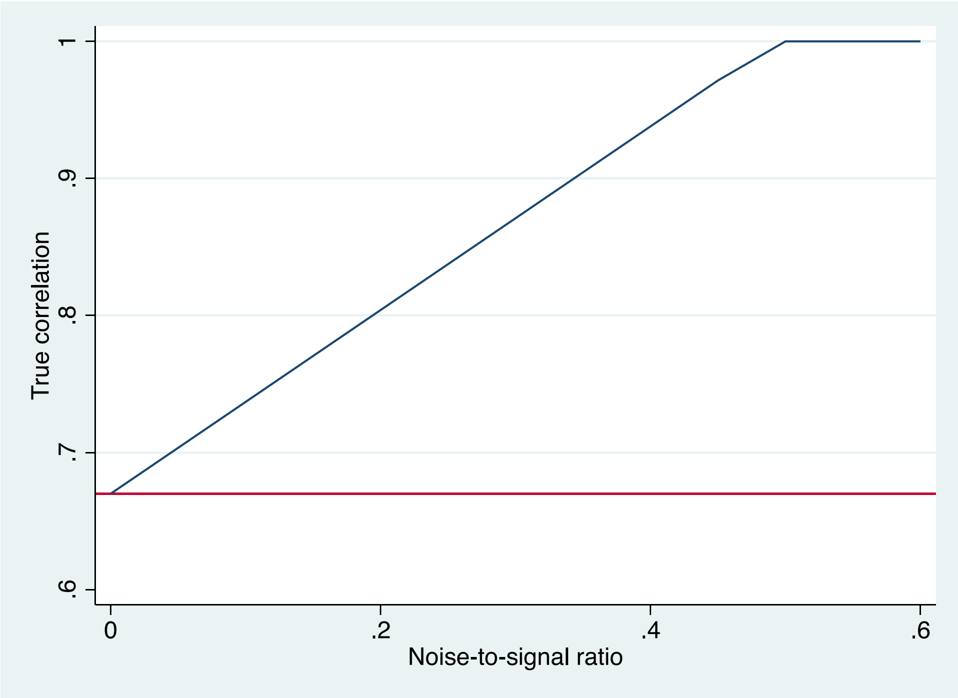

Fig. 2. Correlation coefficient and noise-to-signal ratio. Note: The assumptions are (1) measurement errors are uncorrelated and additive; and (2) the within-person variances, σ_w^2, in 2017 and 2020 are equal. The measurement errors produce attenuation bias (Saccenti et al., 2020), which suggests that our estimated correlation coefficient, $\rho = 0.68$, is a lower bound estimate.

noise-to-signal ratio is equal to the within-person contemporaneous variances, σ_w^2, divided by the variance between individuals, σ_a^2:

$$\rho_0 = \rho \times (1 + \frac{\sigma_w^2}{\sigma_a^2}). \quad (1)$$

The variance in self-control between individuals is observable ($\sigma_a^2 = 53.94$, pooling all observations in 2017 and 2020). However, as we only observe one measure of self-control per respondent per period, there is no within-person variation in BSCS scores in either year. Consequently, we cannot calculate a noise-to-signal ratio for the BSCS using our data. Instead, we illustrate the sensitivity of our correlation to attenuation bias by depicting the true correlation (Y-axis) given the noise-to-signal ratio (X-axis) implied by different degrees of within-person contemporaneous variation. Fig. 2 shows that the true correlation rises sharply from a base of 0.68 (our estimate ignoring measurement error) as variability in contemporaneous within-person self-control – and hence the noise-to-signal ratio – increases. Once the noise-to-signal ratio reaches 0.47 ($\sigma_w^2 = 25.39$), the true correlation coefficient reaches the maximum value of 1.

Alternatively, if one assumes that each of the 13 BSCS items measures the same underlying factor (self-control), one can proxy the contemporaneous within-person variation by calculating the standard deviation across the 13 items for each individual-year observation, which yields an average of 1.07.[4] While this is not exactly the within-person variation in the BSCS score, it likely provides an upper bound for the within-person variation in self-control as single-indicator measures are in general noisier than our composite measure constructed from 13 indicators. Comparing this to the across-person variation averaged across the 13 items so that the numerator and denominator are on the same scale, we obtain an upper bound on the true correlation of 1, which is in line with a high degree of stability of self-control over time.

3.2. Rank-order stability

Rank-order stability captures the extent to which the relative ordering of people on a given personality trait remains constant over time. Traits that meet the criterion for rank-stability are considered to be stable, even if there is mean-level change in trait levels within the population (Golsteyn & Schildberg-Hörisch, 2017; Turner & Piquero, 2002). Assessing the rank-order stability of self-control requires that we move away from population averages to consider the relative position of individuals within the distribution of self-control. Consequently, following others in the literature (see Burt et al., 2006; Coyne & Wright, 2014; Turner &

[4] We thank an anonymous referee for suggesting this procedure.

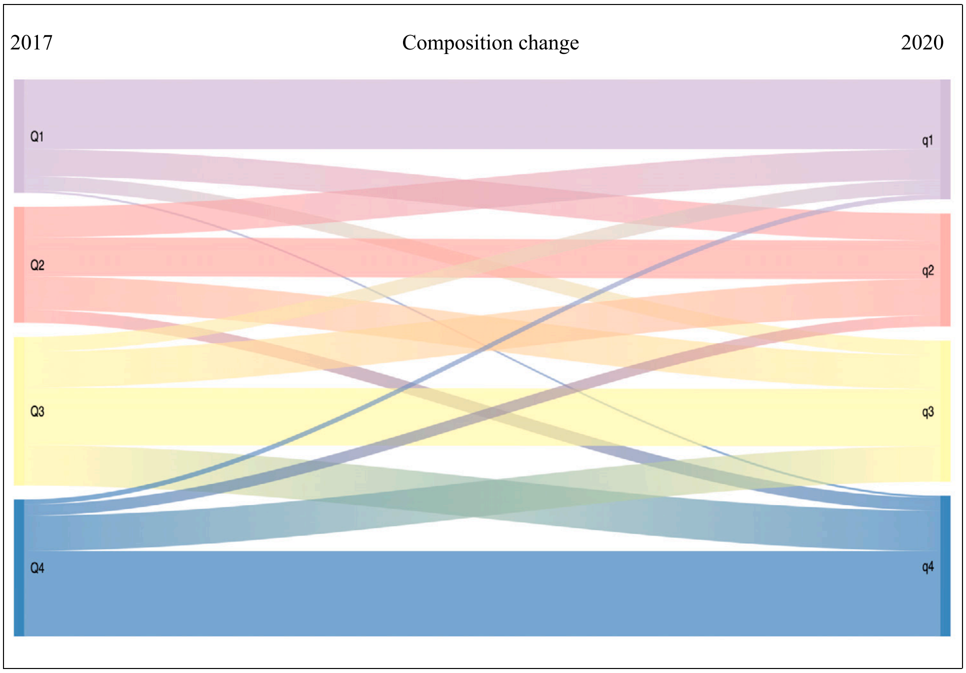

Fig. 3. Alluvial diagram for quartile transitions. Note: The blocks represent nodes for each quartile (Q1–Q4 are 2017-quartiles, and q1–q4 are 2020-quartiles), and stream fields between the blocks represent changes in the composition of these groups over time. The height of a block represents the proportion of the group in the sample, and the height of a stream field represents the percentage of the group that changes to another group. In the sample, 48.8 percent of the respondents remain in the same quartile over the three years.

Piquero, 2002; Yun & Walsh, 2011), we assess the stability of self-control by considering whether people's rank in the self-control distribution remains consistent across time. We illustrate this using an alluvial diagram (see Fig. 3). The quartiles of the 2017-self-control distribution are depicted in different colors on the left Y-axis; those for the 2020-self-control distribution are shown on the right. Overall, we find that 48.8 percent of respondents are in the same quartile in both years, while 24.7 percent are in the same decile. The stability in self-control is particularly evident at both ends of the distribution. Fully 61 percent of those in the bottom quartile in 2017 are also in the bottom quartile in 2020; similarly, 62 percent of those in the top quartile in 2017 remain there in 2020. Among those whose quartile changed, 20 percent move up one quartile, 5 percent move up two quartiles, and less than 1 percent move from the bottom to the top quartile. The transitions among those moving from higher to lower points in the self-control distribution are similar.

The Spearman correlation in our sample is 0.67, also indicating that, over a three-year period, there is a high degree of rank-order stability in self-control within the adult population.[5] Previous studies differ in the study periods, measures, and samples used to assess the stability of self-control, making direct comparisons difficult. There are two previous studies of the short-run stability in the self-control of university students ($N \approx 200$) which produce estimates of intertemporal correlations that are 0.44 to 0.70 over less than one month (Blasco, 2018) and 0.82 over four months (Arneklev et al., 1998)—see Table A.1. Our results are based on a much larger, population-representative sample of adults, and fall between the middle and upper end of this range, despite the much longer time frame we consider.

In addition, our estimate of the inter-temporal correlation in adults' self-control appears to be consistent with, or higher than, most previous estimates for children and adolescents, suggesting that self-control may be more stable in adulthood than in childhood and adolescence. Hay and Forrest (2006), for example, proxy self-control with selected items from the Behavioral Problems Index (BPI) and find that, among U.S. children (aged 7–15), the inter-temporal correlation is around 0.65 when measured over two years, but only 0.43 when measured over eight years. Similarly, Burt et al. (2006) consider a 39-item measure of low self-control and find that, over two years, the correlation in the self-control of Black children (aged 10–12) is 0.48. See Table A.1 for a review.

[5] Constructing Spearman correlations by 5-year age groups, we find that correlation coefficients are between 0.60 to 0.72 in all age groups except for those aged 75 plus, for whom it is lower (see Table A.3). We also regress the change in rank order between 2017 and 2020 on age groups; all age indicators are both individually (except for age 75 plus) and jointly non-significant ($F = 4.03$, $p < 0.001$) (see Table A.4). There appears to be no clear age trend in the rank-order stability of self-control during adulthood.

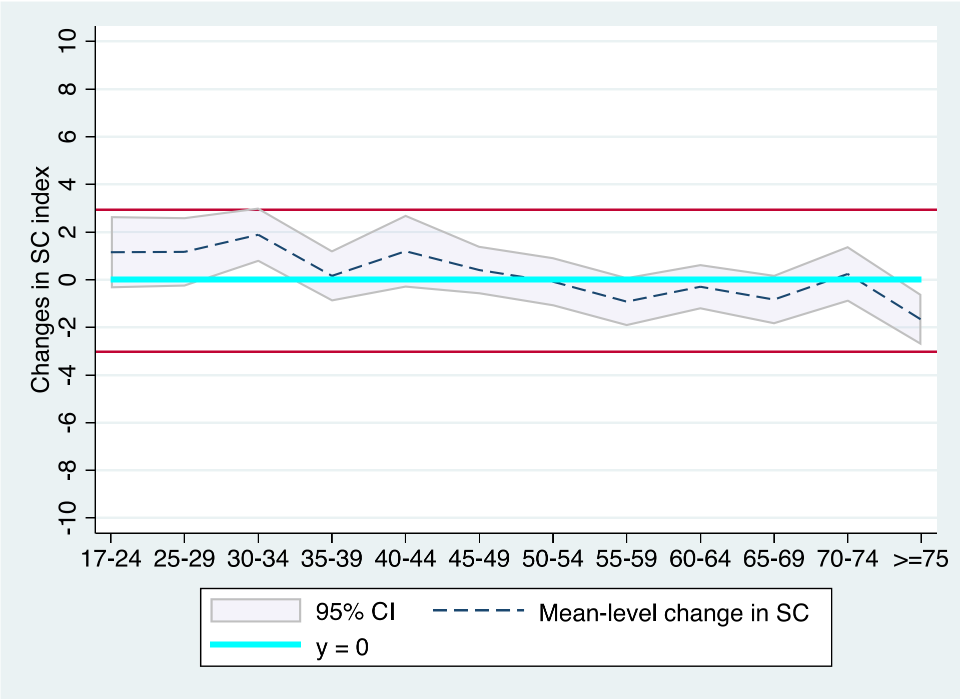

Fig. 4. Changes in SC over the life cycle. Note: SOEP 2017, 2020. Innovation Sample. The Y-axis is the SC index in 2020 minus the SC index in 2017. The SC scale ranges from 13 to 65. Horizontal red lines indicate μ ±0.5 $S.D.$. The X-axis is the respondents' age in the 2017-wave.

3.3. Individual-level stability

Our finding that self-control exhibits a great deal of mean-level and rank-order stability at the population level does not necessarily imply that changes in self-control at the individual level are unimportant or do not exist. The capacity for self-control, for example, may be increasing for some people over time, while simultaneously decreasing for others, producing offsetting changes that result in no mean-level change in the population as a whole (see Roberts, 1997; Roberts et al., 2001). Given this, it is important to understand not only how much individual-level change occurs, but also the extent to which this change is endogenous to people's life experiences.

Individual-level change in self-control is given by:

$$\Delta_i = SC_{i,2020} - SC_{i,2017} \tag{2}$$

On average, BSCS scores change by -0.01 ($S.D. = 5.91$) points between 2017 and 2020. Among our 1237 respondents, 109 (8.8 percent) report exactly the same score in both years; 886 (71.6 percent) report change within 1 standard deviation; 221 (17.8 percent) change scores by more than 1 standard deviation but within 2 standard deviations; only 21 (1.7 percent) change by more than two standard deviations and less than three standard deviations; and no one changes by three standard deviations or more.[6]

The relationship between individual-level change in self-control and age is shown in Fig. 4. The change in self-control tends to be positive up to around age 54, before becoming negative. The overall trend of intra-individual change is not statistically significant except for 30–34 year-olds (significantly positive), and those aged 75 and above (significantly negative). This shows that the aging effect across different cohort groups is relatively small and stable in the medium run.

Thus far, our analysis points to a high degree of individual-level stability in self-control. We turn now to consider whether the changes we do observe are potentially endogenous. That is, does people's measured self-control seem to respond to the major life events they experience? We address this question by estimating the following regression model:

$$\Delta_i = \beta_1 LE_{ij} + \mathbf{X_i}\beta_2 + e_i, \tag{3}$$

where Δ_i is the change in self-control as defined in Eq. (2). Moreover, LE_{ij} captures life-event shocks $j = 1$ to 5 in the years 2017–2020, which are defined as follows: (1) employment shock (= 1 if exiting full-time employment or exiting regular part-time employment for irregular part-time work or unemployment); (2) relationship breakdown (= 1 if marriage or registered same-sex

[6] This compares favorably with estimates of individual-level changes in other personality traits including locus of control (Cobb-Clark & Schurer, 2013) and the Big-Five (Cobb-Clark & Schurer, 2012).

Table 1
Weighted OLS estimates of life events on the individual-level change in self-control, adding age, education, income, and gender as controls.

Variables	Change in SC				
	(1)	(2)	(3)	(4)	(5)
Employment shocks	0.750	0.543	0.558	0.508	0.506
	(0.490)	(0.503)	(0.503)	(0.521)	(0.521)
Observations	2407	2407	2396	2324	2324
Adjusted R-squared	0.001	0.021	0.021	0.021	0.021
Relationship breakdown	−0.673	−0.408	−0.433	−0.455	−0.461
	(0.964)	(0.944)	(0.943)	(0.941)	(0.941)
Observations	2407	2407	2396	2324	2324
Adjusted R-squared	0.000	0.021	0.021	0.021	0.021
Family death	0.202	0.195	0.188	0.145	0.143
	(0.650)	(0.648)	(0.646)	(0.663)	(0.662)
Observations	2407	2407	2396	2324	2324
Adjusted R-squared	0.000	0.021	0.021	0.021	0.021
Childbirth	1.532***	0.318	0.357	0.436	0.434
	(0.458)	(0.564)	(0.566)	(0.578)	(0.578)
Observations	2407	2407	2396	2324	2324
Adjusted R-squared	0.005	0.021	0.021	0.021	0.021
Covid exposure	−0.007	−0.008	−0.008	−0.008	−0.008
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Observations	1170	1170	1170	1134	1134
Adjusted R-squared	0.001	0.021	0.021	0.021	0.021
Age		Yes	Yes	Yes	Yes
Education			Yes	Yes	Yes
Income				Yes	Yes
Gender					Yes

Note: SOEP 2017- and 2020-waves innovation sample for self-control. Dependent variable is the level change in the self-control index. Inverse probability weights are used. Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

partnership ends); (3) family death (= 1 if spouse, father, mother, child, or other household relative dies); (4) childbirth (= 1 if new child is born); (5) COVID exposure (= number of days from declaration of global pandemic on March 11, 2020 to interview date; interviews took place between September, 2020 and February, 2021). Note that shocks $j = 1$ to 4 are dummy variables, whereas shock $j = 5$ is a continuous variable. In the years of 2017–2020, 10 percent of respondents have employment shocks; 3 percent report relationship breakdowns; 5 percent experience family deaths; 8 percent experience childbirth; and the average COVID exposure days is 227 ($S.D. = 27$). Finally, $\mathbf{X}$ is a vector of controls including age, years of education, personal monthly income, and gender—added sequentially.

Our estimates are reported in Table 1.[7] Employment shocks, relationship breakdown, family death, and COVID exposure are not significantly related to individual-level change in self-control. The positive and significant relationship between childbirth and self-control disappears once we account for age. Thus, individual-level changes in self-control seem to be independent of these key life shocks.

4. The economic relevance of changes in self-control

We turn now to consider the economic relevance of observed changes in the capacity for self-control. Our strategy is to benchmark the changes we observe against four key measures of economic well-being; mental and physical health, life satisfaction, and monthly income. We begin by estimating the relationship between economic well-being and self-control using the following model:

$$Y_{itj} = \beta_{OLS,j} \tilde{SC}_{it} + \mathbf{W_{itj}} \gamma_{2j} + v_{itj}, \quad (4)$$

where Y_{itj} is the outcome j for individual i at time t; $\tilde{SC}_{it}$ is the BSCS score standardized to have mean 0, $S.D. = 1$; and $\mathbf{W_{itj}}$ is a vector of controls appropriate for each j. The parameter of interest is $\beta_{OLS,j}$ which captures the relationship between people's outcomes and their self-control. Results are provided in Panel A of Table 2.

[7] To adjust for possible attrition bias, we estimate our models using inverse probability weights. This allows us to use respondents' observed characteristics to reweight the 2020-sample to be consistent with the 2017-sample. A weight of 1 is assigned to all 2017-observations. Probability weights for 2020 are generated by estimating probit models in which the dependent variable is an indicator of whether the respondent was observed in the 2020-sample. The independent variables used to construct the probability weights are an individual's self-control score, age, gender, years of education, marital status, and employment status in 2017. The inverse of these probability weights are used in all estimations.

Table 2
Outcomes and self-control: OLS and SEM estimates with controls in the pooled sample using inverse probability weights.

Variables	Life satisfaction (1)	PCS (2)	MCS (3)	Income (4)
Panel A: OLS				
$\tilde{SC}$	0.319***	0.972***	1.796***	183.956**
	(0.038)	(0.234)	(0.227)	(70.577)
Panel B: SEM & Reliability parameter				
Latent SC	0.362***	1.259***	2.076***	200.639*
	(0.046)	(0.279)	(0.282)	(79.887)
$\hat{\beta}_{OLS}/\hat{\beta}_{SEM}$	88.12%	77.20%	86.51%	91.72%

Note: SOEP 2017- and 2020-waves innovation sample for self-control. Dependent variables are (1) Current Life Satisfaction (range 0–10, mean = 7.6, $S.D.$ = 1.6); (2) Mental Component Summary (MCS) from SF12 (range 0–100, mean = 52.4, $S.D.$ = 9.5); (3) Physical Component Summary (PCS) (range 0–100, mean = 49.0, $S.D.$ = 10.5)—both MCS and PCS following the variables selections according to Ware et al. (1996) and statistical methods according to Nübling et al. (2006); (4) Person gross monthly income in euro (mean = 3027, $S.D.$ = 2179). $\tilde{SC}$ is the standardized BSCS score, and Latent SC is standardized unobserved self-control. Appropriate controls to the dependent variable are used as follows: life satisfaction regression controls for age, income, unemployment status, and physical health; PCS and MCS regressions control for age, income, and education; income regression controls for age, unemployment status, and education. Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

We find little evidence that the individual-level changes in self-control we observe are economically meaningful. As in Cobb-Clark et al. (2022), the results in Table 2 show that variation in self-control across people is predictive of disparities in their economic well-being. Specifically, a one-standard-deviation increase in the BSCS score is associated with a 4-percent increase in life satisfaction (relative to its mean; 0.2 $S.D.$); a 2-percent increase in physical health (0.09 $S.D.$); a 3-percent increase in mental health (0.19 $S.D.$); and an increase in monthly income of 184.0 euro (6 percent, 0.08 $S.D.$).[8] However, individual-level changes in self-control of this magnitude are uncommon. Fewer than one in five people (19.6 percent) experience a change in their BSCS scores of one $S.D.$ or more between 2017 and 2020; for everyone else, the economic relevance of changes in self-control is smaller, often substantially so.

Finally, we consider whether attenuation bias resulting from measurement error may be leading us to understate the economic relevance of inter-temporal change in individual-level self-control. Following Cobb-Clark and Schurer (2013), we assume that self-control is measured with error in both 2017 and 2020 and account for this error by estimating structural equations models:

$$\begin{cases} sc_{it1} &= \alpha_1 + SC_{it}^L \beta_1 + e_{it1} \\ sc_{it2} &= \alpha_2 + SC_{it}^L \beta_2 + e_{it2} \\ & \dots \\ sc_{it13} &= \alpha_{13} + SC_{it}^L \beta_{13} + e_{it13} \\ Y_{itj} &= \alpha_{14} + SC_{it}^L \beta_{SEM} + \mathbf{W_{itj}}\eta + e_{it14} \end{cases} \tag{5}$$

where sc_{it1} to sc_{it13} are the 13 items of the BSCS reported by i in time t. In effect, SC_{it}^L is an indicator of each person's latent self-control (i.e., to be estimated by the model). The first 13 equations model each self-control item in the BSCS as being an indicator of the latent self-control with measurement error. We assume that the measurement errors are independent, and in order to anchor the units of latent self-control, we set its variance to 1. Estimates from this model are compared to OLS estimates using a standardized BSCS score. The reliability parameter is the ratio of the OLS and SEM estimates, providing an indication of the degree of attenuation bias.

Our SEM and OLS estimates are very similar (see Panel B of Table 2). In particular, the reliability parameters range from 77 percent to 92 percent, indicating that the impact of measurement error is small. Thus, attenuation bias is unlikely to be driving our conclusion that individual-level change in self-control is not significantly relevant for economic well-being.

5. Conclusion

People's capacity for self-control is inherently linked to the choices they make and the outcomes they achieve. Our research makes a contribution by demonstrating that self-control exhibits mean-level, rank-order, and individual-level stability at the population level over the medium term. Moreover, changes in people's measured self-control are unrelated to key life events including employment shocks, relationship breakdown, family death, or child birth. Together, these results provide strong support for the

[8] We find little evidence of gender heterogeneity in both the drivers (Table 1) and consequences (Table 2) of self-control. One exception is that longer exposure to COVID is associated with a significant reduction in women's BSCS scores ($p < 0.05$), but is unrelated to changes in men's capacity for self-control. Moreover, the gradient between self-control and income is significantly positive for men ($p < 0.05$) and non-significant for women.

perspective that self-control is a stable personality trait much like the Big-Five personality traits (Cobb-Clark & Schurer, 2012) and locus of control (Cobb-Clark & Schurer, 2013). Any change in people's self-control after reaching adulthood appears to be small, economically unimportant, and likely exogenous to their life experiences.

Crucially, our study period covers the onset of the COVID-19 pandemic which has been unprecedented in the impact it has had on people's lives. The pandemic is, in effect, a natural experiment, providing us with an opportunity to study how population-level self-control responds to major global events. The fact that self-control exhibits little mean-level or rank-order change – both of which are measured at the population level – is testament to the stability of self-control even in the face of extraordinary events.

Given that self-control has been linked to a wide range of social and economic outcomes (see Achtziger, Hubert et al., 2015; Cobb-Clark et al., 2022; de Ridder et al., 2012; Martinsson et al., 2014; Moffitt et al., 2011; Sekścińska et al., 2021), our results may have important policy implications. In particular, the stability of self-control implies that those with high self-control are likely to consistently make decisions that are aligned with their long-term goals, achieving greater overall well-being as a result. In contrast, those with limited self-control are likely to consistently find themselves failing to achieve the life outcomes they desire. The stability of self-control, in effect, may contribute to the persistence in economic outcomes. Consequently, economic opportunity may be enhanced through policies that assist children and adolescents in developing self-control (see Alan et al., 2019; Alan & Ertac, 2018; Sorrenti et al., 2020) or through better commitment tools that facilitate the decision making of adults with low self-control (see Schilbach, 2019, for an overview).

Finally, the recent inclusion of a psychometrically validated measure of trait self-control in population-representative panel studies opens up numerous opportunities for developing new insights into the drivers of self-control as well as the role of self-control in inter-temporal choice. Evidence on the stability of self-control over time will play an important role in supporting these future studies.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.joep.2022.102599.

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