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Extraverted populations have lower savings rates [☆]

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ABSTRACT

Savings rates in the U.S. have reached an historic low, posing challenges to long-term economic well-being. Among individuals, impulsive spending is associated with preferences for immediate gratification, driven by a heightened sensitivity to immediate rewards. Three studies examined whether population levels of trait Extraversion, reflecting dispositional sensitivity to rewards, are associated with aggregate savings rates. In Study 1, cross-cohort increases in U.S. Extraversion, assessed from 16,846 individuals over 28 years, were associated with declining personal savings rates. In Study 2, regional variation in Extraversion as assessed from a sample of 619,397 participants was negatively associated with state-level household saving, although only Openness remained a significant predictor when all traits were simultaneously entered into a regression model. In Study 3, higher nationally-aggregated Extraversion predicted lower gross national savings in a global sample of 17,837 individuals from 53 nations.

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1. Introduction

Savings rates in the United States have been hovering at historically low levels not seen since the great depression. Precipitous declines in national and personal savings since the mid-1980s indicate that Americans have been spending a larger share of their income on immediate consumption, rather than saving their resources for the future. These declining savings rates have been accompanied by increasing debt burdens. At the end of 2012, the national debt in the U.S.A. was 103% of GDP, while household debt was 111% of disposable income. Similar household debt ratios were observed in many of the other OECD nations (Organisation for Economic Co-Operation and Development), including 165% for Canada and 152% for the United Kingdom (OECD, 2013). High levels of debt accompanied by low savings pose many economic risks, including vulnerability to rising interest rates, economic downturns, and higher levels of unemployment. As defined benefit pension plans become less common, personal saving habits play an even stronger role in determining financial well-being during retirement (Butrica, Iams, Smith, & Toder, 2009). At the national level, rising debt levels can also pose serious challenges to long-term economic stability (Leigh, Ignaz, Simon, & Topalova, 2012). Understanding the factors that influence savings rates is thus an important

research goal, as it may help us to forecast large-scale social and economic trends.

A variety of explanations have been proposed for the savings rate decline over the past 30 years, focusing primarily on factors such as the heightened mobility of capital, novel financial instruments, and the economic consequences of an aging population in more developed nations. Although informative, such economic variables have not been able to fully explain the savings rate decline (Guidolin & Jeunesse, 2007). Given that saving behavior ultimately depends upon individual choices, a psychological perspective on declining savings rates may help to provide insights that complement those obtained from purely economic analyses. Such an idea is supported by the growing literature in behavioral economics suggesting that psychological factors play an important role in shaping saving behavior (Gärling, Kirchler, Lewis, & van Raaij, 2009; Wärneryd, 1999). Additional support for this notion comes from preliminary research suggesting that some of the person-level variability in saving behavior is attributable to genetic factors (Cronqvist & Siegel, 2011), indicating an important role for individual differences in psychological processes.

Most psychological accounts of saving behavior have been heavily influenced by the delay of gratification paradigm, in which individuals are asked to make choices between small immediate rewards and larger delayed rewards (Metcalf & Mischel, 1999; Mischel, Shoda, & Rodriguez, 1989). Analysis of such choices enables the calculation of a temporal discounting curve, which reflects the rate at which the subjective value of a reward decreases as the delay to obtaining it increases (Ainslie, 1991;

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Frederick, Loewenstein, & O'Donoghue, 2002; Laibson, 1997). People differ tremendously in the rate at which they discount delayed rewards, with implications for their pursuit of immediate or delayed gratification. While some people indulge their desires as soon as they arise, others forgo such impulses in the hope of realizing larger gains in the future. An inability to delay gratification is associated with many impulsive outcomes, including gambling, substance abuse, weight gain, relationship infidelity, and lower academic performance (Kirby, Winston, & Santiesteban, 2005; Reimers, Maylor, Stewart, & Chater, 2009; Reynolds, 2006). Tendencies toward immediate gratification likewise predict lower credit scores (Meier & Sprenger, 2012) and impulsive spending habits (Joireman, Sprott, & Spangenberg, 2005).

These preferences for immediate rewards are trait-like, characterized by high levels of within-person stability (Odum, 2011) and heritability (Anokhin, Golosheykin, Grant, & Heath, 2011). The tendency to prefer immediate gratification over delayed rewards is in fact associated with greater Extraversion (Hirsh, Guindon, Morisano, & Peterson, 2010; Hirsh, Morisano, & Peterson, 2008; Ostaszewski, 1996, 1997), a dimension of personality associated with social potency and a heightened sensitivity to potential rewards (Elliot & Thrash, 2002; Lucas, Diener, Grob, Suh, & Shao, 2000; Watson & Clark, 1997). This heightened reward sensitivity among extraverts has been linked to a more responsive dopaminergic system (Cohen, Young, Baek, Kessler, & Ranganath, 2005; Depue & Collins, 1999; Wacker, Chavanon, & Stemmler, 2006), which serves as the brain's reward system and supports incentive motivation (Berridge & Robinson, 1998; Spanagel & Weiss, 1999). Dopaminergic neurons are more sensitive to immediate rewards and tend to be less responsive to delayed ones (Kobayashi & Schultz, 2008). Consequently, greater activity in the dopaminergic reward system drives preferences for immediate gratification during intertemporal choices, such that immediate rewards become more salient than long-term gains (McClure, Laibson, Loewenstein, & Cohen, 2004). When asked to choose between smaller immediate and larger delayed rewards, extraverts are thus more likely to choose the smaller but immediate option (Hirsh et al., 2010, 2008).

As a result of their heightened preference for immediate gratification, extraverts also tend to engage in more impulsive spending behaviors compared to introverts, who tend to make more deliberative financial decisions (Verplanken & Herabadi, 2001). A survey of 2800 Dutch households extended this research by revealing that households with extraverted members tend to save less over time compared to more introverted households (Nyhus & Webley, 2001). Among British undergraduate students, Extraversion is likewise associated with an increased use of overdrafts and financial borrowing in order to support personal spending habits (Harrison & Chudry, 2011). The tendency for extraverts to spend money on immediate rewards rather than saving funds for the future is also reflected in their stronger desires to maintain an extravagant lifestyle (McClure, 1984) and engage in conspicuous consumption (Mooradian & Olver, 1996). More generally, extraverts are more likely than introverts to value hedonic enjoyment and a high standard of living as important life goals (Roberts & Robins, 2000). Consistent with the research relating Extraversion to higher temporal discounting rates, extraverts appear to allocate more of their financial resources toward the enjoyment of immediate consumption rather than saving their funds for the future.

If greater sensitivity to immediate rewards leads extraverted individuals to behave more impulsively in their financial decisions, could the additive effect of these individual choices contribute to reduced savings at the population level? Recent analyses support the notion that the aggregated personality traits of a population can predict a variety of important social outcomes, including voting patterns, health indices, and environmental sustainability

(Hirsh, 2014; Rentfrow, Gosling, & Potter, 2008). However, it is not necessarily the case that aggregate-level relationships will always be the same as those observed at the individual level (Chan, 1998). Generalizing individual-level dynamics to higher levels of analysis without empirical evidence for their equivalence has been described as the reverse ecological fallacy, and can produce misleading predictions about population-level dynamics (Hofstede, 2001). A study might observe, for example, that obesity rates tend to be lower among wealthier individuals. It would nonetheless be a mistake to assume that wealthier nations are necessarily characterized by lower obesity rates when the opposite may in fact be true. Although there is evidence for Extraversion's role in shaping individual saving behavior, it thus remains an important question as to whether this relationship would also be observed at the aggregate level. In the current research, three studies were conducted to examine whether population differences in Extraversion, reflecting collective variation in sensitivity to immediate rewards, can predict aggregate savings rates using cross-temporal (Study 1), regional (Study 2), and cross-national (Study 3) data.

2. Study 1

Personality is partially influenced by the sociocultural context in which it develops, such that distinct birth cohorts can express substantial trait differences over time (Twenge, 2008). A cross-temporal analysis was performed using data collected over a 28-year period within the United States to examine whether cohort changes in Extraversion over time could partially account for declines in the savings rate. Mean Extraversion levels were obtained from a meta-analysis of personality data collected between 1966 and 1993 from 16,846 college students (Twenge, 2001) using the Eysenck Personality Inventory (Eysenck, 1968) and Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975). These data provided average Extraversion scores for 23 separate years during this period. Personal savings rates for these same years (calculated as personal saving as a percentage of disposable personal income) were obtained from the Federal Reserve Bank of St. Louis. As shown in Fig. 1, the average yearly level of Extraversion within the American population was negatively associated with personal savings rates during this time, $r(21) = -.50$, $p = .016$. A bootstrapped correlation analysis with 5000 resamples confirmed a robust relationship (95% bias-corrected CI from $-.79$ to $-.11$).

Despite the promising nature of these initial results, the analysis is inherently limited by the fact that many other variables also changed during this time period and may therefore be potential confounds. The changes in Extraversion and the personal savings rate during this period were both relatively linear, suggesting that any number of factors that changed in a linear fashion during the same time may account for the observed correlation. Additionally, data was only available for Extraversion and not for any of the other major personality traits. Studies 2 and 3 address these limitations by employing cross-sectional analyses that complement the cross-temporal approach, while also taking into account the full range of personality traits.

3. Study 2

While Study 1 examined cohort changes in Extraversion throughout the United States, Study 2 examines whether regional differences in this trait are related to household saving behavior. Aggregated levels of the five major personality trait dimensions—Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness—for each of the 50 states were obtained from a database of 619,397 respondents whose personalities were assessed between

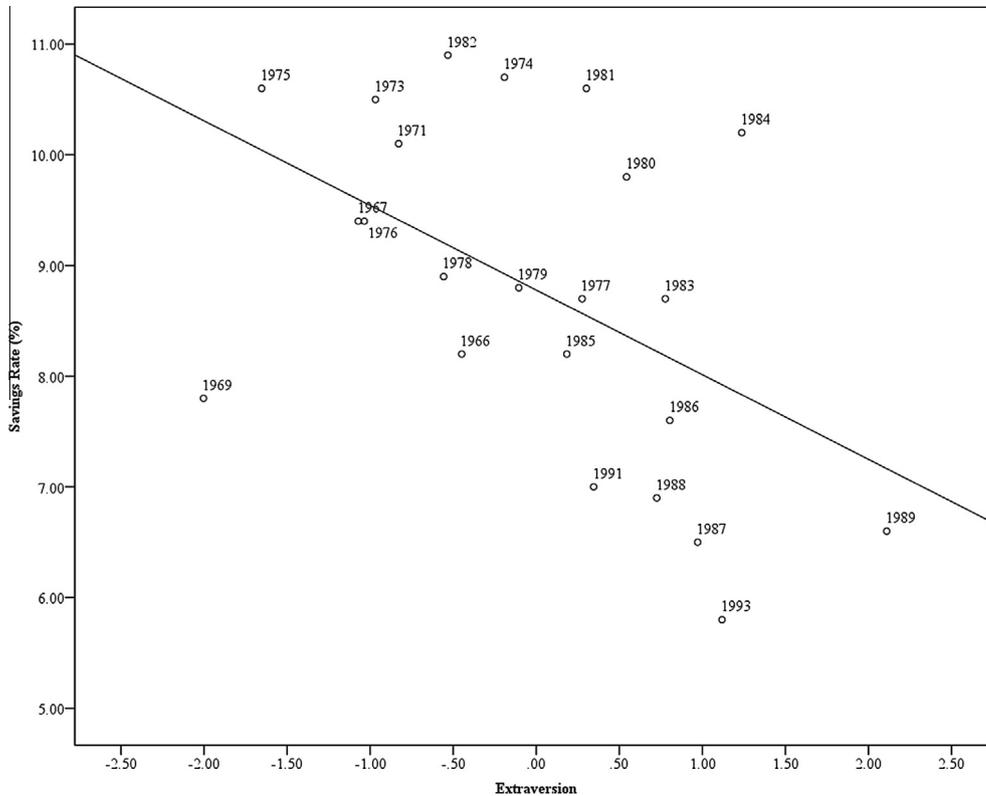


Fig. 1. Scatterplot relating yearly levels of Extraversion (z-scores) and the personal savings rate in the United States for 23 separate years between 1966 and 1993.

December 1999 and January 2005 (Rentfrow et al., 2008) using the Big Five Inventory (John & Srivastava, 1999). This database provides standardized state-level scores for each personality dimension, computed by aggregating raw personality scores to the state level and then converting these aggregated values into z-scores based on their relative distribution. Although official state-level savings rates are not available, an index of household saving behavior within each state was provided by the CredAbility Consumer Distress Index (CCDI) for Household Budget. The CCDI for Household Budget is indexed by the Federal Reserve Bank of St. Louis and reflects the extent to which households within a state are living within their means and saving for the future. CCDI values are calculated for each quarter in the fiscal year using indices of disposable income, savings, and consumer confidence from the Department of Commerce and Bureau of Economic Analysis. The median CCDI values between 2000 and 2004 were used as an index of average state-level saving behavior during the time period in which the personality assessments were made. Lower CCDI values indicate that households within a state are spending more of their income on immediate consumption, rather than setting money aside for savings.

State-level personality traits were examined in relation to the CCDI Household Budget index. Average life expectancy, population dependency ratio (the ratio of non-working to working individuals), and GDP per capita have all previously been related to savings rates and were thus used as statistical control variables to eliminate their status as potential confounds (Browning & Lusardi, 1996). Figure 2 plots the results: Extraversion had a significant negative relationship with state-level saving behavior, $r(45) = -.29$, $p = .023$, with households in more extraverted states tending to save less than households in more introverted states. A bootstrapped correlation analysis with 5000 resamples confirmed that this effect was not driven by outliers (95% bias-corrected CI from $-.54$ to $-.01$). Of the remaining personality traits, only Openness showed a significant relationship with state-level savings, $r(45) = .66$, $p = .001$, with more open states demonstrating

higher household saving. No other traits revealed any significant relationship with the saving measure (all $ps > .05$). Extraversion remained a significant predictor when the control variables were excluded from the analysis, $r(48) = .24$, $p = .044$.

Given that both Extraversion and Openness demonstrated significant relationships with saving behavior, an important question is whether these effects are independent of one another. A multiple regression model was tested that regressed saving behavior on all Big Five traits and covariates simultaneously. Openness emerged as the only significant trait predictor from this analysis, $\beta = .42$, $t(41) = 4.19$, $p = .001$, whereas Extraversion was non-significant, $\beta = .02$, $t(41) = 0.19$, $p = .849$. Although this might suggest that Extraversion is not a significant predictor of saving behavior when controlling for the other traits, there is reason to believe that this result could also be an artifact of multicollinearity. As seen in Table 1, the intercorrelations among aggregate-level personality traits are considerably higher than those that are usually observed at the individual level. Indeed, the regression coefficient for Extraversion had a Variance Inflation Factor (VIF) of 2.64. A VIF larger than 2.5 can indicate multicollinearity problems (Allison, 1999), especially in the context of a small sample (Mason & Perreault, 1991). Multicollinearity can have the effect of increasing the standard errors around any parameter estimates, such that the accuracy of the obtained coefficients is less reliable. In light of the relatively small sample and the large intercorrelations among traits, the multivariate analysis pitting the effects of Openness and Extraversion against each other should likely be interpreted with caution. Nonetheless, the magnitudes of the zero-order correlations do suggest that Openness is a stronger predictor than Extraversion of state-level saving behavior.

4. Study 3

Study 3 extends the results of the regional analysis to examine whether national differences in Extraversion could help explain

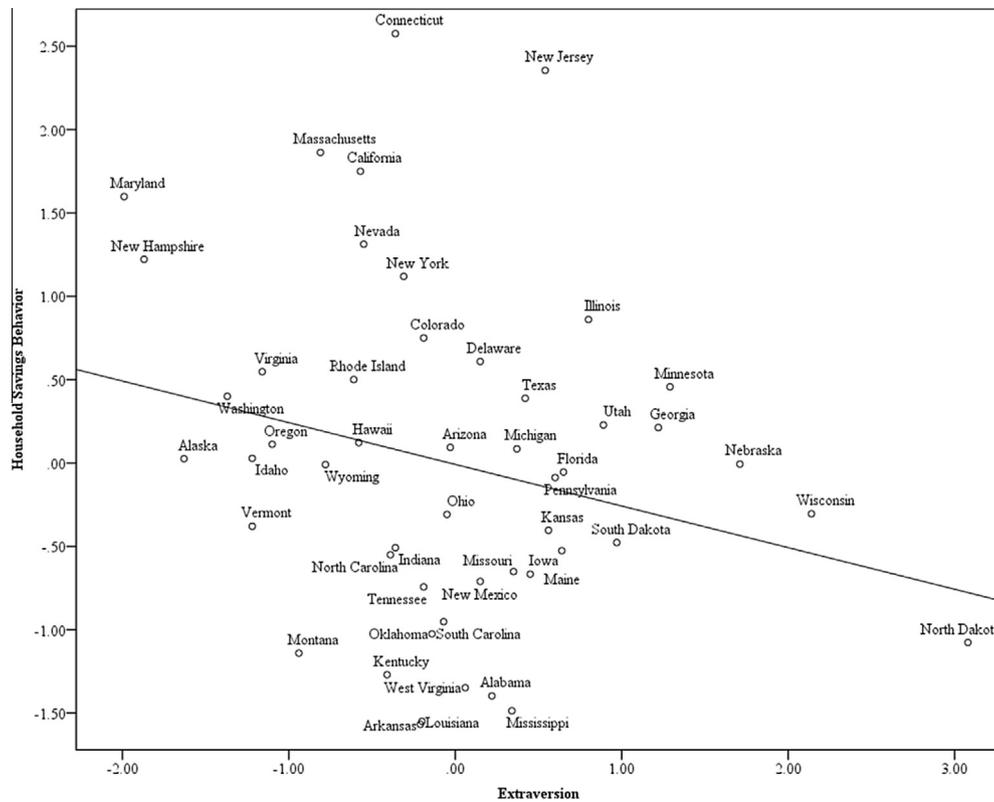


Fig. 2. State-level household saving behavior, as indexed by the CredAbility Consumer Distress Index for Household Budget (z-scores), in relation to Extraversion (z-scores).

Table 1
Correlations between saving and Big Five traits in Studies 2 (lower half) and 3 (upper half).

Variables	1	2	3	4	5	6
1 Saving		-.29 [*] / (-.29 [*])	-.21 / (-.13)	-.32 [*] / (-.25)	.05 / (.01)	-.28 [*] / (-.28)
2 Extraversion	-.24 [*] / (-.29 [*])		.20 / (.18)	.25 / (.27)	-.49 [*] / (-.52 [*])	.27 / (.27)
3 Agreeableness	-.28 [*] / (-.01)	.55 [*] / (.51 [*])		.65 [*] / (.54 [*])	-.48 [*] / (-.37 [*])	.26 / (.33 [*])
4 Conscientiousness	-.27 / (.07)	.43 [*] / (.35 [*])	.67 [*] / (.60 [*])		-.57 [*] / (-.51 [*])	.20 / (.30 [*])
5 Neuroticism	-.06 / (.28)	-.15 / (-.19)	-.09 / (-.13)	-.27 / (-.46 [*])		-.09 / (.12)
6 Openness	.48 [*] / (.66 [*])	-.51 [*] / (-.49 [*])	-.12 / (-.07)	.05 / (.16)	.13 / (.20)	

Values in parentheses reflect partial correlations with average life expectancy, population dependency ratio, and GDP per capita included as controls.
^{*} Significant at $p < .05$.

variation in savings rates across countries. Nationally-aggregated personality trait scores were obtained from an existing cross-cultural database (Schmitt, Allik, McCrae, & Benet-Martinez, 2007). This 2002 database provides aggregate personality scores for 53 nations, as assessed from 17,837 individuals with the Big Five Inventory (John & Srivastava, 1999). The aggregated scores provided by this database are standardized t -scores, normalized so that a score of 50 reflects the trait level observed in the United States. These scores were originally computed by centering each nation's aggregated raw values around the U.S. score and dividing this amount by the U.S. standard deviation. The resulting values were multiplied by 10, and then 50 was added to obtain the final t -scores. Personality scores were correlated with the International Monetary Fund's index of Gross National Savings as a percentage of GDP in 2002. This measure reflects the amount of national disposable income that remains after subtracting public and private consumption expenditures, expressed as a proportion of GDP. Average life expectancy, the population dependency ratio, and GDP per capita were again entered as statistical control variables to eliminate their role as potential confounds. As seen in Fig. 3, national savings rates were negatively related to aggregate levels of

Extraversion, $r(48) = -.29, p = .020$. No other personality trait dimension displayed a significant relationship with national savings rates (all $ps > .05$). Extraversion's relationship with the national savings rate also remained significant when using a bootstrapped correlation analysis with 5000 resamples (95% bias-corrected CI from $-.53$ to $-.03$), suggesting that this effect was not driven by outliers. Excluding the control variables from the analysis did not affect the correlation, $r(51) = -.29, p = .016$. Extraversion likewise emerged as the only significant trait predictor of savings in a multiple regression model that simultaneously included all Big Five traits and covariates, $\beta = -.34, t(44) = -2.17, p = .036$.

5. Discussion

Across three studies using a combination of temporal, regional, and cross-national data, a negative relationship was observed between a population's Extraversion levels and its aggregate savings behavior. Just as dispositional preferences for immediate gratification predict impulsive choices among individuals, so too do

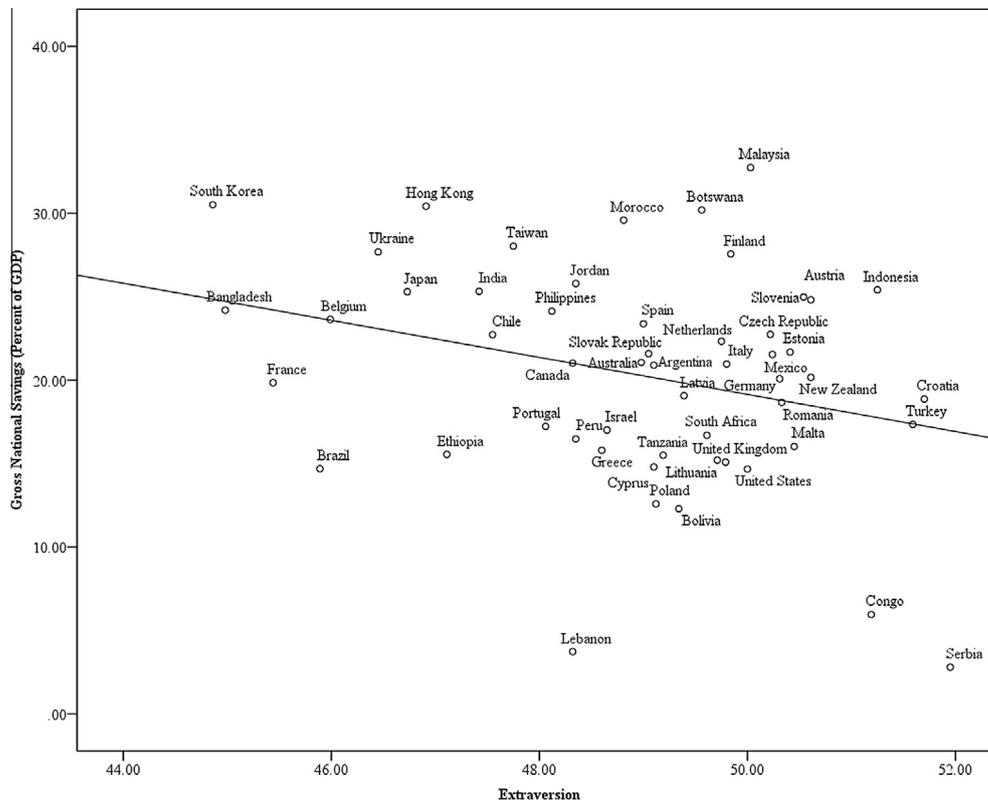


Fig. 3. Gross national savings rate as a function of Extraversion (*t*-scores) across 53 nations.

they predict reduced savings at the aggregated population level. Relatively extraverted populations, which are comprised of individuals who are more sensitive to potential rewards and tend to prefer immediate gratification, allocate more of their financial resources toward immediate consumption and less toward long-term savings compared to more introverted populations.

Although the present analysis cannot definitively identify the mechanisms by which higher population extraversion levels are related to lower savings rates, there are three key factors in models of saving behavior that provide plausible pathways of influence (Browning & Lusardi, 1996). First, saving behavior tends to decrease as consumption needs increase (Ando & Modigliani, 1963). While consumption needs are often examined in relation to demographic factors such as age and number of dependents, there are also important individual differences in the desire for consumption. In particular, extraverts are more likely to value a higher quality of life (Roberts & Robins, 2000), as expressed in a greater desire for an extravagant lifestyle (McClure, 1984) and conspicuous consumption (Mooradian & Olver, 1996). The increased “appetite” for consumption among extraverted populations may thus help to shift their allocation of resources toward present demands and away from future savings. Second, time preferences are critical in saving decisions, with higher rates of temporal discounting predicting lower savings rates (Frederick et al., 2002; Laibson, 1997). Extraverts tend to discount rewards more steeply than introverts, resulting in a strong preference for immediate gratification (Hirsh et al., 2010, 2008; Ostaszewski, 1996, 1997). More extraverted populations will likewise be characterized by an aggregate preference for immediate rewards, supporting their allocation of financial resources to immediate consumption rather than saving for the future. Finally, savings rates are influenced by risk preferences, with tendencies toward risk aversion supporting precautionary savings that protect against future losses of income (Skinner, 1988). A number of studies have demonstrated that

extraverts tend to be less sensitive to potential risks, and are therefore more likely to engage in risky decision-making (Gullone, 2000; Lauriola & Levin, 2001; Nettle, 2005; Nicholson, Soane, Fenton-O’Creavy, & Willman, 2005; Vestewig, 1977). More extraverted populations should thus be less likely to engage in precautionary saving because they are less sensitive to the potential risks of future financial shocks. Taken together, these pathways provide three plausible and related mechanisms by which lower savings rates might emerge among more extraverted populations.

Although Extraversion emerged as a consistent predictor of aggregate savings across the studies, higher levels of Openness were also associated with higher savings rates at the state level (but not the national level). In fact, Openness emerged as a stronger predictor than Extraversion at the state level. While this relationship was not predicted, it may be accounted for by the fact that Openness is the only personality trait that shows a reliable association with intelligence, such that open individuals tend to display better scores on tests of cognitive ability (McCrae, 1993; Moutafi, Furnham, & Crump, 2003). Intelligence is also an important factor in temporal discounting, with greater cognitive ability being associated with preferences for larger delayed rewards over smaller immediate rewards (Shamosh & Gray, 2007). As intelligence increases, people show greater tendencies toward planning, foresight, and self-control, all of which are relevant for saving behavior and the ability to balance a household budget (Baumeister, 2002; Laibson et al., 1998; Thaler & Shefrin, 1981). It remains unclear, however, why Openness would emerge as a predictor of savings at the state level, but not at the national level (where there was in fact a trend in the opposite direction). One possibility is that the state-level scores were based on an index of household budgeting effectiveness, potentially allowing for a greater influence of individual planning ability at the state level as compared with gross national savings. Additional research would be needed to directly test this possibility and further exam-

ine the relationship between aggregate Openness scores and large-scale saving outcomes.

Across three levels of analysis, the present findings support the recent discovery that population variation in micro-level personality characteristics can be an important factor in predicting macro-level social outcomes (Rentfrow et al., 2008). In particular, it would appear that a population's aggregated Extraversion levels are related to its economic focus on immediate versus delayed rewards. This suggests that the individual-level association between Extraversion and reduced saving behavior, mediated by a preference for immediate rewards, also extends to the aggregate population level. Such a finding may be usefully applied by using population-level changes in Extraversion over time to forecast trends in saving behavior. Although cohort changes in Extraversion throughout the United States in the late 20th century have been documented (Twenge, 2001), it may also be useful to forecast the trajectories of such changes in other populations to get a clearer sense of how saving behavior might be affected over time. Similar analyses could be useful in predicting saving behavior across different populations based upon their relative Extraversion levels. An interesting question for future research is whether these results would also extend to smaller-scale populations, such as municipalities or organizations. Given that the relationship remains across national and state-level analyses, there is reason to believe that it might also emerge in smaller populations.

In terms of policy implications, an important question is whether anything can be done to address the impact of Extraversion levels on saving behavior. High levels of Extraversion are often viewed as a cultural ideal to be emulated, in contrast to introverted characteristics which are valued less highly (Cain, 2012). The current findings suggest that this cultural ideal may have the unintended consequence of promoting an excessive focus on immediate rewards as opposed to long-term value. However, understanding the role of Extraversion in shaping population-level savings rates may also be useful in developing new strategies for encouraging saving behavior. It has been demonstrated, for example, that advertising campaigns that are tailored toward the personality traits of the intended message recipients are more effective than those using broad-based appeals (Hirsh, Kang, & Bodenhausen, 2012). The fact that lower savings rates are associated with higher levels of Extraversion suggests that campaigns designed to increase saving behavior may benefit from tailoring message content and framing for extraverts.

Although the relationship between Extraversion and aggregate savings was consistently observed across multiple analyses, there are still some limitations in the current studies. First, the available measures of personality are not necessarily fully representative of the populations from which they are drawn. Although the state-level personality data was taken from a large representative internet sample, the cross-temporal data was drawn from a convenience sample of college students and the cross-national data varied in its representativeness across countries. A second limitation is that although data from many individuals is included in the analyses, the sample sizes at the aggregate level are relatively small. Consequently, it was not possible to examine the potential role of any population-level variables that may moderate the observed relationships. When combined with the high intercorrelations among the aggregate trait scores, the relatively small sample sizes also limited the extent to which the traits could be examined as simultaneous predictors without introducing multicollinearity issues.

Finally, because the results are correlational, no firm causal conclusions can be drawn from these analyses. It is thus worth considering the possibility that savings rates might somehow have a causal impact on Extraversion. It may be the case, for example, that populations that save more for the future have fewer resources

available for immediate consumption and thus cannot support highly extraverted lifestyles. It should be noted, however, that controlling for wealth had no influence on the relationship between Extraversion and saving, suggesting that differing access to financial resources cannot explain the observed correlations. A second possibility is that both Extraversion and savings rates are jointly influenced by an unknown third variable. While this may still be the case, the current analysis was able to rule out three of the most likely confounds that are known to affect savings rates: life expectancy, the population dependency ratio, and wealth (Browning & Lusardi, 1996). Identifying other potential confounds would likely require further research into the socio-cultural factors that can influence population levels of Extraversion. The third possibility is that population levels of Extraversion do indeed have a causal influence on savings rates as theorized. To the extent that population savings rates are affected by individual saving behavior, this appears to be the most likely causal pathway. In particular, such an explanation would be consistent with research at the individual level linking Extraversion to increased consumption and reduced saving, and with experimental studies examining how variation in reward sensitivity can influence decision-making processes.

Overall, the current research suggests that psychological science as a whole and personality psychology in particular can contribute important insights to our understanding of global economic outcomes and events (Almlund, Duckworth, Heckman, & Kautz, 2011; Gärling et al., 2009). Although personality psychologists have traditionally focused on individual-level phenomena, investigating the broader social and economic consequences of personality processes remains an important task for future research.

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References

- Ainslie, G. (1991). Derivation of 'rational' economic behavior from hyperbolic discount curves. *The American Economic Review*, 81, 334–340.
- Allison, P. D. (1999). *Multiple regression: A primer*. Newbury Park, CA: Pine Forge Press.
- Almlund, M., Duckworth, A. L., Heckman, J. J., & Kautz, T. D. (2011). *Personality Psychology and Economics* (Working Paper No. 16822). National Bureau of Economic Research. Retrieved from <<http://www.nber.org/papers/w16822>>.
- Ando, A., & Modigliani, F. (1963). The 'life cycle' hypothesis of saving: Aggregate implications and tests. *The American Economic Review*, 55–84.
- Anokhin, A. P., Golosheykin, S., Grant, J. D., & Heath, A. C. (2011). Heritability of delay discounting in adolescence: A longitudinal twin study. *Behavior Genetics*, 41, 175–183.
- Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research*, 28, 670–676.
- Berridge, K. C., & Robinson, T. E. (1998). What is the role of dopamine in reward: Hedonic impact, reward learning, or incentive salience? *Brain Research Reviews*, 28, 309–369.
- Browning, M., & Lusardi, A. (1996). Household saving: Micro theories and micro facts. *Journal of Economic Literature*, 34, 1797–1855.
- Butrica, B. A., Iams, H. M., Smith, K. E., & Toder, E. J. (2009). The disappearing defined benefit pension and its potential impact on the retirement incomes of baby boomers. *Social Security Bulletin*, 69, 1–27.
- Cain, S. (2012). *Quiet: The power of introverts in a world that can't stop talking*. New York, NY: Random House.
- Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology*, 83, 234–246.
- Cohen, M., Young, J., Baek, J., Kessler, C., & Ranganath, C. (2005). Individual differences in extraversion and dopamine genetics predict neural reward responses. *Cognitive Brain Research*, 25, 851–861.
- Cronqvist, H., & Siegel, S. (2011). *The Origins of Savings Behavior* (SSRN Scholarly Paper No. ID 1649790). Rochester, NY: Social Science Research Network. Retrieved from <<http://papers.ssrn.com/abstract=1649790>>.
- Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: Dopamine, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences*, 22, 491–517.

- Elliot, A. J., & Thrash, T. M. (2002). Approach–avoidance motivation in personality: Approach and avoidance temperaments and goals. *Journal of Personality and Social Psychology*, 82, 804–818.
- Eysenck, H. J. (1968). *Eysenck personality inventory*. San Diego, CA: Educational and Industrial Testing Service.
- Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the Eysenck personality questionnaire*. London: Hodder & Stoughton.
- Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, 40, 351–401.
- Gärting, T., Kirchlner, E., Lewis, A., & van Raaij, F. (2009). Psychology, financial decision making, and financial crises. *Psychological Science in the Public Interest*, 10, 1–47.
- Guidolin, M., & Jeunesse, E. A. L. (2007). The decline in the U.S. personal saving rate: Is it real and is it a puzzle? *Federal Reserve Bank of St. Louis Review*, 89, 491–514.
- Gullone, E. (2000). Adolescent risk-taking and the five-factor model of personality. *Journal of Adolescence*, 23, 393–407.
- Harrison, N., & Chudry, F. (2011). Overactive, overwrought or overdrawn? The role of personality in undergraduate financial knowledge, decision-making and debt. *Journal of Further and Higher Education*, 35, 149–182.
- Hirsh, J. B. (2014). Environmental sustainability and national personality. *Journal of Environmental Psychology*, 38, 233–240.
- Hirsh, J. B., Guindon, A., Morisano, D., & Peterson, J. B. (2010). Positive mood effects on delay discounting. *Emotion*, 5, 717–721.
- Hirsh, J. B., Kang, S. K., & Bodenhausen, G. V. (2012). Personalized persuasion tailoring persuasive appeals to recipients' personality traits. *Psychological Science*, 23, 578–581.
- Hirsh, J. B., Morisano, D., & Peterson, J. B. (2008). Delay discounting: interactions between personality and cognitive ability. *Journal of Research in Personality*, 42, 1646–1650.
- Hofstede, G. H. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Thousand Oaks, CA: Sage Publications.
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In *Handbook of Personality: Theory and Research* (pp. 102–138). New York, NY: Guilford Press.
- Joireman, J., Sprout, D. E., & Spangenberg, E. R. (2005). Fiscal responsibility and the consideration of future consequences. *Personality and Individual Differences*, 39, 1159–1168.
- Kirby, K., Winston, G., & Santiesteban, M. (2005). Impatience and grades: Delay-discount rates correlate negatively with college GPA. *Learning and Individual Differences*, 15, 213–222.
- Kobayashi, S., & Schultz, W. (2008). Influence of reward delays on responses of dopamine neurons. *The Journal of Neuroscience*, 28, 7837–7846.
- Laibson, D. (1997). Golden eggs and hyperbolic discounting. *Quarterly Journal of Economics*, 112, 443–477.
- Laibson, D., Repetto, A., Tobacman, J., Hall, R. E., Gale, W. G., & Akerlof, G. A. (1998). Self-control and saving for retirement. *Brookings Papers on Economic Activity*, 1998, 91–196.
- Lauriola, M., & Levin, I. P. (2001). Personality traits and risky decision-making in a controlled experimental task: An exploratory study. *Personality and Individual Differences*, 31, 215–226.
- Leigh, D., Ignaz, D., Simon, J., & Topalova, P. (2012). *Dealing with household debt* (pp. 89–124). World Economic Outlook. International Monetary Fund.
- Lucas, R., Diener, E., Grob, A., Suh, E., & Shao, L. (2000). Cross-cultural evidence for the fundamental features of extraversion. *Journal of Personality and Social Psychology*, 79, 452–463.
- Mason, C. H., & Perreault, W. D. (1991). Collinearity, power, and interpretation of multiple regression analysis. *Journal of Marketing Research*, 28, 268.
- McClure, R. (1984). The relationship between money attitudes and overall pathology. *Psychology: A Quarterly Journal of Human Behavior*, 21, 4–6.
- McClure, S., Laibson, D., Loewenstein, G., & Cohen, J. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science*, 306, 503–507.
- McCrae, R. R. (1993). Openness to experience as a basic dimension of personality. *Imagination, Cognition and Personality*, 13, 39–55.
- Meier, S., & Sprenger, C. D. (2012). Time discounting predicts creditworthiness. *Psychological Science*, 23, 56–58.
- Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review*, 106, 3–19.
- Mischel, W., Shoda, Y., & Rodriguez, M. (1989). Delay of gratification in children. *Science*, 244, 933–938.
- Mooradian, T. A., & Olver, J. M. (1996). Shopping motives and the five factor model: An integration and preliminary study. *Psychological Reports*, 78, 579–592.
- Moutafi, J., Furnham, A., & Crump, J. (2003). Demographic and personality predictors of intelligence: A study using the NEO personality inventory and the Myers–Briggs type indicator. *European Journal of Personality*, 17, 79–94.
- Nettle, D. (2005). An evolutionary approach to the extraversion continuum. *Evolution and Human Behavior*, 26, 363–373.
- Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P. (2005). Personality and domain-specific risk taking. *Journal of Risk Research*, 8, 157–176.
- Nyhus, E. K., & Webley, P. (2001). The role of personality in household saving and borrowing behaviour. *European Journal of Personality*, 15, S85–S103.
- Odum, A. L. (2011). Delay discounting: Trait variable? *Behavioural Processes*, 87, 1–9.
- OECD (2013). *OECD economic outlook no. 94*. Paris, France: Organisation for Economic Co-operation and Development.
- Ostaszewski, P. (1996). The relation between temperament and rate of temporal discounting. *European Journal of Personality*, 10, 161–172.
- Ostaszewski, P. (1997). Temperament and the discounting of delayed and probabilistic rewards. *European Psychologist*, 2, 35–43.
- Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences*, 47, 973–978.
- Rentfrow, P. J., Gosling, S. D., & Potter, J. (2008). A theory of the emergence, persistence, and expression of geographic variation in psychological characteristics. *Perspectives on Psychological Science*, 3, 339–369.
- Reynolds, B. (2006). A review of delay-discounting research with humans: Relations to drug use and gambling. *Behavioural Pharmacology*, 17, 651–667.
- Roberts, B. W., & Robins, R. W. (2000). Broad dispositions, broad aspirations: The intersection of personality traits and major life goals. *Personality and Social Psychology Bulletin*, 26, 1284–1296.
- Schmitt, D. P., Allik, J., McCrae, R. R., & Benet-Martínez, V. (2007). The geographic distribution of Big Five personality traits patterns and profiles of human self-description across 56 nations. *Journal of Cross-Cultural Psychology*, 38, 173–212.
- Shamosh, N., & Gray, J. (2007). Delay discounting and intelligence: A meta-analysis. *Intelligence*, 36, 289–305.
- Skinner, J. (1988). Risky income, life cycle consumption, and precautionary savings. *Journal of Monetary Economics*, 22, 237–255.
- Spanagel, R., & Weiss, F. (1999). The dopamine hypothesis of reward: Past and current status. *Trends in Neurosciences*, 22, 521–527.
- Thaler, R. H., & Shefrin, H. M. (1981). An economic theory of self-control. *Journal of Political Economy*, 89, 392–406.
- Twenge, J. M. (2001). Birth cohort changes in extraversion: A cross-temporal meta-analysis, 1966–1993. *Personality and Individual Differences*, 30, 735–748.
- Twenge, J. M. (2008). Generation me, the origins of birth cohort differences in personality traits, and cross-temporal meta-analysis. *Social and Personality Psychology Compass*, 2, 1440–1454.
- Verplanken, B., & Herabadi, A. (2001). Individual differences in impulse buying tendency: Feeling and no thinking. *European Journal of Personality*, 15, S71–S83.
- Vestewig, R. E. (1977). Extraversion and risk preference in portfolio theory. *The Journal of Psychology*, 97, 237–245.
- Wacker, J., Chavanon, M., & Stemmler, G. (2006). Investigating the dopaminergic basis of extraversion in humans: A multilevel approach. *Journal of Personality and Social Psychology*, 91, 171–187.
- Wärnerud, K. E. (1999). *The psychology of saving: A study on economic psychology*. Northampton, MA: Edward Elgar.
- Watson, D., & Clark, L. A. (1997). Extraversion and its positive emotional core. In R. Hogan, J. A. Johnson, & S. R. Briggs (Eds.), *Handbook of personality psychology* (pp. 767–793). San Diego, CA: Academic Press.