Department of Economics Discussion Paper Series

Predicting life outcomes with automatic thinking measures in a marginalized population

Lia Q. Flores and Julian Jamison

Number 1005
March, 2023

Department of Economics
Manor Road Building, Manor Road
Oxford, OX1 3UQ

ISSN 1471-0498

Predicting life outcomes with automatic thinking measures in a marginalized population*

Lia Q. Flores† and Julian Jamison‡

March 5, 2023

Abstract

Automatic thinking conditions decisions with intertemporal trade-offs which can matter greatly for life outcomes. Systematically choosing immediate gratification may result in different forms of antisocial behavior and also damage one's economic circumstances. Based on a dataset of almost 1000 Liberian men over the course of one year, we evaluate the predictive power of three proxies of automatic thinking that have been used in different branches of the behavioral science literature: time preferences, executive function and self-control. We find that time preference is a robust predictor of both antisocial behavior and economic performance. Self-control only reliably predicts antisocial behavior, while executive function predicts neither significantly.

Keywords: time preferences, executive function, self-control, predictive power, data from field experiment, life outcomes
JEL classification: D91, C93

*We thank Miguel Fonseca, Giuseppe Cavaliere and Ana Isabel Sá for their valuable comments and suggestions. Lia Flores gratefully acknowledges the financial support from Portuguese public funds through FCT - Fundação para a Ciência e a Tecnologia, I.P., in the framework of the PhD scholarship SFRH/BD/136976/2018. The usual disclaimer applies.

†University of Porto. E-mail: *liaqflores@gmail.com*. Postal address: University of Porto School of Economics and Management (FEP), Rua Dr. Roberto Frias. Porto, Portugal.

‡University of Exeter. E-mail: *J.Jamison@exeter.ac.uk*. Postal address: University of Exeter Business School, Streatham Court, Rennes Drive, Exeter EX4 4ST, United Kingdom.

1 Introduction

Many of our behaviors are automatic, intuitive or even impulsive. However, skipping deliberation is not always desirable (Kahneman, 2011). When automatic thinking prevails in decisions involving intertemporal trade-offs, immediate gratification is bound to shadow the implicit future costs. Examples include responding aggressively to someone that is annoying or threatening as opposed to managing emotional impulses and having a more constructive approach; or spending scarce resources in prostitution and gambling as opposed to saving and planning one's expenditure with long-term goals in mind.

Lack of self-control is at the root of antisocial behavior with consequences that range from social marginalisation to imprisonment (Gottfredson and Hirschi, 1990; Gaik et al., 2010). Additionally, undervaluing or discounting the future relative to the present takes an important role in determining what to buy and consume, and what to save and invest (e.g. Ashraf et al., 2006; Bradford et al., 2017). Such decisions shape peoples' ability to improve their economic circumstances out of poverty. Finally, antisocial behavior and poor economic performance have the potential to make each other worse (e.g. building a damaged social reputation with or without imprisonment affects future job opportunities), especially when automatic decision-making systematically overrides careful planning.

In this paper, we study the predictive power of different measures of automatic thinking for two important life outcomes, antisocial behavior and economic circumstances or, simply, economic performance. We consider time preferences, executive function and self-control as proxies for automatic thinking. While multidimensional, the overarching concept also reflects different traditions in behavioral social science and decision-making (e.g. Duckworth and Kern, 2011, from psychology; Burks et al., 2012, from economics). Our measure of time preferences is an index of hypothetical and incentivized inter-temporal choices between receiving a smaller amount earlier and a larger amount later, plus a minor survey regarding how much time participants wait for rewards; executive function is measured by the performance in a memory task and an adapted version of the Stroop task to assess one's ability to inhibit from the more "shouting" but wrong response and one's ability to switch between different tasks i.e. cognitive flexibility; our measure of self-control is based on well-known standardised surveys and considers different personality traits namely impulsiveness, conscientiousness, grit and reward responsiveness. Our outcome measures are constructed using self-reports, as well as direct observation under trusting relationships with trained validators.

Using a panel dataset of almost 1,000 Liberian males over the course of one year, affected by both violence and poverty, we find that time preferences work best at predicting both antisocial behavior and economic performance, after controlling for a battery of socio-demographics and other characteristics. While self-control is similarly a sound predictor of antisocial behavior, it is not a robust predict of economic performance. Moreover, executive

function does not predict any of the outcomes. Finally, when competing head-to-head in the same regressions, complementarity between the three measures of automatic thinking is low with time preferences explaining most of the variance in outcomes.

To the best of our knowledge, there is no study simultaneously relating the three most common measures of automatic thinking at the individual-level while also studying their predictive power relative to both antisocial behavior and economic performance. Additionally, each of the key variables, both predictors and predicted, is a rich and diverse index (as advocated by Chabris et al., 2008; and Kling, Liebman and Katz, 2007) that focuses on consistent patterns found in year-averages. Our results confirm that intertemporal-choice measures predict more life outcomes than survey-based measures in line with Burks et al. (2012). Executive function is an exception, not predicting any of the considered field behaviors. Additionally, the literature tends to consider samples from developed countries, either students, professionals or psychologically impaired participants. Most of these studies find that automatic thinking predicts more antisocial behavior and worse economic performance. We extend this finding to a developing-country context in which low-income, violence and fragile institutions persist.

2 Background

Executive function, a set of cognitive abilities primarily measured via simple tasks or games, is generally disaggregated in inhibition, working memory or "updating" and cognitive flexibility or "shifting" (Miyake et al., 2000). Inhibition is the capacity to stop oneself from responding motorically in the service of goal execution (e.g., stopping oneself mid-action from touching a hot stove or fragile object once one has been warned). Working memory is the capacity to hold and manipulate information in mind when it is no longer observable in the environment (e.g., mental math). Cognitive flexibility is the capacity to switch behaviour rapidly in the service of different goals (e.g., "dual tasking"). Each of these cognitive functions interact in a synergetic way and are often measured together (see Miyake and Friedman, 2012, for their framework on overlapping yet different executive functions). Executive function is conceptualized as being integral to self-control (Duckworth and Steinberg, 2015; Beaver, Wright and DeLisi, 2007), delay gratification (Eigsti et al., 2006), conscientiousness (Fleming and Heintzelman, 2016), and even fluid intelligence (Roca et al., 2010; Heitz et al., 2006; Garlick and Sejnowski, 2006).

Time preferences concern how much a valued good is worth at an earlier date relative to receiving and enjoying it at a later date. Thus, a price is set on future satisfaction, measuring the extent to which an individual is able to sacrifice a smaller amount earlier on for a bigger amount later on. We consider survey-like measures as well as game-based measures, both hypothetical and incentivized. For illustrative purposes, time preferences in its survey-like form would be elicited with simple questions like how patient the person considers themself to be in a scale of 1 to 5 in which 1 would be "you almost want to have things now" and 5 would be "you are almost always willing to wait". In its game-like form, participants were asked questions like whether they preferred 50 Liberian Dollars (or LD, where 1 USD = 60 LD at the time) now or 150 LD in two weeks and in its incentivized form participants were subject to a lottery that made those decisions have real financial implications.

The self-control index employed in our study is composed of four well-validated survey measures related to personality traits including easy-to-understand items from the Barrett Impulsiveness Scale (Spinella, 2007). An example of a question is whether participants consider themselves to be good at drawing plans and sticking to them.

There are hints on a natural interaction between the constructs related to automatic thinking. Steinberg et al. (2009) characterize the standard view of adolescents as "shortsighted, oriented to the immediate rather than the future, unwilling or unable to plan ahead, and less capable than adults at envisioning the longer term consequences of their decisions and actions". They measure "future orientation" with observed intertemporal financial choices, labelled as "delay discounting", together with a survey measure. The same authors refer to the work by Cauffman, Steinberg and Piquero (2005) in which "myopia" is shown to be due to limitations in working memory among other aspects. Moreover, Eigsti et al. (2006)

associate performance in a delay-of-gratification task to terms such as self-control, inhibition and cognitive control relative to salient information, which are considered determinants of the activation of fronto-striatal regions in the brain. Zhou, Chen and Main (2011) argue the need for an integrated model of self-regulation that encompasses both "effortful control" and "executive function" due to their similarities and compatible definitions and measurements.

A positive association between observed behavioural inhibition, a form of executive function, and questionnaire-measured self-control has been observed for children with psychopathology (e.g. Barkley, 1997). However, this does not seem to apply for other samples of the population with statistically weak associations found in Duckworth and Kern (2011) that run a meta-analysis across 236 studies with both non-clinical and psychologically impaired participants, and a null association found in Saunders et al. (2018) based on 5 datasets of Canadian undergraduates.

Duckworth and Kern (2011), psychologists, run a meta-analysis and find moderate convergence between executive function, delay of gratification and survey-based self-control suggesting a coherent but multidimensional overarching construct - the authors label them as different ways of operationalizing the same construct of "self-control". By contrast, Burks et al. (2012), economists, give the alternative label "time preferences" to the four measures they consider for prediction of different outcomes (smoking, credit score, body mass index, and on-the-job success). The measures were either surveys on impatience or were based on the observation of monetary intertemporal choices as evidence of discounting (β) and present bias (δ), the standard time preferences framework. For the latter, the delay of gratification task was an adaptation of Mischel et al. (1989) in which choosing not to wait until the end of the experiment implied a monetary cost. We consider the three measures - time preferences, self-control and executive function - as different angles or proxies of "automatic thinking".

Antisocial behaviour refers to actions that are disruptive or harmful towards others, violating societal or cultural norms, which can be explicitly delinquent or not (Gaik et al., 2010). We measure the degree of antisocial behavior by considering a large array of behaviours, excluding forms of self-harm such as drug abuse. Questions included whether in the past few weeks one had mugged someone, started a fight with a neighbour or hit their wife.

Lack of self-control is considered to be a significant source of antisocial behavior (Gottfredson and Hirschi, 1990; Hirschi, 2004; Vazsonyi and Huang, 2010). Likewise, executive function has been negatively associated to antisocial behaviour (e.g. Morgan and Lilienfeld, 2000), with even lower levels for violent offenders as opposed to non-violent offenders (Burgess, 2020). The ability to postpone immediate gratification and focus on higher-value goals, even in children as young as 4-year-olds, is documented to be essential for social competence later in life (Mischel, Shoda and Rodriguez, 1989). At school, more impatient adolescents are more likely to be called on misconduct (Sutter et al., 2013). Family, peers and romantic partners are important determinants of one's engagement in crime and each may assume both positive

and negative influences (Simons, Simons and Wallace, 2004; Mowen and Boman, 2020; Cullen and Wilcox, 2015; Costello and Hope, 2016). While adolescence is the life cycle in which people are more prone to be influenced by their social network regarding engagement or not in crime (Boman, 2019), influence and support is essential throughout adulthood.

Criminal offences, a form of antisocial behaviour, are generally believed to be deterred by the possibility of punishment, namely imprisonment. According to the theoretical argument of Becker (1968), those who value the future avoid offences in the present and the incentive is larger the harsher the punishment. However, few empirical evidence supports the link between crime and length of sanctions (Lee and McCrary, 2017). Quasi-experimental evidence by Mastrobuoni and Rivers (2016) suggests that, among offenders, the first few years back in prison deter recidivism (or reoffending) but lengthier sentences do not add much efficacy. They find that offenders largely discount future events which, together with former studies using observational and non-experimental data, confirm that offenders are more likely to neglect the potential consequences of crime. Alternatively, when costs of crime are made as salient and "in the present" as benefits through less job opportunities and more police, crime is reduced (see recent empirical review by Chalfin and McCrary, 2017).

Growing evidence supports that time preferences play a significant role in reducing crime (see van Winden and Ash, 2012, for an integration of cognitive and emotional factors in the rational-choice model of crime). Åkerlund et al. (2016) find that high discount rates predict more crime and worse so for property crime relative to violent crime, and for men with lower intelligence. Additionally, Basiglio, Foresta and Turati (2021) find that a battery of behaviors supposedly related to impatience, some more convincingly than others (e.g. savings-to-income rate, smoking and drinking intensity, obesity, number of sexual partners in the past year, being married or not), predict violent crime among men more than property crime, while both are similarly likely among impatient women.

Interestingly, in contrast with executive function and self-control, we did not find any work regarding the association between time preferences and antisocial behavior that incorporates more dimensions beyond crime and focuses on adults. Among children and adolescents, observed impatience, measured by higher discount rates, predicted bad behaviour at school in Castillo et al. (2011) and Sutter et al. (2013); by contrast, discounting was found not to be significantly different between juvenile offenders and a control group of high school students in Wilson and Daly (2006).

In this paper, economic performance includes a vast array of domains and is measured by the quality of the material resources owned or used by individuals. These include individual earnings, whether men have been living on the streets or have a home with the essential assets, whether they saved and spent their money frugally in the last few months (or, by contrast, engaged in impulsivity-related expenses including drugs, alcohol, gambling and prostitution) or got robbed instead, among other aspects. Note that the sample comes from a developing

country with fragile institutions in which there is general distrust on the police and judicial system to guarantee property rights (Gompert et al., 2007).

There are many examples in the literature of automatic thinking predicting economic outcomes. Measured by intertemporal choices, those that are more willing to delay or consider a larger time span for their money allocation have higher creditworthiness scores (Sprenger and Meier, 2012; Lynch et al., 2010; Rustichini et al., 2016; Burks et al., 2012) and less credit card debt (Meier and Sprenger, 2010; Bradford et al., 2017). Measured by the Barratt Impulsiveness Scale, more impulsive people are more likely to borrow money without collateral (Ottaviani and Vandone, 2011). Measured by intertemporal choices, being more patient predicts not leaving one's job or training in Burks et al. (2009, 2012) but not in Rustichini et al. (2016). Still measured by intertemporal choices, less patience predicts less savings and more expenditure in alcohol and cigarettes in Sutter et al. (2013).

The direct link between poor executive function and poor economic performance is yet a theoretical argument to promote intervention at a very early age since executive function-related plasticity is limited in adulthood (Holden et al., 2009; Whitebread and Bingham, 2013; Drever et al., 2015). It is claimed to be essential not only for academic achievement in children but also for a broader scope of outcomes in adulthood. While at the root of self-regulation, self-control and gratification delay, there is no empirical evidence supporting the link between executive function and economic performance directly. Isquith-Dicker (2021), out of 597 examined studies, find that only two high-quality studies concern the relationship between child development assessment tools and wealth, and none consider executive function as the potential predictor (considered predictors are instead IQ in Fergusson et al., 2005; and survey-based self-control in Moffitt et al., 2011). The closest existing evidence seems to be for specific patient populations in which executive function impairment predicts unemployment (Altshuler et al., 2007; Tomaszewski et al., 2018).

3 Methods

3.1 Data

We analysed the relationship between different variables theoretically related to automatic decision-making, delaying immediate gratification or holding future goals in mind, namely time preferences, executive function and self-control, and outcomes antisocial behaviour and economic performance based on a sample of 999 high-risk men. The data was originally collected as part of a randomized control trial (RCT) that aimed at studying the impacts of Behavioural Cognitive Therapy alone or together with cash on those same outcomes (Blattman, Jamison and Sheridan, 2017). Attrition is lower than 10% due to a significant effort to track down and reach every person across 5 different moments in time, namely at "baseline" before the intervention, 2 and 5 weeks after, and 12 and 13 months after. Along with surveys, individuals participated in games and different tasks, both hypothetical and incentivized.

Men in the sample are mainly young adults aged between 18 to 35 and come from 5 neighbourhoods known for crime in Monrovia, Liberia's capital, exposed to crime and violence to some degree. Recruiters of participants were asked to identify "homeless, drug-using, disreputable in appearance, or present in locations known for crime, armed recruitment, and violence" (p. 1170). Summary statistics at baseline reveal that about a half had committed theft in the past two weeks and a quarter were living on the streets. Moreover, on a daily base, almost half used marijuana and 15%, hard drugs. Education levels were low with an average of nearly 8 years, as were returns to work with earnings around $68 in the past month for 46 hours per week, mostly in low-skill or illicit work, half of it informally saved. Almost 40% were a former member of an armed group. The average man suffered from distress claiming to "sometimes" lose appetite over worrying, feel that he is not important to anybody and lose his temper. Table 1 describes the sample prior to the RCT intervention.

Both predictors and outcomes are constructed as summary indexes of conceptually similar measures to reduce the number of hypothesis tests. As seen in Kling, Liebman and Katz (2007), averages of outcome measures are combined to point in the same direction. Components of summary indices are indices themselves such that similar weight is given to those components – a different approach would be to have the weight of each component in the summary index depend on the number of survey questions in each component, but we remain agnostic about the relative importance of these components. Finally, we consider the standardised averages of the indices across four moments in time in order to capture values at the core or consistent patterns in both the key predictors and outcomes. This is expected to mitigate any noise, reversion to the mean and endogeneity in the relationship between potential predictor and outcome (see section 3.7 for more details). Information on sociodemographic, health and other characteristics are also present in the data as well as assortment to therapy.

Table 1: Summary statistics (N=999)

Sample characteristics at "baseline"	Mean
Age	25.40 (4.85)
Married or partnered	16%
Number of children < under 15	2.23 (3.17)
Years of schooling	7.72 (3.30)
Has any disabilities	8%
Ex-combatant	38%
Weekly cash earnings (US$)	17.16 (20.96)
Currently sleeping on street	24%
Owns no pair of shoes	30%
Savings stock (US$)	34.09 (67.78)
Hours/week in illicit activities	13.48 (27.17)
Hours/week in agriculture	0.35 (3.642)
Hours/week in low-skill wage labor	19.56 (28.96)
Hours/week in low-skill business	11.72 (24.05)
Hours/week in high-skill work	1.53 (7.70)
Sells drugs	20%
Uses marijuana daily	43%
Uses hard drugs daily	15%
Committed theft in the past 2 weeks	53%

Notes: Standard deviations in parentheses.

3.2 Time Preferences

To measure time preferences, namely patience and time inconsistency, subjects performed four tasks. Measures from each task are standardized and have the same weight in the final index of either patience or time inconsistency. Finally, patience and time inconsistency measures are computed with the same weight into a general index of time preferences that is then also standardized. Below each of the four tasks and respective measures are explained.

The first task is a set of questions in which participants self-reported how much time they wait in general and in specific situations. Answers to three questions in that task result in a patience measure (self-reporting how patient they are and whether they save money for future problems), and other three result in a time inconsistency measure (whether money is spent quickly when receiving it, whether it is spent a lot in celebrating with friends and whether the participant avoids being around friends who waste money as a commitment device) with the full list of questions displayed in Table 6 in the appendix. Before aggregating answers, values were rescaled such that higher values mean either more patience or less present bias.

In the second task subjects were asked to make hypothetical choices between receiving smaller amounts of money earlier on or bigger amounts later on. Each subject answered 4 questions and the stakes in the second and fourth question depended on the answer to the first and third questions respectively, enabling a distribution of patience scores in a 0-3 scale for each pair of time frames. Specifically, subjects chose between 50 LD now and 150 LD in two weeks; if they chose 50 LD now (impatient), they were asked to choose between 50 LD now and 300 LD in two weeks (choosing not to wait implied even more impatience); if they chose 150 LD in two weeks, they were asked to choose between 50 LD now and 100 LD in 2 weeks (choosing to wait implied even more patience). Then the reference points in time changed: subjects now chose between 50 LD in two weeks or 150 LD in four weeks; with the same pairs of stakes as in the second question, the choice would now be between 50 LD in two weeks or either 100 LD or 300 LD in four weeks. The sum of patience scores in each pair of intertemporal choices placed subjects in 7 increasingly patient bins. If choices in the now vs 2 weeks frame were equivalent to those made in the 2 weeks vs 4 weeks frame, time inconsistency was considered null (e.g. preferring 50 LD now to 300 LD in 2 weeks and preferring 50 LD in 2 weeks to 300 LD in 4 weeks). Differences of scores between the two time frames placed subjects in 7 increasingly time inconsistent bins. Stakes were pretested to maximize the variance in responses for an average payout of $3 which corresponds roughly to a day's wages.

The third task is the same as the second task but the game-like choices were incentivized or "real"- there was a lottery in which some subjects were randomly selected to be paid for their choices. A patience and time inconsistency measures were constructed in the same way as in the second task.

The fourth task follows the logic of Holt and Laury (2002) with hypothetical intertemporal choices and larger stakes than in previous tasks. Faced with a list of 11 binary choices between receiving a fixed amount of 1000 LD now vs an increasing amount in two weeks (started in 900 LD and went up to 4000 LD), the switching point (or the first time subjects switched from an earlier pay to a later pay) determined the "present" discount rate that could vary between 0.9 and 4. The subject would face a second list with the same stakes in which the time frame was between receiving the fixed amount in two weeks vs an increasing amount in four weeks that would determine the "future" discount rate. The measure of patience was calculated by averaging the inverse of the "present" and "future" discount rates. Moreover, the measure of time inconsistency was calculated by the difference between the two discount rates.

3.3 Executive Function

The measure of executive function refers to performance in two tasks. The final index is the standardized average of 5 standardized components. Components are 1 measure from the first task (digit recall) and 4 measures from the second task (arrows). Each measure has the same weight in the final index.

The first task required subjects to recall a sequence of digits and repeat it after the enumerator had said it out loud with the goal of evaluating subjects' working memory. The "digit span task" started by two 2-digit sequences and would continue to two 3-digit sequences if the subject had got at least one of them right; and this would go on with an increasing number of digits until a 9-digit span was reached. Once subjects failed, the enumerator would do the same exercise but instead of "forward-digits", subjects were expected to repeat the sequence in the reverse order (i.e. backwards-digits). Between surveys close together in time, care was taken so that subjects were presented with different sequences. The measure of performance included in the final index of executive function was the span or number of digits achieved by subjects in the backward-digits activity such that a higher value means higher ability. Note that performance in this activity was strongly and positively correlated to performance in the forward-digits one (Pearson's correlation of almost 40%, $p < 0.001$).

The second task was created by Blattman, Jamison and Sheridan (2017) as a modified version of the directional Stroop task to evaluate inhibition and cognitive flexibility. Presented with a sequence of large black and white arrows that either pointed up or down, subjects were asked to firstly state the observed direction (baseline version); then the opposite direction requiring the inhibition of the more common response; and finally the observed direction if the arrow was white and the opposite if it were black requiring switching between two different goals. Measures included in the final index of executive function refer only to the second and third versions, namely inhibition and flexibility, and are the total time to completion and the

number of correct responses out of 32 arrows in each of those versions. Measures are rescaled such that higher values mean higher ability.

3.4 Self-control

In the index of self-control various personality attributes were included, all of them measured in the Psychology tradition of self-reported behaviour. Answers were placed in psychological scales to evaluate impulsiveness (8-question version of the Barrett Impulsiveness Scale by Spinella, 2007), conscientiousness (8-question version of the NEO-five factor personality inventory by Costa and McCrae, 1997), GRIT (7-question GRIT by Duckworth and Quinn, 2009) and reward responsiveness (8-question Behavioral Inhibition / Behavioral Activation Scale).

Some of the questions are whether they take action before thinking like buying things, whether they don't delay getting work done, whether they are successful at drawing plans and sticking to them, whether they persevere in difficult conditions and whether they enjoy when good things happen. There was care to select more or less the same number of questions for each self-control category and that questions were easy to understand once translated to Liberian English, pre-tested on a different sample of young men from the same population. Moreover, tests on the resulting data were done to ensure that questions in different categories were relevant for the whole set such that impulsivity questions were correlated with each other while negatively correlated with conscientiousness questions and so on. For more detail, see Table 7 in appendix.

3.5 Antisocial behaviour

Antisocial behaviour is an index of seven categorised behaviours based on survey questions, namely whether one usually sells drugs; whether one took part of robberies in the past 2 weeks considering 8 kinds of crimes; whether one got involved in verbal or physical fights in the past 2 weeks, how bad and with whom; whether one carries a weapon around on their body for protection, typically a knife; whether one was arrested in the past 2 weeks staying at the police station or in jail ; whether one has an aggressive and hostile behaviour in general; whether one undertakes intimate partner abuse. The set of survey questions, listed in the appendix in table 8, were the result of intense field work and pre-testing so that they would make sense in the context of the specific population of Liberia. Care was also taken regarding the used language, adapted to pidgin English with local street slang. Each of the questions in a category is standardized, then their mean is calculated and that mean is again standardized resulting in it having unit standard deviation. The mean of the seven standardized categories is calculated and that value is again standardized to get to the antisocial behaviour index.

3.6 Economic performance

Economic performance is an index of eight categories, namely (legal and illegal) earnings in the past two weeks, consumption in the past two weeks, an index of durable assets for consumption, savings, investment as value of either business expenditure or stocks, hours working in the past month and homelessness. Measures are standardized, then their mean is calculated and that mean is again standardized to form the economic performance index (standard deviation equals to one).

Consumption in the past two weeks is an index composed of almost 30 kinds of food (meat, eggs, biscuits, candy, etc.), 12 kinds of non-food items (expenses with their phone, transportation, clothes, gambling, prostitution, cigarettes, etc.), health-related expenses and costs with durable items (bicycle, mattress, furniture, electronics, etc.). The index of durable assets includes how good the conditions are at home namely sanitary conditions and state of the roof, but also objects like bicycles, clothes, tables or mattresses, whether the person owns their own home, and whether they have enough resources to not feel hungry.

Individuals were asked how much money in savings they had in total, kept in different places. Regarding investment, business stock in USD at the beginning of the 1-year period was considered in the form of raw materials, inventory, equipment and structure. The sum was then capped at the 99^{th} percentil. New acquisitions for business or business investment following the first month within the 1-year period under consideration took into account the same categories as business stock. Questions about homelessness considered whether and how often in the past 2 weeks individuals slept outside because they had no other place to stay.

Average earnings at baseline are \$68 in the past month and half of the sample received a grant of \$200 as part of the intervention. The grant could explain the observed increase in consumption and assets after a month of receiving it while the increase in temporary earnings could reflect the investment of more than a half of the grant in petty business. Unfortunately, short-term investments in business assets were fleeting due to high theft levels of their homes and belongings (a robbery happened every other month). Recipients were asked about how they spent the grant and self-reports suggest expenditures on drugs, alcohol, gambling and prostitution were only a small fraction albeit the potential under-reporting of such behaviours.

3.7 Empirical strategy and estimation

Firstly, Pearson correlations between time preferences, executive function and self-control are measured. They should be significantly low to be empirically classified as independent concepts, namely between 10% and 30%. We also evaluate correlations with outcomes.

Secondly, we evaluate the association between the automaticity-related measures and the considered life outcomes, antisocial behavior and economic performance, with OLS regressions, controlling for other characteristics such as age, education, mental health and risk attitudes,

among others. Additionally, we assess any complementarity between the three measures in explaining heterogeneity in the population regarding outcomes by comparing the levels of adjusted R^2 in linear regressions. If the levels significantly increase from separate to joint, i.e. increasing predictive power, this suggests that the measures capture different things that impact outcomes.

Control variables were measured 2 weeks prior to the first moment in which key predictors and outcomes are evaluated, thus can only influence outcomes (and key predictors) and not the other way around. Note that measures at this earlier point in time for key predictors and outcomes exist only partially in the data. We considered it to be risky to include these observation points in the composite indices since the inclusion of the missing components would potentially point in a different direction, distorting conclusions.[1] Moreover, we have a set of less common but potentially relevant control variables, given the marginalised and low-income sample, that are shown separately from the socio-demographic variables (full detail on their construction is found in appendix A.3). These include mental health, self-esteem and locus of control, substance abuse, reputable or neat appearance, being exposed to cognitive behavioral therapy, the quality of their social networks and risk-loving (its inclusion is advocated by Andersen et al., 2008, in which estimated discount rates are shown to be smaller when risk attitudes are taken into account).[2]

The construct of automatic thinking measures and life outcomes consider the average of the respective index across four moments in time throughout a year spaced out two weeks, eleven months and one month. Since there is some literature arguing that the relationship is not strictly unilateral from automatic thinking to outcomes (e.g. Voors et al., 2012; Lahav et al., 2011) while our liberian sample is exposed to violence and social conflict to some degree, we attempt to extract the "net" relationship between the two by comparing averages across time. Robustness checks to model specification were performed, namely we compared the model in which observations for key predictors and outcomes are averaged across time per individual to one in which all observations in every moment in time are considered on their own while clustering them per subject. The latter not only performed worse in terms of meeting the OLS assumptions but also the consequent results were less stable or robust to the inclusion of control variables. Additionally, the antisocial behavior index is divided into explicitly violent and non-violent categories and the relationship with automatic thinking is reevaluated.

[1] The dataset is originally organized as baseline – before the CBT intervention -, short-term and long-term. Since there is significant missing data for "baseline" for the main outcome variables, we do not average the latter across the 3 points in time but only the latter two. Moreover, the variables at "baseline" that are mainly missing (domestic abuse and carrying weapon has 90% and 50% missing values respectively at baseline) add information to the respective index since they move in different directions according to table D.1 of the paper that originated the data ("Program impacts on antisocial behaviors, 12-13 month survey only").

[2] Also see Harrison and Rutström, 2009, for a theoretical framework that reconciles findings from experimental and non-experimental data.

4 Results

We start by assessing the Pearson correlation between the different measures that theoretically tap into automatic thinking (hereafter, all correlation coefficients report to Pearson's correlation coefficients with $p < 0.001$ unless otherwise noted). Between time preferences and executive function, the correlation is less than 10%. There is high correlation between time preferences and self-control with a coefficient of 41%, and moderate between executive function and self-control with a coefficient of 25%.

The correlation between any of the measures and antisocial behavior is positive such that more patience or effortful thinking is linked with less antisocial behavior, with correlation coefficients varying from less than -10% for executive function to -40% and -46% for time preferences and self-control, respectively. For economic performance, all correlations are positive such that more patience or effortful thinking is linked to better economic performance. However, these correlations are much smaller in absolute terms than for antisocial behavior varying between 5% for executive function ($p = 0.005$) and 11% and 15% for self-control and time preferences respectively.

We estimated a series of models of the form:

$$y_i = \beta_0 + \beta_1 automatic + X\gamma + \varepsilon_i \tag{1}$$

where y_i is either antisocial behaviour or economic performance; *automatic* stands for either time preferences, executive function or self-control; and X is a vector of continuous indices that take the role of control variables that are measured prior to the other key dependent and independent variables.

Table 2 shows that time preferences are a robust predictor of both life outcomes. More patient individuals have less antisocial behaviour and better economic performance ($p - value < 0.01$). Moreover, the effect is stronger regarding antisocial behaviour than economic performance, indicated by the magnitude of time preferences' coefficients and adjusted R-squared across the different specifications.

By contrast with time preferences, table 3 shows that executive function is not a statistically significant predictor of any of the considered life outcomes. While on its own the correlation between executive function and antisocial behaviour is negative ($r = -10\%$), the link is not significant when controlling for other factors.

Table 4 shows that the survey-based measure of self-control is a robust predictor of antisocial behavior. The same cannot be said about economic performance since the coefficient of self-control is not always statistically significant across the different specifications considering more or less control variables.

Table 2: Effect of Time Preferences

DV	Antisocial Behaviour				Economic Performance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time Preferences	-0.375***	-0.332***	-0.292***	-0.292***	0.127***	0.117***	0.134***	0.134***
	(0.031)	(0.030)	(0.030)	(0.030)	(0.032)	(0.033)	(0.034)	(0.034)
Mental Health		0.052*	0.013	0.009		0.039	0.022	0.029
		(0.031)	(0.031)	(0.031)		(0.032)	(0.033)	(0.033)
Self-esteem and		-0.073**	-0.048	-0.046		0.013	0.021	0.018
Locus of Control		(0.031)	(0.030)	(0.030)		(0.034)	(0.035)	(0.035)
Reputable or Neat		-0.130***	-0.069**	-0.067**		0.074**	0.094***	0.090**
Appearance		(0.032)	(0.031)	(0.031)		(0.034)	(0.035)	(0.035)
Exposed to		-0.133**	-0.158***	-0.156***		0.014	0.004	0.002
Therapy		(0.058)	(0.056)	(0.056)		(0.060)	(0.060)	(0.060)
Risk-loving			0.030	0.029			0.035	0.037
			(0.029)	(0.029)			(0.038)	(0.038)
Substance Abuse			0.250***	0.246***			0.078**	0.086**
			(0.031)	(0.031)			(0.034)	(0.035)
Quality of				-0.041				0.075**
Social Networks				(0.030)				(0.033)
Constant	0.605***	0.724***	0.757***	0.730***	-0.862***	-0.881***	-0.886***	-0.838***
	(0.185)	(0.188)	(0.180)	(0.183)	(0.209)	(0.216)	(0.218)	(0.219)
N	987	987	987	987	999	999	999	999
R-squared	0.210	0.238	0.290	0.291	0.086	0.091	0.098	0.103
Adjusted R-squared	0.198	0.223	0.274	0.275	0.072	0.074	0.078	0.082

OLS; Time preferences and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year. All control variables are measured 2 weeks earlier. All the variables listed in the table are standardised except the dummy variable "Exposed to therapy". The latter refers to cognitive behavioural therapy and is designed to foster self-regulation and a non-criminal identity. Control variables omitted from the table, included in all specifications, are age, household composition, education, physical health, religion and neighborhood. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

When compared with the remaining automatic thinking variables, time preferences is the only one that remains a robust predictor of both life outcomes. Self-control has a slightly larger coefficient (in absolute value) than time preferences regarding antisocial behaviour; while it is insignificant regarding economic performance. Executive function remains statistically insignificant for both outcomes and does not affect the predictive ability of time preferences and self-control. By contrast with antisocial behavior, it is not clear whether the three variables complement each other in predicting economic performance since the adjusted R-squared remains the same (or decreases slightly) from specifications in which only time preferences are represented among the three (Tables 2) to specifications in which all three are placed vis-à-vis (Table 5).

We now look at the statistical significance of selected covariates, measured at an earlier instance relative to the main predictors and outcomes. Being more risk averse, engaging less in substance abuse, and being exposed to Cognitive Behavioral Therapy are associated to less antisocial behavior, but its association with better economic performance is not stable across specifications (see Tables 5 and 3).

Table 3: Effect of Executive Function

DV	Antisocial Behaviour				Economic Performance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Executive Function	-0.050	-0.035	-0.058*	-0.059*	-0.000	-0.010	-0.015	-0.013
	(0.035)	(0.034)	(0.032)	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Mental Health		0.077**	0.022	0.017		0.032	0.021	0.028
		(0.034)	(0.033)	(0.034)		(0.032)	(0.033)	(0.033)
Self-esteem and		-0.103***	-0.067**	-0.065**		0.025	0.033	0.029
Locus of Control		(0.033)	(0.031)	(0.031)		(0.034)	(0.034)	(0.034)
Reputable or Neat		-0.192***	-0.107***	-0.104***		0.097***	0.115***	0.111***
Appearance		(0.035)	(0.033)	(0.033)		(0.034)	(0.035)	(0.035)
Exposed to		-0.205***	-0.226***	-0.224***		0.038	0.033	0.031
Therapy		(0.060)	(0.058)	(0.058)		(0.061)	(0.061)	(0.061)
Risk-loving			0.075**	0.074**			0.014	0.016
			(0.031)	(0.031)			(0.037)	(0.037)
Substance Abuse			0.292***	0.288***			0.063*	0.071**
			(0.032)	(0.033)			(0.035)	(0.035)
Quality of				-0.042				0.075**
Social Networks				(0.031)				(0.033)
Constant	0.750***	0.909***	0.883***	0.855***	-0.921***	-0.956***	-0.960***	-0.911***
	(0.202)	(0.201)	(0.190)	(0.193)	(0.210)	(0.215)	(0.218)	(0.220)
N	987	987	987	987	999	999	999	999
R-squared	0.074	0.137	0.217	0.219	0.070	0.079	0.082	0.087
Adjusted R-squared	0.060	0.120	0.200	0.201	0.056	0.061	0.063	0.067

OLS; Executive Function and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year. All control variables are measured 2 weeks earlier. All the variables listed in the table are standardised except the dummy variable "Exposed to therapy". The latter refers to cognitive behavioural therapy and is designed to foster self-regulation and a non-criminal identity. Control variables omitted from the table, included in all specifications, are age, household composition, education, physical health, religion and neighborhood. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Keeping a reputable appearance aligned with social norms regarding dressing and personal hygiene (at the subjective judgement of the survey enumerators) is associated to better economic performance while the link with antisocial behavior is not statistically significant across all specifications (Table 4).

Mental health, self-esteem and locus of control are not statistically significant across the different specifications for any of the outcomes when faced with other covariates (see Tables 2 and 3). Moreover, while we find evidence in support of a small role of social networks' quality in one's life outcomes when the former is considered in isolation (correlations of $r = 12\%$ and $r = -14\%$ with economic performance and antisocial behavior, respectively), the link regarding antisocial behavior is statistically insignificant once compared with other covariates, namely time preferences.

While some literature looks at antisocial behavior as a whole, other work focuses on specifically violent forms it may take. We explore whether it would make a difference to our results. Table 9 in the appendix shows that when decomposing the antisocial behavior index in explicitly violent behaviors (specifications (1) to (4)) from other antisocial behaviors

Table 4: Effect of Self-control

DV	Antisocial Behaviour				Economic Performance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Self-control	-0.427***	-0.383***	-0.344***	-0.345***	0.065**	0.048	0.060*	0.061*
	(0.030)	(0.030)	(0.030)	(0.030)	(0.032)	(0.034)	(0.034)	(0.034)
Mental Health		0.060*	0.014	0.008		0.033	0.019	0.027
		(0.031)	(0.031)	(0.032)		(0.033)	(0.033)	(0.034)
Self-esteem and		-0.037	-0.014	-0.012		0.015	0.021	0.018
Locus of Control		(0.029)	(0.028)	(0.028)		(0.035)	(0.036)	(0.036)
Reputable or Neat		-0.124***	-0.060*	-0.057*		0.084**	0.102***	0.097***
Appearance		(0.032)	(0.031)	(0.031)		(0.035)	(0.036)	(0.036)
Exposed to		-0.121**	-0.146***	-0.144***		0.030	0.022	0.019
Therapy		(0.055)	(0.053)	(0.053)		(0.062)	(0.062)	(0.062)
Risk-loving			0.063**	0.062**			0.021	0.024
			(0.030)	(0.030)			(0.038)	(0.038)
Substance Abuse			0.248***	0.243***			0.070**	0.079**
			(0.030)	(0.030)			(0.035)	(0.035)
Quality of				-0.049*				0.080**
Social Networks				(0.028)				(0.033)
Constant	0.394**	0.530***	0.549***	0.517***	-0.863***	-0.900***	-0.897***	-0.844***
	(0.178)	(0.180)	(0.171)	(0.174)	(0.212)	(0.220)	(0.222)	(0.224)
N	976	976	976	976	976	976	976	976
R-squared	0.243	0.265	0.324	0.326	0.073	0.079	0.084	0.090
Adjusted R-squared	0.231	0.250	0.309	0.310	0.058	0.061	0.064	0.069

OLS; Self-control and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year. All control variables are measured 2 weeks earlier. All the variables listed in the table are standardised except the dummy variable "Exposed to therapy". The latter refers to cognitive behavioural therapy and is designed to foster self-regulation and a non-criminal identity. Control variables omitted from the table, included in all specifications, are age, household composition, education, physical health, religion and neighborhood. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

(specifications (5) to (6)), the main results do not change. The coefficient of time preferences, the variable that predicts a larger array of outcomes, has the same direction, magnitude and statistical significance in both cases. Executive function is statistically insignificant in all considered specifications while having more self-control is associated to less antisocial behavior. If anything, we observe that the magnitude of the coefficient of self-control is larger in the case of explicitly violent behaviors, as is the adjusted R-squared. Regarding covariates' effects, there are no significant differences between the two groups of anti-social behaviors.

Table 5: Relative predictive effects of Time Preferences, Executive Function and Self-control

DV	Antisocial Behaviour				Economic Performance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time Preferences	-0.255***	-0.236***	-0.206***	-0.206***	0.124***	0.117***	0.133***	0.133***
	(0.031)	(0.031)	(0.030)	(0.030)	(0.035)	(0.036)	(0.037)	(0.036)
Executive Function	0.019	0.020	-0.002	-0.004	-0.008	-0.013	-0.021	-0.020
	(0.030)	(0.031)	(0.029)	(0.029)	(0.031)	(0.032)	(0.032)	(0.032)
Self-control	-0.322***	-0.296***	-0.270***	-0.271***	0.014	0.006	0.016	0.017
	(0.030)	(0.030)	(0.030)	(0.030)	(0.036)	(0.037)	(0.037)	(0.037)
Mental Health		0.047	0.011	0.006		0.039	0.022	0.030
		(0.029)	(0.030)	(0.030)		(0.033)	(0.033)	(0.033)
Self-esteem and Locus of Control		-0.030	-0.010	-0.008		0.011	0.019	0.016
		(0.028)	(0.027)	(0.027)		(0.036)	(0.036)	(0.036)
Reputable or Neat Appearance		-0.096***	-0.040	-0.037		0.070**	0.091**	0.086**
		(0.031)	(0.030)	(0.030)		(0.035)	(0.036)	(0.036)
Exposed to Therapy		-0.087	-0.115**	-0.112**		0.012	-0.000	-0.004
		(0.054)	(0.053)	(0.053)		(0.061)	(0.061)	(0.061)
Risk-loving			0.034	0.032			0.040	0.042
			(0.029)	(0.029)			(0.038)	(0.038)
Substance Abuse			0.231***	0.226***			0.084**	0.092***
			(0.029)	(0.029)			(0.035)	(0.036)
Quality of Social Networks				-0.049*				0.080**
				(0.027)				(0.034)
Constant	0.373**	0.476***	0.512***	0.480***	-0.852***	-0.874***	-0.878***	-0.825***
	(0.174)	(0.176)	(0.169)	(0.170)	(0.211)	(0.219)	(0.221)	(0.223)
N	976	976	976	976	976	976	976	976
R-squared	0.300	0.312	0.358	0.360	0.086	0.091	0.098	0.104
Adjusted R-squared	0.287	0.297	0.342	0.344	0.070	0.071	0.077	0.081

OLS; Time preferences, Executive Function, Self-control and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year. All control variables are measured 2 weeks earlier. All the variables listed in the table are standardised except the dummy variable "Exposed to therapy". The latter refers to cognitive behavioural therapy and is designed to foster self-regulation and a non-criminal identity. Control variables omitted from the table, included in all specifications, are age, household composition, education, physical health, religion and neighborhood (see Table 10 for details). Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5 Conclusion and discussion

Across behavioral social sciences, there is a common understanding that individuals' way of making decisions play an important role in people's lives - it may be more effortful, intentional or, by contrast, automatic, intuitive and impulsive. We consider three angles of the overarching concept either in the form of preferences (time preferences), in the form of cognitive ability (executive function), or as a personality trait (self-control). Measurements also differ from observed behavior in tasks that imply intertemporal trade-offs to elicited behavior and attitudes in surveys.

More patient people, that are better at regulating their emotions and impulses, fare better in many domains in life, enjoying better interpersonal relations, academic and career success, and avoiding problems such as substance abuse, obesity and delinquency (see review by De Ridder et al., 2012; Moffitt et al., 2011; Converse, Piccone and Tocci, 2014).

Among the three proxies of automatic thinking, each an index of related measurements, time preferences is the most promising predictor of the considered outcomes, antisocial behavior and economic performance (1 s.d. increase in patience is associated to a decrease of 0.3 s.d. in antisocial behavior and an increase of 0.1 s.d. in economic performance). Moreover, basic demographics like age and education predict a smaller range of outcomes than time preferences: the relationships are not statistically significant for age; and years of schooling only significantly (and positively) predicts economic performance.

Self-control measured with four standardised surveys is predictive of antisocial behavior similarly to time preferences but is not a reliable predictor of economic performance due to its statistical insignificance in regression analysis. These results are in line with Burks et al. (2012) in which self-control surveys were predictive of a smaller array of life outcomes than game-like inter-temporal choices.

In our sample of almost 1000 men exposed to crime and violence in Liberia in the course of a year, performance in executive function tasks does not explain variations in economic and social outcomes. It is possible that across men in our sample there isn't enough variation in executive function levels. This would be consistent with the literature in which variations in measured executive function are only found relative to psychologically impaired participants (Duckworth and Kern, 2011; Barkley, 1997, Saunders et al., 2018). Another possible justification is the lack of ecological validity of executive function tests as opposed to surveys that evaluate its dimensions (Barkley and Murphy, 2011).

Seeking consistent patterns, our methodology considers main predictors and outcomes as mean values of four moments in time throughout a year. The literature suggests executive function is stable throughout adulthood considering no significant shocks occur (Hebenstreit, DePrince and Chu, 2014; DePrince, Weinzierls and Combs, 2009). Moreover, time preferences parameters are included in economic models as stable characteristics and found to be

relatively stable in data (Ohmura et al., 2006, Meier and Sprenger, 2015) although there is recent empirical evidence that it can be shaped by exposure to violence (Voors et al., 2012; Lahav et al., 2011). By contrast, self-control is perceived as relatively malleable given programs like cognitive behavioral therapy are believed to work by intervening on participants' "automaticity" and impulsive behaviors (Heller et al., 2017). Nevertheless, it remains unclear whether one or more dimensions related to automatic thinking cannot be used for prediction purposes due to lack of stability.

Our antisocial behavior index benefits from covering many different angles, ranging criminal behavior (best evaluated in its diversity according to Hirschi, 2004, and Marcus, 2003), violent behavior and norm-deviant behavior. Evaluating the relationship between antisocial behaviors and measures of automatic thinking is theoretically more robust when antisocial behaviors are aggregated relative to when they are considered individually (Chabris et al., 2008; Kling, Liebman and Katz, 2007). Nevertheless, some literature, namely Burgess (2020), separate in their analysis violent from non-violent forms of social offence. When we split our index in that way, we find that being more patient is linked with less engagement in explicitly violent behavior as much as other antisocial behaviors.

While time preferences and executive function are theoretically related, in our study, the two are very weakly correlated and time preferences are a robust predictor of life outcomes while executive function is not. A possible explanation is that time preferences taps into motivated cognition in which different choices are associated to different rewards, similar to making choices in real-life and managing long-term goals. Even when these rewards are just hypothetical, they trigger imagining the real monetary rewards. Moreover, performance in tasks that evaluate executive function consider a short-term period which may not extend to real-life long-term goals (Beal, 2011). Nevertheless, Eckel, Johnson and Montmarquette (2005) find that intertemporal monetary choices made for short-term frames predict investment decisions made in the long-run even after controlling for a potential present bias. Interestingly, in our study, self-control measured via introspection over one's habits and attitudes has a manifestly larger correlation with both time preferences and executive function than the correlation between the latter two, while also faring in between them in terms of predictive power. While the three constructs may be complementary, the improvement relative to time preferences alone is low and may not pass a cost-benefit test.

Importantly, a wide variety of variables are likely to impact the expression of antisocial behavior including the degree to which norms are enforced legally and the likelihood of violence resulting in some imperative secondary gain. Our sample is of particular interest since it originates from a developing country in which institutions are fragile. Individual differences in automatic thinking may have a more important role than in more socio-economically favorable contexts, not only because punishment or trust in institutions is less likely but also due to larger social influence and pressure, since there is larger dependency on one's personal circles

and their wants. The finding that time preferences are a strong and robust predictor of outcomes in this environment of more restrained economic freedom highlights its importance.

Based on Evans and Rosenbaum (2008) and Sektnan et al. (2010), men in our sample are likely to have been conditioned in their childhood to lower levels of self-regulation and self-control. Accordingly, the low-income environment they were raised in is likely to have compromised the development of socio-emotional processes necessary for adaptation, even in cases in which their parents invested to some extent in their education. Nevertheless, there is evidence supporting that one can work on and improve their self-control skills despite the unfavourable background both during childhood (Tarullo, Obradovic, and Gunnar, 2009; Diamond et al., 2007) and later in adulthood (Muraven, Baumeister and Tice, 1999; Muraven, 2010).

Finally, future research could study whether our results would extend to longer periods than 1-year and consider other samples of developing countries. Additionally, samples could consider extreme participants, such as clinical participants and wealthy individuals living in those same developing countries. Finally, while the literature suggests impatience tends to be worse in men than women (Dittrich and Leipold, 2014), it would be interesting to study how our results apply to women since our sample is limited to men.

References

[1] Ahsan, N. (2007). Social networks make a difference: Family economic success. Annie E. Casey Foundation http://hdl.handle.net/10244/398

[2] Åkerlund, D., Golsteyn, B. H., Grönqvist, H., & Lindahl, L. (2016). Time discounting and criminal behavior. Proceedings of the National Academy of Sciences, 113(22), 6160-6165.

[3] Altshuler, L., Tekell, J., Biswas, K., Kilbourne, A. M., Evans, D., Tang, D., & Bauer, M. S. (2007). Executive function and employment status among veterans with bipolar disorder. Psychiatric Services, 58(11), 1441-1447.

[4] Andersen, S., Harrison, G. W., Lau, M. I., & Rutström, E. E. (2008). Eliciting risk and time preferences. Econometrica, 76(3), 583-618.

[5] Aron, A. R. (2007). The neural basis of inhibition in cognitive control. The Neuroscientist, 13(3), 214-228.

[6] Ashraf, N., Karlan, D., & Yin, W. (2006). Tying Odysseus to the mast: Evidence from a commitment savings product in the Philippines. The Quarterly Journal of Economics, 121(2), 635-672.

[7] Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: constructing a unifying theory of ADHD. Psychological Bulletin, 121(1), 65.

[8] Barkley, R. A., & Murphy, K. R. (2011). The nature of executive function (EF) deficits in daily life activities in adults with ADHD and their relationship to performance on EF tests. Journal of Psychopathology and Behavioral Assessment, 33(2), 137-158.

[9] Barratt, E. S. (1985). Impulsiveness subtraits: Arousal and information processing. In. J.T. Spence C.E. Izard (Eds.), Motivation, emotion and personality, 99, 137-146. North-Holland: Elsevier Science.

[10] Bartus, T. (2001). Social capital and earnings inequalities. The Role of Informal Job Search in Hungary. ICS-dissertation Groningen.

[11] Basiglio, S., Foresta, A., & Turati, G. (2021). Impatience and crime. Evidence from the NLSY97 (No. def111). Università Cattolica del Sacro Cuore, Dipartimenti e Istituti di Scienze Economiche (DISCE). Working Paper.

[12] Beal, S. J. (2011). The development of future orientation: Underpinnings and related constructs. The University of Nebraska-Lincoln.

[13] Beaver, K. M., Wright, J. P., & DeLisi, M. (2007). Self-control as an executive function: Reformulating Gottfredson and Hirschi's parental socialization thesis. Criminal Justice and Behavior, 34(10), 1345-1361.

[14] Becker, G. S. (1968). Crime and punishment: An economic approach. In The economic dimensions of crime (pp. 13-68). Palgrave Macmillan, London.

[15] Blattman, C., Jamison, J. C., & Sheridan, M. (2017). Reducing crime and violence: Experimental evidence from cognitive behavioral therapy in Liberia. American Economic Review, 107(4), 1165-1206.

[16] Blattman, C., Jamison, J. C., & Sheridan, M. (2017). Reducing Crime and Violence: Experimental Evidence from Cognitive Behavioral Therapy in Liberia: Dataset. American Economic Review. https://doi.org/10.1257/aer.20150503.

[17] Boman, J. H. (2019). The Crucial Role of Friendships and Peer Relationships in the Etiology of Crime, Deviance, and Substance Use. Handbook on Crime and Deviance, 479-496.

[18] Burks, S. V., Carpenter, J. P., Goette, L., & Rustichini, A. (2009). Cognitive skills affect economic preferences, strategic behavior, and job attachment. Proceedings of the National Academy of Sciences, 106(19), 7745-7750.

[19] Burks, S., Carpenter, J., Götte, L., & Rustichini, A. (2012). Which measures of time preference best predict outcomes: Evidence from a large-scale field experiment. Journal of Economic Behavior and Organization, 84(1), 308-320.

[20] Bradford, D., Courtemanche, C., Heutel, G., McAlvanah, P., & Ruhm, C. (2017). Time preferences and consumer behavior. Journal of Risk and Uncertainty, 55(2), 119-145.

[21] Burgess, J. (2020). A brief review of the relationship of executive function assessment and violence. Aggression and Violent Behavior, 101414.

[22] Burks, S., Carpenter, J., Götte, L., & Rustichini, A. (2012). Which measures of time preference best predict outcomes: Evidence from a large-scale field experiment. Journal of Economic Behavior and Organization, 84(1), 308-320.

[23] Castillo, M., Ferraro, P. J., Jordan, J. L., & Petrie, R. (2011). The today and tomorrow of kids: Time preferences and educational outcomes of children. Journal of Public Economics, 95(11-12), 1377-1385.

[24] Cauffman, E., Steinberg, L., & Piquero, A. R. (2005). Psychological, neuropsychological and physiological correlates of serious antisocial behavior in adolescence: The role of self-control. Criminology, 43(1), 133-176.

[25] Chabris, C. F., Laibson, D., Morris, C. L., Schuldt, J. P., & Taubinsky, D. (2008). Individual laboratory-measured discount rates predict field behavior. Journal of Risk and Uncertainty, 37(2), 237-269.

[26] Chalfin, A., & McCrary, J. (2017). Criminal deterrence: A review of the literature. Journal of Economic Literature, 55(1), 5-48.

[27] Chua, V. (2012). Contacts and contexts. Social Networks, 34(4), 534-538.

[28] Converse, P. D., Piccone, K. A., & Tocci, M. C. (2014). Childhood self-control, adolescent behavior, and career success. Personality and Individual Differences, 59, 65-70.

[29] Costa Jr, P. T., & McCrae, R. R. (1997). Stability and change in personality assessment: the revised NEO Personality Inventory in the year 2000. Journal of Personality Assessment, 68(1), 86-94.

[30] Costello, B. J., & Hope, T. L. (2016). Peer pressure, peer prevention: The role of friends in crime and conformity. Routledge/Taylor & Francis Group.

[31] Crutchfield, R. D., & Wadsworth, T. (2003). Poverty and violence. In International handbook of violence research (pp. 67-82). Springer, Dordrecht.

[32] Cullen, F. T., & Wilcox, P. (Eds.). (2015). The Oxford handbook of criminological theory. Oxford University Press.

[33] DePrince, A. P., Weinzierl, K. M., & Combs, M. D. (2009). Executive function performance and trauma exposure in a community sample of children. Child abuse & neglect, 33(6), 353-361.

[34] De Ridder, D. T., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., & Baumeister, R. F. (2012). Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. Personality and Social Psychology Review, 16(1), 76-99.

[35] Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. Science, 318(5855), 1387-1388.

[36] Dittrich, M., & Leipold, K. (2014). Gender differences in time preferences. Economics Letters, 122(3), 413-415.

[37] Drever, A. I., Odders-White, E., Kalish, C. W., Else-Quest, N. M., Hoagland, E. M., & Nelms, E. N. (2015). Foundations of financial well-being: Insights into the role of executive function, financial socialization, and experience-based learning in childhood and youth. Journal of Consumer Affairs, 49(1), 13-38.

[38] Duckworth, A. L., & Kern, M. L. (2011). A meta-analysis of the convergent validity of self-control measures. Journal of Research in Personality, 45(3), 259-268.

[39] Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). Journal of Personality Assessment, 91(2), 166-174.

[40] Duckworth, A. L., & Steinberg, L. (2015). Unpacking self-control. Child Development Perspectives, 9(1), 32-37.

[41] Eckel, C., Johnson, C., & Montmarquette, C. (2005). Saving decisions of the working poor: Short-and long-term horizons. In Field experiments in economics. Emerald Group Publishing Limited.

[42] Eigsti, I. M., Zayas, V., Mischel, W., Shoda, Y., Ayduk, O., Dadlani, M., Davidson, M., Lawrence, A. J. & Casey, B. J. (2006). Predicting cognitive control from preschool to late adolescence and young adulthood. Psychological Science, 17(6), 478-484.

[43] Ersche, K. D., Turton, A. J., Pradhan, S., Bullmore, E. T., & Robbins, T. W. (2010). Drug addiction endophenotypes: impulsive versus sensation-seeking personality traits. Biological Psychiatry, 68(8), 770-773.

[44] Evans, G. W., & Rosenbaum, J. (2008). Self-regulation and the income-achievement gap. Early Childhood Research Quarterly, 23(4), 504-514.

[45] Eysenck, S. B., Easting, G., & Pearson, P. R. (1984). Age norms for impulsiveness, venturesomeness and empathy in children. Personality and Individual Differences, 5(3), 315-321.

[46] Fergusson, D. M., John Horwood, L., & Ridder, E. M. (2005). Show me the child at seven II: Childhood intelligence and later outcomes in adolescence and young adulthood. Journal of Child Psychology and Psychiatry, 46(8), 850-858.

[47] Fleming, K. A., Heintzelman, S. J., & Bartholow, B. D. (2016). Specifying associations between conscientiousness and executive functioning: Mental set shifting, not prepotent response inhibition or working memory updating. Journal of Personality, 84(3), 348-360.

[48] Gaik, L. P., Abdullah, M. C., Elias, H., & Uli, J. (2010). Development of antisocial behaviour. Procedia-Social and Behavioral Sciences, 7, 383-388.

[49] Garlick, D., & Sejnowski, T. J. (2006). There is more to fluid intelligence than working memory capacity and executive function. Behavioral and Brain Sciences, 29(2), 134-135.

[50] Gottfredson, M. R., & Hirschi, T. (1990). A general theory of crime. Stanford: Stanford University Press.

[51] Gompert, D. C., Oliker, O., Stearns, B., Crane, K., & Riley, K. J. (2007). Making Liberia safe: transformation of the national security sector. RAND National Defense Research Inst. Santa Monica CA. https://www.rand.org/pubs/monographs/MG529.html

[52] Harrison, G. W., & Rutström, E. E. (2009). Expected utility theory and prospect theory: One wedding and a decent funeral. Experimental economics, 12(2), 133-158

[53] Hebenstreit, C. L., DePrince, A. P., & Chu, A. T. (2014). Interpersonal violence, depression, and executive function. Journal of Aggression, Maltreatment and Trauma, 23(2), 168-187

[54] Heitz, R. P., Redick, T. S., Hambrick, D. Z., Kane, M. J., Conway, A. R., & Engle, R. W. (2006). Working memory, executive function, and general fluid intelligence are not the same. Behavioral and Brain Sciences, 29(2), 135-136.

[55] Heller, S. B., Shah, A. K., Guryan, J., Ludwig, J., Mullainathan, S., & Pollack, H. A. (2017). Thinking, fast and slow? Some field experiments to reduce crime and dropout in Chicago. The Quarterly Journal of Economics, 132(1), 1-54.

[56] Hirschi, T. (2004). Self-control and crime. In R. F. Baumeister & K.D. Vohs (Eds.),Handbook of self-regulation: Research, theory,and applications(pp. 537–552). New York: Guilford

[57] Holden, K., Kalish, C., Scheinholtz, L., Dietrich, D., & Novak, B. (2009). Financial literacy programs targeted on pre-school children: Development and evaluation. http://digital.library.wisc.edu/1793/36314

[58] Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. American Economic Review, 92(5), 1644-1655.

[59] Isquith-Dicker, L. N., Kwist, A., Black, D., Hawes, S. E., Slyker, J., Bergquist, S., & Martin-Herz, S. P. (2021). Early Child Development Assessments and Their Associations with Long-Term Academic and Economic Outcomes: A Systematic Review. International Journal of Environmental Research and Public Health, 18(4), 1538.

[60] Judge, T. A., & Bono, J. E. (2001). Relationship of core self-evaluations traits—self-esteem, generalized self-efficacy, locus of control, and emotional stability—with job satisfaction and job performance: A meta-analysis. Journal of applied Psychology, 86(1), 80.

[61] Judge, T. A., Erez, A., Bono, J. E., & Thoresen, C. J. (2002). Are measures of self-esteem, neuroticism, locus of control, and generalized self-efficacy indicators of a common core construct?. Journal of personality and social psychology, 83(3), 693.

[62] Kahneman, D. (2011). Thinking, fast and slow. Macmillan.

[63] Kling, J. R., Liebman, J. B., & Katz, L. F. (2007). Experimental analysis of neighborhood effects. Econometrica, 75(1), 83-119.

[64] Lahav, E., Benzion, U., & Shavit, T. (2011). The effect of military service on soldiers' time preferences-Evidence from Israel. Judgment and Decision making, 6(2), 130.

[65] Lee, D. S., & McCrary, J. (2017). The deterrence effect of prison: Dynamic theory and evidence. In Regression discontinuity designs. Emerald Publishing Limited.

[66] Lynch Jr, J. G., Netemeyer, R. G., Spiller, S. A., & Zammit, A. (2010). A generalizable scale of propensity to plan: The long and the short of planning for time and for money. Journal of Consumer Research, 37(1), 108-128.

[67] Marcus, B. (2003). An empirical examination of the construct validity of two alternative self-control measures. Educational and Psychological Measurement, 63, 674–706.

[68] Mastrobuoni, G., & Rivers, D. (2016). Criminal discount factors and deterrence. Available at SSRN 2730969.

[69] Meier, S., & Sprenger, C. (2010). Present-biased preferences and credit card borrowing. American Economic Journal: Applied Economics, 2(1), 193-210.

[70] Meier, S., & Sprenger, C. D. (2012). Time discounting predicts creditworthiness. Psychological Science, 23(1), 56-58.

[71] Meier, S., & Sprenger, C. D. (2015). Temporal stability of time preferences. Review of Economics and Statistics, 97(2), 273-286.

[72] Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. Science, 244(4907), 933-938.

[73] Miliotis, D., Sesma, Jr, A., & Masten, A. S. (1999). Parenting as a protective process for school success in children from homeless families. Early Education and Development, 10(2), 111-133.

[74] Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. Cognitive Psychology, 41(1), 49-100.

[75] Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. Current Directions in Psychological Science, 21(1), 8-14.

[76] Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., ... & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. Proceedings of the National Academy of Sciences, 108(7), 2693-2698.

[77] Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. Clinical Psychology Review, 20(1), 113-136.

[78] Mortensen, D. T., & Vishwanath, T. (1994). Personal contacts and earnings: It is who you know!. Labour Economics, 1(2), 187-201.

[79] Mowen, T. J., & Boman IV, J. H. (2020). (Re) Recognizing the multidimensional roles of family and peers on crime. Sociology Compass, 14(3), e12762.

[80] Muraven, M. (2010). Building self-control strength: Practicing self-control leads to improved self-control performance. Journal of Experimental Social Psychology, 46(2), 465-468.

[81] Muraven, M., Baumeister, R. F., & Tice, D. M. (1999). Longitudinal improvement of self-regulation through practice: Building self-control strength through repeated exercise. The Journal of Social Psychology, 139(4), 446-457.

[82] O'Donoghue, T., & Rabin, M. (1999). Doing it now or later. American economic review, 89(1), 103-124.

[83] Ohmura, Y., Takahashi, T., Kitamura, N., & Wehr, P. (2006). Three-month stability of delay and probability discounting measures. Experimental and Clinical Psychopharmacology, 14(3), 318.

[84] Ottaviani, C., & Vandone, D. (2011). Impulsivity and household indebtedness: Evidence from real life. Journal of Economic Psychology, 32(5), 754-761.

[85] Ripollés, M., & Blesa, A. (2005). Personal networks as fosterers of entrepreneurial orientation in new ventures. The International Journal of Entrepreneurship and Innovation, 6(4), 239-248.

[86] Roca, M., Parr, A., Thompson, R., Woolgar, A., Torralva, T., Antoun, N., ... & Duncan, J. (2010). Executive function and fluid intelligence after frontal lobe lesions. Brain, 133(1), 234-247.

[87] Rustichini, A., DeYoung, C. G., Anderson, J. E., & Burks, S. V. (2016). Toward the integration of personality theory and decision theory in explaining economic behavior: An experimental investigation. Journal of Behavioral and Experimental Economics, 64, 122-137.

[88] Sadri, A. M., Ukkusuri, S. V., Lee, S., Clawson, R., Aldrich, D., Nelson, M. S., ... & Kelly, D. (2018). The role of social capital, personal networks, and emergency responders in post-disaster recovery and resilience: a study of rural communities in Indiana. Natural hazards, 90(3), 1377-1406.

[89] Saunders, B., Milyavskaya, M., Etz, A., Randles, D., & Inzlicht, M. (2018). Reported self-control is not meaningfully associated with inhibition-related executive function: A Bayesian analysis. Collabra: Psychology, 4(1).

[90] Sektnan, M., McClelland, M. M., Acock, A., & Morrison, F. J. (2010). Relations between early family risk, children's behavioral regulation, and academic achievement. Early Childhood Research Quarterly, 25(4), 464-479.

[91] Simons, R. L., Simons, L. G., & Wallace, L. E. (2004). Families, delinquency, and crime: Linking society's most basic institution to antisocial behavior. Los Angeles, CA: Roxbury Publishing Company.

[92] Spinella, M. (2007). Normative data and a short form of the Barratt Impulsiveness Scale. International Journal of Neuroscience, 117(3), 359-368.

[93] Steinberg, L., Graham, S., O'brien, L., Woolard, J., Cauffman, E., & Banich, M. (2009). Age differences in future orientation and delay discounting. Child Development, 80(1), 28-44.

[94] Sutter, M., Kocher, M. G., Glätzle-Rützler, D., & Trautmann, S. T. (2013). Impatience and uncertainty: Experimental decisions predict adolescents' field behavior. American Economic Review, 103(1), 510-31.

[95] Tangney, J. P., Boone, A. L., & Baumeister, R. F. (2018). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. In Self-regulation and self-control (pp. 173-212). Routledge.

[96] Tarullo, A. R., Obradovic, J., & Gunnar, M. R. (2009). Self-control and the developing brain. Zero to three, 29(3), 31.

[97] Tomaszewski, B., Fidler, D., Talapatra, D., & Riley, K. (2018). Adaptive behaviour, executive function and employment in adults with Down syndrome. Journal of Intellectual Disability Research, 62(1), 41-52.

[98] van Winden, F. A., & Ash, E. (2012). On the behavioral economics of crime. Review of Law Economics, 8(1), 181-213.

[99] Vazsonyi, A. T., & Huang, L. (2010). Where self-control comes from: on the development of self-control and its relationship to deviance over time. Developmental Psychology, 46,243–257.

[100] Voors, M. J., Nillesen, E. E., Verwimp, P., Bulte, E. H., Lensink, R., & Van Soest, D. P. (2012). Violent conflict and behavior: a field experiment in Burundi. American Economic Review, 102(2), 941-64.

[101] Whitebread, D., & Bingham, S. (2013). Habit formation and learning in young children. London: Money Advice Service.

[102] Wilson, M., & Daly, M. (2006). Are juvenile offenders extreme future discounters?. Psychological Science, 17(11), 989-994.

[103] Zhou, Q., Chen, S. H., & Main, A. (2012). Commonalities and differences in the research on children's effortful control and executive function: A call for an integrated model of self-regulation. Child Development Perspectives, 6(2), 112-121.

A Appendix

In the appendix, we present details on the construction of some of the main variables, namely time preferences in Table 6, self-control in Table 7 and the antisocial behavior index in Table 8. Additionally, we report in Table 9 the regression output that would result from decomposing the antisocial behavior index into two categories: explicitly violent forms and other antisocial behaviors. Finally, we present extensive details on the construction of each control variable considered across the regression analysis (sub-section A.3).

A.1 Details on key variables

Table 6: Time preferences - Survey for declared time preferences

Question	Options	Additional adjustments to measure
Declared preferences – patience (same weight to 3 questions)		
"You patient person?"	1-Everytime, 2-Sometimes, 3-One one time, 4-No	rescaled so that higher value means more patience
"When you make good money, like 2000 LD, do you keep some for problems?"	1-Everytime, 2-Sometimes, 3-One one time, 4-No	rescaled so that higher value means more patience
"Some people like to have everything now, other people are willing to wait. On a ladder from 1 to 5, where 1 is not very patient (you almost want to have things now) and 5 is the most patient (you are almost always willing to wait) where do you stand?"	Scale 1 to 5;	increasing patience
Declared preferences – time inconsistency (same weight to 3 questions)		
"If you get money, do you spend it quick quick?"	1-Everytime, 2-Sometimes, 3-One one time, 4-No	increasing time consistency or less present bias
"When you make good money, like 2000 LD, can you spend plenty celebrating with friends?"	1-Everytime, 2-Sometimes, 3-One one time, 4-No	increasing time consistency or less present bias
"You can avoid going around friends that you can spoil things together?"	1-Everytime, 2-Sometimes, 3-One one time, 4-No	rescaled so that higher value means less present bias

Table 7: Self-control

Impulsiveness	Conscientiousness	Perseverance / GRIT	Reward responsiveness
I buy things quick without thinking	I am ready anytime	I have overcome hard times to subdue an important challenge	When I want something I can go to any corner to make sure I get it.
I can take action before thinking	I pay attention to things good good	I can think big about my future	When I go after something, even the devil in hell can't stop me.
I can just talk without thinking	I get everyday work done right away	Difficult conditions don't discourage me	Most of the time, I will do things for no other reason than that I will enjoy them.
I am not set or relax at lectures	I make plans and go by them	My greatest prayer is to be successful in life	When I am doing well at something, I will always like to be doing it.
I can catch hard time thinking	I catch hard time to do my work (-)	I'm trying hard to make it	When I get something I want, I can jump with happiness and it gives me plenty strength.
I believe in the present rather than the future	I do unasked additional work after finishing my (rather small) work.	I sometime make a plan but later on change my plan to a different one (-)	When I see a chance to get something I really like, I can jump with happiness on the spot.
I able to control myself (-)	I can't complete/finish things (-)	I do not think too much about big things/success (-)	When good things happen to me, it affects me strongly.
I spend money on things and regret it later	I run away from work (-)		I can jump with happiness when I win a lucky ticket.

Answers were placed in a 1-4 scale; for impulsiveness: 1-Everytime, 2-Sometimes, 3-One one time, 4-Never; for all other: 1-Really Agree, 2-Agree, 3-Disagree, 4-Really Disagree; (-) means answers were rescaled so that higher values mean more impulsiveness, conscientiousness, perseverance or reward responsiveness as appropriate.

Table 8: Antisocial Behaviour Index

Category	Question or topic
1. Usually sells drugs	
2. Number of thefts/robberies in past two weeks	"Took something behind someone not for you"
	"Corrected someone's mistake" (stole unwatched items)
	"Scraped from others" (Cheating)
	Pick-pocketed someone
	"Scammed someone" (Sold false goods or conned)
	"Black deed business" (Con artistry)
	Mugged someone
	Armed robbery
3. Disputes and fights in past two weeks	Small palava (dispute) with a neighbor
	Small palava (dispute) with a leader
	Small palava (dispute) with the police
	Large fight with a neighbor
	Large fight with leader
	Large fight with police
	Physical fight
	Engaged in a fight with a weapon
	Fined for a fight
4. Carries a weapon (typically a knife)	
5. Arrested in past two weeks	
6. Aggressive behaviors	In the last 4 weeks, have you been quick to react against others?
	In the last 4 weeks, have you refused to take advice?
	Do you sometimes make hard jokes about people?
	In the last 4 weeks, have you intentionally destroyed property?
	Do you sometimes cheat or scrape from people?
	In the last 4 weeks, have you ever had confusion with people about things?
	In the last 4 weeks, did you let others see your frustration when you were frustrated?
	In the last 4 weeks, have you threatened other people?
	In the last 4 weeks, have you taken things from behind other people without asking them?
	In the last 4 weeks, have you easily controlled your vexation when vexed? (-)
	Do you get vexed when you lose a game?
	Can you feel fine when you hit or yell at somebody?
	If you are under attack can you hit that person to defend yourself?
	When someone teases you, does that make you vexed?
	Do you ever fight to show that you are the stronger person?
	Do you ever damage things as a joke or for fun?
	Do you ever hurt the person you are playing football with for you to win?
	Do you ever use force on somebody to do something for you?
	Do you ever cuss somebody to do something for you?
7. Verbal/physical abuse of partner	Last month, did you accuse your woman for getting boyfriend?
	Last month, did you ever tell your woman you will beat her?
	Last month, did you ever cuss your woman?
	Last month did you push, hit, slap or throw something at your wife or girlfriend?

A.2 Decomposing the Antisocial Behavior Index

Table 9: Predicting violence with Time Preferences, Executive Function and Self-control

DV	Explicitly Violent Antisocial Behavior				Not Explicitly Violent Antisocial Behavior			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time Preferences	-0.223***	-0.212***	-0.193***	-0.193***	-0.241***	-0.223***	-0.190***	-0.190***
	(0.031)	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)	(0.030)	(0.030)
Executive Function	-0.001	-0.005	-0.016	-0.017	0.015	0.017	-0.008	-0.009
	(0.033)	(0.032)	(0.032)	(0.032)	(0.031)	(0.031)	(0.030)	(0.030)
Self-control	-0.407***	-0.391***	-0.378***	-0.378***	-0.236***	-0.210***	-0.181***	-0.182***
	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.030)	(0.030)
Mental Health		0.092***	0.070**	0.068**		0.017	-0.022	-0.027
		(0.028)	(0.028)	(0.029)		(0.030)	(0.031)	(0.031)
Self-esteem and		-0.006	0.004	0.005		-0.037	-0.013	-0.011
Locus of Control		(0.028)	(0.027)	(0.027)		(0.030)	(0.029)	(0.029)
Reputable or Neat		-0.030	-0.001	0.001		-0.097***	-0.035	-0.031
Appearance		(0.030)	(0.030)	(0.031)		(0.032)	(0.032)	(0.032)
Exposed to		-0.042	-0.057	-0.056		-0.109*	-0.139**	-0.137**
Therapy		(0.053)	(0.053)	(0.053)		(0.057)	(0.056)	(0.056)
Risk-loving			0.033	0.032			0.030	0.028
			(0.030)	(0.030)			(0.030)	(0.030)
Substance Abuse			0.119***	0.116***			0.261***	0.256***
			(0.029)	(0.029)			(0.030)	(0.030)
Quality of				-0.027				-0.052*
social networks				(0.026)				(0.028)
Constant	0.212	0.278	0.287	0.269	0.423**	0.528***	0.574***	0.540***
	(0.175)	(0.179)	(0.176)	(0.176)	(0.187)	(0.189)	(0.182)	(0.185)
N	976	976	976	976	976	976	976	976
R-squared	0.353	0.362	0.375	0.376	0.213	0.225	0.284	0.286
Adjusted R-squared	0.341	0.348	0.360	0.360	0.199	0.208	0.266	0.268

OLS; Time preferences, Executive Function, Self-control and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year. Relative to the DV, the ASB index is constructed from 7 components; their values are aggregated in two groups as the standardised mean of standardised components. Explicitly violent ASB includes domestic abuse, fights, aggressive behavior. Hostile but not explicitly violent ASB includes drug selling, robbing others, getting arrested and carrying weapons on body. All control variables are measured 2 weeks earlier. All the variables listed in the table are standardised except the dummy variable "Exposed to therapy". The latter refers to cognitive behavioural therapy and is designed to foster self-regulation and a non-criminal identity. Control variables omitted from the table, included in all specifications, are age, household composition, education, physical health, religion and neighborhood. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

A.3 Details on control variables

All control variables, measured 2 weeks before the key predictors and outcomes, were standardised with a few exceptions: exposure to cognitive behavioral therapy (a dummy variable) and all socio-demographics (e.g. age, years of schooling) except for general physical health that is intentionally standardised. There was special care to identify aspects that could influence the outcomes; simultaneously, these factors were indices of similar things while sufficiently different from other factors. As a result, multicollinearity is low (f.e., in specifications (4) and (8) of Table 5, the variance impact factor of any regressor is ≤ 3 and its mean is 1.52).

Mental Health

Mental health is represented by a standardized index of depression and distress.

Depression is measured with a survey of 6 questions listed below (answers: 1-No, 2-Yes, one one time; 3- Yes, sometimes; 4- Yes, every time); answers are re-scaled so that the higher the values, the better the mental well-being (in this case, all items are negative and were thus inverted). They are summed up and then this sum is standardised.

- "In the last 4 weeks, do you not feel like doing the things you usually like to do with friends?"
- "In the last 4 weeks, when you were thinking about bad things, did you ever have hard time hearing when people talking to you?"
- "In the last 4 weeks, have you felt sad or down-hearted?"
- "In the last 4 weeks, have you felt tired even if you not doing nothing?"
- "In the last 4 weeks, have you lost appetite from feeling bad or worry?"
- "In the last 4 weeks, have you felt like you not important to nobody?"

Local distress is measured with a survey of 7 questions, listed below (answers categorised in the same scale as with depression); answers are re-scaled so that the higher the values, the better mental well-being (all items are negative and were thus inverted). They are summed up and then this sum is standardised.

- "In the last 4 weeks, have you talked by yourself?"
- "In the last 4 weeks, do you feel that your heart spoiled?"
- "In the last 4 weeks, have you felt frustrated?"
- "In the last 4 weeks, have you thought someone's spirit is hampering you?"

- "In the last 4 weeks, did your body reduce or get dry from worry?"
- "In the last 4 weeks, did your heart not feel satisfied?"
- "In the last 4 weeks, did you feel your heart burning?"

The standardised index of depression and the standardised index of distress are summed up and standardised, originating the mental health index.

Self-esteem and Locus of Control

The index representing self-esteem and locus of control is an index of self-esteem summed up to an index of locus of control that is then standardised.

Self-esteem reflects the sum of the answers to 8 items listed below (answers: 1-Really Agree, 2-Agree, 3-Disagree, 4-Really Disagree). The scale 1-4 is re-scaled to 0-3 with higher values meaning more positive self-regard (values for negative items, indicated by the "(-)" sign, are inverted); and then their sum, in a scale from 0-24, is standardised.

- You are satisfied with yourself.
- Sometimes you feel useless. (-)
- Sometimes you think everything you try your hand on can fail? (-)
- You think you don't have enough respect for yourself (-)
- You feel that you are at least a good person as most people?
- Do you think you are a good person but doing nothing? (-)
- You can do business as well as most other people
- The way life looking with you, you can feel shame? (-)

Locus of control is about the perception of self-efficacy in the sense that a person feels that their actions matter and that they have control over what happens to them in the future as opposed to it being determined solely by luck or fate. The sum of the answers to its 8 items is listed below (answers: 1-Really Agree, 2-Agree, 3-Disagree, 4-Really Disagree). The scale 1-4 is re-scaled to 0-3 so that higher values indicate more locus of control (values for negative items, indicated by the "(-)" sign, are inverted); and then their sum, in a scale from 0-24, is standardised.

- Some of those things you do or some of the choices you make are what make your future.
- You think that you have small control over the things that happen in your life. (-)

- When someone is successful in business, it is because they are lucky. (-)
- If you try hard you can make your life better.
- When you make your plans, you can usually make them work.
- The bad things that happen in people's lives, like sickness, are usually due to bad luck. (-)
- People who live on the streets are there because they don't take care of themselves.
- Success comes from hard work.

The sum of the standardised index of self-esteem and the standardised index of locus of control is then standardised - this is the final index of self-esteem and locus of control. Judge at al. (2002) supports that there is a common core concept that would justify looking at both features together (also see Judge and Bono, 2001, for an application regarding job satisfaction and job performance).

Reputable or Neat Appearance

Appearance was discretely measured by observation of enumerators helping out with the surveys. They were explicitly instructed not to ask participants and thus was not based on participants' own judgement. The set of appearance measures was selected based on qualitative interviews taken prior to the main data collection in order for the measures to be locally-relevant. Intuitively, having a bad appearance could affect getting a job or being integrated in a group of "non-marginal" friends.

Appearance considered 5 aspects, namely whether clothes were in good repair, whether their face was clean, whether their hair was cut low as opposed to "bushy", whether fingernails were clean and whether their breath was fresh (as opposed to smelling like cigarettes, opium, drugs, alcohol or other strong smells). Each aspect was evaluated as a 1 (Yes) or 0 (No). These values were summed up, originating a 0-5 scale (the higher, the better their perceived appearance), and then standardised.

Exposed to Therapy

As part of the randomised control trial (RCT) that motivated the data collection, half of the sample was exposed to cognitive behavioural therapy (CBT). This intervention is designed to foster self-regulation and a non-criminal identity and was expected to influence the dependent variables in our set of regressions, economic performance and anti-social behaviour.

CBT was expected to trigger changes in self-image while fostering anti-criminal and anti-violent values. Additionally, cognitive behavioral therapy was expected to change levels of self-control, thus some imperfect collinearity is expected from the independent variables considered

in the regression specifications. The same does not apply to executive function: not only is executive function a measure of mental or cognitive performance, but also it is hard to change levels of executive function in adulthood. Also note that CBT was not expected to prompt changes in terms of locus of control (see Judge at al., 2002, that argue that self-control and locus of control are not the same and are not triggered in the same way). Meanwhile, appearance is expected to be strongly linked to self-image. Thus, appearance and exposure to CBT were included in the regressions side-by-side as separate control variables.

Substance Abuse

Participants were asked whether they usually drank alcohol (e.g. liquor, gin, beer, palm wine), usually smoked marijuana ("grass") or opium and whether they usually took hard drugs (e.g. "diazepan, bubble, 10-10, or italian white, tie white, rolling tide, dugee, brown brown"). Answers to these 3 items were classified into 1 (Yes) or 0 (No) and were summed up. The 0-3 scale was then standardised.

Quality of Social Networks

The quality of social networks index has 4 components: peers, family, former rebel commanders and "big men" (intended to connote a criminal boss).

To assess the quality of each peer's influence (only the five closest peers were considered) and construct the respective index, 20 questions were asked about them. Positive traits were valued as either 0 or 1, while negative traits were evaluated as -1 or 0: friend in school, friend participates in community meetings, friend goes to church, friend works hard, friend has business or job, friend saves money regularly, friend gives good advice, friend likely to share, friend cheers you up, friend trusted to guard valuables, friend begs for money (-), friend gets drunk regularly (-), friend uses drugs regularly (-), friend pickpockets regularly (-), friend burglarizes (-), friend is armed robber (-), friend gambles (-), friend is ex-combatant (-), friend is former commander (-), friend has small fights with others (-), friend has large fights with others (-). Answers were summed up and standardised.

To assess the quality of family relationships, namely support, 4 questions were asked and each valued in a scale from 0 to 3 (re-scaled so that: 3-"Everytime", 2-"Sometimes", 1-"One one time", 0-"Never"): sees family often, family concerned about you, receives encouragement from family, receives help from family when in trouble. Whenever answers were unclear (including "refuse to answer" or "don't know"), these were imputed at the median (less than 3% of the data). The answers to these items is summed up and standardised to form the family support index.

To assess relationships with ex-commanders, 4 questions were asked, valued as either 0 (No) or 1 (Yes): friend is ex-military commander, has close relations with ex-military

commander, receives job from ex-military commander, reports to commander now. Answers were summed up and standardised.

To assess the quality of "Big men" (patrons or someone that helps out), 5 questions were asked, valued as either 0 (no) or 1 (yes): helps find contracts or jobs, helps with supplies or cash for business, helps with food or cash or any kind of assistance when facing problems, helps with school fees, helps with housing needs. Missing values were replaced by average values (less than 10% of the values). Answers were summed up and standardised.

The four indices were summed up and standardised originating the quality of social networks index.

Risk-loving

The variable relative to risk preferences is an index composed of two indices, one game-like and incentivized, and the other survey-like and not incentivized. These two indices are averaged and standardized, originating the "risk-loving" variable presented in the main regression tables.

The game-like index is constructed by adding the answers to two choices made between lotteries with lower expected amounts but lower risk and lotteries with higher expected amounts but higher risk. The choice made in the first task determines the options in the second task. In a scale of 0 to 3, 0 corresponds to choosing the least risky option twice, while 3 corresponds to choosing the riskiest option twice. Then this sum is standardized. The tasks are as follows (1 USD = 60 LD at the time):

First task:

"You have the choice between two different options: Option 1 is a lucky ticket where if you win, you get 100 LD, and if you lose, you get 50 LD. Option 2 is a lucky ticket where if you win you get 150 LD, and if you lose you get 30 LD. So which one do you choose?"

Second task:

- Only asked if the participant selected option 1 in the first task: "You have the choice between two different options: Option 1 is a lucky ticket where if you win, you get 100 LD, and if you lose, you get 50 LD. Option 2 is a lucky ticket where if you win you get 200 LD, and if you lose you get 40 LD. So which one you pick?"
- Only asked if the participant selected option 2 in the first task: "Option 1 is a lucky ticket where if you win, you get 100 LD, and if you lose, you get 80 LD. Option 2 is a lucky ticket where if you win you get 150 LD, and if you lose you get 30 LD. So which one do you choose?"

The survey-like index is composed by six non-incentivized questions that ask about their perceived risk attitudes and behaviors that imply risk. Each of the answers are standardized; then their mean is computed; that mean is then standardized.

The six questions of the survey are:

- Between generally avoiding and taking risks, the participant would self-report their risk preferences in a 1-5 ladder;
- Self-reporting their preference in two situations between a high paying job "that can end any time" (200 USD and 250 USD) and a lower-paying stable job (75 USD or 50 USD, respectively);
- Self-reporting whether the person usually gambles. ["no?", "one one time?", "sometimes?" or "everytime?"];
- Eliciting whether the participant prefers a business with high profit in which the investment could be lost or one with low profit but no investment is lost;
- Eliciting whether the participant "sometimes" does dangerous things for fun; [Yes or No]
- Eliciting whether the participant ever takes a ride from a motorcycle driver at night (which is considered dangerous in that setting). [Yes or No]

In the main text, the potential dynamic between time preferences and risk preferences mentioned in the literature (Andersen et al., 2008; Harrison and Rutström, 2009) was acknowledged. When risk-loving is added as a control variable, no significant changes occur on the effect of time preferences on the key outcomes. Moreover, while more risk appetite (or, equivalently, less risk aversion) is associated to more antisocial behavior, the effect is statistically non-significant in regards to economic performance.

Socio-Demographics

All regressions considered sociodemographic characteristics such as age, household composition, education, physical health, religion and neighborhood where they lived. With the exception of physical health, no other sociodemographic variable was standardised.

Variables regarding household composition contemplate whether they are married or live with their partner, the number of partners that they financially support and the number of children under 15 they have living with them. Education considers the number of years of schooling and whether they are currently at school. Religion considers only whether they are muslim or not which accounts for less than 15% of the population.

Neighborhood distinguishes sub-samples from different neighborhoods of Liberia, namely Red Light, Central Monrovia, Clara Town, New Kru Town and Logan Town (omitted from regressions for comparison). These variables are dummies thus their means sum up to 1 or 100%. For logistical reasons, participants did not start taking part in the study all at the

same time (baseline moment): participants in Red Light started in December 2010 (cohort 1; $N = 100$); another group of participants from Red Light and Central Monrovia started in June 2011 (cohort 2; $N = 398$); another group of participants from Logan Town and New Kru Town (Clara Town) started in February (or March) 2012 (cohort 3; $N = 501$). However, 2 weeks later from the moment they started, they would all follow a similar timeline of assessments ending 13 months later. Note that only cohort 1 was evaluated 5 months and 7 months later and was not evaluated after 4 weeks.

Physical health considers ease with daily life activities (0-6 scale) and, separately, whether the person has any serious disabilities. Specifically, participants were asked the following questions about their general physical health:

- Can you walk for three hours without problems?
- Do you have the strength to carry a 5 gallon container of water for 20 minutes?
- Can you do brushing for the whole day? ["Brushing" means clearing land. It is hard physical labor.]

Answers were categorised (1- No problem, 2- Small problem, 3- Big problem), summed up and re-scaled so that the larger, the better the physical health. This index was then standardised.

For illustration purposes, we present in Table 10 the estimated effects of the full set of socio-demographics omitted in Table 5, the same set of variables omitted in other regression tables. Interestingly, time preferences are a more robust predictor than age. Larger families to support tend to be associated with better economic performance. Education (specifically, years of schooling) is a robust predictor of economic performance, similar to time preferences: the Pearson's correlations are 17% and 15% respectively ($p < 0.001$ for both). Unlike time preferences, education does not predict antisocial behavior. With the exception of the neighborhood where participants live, no sociodemographic variables predict antisocial behavior with statistical significance.

Table 10: Relative predictive effects of Time Preferences, Executive Function and Self-control - more details

DV	Antisocial behaviour				Economic performance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time Preferences	-0.255***	-0.236***	-0.206***	-0.206***	0.124***	0.117***	0.133***	0.133***
	(0.031)	(0.031)	(0.030)	(0.030)	(0.035)	(0.036)	(0.037)	(0.036)
Executive Function	0.019	0.020	-0.002	-0.004	-0.008	-0.013	-0.021	-0.020
	(0.030)	(0.031)	(0.029)	(0.029)	(0.031)	(0.032)	(0.032)	(0.032)
Self-control	-0.322***	-0.296***	-0.270***	-0.271***	0.014	0.006	0.016	0.017
	(0.030)	(0.030)	(0.030)	(0.030)	(0.036)	(0.037)	(0.037)	(0.037)
(...)								
Age	-0.007	-0.010*	-0.013**	-0.013**	0.008	0.010	0.009	0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
Married or Partnered	-0.046	-0.030	-0.003	-0.002	0.100	0.090	0.096	0.094
	(0.081)	(0.081)	(0.077)	(0.077)	(0.096)	(0.097)	(0.097)	(0.096)
# of Partners	0.123*	0.113*	0.093	0.102	0.192***	0.191***	0.184***	0.170***
	(0.066)	(0.067)	(0.064)	(0.065)	(0.065)	(0.064)	(0.064)	(0.065)
# of Children under 15	-0.003	-0.002	0.002	0.003	0.020**	0.020**	0.022**	0.020*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.010)
Muslim	0.057	0.047	0.063	0.060	-0.108	-0.106	-0.097	-0.092
	(0.095)	(0.094)	(0.090)	(0.091)	(0.101)	(0.102)	(0.103)	(0.102)
Years of Schooling	-0.012	-0.007	-0.008	-0.006	0.039***	0.036***	0.035***	0.033***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Currently at School	-0.266***	-0.211**	-0.124	-0.102	-0.119	-0.122	-0.084	-0.119
	(0.089)	(0.091)	(0.083)	(0.083)	(0.114)	(0.116)	(0.115)	(0.114)
Physical Health	-0.054*	-0.043	-0.036	-0.033	0.025	0.024	0.028	0.023
	(0.030)	(0.030)	(0.029)	(0.029)	(0.034)	(0.034)	(0.034)	(0.034)
Has any Serious Disabilities	0.055	0.043	0.018	0.023	-0.074	-0.076	-0.080	-0.087
	(0.118)	(0.114)	(0.113)	(0.113)	(0.131)	(0.130)	(0.132)	(0.131)
Red Light (cohort 1)	-0.341***	-0.458***	-0.234*	-0.238*	0.382***	0.477***	0.566***	0.573***
	(0.119)	(0.125)	(0.126)	(0.126)	(0.138)	(0.148)	(0.152)	(0.152)
Red Light (cohort 2)	-0.337***	-0.344***	-0.274**	-0.261**	0.248**	0.250**	0.277**	0.255**
	(0.108)	(0.108)	(0.108)	(0.108)	(0.123)	(0.122)	(0.123)	(0.123)
Central Monrovia	-0.214*	-0.201*	-0.165	-0.168	0.216*	0.213*	0.227*	0.232*
	(0.114)	(0.116)	(0.116)	(0.116)	(0.127)	(0.126)	(0.126)	(0.125)
Clara Town	-0.089	-0.084	-0.045	-0.041	0.130	0.115	0.127	0.119
	(0.117)	(0.117)	(0.116)	(0.116)	(0.125)	(0.125)	(0.126)	(0.126)
New Kru Town	-0.070	-0.069	-0.031	-0.020	0.199*	0.190	0.202*	0.185
	(0.112)	(0.113)	(0.112)	(0.112)	(0.119)	(0.119)	(0.120)	(0.120)
Constant	0.373**	0.476***	0.512***	0.480***	-0.852***	-0.874***	-0.878***	-0.825***
	(0.174)	(0.176)	(0.169)	(0.170)	(0.211)	(0.219)	(0.221)	(0.223)
N	976	976	976	976	976	976	976	976
R-squared	0.300	0.312	0.358	0.360	0.086	0.091	0.098	0.104
Adjusted R-squared	0.287	0.297	0.342	0.344	0.070	0.071	0.077	0.081

OLS; Time preferences, Executive Function, Self-control and dependent variables (DV) are measured as the mean value of 4 moments in time throughout a year, standardised. All control variables are measured 2 weeks earlier. These specifications are the same as those in Table 5; here we show more detail relative to the omitted variables in that Table. Due to limited space, the other control variables were omitted ("(...)"), namely mental health, self-esteem and locus of control, reputable or neat appearance, exposed to therapy, risk-loving, substance abuse, quality of social network. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 11: Variables included in regressions

Variables in regressions	Mean (s.d.)
Economic Performance	-0.00
	(1.000)
Antisocial Behavior (ASB)	0.00
	(1.000)
Explicitly Violent ASB	0.00
	(1.000)
Not Explicitly Violent ASB	0.00
	(1.000)
Time Preferences	-0.00
	(1.000)
Executive Function	-0.00
	(1.000)
Self-control	-0.00
	(1.000)
Mental Health	0.00
	(1.000)
Self-esteem and Locus of Control	-0.00
	(1.000)
Reputable or Neat Appearance	0.00
	(1.000)
Exposed to Therapy	53%
Risk-loving	0.00
	(1.000)
Substance Abuse	-0.00
	(1.000)
Quality of Social Networks	-0.00
	(1.000)
Age	25.40
	(4.858)
Married or Partnered	16%
# of Partners	0.53
	(0.637)
# of Children under 15	2.21
	(3.174)
Muslim	10%
Years of Schooling	7.72
	(3.287)
Currently at School	0.06
	(0.230)
Physical Health	-0.00
	(1.000)
Has any Serious Disabilities	8%
Red Light (cohort 1)	10%
Red Light (cohort 2)	22%
Central Monrovia	18%
Clara Town	18%
New Kru Town	24%
Logan Town (omitted in regressions)	9%
N	999

Key outcomes (economic performance and antisocial behavior) and regressors (Time preferences, Executive Function, Self-control) are measured such that the mean of each participant is calculated across 4 moments in time throughout a year; the resulting means are then averaged and standardised. All control variables are measured 2 weeks earlier.