Too smart to be selfish? Measures of cognitive ability, social preferences, and consistency

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Abstract

Although there is an increasing interest in examining the relationship between cognitive ability and economic behavior, less is known about the relationship between cognitive ability and social preferences. We investigate the relationship between consequential measures of cognitive ability and measures of social preferences. We have data on a series of small-stakes dictator-type decisions, known as Social Value Orientation (SVO), in addition to choices in a larger-stakes dictator game. We also have access to the grade point averages (GPA) and SAT (formerly referred to as the Scholastic Aptitude Test) outcomes of our subjects. We find that subjects who perform better on the Math portion of the SAT are more generous in both the dictator game and the SVO measure. By contrast we find that subjects with a higher GPA are more selfish in the dictator game and more generous according to the SVO. We also find some evidence that the subjects with higher GPA and higher SAT outcomes offer more consistent responses. Our results involving GPA and social preferences complement previous work which employ measures of cognitive ability which are sensitive to the intrinsic motivation of the subject. Our results involving SAT scores are without precedent in the literature and suggest that measures of cognitive ability, which are less sensitive to the intrinsic motivation of the subject, are positively related to generosity.

Keywords: dictator game; social value orientation; altruism; intelligence
JEL: C91, D64

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1 Introduction

Researchers have made improvements in understanding behavior by conceptualizing choice as originating from a brain which is heterogenous across subjects and influenced by external factors. For instance, these successes include cognitive hierarchy models (Camerer et al., 2004; Nagel, 1995; Costa-Gomes et al., 2001), the discovery of a relationship between play in games and the working memory capacity of the subject (Devetag and Warglien, 2003), the finding that subjects apply similar strategies across fundamentally different games which are played in parallel (Bednar et al., 2012, Savikhin and Sheremeta, 2012), and a relationship between strategic sophistication and access to sleep (Dickinson and McElroy, 2010).

The benefits of this conceptualization also offer an explanation of the subject-specific heterogeneity which is often found in economics experiments: subjects differ in their cognitive ability.[1] As an implication of this, researchers have sought to identify a relationship between measures of cognitive ability and economic behavior in the laboratory. Specifically, experiments have found that measures of cognitive ability are related to performance on a dynamic savings problem (Ballinger et al., 2011), learning optimal behavior in a decision problem (Palacios-Huerta, 2003), mistakes on a forecasting task (Rydval, 2011), the complexity of the strategies implemented in the repeated prisoner's dilemma game (Jones, 2011), outcomes in the repeated prisoner's dilemma game (Jones, 2008), and choice in a beauty contest game (Burnham et al., 2009).[2]

While these papers examine the relationship between cognitive ability and outcomes in economics experiments, less is known about the relationship between cognitive ability and social preferences. Clarifying the relationship between cognitive ability and social preferences would seem to be useful in the interpretation of these experiments. Here we hope to shed new light on the relationship by analyzing dictator-type allocations decisions and measures of cognitive ability. Our measures of cognitive ability include data on grade point averages (hereafter GPA) and the national rank on the SAT.[3] We refer to these measures as *consequential*

[1] For instance, see Camerer and Hogarth (1999).

[2] We should note that not each such study has turned up such a relationship. For instance, Georganas et al. (2010) find that measures of cognitive ability are poorly related to the strategic sophistication in games.

[3] The SAT is an entrance examination for admission as a freshman to universities in the United States.

because they can have a large effect on the subsequent life outcomes of the subject.

In our experiment, subjects make a choice in a dictator game in which it is possible to keep $10. Our subjects also complete a nine item Social Value Orientation (hereafter SVO) measure for smaller monetary stakes. Each of the nine items has an *individualistic* response, a *prosocial* response, and a *competitive* response. The individualistic response is the one in which the material payoffs accruing to oneself are the largest. In other words, selecting the individualistic choice suggests that the subject neither positively nor negatively values material payoffs accruing to the other subject. The prosocial response is the one in which the sum of the material payoffs accruing to both the subject and the other subject are the largest. In other words, selecting the prosocial response suggests that the subject positively values the material payoffs accruing to the other subject. The competitive response is the one in which the difference between the material payoffs accruing to the subject and the other subject are the largest. In other words, selecting the competitive choice suggests that the subject negatively values material payoffs accruing to the other subject.

We compare our measures of cognitive ability with our measures of social preferences. We find that higher GPA subjects are more selfish in the dictator game than are lower GPA subjects. We also find that subjects who performed better on the Math portion of the SAT are more generous in the dictator game than students who performed worse. We do not find a relationship between the Verbal portion of the SAT and choice in the dictator game. There is also evidence of a positive relationship between generosity in the SVO and each of our measures of cognitive ability.

Each of the nine items contained in the SVO are nearly identical.[4] As such, the coherence of the choices on these items allows a measure of the consistency of a subject. We find evidence that GPA, Math SAT, and Verbal SAT are each related to the consistency of SVO choices. Additionally, we find some evidence that GPA is related to the consistency between the SVO and dictator game choices. However, we do not find evidence that consistency between the SVO and dictator game choices are related to either portion of the SAT.

Originally, SAT was an acronym for Scholastic Aptitude Test. However, presently the letters SAT do not denote a sequence of words.

[4]See Appendix C for the SVO items.

In order to interpret the contributions of our results, it is essential to have an understanding of the literature on the SAT and GPA measures. Although to our knowledge, there does not exist a detailed examination of the differences between the SAT and GPA measures, there does exist helpful research. Research shows that SAT outcomes are strongly related to incentivized measures of general intelligence. For instance, Frey and Detterman (2004) find a positive relationship between SAT scores and scores on the Armed Services Vocational Aptitude Battery.[5] The literature also finds a close relationship between SAT scores and subsequent GPA in college.[6] Despite this close relationship between SAT and GPA measures, there remains variation in this relationship which can only be explained by factors other than those related to cognitive ability. For instance, personality (Noftle and Robins, 2007; Kappe and van der Flier, 2012), patience (Kirby et al., 2005), and self-discipline in adolescents (Duckworth and Seligman, 2005) have been found to vary with GPA. In summary, both the SAT and GPA outcomes provide a measure of cognitive ability, however these measures, particularly GPA, seem to be affected by factors other than cognitive ability.

Finally, we note the research on the effects of rewards for cognitive tests. Research finds that intrinsic motivation and cognitive ability are separate components to the outcomes of tests which require cognitive effort.[7] In particular, Segal (2012) finds evidence that the heterogeneously distributed intrinsic motivation to perform on tests, which require cognitive effort, affects their outcomes. However, intrinsic motivation is not related to self-reported SAT scores.

In light of this literature, our study makes the following contributions. First, to our knowledge, we are the first paper to examine the relationship between social preferences and measures of cognitive ability as consequential as GPA and SAT outcomes. Second, we note that one of our measures of cognitive ability, GPA, similar to the commonly employed unincentivized measures of cognitive ability, is sensitive to the intrinsic motivation of the subject. Also similar to the existing literature, we find that outcomes on a measure of cognitive abil-

[5] Also see Beaujean et al. (2006).
[6] See Coyle and Pillow (2008) and Coyle et al. (2011).
[7] For instance, see Borghans et al. (2008) and Duckworth et al. (2011).

ity, which are affected by intrinsic motivation, are associated with less generous behavior in the dictator game and more generous behavior in the SVO. We therefore view our work as complementary to the existing literature. Third, to the extent that SAT scores are relatively unaffected by the intrinsic motivation of the subjects, our results regarding the SAT outcomes appear to be without precedent in the literature. These results suggest that when the intrinsic motivation of the subject is removed from the measure of cognitive ability, higher cognitive ability subjects are more generous in both the dictator game and the SVO. In other words, it seems that the differences between our results involving GPA and those involving SAT outcomes are due to the differences in the sensitivity to the intrinsic motivation of the subjects. Finally, we find some evidence that GPA and SAT outcomes are related to the consistency of choices.

1.1 Related Literature

There exists a literature which examines the relationship between measures of cognitive ability and economic preferences. However, much of the literature focuses on a different set of preferences, such as time preferences or preferences toward risk. For instance, Frederick (2005) reports that subjects who perform better on an IQ-type test exhibit more patience with respect to payments over time and exhibit less risk aversion over small-stakes gambles.[8] By contrast, we examine the link between social preferences and measures of cognitive ability.[9]

There is also a literature which examines the relationship between the consistency of answers and measures of cognitive ability. For instance, Burks et al. (2009) finds that IQ-type test results are related to the consistency of choices made on questions involving time or risk preferences. Eckel (1999) finds that the GPA of the student subjects is related to the

[8] Also, see Benjamin et al. (2012), Brañas-Garza et al. (2008), Burks et al. (2009), Cokely and Kelley (2009), and Dohmen et al. (2010). Yang and Lester (2008) examine the characteristics of subjects, including cognitive ability, associated with susceptibility to biases. See Hoogendoorn et al. (2012) for a novel field experiment regarding heterogeneity in cognitive ability.

[9] For more on measures of cognitive ability and susceptability to biases see Bergman et al. (2010), Hoppe and Kusterer (2011), Liberali et al. (2012), Oechssler et al. (2009), and Stanovich and West (2008). For more on measures of cognitive ability and play in games, see Bayer and Renou (2011), Brañas-Garza et al. (2012), Brañas-Garza et al. (2011), Gill and Prowse (2012), Putterman et al. (2011), Rydval and Ortmann (2004), Schnusenberg and Gallo (2011), and Thöni et al. (2012). Arruñada et al. (2012) study the relationship between social preferences and strategic sophistication.

consistency of choices made on questions involving risk preferences. We perform a similar exercise and find some evidence that GPA is related to consistency. However, we find only mixed evidence of a relationship between SAT outcomes and consistency.

Researchers have sought to understand the relationship between different personality features and social preferences. For instance, Van Lange et al. (1997) find that age, childhood experiences, and family structure are all related to social preferences. Also, Swope et al. (2008) find a weak relationship between the personality traits of United States Naval Academy students and behavior in the dictator game, ultimatum game, trust game, and prisoner's dilemma game.

To our knowledge, there are only a few other papers which examine the relationship between measures of cognitive ability and social preferences.[10] Brandstätter and Güth (2002) report a negative relationship between giving in a dictator game and performance on cognitive tests.[11] Ben-Ner et al. (2004) find a negative relationship between giving in a dictator game and performance on the Wonderlic test of cognitive ability. Further, the authors find that this relationship is stronger for women than for men.[12] Benjamin et al. (2012) find a weak relationship between cognitive ability and selfishness in the dictator game. These studies suggest that selfishness in the dictator game is increasing in their measures of cognitive ability.

On the other hand, Millet and Dewitte (2007), find a positive relationship between the Raven Progressive Matrix test of cognitive ability and altruistic behavior. Their evidence comes from observations of choice in an expanded version of SVO. Whereas we closely follow the SVO format of Van Lange et al. (1997), which has three responses per item (competitive, individualistic, and prosocial), Millet and Dewitte also employ a fourth option, altruistic. The altruistic choice is distinguished from the prosocial choice in that, while both options

[10] For studies which investigate the effects of heterogeneous cognitive ability, as manipulated by cognitive load, see Cornelissen et al. (2011), Duffy and Smith (2012), Hauge et al. (2009), Roch et al. (2000), and Schulz et al. (2011).

[11] Although the authors conclude that their measure of cognitive ability is not related to bargaining behavior, on page 200, the paper reports negative correlations between their measure of cognitive ability and giving in the dictator game ($r = -0.29$, $p = 0.04$), and expectations of the amounts given by other dictators ($r = -0.34$, $p = 0.01$).

[12] On page 587, the authors report a negative relationship, significant at 0.1, in both specifications of the pooled data. The relationship is not significant when restricted to male subjects, however they report that the negative relationship is significant at 0.05 in the OLS specification for female subjects. Visser and Roelofs (2011) report a similar result.

yield identical amounts to the subject, the prosocial option sends an amount identical to that obtained by the subject, whereas the altruistic choice sends an even greater amount. In other words, the prosocial option is an even split and the altruistic option sends an even larger amount to the other subject, without reducing the subject's own allocation. The authors find evidence under rank order voting on hypothetical allocations that their measure of cognitive ability is positively related to preferences for altruism.[13] However, the authors do not report such a relationship for the prosocial choices.

In this paper, we find that the outcome on the Math portion of the SAT is associated with generosity on both measures of social preferences. We find that GPA is related to generosity on the SVO measure but related to selfishness in the dictator game. Finally, we find a relationship between the outcome of the Verbal portion of the SAT and generosity on the SVO measure, however we do not find a relationship involving the dictator game.

How do our results relate to the literature examining social preferences and measures of cognitive ability? First, to the extent that GPA outcomes are affected by both cognitive ability and intrinsic motivation, as is the case for cognitive tests with low material incentives, then our results closely follow that found by Brandstätter and Güth (2002), Ben-Ner et al. (2004), and Benjamin et al. (2012). Similar to these authors, we find that giving in dictator game is negatively related to such a measure of cognitive ability. Second, given reasonable assumptions about the preferences of the subjects, it would seem that the Millet and Dewitte subjects with a preference for either altruistic or prosocial preferences would be categorized as prosocial in our setting. Hence, similar to Millet and Dewitte (2007), we find a positive relationship between generosity according to the SVO measure and the outcome of a measure of cognitive ability which is relatively sensitive to intrinsic motivation. Third, to the extent that SAT scores are not significantly affected by the intrinsic motivation of the subjects, our results regarding the SAT outcomes seem to be without precedent in the literature. Our results suggest that measures of cognitive ability, which are relatively unaffected by intrinsic motivation, are positively associated with more generous behavior in both the dictator game and the SVO.

[13] James (2011) finds empirical evidence that charitable giving is increasing in cognitive ability.

2 Data and Methodology

The choices on social preferences were obtained an experimental study initially reported in Smith (2012). Each subject was asked for a choice in one of two forms of a dictator game. In one treatment, the subjects were given a standard $10 dictator game. This dictator game was presented to the subjects in $0.25 increments. The subjects were directed to indicate which of the 41 dictator game allocations they most preferred.[14] A total of 96 students enrolled in economics classes at Rutgers University-Camden made a choice in this game. The data for this game was collected in 5 classes of 16, 21, 39, 12, and 8 subjects.

In the other dictator game treatment, the subjects were asked for their choice in a non-standard dictator game in which the relative allocation *price* was 1 to 3. In other words, the most selfish allocation is $10 to self and $0 to other and the most generous allocation is $0 to self and $30 to other. The subject's own payoffs were listed in $0.50 increments and the other subject's payoffs were listed in $1.50 increments. The subjects were directed to indicate which of the 21 dictator game allocations they most preferred.[15] A total of 90 students in economics classes at Rutgers University-Camden made a choice in this nonstandard dictator game. The data for this game was collected in 4 classes of 21, 42, 16, and 11 subjects.

We also measured the Social Value Orientation (SVO) of the subjects. Our specification of SVO was adapted from Van Lange et al. (1997). The subjects were given the 9 SVO items such that three items were listed on each of three pages. In Van Lange et al., the subjects decided on an allocation of points which carry no financial implications. By contrast, in our experiment, subjects were offered a conversion rate of points to money whereby the subject is effectively deciding on an allocation of a very small amount of money. Across all 9 SVO items, the subject could keep as little as $0.94 and as much as $1.06. Also across the SVO items, the subject could send as little as $0.19 and send as much as $0.94. The subjects were not told these amounts, however they could be calculated with relative ease. The exchange rate between the Van Lange et al. numbers and the monetary payment was designed to provide only small monetary incentives.

[14] See Appendix A for this standard dictator game.

[15] See Appendix B for this nonstandard dictator game.

Each of the nine items had an *individualistic* response, a *prosocial* response, and a *competitive* response. The exact items and the conversion from points to money in the SVO measure is given in Appendix C. Van Lange et al. classify a subject as prosocial, individualistic or competitive if the subject answered six of the nine items in a particular fashion.

Although a complete discussion of the motivation of the design of Smith (2012) is beyond the scope of this paper, we note that the experiment was designed in order to detect possible differences in behavior, as a function of the order of the completion of the dictator game and the SVO. As such, within each dictator treatment, we also varied the order of the dictator game and the SVO measurement. Roughly half of each class made a choice in the dictator game then the SVO items and half answered the SVO items then made a choice in the dictator game.

The responses on the SVO and the dictator game were entered on paper. These choices were incentivized to the extent that one out of every four subjects within each class were paid the actual amounts obtained. All decisions were made in the absence of feedback. In an effort to mitigate possible implicit reciprocal behavior, similar to Carpenter (2005), we employ a triadic design whereby each dictator decides an allocation involving self and another dictator. This other dictator does not decide on an allocation involving the original dictator but rather on a third dictator. In particular, the subjects were told to make their allocation decisions involving themselves ("You") and another subject ("Other1"). Another subject ("Other2") was to make allocations involving Other2 and You. Therefore, the amount accruing to each subject was what was kept in the You-Other1 allocation decisions plus what Other2 did not keep in the Other2-You allocation decisions. In both the measurement of SVO and the choice in the dictator game, the status of You, Other1 and Other2 remained fixed. This description of the triadic design was provided verbally by the same male experimenter and in written form given to each subject. The experiment was completed in less than one hour.

The data on measures of cognitive ability were obtained from the Office of the Registrar of Rutgers University-Camden. The registrar could locate data on the cumulative GPA for 185 of the 186 subjects. Data on SAT scores could only be located for 86 of the 186 subjects.

The SAT scores were only available for students who were admitted as freshmen. In other words, the SAT scores for transfer students were not available.

3 Results

3.1 Overview

In the standard dictator game, subjects kept an average of \$6.11 ($SD = 2.66$). In the nonstandard dictator game, subjects kept an average of \$7.18 ($SD = 2.83$). The SVO categorized 40.5% (75) of the subjects as prosocial, 39.5% (73) as individualistic, and 4.9% (9) as competitive. We were not able to categorize 15.1% (28) of the subjects because they did not select a minimum of 6 response items of a particular type. The subjects accrued an average of \$14.47 and again we note that 25% were paid the amount.

We now present an overview of the variables which we use in the analysis. The variable SVO First obtains a value of 1 if the SVO was administered first and 0 otherwise. The Standard Dictator variable obtains a 1 if the standard dictator was used and 0 otherwise. We use two measures of the amount kept in the dictator game: Dictator Kept and Dictator Fraction Kept. The variable Dictator Kept is simply the amount kept in the dictator game. In the case of both the standard version and the nonstandard version, this can range from 0 to 10. The variable Dictator Fraction Kept normalizes the amount of money kept in the dictator game by the total amount of money given to both players. Obviously this amount ranges from 0 to 1.

The variable GPA is the cumulative GPA of the student as of Fall 2009. Math SAT and Verbal SAT variables express the national rank of these portions of the SAT. The variable Female takes a value of 1 if the subject is female and 0 otherwise. The registrar also provided the birthdays of the subjects. From this we calculate Age which is the number of years old as of January 1, 2010. The variable Class indicates the last two digits of the expected year of graduation. For instance, a student expected to graduate in 2011 would obtain a value of 11. The Prosocial variable takes the value of the number of the 9 SVO questions which were answered prosocially. The Classification variable obtains the value of the maximum

of the number of questions answered either prosocially, individualistically, or competitively. The Classification variable provides a measure of the consistency of the SVO responses. We provide the summary statistics for these variables in Table 1.

Table 1
Summary of the variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
SVO First	185	0.502	0.501	0	1
Standard Dictator	185	0.514	0.501	0	1
Dictator Kept	185	6.631	2.792	0	10
Dictator Fraction Kept	185	0.583	0.277	0	1
GPA	185	3.045	0.597	0.323	4.00
Math SAT	86	48.686	19.653	4.0	74.0
Verbal SAT	86	47.116	15.681	5.0	75.0
Female	185	0.357	0.480	0	1
Age	184	22.08	5.27	17.04	60.62
Class	185	10.37	0.805	9	13
Prosocial	185	4.19	3.81	0	9
Classification	185	7.71	1.73	3	9

We note that, although we conduct the experiment in a college setting, there are several students who are older than typical college students.[16] We considered dropping these subjects as outliers however, it was not obvious precisely which students should be excluded and we note that the age variable is not central to our study. We also note that there are no significant differences in the Dictator Kept, Dictator Fraction Kept, GPA, or Prosocial variables of the subjects who have SAT data available and those who do not. Finally, we do not find a significant difference between the Dictator Kept, Dictator Fraction Kept, GPA, Prosocial, or SAT variables of the subjects in each of the 9 experimental sessions.[17] We also include the covariance matrix involving our central variables.

[16] The ages of the subjects over 30 include: 60, 52, 42, 38, 37, 33, 32, and three instances of 31.
[17] These results are available from the corresponding author upon request.

Table 2
Covariance matrix

	1	2	3	4	5	6
1 GPA	1.00					
2 Verbal SAT	0.117	1.00				
3 Math SAT	0.084	−0.047	1.00			
4 Dictator Kept	0.127*	0.122	−0.189*	1.00		
5 Dictator Fraction Kept	0.103	0.126	−0.167	0.920***	1.00	
6 Prosocial	0.0688	0.0989	0.162	−0.363***	−0.479***	1.00
7 Classification	0.105	0.108	0.123	0.0868	0.0537	0.144*

Covariance matrix involving the central variables. Note that *** indicates significance at $p < 0.01$ and * indicates significance at $p < 0.10$.

In addition to the obvious correlations involving Dictator Kept, Dictator Fraction Kept, and Prosocial, we note an additional relationship. The Dictator Kept variable has a positive correlation with GPA and a negative correlation with Math SAT. However, we note that the Dictator Fraction Kept does not exhibit such a relationship.

3.2 Measures of Cognitive Ability and Behavior in the Dictator Game

We now examine the relationship between our measures of cognitive ability and choice in the dictator game. We perform the following tobit regressions with a dependent variable of Dictator Kept. These tobit regressions are performed with a lower bound of 0 and an upper bound of 10. Regression (1) employs only our measures of cognitive ability: GPA and SAT outcomes. Regressions (2) and (3) consider only the GPA and SAT outcomes, respectively, along with the details of the treatment: the order of the experiment, the type of dictator game and the interaction. Regression (4) considers all three cognitive ability measures and the details of the treatment. Finally, regression (5) considers all three measures of cognitive ability, the details of the treatment, and background details for the subjects. We summarize the results in Table 3.

Table 3
Relationship between Dictator Kept and measures of cognitive ability.

	(1)	(2)	(3)	(4)	(5)
GPA	1.553**	0.559	–	1.386**	1.554**
	(0.678)	(0.457)		(0.652)	(0.688)
Math SAT	−0.0412**	–	−0.0370**	−0.0532***	−0.0557***
	(0.0205)		(0.0151)	(0.0196)	(0.0202)
Verbal SAT	0.0228	–	0.0149	0.01567	0.0103
	(0.0251)		(0.0188)	(0.0237)	(0.0240)
SVO First	–	−1.290*	−2.751***	−3.497***	−3.567***
		(0.765)	(0.853)	(1.094)	(1.089)
Standard Dictator	–	−1.463*	−2.084**	−2.115**	−1.664
		(0.756)	(0.791)	(1.009)	(1.060)
SVO First*Standard Dictator	–	1.096	3.277***	4.237***	4.151***
		(1.061)	(1.182)	(1.495)	(1.495)
Female	–	–	–	–	−0.403
					(0.844)
Age	–	–	–	–	0.153
					(0.141)
Class	–	–	–	–	−0.186
					(0.560)
Log likelihood	−194.04	−421.07	−191.01	−188.79	−187.89
Observations	86	185	86	86	86

The tobit regressions were performed with a lower bound of 0 and an upper bound of 10. Note that *** indicates significance at $p < 0.01$, ** indicates significance at $p < 0.05$, and * indicates significance at $p < 0.10$.

We find a relationship between the amount kept in the dictator game and GPA. In regressions (1), (4), and (5) we find that higher GPA subjects keep more in the dictator game, than do lower GPA subjects. We also find a negative relationship between the amount kept in the dictator game and Math SAT. In regressions (1), (3), (4), and (5) we find that higher Math SAT subjects keep less in the dictator game than do lower Math SAT subjects. Finally, note that we do not find a relationship between the amount kept in the dictator game and Verbal SAT.

We note the significant relationships which are related to the details of the experiment. As does Smith (2012), we find that the order of the presentation of the experimental material is related to choice. In particular, we find that subjects who first responded to the SVO were

more generous in the dictator game than subjects who responded first to the dictator game. We also note that the coefficient involving the specification of the dictator game is significant in regressions (2), (3), and (4). Further, the interaction between the order and the form of the game is significant in regressions (3), (4), and (5).[18] Finally, we note when we separately run the regressions for both forms of the dictator game, the sign of the coefficient estimates of our measures of cognitive ability are unchanged. Although we note that in these regressions, the coefficient estimates are largely not significant.[19]

While we are encouraged by the results summarized in Table 3, it is potentially problematic that the term involving the form of the dictator game is significant. In order to account for this feature, we perform the analogous analysis as above. However, here the dependent variable is the fraction kept in the dictator game and the tobit regressions are performed with a lower bound of 0 and an upper bound of 1. We summarize the results in Table 4.

[18] In contrast to Ben-Ner et al. (2004), we do not find a significant interaction between gender and dictator giving.

[19] These results are available from the corresponding author upon request.

Table 4
Relationship between Dictator Fraction Kept and measures of cognitive ability.

	(1)	(2)	(3)	(4)	(5)
GPA	0.142**	0.0670	–	0.154**	0.169**
	(0.0683)	(0.0461)		(0.0639)	(0.0671)
Math SAT	−0.00366*	–	−0.00452**	−0.00482**	−0.00533***
	(0.00205)		(0.00199)	(0.00191)	(0.00196)
Verbal SAT	0.00240	–	0.00211	0.00160	0.000969
	(0.00253)		(0.00241)	(0.00232)	(0.00234)
SVO First	–	−0.122	−0.358***	−0.331***	−0.336***
		(0.0770)	(0.112)	(0.107)	(0.106)
Standard Dictator	–	0.0309	−0.0549	−0.0247	0.0274
		(0.0762)	(0.102)	(0.0985)	(0.103)
SVO First*Standard Dictator	–	0.104	0.403***	0.407***	0.381***
		(0.107)	(0.153)	(0.147)	(0.146)
Female	–	–	–	–	−0.0909
					(0.0823)
Age	–	–	–	–	0.0110
					(0.0138)
Class	–	–	–	–	−0.0319
					(0.0548)
Log likelihood	−50.28	−108.09	−45.98	−43.15	−41.99
Observations	86	185	86	86	86

The tobit regressions were performed with a lower bound of 0 and an upper bound of 1. Note that *** indicates significance at $p < 0.01$, ** indicates significance at $p < 0.05$, and * indicates significance at $p < 0.10$.

Despite the differences in the dependent variables, the qualitative results presented in Table 3 remain largely unchanged here. In particular, we note a positive relationship between the amount kept in the dictator game and GPA, in regressions (1), (4), and (5). We also observe a negative relationship between the amount kept in the dictator game and Math SAT, in regressions (1), (3), (4), and (5). Finally, we do not observe a significant relationship between Verbal SAT and the amount kept in the dictator game.

Also similar to the results of Table 3, here we find that the SVO First and the interaction terms are significant in regressions (3), (4), and (5). However, unlike the previous analysis, here we find that the form of the dictator game is not significant. In our view this suggests that the use of the Dictator Fraction Kept variable is capturing the differences in behavior

due to the different forms of the dictator game.

In summary, we observe a positive relationship between cognitive ability, as measured by GPA, and selfishness in the dictator game. We also observe a negative relationship between cognitive ability, as measured by Math SAT, and selfishness in the dictator game. Finally, we do not observe a significant relationship between cognitive ability, as measured by Verbal SAT, and selfishness in the dictator game.

3.3 Measures of Cognitive Ability and SVO

We now turn our attention to the relationship between the SVO measure and our measures of cognitive ability. As such, we employ the Prosocial variable as the dependent variable. Recall that this variable takes a value of the number of SVO questions which were answered prosocially. In our view, this measure of generosity is most appropriate because a majority of subjects who were not prosocial, were individualistic, rather than competitive or unclassified. With the exception of the dependent variable, and that the analysis is conducted with binomial logistic regressions, the analysis is identical to that summarized in Tables 3 and 4. Table 5 presents a summary of this analysis.

Table 5
The Prosocial variable and measures of cognitive ability.

	(1)	(2)	(3)	(4)	(5)
GPA	0.306**	0.105	–	0.270**	0.262*
	(0.129)	(0.0861)		(0.136)	(0.146)
Math SAT	0.0137***	–	0.0184***	0.0179***	0.0203***
	(0.00387)		(0.00408)	(0.00408)	(0.00427)
Verbal SAT	0.0102**	–	0.0144***	0.0137***	0.0142***
	(0.00482)		(0.0050)	(0.00503)	(0.00519)
SVO First	–	−0.0401	1.005***	1.048***	1.070***
		(0.141)	(0.227)	(0.228)	(0.231)
Standard Dictator	–	−0.292**	−0.2468	−0.199	−0.261
		(0.140)	(0.2015)	(0.204)	(0.219)
SVO First*Standard Dictator	–	−0.328*	−1.026***	−1.014***	−0.903***
		(0.199)	(0.310)	(0.311)	(0.315)
Female	–	–	–	–	0.421**
					(0.178)
Age	–	–	–	–	0.0119
					(0.0302)
Class	–	–	–	–	0.0219
					(0.120)
-2 log L	1045.55	2267.37	1008.65	1004.71	998.15
LR χ^2	24.06***	32.38***	55.34***	58.19***	62.75***
Observations	86	185	86	86	86

Result of binomial logistic regressions where *** indicates significance at $p < 0.01$, ** indicates significance at $p < 0.05$, and * indicates significance at $p < 0.10$.

First, we find evidence of a positive relationship between GPA and social preferences according to SVO, in regressions (1), (4), (5). In other words, higher GPA subjects are more generous in the SVO measure. We also find a positive relationship between Math SAT and the social preferences according to SVO, in regressions (1), (3), (4), and (5). In other words, higher Math SAT subjects are more generous in the SVO measure. Unlike the analysis involving dictator behavior, we find evidence that Verbal SAT scores are related to generosity in the SVO. We note that higher Verbal SAT is associated with more generosity in the SVO, in regressions (1), (3), (4), and (5). Also, unlike the analysis involving dictator behavior, we find that the gender variable is significant. This suggests that women are more generous than men, according to the SVO measure.

3.4 Measures of Cognitive Ability and Consistency

Finally, we turn our attention to the relationship between the consistency of choices and our measures of cognitive ability. Here we discuss the first of our two notions of consistency. Recall that the SVO measure consists of nine nearly identical items. As such, the number of questions answered in a similar manner would seem to be a reasonable measure of consistency. Therefore, we use the Classification variable as the dependent variable. Recall that this takes the value of the maximum of the number of questions answered prosocially, individualistically, or competitively. We perform an analysis, identical to that summarized in Table 5, with the exception that Classification is the dependent variable. Table 6 summarizes this analysis.

Table 6
The Classification variable and measures of cognitive ability.

	(1)	(2)	(3)	(4)	(5)
GPA	0.302*	0.258**	–	0.263	0.239
	(0.163)	(0.118)		(0.171)	(0.183)
Math SAT	0.00840*	–	0.00912*	0.00859*	0.00644
	(0.00463)		(0.00475)	(0.00482)	(0.00509)
Verbal SAT	0.00884	–	0.0113**	0.00998*	0.00774
	(0.00578)		(0.00572)	(0.00583)	(0.00606)
SVO First	–	−0.0865	0.160	0.198	0.217
		(0.217)	(0.308)	(0.309)	(0.312)
Standard Dictator	–	−0.585***	−0.647**	−0.587**	−0.410
		(0.200)	(0.258)	(0.261)	(0.284)
SVO First*Standard Dictator	–	0.542*	0.242	0.254	0.0744
		(0.286)	(0.399)	(0.399)	(0.408)
Female	–	–	–	–	−0.482**
					(0.216)
Age	–	–	–	–	−0.0156
					(0.0352)
Class	–	–	–	–	−0.214
					(0.145)
-2 log L	721.90	1349.52	714.10	711.77	704.08
LR χ^2	9.84**	16.92***	17.54***	19.86***	27.34***
Observations	86	185	86	86	86

Result of binomial logistic regressions where *** indicates significance at $p < 0.01$, ** indicates significance at $p < 0.05$, and * indicates significance at $p < 0.10$.

Here we find some evidence that GPA is related to consistency, in regressions (1) and (2). We also find evidence that both the Math and Verbal SAT scores are related to consistency. However, we note that these relationships are not robust to the specification involving the background details of the subjects.

We also consider another notion of consistency: the agreement between the SVO behavior and the dictator game behavior. To accomplish this, we first run two sets of regressions. The first set involves linear regressions with Dictator Fraction Kept as the dependent variable and Prosocial as an independent variable. The second set involves linear regressions with the squared residuals obtained in the first set, with measures of cognitive ability as the independent variables. In this way we can determine if these measures of cognitive ability are related to the agreement between the choices on the SVO and the choice made in the dictator game.

In both regressions (1) and (2) below we use the responses on the SVO as an independent variable and the fraction of money kept in the dictator game as the dependent variable. In regression (1) we also include the treatment details. In regression (2) we include the treatment details and the background details of the subjects. Table 7 summarizes these results.

Table 7
Relationship between Dictator Fraction Kept and SVO.

	(1)	(2)
Prosocial	-0.0349^{***}	-0.0357^{***}
	(0.00477)	(0.00480)
SVO First	-0.0939^{*}	-0.100^{*}
	(0.0512)	(0.0516)
Standard Dictator	-0.00426	-0.000385
	(0.0507)	(0.0512)
SVO First*Standard Dictator	0.0493	0.0588
	(0.0716)	(0.0721)
Female	–	0.0400
		(0.0377)
Age	–	0.00127
		(0.00353)
Class	–	-0.0301
		(0.0234)
R^2	0.25	0.26
Observations	185	185

Result of linear regressions where *** indicates significance at $p < 0.01$, and * indicates significance at $p < 0.10$.

Now we use the squared residuals obtained in the regressions summarized in Table 7 as dependent variables in the regressions summarized below. In each of the regressions below, we use the measures of cognitive ability as independent variables in order to determine if the agreement between SVO and dictator choices is related to our measures of cognitive ability. In regressions (1.1), (1.2), and (1.3) below, we use the squared residuals obtained in regression (1) as summarized in Table 7 as the dependent variables. In regressions (2.1), (2.2), and (2.3) below, we use the squared residuals obtained in regression (2) as summarized in Table 7 as the dependent variables. We summarize this analysis in Table 8.

Table 8
Relationship between Consistency and measures of cognitive ability.

	(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(2.3)
GPA	−0.0248**	–	−0.0233	−0.0213**	–	−0.0179
	(0.0112)		(0.0168)	(0.0108)		(0.0156)
Math SAT	–	0.00028	0.00034	–	0.00031	0.00035
		(0.00050)	(0.00050)		(0.00046)	(0.00046)
Verbal SAT	–	−0.00087	−0.00076	–	−0.00056	−0.00048
		(0.00062)	(0.00062)		(0.00058)	(0.00058)
R^2	0.03	0.03	0.05	0.02	0.02	0.03
Observations	185	86	86	185	86	86

The dependent variable of the linear regressions (1.1), (1.2), and (1.3) is the squared residuals of regression (1), as summarized in Table 7. The dependent variable of the linear regressions (2.1), (2.2), and (2.3) is the squared residuals of regression (2), as summarized in Table 7. Further, ** indicates significance at $p < 0.05$.

Similar to the analysis summarized in Table 6, we find some evidence that GPA is related to consistency. In both regressions (1.1) and (2.1) we find that GPA is related to consistency as measured by the agreement between SVO and dictator game choices. However, this relationship is not robust to the specification. In particular, when we include the outcomes on the SAT, GPA is no longer significant. In contrast to the results summarized in Table 6, here we do not find evidence that either the Math or Verbal SAT outcomes are related to consistency.

Here we have considered two notions of consistency: the coherence of the SVO behavior and the relationship between our two measures of social preferences. We find evidence that GPA is related to both measures of consistency. Additionally, we find evidence that the first measure is related to SAT outcomes, however, we do not find a relationship involving the second measure of consistency.

4 Discussion and Conclusions

Increasingly in economics, researchers are interested in examining the relationship between cognitive ability and economic behavior. However, before researchers can make accurate inferences of such behavior given measures of cognitive ability, we must have a better understanding of other relevant correlates of cognitive ability. As such, in this paper we examine the relationship between consequential measures of cognitive ability and social preferences.

We find that our measures of cognitive ability are related to social preferences. In particular, we find evidence of a negative relationship between performance on the Math portion of the SAT and selfishness in both the dictator game and the SVO measure. By contrast, we find a positive relationship between GPA and selfishness in the dictator game, but a negative relationship between GPA and selfishness on the SVO measure. Finally, we only find some evidence of a relationship between our measures of cognitive ability and the consistency of choices.

To the extent that GPA is affected by both cognitive ability and intrinsic motivation, as evidence suggests that it is for unincentivized cognitive tests, then our results regarding GPA and generosity closely resemble that found in the literature (Brandstätter and Güth, 2002; Ben-Ner et al., 2004; Benjamin et al., 2012; Millet and Dewitte, 2007). In this sense, we view our results as offering a complementary view of the effects of cognitive tests which are affected by heterogenous intrinsic motivation. However, to our knowledge, our results regarding SAT outcomes are novel. We interpret our results involving SAT outcomes and social preferences as suggesting that higher measures of cognitive ability, when the measures are not significantly related to the intrinsic motivation of the subject, are associated with more generous behavior.

We also note that we only find mixed evidence of a relationship between gender and social preferences. While we find that generosity in the SVO is related to the gender of the subject, we do not find such a relationship in the dictator allocations. Previous work has found a relationship between gender and social preferences,[20] however our data only provides mixed evidence for this.

While we are encouraged by our results, there is more to be explored. For instance, additional data is needed in order to better identify the relative merits of the measures of cognitive ability which we use. We are also aware of the limitations of the measures of social preferences which we use. One way to remedy this would be to conduct a thorough investigation of social preferences, ala Charness and Rabin (2002), when considering such consequential measures of cognitive ability.

[20] For instance, see Eckel and Grossman (1998), Andreoni and Vesterlund (2001), Ben-Ner et al. (2004).

Appendix A

Standard Dictator Game

You: $10.00 Other1: $0.00	You: $9.75 Other1: $0.25	You: $9.50 Other1: $0.50	You: $9.25 Other1: $0.75
You: $9.00 Other1: $1.00	You: $8.75 Other1: $1.25	You: $8.50 Other1: $1.50	You: $8.25 Other1: $1.75
You: $8.00 Other1: $2.00	You: $7.75 Other1: $2.25	You: $7.50 Other1: $2.50	You: $7.25 Other1: $2.75
You: $7.00 Other1: $3.00	You: $6.75 Other1: $3.25	You: $6.50 Other1: $3.50	You: $6.25 Other1: $3.75
You: $6.00 Other1: $4.00	You: $5.75 Other1: $4.25	You: $5.50 Other1: $4.50	You: $5.25 Other1: $4.75
You: $5.00 Other1: $5.00	You: $4.75 Other1: $5.25	You: $4.50 Other1: $5.50	You: $4.25 Other1: $5.75
You: $4.00 Other1: $6.00	You: $3.75 Other1: $6.25	You: $3.50 Other1: $6.50	You: $3.25 Other1: $6.75
You: $3.00 Other1: $7.00	You: $2.75 Other1: $7.25	You: $2.50 Other1: $7.50	You: $2.25 Other1: $7.75
You: $2.00 Other1: $8.00	You: $1.75 Other1: $8.25	You: $1.50 Other1: $8.50	You: $1.25 Other1: $8.75
You: $1.00 Other1: $9.00	You: $0.75 Other1: $9.25	You: $0.50 Other1: $9.50	You: $0.25 Other1: $9.75

You: $0 and Other1: $10.00

Appendix B

Nonstandard Dictator Game

You: $10.00 Other1: $0.00	You: $9.50 Other1: $1.50	You: $9.00 Other1: $3.00	You: $8.50 Other1: $4.50
You: $8.00 Other1: $6.00	You: $7.50 Other1: $7.50	You: $7.00 Other1: $9.00	You: $6.50 Other1: $10.50
You: $6.00 Other1: $12.00	You: $5.50 Other1: $13.50	You: $5.00 Other1: $15.00	You: $4.50 Other1: $16.50
You: $4.00 Other1: $18.00	You: $3.50 Other1: $19.50	You: $3.00 Other1: $21.00	You: $2.50 Other1: $22.50
You: $2.00 Other1: $24.00	You: $1.50 Other1: $25.50	You: $1.00 Other1: $27.00	You: $0.50 Other1: $28.50
You: $0.00 Other1: $30.00			

Appendix C

Social Value Orientation (SVO)

- We asked the following 9 items (from Van Lange et al., 1997) in order to measure the SVO of the subjects.
- Each of the 9 items has a prosocial answer, a individualistic answer and a competitive answer.
- Each item is stated in terms of points where 100 points corresponded to \$0.02103.

Question 1	A	B	C
You:	480 points	540 points	480 points
Other1:	80 points	280 points	480 points
Question 2	A	B	C
You:	560 points	500 points	500 points
Other1:	300 points	500 points	100 points
Question 3	A	B	C
You:	520 points	520 points	580 points
Other1:	520 points	120 points	320 points
Question 4	A	B	C
You:	500 points	560 points	490 points
Other1:	100 points	300 points	490 points
Question 5	A	B	C
You:	560 points	500 points	490 points
Other1:	300 points	500 points	90 points
Question 6	A	B	C
You:	500 points	500 points	570 points
Other1:	500 points	100 points	300 points
Question 7	A	B	C
You:	510 points	560 points	510 points
Other1:	510 points	300 points	110 points
Question 8	A	B	C
You:	550 points	500 points	500 points
Other1:	300 points	100 points	500 points
Question 9	A	B	C
You:	480 points	490 points	540 points
Other1:	100 points	490 points	300 points

- The individualistic answers are: 1B, 2A, 3C, 4B, 5A, 6C, 7B, 8A and 9C.
- The prosocial answers are: 1C, 2B, 3A, 4C, 5B, 6A, 7A, 8C and 9B.
- The competitive answers are: 1A, 2C, 3B, 4A, 5C, 6B, 7C, 8B and 9A.
- Van Lange et al. classifies a subject according to the above labels if six or more items are selected in a similar fashion.

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