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1 **Digit ratio (2D:4D) and prosocial behavior in economic games: No direct**
2 **correlation**

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6
7 **ABSTRACT**

8 Prenatal exposure to hormones, and to sex hormones in particular, exerts organizational
9 effects on the brain and these have observable behavioral correlates in adult life. There
10 are reasons to expect that social behaviors—which are fundamental for the evolutionary
11 success of humans—might be related to biological factors such as prenatal sex hormone
12 exposure. Nevertheless, the existing literature is inconclusive as to whether and how
13 prenatal exposure to testosterone and estrogen, proxied by the second-to-fourth digit
14 ratio (2D:4D), may predict non-selfish behavior. Here, we investigate this question
15 using economic experiments with real monetary stakes and analyzing five different
16 dimensions of social behavior in a comparatively large sample of Caucasian participants
17 ($n=560$). For both males and females, our results show no robust association between
18 right- or left-hand 2D:4D and generosity, bargaining, or trust-related behaviors. We
19 conclude therefore that there is no correlation between 2D:4D and social behavior in
20 economic games.

21
22 **INTRODUCTION**

23 Human social behavior captivates researchers from many different disciplines, both in
24 the natural and the social sciences (Axelrod and Hamilton, 1981; Fehr and Fischbacher,
25 2003; Nowak, 2006). One of the key features of human social architecture is that
26 institutions are often built upon the sporadic cooperation of thousands, sometimes
27 millions, unrelated individuals, and this stands as an evolutionary puzzle: How could
28 behaviors that help others have evolved if they provide a fitness advantage to the
29 recipient(s) over the actor?

30 Humans display a large set of different manifestations of social behavior including
31 generosity, competition, fairness, trust, and reciprocity to name a few. Each of them
32 seems to have its own particularities and bio-psychological underpinnings (Fehr and
33 Fischbacher, 2003; Ebstein et al., 2010; Corgnet et al., 2016; Espín et al., 2016a).
34 However, while our species shows distinctive behavioral patterns in the social domain
35 compared to other taxa, there is also large individual heterogeneity. Even though we
36 know that one part of the variation emanates from cultural differences (Henrich et al
37 2005, 2010; Herrmann et al., 2008), considerable heterogeneity still emerges within
38 cultural groups. The objective of this study is to analyze the biological roots of such
39 individual differences.

40 Given the relevance of social skills and associated behaviors for the evolutionary
41 success of humans, one source of variation might indeed be biological. In fact, many

42 studies—without relying on any particular biological trait—suggest that social behavior
43 is heritable or genetically determined to some extent (Wallace et al., 2007; Cesarini et
44 al., 2008, 2009; Ebstein et al., 2010). Along these lines, different biological and genetic
45 factors at certain times of development might generate predispositions towards different
46 social behaviors (Van Lange et al., 1997; Wingfield et al., 1998; Repetti et al., 2002;
47 Fries et al., 2005). One of such factors may be associated with the amount of hormones
48 individuals are exposed to during prenatal development (Knickmeyer et al., 2005;
49 Auyeung et al., 2009; Berenbaum and Beltz, 2011). Fetal exposure to hormones such as
50 androgens and cortisol is known to exert organizational effects on the human body and
51 brain which may, in turn, influence behavior later in life (Baron-Cohen et al.; 2005;
52 Cohen-Bedeha et al., 2005; Davis and Sandman, 2010; Lombardo et al., 2012). Since
53 hormonal levels are under strong genetic influence (Harris et al., 1998; Bartels et al.,
54 2003), this may represent one possible channel for the intergenerational transmission of
55 behavior.

56 With regards to social behavior, sex hormones, and androgens in particular, have
57 attracted considerable attention and there is now a plethora of studies on the behavioral
58 correlates of circulating (either endogenous or administered) testosterone levels
59 (Burnham, 2007; Zak et al., 2009; Zethraeus et al., 2009; Bos et al., 2010; Eisenegger et
60 al. 2010, 2011; van Honk et al., 2012).

61 In this paper, rather than circulating hormones, we focus on the organizational effects of
62 prenatal exposure to testosterone. More specifically, we explore the relationship
63 between fetal testosterone exposure and social behavior in economic experiments.
64 Previous studies have typically used the second-to-fourth digit ratio (2D:4D) as a
65 putative marker of prenatal exposure to testosterone or, more precisely, of the relative
66 exposure to testosterone compared to estradiol while in uterus (Lutchmaya et al., 2004).
67 We also stick to this measure. Although direct evidence for the 2D:4D-fetal sex
68 hormones link only exists for mice (Zheng and Cohn, 2011), rats (Talarovičová et al.,
69 2009; Auger et al. 2013), and birds (Romano et al., 2005), there exists large indirect
70 evidence and the ratio is commonly accepted as a proxy of fetal hormone exposure
71 (also) in humans. 2D:4D is calculated such that lower ratios correspond to higher
72 exposure to testosterone and lower exposure to estrogen. Consequently, males tend to
73 display lower 2D:4D values than females (Manning, 2002). Many studies have analyzed
74 the association between 2D:4D and diverse aspects of social involvement, ranging from
75 status seeking (Manning and Fink, 2008) to positioning in social networks (Kovářík et
76 al., 2017). Others have linked 2D:4D with certain diseases associated to decreased
77 social skills, such as autism (see e.g. Al-Zaid et al. 2015 and Manning et al. 2001).

78 Regarding the economic games designed to elicit (pro)social preferences, the literature
79 has been inconclusive as to whether and how 2D:4D predicts subjects' social behavior.
80 Some studies report negative effects of fetal testosterone on behaviors such as
81 generosity, cooperation, or trust (Cecchi and Duchoslav, 2018; de Neys et al., 2013),
82 whereas others indicate positive effects on fair or normative behaviors (Millet and
83 Dewitte, 2006, 2009; Van den Bergh and Dewitte, 2006; Ronay and Galinsky, 2011;
84 Buser, 2012). Null and non-linear relationships have also been frequently reported
85 (Miller and Dewitte, 2009; Sanchez-Pages and Turiegano, 2010, 2013; Brañas-Garza et
86 al., 2013; Galizzi and Nieboer, 2015; Parslow et al. 2018). Moreover, other studies find

87 2D:4D-context interactive effects where situational cues change the relationship
88 between 2D:4D and social behavior. For example, Van den Berg and Dewitte (2006)
89 observe that lower 2D:4D either increases or decreases rejection rates in the UG
90 depending on whether subjects are in a neutral or sex-related context, respectively,
91 whereas Millet and Dewitte (2009) detect either a negative or positive association
92 between 2D:4D and giving in DGs, depending on whether participants are primed with
93 cues of aggression or not.

94 In sum, the existing evidence provides no specific hypothesis regarding the how 2D:4D
95 organizes prosocial behavior. It is worth noting that some of these papers are based on
96 hypothetical decisions with no monetary consequences.

97 Three features of this study distinguish it from previous research. First, we use a
98 (comparatively) large sample size that permits for high statistical power. Our sample
99 consists of a total of 560 Caucasian individuals (330 women). This means that we will
100 be able to find a small effect size (specifically, $r = 0.12$) with 80% power and $\alpha = 0.05$.
101 Among the existing economic experiments similar to ours, which effectively measure
102 the participants' fingers length rather than relying on self-reports, the largest Caucasian
103 sample is that in Galizzi and Nieboer (2015) with a total of 201 Caucasians within an
104 ethnically diverse sample of 602 individuals. More recently, Parslow et al. (2018) study
105 a sample of 330 women, but they do not report the ethnicity.

106 Second, we elicit five dimensions of social behavior using three economic games. All
107 our participants decided, in random order, as Dictators in the Dictator Game (Forsythe
108 et al., 1994), as both Proposers and Responders in the Ultimatum Game (Güth et al.,
109 1982), and as both Trustors and Trustees in the Trust Game (Berg et al., 1995; see
110 Methods). For each subject, we thus gathered measures in the domains of generosity
111 (Dictator Game), bargaining (Ultimatum Game) and trust and reciprocity (Trust Game).

112 Finally, our dataset allows us to control for a number of potential confounding factors,
113 such as, for instance, cognitive reflection (Bosch-Domènech et al., 2014; Cueva et al.,
114 2016) or risk preferences (Brañas-Garza and Rustichini, 2011; Brañas-Garza et al.,
115 2018).

116

117 METHODS

118 *Participants and general protocol*

119 In October 2011, all the first-year students ($n=927$) at the School of Economics of the
120 University of Granada (Spain) were invited to participate in a survey/experiment at the
121 EGEO Experimental Economics Lab. Participation was voluntary and the number of
122 participants ended up being 659 (71% of the population), distributed in 27 sessions.
123 Students were officially invited to visit the lab by the Dean of the School so that the
124 original objective was *not* to earn money but to visit the lab, reducing potential self-
125 selection issues with participants of laboratory economic experiments (Abeler and
126 Nosenzo, 2015). We consider the participation rate of 71% very high. Once seated in
127 their respective cubicles (which impeded visual contact between them), the students
128 were invited to complete a survey and to play a variety of experimental games using a

129 computer interface. None of those who showed up in the lab refused to participate. In
130 the analysis below, we exclude from the sample individuals with missing values in any
131 of the variables applied in this paper. To ensure ethnic homogeneity (Manning et al.,
132 2007), non-Caucasian subjects were also excluded. The resulting sample size is 560
133 Caucasian subjects (230 males; age: mean \pm SD = 17.97 \pm 1.82).

134 In each session, the participants were first asked to fill the socio-demographic and
135 personality characteristics section, including self-reported measures of life satisfaction,
136 self-esteem, risk preferences, and trust in others. In addition, the survey contained a
137 math test with four simple questions. After the survey, the subjects were explained in
138 detail all the economic games they would face and then played all the games in a
139 random order (24 different orders). Once finished with the computerized part, the
140 subjects participated in a paper-and-pencil version of the Cognitive Reflection Test
141 (Frederick, 2005). No time pressure was imposed in any of the stages. In what follows,
142 we explain in detail the elicitation and the structure of our three main variable types.

143 *2D:4D measurement*

144 At the end of each session, the participants were scanned their both hands using a high-
145 resolution scanner (Canon Slide 90). The lengths of the index and ring fingers were
146 measured from the scanned images as the distance from the middle of the basal crease
147 to the tip of the finger using Photoshop (see Neyse and Brañas-Garza, 2014). Computer-
148 assisted measurements of 2D:4D from scanned pictures have been found to be more
149 precise and reliable than measurements using other methods (Allaway et al., 2009;
150 Kemper and Schwerdtfeger, 2009). The 2D:4D of each hand was measured twice at an
151 interval of one month by the same experienced researcher (not involved in this paper).
152 These measurements displayed a high repeatability (right hand: intraclass correlation
153 coefficient (ICC) = 0.9566, $p < 0.001$, left hand: ICC = 0.9440, $p < 0.001$) and were
154 averaged to obtain a single value of the 2D:4D ratio for each hand. As expected, the
155 left-hand and right-hand 2D:4Ds were correlated within individuals ($r = 0.67$, $p = 0.000$
156 for males; $r = 0.71$, $p = 0.000$ for females; Pearson correlation) and males displayed lower
157 2D:4D than females (right hand means: $2D:4D_M = 0.960$, $2D:4D_F = 0.972$, $p = 0.000$; left
158 hand means: $2D:4D_M = 0.965$, $2D:4D_F = 0.976$, $p = 0.000$; t-test).

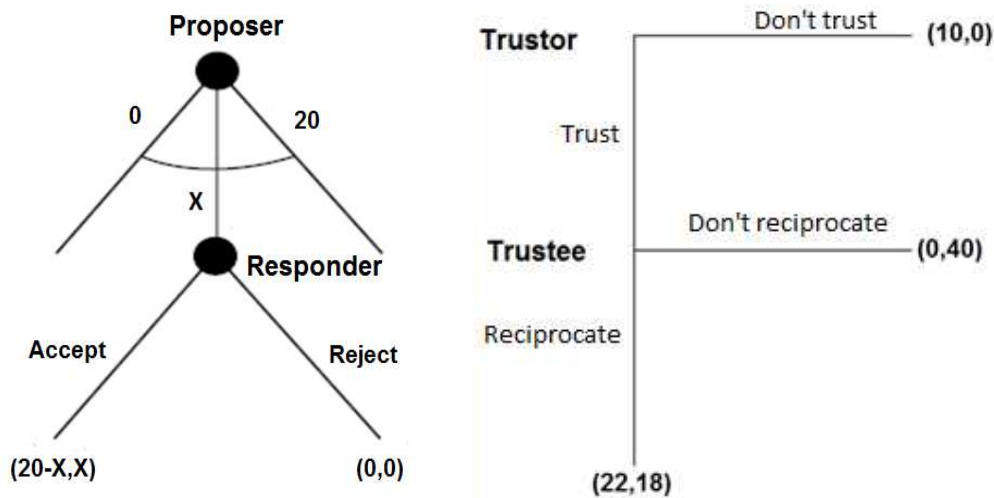
159 *Social behavior measurement - Economic games*

160 Our experiment consists of three canonical two-person games: the Dictator Game (DG,
161 henceforth), the Ultimatum Game (UG), and the Trust Game (TG). The games were
162 faced by each participant in random order and all participants played both roles in each
163 game. For each decision, participants would be matched with a different anonymous
164 individual selected at random among the other participants.

165 In the DG, one player, the Dictator, had to propose a division of €20 between herself
166 and another anonymous participant, the Receiver, who could not but accept the
167 proposed division. In our experiment, subjects were only allowed to propose the split in
168 €2 increments. Below, we employ the amount of money donated to the other participant
169 (*DG offer*) as a measure of generosity. Even though no subject played the role of the
170 Receiver for obvious reasons, they could actually have been paid for this role if selected
171 to make sure that Dictators' decisions affect others.

172 In the UG (Güth et al., 1982; see Figure 1), one player, the Proposer, had to propose a
 173 division of €20 between herself and another anonymous participant, the Responder,
 174 who—in contrast to the DG—could either accept or reject the proposal. If the latter
 175 accepted, the proposed division was implemented; in case of rejection, neither
 176 participant earned anything. Each subject participated in both roles. The *offer* made to
 177 the Responder will be our measure of Proposers' bargaining behavior. For the role of
 178 Responder, we used the strategy method: each subject had to state her willingness to
 179 accept or reject each of the possible proposals without knowing the offer of the
 180 Proposer. Below, we employ the minimum acceptable offer (*mao*, thereafter)—the
 181 minimum amount of money that a subject would accept—as our measure of
 182 Responders' behavior. Such approach is common in the literature and the *mao* is
 183 typically interpreted as indicative for the Responder's willingness to punish the
 184 Proposer at a personal cost (e.g. Fehr and Fischbacher, 2003; Henrich et al., 2005;
 185 Brañas-Garza et al., 2006, Burnham 2007; Brañas-Garza et al., 2014).

186 **Figure 1. Ultimatum (left) and Trust (right) Games in strategic form implemented**
 187 **in our study.** The figure shows the payments (in €) associated to each of the possible
 188 outcomes for the Proposer (Trustor) and Responder (Trustee) in the Ultimatum (Trust)
 189 Game. The Dictator Game only differs from the Ultimatum Game in that the rejection
 190 option does not exist in the second stage and the payoffs consequently are (20-X,X).
 191



192

193

194 As for the TG, we employ a binary version of the game (Ermisch et al., 2009) and again
 195 resort to the strategy method. More precisely, one player, the Trustor, had to decide
 196 whether to pass €10 or €0 to the Trustee. If she passed €0, the Trustor earned €10 and
 197 the Trustee nothing; if she rather passed €10 (i.e., the Trustor trusted the Trustee), the
 198 latter would receive $4 \times €10 = €40$. In such a case, the Trustee had to decide whether to
 199 either send back €22 and keep €18 for herself (that is, being trustworthy) or keep all €40
 200 without sending anything back, in which case the Trustor would not earn anything. The
 201 Trustor's decision thus measures trust, whereas the Trustee's decision measures positive
 202 reciprocity. Figure 1 displays the extensive form of the TG implemented. In the analysis
 203 below, $TG\ trust=1$ if the participant chose to pass the money to the Trustee and 0

204 otherwise. Similarly, $TG\ reciprocity=1$ if as a Trustee the participant chose to return the
205 money to the Trustor and 0 otherwise.

206 Decisions were not hypothetical. Participants' payoffs were computed according to their
207 decisions in the games and/or those of a randomly matched participant. The identity of
208 the other player remained anonymous. One of every ten participants was randomly
209 selected to be paid, and the final payoff was determined by a randomly selected role.
210 The average earnings of those selected for payment, including those winning €0
211 (11.43%), were €10.43.

212

213 *Additional variables*

214 As noted before, we administered all participants a survey eliciting a large amount of
215 information (including *gender, age, household income, math skills, and social capital*).
216 Besides we also include questions on life satisfaction, cognitive abilities and risk
217 attitudes.

218 We measured participants' subjective well-being through the *life satisfaction* question
219 (Zilioli et al., 2015; Espín et al., 2016b): “*In a scale from 1 to 7, where 1 means*
220 *‘completely unsatisfied’ and 7 means ‘completely satisfied’, in general, how satisfied*
221 *are you with your life?’”.*

222 In addition, we also control for two measures of cognitive functioning. The first one is
223 given by the number of correct responses in a simple *math* skills test (from 0 to 4). The
224 second one measures the participants' tendency to *reflect* on their first intuition (i.e.,
225 their cognitive style, intuitive vs. reflective) and is given by the number of correct
226 answers (from 0 to 3) in the Cognitive Reflection Test (Frederick, 2005). Cognitive
227 skills and cognitive styles have been previously related to both social behaviors (Burks
228 et al. 2009; Corgnet et al., 2015, 2016; Al-Ubaydli et al., 2016; Cabrales et al., 2017;
229 Capraro et al., 2017) and 2D:4D (Brañas-Garza and Rustichini, 2011; Bosch-Domènech
230 et al., 2014; Cueva et al., 2017) and thus represent potential confounding factors.

231 Finally, our battery of controls includes three measures for participants' *risk attitudes*
232 obtained from a series of binary decisions involving (hypothetical) monetary lotteries.
233 Risk attitudes may correlate with both social behavior (Bohnet and Zeckhauser, 2004;
234 Corgnet et al., 2016) and 2D:4D (e.g. Brañas-Garza and Rustichini, 2011; Brañas-Garza
235 et al., 2018).

236 *Econometric analysis*

237 We first run a series of regression models. Our five social behavior measures (*DG offer,*
238 *UG offer, UG mao, TG trust, and TG reciprocity*) are regressed on 2D:4D and 2D:4D-
239 squared (*2D:4D-sq*). Additionally, since 2D:4D is sexually dimorphic, the relation
240 between 2D:4D and behavioral traits is often gender-specific (Auyeung et al., 2009;
241 Brañas-Garza and Rustichini, 2011), the adherence to sharing rules may differ across
242 men and women (Croson and Gneezy, 2009; Espinosa and Kovářik, 2015), and
243 testosterone affects men and women asymmetrically (Zethraeus et al., 2009; Eisenegger
244 et al., 2010), we use a male dummy to control for gender and the interaction between
245 gender and either 2D:4D or 2D:4D-squared. The regressions are conducted both with

246 and without other control variables and for both the left- and right-hand 2D:4D. The
247 control variables are *order effects*, *age*, *income*, *life satisfaction*, *social capital*, *math*,
248 *reflection*, and *risk attitudes*. We use OLS regressions for *DG offer*, *UG offer*, and *UG*
249 *mao*, and logistic regressions for *TG trust* and *TG reciprocity*.

250 The analysis was performed using Stata/SE 15.1 (StataCorp).

251 *Ethics Statement*

252 All participants were informed about the content of the experiment before they
253 participated and provided written consent. Besides, their anonymity was always
254 preserved (in agreement with the Spanish Law 15/1999 for Personal Data Protection) by
255 assigning them a random numerical code, which would identify them in the system. No
256 association was ever made between their real names and the results. As it is standard in
257 socio-economic experiments, no ethic concerns are involved other than preserving the
258 anonymity of participants. This procedure was checked and approved by the Vice dean
259 of Research of the School of Economics of the University of Granada, the institution
260 hosting the experiment.

261

262 RESULTS

263 Tables 1 – 5 report the estimates of a series of models in which we regress the behavior
264 in a particular role in a particular game on all the combinations of 2D:4D, 2D:4D-
265 squared, and a gender dummy (including interactions of the two former measures with
266 the latter). The models are conducted both with and without control variables and for
267 the left and right hands separately.

268

269 This exercise provides a clear message: 2D:4D is not systematically related to the
270 subjects' behavior in any economic game under scrutiny. Independently of the
271 dependent variable and the model specification, in a total of 40 regressions, there does
272 not appear to be any single significant effect of 2D:4D at less than 5% level. The very
273 few effects which are significant at the 10% level disappear if we either include
274 additional control variables and/or adjust for multiple comparisons.

275

276 These findings reveal that 2D:4D is not systematically related to behavior in our data
277 and that the effects do not depend on gender. That is, the null results hold for both males
278 and females. Since the preformed multiple comparison procedures only corroborate the
279 null findings from Tables 1 - 5, we do not report them here.

280

281

282 DISCUSSION

283 This article contributes to the recent literature analyzing the link between prenatal
284 exposure to testosterone and estrogen, proxied by the second-to-fourth digit ratio
285 (2D:4D) and prosocial behavior in economic games. We investigate this question using
286 three canonical two-person games—the Dictator Game, the Ultimatum Game, and the
287 Trust Game—in the lab with real monetary incentives.

288 Our experimental set up thus comprises five different dimensions of social behavior:
289 generosity, bargaining, fairness, trust and reciprocity. Subjects faced games in rrandom

290 order. It is important to remark that our study uses a large sample of Caucasian
291 participants ($n=560$) with enough power to find a small effect size (specifically, $r =$
292 0.12) with 80% power and $\alpha = 0.05$.

293 For both males and females, our results show no robust association between right- or
294 left-hand 2D:4D and generosity, bargaining, or trust-related behaviors in any of the 40
295 regressions conducted. We conclude therefore that there is no direct correlation between
296 2D:4D and social behavior in economic games. These results are in line with the null
297 findings in a recent study by Parslow et al. (2018), who relate the Dictator Game giving
298 to 2D:4D in a sample of 330 Swedish women (exactly the same number of women as in
299 our sample).

300 How can we reconcile the differing findings in the literature analyzing the association
301 between 2D:4D and prosocial behavior? It has been argued more generally that—
302 similarly to its circulating counterpart (Mazur and Booth, 1998; Eisenegger et al.,
303 2011)—prenatal testosterone can be understood as a marker for social status (Millet,
304 2011). The evidence indeed suggests that the association between 2D:4D and other
305 traits is moderated by the context and its relation to status attainment. Low 2D:4D
306 (reflecting *high* testosterone exposure) robustly predicts aggressive or retaliation
307 behavior only if status is at stake or if aggression is provoked (Millet and Dewitte,
308 2007; Ronay and Galinsky, 2011), while many inconsistencies arise in neutral settings
309 (Millet, 2011; Ryckmans et al., 2015). Furthermore, it seems that this association is
310 more robust using real-life behaviors and outcomes, compared to hypothetical and lab
311 environments (see Millet and Buehler, 2018, for an extensive discussion and review of
312 the evidence). Similarly, Brañas-Garza et al. (2018) document a negative correlation
313 between risk taking and 2D:4D only if the elicitation of risk attitudes is incentivized—
314 and thus potentially relevant for status attainment—but not in a hypothetical task. Millet
315 and Buehler (2018) provide a direct test of the moderating effect of a status-related
316 framing and find strong evidence supporting this hypothesis. These examples are in line
317 with the status- or dominance-related interpretation of the 2D:4D-behavior linkage
318 (Millet, 2011). This interpretation brings the argument that fetal testosterone mainly
319 manifests itself through enhancing the sensitivity to its circulating counterpart,
320 supported by the observation that administered testosterone only affects low 2D:4D
321 individuals (Buskens et al., 2016; Chen et al., 2016; see also Millet and Buehler, 2018).
322 The role of circulating testosterone in status-related situations is widely documented
323 (e.g. Burnham, 2007; Zak et al., 2009; Eisenegger et al., 2011).

324 The above discussion might also explain the differing findings across studies analyzing
325 prosocial behavior: prosocial behavior might be affected by contextual variables
326 similarly and not controlling for the context might generate omitted-variable issues
327 (Millet, 2011). In our neutral setting without priming status, dominance, or any
328 competition but in which all tasks are incentivized, neither (pro)sociality nor selfishness
329 is *ex ante* status-enhancing and we may expect—and find—little relation between
330 2D:4D and behavior. This conclusion notwithstanding, these arguments clearly point to
331 the need of exploring potential interactions of 2D:4D with contextual factors in future
332 research.

333

Table 1. DG offer as a function of 2D:4D

RIGHT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	7.038*	5.717	-177.111	-121.709	3.197	1.927	-251.985	-216.667
	(0.056)	(0.120)	(0.208)	(0.387)	(0.462)	(0.664)	(0.143)	(0.202)
Male	0.070	0.005	0.058	-0.005	-9.046	-8.914	-37.451	-62.821
	(0.812)	(0.988)	(0.844)	(0.987)	(0.229)	(0.247)	(0.787)	(0.671)
2D:4D ²			94.754	65.543			130.738	111.933
			(0.189)	(0.364)			(0.138)	(0.199)
2D:4D *Male					9.449	9.248	65.609	118.630
					(0.220)	(0.240)	(0.818)	(0.697)
2D:4D ² *Male							-27.678	-55.411
							(0.850)	(0.723)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560
LEFT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	7.504*	5.784	-97.719	-145.191	1.579	0.294	-125.801	-185.837
	(0.084)	(0.166)	(0.642)	(0.497)	(0.759)	(0.953)	(0.622)	(0.472)
Male	0.062	-0.002	0.061	-0.006	-14.252	-13.185	16.890	0.940
	(0.833)	(0.995)	(0.835)	(0.986)	(0.106)	(0.139)	(0.931)	(0.996)
2D:4D ²			54.083	77.589			65.308	95.412
			(0.616)	(0.479)			(0.619)	(0.473)
2D:4D *Male					14.769	13.606	-50.361	-16.761
					(0.101)	(0.134)	(0.900)	(0.969)
2D:4D ² *Male							34.008	16.272
							(0.868)	(0.941)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

336 Estimates of OLS regressions (p-values). *** p<0.01, ** p<0.05, * p<0.1
337

Table 2. UG offer as a function of 2D:4D

RIGHT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	-0.795 (0.685)	-0.754 (0.706)	119.560 (0.103)	99.483 (0.1429)	-19.49 (0.448)	-1.417 (0.577)	66.154 (0.521)	48.608 (0.619)
Male	0.095 (0.529)	0.111 (0.531)	0.103 (0.496)	0.118 (0.503)	-2.643 (0.494)	-1.464 (0.701)	-59.721 (0.420)	-61.474 (0.397)
2D:4D ²			-61.929 (0.100)	-51.559 (0.138)			-34.891 (0.508)	-25.629 (0.607)
2D:4D *Male					2.838 (0.475)	1.633 (0.675)	121.941 (0.425)	126.595 (0.398)
2D:4D ² *Male							-62.049 (0.430)	-64.970 (0.399)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560
LEFT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	-1.016 (0.655)	-0.903 (0.703)	40.589 (0.652)	31.333 (0.742)	-3.306 (0.205)	-3.009 (0.244)	-45.680 (0.569)	-62.339 (0.492)
Male	0.094 (0.531)	0.110 (0.535)	0.094 (0.529)	0.111 (0.533)	-5.440 (0.251)	-4.965 (0.297)	-91.337 (0.357)	-99.727 (0.375)
2D:4D ²			-21.384 (0.643)	-16.570 (0.733)			21.725 (0.598)	30.412 (0.513)
2D:4D *Male					5.709 (0.240)	5.236 (0.281)	182.295 (0.370)	200.627 (0.387)
2D:4D ² *Male							-91.274 (0.384)	-100.610 (0.400)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

Estimates of OLS regressions (p-values). *** p<0.01, ** p<0.05, * p<0.1

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342 **Table 3. UG MAO as a function of 2D:4D**

RIGHT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	-0.525 (0.890)	-1.804 (0.621)	-104.860 (0.477)	-37.509 (0.792)	-1.910 (0.673)	-3.282 (0.455)	-79.306 (0.609)	-44.706 (0.775)
Male	-0.243 (0.367)	0.033 (0.908)	-0.250 (0.352)	0.030 (0.916)	-3.531 (0.647)	-3.480 (0.636)	54.744 (0.730)	11.729 (0.949)
2D:4D ²			53.686 (0.479)	18.366 (0.802)			31.678 (0.618)	21.218 (0.791)
2D:4D *Male					3.408 (0.670)	3.641 (0.633)	-118.279 (0.719)	-28.341 (0.930)
2D:4D ² *Male							63.439 (0.708)	16.785 (0.919)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

LEFT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	0.389 (0.920)	-1.110 (0.773)	-317.134* (0.075)	-185.407 (0.302)	2.419 (0.617)	0.730 (0.880)	-282.032 (0.197)	-166.678 (0.470)
Male	-0.231 (0.391)	0.043 (0.880)	-0.234 (0.384)	0.039 (0.891)	4.673 (0.551)	4.477 (0.554)	134.006 (0.851)	11.825 (0.949)
2D:4D ²			163.201* (0.076)	94.759 (0.306)			145.838 (0.195)	85.843 (0.470)
2D:4D *Male					-5.060 (0.531)	-4.575 (0.558)	-67.432 (0.857)	-20.782 (0.957)
2D:4D ² *Male							33.088 (0.864)	8.886 (0.964)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

343 Estimates of OLS regressions (p-values). *** p<0.01, ** p<0.05, * p<0.1

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345 **Table 4. TG trust as a function of 2D:4D**

RIGHT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	1.463 (0.594)	0.878 (0.760)	-38.939 (0.733)	-31.118 (0.782)	1.961 (0.573)	1.489 (0.679)	-55.377 (0.692)	-50.114 (0.721)
Male	0.287 (0.136)	0.124 (0.559)	0.284 (0.140)	0.122 (0.566)	1.544 (0.777)	1.662 (0.774)	-25.762 (0.827)	-32.615 (0.780)
2D:4D ²			20.799 (0.723)	16.465 (0.776)			29.405 (0.682)	26.431 (0.713)
2D:4D *Male					-1.304 (0.818)	-1.596 (0.790)	54.763 (0.821)	68.952 (0.774)
2D:4D ² *Male							-28.748 (0.818)	-36.259 (0.770)
Controls	no	yes	no	yes	no	yes	no	Yes
Observations	560	560	560	560	560	560	560	560
LEFT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	-1.627 (0.597)	-1.627 (0.597)	172.769 (0.160)	182.877 (0.147)	0.879 (0.818)	-0.011 (0.998)	295.392* (0.055)	292.150* (0.061)
Male	0.092 (0.665)	0.092 (0.665)	0.263 (0.173)	0.092 (0.666)	4.292 (0.464)	4.265 (0.494)	154.786 (0.233)	137.625 (0.320)
2D:4D ²			-89.122 (0.158)	-94.812 (0.143)			-151.029* (0.055)	-149.861* (0.061)
2D:4D *Male					-4.158 (0.491)	-4.307 (0.502)	-313.274 (0.241)	-278.120 (0.328)
2D:4D ² *Male							158.553 (0.248)	140.384 (0.336)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

346 Estimates of logistic regressions (p-values). *** p<0.01, ** p<0.05, * p<0.1

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Table 5. TG reciprocity as a function of 2D:4D

RIGHT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	1.093 (0.707)	1.696 (0.588)	-153.481 (0.220)	-178.953 (0.149)	-3.042 (0.416)	-2.541 (0.529)	-204.001 (0.218)	-253.79 (0.153)
Male	0.197 (0.355)	0.052 (0.828)	0.187 (0.378)	0.035 (0.884)	-10.587* (0.070)	-10.932* (0.072)	48.031 (0.705)	59.75 (0.663)
2D:4D ²			79.600 (0.216)	92.967 (0.146)			102.783 (0.224)	128.31 (0.156)
2D:4D *Male					11.204* (0.065)	11.417* (0.070)	-114.918 (0.661)	-141.70 (0.618)
2D:4D ² *Male							67.768 (0.616)	82.68 (0.574)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560
LEFT HAND								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2D:4D	2.105 (0.501)	2.182 (0.527)	-126.253 (0.459)	-156.532 (0.392)	-0.573 (0.881)	-0.893 (0.8349)	-292.803 (0.240)	-355.02 (0.180)
Male	0.206 (0.336)	0.055 (0.821)	0.206 (0.337)	0.054 (0.823)	-6.833 (0.287)	-8.055 (0.240)	-163.398 (0.321)	-193.79 (0.273)
2D:4D ²			66.049 (0.452)	81.692 (0.386)			141.745 (0.243)	181.472 (0.183)
2D:4D *Male					7.279 (0.273)	8.392 (0.237)	328.816 (0.332)	389.684 (0.285)
2D:4D ² *Male							-164.920 (0.344)	-195.48 (0.298)
Controls	no	yes	no	yes	no	yes	no	yes
Observations	560	560	560	560	560	560	560	560

349 Estimates of logistic regressions (p-values). *** p<0.01, ** p<0.05, * p<0.1

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