Games and Economic Behavior 76 (2012) 457–470

Contents lists available at SciVerse ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

Digit ratios, the menstrual cycle and social preferences

Thomas Buser

University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands

ARTICLE INFO

Article history:
Received 12 April 2011
Available online 25 July 2012

JEL classification:
A13
C91
D87

Keywords:
2D:4D
Menstrual cycle
Endocrinological economics
Trust
Altruism
Reciprocity
Lab experiment

ABSTRACT

We examine whether social preferences are partially determined by biological factors. We do this by investigating whether digit ratios (2D:4D) and menstrual cycle information are correlated with choices in ultimatum, trust, public good and dictator games. Digit ratios are thought to be a proxy for prenatal testosterone and oestrogen exposure and the menstrual cycle is a proxy for contemporary variations in a range of hormones. We find that digit ratios predict giving in all games. In our preferred specification, giving in the trust and public good games as well as reciprocity in the trust and ultimatum games vary significantly over the menstrual cycle. We discuss possible mechanisms behind these effects and conclude that biological factors play an important role in shaping social preferences.

1. Introduction

There is a large literature showing that levels of altruism, trust and reciprocity vary strongly across individuals. While we know that culture plays a role,[1] it is unclear whether nature too plays a part in forming these differences. In this paper, we analyse the correlation between behaviour in social preference games and physical proxies for biological factors. In particular, we use the second-to-fourth digit ratio, which is thought to be a marker for prenatal hormone exposure, and menstrual cycle information, which is a proxy for current fluctuations in a range of hormones and other biological processes. We argue that a significant correlation between these markers and economic choices in social situations would suggest that biological factors play a role in shaping social preferences.

The second-to-fourth digit length ratio (2D:4D), the ratio of the length of the index finger to the length of the ring finger, is established in utero and is frequently used as a proxy for prenatal exposure to testosterone and oestrogen which in turn is thought to have a crucial impact on brain development (Hines, 2011). The higher the exposure to testosterone and the lower the exposure to oestrogen, the longer the length of the ring finger relative to the index finger, which leads to a lower 2D:4D. The literature supporting these links is summarised in Section 2.1. Millet (2011) summarises the economic literature, which mainly emphasises 2D:4D as a proxy for the relative strength of prenatal testosterone exposure. This literature has

E-mail address: t.buser@uva.nl.
URL: http://buser.economists.nl.

[1] Oosterbeek et al. (2004), Henrich et al. (2001), Gächter et al. (2010), Herrmann et al. (2008).

0899-8256/$ – see front matter
http://dx.doi.org/10.1016/j.geb.2012.07.006

focused mainly on risk preferences, finding mixed results.[2] But there is a small number of studies looking at behaviour in social preference games, finding a negative correlation of 2D:4D with rejection rates in the ultimatum game in an all-male sample (van den Bergh and Dewitte, 2006) and a negative correlation with giving in the dictator game (Millet and Dewitte, 2006).[3] Sanchez-Pages and Turiegano (2010) find a non-monotonic effect of 2D:4D in a prisoner's dilemma whereby subjects with intermediary finger ratios are most likely to cooperate.

The menstrual cycle is characterised by predictable variations in the levels of a range of hormones, as well as other physiological mechanisms such as body temperature. These are described in detail in Section 2.2. While this is the first study looking at the correlation between the menstrual cycle and social preferences, a number of previous studies in economics have used the menstrual cycle as a proxy for hormonal fluctuations. Chen et al. (2009) and Pearson and Schipper (2012) find that bidding in first price auctions fluctuates over the cycle. Buser (2012) and Wozniak et al. (2010) find cycle effects for competitiveness, a trait which in turn has been found to be related to inequality aversion (Bartling et al., 2009).

A number of studies have also found links between specific hormones and social preferences. A series of placebo controlled studies demonstrates that oxytocin induces higher offers in the trust game (Kosfeld et al., 2005; Baumgartner et al., 2008) and increases generosity in the ultimatum game (Zak et al., 2007). Endogenous oxytocin, stimulated through massage and receiving money in a trust game, increases reciprocity (Morhenn et al., 2008). Burnham (2007) detects a positive correlation between current testosterone levels and rejections in the ultimatum game and Zak et al. (2009), in a placebo controlled study, find testosterone to cause both lower offers and more rejections in men. Conversely, Eisenegger et al. (2010) find that testosterone increases ultimatum offers in women. Randomly treating a sample of post-menopausal women with oestrogen and testosterone, Zethraeus et al. (2009), on the other hand, find no impact on altruism, trust or fairness.[4]

We conduct a laboratory experiment on social preferences and collect information on menstrual cycles, contraceptive use, and 2D:4D through a post-experimental questionnaire. This paper contributes to the literature in several ways. We are the first to investigate the correlation between 2D:4D and trust and positive reciprocity. Compared to previous investigations on 2D:4D and other social preferences, our study features a larger range of games and a much larger sample size. This study is also the first to investigate the impact of the menstrual cycle on social preferences, using a range of social preference games covering trust, altruism, and positive as well as negative reciprocity.

We find that digit ratios are strongly and significantly correlated with choices in the social preference games. Subjects with a lower digit ratio give less in all four games. We find at least some evidence that giving in the trust, public good and dictator games, and reciprocity in the trust and ultimatum games vary over the menstrual cycle. The results are most robust for giving and reciprocating in the trust game. These findings are consistent with the hypothesis that social preferences are partially biologically predetermined and are influenced by contemporary biological processes.

Section 2 gives details on our biological markers. Section 3 describes the data and Section 4 explains the experimental design. Section 5 describes the results and Section 6 discusses possible mechanisms. Section 7 concludes.

2. Biological markers

2.1. 2D:4D

The ratio of the length of the index finger to the length of the ring finger (2D:4D), which is established in utero, has been used extensively as a marker for the strength of prenatal hormone exposure (see Manning, 2002, for an introduction). Outside of economics, 2D:4D has been found to be correlated with many traits including reproductive success (Manning et al., 2000), sexual orientation (Robinson and Manning, 2000) and competitiveness in sports (Manning and Taylor, 2001).[5] 2D:4D is thought to be negatively correlated with testosterone exposure — the stronger the exposure, the shorter the index finger relative to the ring finger — and positively with oestrogen exposure in utero. It is reliably higher in women, at least in samples of white individuals. Some studies have also pointed towards a correlation between 2D:4D and current hormone concentrations in adults (Manning et al., 1998) but a meta study (Hönekopp et al., 2007) concludes that there is no significant link. However, lower 2D:4D has also been associated with higher sensitivity to the effects of testosterone

[2] See Dreber and Hoffman (2007), Apicella et al. (2008), Sapienza et al. (2009), Garbarino et al. (2011), Schipper (2011a), Branas-Garza and Rustichini (2011) and Coates et al. (2009). Also see Pearson and Schipper (2011) on bidding in auctions and Kastlunger et al. (2010) on tax compliance in a laboratory game, both of whom fail to find significant effects of 2D:4D.

[3] However, van den Bergh and Dewitte (2006) find that exposure to sexually stimulating photographs reverses the relationship between 2D:4D and rejections in the ultimatum game and Millet and Dewitte (2009) find that exposure to aggression cues reverses the relationship between 2D:4D and giving in the dictator game.

[4] A number of further studies have investigated the link between biological factors and social preferences using other approaches. Comparing the behaviour of monozygotic and dizygotic twins, a series of studies demonstrates that giving and reciprocity in the trust game (Cesarini et al., 2008), responder behaviour in the ultimatum game (Wallace et al., 2007), and generosity in the dictator game (Cesarini et al., 2009) are partly hereditary. Yet another strand of the literature has found links between specific genes and behaviour in the dictator game (Knafo et al., 2008; Israel et al., 2009). Finally, Buser (2010) finds significant correlations between handedness and choices in the trust, ultimatum, and dictator games.

[5] See Putz et al. (2004) for a summary of sexually dimorphic traits which have been found to correlate with 2D:4D. In a replication, the authors fail to reproduce most of them.