



## Why can't a woman bid more like a man?

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### ABSTRACT

We investigate gender differences and menstrual cycle effects in first-price and second-price sealed-bid auctions with independent private values in a laboratory setting. We find that women bid significantly higher and earn significantly less than men do in the first-price auction, while we find no evidence of a gender difference in bidding or earnings in the second-price auction. Focusing on the first-price auction, we find that, while the gender gap in bidding and earnings persists over the entire course of the menstrual cycle, bidding of contraceptive pill users follows a sine-like pattern throughout the menstrual cycle, with higher than average bidding in the follicular phase and lower than average bidding in the luteal phase. In comparison, pill non-users have a flat bidding profile throughout the cycle.

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### 1. Introduction

Gender differences in decision-making have long fascinated economists, psychologists and other social scientists. In a recent survey, [Croson and Gneezy \(2009\)](#) synthesize findings from studies of preference differences in both laboratory and field experiments in economics and psychology. Focusing on risk taking, social preferences and reaction to competition, their synthesis indicates that women are more risk averse than men, with a few caveats and exceptions. Furthermore, various studies find that women's preferences for competitive situations are lower than those of men ([Gneezy et al., 2003](#); [Gneezy and Rustichini, 2004](#); [Niederle and Vesterlund, 2007](#)). These experimental results are consistent with findings from survey data on gender differences in financial decision-making ([Jianakoplos and Bernasek, 1998](#)) and health behavior ([Hersch, 1996](#)).<sup>3</sup>

However, while both experimental and survey results point towards robust gender differences in various decision-making tasks, it is not clear how much of this difference is due to environmental versus biological differences. Economic research has traditionally focused on environmental causes, examining variations in observable demographics, educational

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<sup>3</sup> [Jianakoplos and Bernasek \(1998\)](#) examine household holdings of risky assets, and find that, as wealth increases, the proportion of wealth held in risky assets increases by a smaller amount for single women than for single men. In a related study, [Hersch \(1996\)](#) examines data from a large national survey and finds substantial differences by both gender and race in risky behavior such as smoking, seat belt use, preventive dental care, exercise and blood pressure monitoring. Overall, [Hersch](#) finds that women make safer choices than men.

and professional background. In contrast to this approach, we examine the effects of biological processes on behavior. In particular, the menstrual cycle has been documented to influence women's cognition (visual information processing, and memory) and mood (Richardson, 1992), suggesting that strategic decision-making may also be influenced by the menstrual cycle. This motivates us to investigate whether the menstrual cycle has an effect on women's bidding behavior.

The menstrual cycle is "one of the very few biological processes that exhibit a virtually complete dimorphism between male and female members of the human species" (Nyborg, 1983). Most women between the ages of 15 and 50 are regularly affected by the hormonal, physiological and psychological changes that are associated with the cyclical process of ovulation and menstruation (Richardson, 1992). This is also an age interval when many important life-changing decisions are made. Thus, whether these hormonal and physiological changes affect women's cognitive performance, strategic decision-making, or attitudes towards competition is an important yet open question.

In particular, if the menstrual cycle affects women's strategic decision-making behavior, then it might be beneficial for them to know how their decision-making systematically varies during the cycle, to better time key decisions. This might lead to better decisions in investments, negotiations and other competitive situations, which could improve women's earnings and social positions.

Despite the potential importance of the menstrual cycle for economic decision-making and market outcomes, economic research on this topic has so far been scant to our knowledge.<sup>4</sup> In a pioneering study, Chawla et al. (2002) measure lost productivity among women due to the pre-menstrual syndrome (PMS) using a sample of pre-menopausal Californian women. Similarly, Ichino and Moretti (2009) investigate absenteeism using an administrative dataset from a large Italian bank. They find that, below the age of 45, absenteeism of women follows a 28-day cycle, a pattern much more pronounced than that of men, whereas this gender difference is absent among older workers. They interpret this evidence as suggesting that, among pre-menopausal women, the menstrual cycle is a significant determinant of sick-day absenteeism, accounting for as much as one-third of the gender gap in days absent and more than two-thirds of the gender gap in the number of absences. Furthermore, the menstrual cycle can account for about one-seventh of the gender wage gap and the probability of promotion into a managerial position.<sup>5</sup>

While such estimates of menstrual cycle-related effects are interesting and important, field data do not provide sufficient information to infer the extent to which the *phases* of the menstrual cycle affect strategic decision-making or reactions in competitive situations. To address this issue, we use a laboratory experiment to examine gender difference and the menstrual cycle effects in bidding in first-price (FPA) and second-price (SPA) sealed-bid auctions. Theoretically, in the FPA, the Bayesian Nash equilibrium is sensitive to bidder risk preferences, while in the SPA, bidding one's true value is a weakly dominant strategy regardless of bidder risk preferences. Thus, these two auction formats provide two distinct competitive situations in which to study gender differences and menstrual cycle effects on decision-making and resulting market outcomes.

This experiment yields three significant findings. First, we find that women bid significantly higher and earn significantly less than men do in the FPA, while we find no evidence of a gender difference in bidding or earnings in the SPA. Our second finding relates to menstrual cycle effects in the FPA. Specifically, we find that, pooling across all women, women in all phases of their cycle bid significantly higher and earn significantly less than men do. Our third finding further distinguishes the impact of the menstrual cycle between contraceptive pill users and non-users. Pill users display a sine-like bidding pattern throughout the cycle, with higher than average bids in the follicular phase and lower than average bids in the luteal phase. They bid significantly higher than men do only in the follicular phase. We obtain analogous results with a reversed sign for earnings. Pill non-users, on the other hand, have a flat bidding profile throughout the cycle. When pooling across all phases of the cycle, they bid more and earn less than men do. In addition, the results are robust to controlling for treatment differences, a set of demographic variables, a set of academic major indicators and, in relevant specifications, also a set of risk aversion indicators.

Our paper thus presents the first experimental study in economics on how the menstrual cycle affects economic decision-making and market outcomes. We provide evidence of a systematic variation in bidding behavior in the FPA among contraceptive pill users depending on the phase of the cycle. While the behavioral endocrinology literature has examined the relation between menstrual cycles and cognition, it has not examined the domain of auctions or other competitive tasks. Thus, this paper contributes to the general literature on menstrual cycles and cognition by opening up a new and important domain of investigation. Results in this new domain can provide insights for economic policymakers.<sup>6</sup>

We are aware of three related studies that examine the effects of demographics in auctions. First, in an experimental study of the English, Vickrey and the Becker–DeGroot–Marschak (1964) mechanisms in auctions of a box of gourmet chocolate truffles using home-grown values, Rutstrom (1998) finds both gender and race differences in bidding. In another study,

<sup>4</sup> Menstrual cycle research in medicine and psychology has found that most menstruating women tend to "experience a variety of physical, psychological and behavioral changes during the period between ovulation and menstruation" (Richardson, 1992). Researchers have studied the effects of the cycle on such characteristics as spatial ability (Hampson and Kimura, 1992), visual information processing, memory, and mood. However, none of the tasks involves economic decision-making.

<sup>5</sup> Herrmann and Rockoff (2012) argue, though, that this evidence is not robust to a correction of coding errors or small changes in specification, and they find no evidence of increased female absenteeism on 28-day cycles in data on school teachers.

<sup>6</sup> Since our 2005 working paper was posted, others have looked at correlations between menstrual cycle and women's behavior in economic environments, such as selection into tournaments (Wozniak et al., 2010; Buser, 2012a) and social preferences (Buser, 2012b).

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