



# University of Essex

Department of Economics

## Discussion Paper Series

No. 672 February 2009

### Gender Differences in Risk Behaviour: Does Nurture Matter?

Alison L. Booth and Patrick Nolen

Note : The Discussion Papers in this series are prepared by members of the Department of Economics, University of Essex, for private circulation to interested readers. They often represent preliminary reports on work in progress and should therefore be neither quoted nor referred to in published work without the written consent of the author.

# Gender Differences in Risk Behaviour: Does Nurture Matter?\*

Alison L. Booth

Economics Program

Australian National University

ACT 0200 Australia

Patrick Nolen

Economics Department

University of Essex

CO4 3SQ, UK

February 5, 2009

Women and men may differ in their propensity to choose a risky outcome because of innate preferences or because pressure to conform to gender-stereotypes encourages girls and boys to modify their innate preferences. Single-sex environments are likely to modify students' risk-taking preferences in economically important ways. To test this, we designed a controlled experiment in which subjects were given an opportunity to choose a risky outcome - a real-stakes gamble with a higher expected monetary value than the alternative outcome with a certain payoff - and in which the sensitivity of observed risk choices to environmental factors could be explored. The results of our real-stakes gamble show that gender differences in preferences for risk-taking are indeed sensitive to whether the girl attends a single-sex or coed school. Girls from single-sex schools are as likely to choose the real-stakes gamble as boys from either coed or single sex schools, and more likely than coed girls. Moreover, we found that gender differences in preferences for risk-taking are sensitive to the gender mix of the experimental group, with girls being more likely to choose risky outcomes when assigned to all-girl groups. This suggests that observed gender differences in behaviour under uncertainty found in previous studies might reflect social learning rather than inherent gender traits.

**JEL Classification:** C9, C91, C92, J16

**Keywords:** gender, controlled experiment, risk aversion, risk attitudes, single-sex schooling, coeducation, identity

\*We are grateful to the students who participated in the experiment and to their teachers who facilitated this. For financial support we thank the Australian Research Council, the British Academy, the Department of Economics at the University of Essex, and the Nuffield Foundation.

# I. INTRODUCTION

It is well-known that women are under-represented in high-paying jobs and in high-level occupations. Recent work in experimental economics has examined to what degree this under-representation may be due to innate differences between men and women. For example, gender differences in risk aversion, feedback preferences or fondness for competition may help explain some of the observed gender disparities. If the majority of remuneration in high-paying jobs is tied to bonuses based on a company's performance, then, if men are less risk averse than women, women may choose not to take high-paying jobs because of the uncertainty. Differences in risk attitudes may even affect individual choices about seeking performance feedback or entering a competitive environment.

Understanding whether and to what extent risk attitudes are innate or shaped by one's environment is important for policy. If risk attitudes are innate then the under-representation of women in high-paying jobs may only be solved by changing the way in which remuneration is rewarded. However, if risk attitudes are primarily shaped by one's environment than changing the context in which one is educated, or trained in sports could help address the under-representation. Thus the policy prescription for dealing with under-representation of women in high-paying jobs will depend upon if the reason for the absence is innate to one's gender.

Why women and men might have different preferences or risk attitudes has been discussed but not tested by economists. Broadly speaking, those differences may be due to either nurture, nature or some combination of the two. For example, boys are pushed to take risks when participating in competitive sports and girls are often encouraged to remain cautious. Thus, the riskier choices made by males could be due to the nurturing received from parents or peers. Likewise the disinclination of women to take risks could be the result of parental or peer pressure not to do so.

With the exception of Gneezy, Leonard and List (2008) and Gneezy and Rustichini (2004), the experimental literature on competitive behaviour has been conducted with college-age men and women attending coeducational universities. And yet the education literature shows that the academic achievement of girls and boys responds differentially to coeducation, with boys typically performing better and girls worse than in single-sex environments (Kessler et al., 1985; Brutsaert, 1999). Moreover, psychologists argue that the gendered aspect of individuals' behaviour is brought into play by the gender of others with whom they interact (Maccoby, 1998, and references therein.) In this paper we sample a different subject pool to that normally used in the literature to investigate the role that nurturing might play in shaping one particularly important facet underlying competitive behaviour – risk attitudes.

We use students from years 10 and 11 who are attending either single-sex or coeducational schools. We will examine the effect of three potential types of nurturing on risk attitudes – educational environment, household characteristics, and randomly assigned experimental peer-groups. The first two represent longer-run nurturing experiences, while the last – the experimental group – captures short-run environmental effects. Finally, we will compare the results of our experiment with survey information – stated attitudes to risk obtained from a post-experiment questionnaire – to examine if reported and observed levels of risk aversion differ.

A number of studies have looked at parental influences and intergenerational transmission of risk attitudes (see Dohmen et al., 2006, and references therein) and an important paper by Gneezy, Leonard and List (2008) explores the role that culture plays in determining gender differences in competitive behaviour. Gneezy et al. investigate two distinct societies – the Maasai tribe of Tanzania and the Khasi tribe in India. The former are patriarchal while the latter are matrilineal. They find that, in the patriarchal society, women are less competitive than men, which is consistent with experimental data from Western cultures. But in the matrilineal society, women are more competitive than men. Indeed, the Khasi women were found to be as competitive as Maasai men.<sup>1</sup> The authors interpret this as evidence that culture has an influence.<sup>2</sup> We too use a controlled experiment to see if there are gender differences in the behaviour of subjects from two distinct environments or “cultures.” But our environments – publicly-funded single-sex and coeducational schools – are closer to one another than those in Gneezy et al (2008) and it seems unlikely that there is much evolutionary distance between subjects from our two separate environments.<sup>3</sup> Any observed gender differences in behaviour across these two distinct environments is unlikely to be due to nature but more likely to be due to the nurturing received from parents, teachers or peers, or to some combination of these three.

Women are observed to be on average more risk averse than men, according to the studies summarized in Eckel and Grossman (2002).<sup>4</sup> This could be through inherited attributes or

1. The experimental task was to toss a tennis ball into a bucket that was placed 3 metres away. A successful shot meant that the tennis ball entered the bucket and stayed there.

2. Interestingly the authors find no evidence that, on average, there are gender differences in risk attitudes within either society.

3. We use subjects from two adjacent counties in south-east England, Essex and Suffolk. One would be hard-pressed to argue that Essex girls and boys evolved differently from Suffolk girls and boys, popular jokes about "Essex man" notwithstanding. Gneezy et al. (2008) note: "Evolutionary psychologists maintain that the human mind was formed by one million years of common evolution that ended only 12,000 years ago, and it is therefore impossible that systematic psychological differences across populations of humans can be caused by evolution (Daly and Wilson, 2003, Campbell, 2002)."

4. However some experimental studies find the reverse. For example, Schubert et al. (1999) using as subjects undergraduates from the University of Zurich, show that the context makes a difference. While women do not generally make less risky financial choices than men, they are less likely to engage in an

nurture. The available empirical evidence suggests that parental attributes shape these risk attitudes. For instance Dohmen et al. (2006) find, using the German Socioeconomic Panel, that individuals with highly educated parents are significantly more likely to choose risky outcomes. When looking at the role of peer groups on individuals, we potentially face an endogeneity issue. If individuals choose the peer groups with whom they associate, they might sort themselves into groups with similar or opposite characteristics. That is, individuals might positively or negatively assortatively match on risk attitudes. Peer-group endogeneity would seem particularly likely if the group under consideration comprised friends. But fortunately, we have available information on peer groups that is exogenous to the individual: attendance at publicly-funded single-sex or coeducational schools. If girls are on average more risk averse than boys, as empirical evidence suggests, will girls who are surrounded by risk-averse individuals (girls) at school behave in a more risk averse way than girls who are surrounded by less risk averse individuals (boys)? That is, will girls from single-sex schools exhibit less risk aversion than girls from coeducational schools?

The characteristics of a child's household – such as the number of siblings, gender make-up of siblings, or parental education – are also likely to be exogenous to the child. Thus in looking at how the propensity to make risky choices varies with household characteristics, we are able to see how a student's home environment may influence risk attitudes. If a girl grows up with sisters, will she be any less risk averse than a girl who grows up with brothers? The work of Dohmen et al. (2006) would suggest that, at the least, parental education should relate to children's risk aversion.

Our third potential nurturing environment is the randomly assigned experimental peer-group. On arriving at the experiment, students were randomly assigned to three different groups: all-girls; all-boys; or mixed gender. Just as educational and household environments may affect individual subjects' choices, so too might the experimental peer-group. Girls in an all-girl group may feel more comfortable taking a risk for instance. Given that the peer-group was randomly assigned, there are no issues of endogeneity. We will test if the experimental environment has a separate influence on girls' and boys' behaviour under uncertainty. We are particularly interested in seeing if girls and boys who are placed in a same-sex group for the experiment behave differently to girls and boys placed in a mixed group. While this has been explored in previous work by Gneezy et. al. (2003), Niederle and Yestrumskas (2007) and Datta Gupta et. al. (2005), those studies all use students from coeducational environments and the studies did not look at the effect on risk attitudes.

Our final goal is to use the controlled experiment to see if commonly asked survey questions about risk yield the same conclusions about gender and risk-aversion to those based abstract gamble.

on an experiment. During the experiment, our subjects can choose to make risky choices with real money at stake. At the end of the experiment, they answer questions about their risk-attitudes as well as respond to a hypothetical lottery question.<sup>5</sup> We are therefore able to compare actual behaviour with stated attitudes. This allows us to investigate (i) if girls and boys *behave* differently when there is actual money at stake; (ii) if girls and boys differ significantly in their *stated* attitudes to risk;<sup>6</sup> (iii) if there are significant gender differences in the distance between actual choices made under uncertainty and stated behaviour under uncertainty; and (iv) if the general risk question is sufficient to describe actual risk-taking behaviour. In so doing, we explore the degree to which observed gender differences in choices under uncertainty and stated risk attitudes vary across subjects who have been exposed to single-sex or coeducational schooling. Furthermore we are able to provide a comparison of results from a controlled experiment to commonly asked survey questions.

## II. HYPOTHESES

Women and men may differ in their propensity to choose a risky outcome because of innate preferences or because pressure to conform to gender-stereotypes encourages girls and boys to modify their innate preferences. Our prior is that single-sex environments are likely to modify students' risk-taking preferences in ways that are economically important. To test this, we designed a controlled experiment in which subjects were given an opportunity to choose a risky outcome – a real-stakes gamble with a higher expected monetary value than the alternative outcome with a certain payoff – and in which the sensitivity of observed risk choices to environmental factors could be explored. Suppose there are preference differences between men and women. Then, using the data generated by our experiment to estimate the probability of choosing the real-stakes gamble, we should find that the female dummy variable is statistically significant. Furthermore, if any gender difference is due *primarily* to nature, the inclusion of variables that proxy the students' "socialization" should not greatly affect the size or significance of the estimated coefficient to the female dummy variable. However, if proxies for "socialization" are found to be statistically significant, this would provide some evidence that nurturing plays a role.

Our hypotheses can be summarised as follows.

CONJECTURE 1. Women are more risk averse than men.

As summarized in Eckel and Grossman (2002) most experimental studies have found that

5. They are also asked questions about their family background, to be discussed later.

6. For instance, boys might state they are more risk-loving as a form of bragging.

women are more risk averse than men. A sizable number of the studies used elementary and high school aged children from coed schools (for example see Biring (1995) and Harbaugh, Krase and Versterlund (2002)). Since our subject pool varies from this standard young adult sample in that it involves students from both single-sex and coed schools we will first examine whether there is a gender difference in risk aversion. We expect to find that there is a gender gap in risk attitudes – we expect that women in our sample will be more risk averse than men.

CONJECTURE 2. Girls from single-sex schools are less risk averse than girls from coed schools.

Studies show that there may be more pressure for girls to maintain their gender identity in schools where boys are present than for boys when girls are present (Maccoby, 1990; Brutsaert, 1999). In a coeducational environment, girls are more explicitly confronted with adolescent subculture (such as personal attractiveness to members of the opposite sex) than they are in a single-sex environment (Coleman, 1961). This may lead them to conform to boys' expectations of how girls should behave to avoid social rejection (American Association of University Women, 1992). If risk avoidance is viewed as being a part of female gender identity while risk-seeking is a part of male gender identity, then being in a coeducational school environment might lead girls to make safer choices than boys.

How might this actually work? It is helpful to extend the identity approach of Akerlof and Kranton (2000) to this context. Adolescent girls in a coed environment could be subject to more conflict in their gender identity, since they have to compete with boys academically while at the same time they may feel pressured to develop their femininity in order to be attractive to boys. Moreover, there may be an externality at work, since girls are competing with other girls to be popular with boys. This externality may reinforce their need to adhere to their female gender identity. Why would not boys feel similarly pressured? First, academic success, assertive behaviour and being attractive to girls are not such contradictory goals, owing to the prevalence of the male bread-winner model in our society. While adolescent boys in a coed environment are likely to be very aware of their gender identity, they may experience different conflicts to those of the girls. To the extent that the presence of girls pressures boys to develop their masculinity to increase their popularity – or to reduce any threat to their male identity – this might make them more assertive and risk-taking. The fact that they are also competing with other boys for popularity might reinforce this tendency.

If this is true, we would expect girls in coed schools to be less likely than girls in single-sex schools to take risks. One might also expect coed schoolboys to be more likely to take risks than single-sex schoolboys, although the education literature suggests that there is greater

pressure for girls to maintain their gender identity in schools where boys are present than for boys when girls are present (Maccoby, 1990, 1998).<sup>7</sup>

CONJECTURE 3. Girls in same-gender groups are less risk averse than girls in coed groups.

Psychologists have shown that the framing of tasks and cultural stereotypes does affect the performance of individuals (see inter alia Steele, Spencer, and Aronson, 2002). Being in a single-sex group for the experiment might have the same effect on girls as being in a single-sex school. For example, a girl assigned to mixed-sex groups may feel their gender identity is threatened when they are confronted with boys. This might lead them to affirm their femininity by conforming to perceived male expectations of girls' behaviour, leading them to make less risky choices if they perceive risk-avoidance as being a feminine trait. Should the same girl be assigned instead to an all-girl group, such reactions would not be triggered. If girls do feel more pressured to maintain their gender identity when boys are present than boys feel when girls are present, then we should expect to observe a gender gap in risk-taking for girls and boys attending single-sex schools who are assigned to mixed-sex groups.

CONJECTURE 4. Girls in same-gender environments (single-sex schooling or same-gender experimental groups) are no less risk averse than boys.

The psychological and education literature cited above suggests that girls, rather than boys, are likely to respond to the same-gender environments. The question is: how much will girls change? Given that we hypothesize that girls will be less risk averse because of same-gender environments we conjecture that girls' risk attitudes in single-sex environments will be the same as their male counterparts. If this is the case it would suggest that the gender differences in observed risk attitudes is due to one's environment and not innate differences.

CONJECTURE 5. Gender differences in risk aversion are sensitive to the way the preferences are elicited.

To test this, we will compare the results from the choice of whether or not to engage in a real-stakes gamble with responses obtained from two post-experiment survey questions. The first survey question is on general risk attitudes while the second asks how much the respondent would invest in a risky asset using hypothetical lottery-winnings. (Both questions will be given in full in the next section.) Moreover, abstract real-stakes gambles might

7. There is also evidence that in coed classrooms boys get more attention and dominate activities (Sadker et al, 1991; Brutsaert, 1999)



generate different gender gaps in risky choices than context-specific hypothetical gambles (Schubert, Brown, Gysler and Brachinger, 1999).

In particular, we will examine how much, if at all, the answers about general risk attitudes or the hypothetical lottery explain observed choices made in the real-stakes experimental gamble. This will allow us to examine how close stated risk attitudes are to observed behaviour and to see if girls and boys differ on any "gap" that may exist. For example, suppose that boys state that they are more risk-seeking than they are in actuality, perhaps because being risk-loving is associated with a notion of "hegemonic masculinity" governing male gender identity (Kessler, Ashenden, Connell and Dowsett, 1985). If so, then boys might overstate their willingness to take risks when responding to a gender-attitudes survey question – after all, no real outcome depends on it – but be more likely to express their true risk aversion when confronted with a real-stakes gamble. In contrast, if being risk-loving is not part of female identity, there should be less distance in outcomes for girls.

### III. EXPERIMENTAL DESIGN

Our experiment was designed to test the four conjectures listed above. To examine the role of nurturing, we recruited students from coeducational and single-sex schools to be subjects. We also designed an ‘exit’ survey to elicit information about family background characteristics. At no stage were the schools we selected, or the subjects who volunteered, told why they were chosen. Our subject pool is relatively large for a controlled, laboratory-type experiment. We wished to have a large number of subjects from a variety of educational backgrounds in order to be able to investigate the conjectures outlined above.

Below we first discuss the educational environment from which our subjects were drawn, and then the experiment itself.

#### *III.A. Subjects and Educational Environment*

In September 2007, students from eight publicly-funded schools in the counties of Essex and Suffolk in the UK were bused to the Colchester campus of the University of Essex to participate in the experiment. Four of the schools were single-sex.<sup>8</sup> The students were from years 10 or 11, and their average age was just under 15 years. On arrival, students from each

8. A pilot was conducted several months earlier, in June at the end of the previous school year. The point of the pilot was to determine the appropriate level of difficulty and duration of the actual experiment. The pilot used a different subject pool to that used in the real experiment. It comprised students from two schools (one single-sex in Essex and one coeducational in Suffolk) who had recently completed year 11. The actual experiment conducted some months later, at the start of the new school year, used, as subjects, students who had just started years 10 or 11.

school were randomly assigned into 65 groups of four. Groups were of three types: all-girls; all-boys; or mixed. Mixed groups had at least one student of each gender and the modal group comprised two boys and two girls. The composition of each group - the appropriate mix of single-sex schools, coeducational schools and gender - was determined beforehand. Thus only the assignment of the 260 girls and boys from a particular school to a group was random. The school mix was two coeducational schools from Suffolk (103 students), two coeducational schools from Essex (45 students), two all-girl schools from Essex (66 students), and two all-boy schools from Essex (46 students).

In Suffolk county there are no single-sex publicly-funded schools. In Essex county the old “grammar” schools remain, owing to a quirk of political history.<sup>9</sup> These grammar schools are single-sex and, like the coeducational schools, are publicly funded. It is highly unlikely that students themselves actively choose to go to the single-sex schools. Instead Essex primary-school teachers, with parental consent, choose the more able children to sit for the Essex-wide exam for entry into grammar schools.<sup>10</sup> Parents must be resident in Essex for their children to be eligible to sit the entrance exam (the 11+ exam). A student must attain above a certain score (the score will vary from year to year) to attend one of the schools. Therefore students at the single-sex schools are not a random subset of the students in Essex, since they are selected based on measurable ability at age 11. If ability is correlated with one’s risk attitudes we may have a problem when identifying the effect of single-sex education. To examine this we will compare the sample of single-sex students to different subgroups of our sample and use two econometric techniques – instrumental variables and propensity score matching – to examine any possible bias that may exist. However, unlike schooling, the gender composition of the experimental peer-group is randomly assigned and therefore the identification is not in doubt. At the time the “fiver” lottery described below the student will have been in her group for only 30 minutes, much less than the average four-years of attendance at a single-sex or coed school, so any effect of from the peer-group may also allow us examine the reliability of the estimated schooling effect.

9. In the UK, schools are controlled by local area authorities but frequently “directed” by central government. Following the 1944 Education Act, grammar schools became part of the central government’s tripartite system of grammar, secondary modern and technical schools (the latter never got off the ground). By the mid-1960s, the central Labour government put pressure on local authorities to establish “comprehensive” schools in their place. Across England and Wales, grammar schools survived in some areas (typically those with long-standing Conservative boroughs) but were abolished in most others. In some counties the grammar schools left the state system altogether and became independent schools; these are not part of our study. However, in parts of Essex, single-sex grammar schools survive as publicly-funded entities, while in Suffolk they no longer exist.

10. If a student achieves a high enough score on the exam, s/he can attend one of the 12 schools in the Consortium of Selective Schools in Essex (CSSE). The vast majority of these are single-sex. The four single-sex schools in our experiment are part of the CSSE.

The experiment took place in a very large auditorium with 1,000 seats arranged in tiers. Students in the same group were seated in the same row with an empty seat between each person. There was also an empty row in front of and behind each group. While subjects were told which other students were in the same group, they were sitting far enough apart for their work to be private information. If two students from the same school were assigned to a group, they were forced to sit as far apart as possible; for example, in a group of four, two other students would sit between the students from the same school. There was one supervisor, a graduate student, assigned to supervise every five groups. Once the experiment began, students were told not to talk. Each supervisor enforced this rule and also answered individual questions. Consequently, during the experiment there was very little talking within or between groups.

### ***III.B. Experiment***

Five rounds were conducted during the experiment. In Appendix A we give full details of all rounds, and there we also describe payments and incentives, which varied from round to round.<sup>11</sup> In the present paper we focus on the results from the round involving the real-stakes gamble or "fiver" lottery. After the experiment ended, students filled out a post-experimental questionnaire that had questions on risk attitudes, family background, and that also included a hypothetical investment decision using the proceeds from winning a lottery. (Results from the first four rounds, designed to elicit differences in competitive behaviour under piece rates and tournaments, are reported in Booth and Nolen (2008).)

A description of the real stakes gamble (called the "Fiver" Lottery) and the two main survey questions are discussed below.

**"Fiver" Lottery.** Each student chooses Option One or Option Two. Option One is to get £5 for sure. Option Two is to flip a coin and get £11 if the coin comes up heads or get £2 if the coin comes up tails.

**Survey Question: General Risk.** Each student was asked: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" The students then ranked themselves on a scale from 0 to 10 with 0 being labelled "risk averse" and 10 as "fully prepared to take risks."

**Survey Question: Hypothetical Lottery.** Each student was asked to consider what they would do in the following situation: "Imagine that you have won £100,000 in the lottery.

11. After completing all five rounds a number 1-5 was randomly chosen and students were paid according to the rules of that round.

Almost immediately after you collect the winnings, you receive the following financial offer from a reputable bank, the conditions of which are as follows: (i) there is a chance to double your the money within two years; (ii) it is equally possible that you could lose half the amount invested; (iii) you have the opportunity to invest the full amount, part of the amount or reject the offer. What share of your lottery winnings would you be prepared to invest in this financially risky yet lucrative investment?" The subject then ticked a box indicating if she would invest £100,000, £80,000, £60,000, £40,000, £20,000, or Nothing (reject the offer).

The payments (both the show-up fee of £5 plus any payment from performance in the randomly selected round) were in cash and were hand-delivered in sealed envelopes (clearly labelled with each student's name) to the schools a few days after the experiment. The average payment was £7. In addition, immediately after completing the Exit Questionnaire, each student was given a bag containing a soft drink, packet of crisps and bar of chocolate.

## IV. EXPERIMENTAL RESULTS

In this section we discuss whether the results from the fiver lottery support the first four conjectures. We then use a series of robustness checks to see, first, if the evidence stands up to using different control groups and, second, if the results alter when we instrument for single-sex schooling or use propensity score matching.

### *IV.A. The Sample*

Table 1 shows means for each of our four subsamples – school differences for girls and boys and gender differences by school type. Risk attitudes and the demographic variables were obtained from the post-experiment survey questionnaire. The goal is to have the treatment and control groups roughly equivalent and to control for any differences that may exist. Table 1 shows that there are some differences between students from coeducational and single-sex schools. For example, girls and boys at single-sex schools were far more likely to have both parents with a university (college) degree than their coeducational counterparts. As discussed before, an educated parent could have an effect on their child's level of risk-aversion. Furthermore, boys at single-sex schools tend to be older than girls at single-sex schools. For our variable of interest, whether a student choose option two in the "Fiver" lottery, there is a gender difference among coed students but not among single-sex students and that girls from single-sex schools enter the lottery more than girls from coed schools.

This is despite there being much difference in reported levels of risk.<sup>12</sup>

[Insert Table 1 here]

#### ***IV.B. Gender Differences and Nurture***

The expected monetary value of the fiver lottery discussed above is £6.50 which is greater than the alternative choice – a certain outcome of £5. Assuming a constant relative risk aversion utility function of the type  $u(x) = x^{1-\sigma}/(1-\sigma)$ , where  $\sigma$  is the degree of relative risk aversion, we calculate that the value of  $\sigma$  making an individual just indifferent between choosing the lottery and the certain outcome is approximately 0.53. Individuals with  $\sigma > 0.53$  will choose the certain outcome, while those with  $\sigma < 0.53$  will choose the lottery.<sup>13</sup> In the risk preference classification used by Holt and Laury (2002: 1649), a person with  $0.41 < \sigma < 0.68$  would be classified as “risk averse” and is within the 0.3-0.5 range which is “consistent with the estimates implied by behavior in games, auctions and other decision tasks.” Likewise, our chosen value of  $\sigma$  is close to the mean coefficient of relative risk aversion found in the empirical work by Dohmen et al. (2006). Therefore the fiver lottery presented here is consistent with existing experimental and empirical data.

To examine if there are any gender differences in the choice of whether or not to enter the fiver lottery we construct an indicator variable taking the value one if the individual chooses to enter the fiver lottery and zero otherwise. This becomes our dependent variable in a simple probit model of the probability of choosing the lottery. Table 2 shows the marginal effects of those probit regressions.

[Insert Table 2 here]

Column [1] of Table 2 shows that, on average, girls choose to enter the lottery 16 percentage points less than boys. The sign and significance of this coefficient is consistent with other work looking at gender and risk aversion and suggests that in our sample female students are also more risk averse than male students. This provides evidence for conjecture one. Now we want to investigate next if the gender differences alter when environmental factors reflecting nurture are incorporated into the estimation.

The specification in Column [2] adds controls for school-type and experimental group composition. In this specification the gender gap for girls in single-sex schooling becomes

12. In the post-experiment survey questionnaire, individuals were asked to report their risk attitudes on a scale running from 0 to 10, with 0 labelled as "risk averse" and 10 as "fully prepared to take risks". We will describe this in more detail in Section 4.

13. This was calculated from  $pu(x) + (1-p)u(y) = u(z)$ , where  $p=0.5$ ,  $x=11$ ,  $y=2$  and  $z=5$ . We use the specific CRRA functional form for  $u(\cdot)$  given in the text.

even more obvious; girls now choose to enter the lottery 36 percentage points less than coed boys. However, girls in single-sex schools are now just as likely to enter the tournament as boys from coed and single-sex schools. This evidence allows us to discuss conjectures two and four. Given that the coefficient on female interacted with single-sex is positive it appears that females are benefiting from single-sex education, supporting conjecture three. Furthermore, since the marginal effect for comparing a single-sex girl to a coed boy is insignificant, -0.07, then there is no evidence that single-sex girls are any different than coed boys. We can now examine conjectures three and more of conjecture four. Girls in all-girls groups are 12 percentage points more likely to enter the lottery than girls in mixed groups. This means that being in an all-girls group is causing women to be less risk averse since girls were randomly assigned to their groups. Thus there is strong evidence for conjecture three, that girls in same-gender experimental groups are less risk averse than girls in mixed gender experimental groups. This result is after 30 minutes of being in an all-girls group and, in comparison to the female single-sex schooling interaction, suggests that women are not more risk averse than men by nature. However the effect from being in an all-girls group does not cancel out the effect of being female and thus it seems that girls in same gender experimental groups do not choose to enter the tournament as much as coed boys.

Columns [1] and [2] provide strong evidence for conjectures one, two, and three and some evidence for conjecture four. Columns [3]-[6] provide robustness checks for that evidence.

#### ***IV.C. Robustness Checks***

A student’s attendance a single-sex school is likely to be influenced by her ability as well as by the choices of her parents or teachers.<sup>14</sup> Therefore students from single-sex schools may not be a random subset of the students from Essex. However it should be remembered that we asked only top students from coeducational schools to participate in the experiment. As a sensitivity analysis we performed three checks of the single-sex schooling and female interaction results. First, we compared single-sex students to a different comparison group: students from Suffolk *plus* students in Essex who took the 11+ exam. Second, we instrumented for single-sex school attendance. Finally we used propensity score matching to examine the female, single-sex schooling interaction.

Column [3] of Table 2 uses only the sample of students from Suffolk, those who took the 11+ exam, and students from single-sex schools. Students in Suffolk have to attend there closest school so they are likely to be a more representative sample. Furthermore, if

14. As noted earlier, Essex primary-school teachers and parents choose which children sit for the Essex-wide exam for entry into grammar schools. Parents must be resident in Essex for their children to be eligible to sit the entrance exam (the 11+ exam).

"parental pushiness" is an issue than those students who took the 11+ exam should look more like the single-sex students. Using this sample, we see that the gender gap actually gets slightly larger; girls are 48 percentage points less likely to enter the lottery. However, the single-sex coefficient is also negative and significant. This suggests that there may be evidence that boys in coed schools are being encouraged to take more risks and "show off" for the girls, i.e. that stereotype threat could be causing the gender gap in risk aversion to be larger. This evidence would fit with the discussion of conjecture two. Girls in same-gender groups, are again 12 percentage points less likely to enter the lottery than girls in coed groups, still providing evidence for conjecture three. Finally with regards to conjecture four, the marginal effect for the difference between a single-sex girl and a coed boy is now significant and negative; a single-sex girls is 8 percentage points less likely to choose the lottery than a coed boy. By comparing single-sex students to a different control group we find that there is still evidence for conjectures one, two, and three but that the evidence to support conjecture four is weaker. However, it should still be noted that girls from single-sex schools, while not taking the lottery at the same proportion as boys, are entering the lottery more than coed girls.

In column [4] of Table 2 we present the regression results of the linear probability model (LPM). We do this so that we can address the potential endogeneity of the single-sex schooling variable in another way: by instrumenting for single-sex schooling. We used the six-digit residential postcode for each student to calculate the distances to the nearest single-sex school and to the nearest coed school. (Our sample size shrinks slightly, as some postcode responses were unreadable.) From this, we imputed the minimum traveling time to the closest coeducational school and to the closest single-sex school.<sup>15</sup> We next calculated a variable equal to the minimum time needed to travel to the closest single-sex school minus the minimum time to travel to the closest coeducational school. We then break this variable into deciles creating 10 dummy variables. For example, if the difference in travelling time for a student fell in the first decile, that student would be assigned a one for the first dummy variable and a zero for all others. Using these 10 variables, we instrumented for attendance at a single-sex school using a two-step process. First, we estimated the probability of a student attending a single-sex school, where the explanatory variables were an Essex dummy (taking the value one if the student resides in Essex and zero otherwise) and an interaction

15. To calculate this, we used the postcode of each school and the postcode in which a student resides. We then entered the student's postcode in the "start" category in MapQuest.co.uk (<http://www.mapquest.co.uk/mq/directions/mapbydirection.do>) and the school's postcode in the "ending address." Mapquest then gave us a "total estimated. time" for driving from one location to the other. It is this value that we used. Thus the "average time" is based on the speed limit of roads and the road's classification (i.e. as a motorway or route).

of Essex-resident with the 10 travelling-time variables. We then estimated the regression reported in column [5], which is a LPM, where we use predicted single-sex school attendance in place of the original single-sex school dummy. Since the equation uses predicted values, we bootstrapped the standard errors for attending a single-sex school.<sup>16</sup> Even here we find that the female, single-sex schooling interaction and all-girls group variable are statistically significant.

Given that there were some differences between our samples in Table 1. We used all controls that were different at the 5% level in our summary statistics and added them as controls in column [6] of Table 2. The controls used were whether a student’s mother had a university degree, whether a student’s father had a university degree, whether a student was the eldest child, and whether the student was aged 14 years. Furthermore we allowed these factors to effect a student’s risk aversion differently by gender and schooling type so we interacted the controls by female, single-sex schooling, and their interaction. The regression results in column [6] again provide strong evidence for conjectures one, two, three and parts of conjecture four.

Finally, since the distance to one’s school may not be exogeneous to the choice of where to go to school and perhaps one’s risk attitudes we also use propensity score matching to examine the effect of the female, single-sex schooling interaction. The results are presented in Table 3.

[Insert Table 3]

The estimations in Table 3 are calculated using all pretreatment characteristics. We use the number of sinblings a student has, the number of female siblings, the education level of the mother and father, the mother and father’s employment status when the student was aged 14, and finally the industry in which the student’s mother or father was employed when the student was 14 years old. Based on those charateristics we estimate the propensity score presented in Table 3. The point estimates are all significant at the 1% level and are roughly the same as the female, single-sex interaction point estimate in column [6] of Table 2.

Given these there robustness checks and the continued significance of the single-sex, female interaction and the all-girls group variable, there seems to be strong evidence for conjectures two and three, that single-sex girls enter the lottery more than coed girls and that girls in same-gender groups enter the lottery more than girls in mixed gender groups. However, the evidence for conjecture four is mixed. There is some evidence that girls from single-sex schools enter the lottery as much as boys from coed and single-sex school but the

16. We randomly drew 1,000 different samples from our experimental data to calculate the bootstrap results.



robustness of that estimate does not hold in all specifications in Table 2. Furthermore, the girls in same-gender groups are not entering the tournament as much as coed boys. Despite the lack of firm support for conjecture four, the evidence does show that girls in single-sex and coed groups are entering the tournament more than girls from coed schools. This provides strong evidence that nurture is effecting the risk attitudes of girls. We now want to examine if this evidence is able to be derived using commonly asked survey questions.

## V. SURVEY VERSUS EXPERIMENTAL RESULTS

The experimental setting provided evidence that nurturing affects at least a girl's behaviour under uncertainty. We now examine whether survey questions could have been used to obtain those results and if the answers to commonly used survey questions provide any predictive power in explaining how a subject behaves in an experimental setting. To see if a student's answer to the general risk question, outlined in detail in Section 4, provided any insight into whether the student would enter the "fiver" lottery we reran that probit regression with an additional control for general risk attitude. The marginal effects are reported in column [2] of Table 4. The results show that choosing the "fiver" lottery is positively correlated with how prepared a student is to take risks. But inclusion of risk attitudes does not take away the explanatory power of the single-sex, female interaction or of the all-girls group coefficient.<sup>17</sup> Furthermore, the interaction of responses to the general risk question with being female is statistically insignificant. If student responses to the general risk attitudes question pick up their unobserved propensity to overstate their risk-loving, then the insignificance of this interaction implies that neither sex overstates more than the other. Likewise, when we use the student's answer to the hypothetical lottery – see column [3] of Table 4 – the explanatory power of the single-sex female interaction and being in all-girls group coefficient remain statistically significant even though some of the coefficients to the survey response are also statistically significant. However there is little difference in how boys and girls responded the survey question as the hypothetical amount interacted with being female has little explanatory value. This again suggests that the survey questions are being answered in a similar way by both boys and girls.

[Insert Table 4 here]

Since the general risk question and the answer to the hypothetical lottery are positively correlated with choosing to enter the fiver lottery, we will now examine if the answers to

17. This result is robust to entering a dummy variable for each option, i.e. 0-10, or for entering a squared term for the general risk question.

the two survey questions could have been used as dependent variables instead of the real stakes experimental outcome. Column [4] of Table 4 uses the responses to the general risk question as the dependent variable. In this case the regression model used is OLS. Notice that all of the variables of interest are now statistically insignificant. There is no gender effect (the female dummy is not significant); there is no school-level nurturing (the single-sex and female interaction is insignificant); and there is no effect of the experimental peer-group. Even if a binary variable is created from the general risk attitudes question – using any cut point ranging from 3 to 8 – the survey question does not yield the same results as the real stakes experimental lottery.

Columns [5]-[7] of Table 4 use the responses to the hypothetical risky investment as the dependent variable. As noted earlier, this not only represents a risky investment decision, as distinct from the abstract gamble for real stakes represented by the fiver lottery, but it also involves hypothetical amounts. Column [5] reports the results from OLS estimation. Notice that the female dummy has a statistically insignificant effect but that the interaction of female with single-sex schooling is statistically significant at the 5% level. In column [6] a tobit model is used (because a student can choose to put none of her hypothetical lottery winnings in the risky investment). Again, only the single-sex school and female interaction is significant at the 5% level. Finally, in column [7] an ordered probit model is used and again only the single-sex and female result is significant (5% level). This suggests that, while the hypothetical lottery investment does not provide the same evidence about relative risk-aversion as the real stakes experimental lottery, nonetheless the interaction of female with single-sex schooling remains statistically significant across the three estimation methods. Using the survey question would suggest there is not gender difference in risk aversion but that women attending single-sex schools are not only as likely as men to enter the real-stakes gamble, but they also invest more in the hypothetical risky investment than do coed women and all men.

Given the results in Table 4, it seems that there is mixed evidence for the fifth conjecture. While the commonly used general risk attitude question is positively correlated with actual risky choices made under uncertainty, the determinants of these general risk attitudes differ quite markedly from the determinants of actual risky choices under uncertainty. This suggests that relying only on general risk attitudes might lead researchers to make misleading inferences about gender differences in choice under uncertainty. In contrast, the determinants of the amounts invested from the hypothetical lottery had some similarities to the determinants of actual risky choices under uncertainty. Estimating the determinants of amounts invested from the hypothetical lottery yielded the insight that girls attending single sex schools invest more in the risky outcome than boys. The real-stakes experimental lottery

showed that girls from single-sex school were as likely as boys to enter the lottery, which is not inconsistent with the hypothetical lottery results. Finally, the gender gap in risk aversion that is present in much of the experimental literature is not present in the survey questions. This example illustrates the complementary roles of experimental and survey data.

## VI. CONCLUSION

Women and men may differ in their propensity to choose a risky outcome because of innate preferences or because pressure to conform to gender-stereotypes encourages girls and boys to modify their innate preferences. Single-sex environments are likely to modify students' risk-taking preferences in economically important ways. To test this, we designed a controlled experiment in which subjects were given an opportunity to choose a risky outcome – a real-stakes gamble with a higher expected monetary value than the alternative outcome with a certain payoff – and in which the sensitivity of observed risk choices to environmental factors could be explored. The results of our real-stakes gamble show that gender differences in preferences for risk-taking are indeed sensitive to whether the girl attends a single-sex or coed school. Girls from single-sex schools are as likely to choose the real-stakes gamble as boys from either coed or single sex schools, and more likely than coed girls. Moreover, we found that gender differences in preferences for risk-taking are sensitive to the gender mix of the experimental group, with girls being more likely to choose risky outcomes when assigned to all-girl groups.

We also found that gender differences in risk aversion are sensitive to the method of eliciting preferences. While the commonly used general risk attitude question is positively correlated with actual risky choices made under uncertainty, the determinants of these general risk attitudes differ quite markedly from the determinants of actual risky choices under uncertainty. This suggests that relying only on survey-based general risk attitudes might lead researchers to make misleading inferences about gender differences in choice under uncertainty. In contrast, the determinants of the amounts invested from the hypothetical lottery had some similarities to the determinants of actual real-stakes gambles under uncertainty.

To summarize our main results, we have discovered at least one setting – in addition to the Kasai tribe of India studied by Gneezy, Leonard and List (2008) – in which it is untrue that the average female avoids risky behaviour more than the average male. On average girls from single-sex schools are found in our experiment to be as likely as boys to choose the risky behaviour. This suggests that observed gender differences in behaviour under uncertainty found in previous studies might reflect social learning rather than inherent gender traits, a

finding that would be hard, if not impossible, to show using survey-based evidence alone.

While our research should not be interpreted as saying that we should all immediately enrol our daughters in single-sex schools, it does provide food for thought. It seems appropriate to conclude with the following quotation from the classic work by educational sociologists Kessler et al. (1985: 44): "Particular kinds of behavior, particular ways of being, are culturally dominant.... We have come to refer to the dominant patterns as 'hegemonic masculinity' and 'emphasised femininity'....What is hegemonic at any given time depends on how the relations among different kinds of masculinity and femininity have been worked out. That negotiation is one of the key roles of the school."

## REFERENCES

- Akerlof, GA and RE Kranton (2000) "Economics and Identity." *The Quarterly Journal of Economics*, CXV (3), August, pp. 715-753.
- American Association of Univesrity Women (1992). *How Schools Shortchange Girls*. Washington, DC: American Association of Univesrity Women.
- Barber, B.M., and T. Odean (2001). "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment," *Quarterly Journal of Economics*, 116 (1), 261-292, February.
- Barres, B. (2006). "Does Gender Matter?" *Nature*, 442, 133-136.
- Barsky, R.B., T.F. Juster, M.S. Kimball and M.D. Shapiro (1997). "Preference Parameters and Individual Heterogeneity: An Experimental Approach in the Health and Retirement Study," *Quarterly Journal of Economics*, 112(2), 537-79.
- Bertrand, M., and K. F. Hallock (2001). "The Gender Gap In Top Corporate Jobs," *Industrial And Labor Relations Review*, 55(1), 2-21.
- Blau, F. D., and L. M. Kahn (2004). "The US Gender Pay Gap In The 1990s: Slowing Convergence," NBER Working Paper 1085.
- Brutsaert, H., (1999). "Coeducation and Gender Identity Formation: A Comparative Analysis of Schools in Belgium". *British Journal of Sociology of Education*, 20(3) , 343-353, September.
- Campbell, P., and J. Sanders (2002). "Challenging the System: Assumptions and Data Behind the Push for Single-Sex Schooling," in *Gender in Policy and Practice: Perspectives on Single-Sex and Coeducational Schooling*, ed. by A. Datnow, and L. Hubbard, 31-46. Routledge, New York.
- Datta Gupta, N., A. Poulsen, and M. Villeval (2005). "Male and Female Competitive Behavior: Experimental Evidence," IZA Working Paper 1833, Nov. 2005.
- Dohmen, T. J., Falk, A., Huffman, D., Schupp, J., Sunde, U. and Wagner, G. G. (2006). "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-Validated Survey" (February). CEPR Discussion Paper No. 5517.
- Donkers, B., B. Melenberg and A. van Soest (2001). "Estimating Risk Attitudes Using Lotteries - a Large Sample Approach", *Journal of Risk and Uncertainty*, 22, 165-95.
- Eckel, C., and P. Grossman (2002). *Differences in the Economic Decisions of Men and Women: Experimental Evidence*. Elsevier Science B.V./North-Holland, Amsterdam, The Netherlands.
- Gneezy, U., M. Niederle, and A. Rustichini (2003). "Performance in Comptitive Environments: Gender Differences," *Quarterly Journal of Economics*, 118 (3), 1049-1074, August.
- Gneezy, U. and A. Rustichini (2004). "Gender and Competition at a Young Age," *American Economic Review Papers and Proceedings*, pp.. 94 (2), 377-381, May.
- Gneezy, U., K. L. Leonard, J.A. List. (2008). "Gender Differences in Competition: Evidence from a Matrilineal and a Patriarchal Society." NBER Working Paper 13727.
- Holt, C.A., and S.K. Laury (2002). "Risk Aversion and Incentive Effects," *American Economic Review*, 92(5), 1644-1655, December.

- Jianakoplos, N.A. and A. Bernasek (1998). "Are Women More Risk Averse?" *Economic Inquiry* 36 (4) , 620–630.
- Kessler, S., D. J. Ashenden, R. W. Connell and G. W. Dowsett (1985). "Gender Relations in Secondary Schooling". *Sociology of Education*, 58 (1), 34-48, January.
- Lawrence, P. (2006). "Men, Women, and Ghosts in Science," PLoS Biology, 4(1), 13–15.
- Maccoby, E. E. (1990). "Gender and Relationships: A Developmental Account". *American Psychologist*, 45(4), 513-520, April.
- Maccoby, E. E. (1998). *The Two Sexes: Growing up Apart, Coming Together*. Cambridge Ma: Harvard University Press.
- Niederle, M. and L. Vesterlund (2007). "Do Women Shy Away From Competition? Do Men Compete Too Much?," *Quarterly Journal of Economics*, 122 (3) 1067–1101, Nov..
- Niederle, M. and A. H. Yestrumskas (2008). "Gender Differences in Seeking Challenges: The Role of Institutions", February 2008, Mimeo, Stanford University.
- Sadker M, Sadker D and S Klein (1991). "The Issue of Gender in Elementary and Secondary Education". *Review of Research in Education*. 17, 269-334.
- Schubert, R., M. Brown, M. Gysler and H.W. Brachinger (1999). "Financial Decision-Making: Are Women Really More Risk-Averse?". *American Economic Review*, 89(2),. 381-385, May.
- Steele, C. M., S. J. Spencer, and J. Aronson (2002). "Contending with Group Image: The Psychology of Stereotype and Social Identity Threat," *Advances in Experimental Social Psychology*, 34, 379–440.

## VII. APPENDIX A: THE EXPERIMENT

In the experiment, students were escorted into a large auditorium. One individual read off the instructions at the same time to everyone who was participating. All the graduate supervisors hired to supervise groups were given a copy of the instructions, were involved in the pilot that had taken place, and had gone through comprehensive training. These supervisors answered questions if they were raised.

Below are the text of the slides that were shown to the students when they arrived at the auditorium:

### **Slide 1:**

Welcome to the University of Essex!

Today you are going to be taking part in an economics experiment.

Treat this as if it were an exam situation:

No talking to your neighbours.

Raise your hand if you have any questions.

There will be no deception in this experiment.

### **Slide 2:**

The experiment today will involve completing 3 rounds of mazes.

Rules for completing a maze:

Get from the flag on the left hand side to the flag on the right hand side.

Do not cross any lines!

Do not go outside of the box.

We will now go through an example!!

*Comment:*

At this point students were shown one practice maze and were walked through how to solve it, illustrating the three points raised above.

### **Slide 3:**

The supervisors in your row will be handing you maze packets throughout the session. At all times you need to put your seat letter and number on the packet and your name.

Please make sure you know your row letter and seat number.

Your seat is also on your badge. It is the middle grouping. For example, if you badge was 1-A3-F your seat number should be A3. Make sure this is correct now.

Mazes: You should do the mazes in order.

If you cannot solve a maze put an X through it and go onto the next maze.

If you do not put an X through it none of the following mazes will be marked.

Note: If you do not have the correct seat number on your maze packets you may be paid incorrectly.

**Slide 4:**

We are going to be doing six rounds of mazes.

Before each round of mazes we will explain how you will be paid for that round.

After all six rounds of mazes are finished we will choose one round to "implement".

That means you will get paid for your performance in that round.

The round for which you will be paid will be chosen randomly from this cup.

You will also receive GBP 5 for showing up today.

Since you do not know for which round you will be getting paid, you should do your best in each round and treat each round separately.

**Slide 5:**

You will get 5 minutes to solve up to 15 mazes.

Please solve as many mazes as you can.

Do not begin until I say go!

For this round you will get \pounds 0.50 for each maze you solve correctly:

Example: If you solve 8 mazes correctly you will earn GBP 4.

Please make sure you have put your name and seat on the maze packet now.

Are there any questions?

OK -> GO!

OK -> STOP

No Talking!

**Slide 6:**

Now you will get \pounds 2 for each maze you solve correctly IF you solve the most mazes correctly in your group.

Your group consists of you and the 3 other people sitting in your \textquotedblleft row\textquotedblright who have the same first number on their badge.

Example: If your badge number is 1-B2-M then your group consists of you and the three other students with the badges 1-\*\*-\* in your row.

If you are in group 1 and you solve 8 mazes correctly then:

IF everyone else in your group solved fewer than 8 mazes correctly you will get GBP 16.

IF someone in your group solved 9 mazes correctly, you would get GBP 0.



Note: Ties will be broken randomly. Thus IF two people in your group solve 8 mazes correctly we flip a coin to see who gets the GBP 16.

Are there any questions?

**Slide 7:**

You will get 5 minutes to solve up to 15 mazes.

Please solve as many mazes as you can

Please make sure you have put your name and seat on the maze packet now.

Do not begin until I say go!

OK → GO!

OK → STOP

No Talking!

**Slide 8:**

In this round you choose between two options.

Option 1: Get GBP 0.50 per maze you solve correctly.

Option 2: Get GBP 2 per maze you solve correctly IF you solve more mazes correctly than the other three people in your group did LAST round.

Example: Say you solve 8 mazes correctly this round.

If you chose option 1 you get GBP 4.

If you chose option 2:

You get GBP 16 IF the other three people in your group solved fewer than 8 mazes correctly in Round 2.

You get GBP 0 IF one other person solved 9 mazes correctly in Round 2.

Note: Ties will be broken randomly. Thus IF one person in your group solved 8 mazes correctly in round 2 we flip

a coin to see if you get the GBP 16.

Are there any questions?

**Slide 9:**

A supervisor will now come by and give you a card for you to circle option 1 or option 2.

Option 1: Get GBP 0.50 per maze you solve correctly.

Option 2: Get GBP 2 per maze you solve correctly IF you solve more mazes correctly than the other three people in your group did LAST round.

Circle your choice, fold the paper and give it back to the supervisor.

You need to write your seat number on the piece of paper

Do not tell anyone your choice!

You will get 5 minutes to solve up to 15 mazes.

Please solve as many mazes as you can

Do not begin until I say go!

Please make sure you have put your name and seat on the maze packet now.

Do not begin until I say go!

OK -> GO!

OK -> STOP

No Talking!

**Slide 10:**

In this round you will not have to do any mazes.

Everyone will be given £5 to play with. Think of the £5 as already being your own money.

You now face a choice:

Option One: Keep your £5.

Option Two: Gamble with your £5.

IF you choose option two you will flip a coin at the end of this round.

IF the coin comes up heads you will get £11.

IF the coin comes up tails you will get £2.

A supervisor will now hand you a piece of paper. Choose Option One or Option Two and then fold the paper.

Please put your seat number on the option card

Do not tell anyone your choice!

Everyone will now stand up when the supervisor comes to you and Flip a coin. Your supervisor will record the flip.

**Slide 11:**

Thank you for completing the mazes!

Your last set of mazes will now be collected – please stay seated.

I will now pull the number from the hat..... AND!?

You will be handed a survey – Read the questions very carefully and make sure you respond to ALL the questions including the ones at the very end.

After everyone is done completing the survey a supervisor will hand you some refreshments.

Make sure you put your seat on the survey!

Then after 10-15 minutes, your supervisor will give you an envelope with your money and ask you to sign a piece of paper. Then you will go to your bus.

Please keep your winnings confidential.

THANKS!

*Comment:*

Due to the time it took to fill all the envelopes with money, subjects ended up receiving the money two days later as the students needed to get back to their schools to be picked up by their parents.

**Table 1: Sample proportions and averages by gender and school-background**

VARIABLES	GIRLS			BOYS			SINGLE-SEX			COED		
	Coed	SS	Dif	Coed	SS	Dif	Girls	Boys	Dif	Girls	Boys	Dif
Option Two in "Fiver" Round (=1)	0.54	0.86	0.32***	0.88	0.78	-0.10	0.86	0.78	0.08	0.54	0.88	-0.34***
	[0.05]	[0.07]		[0.05]	[0.07]		[0.07]	[0.06]		[0.08]	[0.06]	
Number of Siblings	1.67	1.59	-0.08	1.69	1.28	-0.41*	1.59	1.28	0.31	1.66	1.69	-0.03
	[0.11]	[0.17]		[0.15]	[0.22]		[0.19]	[0.15]		[0.19]	[0.16]	
Number of Female Siblings	0.80	0.57	-0.23*	0.87	0.68	-0.19	0.57	0.67	-0.10	0.81	0.87	-0.06
	[0.08]	[0.12]		[0.13]	[0.19]		[0.15]	[0.11]		[0.15]	[0.12]	
Birth Order	1.73	1.78	0.05	1.86	1.46	-0.40**	1.78	1.47	0.31*	1.72	1.86	-0.14
	[0.09]	[0.15]		[0.12]	[0.17]		[0.16]	[0.12]		[0.17]	[0.13]	
Age	14.80	14.95	0.15	14.81	14.48	-0.33**	14.95	14.48	0.47***	14.8	14.81	-0.01
	[0.06]	[0.10]		[0.09]	[0.13]		[0.12]	[0.09]		[0.11]	[0.09]	
Mother went to University	0.12	0.48	0.36***	0.15	0.43	0.28***	0.48	0.43	0.05	0.12	0.15	-0.03
	[0.04]	[0.07]		[0.06]	[0.09]		[0.10]	[0.07]		[0.06]	[0.05]	
Father went to University	0.16	0.52	0.36***	0.27	0.54	0.27***	0.51	0.54	-0.03	0.16	0.27	-0.11*
	[0.04]	[0.07]		[0.07]	[0.10]		[0.10]	[0.07]		[0.07]	[0.05]	
Min travel nearest coed school	13.45	24.23	10.78***	14.59	27.63	13.04***	24.23	27.63	-3.40*	13.45	14.59	-1.14
	[1.04]	[1.64]		[1.48]	[2.21]		[2.02]	[1.55]		[1.64]	[1.32]	
Min travel nearest single-sex school	24.18	15.32	-8.86***	24.53	12.95	-11.58***	15.32	12.95	2.37	24.18	24.53	-0.35
	[0.80]	[1.24]		[1.29]	[1.91]		[1.69]	[1.30]		[1.06]	[0.85]	
Average risk score ( Scale = 1-10)	6.40	6.95	0.55*	6.90	6.69	-0.21	6.95	6.69	0.26	6.4	6.90	-0.50
	[0.18]	[0.29]		[0.93]	[1.38]		[0.38]	[0.29]		[0.30]	[0.24]	
OBSERVATIONS	96	66		52	46		66	46		96	52	

**Table 2: Dependant variable (=1) if student choose option two in "Fiver Round"**

COEFFICIENT	[1]	[2]	[3]	[4]	[5]	[6]
Female (=1)	-0.16*** [0.05]	-0.36*** [0.07]	-0.48*** [0.09]	-0.43*** [0.08]	-0.46*** [0.09]	-0.34*** [0.11]
Single-Sex (=1)		-0.13 [0.10]	-0.28** [0.11]	-0.10 [0.08]	-0.11 [0.09]	-0.06 [0.18]
Female * Single-Sex		0.33*** [0.06]	0.44*** [0.07]	0.42*** [0.10]	0.47*** [0.13]	0.30** [0.12]
All-Girls Group (=1)		0.12* [0.06]	0.12* [0.07]	0.13* [0.07]	0.14* [0.08]	0.14** [0.06]
All-Boys Group (=1)		-0.05 [0.10]	-0.03 [0.11]	-0.04 [0.08]	-0.00 [0.08]	-0.05 [0.11]
Marginal Effect for Female + Single-Sex + Female * Single-Sex		-0.07 [0.05]	-0.08* [0.04]			-0.04 [0.06]
Controls	No	No	No	No	No	Yes
Controls * Female	No	No	No	No	No	Yes
Controls * Single-Sex	No	No	No	No	No	Yes
Controls * Female * Single-Sex	No	No	No	No	No	Yes
Model Type	Probit	Probit	Probit	LPM	IV LPM	Probit
Constant				0.90*** [0.05]	0.90*** [0.06]	
Observations	260	260	201	260	243	260
R-squared				0.131	0.115	
F-Stat for IV Variables					155.6	

Columns [1], [2], [4], [5], and [6] use the entire sample. Column [3] uses only students from Suffolk, those who took the 11+ exam, and single-sex students. Controls that are used are: Mother went to University (=1); Father went to University (=1); Eldest Child (=1); Aged 14 years (=1). Standard errors for Single-Sex and Female \* Single-Sex are estimated using a bootstrap in column [5]. Marginal Effects are reported when model is probit.

Robust standard errors in brackets

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 3: Propensity Score Estimate for the female, single-sex education interaction.**

Female * Single-Sex (=1)	0.28**	0.29***	0.26***	0.28***	0.27***	0.26***	0.23***	0.25***	0.25***	0.24***
	[0.11]	[0.10]	[0.09]	[0.09]	[0.09]	[0.08]	[0.08]	[0.08]	[0.08]	[0.08]
Observations	242	242	242	242	242	242	242	242	242	242
Using nearest (#) of neighbors	1	2	3	4	5	6	7	8	9	10

*Standard errors are calculated by bootstrap*

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 4: Examining the Experimental and Survey Results Together.**

VARIABLES	DEPENDENT VARIABLE						
	(=1) if Student Choose Option Two in "Fiver" round			Readiness to take Risk (1-10)	Hypothetical Lottery Investment		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Female (=1)	-0.36*** [0.07]	-0.51*** [0.13]	-0.33*** [0.08]	-0.44 [0.37]	-0.79 [0.58]	-0.92 [0.75]	-0.29 [0.23]
Single-Sex (=1)	-0.13 [0.10]	-0.12 [0.10]	-0.13 [0.10]	-0.21 [0.40]	-0.34 [0.56]	-0.31 [0.71]	-0.11 [0.22]
Female * Single-Sex	0.33*** [0.06]	0.32*** [0.06]	0.28*** [0.06]	0.75 [0.50]	1.83** [0.71]	2.25** [0.89]	0.70*** [0.27]
All-Girls Group (=1)	0.12* [0.06]	0.13** [0.06]	0.12** [0.05]	-0.18 [0.29]	0.25 [0.43]	0.29 [0.55]	0.09 [0.16]
All-Boys Group (=1)	-0.05 [0.10]	-0.06 [0.11]	-0.04 [0.10]	-0.12 [0.42]	1.00 [0.61]	1.24* [0.75]	0.38* [0.23]
Readiness to take Risk (		0.04* [0.02]					
Female * Readiness to t		0.04 [0.03]					
Invest £20,000 (=1)			-0.07 [0.14]				
Invest £40,000 (=1)			0.06 [0.11]				
Invest £60,000 (=1)			0.04 [0.12]				
Invest £80,000 (=1)			0.34*** [0.04]				
Invest £100,000 (=1)			-0.14 [0.28]				
Female * Invest £20,00			0.05 [0.13]				
Female * Invest £40,00			-0.13 [0.18]				
Female * Invest £60,00			0.16** [0.08]				
Female * Invest £80,00			-0.88*** [0.02]				
Female * Invest £100,0			0.13 [0.12]				
MODEL TYPE	Probit	Probit	Probit	OLS	OLS	Tobit	ordered Probit
Constant				6.94*** [0.27]	3.41*** [0.45]	2.87*** [0.59]	
Observations	260	255	259	255	259	259	259
R-squared				0.019	0.058		
Cut 1							-0.72*** [0.18]
Cut 2							-0.05 [0.18]
Cut 3							0.64*** [0.18]
Cut 4							1.22*** [0.20]
Cut 5							1.90*** [0.22]

*Robust standard errors in brackets*

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$