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Handling Risk: Testosterone and Risk Preference, Evidence from Dhaka, Bangladesh

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Abstract

The relationship between testosterone and risk aversion is of increasing interest in the experimental economics. Using the ratio of the second digit to the fourth digit (2D:4D) as a rough indicator of level of prenatal testosterone exposure, this study attempts to replicate recent results from Garbarino et al., (2011), which found that individuals with digit ratios above the sample average were significantly more risk averse, and indivudals with digit ratios one standard deviation below the sample average were significantly more risk seeking in a subject pool of male and female Caucasian students. Here, a subject pool from Dhaka, Bangladesh, is used. The results are somewhat mixed, but similar to the findings in Garbarino et al (2011). This study also controlled for other factors that have been shown to contribute to risk preference in an effort to make sure any relationship found between digit-ratio and risk aversion did not arise due to omitted variables.

1 Introduction

Risk has an underlying presence in most economic decisions at the individual level. It is easily observed that people have different risk preferences; some are risk loving, some are risk averse. Relatively little is known, however, about the

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origins of risk preference heterogeneity or the factors that contribute to individual preference for risk. Given that risk is such an important facet of economic decision-making, understanding risk aversion heterogeneity has potential implications for economic theory.

One of the most consistent findings in experimental economics is the significant difference in risk attitudes between men and women. This raises the question: are differences in risk preferences due to genetic or to social reasons? Recent evidence from the experimental and behavioral economics literature suggests that hormonal differences can account for a significant portion of preference for risk between, and within, men and women. These studies, which are discussed in depth later, suggest that biological characteristics may explain some of the heterogeneity in risk preferences between, and within, genders. While these studies have provided evidence of biological correlates, the magnitude of the relationship is small, which suggests that the majority of risk preference heterogeneity between men and women is likely social in nature, and that behavior differences that we observe between genders may not be as dichotomous as we believe.

This study provides further evidence of the link between prenatal testosterone exposure and attitude toward risk. Results from previous studies have been mixed, implying that further research is needed. The first goal of this study was to attempt to replicate the results of Garbarino et al (2011), using a similar experimental procedure. Second, this study extends the current literature by including control variables that have been omitted from past studies. It is known that attitude toward risk is multifaceted in nature, thus only controlling for prenatal testosterone exposure, as previous studies have done, is not sufficient in creating accurate risk profiles. By adding controls for parental occupation and parental education, this study merges the literatures of the influence of hormones and learned behavior (parental mimicking) on attitude toward risk. Finally, a simple reduced form model is derived and tested. The results provide some evidence of a correlation between digit-ratio and attitude toward risk within, and between, genders. Multiple robustness checks are conducted in an effort to be as conservative as possible with inference.

2 Literature Review

2.1 Theoretical Determinants of Risk Aversion

The interdisciplinary approach that has been taken in studying risk suggests that risk preferences are determined through many channels (Hryshko et al., 2011). Evidence suggests that cognitive ability, especially in math, (Benjamin, Brown, and Shapiro 2005), emotions (Lowenstein, Weber, Hsee, and Welsh, 2001), and parental mimicking (Charles and Hurst, 2003; Hryshko, Luengo-Pardo, and Sorensen, 2011; Paola, 2010) all contribute to risk preference through environmental, or societal means. Further evidence supports the claim that, to some degree, genetics and hereditary traits may contribute to risk preference. Prenatal testosterone exposure (Garbarino et al., 2011; Coates, Gurnell, and Rustichini, 2009), and genes that regulate neurotransmission of dopamine and serotonin (Kuhnen and Chiao, 2009; Carpenter, Garcia, and Lum, 2011) have been shown to correlate with risk aversion. A study by Cesarini et al. (2009) estimated that approximately twenty percent of individual variation in risk aversion can be explained by genetic differences. Section 2.3 presents a more in depth discussion of the influence hormones have on risk preference.

Parental mimicking seems to play a significant role in determining an individuals preference for risk. Studies have shown that parental risk aversion correlates significantly with offspring risk aversion. The majority of studies examining the hereditary behavior of risk were done by using survey methods rather than risk experiments. Dohmen et al. (2010) used data from the German Socio Economic Panel to show that there is a correlation between parental preference for risk and their sons preference for risk. Leurerman and Necker (2010) provide evidence of the relationship by examining occupation choices, finding that fathers who have chosen risky jobs have sons with higher risk jobs. A study by Paola (2010) found a correlation between a fathers occupational choice and offspring preference for risk. He used a survey method and a risky investment game to identify how subjects behave in risky situations, and found that having a father who is an entrepreneur significantly decreased risk aversion of children. Although these results are based on survey questions and not observed behavior, they provide some evidence that parental occupational choice may be a promising proxy for parental preference for risk when other data is not available.

2.2 Gender Differences in Preference for Risk

One of the most consistent findings in the experimental economic and psychology literature is the gender difference in risk attitude. Evidence from risk experiments involving monetary and non-monetary risks, both in the laboratory and in the field, suggests that women tend to be more risk-averse than men. Women were shown to be more risk averse in 14 of 16 different measures of risk in a meta-analysis by Byrnes, Miller, and Schafer (1999). In economic experiments that involve financial risk decisions, women express more aversion to risk then men (Croson and Gneezy, 2009). Similarly, studies that examine loss-aversion find that women tend to be more loss averse than men (Brooks and Zank, 2005). Further evidence of a gender difference in preferences for risk is provided by Dohmen and Falk, 2006; Hryshko et al, 2011; and Eckel, Grossman et al, 2012. The gender difference is so strong that experiments by Daruvala (2007) and, Ball et al. (2010) found that both men and women predict that women will make more risk averse decisions than men. This suggests that the observed gender differences in risk preferences may be engrained in gender stereotypes. This stereotype has negative consequences for women in the workplace, as stereotypical attitudes can lead to discrimination and institutional barriers (Garbarino et al., 2011).

Why the gender difference in preferences for risk occurs is still an open question. It is possible that the gender difference is purely artifactual, arising from the methods used to examine risk (Bromiley and Curley, 1992; Eagly, 1995; Unger, 1990), but this is unlikely. Many experimental methods have been used to examine risk preference, thus it is unlikely that the consistency of gender differentiated risk preference has arisen due to experimental procedures (Powell and Ansic, 1997). Recent experimental economic and psychological studies have examined observed gender difference in risk preference while controlling for sex hormones. Findings from these studies have produced mixed results, but those that find a significant correlation between testosterone and preference for risk suggest that the difference in behavior between men and women may not be clearly defined by gender. Interestingly, recent research provides evidence that the gender difference disappears with high and low levels of prenatal testosterone exposure (Garbarino et al., 2011). Replication is needed, but the findings present evidence that by controlling for hormonal factors some gender difference in risk preference can be explained.

2.3 Risk Attitudes and Testosterone

Testosterone levels differ between men and women and are correlated with behaviors such as aggression (Cohen-Bendahan et al, 2005), sensation-seeking (Feij et al., 1997; Daitzman and Zuckerman, 1980) and confidence (Johnson et al., 2006). All of these behaviors correspond with willingness to take risks. Circulating testosterone levels were found to effect risk aversion in some studies, but over all results have been mixed (Garbarino et al., 2011). Research has linked behavior with sex hormones in a number of studies such as risk aversion (Schipper, 2012) and fairness (Burnham, 2007). Similarly, circulating testosterone levels have been shown to significantly predict financial performance of male financial traders (Coates et al., 2009). In a laboratory experiment, Apicella et al. (2008) found that a positive correlation existed between circulating testosterone and experimental risk taking. Lack of evidence of a hormonal influence on risk behavior, however, was shown in a study by Sapienza, Zingales and Maestripieri (2009), who found that increased testosterone levels in women predicted lower levels of risk aversion, but found no significant effect in men. Similarly, manipulating the amount of circulating testosterone in women was found to not have a significant effect on risk taking (Zethraeus et al., 2009).

Problems with measuring the effect of circulating testosterone on behavior are evident when one considers the fact that testosterone levels fluctuate throughout the day (Garbarino et al., 2011). Similarly, it is difficult to unravel the relationship between circulating testosterone and risk taking behavior because the two suffer from endogeniety issues. Higher circulating testosterone has been shown to decrease risk aversion, but taking risks may increase the levels of testosterone circulating in the body through adrenalin. Thus, pointing to any direct relationship is nearly impossible. The mixed results in examination of circulation testosterone and risk may be evidence of measurement difficulties.

2.4 2D:4D

Surprisingly, prenatal testosterone exposure may offer a better way to examine how testosterone levels influence risk aversion. Testosterone exposure in utero has important organizational effects on brain development (For explanation see: Manning, 2011). Sex steroids acting in utero permanently alter neural systems that make reception of these steroids stronger in later life (Coates et al., 2009). If an individual was exposed to higher levels of prenatal androgens (male sex hormones, such as testosterone), their central nervous system is more sensitive to fluctuations in testosterone later in life. Furthermore, exposure to prenatal androgens leads to a very specific sexual dimorphism; those exposed to higher levels of prenatal testosterone (usually males) have lower ratios of second to forth digit length (2D:4D) (Zheng and Cohn, 2011).

Evidence of the relationship between second to fourth digit ratio and prenatal testosterone exposure has been provided by many observational studies. Females with male twins have lower 2D:4D ratios (indicative of higher prenatal testosterone) than females with female twins (Van Anders et al., 2006); individuals with autism have lower 2D:4D ratios (Manning et al., 2010); individuals with congenital adrenal hyperplasia have lower 2D:4D ratios (Brown et al., 2002; Okten et al., 2002); and, androgen-insensitive men have higher 2D:4D ratios (Manning, Bundred, Newton, and Flanagan, 2003). While these observational studies have provided correlative evidence, a controlled laboratory study by Zheng and Cohn (2011) provided evidence of a more definitive relationship. By exposing rats to different levels of androgens and estrogens during specific periods of fetal development, the authors were able to manipulate digit ratios. Thirty-two years ago Wilson (1982) examined how digit ratio correlated with assertiveness in women. The study surveyed 985 women asking them to describe their personality as well as submit a measurement of their digit ratio. The results show that women lower with 2D:4D were more likely to have described themselves as assertive and competitive.

Interest in the relationship between prenatal testosterone and attitude toward risk began in 2007, but one of the most well-known studies in linking prenatal testosterone and preference for risk was published by Coats et al. (2009). They presented evidence of the relationship between higher levels of prenatal testosterone exposure (lower 2D:4D measurements) and higher profits in a sample of traders on the London Stock Exchange. The premise of this study was built on the idea that in order for traders to make higher profits they must engage in higher risk situations. The findings, being rather sensational, were published in PNAS and drew considerable interest in the experimental economic literature.

The Coates et al. (2009) study was replicated in a laboratory setting by Branas-Garza and Rustichini (2011), who found that the mediating factor between prenatal testosterone and risk aversion was spatial reasoning ability. Mediation analysis is often conducted in order to determine the mechanism that underlies the relationship between control and dependent variables. In this case, Branas-Garza and Rustichini (2011) found that digit ratio correlates with IQ, and IQ correlates with risk preference, but there is no direct relationship between digit ratio and risk preference. The study concludes that IQ is the mediating factor between prenatal testosterone exposure and risk preference. The numerous ways mediation analysis is often flawed (See: Gerber and Green, 2012) notwithstanding, this study also found that men performed significantly better than women on an IQ test (Ravens Progressive Matrices). The significant difference in men and womens scores on this test seem to have driven the conclusions in this study, and given that there is no evidence that women should score lower on Ravens Progressive Matrices tests, the results are likely an exception.

Garbarino et al., (2011) provided evidence that 2D:4D not only correlates with risk aversion levels between men and women but also predicts risk aversion differences within men and women. The study conducted a simple risk experiment in a laboratory setting and found that men and women with higher right hand 2D:4D showed similar levels of risk-aversion. They also find that men and women with lower 2D:4D exhibited similar levels of risk seeking behavior. Missing from this study, however, was measure of inherited behavior. A variable controlling for parental preference for risk, which has been shown to correlate strongly with offsprings preference for risk, should have been included. Thus, while this study presented evidence that there is a biological correlate to risk aversion, and this correlate is not gender specific, the study does not distinguish between biological and learned behavior. It is possible that the study is attributing too much of the variation in risk preference to 2D:4D, thus biasing the results upward by leaving parental preferences for risk out of their analysis.

Apicella et al. (2007) showed that 2D:4D ratio is positively correlated with risk aversion in a sample of Caucasian men and women in Sweden. Results from there study showed that higher 2D:4D ratios significantly correlate with risk aversion, even after controlling for gender. They reported that left hand 2D:4D ratios significantly correlated with risk aversion (P=.0025), while right hand 2D:4D ratios were not significant (P=.091). The authors also concluded that there was no significant interaction effect between gender and 2D:4D ratio, indicating that there is no evidence that the effect is different for men and women (Interaction of 2D:4D and gender, P=.781).

It has also been shown that 2D:4D does not directly correlate with levels of circulating testosterone. This is important, as it could be the case that those with lower digit ratios have more testosterone in their systems at any given time. A study by Dreber and Hoffman (2008) confirmed this, finding that circulating testosterone did not correlate with 2D:4D on either hand. These results were congruent with similar findings by Honekoppet et al. (2007). The Dreber and Hoffman (2008) study failed, however, to find a significant correlation between 2D:4D on either hand and risk aversion.

Evidence of the consistency of 2D:4D has been provided by Trivers et al. (2006), who showed that the 2D:4D ratio is consistent though life. The authors followed a cohort of Jamaican children, taking measurements of their digit ratios in 1998 and then again in 2002. Findings from this study showed that while the average 2D:4D increases with growth, there is no evidence that the rank order of the ratio changes with growth. Individuals with below average 2D:4D at a young age did not show significant growth in the second digit, leaving them with below average 2D:4D in later ages. Also, the authors found no evidence that there are significant changes in digit ratio for either males or females.

The relationship between 2D:4D and risk aversion is not clearcut. Sapienza et al., (2009) found only a marginally significant positive correlation between risk aversion and 2D:4D in a sample of female university students who played a computer game designed to elicit preference for risk. Their results also suggested that testosterone has a non-linear correlation with risk aversion regardless of gender. Similarly, Pearson and Schipper (2012) failed to find a significant correlation between 2D:4D and risk aversion, which the authors concluded could be due the method used to elicit behavior. The authors used a competitive bidding experiment to examine competitiveness in an attempt to replicate findings by Coates et al., (2009) and concluded that it is possible the endocrinological, or hormonal factors that effect behavior in strategic games may not be the same as the ones effecting single-person lottery tasks. A third study which did not produce a significant correlation between risk aversion and digit ratio, Apicella et al. (2008), used a risky investment method to elicit risk attitude. All of these studies present evidence of a possible artifactual relationship between risk aversion and 2D:4D, indicating that method of risk preference elicitation may be driving the significant results others have found. Pearson and Schipper (2012) go further and suggest that hormonal factors that contribute to some behaviors, such as risk aversion derived from a lottery method, may not be the same as hormonal factors that contribute to competitive behavior.

This new line of research presents a plethora of interesting findings, however, little experiment replication has occurred. Perhaps nowhere else in the experimental and behavioral economics literature is replication more needed than in the area of biological and genetic correlates of behavior. Furthermore, it seems that exact replication of previous experiments may be the most ideal method for replication of results. This study replicated the study of Garbarino et al., (2011), which found that prenatal testosterone exposure correlates with risk aversion between, and within, men and women. Additional control variables of parental risk aversion (proxied through parental occupation and education level) were added as well, in an attempt to account for mimicked behavior. Finally, the study was the first conducted with a subject pool from Bangladesh. Results of 2D:4D studies using ethnically mixed samples have been not conclusive, (see: Apicella et al., 2008; Schipper, 2011). It is also known that average digit ratios are not constant across ethnicities. Therefore, at this point, restricting sample populations to homogeneous groups is a necessity (Manning et al. 2002, 2004; Pearson and Schipper, 2012). The results from this study add some degree of external validity to the findings that others have produced.

3 Methodology

Measuring risk attitude can be difficult, as risk attitude is a construct of many complicated behavioral traits. The ordered lottery method of eliciting risk preferences has been used frequently in the last three decades. In the 1980s Binswanger (1980, 1981) used an ordered lottery system in a field experiment to uncover risk preferences of rural farmers in Bangladesh and India. Murnighan et al. (1988) brought this method to a laboratory setting later that decade, where it continues to be a popular method of measuring risk preference (See: Eckel and Grossman 2002, 2008). Another method used to measure risk preference, popularized by Holt and Laury (2002), involves a higher level of cognitive assessment by the subject. The Holt-Laury method allows for a more fine-tuned measure of risk preference than the ordered lottery method, and may allow for more statistical prediction power. However, due to the complicated nature of the Holt-Laury method, and the amount of mathematical ability required for a subject to make an informed choice, the Holt-Laury method introduces more noise in to the data (Dave et al., 2010). Thus, choosing a method of eliciting risk preference becomes a balancing act between minimizing noise and maximizing predictive power.

The Holt-Laury method is slightly more complicated. This method involves a set of 10 binary choices, high risk gambles and low risk gambles. Both the high risk and the low risk gambles have the same probabilities, but have different low and high payoffs. Thus, the risk gambles are risky due to the high variance between low and high payoffs. As subjects move down the list of binary choices, the probability of a high or low payoff changes. The majority of subjects will notice that they should choose the low-risk lottery when the probability of getting the high payoff is low, and the high-risk lottery when the probability of getting the high-risk payoff is high. The point at which a subject switches from the low risk to the high-risk lottery is then used to calculate risk aversion.

The ordered lottery experiment, used in this paper, was conducted as follows. Each subject was presented six possible gambles from which they are asked to choose the one they wished to play. All gambles have a 50/50 chance of either a high or low payoff. The first gamble is the safest, with a sure payoff with zero variance. From the first gamble, each proceeding gamble increases in expected payoff as well as risk (standard deviation). The last gamble, however, does not have a higher expected payoff than the proceeding gamble, it only has a larger standard deviation. Thus, the last gamble should only be chosen by individuals who are risk seeking, rather than simply risk-neutral.

For the experimenter, there is a certain degree of risk in choosing which method to utilize. First, knowing the subject pool is important. If it is reasonable to suspect that the subjects have sufficient aptitude in mathematics, then perhaps the Holt-Laury method is best. However, sometimes mathematical aptitude can be difficult to gauge and if subjects do not have the mathematical ability to understand the Holt-Laury method the results tend to be risk averse biased (Dave et al., 2010). The ordered lottery method, on the other hand, is simpler to understand but produces a more crude estimation of risk preference. It has been shown, however, that the ordered lottery method produces a more consistent estimate of risk preference (Dave et al., 2010).

Replication is one of the most important aspects of the scientific method, thus an attempt to produce similar results should follow from an attempt to replicate procedures. For this reason I used the same methodology as Garbarino et al. (2011), an ordered lottery method with a modification of an additional lottery designed to elicit loss aversion preference. Loss aversion is closely related to risk aversion, and contributes to the risk profile of an individual.

3.1 Experiment Procedure

The experiment was conducted at the Independent University of Bangladesh, Dhaka, which is a private university in the neighborhood of Bashundhara, Dhaka. Subjects were recruited by the use of flyers around campus, as well as word of mouth.

Subjects entered the large lecture hall where the experiment took place. As the students entered they were handed a set of instructions and told to take a seat and read through the instructions. Subjects were encouraged to raise their hands if they had a question.

After subjects had read and signed the consent form, they were asked to make their choices in two lotteries. Next, they were asked to fill out a survey, which asked questions about their personal backgrounds. Finally, subjects were asked to complete a short IQ test. The test used was the Ravens Progressive Matrices, which has been used in similar studies (Branas-Garza and Rustichini, 2011). Once subjects had completed the tasks, payment was determined and subjects had their hands scanned by a volunteer.

Digit ratios were measured using the GNU Image Manipulation Program (GIMP), which allows for measurement in pixels. This program has been used in previous studies (Pearson and Schipper, 2009; Baily and Hurd, 2005). Digital measurements have been shown to be more precise and reliable than other methods of digit ratio measurement (Kemper and Schwerdtfeger, 2009).

3.2 Payoff Structure

The lotteries were constructed as follows. Every subject was presented with two (identical) lotteries; the only difference between the two lotteries was in the way the lotteries were framed. In the first lottery, which will be called the Gains Lottery, subjects were presented with six choices; the first and lowest risk lottery paid 100 Taka with 100

The second lottery, which will be called the Losses Lottery, was an exact mirror of the Gains Lottery. This time, instead of subjects starting with zero Taka, and taking risks to increase their winnings, subjects started with 500 Taka and each lottery deducted from this 500 Taka endowment. For example, if a subject chose the first lottery they would lose 400 Taka with a certainty of 100

4 Model

Thus far, no theoretical framework has been laid in the existing literature as to how hormones may relate to behaviors. For the purpose of extending the literature, a simple model is outlined below.

First, it is assumed that risk tolerance consists of two aspects; time variant factors, and time invariant factors.

$$R_{it} = f(X_{it}, h_i)$$

R_{it} = Risk tolerance of individual i at time t

X_{it}= A vector of time-varying factors

h_i= A vector of time invariant factors

There are a number of time varying factors that could potentially contribute to an individuals risk tolerance. These factors can change over time through exogenous or endogenous channels. For example:

$$X_{it} = f(inc_{it}, IQ_{it}, P_{it})$$

$inc_{it} \equiv$ income level of i at time t

$IQ_i \equiv$ IQ of i at time t

$P_{it} \equiv$ factors external to i at time t

Similarly, there are a number of time invariant factors that could potentially contribute to an individuals risk tolerance. Factors such as sex, and genetics, do not vary with time and have been show to effect risk tolerance of individuals in previous studies (Kuhnen and Chiao, 2009; Carpenter, Garcia, and Lum, 2011). For the purpose of this study, exposure to testosterone prenatally will serve as a time invariant factor.

$$h_i = f(g_i)$$

$g_i \equiv$ a vector of genetic characteristics of individual i

Linearly, the model takes the following form. Time invariant factors allow for separate constant terms, unique to each individual.

$$R_{it} = \alpha + X_{it} + h_i + \epsilon_{it}$$

In this study, given the limited available data, the complete reduced form model looks as follows. The controls in this model are; IQ, father is a businessman, father is a government worker, mother works, mothers level of education, fathers level of education, digit ratio, and gender. The variables parental occupation and education level are used to measure external factors, and attempt to control for learned behavior. IQ is used as a measure of intelligence of the individual. A gender dummy variable controls for sex of the individual. It is important to note, however, that gender and sex are not one in the same. Gender is a social construct, and has the potential to vary over time, while sex is purely biological and can be considered time invariant. Thus, being female or male may influence risk attitude through multiple channels. To account for time invariant, biological characteristics digit-ratio is used as a rough measure of exposure to testosterone prenatally.

$$R_{it} = \alpha + \beta_1 Rscore_{it} + \beta_2 bus_{it} - \beta_3 gov_{it} + \beta_4 mwork_{it} + \beta_5 medu_{it} + \beta_6 fedu_{it} - \beta_7 digit_i - \beta_8 gender_i + \epsilon_{it}$$

4.1 Expectations

This section discusses the expected relationships between the dependent and control variables. Individuals who score higher on the Ravens test are expected to have a higher tolerance for risk, perhaps due to the mental calculations needed to evaluate the expected value of lottery choices.

Individuals with fathers who are businessmen are expected to have a higher tolerance for risk as well - an expectation based on previous studies (Paola, 2012)- because it is expected that individuals who observe their parents taking risks will be more likely to take risks themselves. On the other hand, and based on findings from Paola (2012), individuals whos fathers are government workers are expected to be less risk tolerant.

Individuals whose parents completed higher levels of education are expected to be more tolerant to risk. It is likely that parental education plays a large role in shaping the beliefs and behaviors of an individual, thus, it is expected that individuals whose parents valued education more (or were better able to afford it) will be more risk tolerant than those whose parents are less educated.

The expectation of the relationship between digit ratio controls and risk tolerance are based in previous studies as well, individuals with lower digit ratios (indicating higher levels of prenatal testosterone exposure) will be more risk tolerant than those with higher digit ratios. Lastly, it is expected that females will be more risk averse than males, however, it is also expected that the significance of this relationship will decrease when digit ratio controls are added. If this is the case, the results will be inline with findings of Garbarino (2011) and could add some degree of external validity.

5 Summary Statistics

The sample consists of 190 subjects, all of which are International University of Bangladesh students. The majority of the subjects were male. The fact that the sample is skewed away from females does not create problems later in regression analysis, but does reduce the power of tests, making it difficult to find relationships within female subjects. Figure 1 below presents descriptive statistics from the sample.

Figure 1: Summary Statistics

Variable	Male	Female	p-value
Number	147	43	
Choice in Loss	4.102	3.279	0.004
Choice in Gains	4.088	3.442	0.0196
Average of choices	4.095	3.36	0.0014
Left hand digit ratio	0.951	0.973	0.00
Right hand digit ratio	0.962	0.982	0.0005
Average digit ratio	0.956	0.9778	0.00
Smokes everyday	0.394	0.05	0.00
Mother works	0.558	0.698	0.0511
Age	21.069	20.886	0.285
Number of Siblings	1.897	1.767	0.713
Age of mother at birth	2.493	2.333	0.069
Birth order	1.938	1.85	0.31
Father's years of edu	3.562	3.738	0.9299
Mother's years of edu	2.935	3.07	0.8141
Father is a businessman	0.508	0.576	0.7531
Father works for Government	0.098	0.152	0.8054
Father works in service sector	0.164	0.151	0.4322
Owns Credit Card	0.221	0.171	0.2448
Somkes Some days	0.168	0.175	0.57
Raven's Score	6.945	6.534	0.5095

As is evident, females chose significantly lower risk lotteries in both the Gains Lottery and the Losses Lottery. Females also had significantly higher digit ratios, in both hands. The difference between male and female answers when asked if they smoke every day is significant, in that males responded in the affirmative significantly more than females. These are the only variables carrying a significant gender difference. This is of importance because, as the table above presents, all control variables show no significant gender differences. Of particular interest is the Ravens Test score, which show no significant gender differences. This finding contrasts what was found in Branas-Garza and Rustichini (2011), which found that males scored significantly higher than females.

The variables motherschool and fatherschool are categorically coded. Subjects were asked to indicate how many years of schooling their parent completed. Categories were; primary school, secondary school, college, and university.

Choices in both the gains framed lottery and the loss framed lottery had similar patterns. Males tended to chose higher risk choices in both lotteries. Interestingly, very few individuals chose choice 5. Choice 5 had the same expected payoff as choice 6 (the highest risk lottery), but was less risky. If were operating under the assumptions put forward by Expected Utility Theory, individuals should have chosen this lottery.

Due to the irregular distribution of both the gains and losses lottery choices, a third measure was used. By taking the average of an individuals choice in the two lotteries, the average gamble (or average choice) distribution was formed. This distribution more closely resembles a normal distribution and will be used later in regression analysis. Digit ratios on both hands are broken up by gender and their distributions are plotted. Both left and right hand distributions have significant overlap between genders, but in both cases males have, on average, lower digit ratios than females.

Figure 2: Lottery Choices

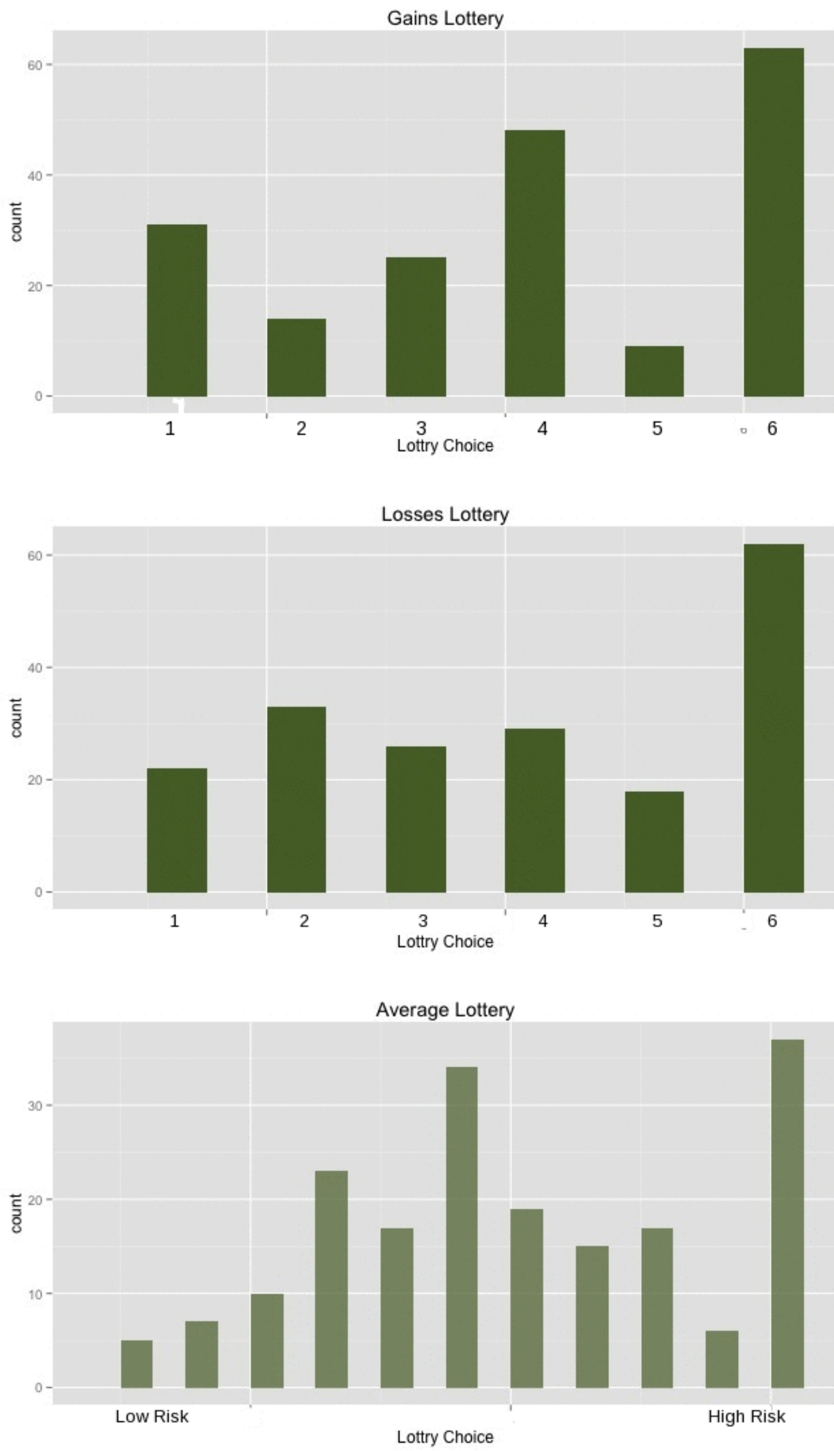
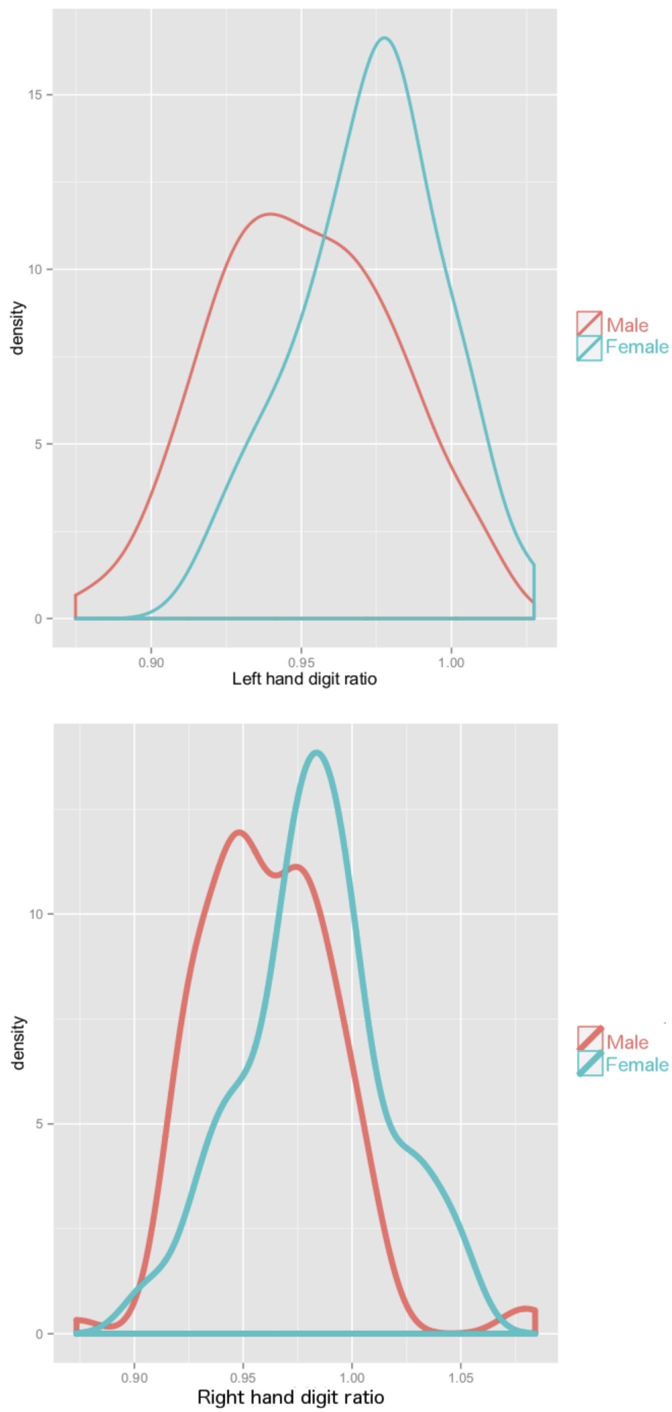


Figure 3: Distributio of Digit Ratios



Using left hand digit ratios, which were found in this study to be more significantly different between genders, a non-parametric graph indicated a negative relationship with the average lottery choice for males, but no clear relationship for females. Linearly, the relationship is similar.

Figure 4: Non-parametric relationship between digit ratio (left hand) and average lottery choice

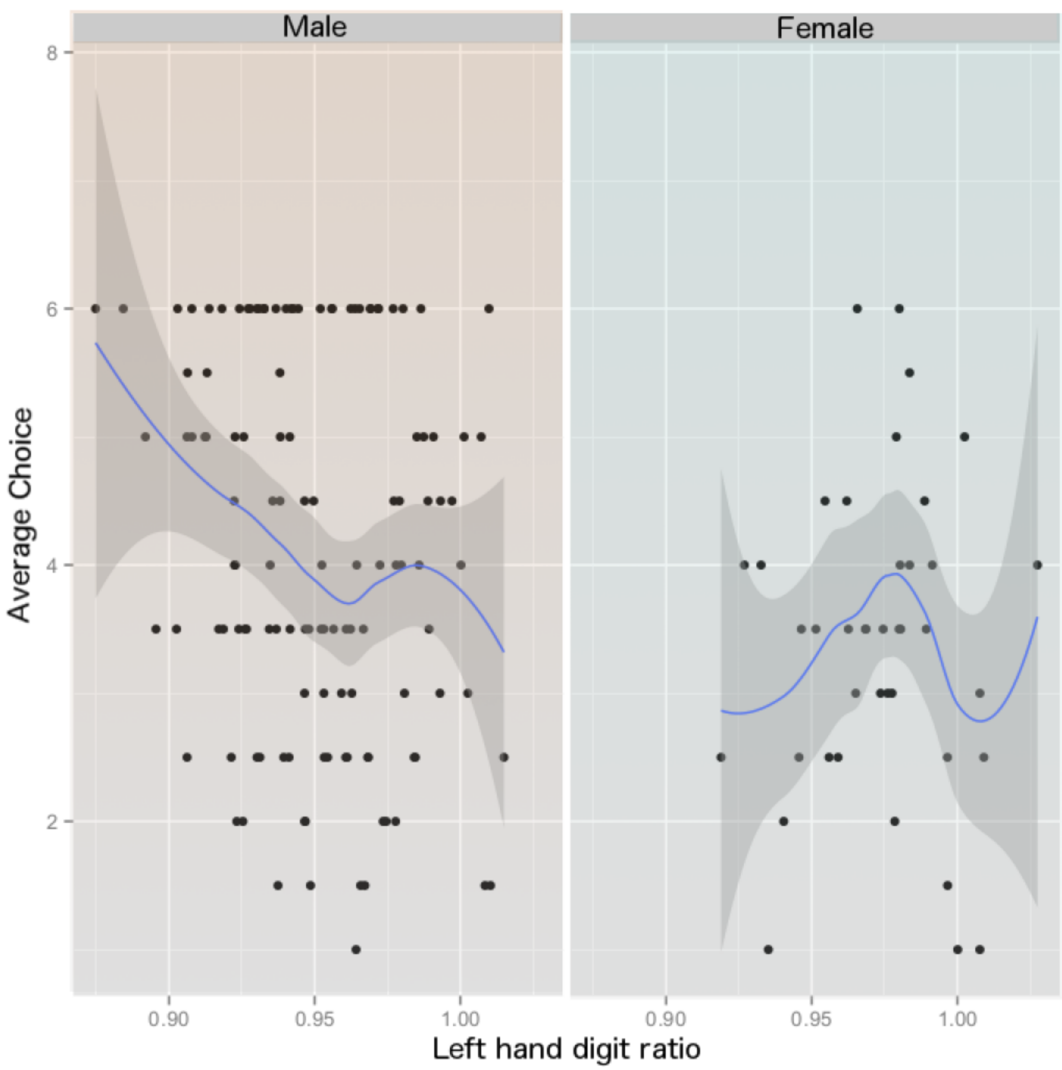
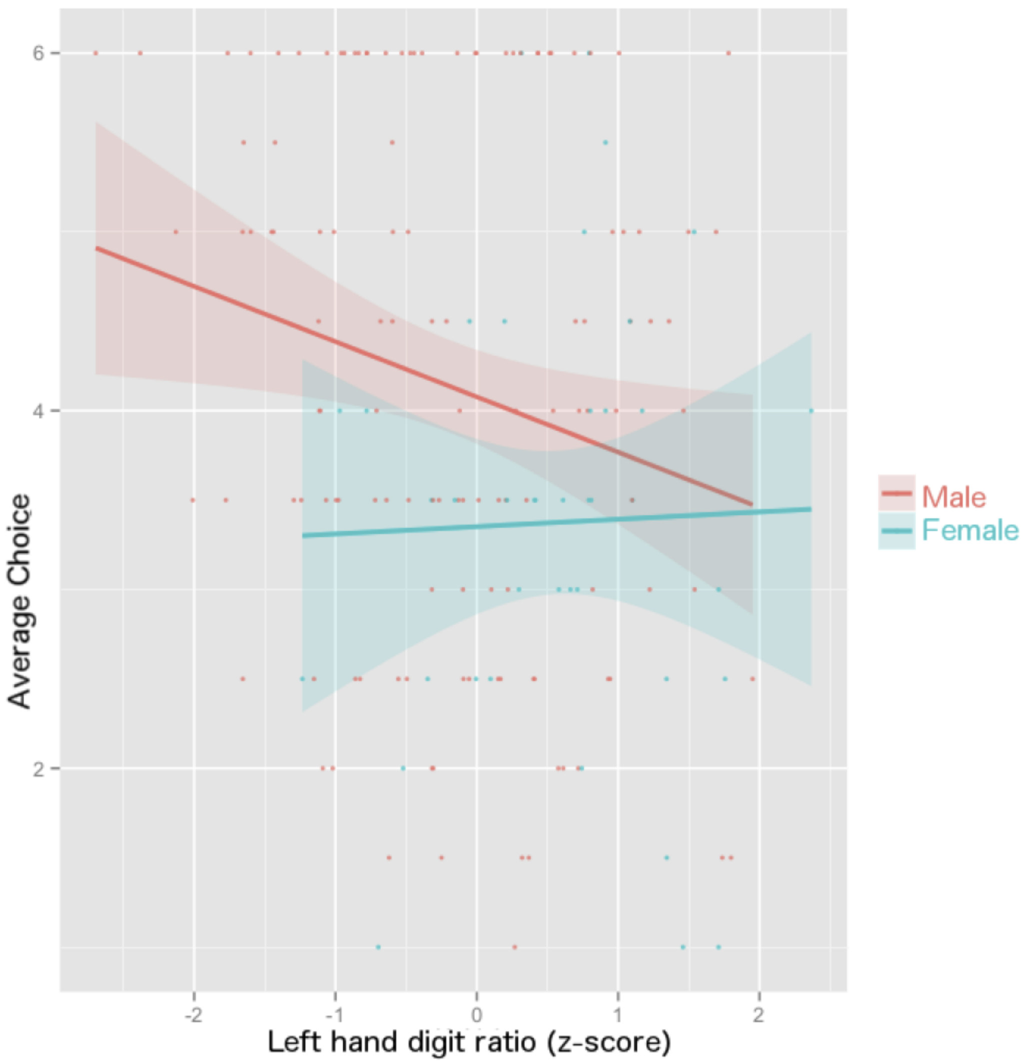


Figure 5: Linear relationship between standardized digit ratio (left hand) and average lottery choice



6 Regression Analysis

6.1 OLS Estimates

OLS estimation was carried out on a number of different specifications, with the data is broken down by lottery and gender.

6.1.1 Gains Framed Lottery

Figure 6 presents the most basic results of this study. In the first two specifications, the dependent variable is choice in the gains framed lottery. Here, the control for gender is significant when it is the lone control variable. When left hand digit ratio is added as a control, there is no longer a significant relationship between gender and lottery choice. In the third and fourth column a similar procedure is carried out using choice in the loss framed lottery as a dependent variable. Here, however, the relationship between female and lottery choice remains significant after left hand digit ratio is controlled for, although significance is reduced.

Figure 6

VARIABLES	(1) Gains	(2) Gains	(1) Loss	(2) Loss
female	-0.647**	-0.402	-0.823***	-0.744**
	(0.311)	(0.346)	(0.309)	(0.342)
zscore 2D:4D (left)		-0.273*		-0.223
		(0.149)		(0.147)
Constant	4.088***	4.031***	4.102***	4.145***
	(0.148)	(0.164)	(0.147)	(0.162)
Observations	190	164	190	164
R-squared	0.022	0.040	0.036	0.060

Standard Errors in Parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 7 presents the results of regressing dependent variables on an individuals choice in the gains lottery. Here, higher levels of the dependent variable indicate lower levels of risk aversion. Thus, negative coefficients correspond with increased risk aversion, while positive coefficients correspond with increased risk tolerance. Interestingly, females did not seem to make significantly lower risk choices in this lottery. Score on the Ravens Test also does not correlate with any significant change in lottery choice with lotteries framed as gains. Years of mothers schooling has a somewhat consistent relationship with lottery choice here, having a mother who completed more years of schooling (moving from one category to the next in the survey) is correlated with a decline in lottery choice (moving to a lower risk lottery). The variable business also showed significant correlation with risk aversion in this lottery. Subjects with fathers who are businessmen were more risk averse than those who had fathers in other occupations. The business indicator correlated with a lower risk lottery choice in all specifications, but the effect was strongest when digit-ratio was not included. Lastly, only digit-ratio on the left hand was statistically significant in this lottery framing. The results indicated that a digit-ratio one standard deviation below the sample average correlated with a decrease in risk aversion of .308 units. Again, risk tolerance was measured in relation to lottery number choice, where a choice of lottery 1 is the lowest risk and a choice of lottery 6 is the highest. So, the results were fairly small in magnitude.

Figure 8 presents the same regression analysis for males only. Here, only two variables show significance, and neither is consistent through the four specifications. Digit ratio controls are not significant in any specification.

Figure 9 displays the results for females. First, it should be noted that due the very small sample size, any results from this regression are hardly indicative of any meaningful relationship. That being said, there are a number of significant controls, including digit-ratio controls on both hands. Having a father who is a businessman is highly significant in all specifications, and the coefficient on the variable is around -3.0 in all specifications. This is quite large in magnitude. Mothers education level was also highly significant in all specifications. The results indicated that subjects with mothers who have achieved higher levels of education preferred the lower risk lotteries, or, were more risk averse. Again, the coefficient here is quite large in magnitude. Digit-ratio controls are significant as well (left hand p-value =.025, right hand p-value=.047).

6.1.2 Losses Framed Lottery

Figure 10 presents the results from regressing choice in the loss-framed lottery on a number of controls for the full sample. Unlike the gains-framed lottery from the previous section both Female and Rscore were consistently significant. Females chose lower risk lotteries in the loss-framed lottery, and a one-point increase in Ravens test score correlated with higher risk choices. Digit-ratio controls were not significant in any specification.

Figure 11 presents results for males only. Again, the results indicated that individuals who scored higher on the Ravens test preferred the higher risk lotteries. The left hand digit-ratio control was significant as well (p-value=.032). Figure 11 presents the results for females only, of note was the positive correlation between mothers education and risk tolerance, which was significant in two of the four specifications. This was the exact opposite of the effect found in the gains framed lottery for females.

6.1.3 Average of Lottery Choices

The average choice lottery is the most normally distributed dependent variable, and it has the added benefit of offering insight in to which effects from the gains and losses lottery are more powerful. For example, in the gains framed lottery (Table 7) the business dummy variable was highly significant through all specifications, while in the loss framed lottery (Table 10) it was not significant in any specification. When the average of choices made in the loss and gains framed lotteries was used as the dependent variable, the business dummy variable was only marginally significant in one specification. Similarly, the left hand digit-ratio control was significant in the gains lottery, but not the loss lottery. When the average of lottery choices was used as a dependent variable the left hand digit-ratio is significant (.029). Using the average of lottery choices as a dependent variable in this way could be problematic if individuals exhibited loss aversion, or were more risk averse in the loss lottery. Loss aversion was not found in this sample.

The results from regressing a number of controls on the average of lottery choices are presented in Figure 12. Here, the dependent variable was simply the mean lottery choice for each individual. Females made lower average risk choices, and individuals who scored higher on the Ravens test chose higher average risk choices. Of the digit-ratio controls, only left hand digit-ratio was significant (p-value=.028).

The Figures 13 and 14 present the results for males and females only. For males, the only significant covariate is the left hand digit-ratio control and IQ. For females, the only consistently significant covariate was the business dummy variable, which remained highly significant, and negative, through all specifications. Fathers schooling was also significant, but in the opposite direction of what was expected. For females, the digit-ratio controls were not significant. For males, IQ was marginally significant in three of the four specifications and left hand digit-ratio was significant (p-value=.024).

7 Robustness Check

7.1 Tobit

Censoring in the data was a potential concern. Due to the fact that risk preference was measured by lottery choice, an observed signal of an underlying latent variable, it is possible that an individuals true risk preference may have been censored simply by the construction of the lottery choices.

$$R_{it} = \alpha + \beta X_{it} + h_i + \epsilon_{it} \equiv C_i$$
$$R^*_{it} = R_{it} \iff \underline{C_i} \leq R^*_{it} \leq \overline{C_i}$$

For example, the signal observed of an individual choosing lottery 6 (the highest risk lottery) may not be a completely accurate measure of the individuals risk preference. The individual may have preferred an even higher risk lottery, if one had been available. Thus, the possibility of censoring may arise. Censoring was confirmed by examining the frequency of lottery choices. The results of the Tobit regressions (Tables 14-22) show that after accounting for censoring in the dependent variable, no significance is lost. In fact, a few variables gain significance when moving from OLS estimates to Tobit estimates.

7.2 Smoking

Given the evidence that digit ratio correlated with attitude toward risk elicited by the ordered lotteries, a significant relationship between digit ratio and other measures of risk should be expected. The risks associated with smoking are well known, even in Dhaka where many smoke. As part of the survey individuals were asked if they smoke, and this was used as a binary dependent variable to test the relationship between digit ratio and another behavioral risk. The results, presented in Table 23, show individuals with lower than average digit ratios (associated with higher levels of prenatal testosterone) were more likely to smoke. The relationship was then broken down by gender. The relationship was not significant for males, but was significant for females. The lack of significance for males was not surprising, most males in Dhaka smoke, and thus smoking may not be the best measure of risky behavior. The significant relationship found with the female subjects was more surprising, but makes intuitive sense when the culture of Dhaka is taken into account. In Dhaka culture, a female smoking in public is taboo. So, while many females do smoke, responding positive to the question do you smoke? is more of a risky behavior for females than it is for males.

7.3 Potential Omitted Variables

The possibility exists that unobservable factors in the error term may be correlated with observed control variables. Due to the small sample size present in this study, the inclusion of too many control variables quickly leads to degree of freedom loss. For this reason I chose to control for only a limited number of variables, based on a priori notions, in the model presented and in previous regressions. In this section I explore the possibility of potential omitted variables.

One situation, likely to introduce bias, arose when considering how parents chose their level of education. It is reasonable to assume that educational pursuits may be put on hold when children are born, especially for mothers. Further, it is likely that persuing education becomes more difficult as the number of children a parent has to raise increases. Thus, it is likely that number of children is negatively correlated with educational attainment. To control for this, a variable was added for the number of siblings a subject had.

The relationship between autism and older maternal age at birth is well documented in the medical literature (Gillberg, 1980; Reichenberg et al., 2006) Similarly, the link between testosterone and autism has been documented (Ingudomnukul et al., 2007; Auyeung et al., 2009). Thus, it is possible that omitting this variable could bias the relationship between digit ratio and risk preference. To control for this, age of mother at birth was added to the regressions.

Tables 28-33 present OLS results produced when including these variables. No significance was lost when including these potential confounders. In fact, these variables increase the predictive power of the model, and some digit ratio controls gain significance.

Lastly, to determine whether the non-digit ratio controls were contributing some of the variation associated with digit ratio controls, a simplified model was run. Figure 34 presents the results for the gains lottery, and shows that as more controls were added the left hand digit ratio control did not lose significance. The coefficient, however, associated with the left hand digit ratio control did decrease slightly in magnitude. This indicates that excluding the additional controls led to over estimation of the influence of digit ratio controls. In the loss framed lottery (Figure 35), the left hand digit ratio control did lose significance when other factors were controlled for. This was interesting, however, digit ratio controls were not significant in the initial run of the loss framed lottery (see: Figure 10). To investigate further, a similar procedure was conducted on the loss framed lottery for males only. Previously, this specification had the most consistent, and significant, digit ratio controls. The results (Figure 36) indicated no loss of significance in left hand digit ratio, and decline in effect magnitude.

8 Discussion

This research examined the relationship between prenatal testosterone exposure, measured roughly by digit-ratios, and behavior under uncertainty. Recent reports in the literature, suggest that prenatal testosterone may explain preference for risk between, and within genders; the results of this study did not support this conclusion. In this study prenatal testosterone controls were significant for males in a loss framed lottery, and the relationship within the female sub-sample was significant in the gains framed lottery.

Previous studies have used samples of individuals from developed countries. While results of previous studies have been mixed, one common thread among them was the use of mostly Caucasian samples from North America or Europe. Using a sample from Dhaka, Bangladesh, this study furthers the literature by examining the correlates of financial risk preference in a new environment. Not only is the sample of individuals unique, in that Bangladesh has not been represented in previous studies, but the culture in Dhaka is quite different than the culture in North America and Europe, which could lead to different behavior under uncertainty.

A second contribution to the existing literature is the inclusion of learned behavior cofactors. Controls for parental occupation and parental education levels are missing in previous studies, and their exclusion could have lead to omitted variable bias, or over estimated the influence that prenatal testosterone has on behavior.

There are a few interesting findings that contradict a priori expectations based on findings from previous studies. First, individuals with fathers who are businessmen made significantly lower risk choices. Previous studies (conducted in developed countries) found that parents with higher risk jobs (entrepreneurs, businessmen, etc) had offspring with higher risk tolerance (Leurerman and Necker, 2010; Paola, 2010). These studies were used to inform the hypothesis that individuals in this sample whose fathers were businessmen would chose higher risk lotteries, as it is usually assumed that the business profession is more risky than, for example, working for the government. What is more curious, perhaps, is the fact that this control was only significant for females, and only in the gains framed lottery. In the male only sub-sample having a father who is a businessman did not significantly correlate with risk preference. Reading in to this finding is difficult. Inference complications arise when considering the business culture in Dhaka. It may be the case that business is not a risky undertaking in Dhaka, especially when one has ties to the government. This is only a speculation at this point, and the data in this study do not provide any way of testing this speculation. Also, it may be the case that the females in this study are not a representative sample. The females in this sample are university students, a choice that may be risky in-and-of itself. The fact that they chose to go to college in the face of potential family or cultural pressures not to go could lead to selection for a population of risk takers. Again, this is purely speculation at this point. Further research needs to be conducted.

Second, it is striking that score on the Ravens test was a significant correlate only in the loss framed lottery. One possible explanation for this is that those who also did well on the IQ test were more able to do the calculation required for an individual to make a choice that best reflects their preference. The gains framed lottery is fairly straightforward and does not require as much mental calculation as the loss framed lottery.

Third, the control for mothers education level presents contradictory evidence. In the gains framed lottery, females with mothers who had more education made lower risk choices, while in the loss framed lottery females with mothers who have more education made higher risk choices. This is thought provoking, however, due to the small sample size it is difficult to form any definite conclusion. If nothing else, these results provide fodder for future studies.

Lastly, the goal of this study was to test the robustness of digit ratio controls. It is important to remember that in these studies the analyses of digit-ratios were all relative to the sample average digit ratio. It is not possible to predict behavior by examining an individuals digit-ratio in isolation, only in comparison to a sample average, which may vary from sample to sample. Assigning any sort of causal relationship between prenatal testosterone and behavior was not possible at this stage. The relationship between neural activity and behavior is complicated, and digit ratio is a course measure of prenatal testosterone. Drawing inference is made more difficult due to somewhat heteroskedastic standard errors in some specifications. Convention, White Robust, HC2, and HC3 errors were all tested, and conventional errors were used in this study because they were the largest out of the four. Even with the small sample size, however, I found evidence that prenatal testosterone exposure can partially explain risk preference heterogeneity between and within genders in a sample of students from Dhaka, Bangladesh.

9 appendix

Figure 7: Gains Framing

Dependent Variable: Gains Lottery Choice	(1)	(2)	(3)	(4)	(5)
female	-0.621**	-0.483	-0.357	-0.198	-0.207
	(0.312)	(0.349)	(0.414)	(0.391)	(0.424)
rscore	0.0402	0.0373	0.00771	0.0337	0.0524
	(0.0633)	(0.0707)	(0.0803)	(0.0759)	(0.0813)
business		-0.888***	-0.859**	-0.811**	-0.687*
		(0.317)	(0.349)	(0.339)	(0.359)
government		-0.264	-0.0598	0.0676	0.169
		(0.491)	(0.525)	(0.530)	(0.531)
motherworks		0.453	0.532	0.441	0.631*
		(0.296)	(0.328)	(0.312)	(0.331)
motherschool		-0.322	-0.509**	-0.443*	-0.620**
		(0.203)	(0.235)	(0.226)	(0.242)
fatherschool		-0.0777	-0.0289	0.0277	0.0455
		(0.254)	(0.343)	(0.309)	(0.356)
z_r2d4d			-0.114		
			(0.168)		
z_l2d4d				-0.308**	
				(0.155)	
z_averagedigit					-0.235
					(0.170)
Constant	3.783***	5.294***	5.764***	5.162***	5.346***
	(0.464)	(1.020)	(1.287)	(1.175)	(1.331)
Observations	188	153	122	134	115
R-squared	0.023	0.090	0.108	0.121	0.130

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 8: Gains Framing for Males Only

Gains Lottery (Males)	(1)	(2)	(3)	(4)
rscore	0.0473	0.00570	0.0291	0.0586
	(0.0929)	(0.0894)	(0.0831)	(0.0904)
business	-0.793*	-0.591	-0.439	-0.356
	(0.415)	(0.388)	(0.375)	(0.399)
government	-0.711	0.240	0.247	0.432
	(0.642)	(0.636)	(0.611)	(0.626)
motherworks	0.198	0.465	0.466	0.551
	(0.388)	(0.372)	(0.353)	(0.377)
motherschool	-0.0120	-0.428	-0.311	-0.573**
	(0.266)	(0.259)	(0.249)	(0.269)
fatherschool	-0.228	0.0552	0.171	0.143
	(0.333)	(0.373)	(0.339)	(0.391)
z_maledigitright		-0.0563		
		(0.186)		
z_maledigitleft			-0.278	
			(0.168)	
z_maleavgdigit				-0.208
				(0.184)
Constant	4.136***	5.117***	4.125***	4.703***
	(1.339)	(1.386)	(1.277)	(1.445)
Observations	153	98	105	92
R-squared	0.032	0.065	0.077	0.092

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 9: Gains Framing for Females Only

Gains Lottery (Females) VARIABLES	(1)	(2)	(3)	(4)
rscore	-0.0887	-0.0557	-0.0926	-0.0669
	(0.157)	(0.176)	(0.159)	(0.186)
business	-2.892***	-3.277***	-3.664***	-3.425***
	(0.750)	(0.895)	(0.749)	(0.943)
government	-0.515	-1.487	-0.867	-1.224
	(0.883)	(0.914)	(0.911)	(0.982)
motherworks	-0.0428	0.277	-0.269	0.214
	(0.621)	(0.741)	(0.588)	(0.752)
motherschool	-1.534***	-1.253**	-1.426***	-1.302**
	(0.439)	(0.534)	(0.453)	(0.562)
fatherschool	-0.254	-1.721*	-0.722	-1.363
	(0.516)	(0.914)	(0.614)	(0.893)
z_femaledigitright		-0.758**		
		(0.353)		
z_femaledigitleft			-0.670**	
			(0.278)	
z_femaleavgdigit				-0.731*
				(0.360)
Constant	11.34***	15.97***	13.49***	14.98***
	(2.523)	(4.010)	(2.617)	(4.074)
Observations	32	24	29	23
R-squared	0.465	0.567	0.613	0.560

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 10: Loss Framing

Dependent Variable: Loss Lottery Choice	(1)	(2)	(3)	(4)	(5)
female	-0.798***	-0.845**	-0.956**	-0.689*	-0.741*
	(0.303)	(0.347)	(0.419)	(0.388)	(0.432)
rscore	0.180***	0.191***	0.221***	0.182**	0.190**
	(0.0616)	(0.0703)	(0.0813)	(0.0754)	(0.0829)
business		-0.0245	-0.0582	0.0724	-0.0958
		(0.315)	(0.353)	(0.337)	(0.366)
government		0.217	0.278	0.305	0.314
		(0.488)	(0.531)	(0.526)	(0.541)
motherworks		-0.100	-0.191	-0.242	-0.222
		(0.294)	(0.332)	(0.310)	(0.338)
motherschool		0.317	0.268	0.494**	0.383
		(0.201)	(0.238)	(0.225)	(0.247)
fatherschool		-0.0233	-0.0247	-0.0995	-0.153
		(0.252)	(0.347)	(0.307)	(0.363)
z_r2d4d			-0.0705		
			(0.170)		
z_l2d4d				-0.231	
				(0.154)	
z_averagedigit					-0.251
					(0.173)
Constant	2.824***	1.920*	1.977	1.785	2.323*
	(0.451)	(1.014)	(1.302)	(1.167)	(1.358)
Observations	188	153	122	134	115
R-squared	0.077	0.121	0.131	0.168	0.153

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 11: Loss Framing for Males Only

Losses Lottery (Males)	(1)	(2)	(3)	(4)
rscore	0.205**	0.277***	0.228***	0.245***
	(0.0927)	(0.0887)	(0.0812)	(0.0901)
business	-0.252	-0.00256	0.127	0.00928
	(0.415)	(0.384)	(0.366)	(0.398)
government	-0.419	0.338	0.301	0.341
	(0.641)	(0.631)	(0.597)	(0.624)
motherworks	-0.292	-0.294	-0.400	-0.361
	(0.387)	(0.369)	(0.345)	(0.376)
motherschool	0.231	0.113	0.323	0.234
	(0.265)	(0.257)	(0.244)	(0.268)
fatherschool	-0.0617	0.203	0.0523	0.123
	(0.332)	(0.370)	(0.332)	(0.389)
z_maledigitright		-0.158		
		(0.184)		
z_maledigitleft			-0.358**	
			(0.164)	
z_maleavgdigit				-0.338*
				(0.184)
Constant	1.666	1.257	1.534	1.450
	(1.337)	(1.375)	(1.247)	(1.440)
Observations	153	98	105	92
R-squared	0.049	0.124	0.154	0.149

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 12: Loss Framing for Females Only

Loss Lottery (Females) VARIABLES	(1)	(2)	(3)	(4)
rscore	-0.00250	0.0178	0.0786	0.0485
	(0.174)	(0.217)	(0.198)	(0.230)
business	0.527	-0.650	0.811	-0.517
	(0.834)	(1.102)	(0.933)	(1.162)
government	-0.00403	-0.0424	0.289	0.170
	(0.981)	(1.126)	(1.134)	(1.210)
motherworks	0.481	-0.195	0.431	-0.156
	(0.690)	(0.913)	(0.733)	(0.927)
motherschool	1.215**	1.152*	1.478**	1.226*
	(0.488)	(0.657)	(0.564)	(0.693)
fatherschool	-0.594	-1.650	-0.859	-1.686
	(0.574)	(1.126)	(0.765)	(1.101)
z_femaledigitright		0.196		
		(0.435)		
z_femaledigitleft			0.434	
			(0.346)	
z_femaleavgdigit				0.203
				(0.444)
Constant	1.226	6.106	0.761	5.709
	(2.803)	(4.939)	(3.259)	(5.022)
Observations	32	24	29	23
R-squared	0.232	0.250	0.317	0.265

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 13: Average of Lottery Choices

Dependent: Average Lottery Choice	(1)	(2)	(3)	(4)	(5)
female	-0.709***	-0.664**	-0.656*	-0.443	-0.474
	(0.216)	(0.269)	(0.332)	(0.307)	(0.347)
rscore	0.110**	0.114**	0.114*	0.108*	0.121*
	(0.0463)	(0.0545)	(0.0643)	(0.0596)	(0.0665)
business		-0.456*	-0.459	-0.370	-0.391
		(0.244)	(0.280)	(0.266)	(0.294)
government		-0.0238	0.109	0.186	0.242
		(0.379)	(0.420)	(0.416)	(0.434)
motherworks		0.176	0.171	0.0995	0.204
		(0.228)	(0.262)	(0.245)	(0.271)
motherschool		-0.00292	-0.121	0.0259	-0.118
		(0.156)	(0.188)	(0.178)	(0.198)
fatherschool		-0.0505	-0.0268	-0.0359	-0.0539
		(0.196)	(0.275)	(0.243)	(0.292)
z_r2d4d			-0.0924		
			(0.134)		
z_l2d4d				-0.269**	
				(0.122)	
z_averagedigit					-0.243*
					(0.139)
Constant	3.304***	3.607***	3.870***	3.474***	3.835***
	(0.345)	(0.786)	(1.030)	(0.923)	(1.090)
Observations	188	153	122	134	115
R-squared	0.070	0.110	0.103	0.141	0.123

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 14: Average of Lottery Choices for Males

Average Lottery Choice (Males)	(1)	(2)	(3)	(4)
rscore	0.126	0.141*	0.128*	0.152**
	(0.0852)	(0.0728)	(0.0687)	(0.0756)
business	-0.523	-0.297	-0.156	-0.173
	(0.381)	(0.316)	(0.310)	(0.333)
government	-0.565	0.289	0.274	0.387
	(0.589)	(0.518)	(0.505)	(0.523)
motherworks	-0.0474	0.0856	0.0333	0.0947
	(0.356)	(0.303)	(0.292)	(0.315)
motherschool	0.110	-0.157	0.00607	-0.169
	(0.244)	(0.211)	(0.206)	(0.224)
fatherschool	-0.145	0.129	0.111	0.133
	(0.305)	(0.303)	(0.280)	(0.326)
z_maledigitright		-0.107		
		(0.151)		
z_maledigitleft			-0.318**	
			(0.139)	
z_maleavgdigit				-0.273*
				(0.154)
Constant	2.901**	3.187***	2.830***	3.076**
	(1.228)	(1.129)	(1.055)	(1.207)
Observations	153	98	105	92
R-squared	0.036	0.069	0.106	0.097

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 15: Average of Lottery Choices for Females

Average Lottery Choice (Females) VARIABLES	(1)	(2)	(3)	(4)
rscore	-0.0456	-0.0190	-0.00700	-0.00920
	(0.106)	(0.135)	(0.118)	(0.141)
business	-1.182**	-1.964**	-1.426**	-1.971**
	(0.506)	(0.687)	(0.556)	(0.713)
government	-0.259	-0.764	-0.289	-0.527
	(0.595)	(0.702)	(0.677)	(0.742)
motherworks	0.219	0.0408	0.0807	0.0290
	(0.419)	(0.569)	(0.437)	(0.568)
motherschool	-0.159	-0.0503	0.0262	-0.0379
	(0.296)	(0.410)	(0.337)	(0.425)
fatherschool	-0.424	-1.686**	-0.791*	-1.525**
	(0.348)	(0.702)	(0.456)	(0.675)
z_femaledigitright		-0.281		
		(0.271)		
z_femaledigitleft			-0.118	
			(0.206)	
z_femaleavgdigit				-0.264
				(0.272)
Constant	6.281***	11.04***	7.127***	10.34***
	(1.700)	(3.080)	(1.944)	(3.080)
Observations	32	24	29	23
R-squared	0.251	0.420	0.345	0.435

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 16: Tobit: Gains Framed

Tobit Gains Framed	(1) model	(2) model	(3) model	(4) model	(5) model
female	-0.853*	-0.737	-0.541	-0.332	-0.348
	(0.446)	(0.494)	(0.576)	(0.545)	(0.589)
rscore	0.0633	0.0632	0.0221	0.0575	0.0907
	(0.0917)	(0.102)	(0.113)	(0.107)	(0.115)
business		-1.184**	-1.187**	-0.978**	-0.876*
		(0.460)	(0.496)	(0.481)	(0.506)
government		-0.416	-0.242	0.0105	0.0921
		(0.704)	(0.738)	(0.749)	(0.748)
motherworks		0.607	0.751	0.600	0.894*
		(0.423)	(0.461)	(0.440)	(0.467)
motherschool		-0.526*	-0.748**	-0.668**	-0.901***
		(0.291)	(0.331)	(0.319)	(0.343)
fatherschool		-0.0419	-0.0396	0.121	0.104
		(0.362)	(0.479)	(0.432)	(0.498)
z_r2d4d			-0.211		
			(0.235)		
z_l2d4d				-0.425*	
				(0.221)	
z_averagedigit					-0.385
					(0.242)
Constant	4.171***	6.237***	7.003***	5.850***	6.188***
	(0.672)	(1.466)	(1.801)	(1.640)	(1.849)
Observations	188	153	122	134	115

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 17: Tobit: Gains Framed for Males

Tobit Gains Framed (Males)	(1) model	(2) model	(3) model	(4) model
rscore	0.0828	0.0323	0.0625	0.115
	(0.126)	(0.132)	(0.121)	(0.133)
business	-1.065*	-0.905	-0.530	-0.490
	(0.566)	(0.573)	(0.549)	(0.586)
government	-0.838	0.294	0.398	0.603
	(0.868)	(0.943)	(0.903)	(0.929)
motherworks	0.302	0.678	0.661	0.804
	(0.522)	(0.545)	(0.515)	(0.553)
motherschool	-0.134	-0.666*	-0.511	-0.862**
	(0.358)	(0.379)	(0.363)	(0.395)
fatherschool	-0.251	0.0289	0.286	0.184
	(0.448)	(0.541)	(0.487)	(0.566)
z_maledigitright		-0.156		
		(0.269)		
z_maledigitleft			-0.415*	
			(0.248)	
z_maleavgdigit				-0.377
				(0.273)
Constant	4.940***	6.346***	4.551**	5.516***
	(1.814)	(2.016)	(1.826)	(2.082)
Observations	153	98	105	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 18: Tobit: Gains Framed for Females

Tobit Gains framed (Females)	(1) model	(2) model	(3) model	(4) model
rscore	-0.110	-0.0983	-0.127	-0.114
	(0.174)	(0.176)	(0.173)	(0.188)
business	-3.274***	-3.561***	-4.108***	-3.711***
	(0.842)	(0.905)	(0.830)	(0.956)
government	-0.778	-2.021**	-1.202	-1.683
	(0.976)	(0.944)	(0.991)	(1.003)
motherworks	-0.0477	0.587	-0.329	0.457
	(0.688)	(0.744)	(0.643)	(0.755)
motherschool	-1.813***	-1.506**	-1.669***	-1.558**
	(0.497)	(0.560)	(0.504)	(0.599)
fatherschool	-0.307	-1.746*	-0.867	-1.244
	(0.582)	(0.904)	(0.707)	(0.893)
z_femaledigitright		-1.037**		
		(0.405)		
z_femaledigitleft			-0.748**	
			(0.302)	
z_femaleavgdigit				-0.940**
				(0.395)
Constant	12.98***	17.41***	15.54***	15.94***
	(2.929)	(4.049)	(3.091)	(4.070)
Observations	32	24	29	23

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 19: Tobit: Loss Framed

Tobit Loss Framed	(1) model	(3) model	(5) model	(7) model	(9) model
female	-1.158***	-1.243***	-1.450**	-1.006*	-1.138*
	(0.428)	(0.475)	(0.580)	(0.541)	(0.604)
rscore	0.262***	0.258***	0.307***	0.270**	0.275**
	(0.0868)	(0.0963)	(0.112)	(0.105)	(0.116)
business		-0.0562	-0.0801	0.0863	-0.136
		(0.438)	(0.494)	(0.479)	(0.518)
government		0.482	0.530	0.563	0.594
		(0.701)	(0.768)	(0.776)	(0.796)
motherworks		-0.00229	-0.109	-0.152	-0.0979
		(0.409)	(0.463)	(0.439)	(0.478)
motherschool		0.476*	0.450	0.728**	0.596*
		(0.278)	(0.332)	(0.317)	(0.349)
fatherschool		-0.0904	-0.119	-0.238	-0.362
		(0.345)	(0.483)	(0.429)	(0.512)
z_r2d4d			-0.0830		
			(0.239)		
z_l2d4d				-0.355	
				(0.225)	
z_averagedigit					-0.365
					(0.252)
Constant	2.818***	1.703	1.714	1.506	2.386
	(0.629)	(1.395)	(1.818)	(1.641)	(1.920)
Observations	188	153	122	134	115

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 20: Tobit: Loss Framed for Males

Tobit Loss Framed (Males)	(1) model	(2) model	(3) model	(4) model
rscore	0.290**	0.402***	0.351***	0.371***
	(0.124)	(0.131)	(0.122)	(0.135)
business	-0.311	0.0311	0.187	0.0538
	(0.559)	(0.575)	(0.562)	(0.606)
government	-0.281	0.907	0.784	0.905
	(0.878)	(1.005)	(0.971)	(1.011)
motherworks	-0.283	-0.263	-0.388	-0.288
	(0.523)	(0.552)	(0.530)	(0.574)
motherschool	0.390	0.283	0.567	0.436
	(0.356)	(0.383)	(0.369)	(0.405)
fatherschool	-0.151	0.133	-0.0912	-0.0623
	(0.442)	(0.548)	(0.498)	(0.586)
z_maledigitright		-0.238		
		(0.279)		
z_maledigitleft			-0.557**	
			(0.262)	
z_maleavgdigit				-0.542*
				(0.292)
Constant	1.450	0.698	1.073	1.219
	(1.788)	(2.043)	(1.885)	(2.175)
Observations	153	98	105	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 21: Tobit: Loss Framed for Females

Tobit Loss Framed (Females)	(1) model	(2) model	(3) model	(4) model
rscore	-0.0158	-0.0144	0.0608	0.0174
	(0.176)	(0.202)	(0.195)	(0.212)
business	0.453	-0.915	0.700	-0.791
	(0.837)	(1.021)	(0.919)	(1.068)
government	-0.138	-0.186	0.132	0.0677
	(0.996)	(1.058)	(1.130)	(1.132)
motherworks	0.660	-0.115	0.614	-0.0689
	(0.690)	(0.839)	(0.715)	(0.846)
motherschool	1.321**	1.318**	1.649***	1.399**
	(0.488)	(0.612)	(0.554)	(0.640)
fatherschool	-0.659	-1.957*	-1.029	-2.011*
	(0.573)	(1.051)	(0.750)	(1.023)
z_femaledigitright		0.197		
		(0.397)		
z_femaledigitleft			0.414	
			(0.336)	
z_femaleavgdigit				0.195
				(0.402)
Constant	1.306	7.183	1.126	6.833
	(2.830)	(4.641)	(3.219)	(4.679)
Observations	32	24	29	23

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 22: Tobit: Average Choice

Tobit: Average Choice	(1) model	(3) model	(5) model	(7) model
female	-0.847***	-0.860**	-0.601	-0.648
	(0.320)	(0.394)	(0.366)	(0.415)
rscore	0.143**	0.147*	0.141*	0.159*
	(0.0651)	(0.0768)	(0.0715)	(0.0803)
business	-0.501*	-0.535	-0.390	-0.463
	(0.292)	(0.334)	(0.321)	(0.355)
government	0.0486	0.196	0.309	0.354
	(0.461)	(0.509)	(0.509)	(0.533)
motherworks	0.213	0.204	0.122	0.247
	(0.273)	(0.314)	(0.296)	(0.329)
motherschool	0.00407	-0.124	0.0313	-0.131
	(0.186)	(0.224)	(0.213)	(0.239)
fatherschool	-0.0809	-0.116	-0.0933	-0.175
	(0.232)	(0.329)	(0.291)	(0.354)
z_r2d4d		-0.129		
		(0.160)		
z_l2d4d			-0.346**	
			(0.149)	
z_averagedigit				-0.335*
				(0.170)
Constant	3.670***	4.184***	3.628***	4.269***
	(0.934)	(1.228)	(1.105)	(1.316)
Observations	153	122	134	115

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 23: Tobit: Average Choice for Males

Tobit Average Choice (Males)	(1) model	(2) model	(3) model	(4) model
rscore	0.165*	0.185**	0.176**	0.204**
	(0.0992)	(0.0896)	(0.0857)	(0.0944)
business	-0.572	-0.346	-0.130	-0.195
	(0.446)	(0.389)	(0.388)	(0.417)
government	-0.431	0.526	0.531	0.659
	(0.696)	(0.657)	(0.653)	(0.676)
motherworks	-0.0520	0.0959	0.0266	0.104
	(0.417)	(0.374)	(0.367)	(0.396)
motherschool	0.117	-0.173	0.00755	-0.198
	(0.284)	(0.259)	(0.257)	(0.279)
fatherschool	-0.185	0.0415	0.0519	0.0166
	(0.354)	(0.374)	(0.350)	(0.409)
z_maledigitright		-0.170		
		(0.187)		
z_maledigitleft			-0.423**	
			(0.178)	
z_maleavgdigit				-0.399**
				(0.197)
Constant	2.996**	3.464**	2.931**	3.462**
	(1.428)	(1.386)	(1.313)	(1.506)
Observations	153	98	105	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 24: Tobit: Average Choice for Females

Tobit Average choice (Females)	(1) model	(2) model	(3) model	(4) model
rscore	-0.0550	-0.0300	-0.0186	-0.0207
	(0.0965)	(0.115)	(0.104)	(0.119)
business	-1.216**	-1.988***	-1.468***	-1.997***
	(0.461)	(0.584)	(0.490)	(0.600)
government	-0.306	-0.821	-0.352	-0.587
	(0.543)	(0.599)	(0.597)	(0.627)
motherworks	0.236	0.0644	0.0987	0.0541
	(0.381)	(0.484)	(0.384)	(0.479)
motherschool	-0.139	-0.0146	0.0556	-0.00326
	(0.270)	(0.350)	(0.297)	(0.359)
fatherschool	-0.434	-1.697**	-0.815*	-1.540**
	(0.317)	(0.596)	(0.401)	(0.568)
z_femaledigitright		-0.277		
		(0.230)		
z_femaledigitleft			-0.125	
			(0.181)	
z_femaleavgdigit				-0.263
				(0.229)
Constant	6.346***	11.07***	7.248***	10.40***
	(1.548)	(2.615)	(1.712)	(2.591)
Observations	32	24	29	23

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 25: Additional Controls: Gains Framed

Gains Framed	(1)	(2)	(3)	(4)	(5)
female	-0.621**	-0.362	-0.249	-0.0254	-0.0308
	(0.312)	(0.346)	(0.419)	(0.386)	(0.431)
rscore	0.0402	0.0658	-0.000160	0.0649	0.0395
	(0.0633)	(0.0705)	(0.0801)	(0.0753)	(0.0805)
business		-0.860***	-0.837**	-0.781**	-0.624*
		(0.317)	(0.359)	(0.336)	(0.367)
government		-0.314	-0.0303	0.0119	0.206
		(0.481)	(0.522)	(0.511)	(0.522)
Mother works		0.201	0.149	0.179	0.291
		(0.302)	(0.341)	(0.316)	(0.342)
Mother school		-0.364*	-0.566**	-0.507**	-0.727***
		(0.202)	(0.241)	(0.224)	(0.249)
Father school		-0.169	-0.00304	-0.0933	0.0182
		(0.251)	(0.349)	(0.304)	(0.360)
siblings		-0.204*	-0.275*	-0.250**	-0.342**
		(0.108)	(0.162)	(0.109)	(0.164)
Age of mother at birth		0.204	-0.0660	0.316	0.0878
		(0.244)	(0.285)	(0.257)	(0.297)
z_r2d4d			-0.0544		
			(0.168)		
z_l2d4d				-0.303**	
				(0.153)	
z_averagedigit					-0.213
					(0.170)
Constant	3.783***	5.569***	6.758***	5.414***	6.419***
	(0.464)	(1.207)	(1.473)	(1.365)	(1.558)
Observations	188	146	116	127	109
R-squared	0.023	0.122	0.133	0.169	0.159

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 26: Additional Controls: Gains Framed for Males

Gains Lottery (Males)	(1)	(2)	(3)	(4)
rscore	0.0795	0.00872	0.0791	0.0565
	(0.0939)	(0.0883)	(0.0823)	(0.0888)
business	-0.687	-0.585	-0.434	-0.313
	(0.422)	(0.395)	(0.370)	(0.404)
government	-0.768	0.139	0.0858	0.348
	(0.638)	(0.625)	(0.589)	(0.611)
motherworks	0.0246	0.125	0.187	0.259
	(0.401)	(0.385)	(0.357)	(0.386)
motherschool	-0.119	-0.507*	-0.378	-0.708**
	(0.269)	(0.266)	(0.247)	(0.277)
fatherschool	-0.291	0.0638	0.0113	0.0851
	(0.334)	(0.380)	(0.335)	(0.394)
siblings	-0.211	-0.335*	-0.245**	-0.401**
	(0.144)	(0.185)	(0.116)	(0.188)
Age of mother at birth	0.543*	0.0548	0.345	0.142
	(0.322)	(0.344)	(0.287)	(0.344)
z_maledigitright		-0.00165		
		(0.186)		
z_maledigitleft			-0.277*	
			(0.166)	
z_maleavgdigit				-0.196
				(0.184)
Constant	3.591**	5.964***	4.343***	5.864***
	(1.602)	(1.603)	(1.479)	(1.688)
Observations	146	93	99	87
R-squared	0.073	0.109	0.135	0.142

Standard errors in parentheses

Figure 27: Additional Controls: Gains Framed for Females

Gains Framed (Females)	(1)	(2)	(3)	(4)
rscore	-0.127	-0.0545	-0.109	-0.0800
	(0.167)	(0.211)	(0.169)	(0.221)
business	-2.791***	-3.317***	-3.576***	-3.503***
	(0.789)	(1.013)	(0.806)	(1.120)
government	-0.381	-1.322	-0.551	-1.096
	(0.951)	(1.090)	(0.986)	(1.187)
Mother works	-0.269	0.109	-0.530	-0.0622
	(0.686)	(0.927)	(0.651)	(0.947)
Mother school	-1.505***	-1.157*	-1.477***	-1.285*
	(0.463)	(0.597)	(0.477)	(0.636)
Father school	-0.235	-1.772	-0.724	-1.493
	(0.550)	(1.066)	(0.648)	(1.096)
siblings	-0.135	0.00349	-0.314	-0.104
	(0.304)	(0.364)	(0.296)	(0.380)
Age of mother at birth	-0.00667	-0.443	-0.256	-0.435
	(0.479)	(0.532)	(0.540)	(0.645)
z_digitright		-0.731*		
		(0.384)		
z_digitleft			-0.737**	
			(0.306)	
z_avgdigit				-0.725*
				(0.400)
Constant	11.83***	16.97***	15.03***	16.87***
	(3.068)	(4.883)	(3.285)	(5.421)
Observations	31	23	28	22
R-squared	0.460	0.553	0.616	0.532

Standard errors in parentheses

Figure 28: Additional Controls: Loss Framed

Loss Framed	(1)	(2)	(3)	(4)	(5)
female	-0.798***	-0.812**	-0.973**	-0.672	-0.743
	(0.303)	(0.360)	(0.442)	(0.407)	(0.462)
rscore	0.180***	0.208***	0.240***	0.198**	0.205**
	(0.0616)	(0.0733)	(0.0845)	(0.0793)	(0.0863)
business		-0.0983	-0.190	-0.0170	-0.216
		(0.329)	(0.379)	(0.354)	(0.393)
government		0.193	0.189	0.248	0.228
		(0.500)	(0.551)	(0.538)	(0.559)
Mother works		-0.216	-0.363	-0.387	-0.394
		(0.313)	(0.360)	(0.333)	(0.367)
Mother school		0.324	0.302	0.514**	0.411
		(0.210)	(0.254)	(0.235)	(0.267)
Father school		-0.0169	-0.0211	-0.121	-0.172
		(0.261)	(0.368)	(0.320)	(0.386)
siblings		0.0319	0.0386	0.0156	0.0160
		(0.112)	(0.171)	(0.115)	(0.176)
Age of mother at birth		-0.0165	0.0163	0.00839	0.0485
		(0.253)	(0.301)	(0.271)	(0.318)
z_r2d4d			-0.0148		
			(0.177)		
z_l2d4d				-0.199	
				(0.161)	
z_averagedigit					-0.205
					(0.182)
Constant	2.824***	1.832	1.804	1.779	2.233
	(0.451)	(1.254)	(1.555)	(1.437)	(1.671)
Observations	188	146	116	127	109
R-squared	0.077	0.126	0.139	0.174	0.159

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 29: Additional Controls: Loss Framed for Males

Loss Framed (Males)	(1)	(2)	(3)	(4)
rscore	0.221**	0.308***	0.256***	0.274***
	(0.0959)	(0.0911)	(0.0848)	(0.0928)
business	-0.217	-0.156	0.0411	-0.143
	(0.430)	(0.407)	(0.382)	(0.423)
government	-0.480	0.154	0.204	0.168
	(0.651)	(0.644)	(0.606)	(0.639)
motherworks	-0.321	-0.411	-0.505	-0.492
	(0.410)	(0.397)	(0.367)	(0.403)
motherschool	0.148	0.155	0.311	0.279
	(0.274)	(0.275)	(0.255)	(0.290)
fatherschool	-0.0223	0.168	0.0131	0.0737
	(0.341)	(0.392)	(0.345)	(0.412)
siblings	0.0172	0.0794	0.0444	0.0747
	(0.147)	(0.191)	(0.120)	(0.196)
Age of mother at birth	0.480	0.271	0.279	0.273
	(0.329)	(0.355)	(0.296)	(0.360)
z_maledigitright		-0.110		
		(0.192)		
z_maledigitleft			-0.349**	
			(0.171)	
z_maleavgdigit				-0.302
				(0.193)
Constant	0.446	0.401	0.850	0.662
	(1.635)	(1.654)	(1.524)	(1.765)
Observations	146	93	99	87
R-squared	0.068	0.154	0.183	0.178

Standard errors in parentheses

Figure 30: Additional Controls: Loss Framed for Females

Loss Framed (Females)	(1)	(2)	(3)	(4)
rscore	-0.0215	0.0486	0.0446	0.0502
	(0.178)	(0.243)	(0.210)	(0.257)
business	0.577	-0.801	0.782	-0.806
	(0.839)	(1.170)	(1.001)	(1.305)
government	0.417	0.583	0.470	0.441
	(1.012)	(1.260)	(1.224)	(1.384)
motherworks	0.112	-0.840	0.0990	-0.759
	(0.730)	(1.072)	(0.808)	(1.103)
motherschool	1.343**	1.225*	1.498**	1.236
	(0.493)	(0.690)	(0.592)	(0.741)
fatherschool	-0.734	-1.974	-0.860	-2.135
	(0.586)	(1.231)	(0.805)	(1.277)
siblings	-0.241	-0.322	-0.143	-0.283
	(0.324)	(0.420)	(0.367)	(0.443)
Age of mother at birth	-0.823	-0.954	-0.630	-0.974
	(0.510)	(0.614)	(0.670)	(0.752)
z_femaledigitright		0.259		
		(0.443)		
z_femaledigitleft			0.387	
			(0.380)	
z_femaleavgdigit				0.182
				(0.466)
Constant	4.016	10.00*	2.840	10.50
	(3.266)	(5.642)	(4.076)	(6.317)
Observations	31	23	28	22
R-squared	0.323	0.371	0.364	0.363

Standard errors in parentheses

Figure 31: Additional Controls: Average Choice

Average Lottery Choice	(1)	(2)	(3)	(4)	(5)
female	-0.709***	-0.587**	-0.611*	-0.349	-0.387
	(0.216)	(0.268)	(0.337)	(0.308)	(0.357)
rscore	0.110**	0.137**	0.120*	0.132**	0.122*
	(0.0463)	(0.0547)	(0.0644)	(0.0600)	(0.0666)
business		-0.479*	-0.514*	-0.399	-0.420
		(0.246)	(0.289)	(0.268)	(0.304)
government		-0.0608	0.0796	0.130	0.217
		(0.374)	(0.420)	(0.407)	(0.432)
motherworks		-0.00767	-0.107	-0.104	-0.0512
		(0.234)	(0.274)	(0.252)	(0.283)
motherschool		-0.0195	-0.132	0.00341	-0.158
		(0.157)	(0.194)	(0.178)	(0.206)
fatherschool		-0.0931	-0.0121	-0.107	-0.0767
		(0.195)	(0.281)	(0.242)	(0.298)
siblings		-0.0862	-0.118	-0.117	-0.163
		(0.0839)	(0.130)	(0.0871)	(0.136)
Age of mother at birth		0.0936	-0.0249	0.162	0.0681
		(0.189)	(0.230)	(0.205)	(0.246)
z_r2d4d			-0.0346		
			(0.135)		
z_l2d4d				-0.251**	
				(0.122)	
z_averagedigit					-0.209
					(0.141)
Constant	3.304***	3.701***	4.281***	3.596***	4.326***
	(0.345)	(0.936)	(1.184)	(1.087)	(1.290)
Observations	188	146	116	127	109

Figure 32: Additional Controls: Average Choice for Males

Average Lottery Choice (Males)	(1)	(2)	(3)	(4)
rscore	0.150*	0.158**	0.168**	0.165**
	(0.0868)	(0.0723)	(0.0690)	(0.0752)
business	-0.452	-0.371	-0.197	-0.228
	(0.390)	(0.323)	(0.310)	(0.342)
government	-0.624	0.147	0.145	0.258
	(0.589)	(0.512)	(0.493)	(0.518)
motherworks	-0.148	-0.143	-0.159	-0.116
	(0.371)	(0.315)	(0.299)	(0.327)
motherschool	0.0143	-0.176	-0.0335	-0.215
	(0.248)	(0.218)	(0.207)	(0.235)
fatherschool	-0.157	0.116	0.0122	0.0794
	(0.309)	(0.311)	(0.280)	(0.334)
siblings	-0.0971	-0.128	-0.101	-0.163
	(0.133)	(0.151)	(0.0975)	(0.159)
Age of mother at birth	0.511*	0.163	0.312	0.208
	(0.298)	(0.282)	(0.241)	(0.292)
z_maledigitright		-0.0557		
		(0.153)		
z_maledigitleft			-0.313**	
			(0.139)	
z_maleavgdigit				-0.249
				(0.156)
Constant	2.018	3.183**	2.597**	3.263**
	(1.481)	(1.313)	(1.240)	(1.431)
Observations	146	93	99	87
R-squared	0.068	0.105	0.155	0.131

Standard errors in parentheses

Figure 33: Additional Controls: Average Choice for Females

Average Lottery Choice (Females)	(1)	(2)	(3)	(4)
rscore	-0.0741	-0.00296	-0.0323	-0.0149
	(0.106)	(0.146)	(0.120)	(0.152)
business	-1.107**	-2.059**	-1.397**	-2.155**
	(0.499)	(0.701)	(0.572)	(0.769)
government	0.0181	-0.370	-0.0405	-0.328
	(0.601)	(0.755)	(0.699)	(0.816)
motherworks	-0.0782	-0.365	-0.215	-0.411
	(0.434)	(0.642)	(0.462)	(0.650)
motherschool	-0.0808	0.0339	0.0104	-0.0243
	(0.293)	(0.413)	(0.338)	(0.437)
fatherschool	-0.484	-1.873**	-0.792	-1.814**
	(0.348)	(0.738)	(0.460)	(0.752)
siblings	-0.188	-0.159	-0.228	-0.193
	(0.192)	(0.252)	(0.210)	(0.261)
Age of mother at birth	-0.415	-0.699*	-0.443	-0.705
	(0.303)	(0.368)	(0.383)	(0.443)
z_femaledigitright		-0.236		
		(0.266)		
z_femaledigitleft			-0.175	
			(0.217)	
z_femaleavgdigit				-0.272
				(0.275)
Constant	7.925***	13.49***	8.934***	13.68***
	(1.941)	(3.382)	(2.329)	(3.724)
Observations	31	23	28	22
R-squared	0.303	0.502	0.381	0.494

Figure 34: Robustness Check: Gains Framed

Gains Framed VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
z_l2d4d	-0.329**	-0.317**	-0.311**			
	(0.141)	(0.157)	(0.156)			
female		-0.185	-0.165		-0.503	-0.334
		(0.388)	(0.392)		(0.410)	(0.417)
rscore		0.0228	0.0526		0.00388	0.0309
		(0.0739)	(0.0750)		(0.0800)	(0.0796)
business		-0.673**	-0.811**		-0.760**	-0.866**
		(0.325)	(0.340)		(0.342)	(0.352)
government		0.0318	0.117		-0.153	0.00479
		(0.529)	(0.530)		(0.527)	(0.527)
motherschool			-0.397*			-0.465*
			(0.225)			(0.235)
fatherschool			0.0244			0.0112
			(0.310)			(0.345)
z_r2d4d				-0.111	0.0165	-0.0958
				(0.147)	(0.160)	(0.169)
Constant	3.933***	4.177***	5.136***	3.935***	4.422***	5.603***
	(0.141)	(0.581)	(1.180)	(0.147)	(0.622)	(1.292)
Observations	164	135	134	154	123	122
R-squared	0.032	0.086	0.107	0.004	0.055	0.087

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 35: Robustness Check: Loss Framed

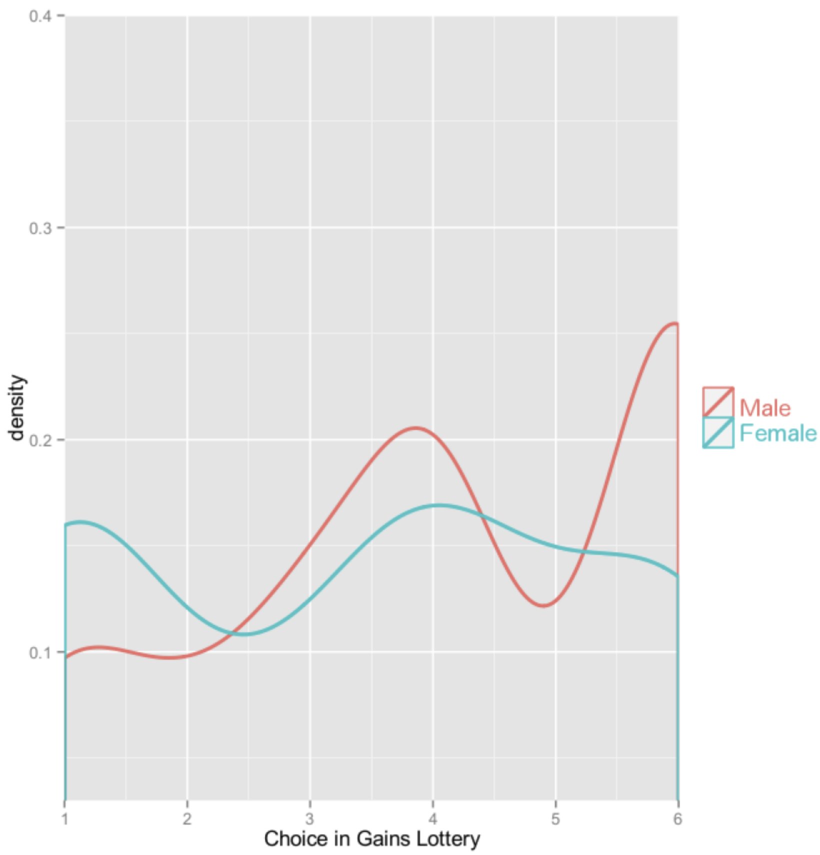
Loss Framed VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
z_l2d4d	-0.326**	-0.250	-0.230			
	(0.141)	(0.156)	(0.154)			
female		-0.827**	-0.707*		-1.061***	-0.964**
		(0.385)	(0.387)		(0.405)	(0.418)
rscore		0.187**	0.172**		0.212***	0.213***
		(0.0734)	(0.0741)		(0.0791)	(0.0798)
business		-0.122	0.0724		-0.171	-0.0560
		(0.323)	(0.336)		(0.338)	(0.352)
government		0.418	0.278		0.364	0.255
		(0.525)	(0.524)		(0.520)	(0.528)
motherschool			0.469**			0.252
			(0.222)			(0.235)
fatherschool			-0.0977			-0.0391
			(0.306)			(0.346)
z_r2d4d				-0.181	-0.0909	-0.0771
				(0.146)	(0.158)	(0.169)
Constant	3.963***	2.828***	1.800	3.974***	2.692***	2.035
	(0.140)	(0.577)	(1.165)	(0.146)	(0.614)	(1.294)
Observations	164	135	134	154	123	122
R-squared	0.032	0.133	0.164	0.010	0.121	0.128

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 36: Robustness Check: Loss Framed for Males

Losses Lottery (Males)	(1)	(2)	(3)	(4)	(5)	(6)
z_maledigitleft	-0.313**	-0.361**	-0.351**			
	(0.158)	(0.164)	(0.164)			
rscore		0.224***	0.209**		0.266***	0.262***
		(0.0781)	(0.0797)		(0.0852)	(0.0866)
business		-0.0250	0.102		-0.0914	-0.0189
		(0.350)	(0.366)		(0.370)	(0.383)
government		0.336	0.284		0.367	0.326
		(0.594)	(0.598)		(0.618)	(0.629)
motherschool			0.275			0.0867
			(0.240)			(0.254)
fatherschool			0.0599			0.178
			(0.332)			(0.367)
z_maledigitright				-0.186	-0.213	-0.164
				(0.164)	(0.172)	(0.184)
Constant	4.185***	2.581***	1.579	4.168***	2.291***	1.387
	(0.157)	(0.606)	(1.249)	(0.164)	(0.658)	(1.362)
Observations	124	105	105	119	98	98
R-squared	0.031	0.123	0.142	0.011	0.111	0.118

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1



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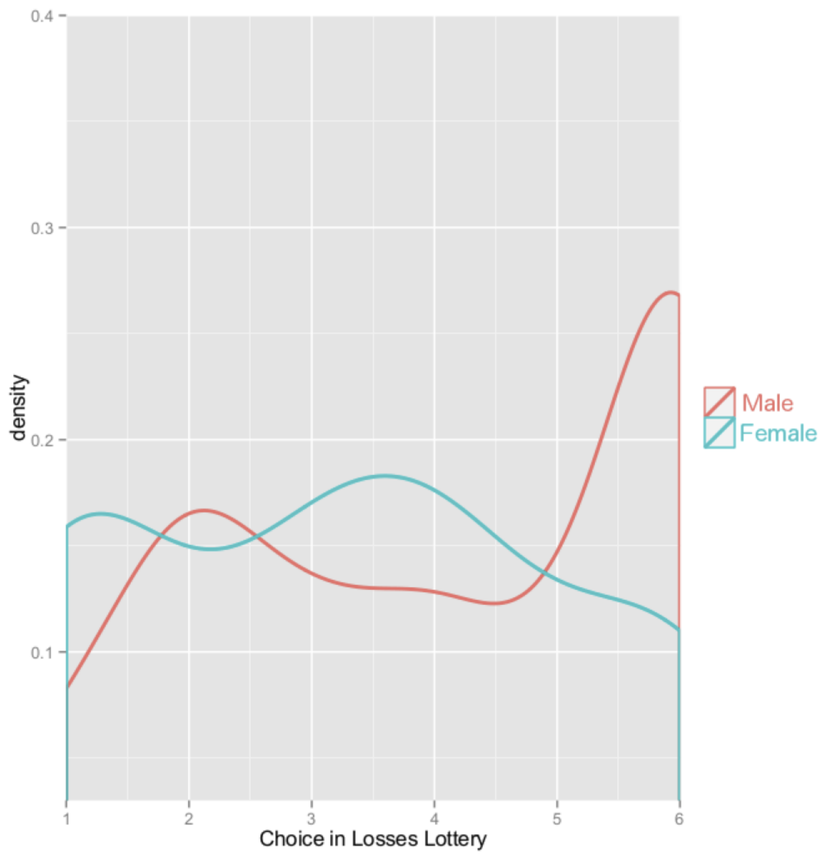
0.3
0.2
0.1
density
1
2
3
4
5
6
Choice in Gains Lottery
Male
Female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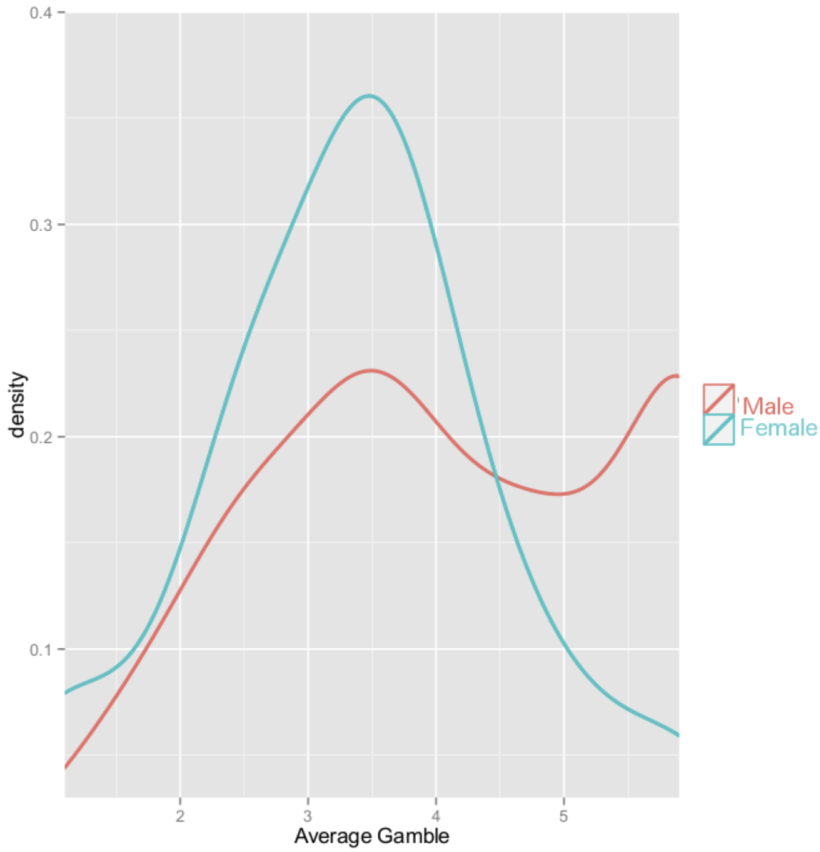
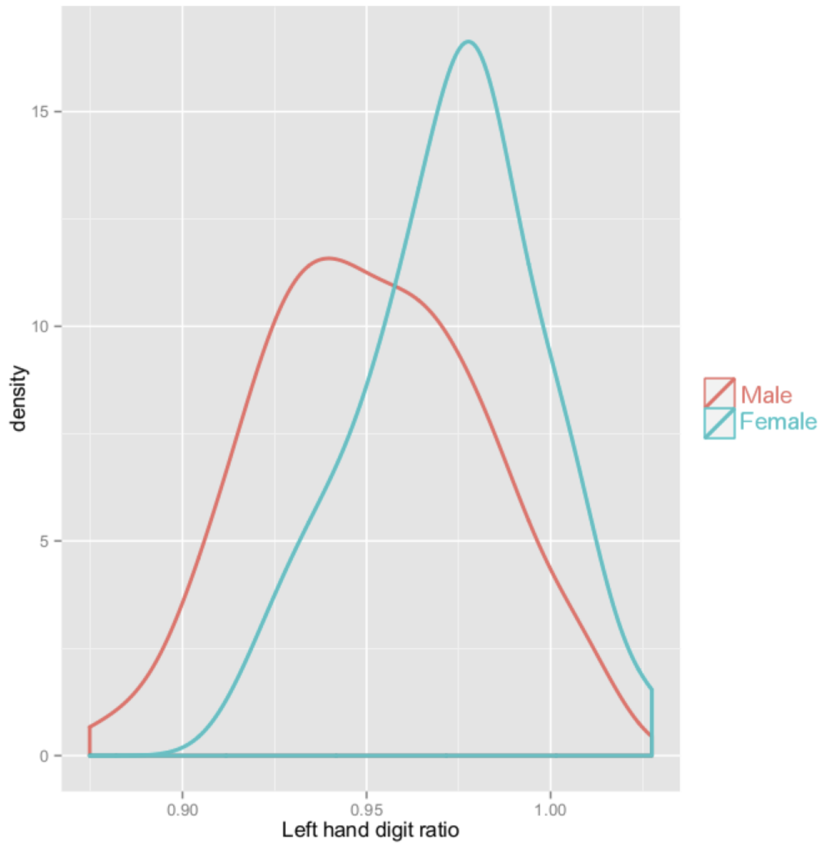
0.1
density
1
2
3
4
5
6
Choice in Losses Lottery
Male
Female



0.4
0.3
0.2
0.1
density
2
3
4
5
Average Gamble
Male
Female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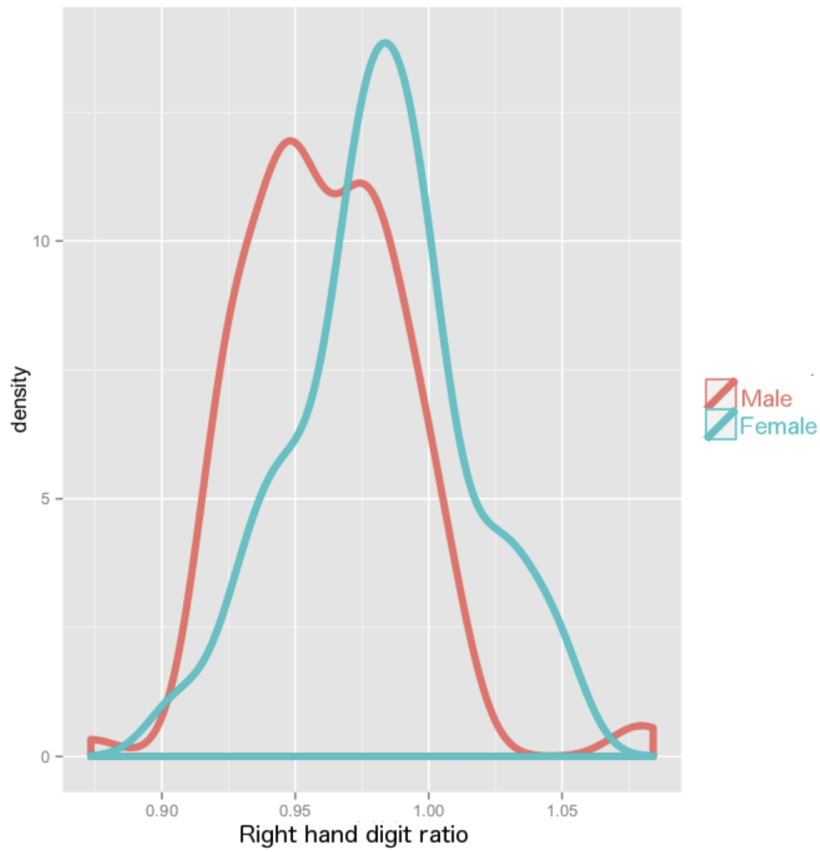
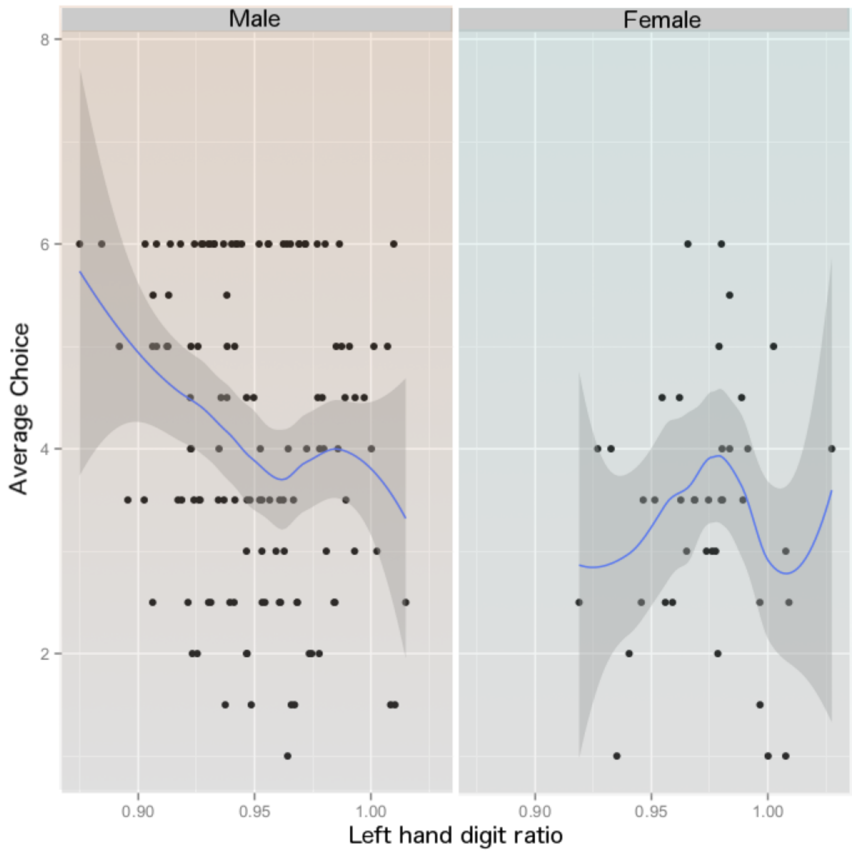
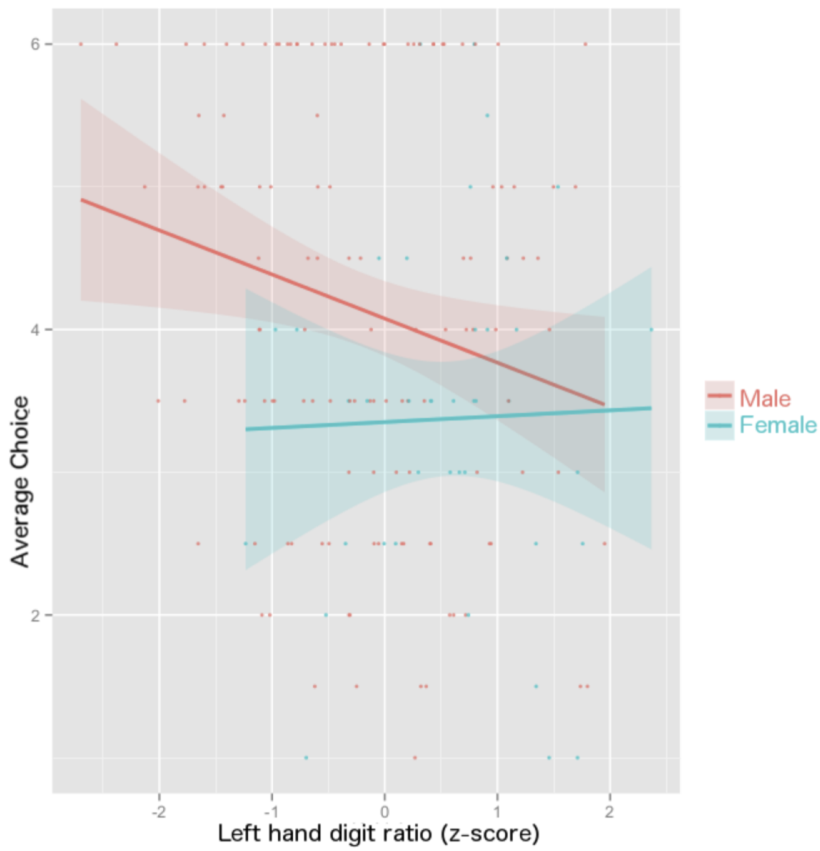
10
5
0
density
0.90
0.95
1.00
Left hand digit ratio
Male
Female



density
10
5
0
0.90
0.95
1.00
1.05
Right hand digit ratio
Male
Female


Male
Female
Average Choice
Left hand digit ratio
8
6
4
2
0.90
0.95
1.00
0.90
0.95
1.00



Average Choice
6
4
2
-2
-1
0
1
2
Left hand digit ratio (z-score)
Male
Female