Female Babies and Risk-Aversion: Causal Evidence from Hospital Wards*

Ganna Pogrebna† Andrew J Oswald# David Haig‡

29 December 2017

Abstract

Using ultrasound scan data from paediatric hospitals, and the exogenous 'shock' of learning the gender of an unborn baby, this paper documents the first causal evidence that offspring gender affects adult risk-aversion. On a standard Holt-Laury criterion, parents of daughters, whether unborn or recently born, become almost twice as risk-averse as parents of sons. The study demonstrates this in longitudinal and cross-sectional data, for fathers and mothers, for babies in the womb and new-born children, and in a West European nation and East European nation. These findings may eventually aid our understanding of risky health behaviors and gender inequalities.

JEL Classification: I10, J16, C93, C90, D81

Keywords**:** pregnancy, risk attitudes, daughters, child gender

* Acknowledgement: We thank the referees, the editor, and Dalton Conley, Clement Chaise-Martin, Amanda Goodall, Botond Koszegi, Ulrike Malmendier, and Carl Veller, for their helpful comments and suggestions. The research described in the paper was sponsored by the Leverhulme Trust Early Career Fellowship "Pregnancy, Parenting and Risk Attitudes" awarded to Ganna Pogrebna. We are grateful to the maternity hospital in southern Ukraine for help in collecting the Ukrainian data. In the United Kingdom, we thank Professor Dilly Anumba and research midwives Alison Carey, Anne Chamberlain, Hillary Rosser, Sarah Senbeto, and Siobhan Gillespie for help in collecting the UK sample in the Jessop Wing Unit at Sheffield Teaching Hospitals (STH) NHS Trust. We thank the National Institute for Health Research (NIHR) for financial support provided to the STH research team. We thank Daniele Swain for administrative assistance and the STH research coordinators Clare Pye, Lema Vernon and Angela Pinder. Andrew Oswald acknowledges funding through the CAGE centre from the UK Economic and Social Research Council. Ganna Pogrebna also acknowledges financial support from RCUK/EPSRC research grants EP/N028422/1 and EP/P011896/1. The authors declare no competing financial interests.

† Birmingham Business School, Department of Economics, University of Birmingham; the Alan Turing Institute; Warwick Manufacturing Group (WMG), Centre for Competitive Advantage in the Global Economy (CAGE), and Warwick Institute for the Science of Cities (WISC), University of Warwick; JG Smith Building, Birmingham, B15 2TT.

Corresponding author: Department of Economics, University of Warwick, Gibbet Hill Road, Coventry, CV4 7AL, UK, email: andrew.oswald@warwick.ac.uk

‡ Department of Organismic and Evolutionary Biology, Harvard University, 26 Oxford Street, Cambridge, MA 02138, USA

Female Babies and Risk-Aversion: Causal Evidence from Hospital Wards

1.Introduction

There is growing awareness in the industrialized nations that, because many traditional contagious diseases have been approximately conquered, people's choices and behaviors now play a crucial role in their healthiness through life (Banks, Marmot, Oldfield and Smith, 2006). So-called *risky health behaviors* have thus become central to the future of medicine and health policy. The motivation for such behaviors, however, remains imperfectly understood.

A key parameter involved in health choices and economic choices is the individual's underlying degree of risk-aversion (as sometimes measured by the second derivative of a utility function). Everyday observation suggests that humans vary greatly in their tolerance for risk. However, formal research has so far been able to account statistically for a relatively small proportion of these apparent differences (Eckel and Grossman, 2002; Holt and Laury, 2002; Dohmem, Falk, Huffman, and Sunde, 2011; Loomes and Pogrebna, 2014). Truly causal and near-causal evidence, moreover, appears to be limited to recent work on health shocks by Decker and Schmitz (2016), on historical recessions by Malmendier and Nagel (2011), and on cognitive load by Deck and Jahedi (2015).

This paper pursues a new approach and draws on an unusual kind of hospital data. It shows that -- from the moment the sex of the youngest child is identified in an ultrasound scan -- daughters induce parental risk-aversion. As its main dependent variable, the paper uses a Holt-Laury measure of aversion to risk, which has been validated in a range of health-behavior and risky-choice settings (Anderson and Mellor, 2008[1]). The paper also offers a check using seat-belt use and the feeling of financial security as the dependent variables.

The study links also to fundamental issues of gender in modern society. There is an expanding scientific literature on the causal role of offspring sex (for an earlier review, see Lundberg, 2005). Postnatal effects of child gender have now been found, for example, on labor supply and marriage, and on the liberalness of political voting[2] and parental attitudes to work and to women's rights (Warner, 1991; Warner and Steel, 1999; Lundberg and Rose, 2002; Lundberg and Rose, 2003; Peresie, 2005; Washington, 2008; Oswald and Powdthavee, 2010; Shafer and Malhotra, 2011; Dahl and Moretti, 2008; Dahl et al., 2012; Wei and Zhang, 2011; and Glynn and Sen, 2015).

Yet some of these claims are disputed (Conley and Rauscher, 2013; Lee and Conley, 2016) on, for example, the reasonable grounds that cause-and-effect is hard to establish definitively. This study is an attempt to tackle the causality problem in a new way. It examines how people are affected by being told by a hospital paediatrician, and learning directly, whether their baby is a boy or a girl.

We document evidence that mothers carrying unborn daughters are more risk-averse than mothers carrying unborn sons. The estimated effect is large. It persists into the immediate postnatal period. Similar results are then shown for fathers. The analysis uses cross-sectional data on approximately 500 parents, and longitudinal data on approximately 100 further parents (who are each sampled at three points in time). Greater parental risk-aversion appears to be a direct

[1] Anderson and Mellor (2008) show, for example, that Holt-Laury scores are correlated with 5 kinds of risky behaviors, including seatbelt non-use and smoking.

[2] The current research aimed to include a political variable of this kind, but the university ethics board took the view that such information was too sensitive to be collected from parents in this project.

response to learning that the baby will be a girl; it seems not to be some kind of intrinsically hormonal, biological, or subconscious effect of foetal sex. The study's findings are potentially relevant to researchers across a range of disciplines in the natural and social sciences. Although the current study has been in construction for some years, its results are complementary to those in a new paper, using different methodology, on older Chinese twins (Chew, Yi, Zhang, and Zhong, 2017).

Section 2 describes the data and the experimental design. Section 3 provides results of the study. Sections 4 and 5 conclude, and touch on broader implications.

2. Data collection

For this study, data were initially collected on expectant mothers in the United Kingdom and the Ukraine.[3] Each person completed a questionnaire about themselves. They also answered a monetary decision-making task of the famous kind described in Holt and Laury (2002). From this, a Holt–Laury risk attitude rank (RAR) score was calculated by observing the switching point as the participant was offered increasingly risky gambles. RAR measures an individual's risk-aversion on a scale from zero (extremely risk-loving) to ten (extremely risk-averse). Sex of child, once known, was recorded for all participants. UK fathers were also sampled. In the case of UK parents, who initially did not know foetal sex, this information was entered from linked medical records after birth. As expected, almost equal numbers of participants had a male or female child in all comparisons. Each of the subjects was a regular patient in prenatal and postnatal care who,

[3] We obtained the Ukraine results before the UK ones. Because those early results were striking, and to ensure there was not some kind of spurious pattern, we decided to re-do the methodology of the study on UK data.

to our knowledge, had not selected the sex of their children (the longitudinal nature[4] of the data makes it possible to check, indirectly, whether the parents did have prior knowledge of the sex).

In this paper we exploit the fact that women in the Ukraine and the United Kingdom typically attend two ultrasound scans during pregnancy. Human pregnancy lasts approximately 40 weeks. The first 'dating' scan takes place during first trimester (usually around week 12) and allows the determination of an estimated date of delivery (EDD). The second 'anomaly' scan takes place at mid-pregnancy (around week 20) and checks for structural anomalies in the baby as well as providing information about foetal sex. Thus at some point many of the mothers (and fathers) become aware of the sex of the unborn child. This can be thought of as an exogenous informational shock.

The study includes mothers at different stages of pregnancy (weeks 11–40 in the UK sample and 21–40 in the Ukrainian sample) as well as after childbirth. The UK sample also included male partners of the mother. Prenatal and postnatal Ukrainian mothers participated after they knew the sex of the child; the UK sample includes some parents before they knew the sex of their future child, some after they knew the sex but before childbirth, and some after childbirth.

Our initial study included 340 prenatal or postnatal mothers who were patients at a maternity hospital in southern Ukraine. 175 of these mothers were pregnant with (or had recently given birth to) a son. The remaining 165 mothers were pregnant with (or had recently given birth to) a daughter. Ukrainian men rarely accompany their partners to hospital appointments and we obtained no data from them. The subsequent UK study included 111 mothers and 75 male partners. Of these mothers, 46 participated before week 20 (23 with sons, 23 with daughters) and 65

[4] Later results find marked consequences from the announcement effect of the child's gender.

participated after week 20 (33 with sons, 32 with daughters). For the male partners, 34 participated before week 20 (15 with sons, 19 with daughters) and 41 participated after week 20 (19 with sons, 22 with daughters).[5]

Ukrainian participants were approached either by the experimenter or by maternity hospital staff/qualified maternity hospital psychologist. They were asked to fill out a two-page paper-and-pen survey. UK women and their partners were also asked to answer the paper-and-pen survey. All UK participants were patients or partners at the Jessop Wing, a large maternity unit at the Sheffield Teaching Hospitals NHS Trust. They were approached either in Jessop Wing (while they were waiting for their hospital appointments) or by mail. Therefore, they had an opportunity to either fill out the survey on site and return it to the experimenter or return it by mail. In both samples, for ethical reasons, we only recruited participants with uncomplicated pregnancies.

In the Ukrainian study, 30 randomly selected participants received payment for their participation. Others were asked to complete the experiment with hypothetical incentives. In the UK study, 94 of 186 participants answered questions in the maternity unit's waiting room before their appointment with a doctor or midwife. These participants received small payments for filling out the questionnaire (£3 each) and were also paid for one of their decisions (a randomly chosen decision) in the list choice risk-attitude elicitation procedure (*2*). The remaining participants received questions in the mail and were not paid for participation. Results of Mann-Whitney-Wilcoxon tests revealed no statistically significant difference between parental risk attitudes in the incentivized and non-incentivized versions of the experiment (UK: $z = 0.699$, $p = 0.4845$; Ukraine: $z = 0.482$, $p = 0.6296$).

[5] The study response rate was reasonably high – 37% of all approached subjects took part in the study in the Ukrainian sample and 34% in the UK sample.

Week of pregnancy (women) or week of partner's pregnancy (men) was recorded for all prenatal participants. Most parents who were approached postnatally took part within 4-8 weeks of their child's birth but did not provide the week of pregnancy. For pre-natal UK subjects tested before week 20, the sex of child was recorded after birth and retrospectively linked to parental risk attitudes measured early in pregnancy. For pre-natal subjects tested after week 20, the stated sex of the child before birth was compared with the actual sex of the child after birth. In all cases, parents received accurate information about the sex of the child at the 'anomaly' scan. [6]

As explained earlier, one measure of risk-aversion used here was the well-known Holt-Laury choice procedure on gambles offered[2] (see the Appendix), but the subjects in the study were also asked to state their likelihood of engaging in a risky activity (not wearing a seatbelt while driving a car) and their confidence in their current financial position. The last of these variables is not a conventional measure of risk-aversion, but seemed a potentially interesting indicator of fearfulness.

All participants also answered demographic questions about their age, income, education, and family composition. In the UK sample, 59.7% of participants were female. All Ukrainian participants were female. The mean ages of female and male participants in the UK were 30.3 and 33.9 years respectively. The mean age of female participants in the Ukraine was 26.2 years. More than half of our participants (61.8 % in the UK and 78.3% in Ukraine) were married. For an overwhelming majority of participants (over 80% in both Ukrainian and UK samples), the pregnancy was planned. Over 80% of participants were employed in the UK and over 46% in the

[6] In the pre-screen stage, we ensured that all parents who took part in the study were not informed about the sex of their children before week 20 of pregnancy. If a few parents had correctly guessed, before being told, that would create a form of measurement error in our study. That would tend to lead to an underestimate of the true child-gender coefficient.

Ukraine. Participants indicated their level of education from School (the lowest) to Doctoral degree (the highest) and income level from Low (score of 1) and equivalent to an annual income of up to £25,000 in the UK and an equivalent of 1,000 Ukrainian Hrivnia's (UAH) monthly income in Ukraine to high (score of 4) and equivalent to an annual income of £65,000 or more in the UK and over 4,000 UAH monthly income in Ukraine. In addition, we collected data on whether participants smoked or kept pets.

Average Holt-Laury risk-aversion rank (RAR) scores were compared between groups using two-sample Mann-Whitney–Wilcoxon tests. The results are reported in the text by a z-score and associated p-value. The full data set was analyzed by ordinary least squares (OLS) regression.

3. Results

Figure 1a provides a simple histogram of participants' risk-aversion scores. These RAR scores, shown in the left panel of Figure 1a, were found to be 7.40 for Ukrainian mothers of daughters and 3.27 for Ukrainian mothers of sons and ($z = –13.70$, $p = 0.0000$; here and henceforth Mann-Whitney-Wilcoxon test). In the right panel of Figure 1a, which is for UK parents who knew their child's sex, average RAR scores were 6.59 for mothers of daughters and 4.64 for mothers of sons ($z = –3.92$, $p = 0.0001$). The scores were 3.80 for fathers of sons versus 6.32 for fathers of daughters ($z = –3.39$, $p = 0.0007$) (seen in Figure 1b). For ease of comparison, Figure 1 includes the UK mothers in two places.

These are strong cross-sectional associations. They seem to indicate some kind of deep connection between adult risk-aversion and offspring sex. Adjusting for other influences, the sex of the child explains slightly more than one third of the variance in parental RAR scores in an OLS regression of the kind depicted in Table 1. A small amount of variance is explained by the inclusion of other variables from our questionnaires. The full regression allows a comparison of the magnitude of the sex-of-child effect relative to the effects of other variables. For example, there is an average decrease of roughly one RAR point for someone who had *very high education* and was *employed* relative to someone who had *very low education* and was *unemployed*. However, this compares to the increase of three RAR points that is found for parents who have daughters rather than sons. If taken literally, the effect of child sex is to be thought of as stronger than the combined consequences of employment and education.

Most mothers attend a scan around 20 weeks of gestation.[7] Therefore, under the hypothesis that it is knowing the child's sex that changes the degree of parental risk-tolerance, no statistical effect from foetal sex is to be expected before 20 weeks. Yet is that true? This prediction could be tested in our UK data which included participants who did not know the sex of the future child (weeks 11–19 of pregnancy) and participants who knew the child's sex (after 20 weeks). Reassuringly for that hypothesis, mothers of sons and daughters did have almost identical average RAR scores before 20 weeks (4.39 and 4.48; $z = -0.035$, $p = 0.972$).

Similar results were replicated in the sample of male partners. There was no discernible effect before 20 weeks (3.87 and 4.16; $z = -1.190$, $p = 0.234$) but a strong effect after 20 weeks (3.79 and 6.32; $z = -3.394$, $p = 0.0007$). Foetal sex thus apparently has little, if any, effect on RAR scores when parents do not know foetal sex, but a strong effect, of similar magnitude in mothers and male partners, after parents know whether they will be having a son or daughter. This suggests that the announcement effect from the doctors, rather than hormonal differences or subconscious biology, is what is producing the patterns in measured risk-aversion.

[7] This is a typical procedure for mothers who do not have any apparent health problems during pregnancy (i.e., mothers with "normal" pregnancies). Where there are health issues or concerns, additional scans may be administered. However, in our sample, we deliberately concentrated on mothers with "normal" pregnancies as risk attitudes of mothers who have health issues during pregnancy may be affected by their health state or other related factors.

RAR scores before and after 20 weeks were significantly different for mothers of daughters (z = –3.789, p = 0.0002) and for their male partners (z = –3.036, p = 0.0024). But the before and after scores did not differ significantly for mothers of sons (z = 0.309, p = 0.757) nor for their male partners (z = 0.077, p = 0.939).

Table 2 turns to a more detailed kind of longitudinal evidence.[8] This covers UK individuals. Here the sample is necessarily smaller, at 95 adults, who were each sampled on three occasions. Crucially, the within-person 'switching' observations reveal the same broad pattern as before. As can be seen in Figure 2a, risk-aversion increases approximately 2 to 3 Holt-Laury points when the parent discovers the child will be a girl. More precisely, UK mothers begin in Figure 2b with risk-aversion levels of approximately 4.0. After discovering the sex of the child, those carrying baby boys drop to an RAR score of 3.5, while those carrying baby girls have an increased score of 6.1. After the birth of the child, these numbers are measured, respectively, at 3.5 for those with sons and 5.5 for those with daughters. The basic pattern is repeated in fathers (although the baseline adult male RAR scores are always lower than those for adult females). After discovering the sex of the child, as shown in Figure 2c, those fathers who learn that they are to have sons have a measured RAR score of 3.1, while those who will have a daughter have a score of 5.2. After the birth, these numbers are measured at 3.4 for those with sons and 5.1 for those with daughters.

What is the role of pure biology? It is known that mothers of female foetuses experience more severe nausea, asthma, and insulin resistance during pregnancy than mothers of male foetuses (Basso and Olsen 2001, Clifton and Murphy 2004, Xiao et al. 2014, Catalano and Bruckner 2006).

[8] In our longitudinal sample, the response rate was similar to that in the cross-sectional samples. Of all subjects approached, 34% took part in the study. The attrition rate was negligible: only 2 couples dropped out from the study after submitting their first responses (before 20^{th} week of pregnancy).

Hormonal and other influences of foetal sex on the mother could increase with gestational age and perhaps influence a mother's risk attitudes. Therefore, parental knowledge of foetal sex may be confounded with differences of gestational age. Our observations could, in principle, be explained either by a parental response to knowledge of foetal sex or by a direct effect of foetal sex (independent of knowing the child's sex) that only becomes noticeable in the second half of pregnancy. Foetal sex, however, also influences risk attitudes of male partners who were not directly exposed to the hormonal milieu of pregnancy. One could perhaps still argue that the effect in males results from some kind of 'contagious' risk-aversion, from female foetus to mother to partner, but the simplest interpretation seems to be that knowing a child will be a girl causes greater risk-aversion in parents of both sexes.

Although the Holt-Laury measure is a fairly standard way to measure risk-aversion, it can be criticized. Two other findings in our data set may be consistent with greater risk-aversion in parents of daughters. First, as shown in the Appendix, parents of daughters reported a higher propensity-to-wear-a-seatbelt (Appendix Table A2). Second, parents of daughters also reported lower feelings of financial security (Appendix Table A2).

Effects of daughters on parental political attitudes have been reported to persist through childhood[9]. One might expect an effect of sex of older children if consequences of child gender on parental risk attitudes were similarly persistent, but the nature of our data means it is not possible to examine that persuasively in the current study.

Finally, we consider a further biological possibility. Could our results be explained by male-biased pregnancy losses in risk-averse women and female-biased pregnancy losses in risk-tolerant women (to account for the evenly balanced sex ratio)? We consider two versions of this hypothesis -- the first invokes early spontaneous losses and the second elective abortions. In the first version, women who are relatively stressed and risk-averse preferentially lose male pregnancies, and the less stressed, more risk-tolerant women preferentially lose female pregnancies, perhaps as an adaptation to maximize a woman's expected number of grandchildren (Trivers and Willard, 1973). The population-level expression of such a phenomenon would be the reported reduction in the proportion of males born at times of stress[13]. If this hypothesis were true, fewer risk-averse women would have carried male foetuses and fewer risk-tolerant women would have carried female foetuses before recruitment into our study. Contrary to this, we found no association between risk tolerance and foetal sex before week 20 by which time the purported pregnancy losses should already have occurred. The second version of the selective-loss hypothesis would posit illegal sex-specific elective abortions after parents knew foetal sex. However, there is no evidence of substantial pregnancy losses after sex is learnt but before risk attitudes were assessed. The natural interpretation seems to remain that parental risk attitudes are changed by the sheer *knowledge* of foetal sex.[9]

4. Discussion

A natural set of questions -- we are grateful to referees for their ideas and prompting -- remain to be considered. What might explain the paper's key finding? How might the statistical

[9] Further statistical explorations are described in the Appendix. Specifically, Table A0 and Table A1 provide further details about our subject pool; they describe the composition and numbers of parents in each of our treatment groups. Figure A1 provides a summary of tasks which were presented to each participant in the study. Table A2 shows that parents whose youngest child is female are more likely to wear seatbelts (this result is important for the Ukrainian subsample where the local population does not always wear seatbelts) and less likely to feel financial secure than parents whose youngest child is male. These results establish that there is an effect of youngest-child sex not only on risk attitudes of parents but also on behaviour in different domains. Tables A3 and A4 provide more detailed statistical results for different sub-samples of parents who know and do not know the sex of their youngest child. Tables A5 and A7 show that there is no effect of first-born children on parental risk attitudes which suggests that the effect of the youngest child surpasses the effect of previous children. There is apparently also no cumulative effect of multiple daughters on parental risk attitudes, as shown in Table A6. Finally, Figure A2 depicts the sample of mothers from Ukraine and UK after they know the sex of their youngest child -- highlighting the difference between mothers of sons and mothers of daughters.

results be related to the existence of gender discrimination in today's society? What are the policy implications, if any, of the paper's findings?

First, the principal contribution of the paper is a narrowly defined, and traditional, scientific one. It is to document a previously unknown cause-and-effect pattern. The size of the effect appears to be a large one. We cannot currently be sure why the observed RAR-switching exists. Although our ignorance here is undesirable, it is not uncommon in the history of scientific research (Isaac Newton is reputed to have said about the Principia: "*I have not as yet been able to discover the reason for these properties of gravity from phenomena, and I do not feign hypotheses.*").

Second, in response to referee inquiry, one possible mechanism is the following. In their previous and historically given role, as beings who were considered subsidiary to men, women traditionally were treated as a weaker sex who needed to be protected. Indeed the wording 'the weaker sex' has entered into parts of English usage. It is possible that in our data we are observing the long shadow of such attitudes. It may thus be that modern adults of both sexes have been brainwashed, by their upbringing, to have this kind of image in their minds. If so, on hearing that they are to become the parent of a girl or a boy, they may revert, if only subconsciously, to that image. The news that the baby will be a girl may trigger a repressed subliminal feeling that it is necessary to be more cautious about how the unborn child is to be protected.

Third, if such an account is correct, or even somewhat correct, the phenomenon of increased risk-aversion that we observe in these data could be viewed as a form of implicit discrimination or conceptual error. It might be an out-dated visceral reaction that stems from a medieval period when females were more vulnerable to violence.

Fourth, it is too early to say what policy implications might one day spring from the paper's results. Nevertheless, we would like to hope that these findings may help, eventually, to foster a deeper understanding of the nature and ultimate source of discriminatory views.

5. Conclusions

This paper is motivated by two issues that are of increasing concern within modern society. One is the puzzle of what determines the prevalence of human risk-taking. The other concerns the puzzle of persistent gender inequalities.

For any parent, learning the sex of an unborn child is one of life's exogenous 'shocks'. The paper exploits this simple idea and builds on it in a form of natural experiment. The aim is to help to understand the underlying forces that shape human risk-aversion; our inquiry may also be relevant to debates about the role of males and females in modern society. Using data that we collected from hospitals, the analysis finds that parental attitudes to risk are affected by the gender of their child. In a regression equation, the measured effect of child gender is, in these data, larger than that of other influences upon adult risk-aversion. On a Holt-Laury criterion, the parents of daughters, whether unborn or recently born, are nearly twice as risk-averse as parents of sons. Importantly, the patterns are the same in longitudinal and cross-sectional samples, and the results do not depend on whether or not the participants are paid for completing the Holt-Laury procedure. The child-gender effect is detectable before birth and for some months after birth. We cannot say for how long this effect prevails, because our data do not extend for many years after birth. However, a potentially important recent study by Chew et al. (2017) suggests, using a sample of Chinese twins of older ages than children considered in our study, that the presence of sons in the family seems to make parents less risk-averse.[10] This complementary result from the recent risk-aversion literature gives us reason to conjecture that (a) the effect discovered in our study may be at work in parents with older children and (b) that the findings may be observed in other countries apart from countries considered in this paper. The gender effect[11] found in this study is visible in parents of both sexes, which is one reason to suggest that it cannot have a single hormonal explanation. Our results seem potentially of relevance to a range of scientific disciplines.

The pattern documented in the paper is not simply a cross-sectional phenomenon. In a further longitudinal sub-sample (of 95 UK parents: 48 mothers and 47 fathers), which offers a natural form of test, it is possible to check for 'switching' behaviour. Substantial effects are observed (e.g. Figure 2a). A within-person comparison reveals that parents alter their risk attitudes in a discernible way after being informed of the gender of their own baby.

More broadly, this study is designed as a contribution to the research literature on the possible links between gender and risk-aversion (Dwyer et al., 2002; Lundberg and Rose, 2002, 2003; Dahl and Moretti, 2008; Croson and Gneezy, 2009; Sapienza, et al., 2009; Reuben et al., 2012; Booth and Nolen, 2012; Filippin and Crosetto, 2016). Why do parents become much more risk-averse when told they will have a daughter, how might that further our understanding of adult men's and women's different roles in human society, and could it be that equivalent effects might eventually be detectable in other species? Such questions are important and demand attention in future research.

[10] Chew et al. (2017) do not consider the question of whether "knowing" the gender of the child influences parental risk preferences and do not follow future parents throughout pregnancy. Apart from this important difference, our study originally pre-dates that of Chew et al. (2017), yet, results reported in Chew et al. (2017) seem to support our findings.

[11] The result can also be shown with kernel density plots of risk aversion among those with a boy or girl. The plots are available upon request.

REFERENCES AND NOTES

Anderson, L.R. & Mellor, J.M. Predicting health behaviors with an experimental measure of risk preference. *Journal of Health Economics* **27**, 1260–1274 (2008).

Basso, O. & Olsen, J. Sex ratio and twinning in women with hyperemesis or pre-eclampsia. *Epidemiology* **12**, 747–749 (2001).

Banks, J., Marmot, M., Oldfield Z. & Smith, J.P. Disease and disadvantage in the United States and England. *JAMA – Journal of the American Medical Association* **295**, 2037-2045 (2006).

Booth, A. L. & Nolen, P. Gender differences in risk behavior: Does nurture matter? *Economic Journal* **122**, F56–F78 (2012).

Catalano, R. & Bruckner, T. Secondary sex ratios and male lifespan: Damaged or culled cohorts. *Proceedings of the National Academy of Sciences of the USA* **103**, 1639–1643 (2006).

Chew, S. H., Yi, J., Zhang, J., & Zhong, S. Risk-aversion and son preference: Experimental evidence from Chinese twin parents. IZA Working Paper (2017).

Clifton, V. L. & Murphy, V. E. Maternal asthma as a model for examining fetal sex-specific effects on maternal physiology and placental mechanisms that regulate human fetal growth. *Placenta* **25** (suppl. A), S45–S52 (2004).

Conley, D. & Rauscher, E. The effect of daughters on partisanship and social attitudes toward women. *Sociological Forum* **28**, 700-718 (2013).

Croson, R. & Gneezy, U. Gender differences in preferences. *Journal of Economic Literature* **47**, 1-27 (2009).

Dahl, G. & Moretti, E. The demand for sons. *Review of Economic Studies* **75(4)**, 1085–1120 (2008).

Dahl, M. S., Dezso, C.L. & Ross, D. G. Fatherhood and managerial style: How a male CEO's children affect the wages of his employees. *Administrative Science Quarterly* **57**, 669-693 (2012).

Deck, C. & Jahedi, S. The effect of cognitive load on economic decision-making: A survey and new experiments. *European Economic Review* **78**, 97-119 (2015).

Decker, S. & Schmitz, H. Health shocks and risk aversion. *Journal of Health Economics* **50**, 156-170 (2016).

Dohmen, T., Falk, A., Huffman, D. & Sunde, U. Individual risk attitudes: measurement, determinants, and behavioral consequences. *Journal of the European Economic Association* **9**, 522–550 (2011).

Dwyer, P.D., Gilkeson, J.H. & List, J.A. Gender differences in revealed risk taking: Evidence from mutual fund investors. *Economics Letters* **76**, 151–158 (2002).

Eckel, C. C. & Grossman, P. J. Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behavior* **23**, 281–295 (2002).

Filippin, A. & Crosetto, P. Reconsideration of gender differences in risk attitudes. *Management Science* **62**(11), 3138-3160 (2016).

Glynn, A.N. & Sen, M. Identifying judicial empathy: Does having daughters cause judges to rule for women's issues? *American Journal of Political Science* **59**, 37–54 (2015).

Holt, C. A. & Laury, S. K. Risk-aversion and incentive effects. *American Economic Review* **92**, 1644–1655 (2002).

Lee, B. & Conley, D. Does the gender of offspring affect parental political orientation? *Social Forces* **94**, 1103–1127 (2016).

Loomes, G. & Pogrebna, G. Measuring individual risk attitudes when preferences are imprecise. *Economic Journal* **124**, 569–593 (2014).

Lundberg, S. Sons, daughters, and parental behaviour. *Oxford Review of Economic Policy* **21**, 340-356 (2005).

Lundberg, S. & Rose, E. The effects of sons and daughters on men's labor supply and wages. *Review of Economics and Statistics* **84**, 251–268 (2002).

Lundberg, S. & Rose, E. Child gender and the transition to marriage. *Demography* **40**(2), 333–349 (2003).

Malmendier, U. & Nagel, S. Depression babies: Do macroeconomic experiences affect risk taking? *Quarterly Journal of Economics* **126**, 373-416 (2011).

Oswald, A. J. & Powdthavee, N. Daughters and left-wing voting. *Review of Economics and Statistics* **92**, 213–227 (2010).

Peresie, J. L. Female judges matter: gender and collegial decision-making in the Federal apellate courts. *Yale Law Journal* **114**, 1759–1790 (2005).

Reuben, E., Rey-Biel, P., Sapienza, P., & Zingales, L. The emergence of male leadership in competitive environments. *Journal of Economic Behavior & Organization* **83(1)**, 111-117. (2012).

Sapienza, P., Zingales, L. & Maestripieri, D. Gender differences in financial risk-aversion and career choices are affected by testosterone. *Proceedings of the National Academy of Sciences of the USA* **106**, 15268–15273 (2009).

Shafer, E.F. & Malhotra, N. The effect of a child's sex on support for traditional gender roles. *Social Forces* **90**, 209-222 (2011).

Trivers, R. L. & Willard, D. E. Natural selection of parental ability to vary the sex ratio of offspring. *Science* **179**, 90–92 (1973).

Warner, R. L. Does the sex of your children matter? Support for feminism among women and men in the United States and Canada. *Journal of Marriage and the Family* **53**, 1051–1056 (1991).

Warner, R. L. & Steel, B. S. Child rearing as a mechanism for social change: the relationship of child gender to parents' commitment to gender equity. *Gender and Society* **13**, 503–517 (1999).

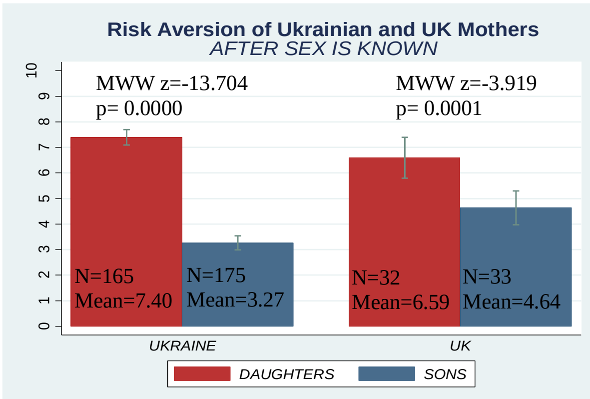
Washington, E.L. Female socialization: How daughters affect their legislator fathers' voting on women's issues. *American Economic Review* **98**, 311–332 (2008).

Wei, Sh.-J., & Zhang, X. The competitive saving motive: evidence from rising sex ratios and savings rates in china. *Journal of Political Economy* **119**(3), 511–564 (2011).

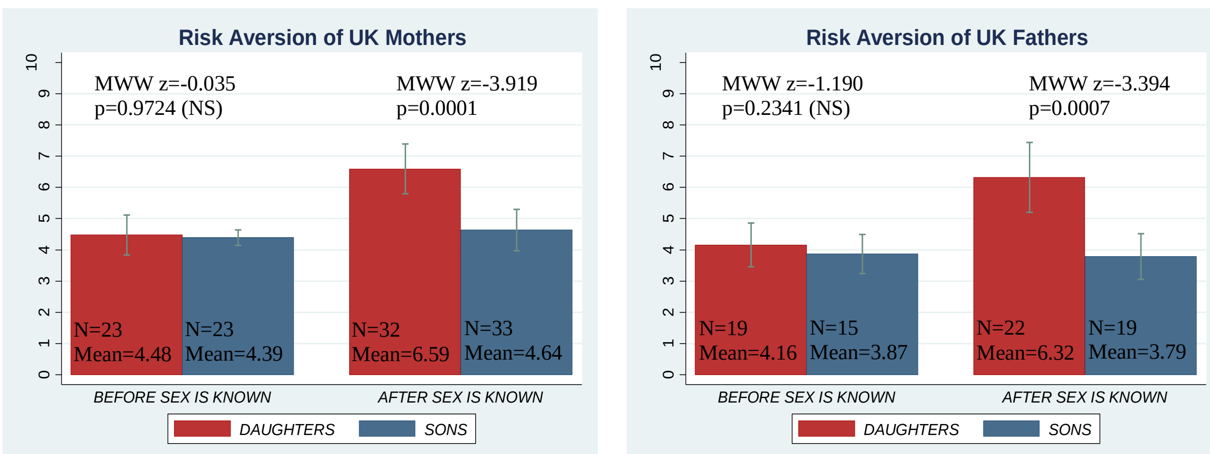
Xiao, L., Zhao, J. P., Nuyt, A. M., Fraser, W. D. & Luo, Z. C. Female fetus is associated with greater maternal insulin resistance in pregnancy. *Diabetic Medicine* **31**, 1696–1701 (2014).

Figure 1. Cross-Sectional Evidence: Risk Attitude Rank (RAR) Scores of Parents by Sex of Child

a Cross-Sectional Evidence: Ukrainian and UK Mothers



b Cross-Sectional Evidence: UK Mothers and Fathers



Notes: a, Ukrainian and UK mothers after week 20 of pregnancy have higher RAR scores if the child is a girl (red) rather than a boy (blue). **b**, RAR scores of UK mothers and male partners do not differ by foetal sex before week 20, but RAR scores are significantly higher after week 20 if the child is a girl. Quoted p-values are for Mann–Whitney–Wilcoxon test, NS = not significant.

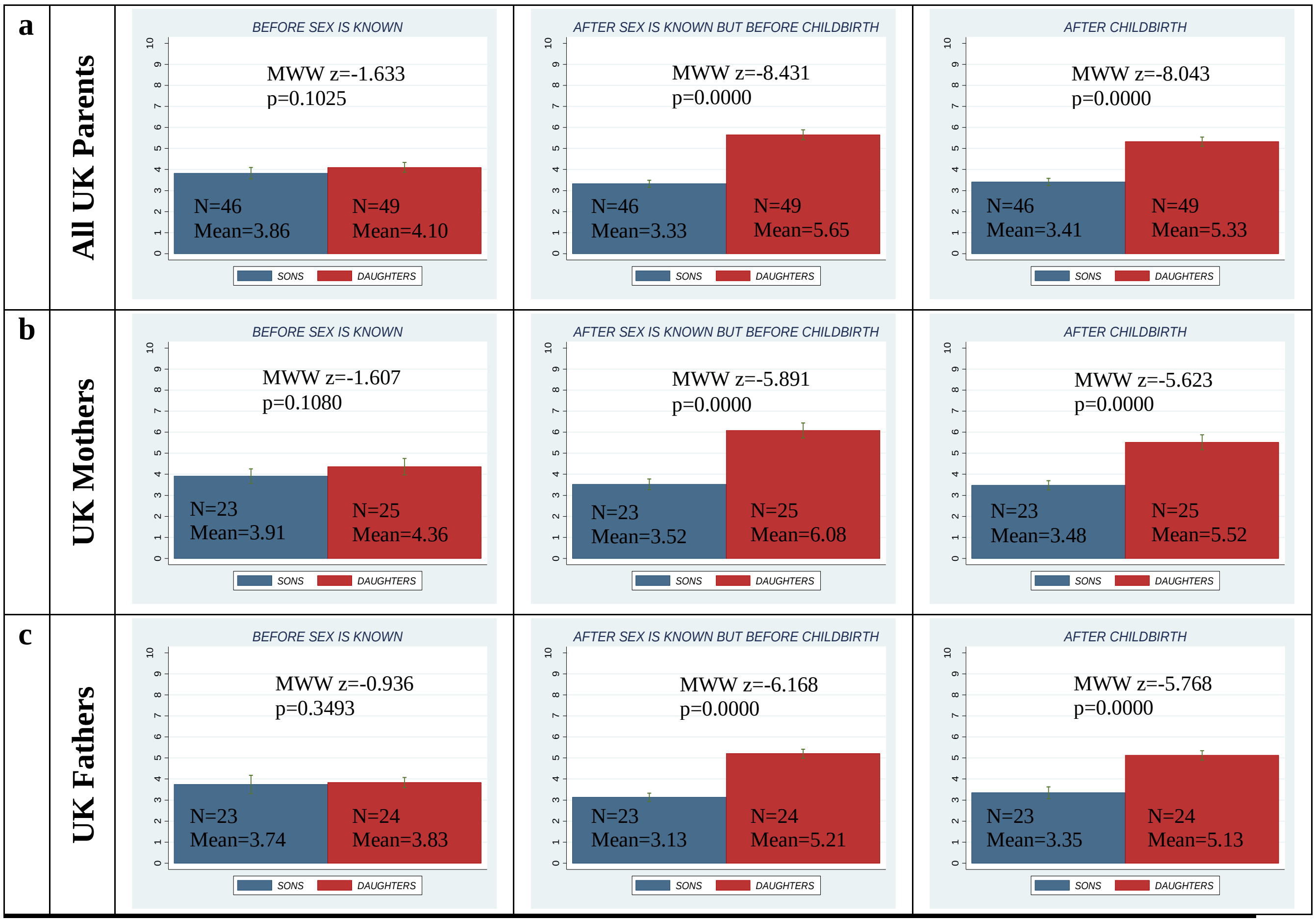
Table 1. Cross-Sectional Evidence: Regression Equations Estimating the Impact of the Child's Sex on Parental Risk-aversion Measured by the Holt-Laury RAR Method (in a Sample of 526 Parents)

Explanatory variables	Model 1: Coeff. (SE)	Model 2: Coeff. (SE)
Constant	3.607*** (0.124)	3.176*** (0.807)
Sex of child[§] (0 if SONS; 1 if DAUGHTERS)	3.105*** (0.176)	3.366*** (0.180)
Country (0 = Ukraine; 1 = UK)	—	–0.179 (0.347)
Sex of parent (0 if male; 1 if female)	—	0.700* (0.349)
Parental age (parent's age in years)	—	0.025 (0.023)
Previous children (0 if no previous children; 1 otherwise)	—	0.066 (0.346)
Income (from low 0 to high 4)	—	–0.011 (0.089)
Employed (0 if unemployed; 1 if employed)	—	–0.489* (0.202)
Study (0 if presently studying; 1 otherwise)	—	0.179 (0.236)
Education (from low 0 to high 4)	—	–0.151* (0.076)
Smoking (0 if parent does not smoke; 1 otherwise)	—	0.089 (0.368)
Pets (0 if parent does not keep a pet; 1 otherwise)	—	0.264 (0.310)
Pregnancy plan (0 if latest pregnancy unplanned; 1 otherwise)	—	–0.282 (0.363)
Married (0 if parent unmarried; 1 otherwise)	—	0.237 (0.242)
Adjusted R^2	0.369	0.418
N	526	526

[§] For parents with children already born, the sex is that of the most recent child.

Notes: The dependent variable is the parent's RAR score from 0 (extremely risk loving) to 10 (extremely risk averse). * $p < 0.05$ level; *** $p < 0.001$ level. Standard errors are given in parentheses. [In the UK data, it might be argued that the standard errors should be clustered at the level of the couple; results remain unchanged.]

Figure 2. Longitudinal Evidence: Risk Attitudes of UK Parents by Sex of Child



d Measured risk-aversion of those who go on to have ***SONS***			**e** Measured risk-aversion of those who go on to have ***DAUGHTERS***		
Before sex is known (pregnant mothers and partners)	After sex is known but before childbirth (pregnant mothers and partners)	After childbirth (post-natal mothers and partners)	Before sex is known (pregnant mothers and partners)	After sex is known but before childbirth (pregnant mothers and partners)	After childbirth (post-natal mothers and partners)
3.86	3.33	3.41	4.10	5.65	5.33
Sign rank test (Before vs After sex is known but before childbirth) z=3.257; p=0.0011			Sign rank test (Before vs After sex is known but before childbirth) z=-6.170; p=0.0000		
Sign rank test (Before sex is known vs After childbirth) z=2.756; p=0.0058			Sign rank test (Before sex is known vs After childbirth) z=-6.089; p=0.0000		

Notes: British parents (48 mothers and 47 fathers) in the longitudinal subsample were serendipitously sampled on 3 occasions: (1) before week 20 of pregnancy/partner pregnancy (‘Before sex is known’); (2) after week 20 of pregnancy/partner pregnancy but before childbirth (‘After sex is known but before childbirth’); and (3) after childbirth (‘After childbirth’). a, Three bar charts showing differences between RARs of all UK parents in the study (mothers and fathers) of sons versus parents of daughters Before sex is known, After sex is known but before childbirth and After childbirth are presented sequentially. We report sample size (N), mean RARs and the results of Mann-Whitney-Wilcoxon (MWW) test. b, Three bar charts showing differences between risk attitude ranks (RARs) of UK mothers of sons versus mothers of daughters Before sex is known, After sex is known but before childbirth and After childbirth are presented sequentially. Similarly to a, we report N, mean RARs of both groups and the results of MWW test. c, Three bar charts showing differences between RARs of UK fathers of sons versus fathers of daughters Before sex is known, After sex is known but before childbirth and After childbirth presented sequentially. Similarly to a and b, we report N, mean RARs and the results of MWW test. d, Mean RARs and results of the Wilcoxon sign rank tests for British parents (mothers and fathers) of sons. e, Mean RARs and results of the Wilcoxon sign rank tests for British parents (mothers and fathers) of daughters.

Table 2. Longitudinal Evidence: Results of Non-parametric Tests for Comparisons of UK Parents' Risk Attitudes

a — **UK All Parents**

	Before (N=95)	After (N=95)	Birth (N=95)	Sign rank test Before vs After	Sign rank test Before vs Birth
SONS	3.83 SD=0.90 (N=46)	3.33 SD=0.56 (N=46)	3.41 SD=0.58 (N=46)	z=3.257 p=0.0011	z=2.756 p=0.0058
DAUGHTERS	4.10 SD=0.82 (N=49)	5.65 SD=0.83 (N=49)	5.33 SD=0.75 (N=49)	z=-6.170 p=0.0000	z=-6.089 p=0.0000
MWW test	z=-1.633 p=0.1025	z=-8.431 p=0.0000	z=-8.043 p=0.0000		

b — **UK Mothers**

	Before (N=48)	After (N=48)	Birth (N=48)	Sign rank test Before vs After	Sign rank test Before vs Birth
SONS	3.91 SD=0.79 (N=23)	3.52 SD= 0.59 (N=23)	3.48 SD=0.51 (N=23)	z=1.771 p=0.0765	z=2.191 p=0.0285
DAUGHTERS	4.36 SD=0.95 (N=25)	6.08 SD=0.86 (N=25)	5.52 SD= 0.87 (N=25)	z=-4.382 p=0.0000	z=-4.259 p=0.0000
MWW test	z=-1.607 p=0.1080	z=-5.891 p=0.0000	z=-5.623 p=0.0000		

c — **UK Fathers**

	Before (N=47)	After (N=47)	Birth (N=47)	Sign rank test Before vs After	Sign rank test Before vs Birth
SONS	3.74 SD=1.01 (N=23)	3.13 SD=0.46 (N=23)	3.35 SD=0.65 (N=23)	z=2.978 p=0.0029	z=1.725 p=0.0844
DAUGHTERS	3.83 SD=0.56 (N=24)	5.21 SD=0.51 (N=24)	5.13 SD= 0.54 (N=24)	z=-4.394 p=0.0000	z=-4.354 p=0.0000
MWW test	z=-0.936 p=0.3493	z=-6.168 p=0.0000	z=-5.768 p=0.0000		

APPENDIX (for publication only if desired)

Table A0. Summary of Subject Pool Used in the Study

Country	Sex of Parent	Sample	Sex of Child	Before	After	Birth	All
Ukraine	Mothers	Cross-sectional	*SONS*	-	84	91	175
			DAUHTERS	-	89	76	165
			Total	-	173	167	340
UK	Fathers	Cross-sectional	*SONS*	15	14	5	34
			DAUHTERS	19	14	8	41
			Total	34	28	13	75
UK	Mothers	Cross-sectional	*SONS*	23	26	7	56
			DAUHTERS	23	22	10	55
			Total	46	48	17	111
UK	Fathers	Longitu-dinal	*SONS*	23	23	23	23
			DAUHTERS	24	24	24	24
			Total	47	47	47	47
UK	Mothers	Longitu-dinal	*SONS*	23	23	23	23
			DAUHTERS	25	25	25	25
			Total	48	48	48	48

Notes: Table A0 provides a brief overview of the subject pool used in our study. It describes the composition of our sample of Ukrainian as well as British population and shows how many subjects took part in our study: (i) before they knew the sex of their youngest child; (ii) after they knew the sex of their youngest child but prior to birth; and (iii) after the birth of their youngest child.

Table A1. Weeks After Birth (by Sex of the Youngest Child) in Different Sub-samples of the Study for Parents After Childbirth

Sub-sample	Sex of parent	Number of parents with	Mean weeks after birth	Median weeks after birth	St. Deviation
Ukraine Cross-sectional	Mothers	*SONS*=91	6.5	6.0	0.9
		DAUGHTERS=76	6.5	6.0	0.8
		All=167	6.5	6.0	0.9
UK Cross-sectional	Fathers	*SONS*=5	2.1	1.9	1.6
		DAUGHTERS=8	0.8	0.5	0.7
		All=13	1.3	1.4	1.3
	Mothers	*SONS*=7	1.7	1.7	0.9
		DAUGHTERS=10	1.0	1.0	0.8
		All=17	1.3	1.4	0.9
	Total	*SONS*=12	1.9	1.8	1.2
		DAUGHTERS=18	0.9	0.6	0.7
		All=30	1.3	1.4	1.0
UK Longitudinal	Fathers	*SONS*=23	18.9	19.0	1.4
		DAUGHTERS=24	18.5	18.5	1.1
		All=47	18.7	19.0	1.2
	Mothers	*SONS*=23	18.9	19.0	1.4
		DAUGHTERS=25	18.6	19.0	1.3
		All=48	18.8	19.0	1.3
	Total	*SONS*=46	18.9	19.0	1.4
		DAUGHTERS=49	18.6	19.0	1.1
		All=95	18.7	19.0	1.2

Notes: Table A1 provides details about the age of children of post-natal parents which took part in the study. We report the mean age of all children for all parents in our after-birth subsample (“Birth”) in number of weeks.

Figure A1. Risk Attitude Rank (RAR) Elicitation Procedure and Additional Questions Used in the Study

a Holt-Laury (2002) procedure used in the study to elicit RARs

We are inviting you to take part in a decision making study. To participate, you will need to answer several questions, which we think will take you about 10-15 minutes. You will receive £3 for your participation. In addition, we will select one question from Part 1 at random and pay you on the basis of your decision in that question. Your answers are confidential: in this questionnaire you will never be asked your name, address or any other identifying information. There is no single right or wrong answer in any one of these questions: we simply want you to tell us your personal preference.

Part 1

You have a choice between the following two options:

Left Option	**Right Option**
There are 10 balls in the sealed box. Balls can be either red or green. You blindly draw one ball out of the box. If you draw a **red** ball, you receive **£5**. If you draw a **green** ball, you receive **£4**.	There are 10 balls in the sealed box. Balls can be either blue or yellow. You blindly draw one ball out of the box. If you draw a **blue** ball, you receive **£10**. If you draw a **yellow** ball, you receive **£0.50**.

In each of the following ten questions please choose either Left Option or Right Option. Please tick either "Left Option" or "Right Option" under "I choose".

	Left Option										**I choose**		**Right Option**									
											Left Option	Right Option										
1	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	☐	☐	10.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
2	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	☐	☐	10.00	10.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
3	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	☐	☐	10.00	10.00	10.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50
4	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	☐	☐	10.00	10.00	10.00	10.00	0.50	0.50	0.50	0.50	0.50	0.50
5	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	☐	☐	10.00	10.00	10.00	10.00	10.00	0.50	0.50	0.50	0.50	0.50
6	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	☐	☐	10.00	10.00	10.00	10.00	10.00	10.00	0.50	0.50	0.50	0.50
7	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	☐	☐	10.00	10.00	10.00	10.00	10.00	10.00	10.00	0.50	0.50	0.50
8	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	☐	☐	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	0.50	0.50
9	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	☐	☐	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	0.50
10	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	☐	☐	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

b Self-reported measure of the propensity to wear seatbelt.

Do you always wear a seatbelt when in a car?	yes	no

c Self-reported measure of financial security

Do you feel financially secure?	yes	no

Notes: Figure A1 depicts the basic RAR elicitation question sheet as seen by the participants in our study. The jargon and technical headings, of course, were not shown to participants.

Table A2. Cross-Sectional Evidence: Impact of Sex of the Youngest Child on Parental "Propensity to Wear a Seatbelt" and "Feeling Financially Secure"

Estimated Using Logit Regression

Explanatory variables:	Propensity to wear a seatbelt		Feeling financially secure	
	Model 1: Coeff. (SE)	Model 2: Coeff. (SE)	Model 3: Coeff. (SE)	Model 4: Coeff. (SE)
Constant	–0.6315***	–5.5662***	1.0440***	–0.0989
	(0.1290)	(1.4333)	(0.1400)	(1.0117)
Sex of child†	0.7620***	1.75327***	–1.842516***	–2.3959***
(0 if SONS; 1 if DAUGHTERS)	(0.1790)	(0.3227)	(0.1936)	(0.2427)
Country	—	4.4265***	—	1.9890***
(0 = Ukraine; 1 = UK)		(0.6452)		(0.4524)
Sex of a parent	—	–1.1668	—	–0.2308
(0 if a parent is male ;1 if female)		(0.7461)		(0.4565)
Parental age	—	0.0812*	—	0.0039
(actual age of the parent in years)		(0.0386)		(0.0287)
Previous children	—	–0.1919	—	0.0952
(0 if no previous children and 1 otherwise)		(0.6680)		(0.4446)
Income	—	–0.1593	—	0.0645
(from low 0 to high 4)		(0.1418)		(0.1074)
Employed	—	–0.0843	—	0.0276
(0 if a parent is unemployed; 1 if employed)		(0.2996)		(0.2456)
Study	—	–0.2816	—	–0.3146
(0 if parent not studying at present; 1 otherwise)		(0.3510)		(0.2840)
Education	—	0.3718**	—	0.1055
(from low 0 to high 4)		(0.1403)		(0.0932)
Smoking	—	–0.8455	—	–0.6632
(0 if parent does not smoke; 1 otherwise)		(0.6211)		(0.4569)
Pets	—	0.1733	—	–0.4571
(0 if a parent does not keep a pet; 1 otherwise)		(0.5420)		(0.3786)
Pregnancy plan	—	0.4401	—	0.2753
(0 if latest pregnancy unplanned; 1 otherwise)		(0.6441)		(0.4417)
Married	—	0.5762	—	0.2330
(0 if parent unmarried; 1 otherwise)		(0.4177)		(0.2971)
Adjusted R^2	0.0256	0.4763	0.1380	0.2631
N	526	526	526	526

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
† For parents with more than one child, the sex assigned is that of the youngest (most recent) child.

Notes: Table A2 reports the results of logit regressions that estimate the impact of sex of the child on parental self-reported propensity to wear a seatbelt (Models 1 and 2). In these models, the dependent variable is thus seat-belt use: 1 (always wear seatbelt when driving) or 0 (otherwise). The table also displays the results of logit regressions which show the impact of sex of the child on parents' self-reported "feeling financially secure" (Models 3 and 4). In Models 3 and 4, the dependent variable is perceived security: 1 (feeling financially secure) or 0 (otherwise).

Table A3. Cross-Sectional Evidence: OLS Regression Results Including a Variable for Gestational Age (dependent variable – RAR)

Explanatory variables:	**N=329 (excludes parents after childbirth):**				**N=526 (includes parents after childbirth):**	
	BEFORE SEX IS KNOWN		*AFTER SEX IS KNOWN*		*AFTER SEX IS KNOWN*	
	Model 1 Coeff. (SE)	**Model 2 Coeff. (SE)**	**Model 1 Coeff. (SE)**	**Model 2 Coeff. (SE)**	**Model 1 Coeff. (SE)**	**Model 2 Coeff. (SE)**
Constant	4.6611	6.0417	1.0563	3.5574	0.32204	0.05506
	(2.9534)	(3.4520)	(3.0888)	(3.6511)	(2.3805)	(2.8419)
Sex of child	0.1296	0.56072*	3.8426***	3.8638***	3.6385***	3.7335***
(0 if *SONS* and 1 if *DAUGHTERS*)	(0.2780)	(0.27416)	(0.24705)	(0.2534)	(0.18733)	(0.19469)
Gestational age	–0.0405	–0.2788	0.17067	0.03453	0.23199	0.21684
(week of pregnancy)‡	(0.3639)	(0.3802)	(0.21580)	(0.24184)	(0.15550)	(0.1722698)
Gestational age²	0.0006	0.00655	–0.00277	–0.00047	–0.00386	–0.003582
(week of pregnancy squared)	(0.0106)	(0.0112)	(0.00364)	(0.00404)	(0.00241)	(0.0026391)
Sex of a parent		0.16337		0.63618		0.59845
(0 if a parent is male and 1 if female)		(0.29054)		(0.49127)		(0.44446)
Parental age		0.04910		-0.03031		0.01671
(actual age of the parent in years)		(0.02778)		(0.03238)		(0.02598)
Previous children		0.21562		0.38015		0.3272562
(0 if no previous children and 1 otherwise)		(0.31419)		(0.47299)		(0.4205225)
Income		–0.11243		–0.08372		–0.0039
(from low 0 to high 4)		(0.1613)		(0.1213)		(0.09139)
Employed		–0.56089		–0.11173		–0.46923*
(0 if a parent is unemployed; 1 if employed)		(0.43732)		(0.28522)		(0.21130)
Study		–0.49079		–0.15029		0.16409
(0 if a parent does not study at the moment and 1 otherwise)		(0.79500)		(0.33474)		(0.23997)
Education		0.06843		–0.06527		–0.16436*
(from low 0 to high 4)		(0.10497)		(0.10786)		(0.08348)
Smoking		–0.20008		0.65087		0.10218
(0 if a parent does not smoke and 1 otherwise)		(0.44573)		(0.52541)		(0.418658)
Pets		0.10864		0.22183		0.32527
(0 if a parent does not keep a pet and 1 otherwise)		(0.3001284)		(0.4545622)		(0.3843801)
Pregnancy plan		–0.21017		–0.31484		–0.03561
(0 if the latest pregnancy was not planned and 1 otherwise)		(0.5993)		(0.48702)		(0.38206)
Married		–0.50220		0.39360		0.28028
(0 if a parent is not married and 1 otherwise)		(0.30821)		(0.34831)		(0.26936)
R^2	0.0072	0.2926	0.5015	0.5239	0.4669	0.4882
N§	80	61	249	243	446	423

* - significant at 0.05 level; *** - significant at 0.001 level

‡ For all post-natal parents, gestational age is assumed to be equal to 41 weeks.

§ Ns are not the same in different columns because some participants did not answer all questions in the demographic questionnaire. The total number of parents in our sample is 526. This includes 80 parents who were approached before they learned the gender of their child (see last row in column 2 of the Table) and 446 parents (see last row in column 6 of the Table) who knew the gender of their child either because their child was already born (*BIRTH*) or because they learned the gender during 20th week scan (*AFTER*). 249 parents (see last row in column 4 of the Table) are parents who learned the gender of their child before childbirth during 20th week scan taken separately. In other words, columns 2 show results for 80 pre-natal parents who do not know the gender of their child, column 4 shows 249 pre-natal parents who know the gender of their child, while column 6 includes additional 197 post-natal parents who know the gender of their child (i.e., 249+197=446). Adding up 80 parents who don't know the gender of their child and 446 parents who do know the gender we get 446+80=526. 61 of 80, 243 of 249, and 423 of 446 parents answered all questions in the demographic questionnaire. This is why numbers in columns 3, 5, and 7, respectively, are different from those in columns 2, 4, and 6.

Notes: Table A3 reports results of OLS regressions for (i) pre-natal parents before and after they learn the sex of their youngest child (N=329), as well as (ii) parents (pre-natal and post-natal) who know the sex of their youngest child (N=526). Dependent variable – risk attitude rank (RAR).

Table A4. Cross-sectional Evidence: Additional Comparisons of RARs in ‘Before’ and ‘After’ Groups

a — UK Mothers

Parents after childbirth are excluded

	Before (N=46)	After (N=48)	MWW test
SONS	4.3913 (N = 23)	4.6154 (N = 26)	z = 0.480 p = 0.6309
DAUGHTERS	4.4783 (N = 23)	6.5 (N=22)	z = –3.385 p = 0.0007
MWW test	z = –0.035 p = 0.9724	z = –3.919 p = 0.0001	

Parents after childbirth are included

	Before (N=46)	After (N=65)	MWW test
SONS	4.3913 (N=23)	4.6364 (N=33)	z = 0.309 p= 0.7570
DAUGHTERS	4.4783 (N=23)	6.5938 (N=32)	z = –3.789 p = 0.0002
MWW test	z = –0.035 p = 0.9724	z = –3.919 p = 0.0001	

b — UK Fathers

Parents after childbirth are excluded

	Before (N=34)	After (N=28)	MWW test
SONS	3.8667 (N = 15)	3.9286 (N = 14)	z = –0.601 p = 0.5476
DAUGHTERS	4.157895 (N=19)	6 (N=14)	z = –1.764 p = 0.0777
MWW test	z = –1.190 p = 0.2341	z = –1.836 p = 0.0664	

Parents after childbirth are included

	Before (N=34)	After (N=41)	MWW test
SONS	3.8667 (N = 15)	3.7895 (N = 19)	z = 0.077 p = 0.9389
DAUGHTERS	4.1579 (N = 19)	6.3182 (N = 22)	z = –3.036 p = 0.0024
MWW test	z = –1.190 p = 0.2341	z = –3.394 p = 0.0007	

c — UKRAINE Mothers

Parents after childbirth are excluded

	Before (N=0)	After (N=173)	MWW test
SONS	—	3.1786 (N = 84)	—
DAUGHTERS	—	7.8764 (N = 89)	—
MWW test	—	z = –10.747 p = 0.0000	

Parents after childbirth are included

	Before (N=0)	After (N=340)	MWW test
SONS	—	3.2686 (N = 175)	—
DAUGHTERS	—	7.3939 (N = 165)	—
MWW test	—	z = –13.704 p = 0.0000	

Notes: Table A4 provides additional evidence from different subsamples of the study. Before’ refers to ‘*Before sex is known*’. In column ‘Parents after childbirth are excluded’, ‘After’ refers to ‘*After sex is known but before childbirth*’. In column ‘Parents after childbirth are included’, ‘After’ refers to ‘*After sex is known but before childbirth*’ or ‘*After childbirth*’. **a,** Shows mean RARs and results of Mann-Whitney-Wilcoxon (MWW) tests for UK Mothers. **b**, Shows RARs and results of MWW tests for UK Fathers. **c**, Shows RARs and results of MWW tests for UKRAINE Mothers

Table A5. Cross-sectional Evidence: Effect of Previous First-born Children on Parental Risk Attitude Rank (RAR) in UK Parents

	UK Mothers	**UK Fathers**	**ALL UK Parents**
SONS	5.1364	4.7368	4.9512
	(N = 22)	(N = 19)	(N = 41)
DAUGHTERS	4.8571	5	4.9091
	(N = 28)	(N = 16)	(N = 44)
MWW test	MWW test: z = 0.785	z = –0.085	z = 0.515
	p= 0.4324	p = 0.9325	p = 0.6068

Notes: Table A5 shows the effect of previous first-born children on parental RARs. All tests reported above exclude the current pregnancy (if pregnant). Since all Ukrainian mothers were first-time mothers who did not have previous children, the effect of first-borns was explored using the UK subsample of data. This table shows that (unlike the youngest children) the first-born children do not seem to affect parental RARs.

Table A6. Cross-sectional Evidence: Effect of the Total Number of Female Children on Parental Risk Attitude Rank (RAR) in UK Parents

	UK Mothers Coeff. (SE)	UK Fathers Coeff. (SE)	ALL UK Parents Coeff. (SE)
Total number of female children	-0.0355 (0.3318)	0.1862 (0.3681)	0.0755 (0.2428)
Constant	5.0098*** (0.3870)	4.7188*** (0.4400)	4.8690*** (0.2861)
R^2	0.0002	0.0077	0.0012
N	50	35	85

*** - significant at 0.001 level

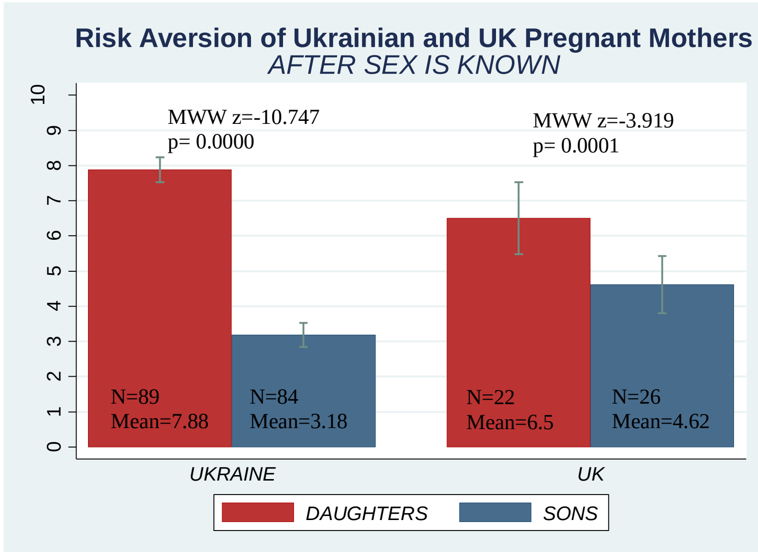
Notes: Table A6 shows the effect of the total number of female children on parental RARs. This effect is estimated using OLS regressions with parental RAR as a dependent variable. Since all Ukrainian mothers were first-time mothers who did not have previous children, the effect of the total number of female children was explored using the UK subsample of data.

Table A7. Cross-sectional Evidence: Impact of the Age of the First-born Child on Parental Risk Attitude Rank (RAR) in UK Parents

Age of first-born (in years)	*SONS*		*DAUGHTERS*	
	Mean parental RAR	Sample size	Mean parental RAR	Sample size
0.75	-	-	5	1
1	5	1	10	1
1.33	3.67	3	8	2
1.42	-	-	3	1
1.5	4	1	4	1
1.67	5	1	-	-
1.75	4	2	6	1
1.83			6	2
2	4.17	6	5.13	8
2.4	5	1	3	1
2.5	-	-	5	3
2.6	4	1	-	-
2.75	4.25	4	-	-
3	7.5	2	5	4
3.25	-	-	4	1
4	4.5	2	-	
4.5	-	-	9	2
5	4	2	5	1
5.5	3	1	-	-
6	-	-	4	1
7	4	3	3	1
8	4	3	6	4
9	5	1	-	-
10	4	1	5.5	2
11	-	-	2	1
12	4.67	3	-	-
13	-	-	8	1
15	4	2	-	-
16	2.5	2	-	-
17	-	-	5	1
18	-	-	7.5	2
21	-	-	6	1

Notes: Table A7 shows that the age of the first child (if the first child is female) does not have an impact on parental risk attitude. There is a lot of variability in first-child age. The summary statistics reported in the Table include parents who have previous first-born children, i.e., the data exclude the latest/current pregnancy information. Since all Ukrainian mothers were first-time mothers, the effect of the total number of female children was explored using the UK subsample of data.

Figure A2. Cross-sectional Evidence: Comparisons of RARs of Mothers of Daughters and Sons in Ukraine and the UK (Mothers After Childbirth Are Excluded)



Notes: Figure A2 compares risk attitude ranks (RARs) in the Ukrainian sample and the British sample in the pre-natal group after sex of the child is known. Only female parents (mothers) are included in this analysis. In both subsamples, mothers after childbirth are excluded. Number of observations, mean RARs and results of Mann-Whitney-Wilcoxon (MWW) tests are reported in the plots.