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Gender Difference in Risk Attitude: A Literature Review

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Abstract <p>Gender differences in risk attitudes are frequently observed and the scientific community widely agrees upon their existence. However, recent literature has challenged the notion that the gender gap is ubiquitous. In this literature review, the recent literature is examined with the purpose of verifying the existence of gender differences in risk attitudes and then examining the determinants of the gender gap. From the set of literature reviewed, there appears to be a significant difference in risk attitudes between genders, with women being more risk averse, although the difference appears to be highly context-dependent. Examined determinants that significantly affect the size of the gender gap include the presence of a safe alternative, the presence of a gender-homogenous group, salivary testosterone levels, the societal structure regarding prevailing gender roles, the role of the women in the work environment, and the framing of the decision tasks used in the study. Further developing an understanding of the gender gap in risk attitudes may aid in explaining some of the differences in behavior between men and women, for example, the sorting question related to differences in career selection. In addition, it can guide policy decisions regarding compensation toward the goal of equality between the genders.</p>			
Keywords Gender difference, risk attitudes, risk aversion, gender gap			
Additional information			

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1. INTRODUCTION

Gender differences in risk aversion have been a widely studied topic for decades. One of the main reasons for the interest in risk aversion topics is due to the fact that people face economic and strategic decisions that include a risk factor extremely often and risk attitudes have far-reaching consequences in the lifetime of an individual. From the large body of literature, a consensus has been developed that women are more risk-averse than men on average (Weber, Blais and Betz, 2002). However, some more recent studies have questioned the strength of the consensus (Maxfield and Shapiro, 2010). Additionally, contrary to previous belief the results appear to be at least partly context-dependent (Schubert, Gysler, Brown and Brachinger, 2000).

Focusing purely on observations and statistics of risky behavior in real world domains it does appear that men dominate many categories. For example, men are involved in more road accidents and more road fatalities (Roads and Traffic Authority of NSW, 2001; WHO, 2002). Being male places one in the highest risk demographic for early mortality in developed countries (Strulik, Trimborn and Schünemann, 2020). There are multiple reasons for these statistics, and they raise more questions rather than provide answers to why women appear to be more risk-averse than men. This study aims to shed light on some of these questions.

Research regarding gaps by gender has been in the public eye increasingly over the last decade and deservedly so. Understanding the differences between men and women more comprehensively can help us understand individuals' behavior and choices. The landscape of gender equality is shifting and issues such as equal representation in governing bodies are gaining traction. This particular issue and many more like it can benefit from risk attitude research with a focus on gender differences.

Understanding the differences in risk attitudes between men and women is crucial as it helps explain and predict decision-making behavior in situations involving uncertainty. The choice of risk attitude can significantly impact the strategies individuals adopt in financial investments, business decisions, and various other aspects of life where uncertainty plays a role. In addition, understanding the origins of

these differences is not only crucial for unraveling the complexities of human behavior but also has important implications for various fields, including economics, psychology, and public policy.

This thesis seeks to answer the following research questions: Is there a gender gap in risk attitudes between men and women? And furthermore, if the answer to the first question is yes, then what are the determinants of the gender gap?

This literature review studies the current literature regarding risk aversion differences between genders. It is structured so that Chapter 2 focuses on definitions, how risk attitudes are developed from childhood, the different research methods, and the role of personality in risk attitude gender gap. Chapter 3 looks at risk attitude from an economic point of view. Chapter 4 focuses on the research question listed above, first looking at the gender gap and then going through the possible determinants. Determinants are categorized and the categories include behavioral context, hormonal effects, framing and individual characteristics, and the effects of societal structure and status. Chapter 4 also looks at criticism of gender and risk-taking research and the nature vs nurture debate on the topic. Lastly chapter 5 includes discussion and the conclusion of this Master thesis.

2. RISK AND RISK ATTITUDE

2.1 Defining Risk Attitudes

Let us begin with definitions for the term “Risk Attitude.” The word “risk” is a widely-used word in today’s world. It can relate to a person and their circumstances, such as health or investments. However, it can also relate to societal topics, such as terrorism or economic performance, and also business-related topics, such as corporate governance or business strategy. There is no broad consensus on what the term risk means, but there are some aspects of it that are agreed upon. All definitions have two characteristics: risk and uncertainty are related, and there are always consequences to risks. But risk and uncertainty are not the same. One of the most effective definitions of risk is the following. “An uncertainty that could have a positive or negative effect on one or more objectives” (Hilson 2004). Hilson defines the attitude and combines the two definitions. “Attitude can be defined as a chosen state of mind, mental view or disposition with regard to a fact or state. Therefore we get the initial definition of “risk attitude” as a chosen state of mind with regard to those uncertainties that could have a positive or negative effect on objectives” (Hilson 2004).

Another distinction between uncertainty and risk was made by Frank Knight in his paper titled Risk, Uncertainty and Profit published in 1921. According to the author risk refers to situations, where an individual can calculate probabilities based on an objective evaluation of contingencies, meaning where the probability for each contingency is known, and the distribution of the stochastic variable is known. Uncertainty refers to situations where no objective classification is possible (Knight 1921).

Perception is another crucial factor that needs to be taken into consideration. Both “risk” and “attitude” are influenced by perception (Tversky & Kahneman, 1974). There are some factors such as familiarity and manageability that need to be taken into consideration, but there are also other subconscious factors as well such as availability and groupthink. Additionally, emotions play a crucial role in the perception of risk. If we add perception to what was discussed above and the definition there, we get the following definition which gives a more well rounded definition. “Risk attitude is the

chosen response to uncertainty that matters, influenced by perception” (Hillson & Murray-Webster, 2005).

Another important aspect of risk attitudes is that they exist on a spectrum and are not static across all domains of risk. Depending on how a person or group perceives the uncertainty of a situation can cause different risk attitude responses. “Since attitude drives behavior, different people will exhibit different responses to the same situation, as a result of their differing underlying risk attitudes” (Hillson & Murray-Webster, 2005). A situation that involves risk can be perceived as too risky by someone but acceptable by another.

2.2 Development of Risk Attitude from Childhood

The reasons for how risk attitude develops with age have a lot to do with neuroscience and how the brain develops, but there are a lot of behavioral studies on the subject as well, which can shed light on the matter within the scope of this literature review. Studies seem to suggest that children are less risk-averse than adults, and that averseness to risk appears to increase monotonically with age. For example, Harbaugh et al. in 2001 studied risk attitudes of both children and adults from ages 5 to 64. Individuals were given options between basic bets and the anticipated value of those bets. Surprisingly, numerous participants tended to pursue risk when confronted with probable gains, but avoided risk when confronted with improbable gains. Conversely, when it came to potential losses, the opposite behavior was observed. Children consistently underestimated unlikely events and overestimated likely ones. This behavior decreased with age, with adults generally relying on objective probabilities when assessing risky opportunities. (Harbaugh et al. 2001).

Interestingly, adolescents or teenagers showed a comparatively higher inclination towards risk-taking than both children and adults, particularly evident when subjected to more intricate gambling scenarios with an emotional aspect. Figner et al. (2009) delved into this phenomenon, exploring risk-taking behaviors and the underlying utilization of information among adolescents aged 13 to 16, 17 to 19, and adults across

four experiments. They employed a dynamic risk-taking task known as the Columbia Card Task (CCT), examining risk-taking behaviors under varying degrees of involvement of affective versus deliberative processes. The CCT was presented in two versions: the "hot" CCT aimed to evoke more impulsive, emotionally-driven decision-making, while the "cold" CCT aimed to prompt more thoughtful, deliberative decision-making. The authors concluded the following: "Results were consistent with dual-system explanations of risk-taking as the result of competition between affective processes and deliberative cognitive-control processes, with adolescents' affective system tending to override the deliberative system in states of heightened emotional arousal." (Figner et al. 2009)

Therefore, while aversion to risk appears to increase monotonically with age, other factors such as emotional state of the person and probabilities related to the decision can significantly alter this general pattern.

2.3 Introduction to Different Research Methods

Some of the most common research methods used to study gender differences in risk attitudes include surveys, laboratory experiments and field and online experiments.

In survey method studies the first step is to gather the data on risk attitudes of research subjects. This is generally done using a specific set of questions or scenarios presenting different risk scenarios to measure willingness of the participants to take risks. Gender differences in responses can then be analyzed statistically to identify any disparities in risk attitudes between men and women.

In laboratory experiments method controlled experiments are designed to manipulate certain variables related to risk attitudes and then responses are observed and recorded. These experiments may involve tasks such as decision-making games or investment simulations where participants make choices involving different levels of risk. Iowa Gambling Task (IGT) (Bechara et al., 1994) is one example of this.

Field and online experiments include many different methods but few of the most used in risk attitude research are cross-cultural research, behavioral studies, and longitudinal studies. The main goal can be for example to study the behavior of men and women in different cultures to look for differences in gender gap in risk attitudes. Chapter 4 introduces the individual studies from different research methods in detail.

2.4 Personality and Risk Attitude

To get a more comprehensive understanding of gender difference in risk attitudes, it is crucial to delve deeper into the role of personality. Personality traits have been found to influence likelihood of risk-taking of individuals, and exploring their effects can provide valuable insights into the underlying mechanisms driving risk-taking behavior.

Personality traits, as defined by “the Big Five” (Goldberg 1990), also known as the Five-Factor Model (FFM) (Chmielewski & Morgan 2013), is the most widely used and empirically supported model of normal personality traits. It encompasses five broad dimensions: extraversion, neuroticism, openness to experience, agreeableness, and conscientiousness.

The origin of “the Big Five” begins with early researchers like Cattell and Tupes, who used factor analysis to identify core dimensions of personality. As evidence from different research traditions started to align, the Big Five model gradually took shape. The five traits were found to be consistent across various cultures and languages, demonstrating their universal relevance in understanding human personality (John & Srivastava 1999).

Researchers now focus on exploring the effects of personality traits on various theoretical or applied phenomena such as emotion, social behavior, relationships, work, achievement, physical, and mental health. Utilizing the Big Five model they select from several well-validated instruments to operationalize these personality domains. Literature reviews and meta-analyses are frequently conducted to synthesize empirical findings on specific phenomena, such as changes in personality traits during

adulthood, into coherent sets of hypotheses and findings. This shift represents a significant departure from the previous fragmentation and competition among incompatible systems, fostering commonalities and convergences in the field of personality psychology (John et al. 2008).

While personality traits influence risk-taking behavior across genders, the nature of these effects may vary between men and women. Several studies have examined gender differences in the relationship between personality and risk attitudes.

When it comes to extraversion and neuroticism, the current research suggests that men tend to score higher on extraversion, while women score higher on neuroticism. Due to these differences, men may show higher levels of risk-taking behavior due to their greater inclination toward sensation-seeking, whereas women's risk aversion may be influenced by their higher levels of anxiety and emotional sensitivity (Cross et al. 2011; Byrnes et al. 1999).

Regarding openness to experience, agreeableness, and conscientiousness, gender differences in these traits are less significant compared to extraversion and neuroticism differences discussed above. However, variations in risk-taking behavior may still occur based on individual differences in these traits. Factors like socialization and cultural expectations can further shaping gender-specific risk attitudes (Sibley & Overall, 2011).

The interaction between personality and gender is very complicated and more research should be made on the topic. It would be interesting to see more research on how large variation personality has on the level of an individual.

3. RISK ATTITUDE FROM AN ECONOMIC POINT OF VIEW

Risk attitudes are generally split into three separate categories: risk-averse, risk-neutral and risk-seeking. This categorization was first introduced by John W Pratt in *Econometrica* in 1964 and later became generally accepted by the scientific community.

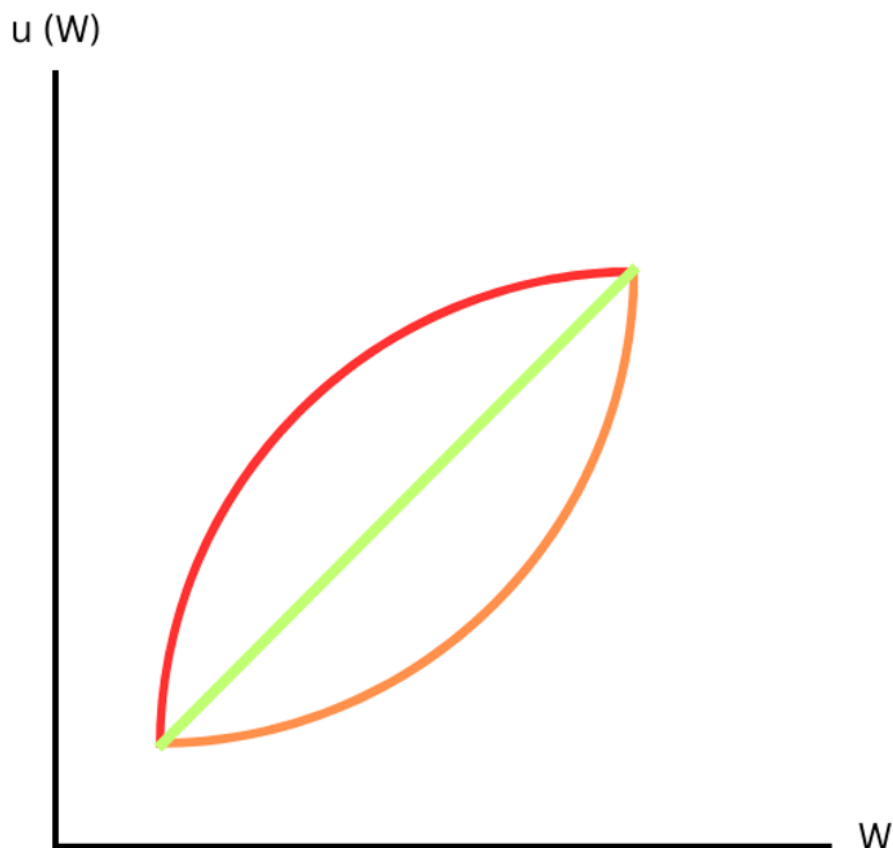


Figure 1: Basic utility function with the different risk attitudes depicted

Risk-averse individuals, redline in Figure 1, prefer certain outcomes over uncertain ones, even if the expected value of the uncertain outcome is higher. In other words, risk-averse individuals are more willing to accept a lower but guaranteed return rather than take on the uncertainty associated with a higher potential return. This behavior is typically characterized by a dislike of variability or volatility in outcomes.

Risk-neutral individuals, yellow line in Figure 1, do not care if what they are doing is risky or not. A risk-neutral person decided only based on the expected values of different outcomes and does not care about variability or risk with possible outcomes. In this case, individuals are neither risk-averse nor risk-loving, displaying a neutral stance towards uncertainty.

Risk-loving or risk-seeking individuals, orange line in Figure 1, are inclined to prefer uncertain outcomes with higher variability, even if the expected value is not significantly greater than a certain outcome. Such individuals are willing to take on higher levels of risk in pursuit of potentially higher returns. Risk-loving behavior is often associated with a higher tolerance for uncertainty and a desire for excitement or challenge.

Pratt in 1964 and Arrow in 1965 developed the concept of risk aversion. Standard ways of defining the level of risk aversion include the coefficient of absolute risk aversion and the coefficient of relative risk aversion. According to work by Arrow and Pratt, equation number 1 represents the coefficient of absolute risk aversion (A), and equation number 2 represents the coefficient of relative risk aversion (B). U denotes the utility function with the argument wealth, denoted by C. A and B denote income level. Since there is a minus sign on both of the equations it means the answer is positive and increase as risk aversion increases.

$$A = -\frac{U''(C)}{U'(C)} \quad 1$$

$$B = -\frac{U''(C)C}{U'(C)} \quad 2$$

One of the most effective ways to quantify risk aversion is using expected utility functions as the properties of the functions illuminate how individuals with different risk attitudes choose under uncertainty. Terms risk averse, risk neutral and risk loving (Harris & Wu, 2014) will be important to understand at a fundamental level at this point.

Imagine a situation where an individual has 100€ and is contemplating a gamble that gives him a 50 % probability of winning 50€ and a 50 % probability of losing 50€. Wealth will therefore be random: they have a 50 % probability of ending up with 50€ and a 50 % probability of ending up with 150€. The expected value of their wealth is 100, and the expected utility is

$$0.5u(50\text{€}) + 0.5u(150\text{€})$$

Now let us assume the utility of expected wealth for 100€ for this individual is larger than the expected utility mentioned above. In this case, the individual has a concave utility curve, its slope gets flatter as wealth is increased, and they are said to be “risk averse” as they prefer to have the expected value of their wealth rather than risk the gamble. On the other hand, an individual is a “risk lover” if they prefer to face the gamble over having the expected value of their wealth. A risk lover has a convex utility curve as its slope gets steeper as wealth increases. The curvature of the utility function matters as it measures the individual’s attitude toward risk. In general, the more concave the utility function, the more risk-averse the individual is, and the more convex the utility function, the more risk-loving the individual is. The third case, “risk neutral” is indifferent between the expected utility of their wealth and the gamble, and they have a linear utility curve. A risk-neutral individual does not care about the riskiness of their wealth at all, only about its expected value (Pratt, 1964). Figure 3.1 (Harris and Wu 2014) effectively visualizes the differently shaped utility curves of the three different categories: risk averse, risk neutral, and risk seeking.

In efficient markets, investors anticipate increased returns for dealing with greater risk. Consequently, individuals with higher risk tolerance often allocate their investments towards assets with elevated levels of risk, like stocks, aiming for superior long-term returns (Yao, Hanna, & Lindamood, 2004). This strategy helps them to accumulate greater wealth over time (Neelakantan, 2010). Therefore, investors with low levels of risk tolerance can find it harder to get their financial goals as they are less likely to invest in stocks.

The economic theory of risk attitudes provides a framework for understanding how people weigh potential gains and losses in decision-making under uncertainty. It has

applications in many different fields, such as finance and behavioral economics, but also public policy.

4. GENDER AND RISK ATTITUDE

This chapter is formulated so that 4.1 seeks to answer to the first research question, is there a gender gap in risk attitudes between men and women. 4.2 examines the available literature to seek answers to the second research question, what are the determinants of the gender gap. 4.2 is divided into five categories which include behavioral context, hormonal effects, framing and individual characteristics, the effects of societal structure, and the effects of social status.

4.1 Existence of gender gap

Eckel and Grossman in 2008 focused on reviewing the existing literature on different experiments that were conducted to examine the difference between men and women on risk aversion topics. They concluded that abstract gamble experiments show a greater gender gap than both contextual environment experiments and field experiments. However, the gender gap, women being more risk-averse, can be examined in all three methods of research (Eckel and Grossman 2008).

Dohmen et al in their 2011 study discovered that gender, age, height, and parental background all have a large impact on peoples risk aversion. In their study they used a large representative survey and a complementary experiment by using the SOEP as their survey material in the study. The authors used the SOEP as the primary dataset in the study. The SOEP, or Socio-Economic Panel, is a comprehensive panel survey encompassing the adult population of Germany and the data collection was started in 1984. In the SOEP, data is gathered by surveying the head of each household in the sample, but all other household members aged 17 and above also participate in the survey and get the full survey. Participants are asked about various aspects of their personal and household circumstances, as well as their opinions on diverse subjects, for example views on political and social matters. The authors analysis used the 2004 survey, which included 22019 individuals in 11803 different households. The authors conclude that women were found to be more risk-averse than men on average (Dohmen et al, 2011).

Fehr-Duda et al. in 2006 set out to examine gender differences in actual risk-taking behavior by using a laboratory experiment with financial incentives. The authors wanted to find out if gender differences in risk-taking were influenced more by how outcomes are valued or how probabilities are weighted. The results show that value functions are not that different in men and women. Men and women differ more in how they weigh probability schemes. The authors conclude the following: “In general women tend to be less sensitive to probability changes. Women also tend to underestimate large probabilities of gains more strongly than men. This effect is particularly pronounced when the decisions are framed in investment terms. As a result, women appear to be more risk-averse than men in specific circumstances.” (Fehr-Duda et al. 2006)

Daruvala in 2007 used an experiment in which subjects were asked to make choices for themselves and others regarding risk related questions and outcomes. The aim was to investigate the subjects’ own risk preferences and how their choices relate to the stereotype that women are more risk averse than men. The results showed the following: “No significant differences in risk preferences between men and women in the experiment. However, both men and women perceive women to be more risk-averse than men, and when predicting other people’s risk preferences, the respondents tended to use a combination of their own risk preferences and stereotypes. Lastly, when making risky choices for other people, the respondents generally used a combination of their own risk preferences and their average predicted risk preference of the targeted group.” (Daruvala 2007)

Harris and Jenkins in their 2006 study examined with a survey some of the reasons why it appears that men dominate in real world domain risk categories. The likelihood of 657 participants was measured in terms of them engaging in various risky activities relating to four different domains. These included gambling, health, recreation, and social. The authors concluded the following regarding the results of the study: “Women’s greater perceived likelihood of negative outcomes and lesser expectation of enjoyment partially mediated their lower propensity toward risky choices in gambling, recreation, and health domains. Perceptions of severity of potential outcomes was a partial mediator in the gambling and health domains. The genders did not differ in their propensity towards taking social risks. A fifth domain of activities

associated with high potential payoffs and fixed minor costs was also assessed. In contrast to other domains, women reported being more likely to engage in behaviors in this domain. This gender difference was partially mediated by women's more optimistic judgments of the probability of good outcomes and of outcomes being more intensely positive" (Harris & Jenkins 2006).

Charness and Gneezy 2011 compiled data from many different papers using a simple investment game as the method. Most of these experiments were not designed to investigate gender differences and were conducted by different researchers in different countries and with different choices for various factors in the investment game. All data came from the same basic investment game and this made it possible to test the robustness of the findings. To conclude the findings, a very consistent result was found that women invest less, and thus appear to be more financially risk-averse than men (Charness and Gneezy, 2011).

4.2 Determinants of the Gender Gap

4.2.1 Hormonal effects

Testosterone is the primary male sex hormone and androgen in males. The link between testosterone and economic risk-taking has been the subject of study by multiple researchers and the results vary. Many studies report that higher levels of testosterone result in higher levels of economic risk-taking. On average, testosterone generally appears in larger quantities in men's blood than in women's. Therefore, it has potentially significant effects on the gender gap in risk attitudes and needs to be included in the scope of this research.

Apicella et al. published many studies 2009 all the way to 2014 and their main objective was to examine the link between testosterone and financial risk-taking. For example, in 2008 they explored the relationship between prenatal and pubertal testosterone exposure, current testosterone, and financial risk preferences in men. The authors conclude the following: "Risk-taking in an investment game with the potential

for real monetary payoffs correlates positively with salivary testosterone levels and facial masculinity, with the latter being a proxy of pubertal hormone exposure.” (Apicella et al. 2008)

Cronqvist et al., 2016 examined differences in the prenatal environment, meaning before birth, explain heterogeneity in the investment behavior of adults and specially how it influences financial risk taking. The data they used was twin data. Either same sex or opposite sex twins were examined and because in the case of opposite sex, there are higher level of prenatal testosterone in the amniotic fluid contributed by the male twin. In this case as the female gets increased exposure to testosterone as they share the womb with the male fetus. The data used in the study was from the Swedish Twin Registry, which has some detailed birth cohort data with extensive information on twins. This data was matched with detailed financial data from the Swedish Tax Authority and other more individual data from Statistics Sweden, and this combination of data allowed the authors to measure financial decisions of the participants over several years. The result of the study is as follows: “An exogenous increase in exposure to prenatal testosterone is associated with the masculinization of financial behavior, specifically with elevated risk-taking and trading in adulthood.” The authors claim that their study is evidence of how prenatal testosterone exposure suggests that biological factors could explain a sizeable proportion of the gender gap in financial decisions (Cronqvist et al., 2016).

Sapienza et al. (2009) studied between- and within-gender variation in salivary concentrations of testosterone and markers of prenatal testosterone exposure, and how much they accounted for the variation of financial risk aversion. They investigated the possible activational effects of testosterone by analyzing the relationship between salivary concentrations of this hormone and an experimental measure of financial risk aversion. The authors concluded: “That higher levels of circulating testosterone were linked to being less risk-averse among women, but not among men. However, gender differences in risk aversion disappeared at comparably low salivary testosterone concentrations. This suggests that testosterone has nonlinear effects on risk aversion regardless of gender.” (Sapienza et al. 2009)

Stanton, Liening, and Schultheiss 2010 conducted a study aimed to characterize what if any relationship testosterone has with risky economic decisions. They selected 154

participants, of which 78 were men, and had them complete the Iowa Gambling Task (IGT) (Bechara et al., 1994). Participants also provided saliva samples, which were measured for endogenous testosterone levels. The results showed that high levels of endogenous testosterone were associated with choosing less frequently from advantageous IGT decks of cards, indicating greater risk-taking. The effects of testosterone on IGT performance were similar for both men and women. High-testosterone women and high-testosterone men made riskier choices than their low-testosterone counterparts of the same sex, and this effect was pronounced in women in this study.

The results from individual studies suggest a strong causal relationship between testosterone and economic risk-taking. However, the reality of the relationship appears to be more complicated than that. Fisk, Miller & Overton in their 2016 study challenged the casual relationship claim and argued that social status plays an important role. Fisk, Miller & Overton reviewed 33 studies on testosterone and financial risk-taking. The aggregation of the reviewed studies suggests that there is a positive association between testosterone and economic risk-taking, although it is unlikely to be a large association given the abundance of null results. Of the 41 studies on testosterone and risk-taking behavior included in the review, 19 (47%) found a positive relationship, 14 (34%) showed a null relationship, and the rest showed a mixed or curvilinear relationship (Fisk, Miller & Overton 2016).

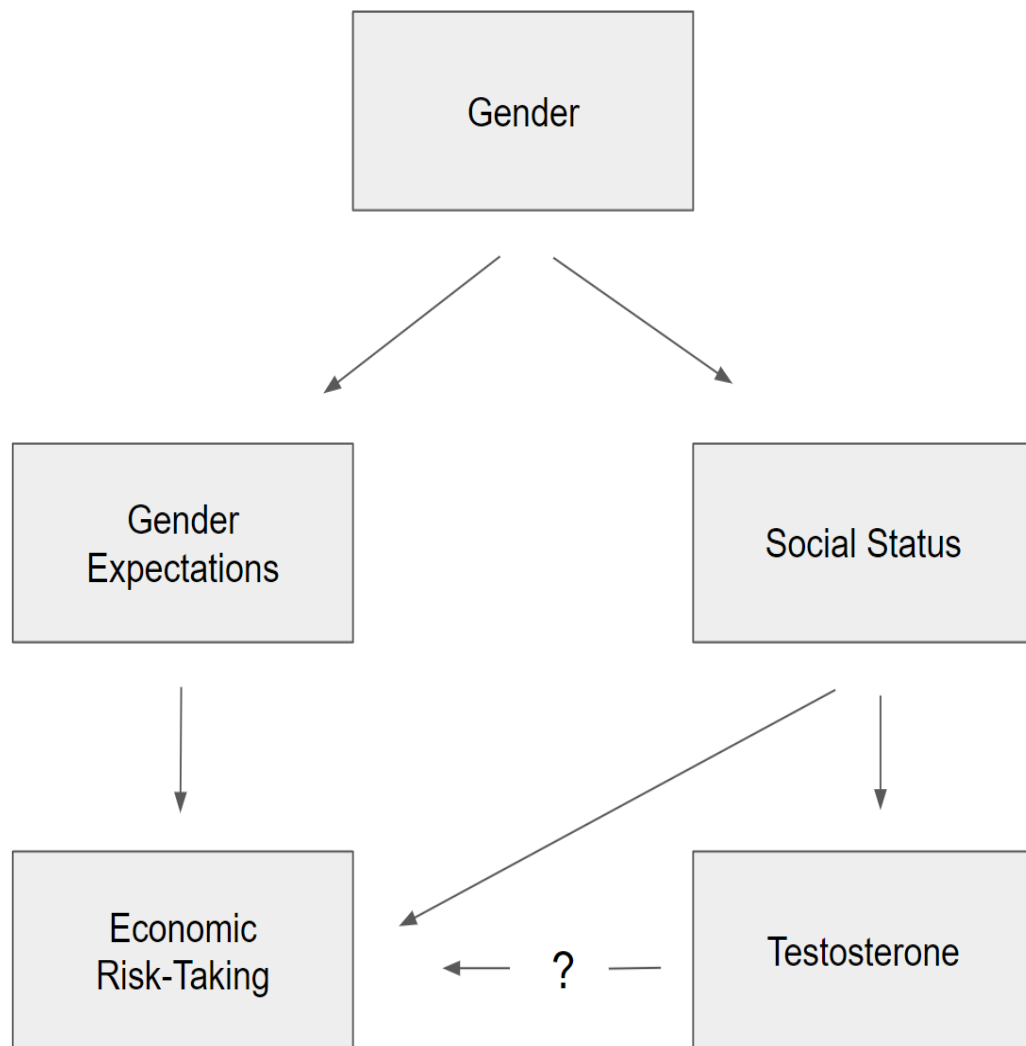


Figure 2: How gender expectations and social status mediate gender, economic risk taking and testosterone (adapted from Fisk, Miller & Overton, 2016)

Figure 2 shows how social status and gender expectations act as mediators between gender, testosterone, and economic risk-taking. Fisk, Miller & Overton argue that situational factors and social processes are key components in the connection between testosterone and economic risk-taking behavior.

The authors say that the studies in the review do not take into account the relationship between social status and testosterone. They make the argument that testosterone is a social hormone that is closely associated with social status and that the relationship between testosterone and status is both causal and reciprocal.

4.2.2 Behavioral context

Ronay and Kim (2006) examined the question of whether gender differences in hypothetical risk decisions could be socially facilitated by the presence of gender-homogenous groups and investigated the conscious and non-conscious motivators of risk-taking by using both explicit and implicit measures of risk attitude. The authors applied a multi-method approach to the subject of gender differences in risk-taking with the thought that it might help alleviate the factors causing inconsistencies in reported data. More specifically, the relatively small gender differences observed in paper and pencil measures compared to the larger differences observed in real-world accident data. The multiple methods used in the study included questionnaires and group experimental sessions. The authors concluded that using hypothetical choice dilemma items, there was no gender difference examined on an individual level. However, when placed in gender homogenous groups, males expressed a stronger pro-risk position than females. Additionally, males self-reported a stronger pro-risk position than females did on two explicit measures of risk attitude. No gender difference was found on the two parallel implicit measures (Ronay & Kim 2006).

Booth and Nolen in their 2012 study hypothesized that single-sex environments are likely to modify students' risk-taking preferences in economically important ways. To test this hypothesis they used a controlled experiment that gave subjects an opportunity to choose a risky outcome and in which the sensitivity of observed risk choices to environmental factors could be explored. The authors found the following result: "girls from single-sex schools are as likely to choose the real-stakes gamble as much as boys from either coed or single-sex schools, and more likely than coed girls. Moreover, gender differences in preferences for risk-taking are sensitive to the gender mix of the experimental group, with girls being more likely to choose risky outcomes when assigned to all-girl groups" (Booth & Nolen 2012).

Another study by Booth and Nolen in 2009 examined the role of nurture in explaining the claim that women shy away from competition. The subjects of the study attend publicly-funded single-sex and coeducational schools and they were tested in a controlled, laboratory type experiment. The study found a large difference between the competitive choices of girls from single-sex and coed schools. Moreover, girls from

single-sex schools behave more like boys even when randomly assigned to mixed-sex experimental groups. The authors therefore conclude that it is untrue that the average female avoids competitive behaviour more than the average male (Booth and Nolen, 2009). The findings of this and the previously introduced study suggest that observed gender differences might reflect social learning rather than inherent gender traits.

However, Lee et al. in 2014 studied a similar topic as they examined the effect of single-sex schooling on students' competitiveness by studying middle school students in Seoul who were randomly assigned to either single-sex or coeducational schools within their school districts. Results showed that single-sex schooling did not reduce the gender gap in competitiveness conditional on student and parental characteristics. (Lee et al. 2014)

Lindquist & Säve-Söderbergh in their 2011 study set out to find information on how men and women behave in either gender dominated group. They used data from the Swedish version of the TV show Jeopardy. The authors used a natural experiment from this large-stake game show and looked at cases in which the gender of the opponent is suddenly changed. The results show the following: "Women play more conservatively, particularly if they compete only against males and this is in spite of there being any strategic gain from this behavior." (Lindquist & Säve-Söderbergh, 2011)

Crosetto and Filippin (2017) studied the effects of having a safe option in decision-making situations and how it explains the gender difference in risk attitudes. They found out that the availability of a safe option causally affects risk attitudes, and that the presence of a riskless alternative does not entirely explain the gender gap, but it has a significant effect in triggering or magnifying such differences (Crosetto & Filippin 2017).

Charness, Dao & Shurchkov in their 2022 study investigate the impact of delaying competition on individuals' willingness to compete using an online experiment. Interestingly and opposite to previous findings, it is discovered that both men and women show close to the same probability of competing in the baseline condition, when the task is shown to be gender neutral. The study highlights that the gender gap in entry rates is not consistently present but rather relied on various factors and beliefs. While men show a significantly higher tendency than women to initially sign up for a

delayed tournament when offered the opportunity to study for the task they will be performing, this difference diminishes when the actual choice is made later. Interestingly, women who have the choice and access to study before the task have an increase in performance, while it is not found for men. The authors suggest that delaying competition does not generate a gender gap in competitiveness. Various potential reasons for the observed gender gap in tournament entry among individuals who have access to studying are explored. The authors rule out differences in risk aversion, confidence, and task stereotypes. Control treatments where the delay itself is a choice rule out the possibility that the forced nature of delay may be at the root of the overly competitive initial decisions by the men. The authors conclude that the patterns recognized may arise due to men being more confident than women and making choices based on an overly ambitious view about future selves' ability to study. (Charness, Dao & Shurchkov 2022).

4.2.3 Effects of Societal Structure

Gneezy, Leonard and List (2008) conducted a study in which they used a controlled experiment to explore whether there are gender differences in selecting into competitive environments across two distinct societies: the Maasai in Tanzania and the Khasi in India. These societies were chosen because the Maasai represent an example of a patriarchal society while the Khasi are matrilineal. In this study they also looked at risk aversion and they did so by conducting parallel risk aversion experiments to explore whether the competitive differences of the tribes might be driven by heterogeneous risk postures across gender groups. They used a standard risk game familiar to the researchers (Gneezy and Potters, 1997 and Haigh and List, 2006). The risk experiment has subjects play a one-shot game in which they are endowed with 100 units of currency. The subjects of the game must decide what portion of this endowment they desire to bet in a lottery that returns three times the bet with one-half probability and nothing with one-half probability. They concluded that although the Khasi and Maasai appear to have different risk preferences, there are no gender differences observed in either society. Both male and female Khasi risked approximately 85% of their total endowment, while among the Maasai the average bet

represented approximately 60% of the total endowment. It is worthwhile noting that there were different findings in terms of the main research question concerning competitiveness. Maasai men opted to compete at roughly twice the rate as Maasai women, but this result is reversed amongst the Khasi, where women chose the competitive environment more often than Khasi men, and even choose to compete weakly more often than Maasai men (Gneezy, Leonard and List 2008).

Gong and Yang (2011) conducted experiments with two different risk tasks in two areas with different societal structures. The subjects were from two neighboring ethnic groups, the matrilineal Mosuo, and the patriarchal Yi, both in China. The authors used a similar standard risk game as Gneezy, Leonard and List used in their 2008 study introduced above. The authors concluded that women were more risk averse than men on both tasks within both ethnic groups. However, the gender difference was significantly smaller in the matrilineal Mosuo.

According to research, there appears to be a link between marital status, gender, and risk tolerance. Sunden and Surette in their study in 1998 used survey data on consumer finances to study gender differences in asset allocation in retirement plans. They concluded that gender and marital status interact and have an effect on the investment choices of households. They found out that single men were more likely to allocate their assets to stocks when compared with single women and married men, which indicates more financial risk (Sunden and Surette 1998). Yao and Hanna (2005) also focused on the effect of gender and marital status on financial risk tolerance, but their study also differentiates married males from married females. They concluded that risk tolerance is highest for single males, followed by married males, then unmarried females, and then married females (Yao and Hanna 2005).

Fisher and Yao (2017) explored gender differences in financial risk tolerance using a large, nationally representative dataset, the Survey of Consumer Finances. They allowed the impact of the explanatory variables in the model to differ between men and women to decompose gender differences in financial risk tolerance. Their results indicate that gender differences in financial risk tolerance are explained by gender differences in the individual determinants of financial risk tolerance and that the disparity does not result from gender in and of itself. The individual variables that

moderate the relationship between gender and high-risk tolerance are income uncertainty and net worth, with income uncertainty moderating the relationship between gender and some risk tolerance (Fisher and Yao 2017).

4.2.4 Framing and Individual Characteristics

In terms of gender differences in risk attitude, individual characteristics, and the decision tasks' framing appear to be important.

Levin et al. in their 1988 study had students respond to a series of gambling options described in terms of the amount of initial investment, the amount to be won, and the probability of winning or losing. Half of the subjects were given the “chance of winning” each gamble, and half were given the “chance of losing” each gamble. Students' experiences as gamblers were also recorded. Students, both men and women, generally responded more favorably to gambles when the probability information was phrased in positive terms than when it was phrased in negative terms. The study found that the more familiar a woman is with a specific type of decision problem and the more experienced she is in the corresponding domain, the more risk-loving she will be (Levin et al., 1988).

Johnson and Powell in their 1994 paper explored differences in the nature of decisions taken by males and females in managerial roles. The decision-making characteristics of males and females in a ‘non-managerial’ population in which the majority of individuals have not undergone formal management education are contrasted with a ‘managerial’ population of potential and actual managers who have undertaken such education. The paper makes the following claim: “Women are often excluded from managerial positions of authority and leadership due to stereotypes, which have been constructed by observing ‘non-managerial’ populations at large. These stereotypes may not apply to managers as in the ‘managerial’ sub-population males and females display similar risk propensity and make decisions of equal quality” (Johnson & Powell 1994).

Risk theories typically assume individuals make risky choices using probability weights that differ from objective probabilities. Booth and Nolen in their 2012 study researched if the probability weights vary depending on which portion of a risky environment is made salient. They used experimental data to show that salience affects young men and women differently, even after controlling for cognitive and non-cognitive skills. The study concludes: “Men are significantly more likely than women to switch from a certain to a risky choice once the upside of winning is made salient, even though the expected value of the choice remains the same.” (Booth & Nolen, 2012)

Competitive desirable job positions are mostly occupied by men and so are engineering and science fields in universities around the world. It is sometimes argued that discrimination is the cause of this. Niederle and Vesterlund in their 2005 study set out to explore an additional factor, that women and men simply differ in their selection into competitive environments. The authors examine an environment in which women and men perform equally well under both a non-competitive piece rate and a competitive tournament scheme. After that the participant got the choice of their incentive scheme for the next performance. The authors found that twice as many men as women choose the tournament over the piece rate and go a step further in their analysis: “In a final treatment, we show that gender differences exist even when participants simply decide how to be paid for a past performance. We use this decision as a control for non-tournament specific gender differences (such as risk aversion, feedback aversion, general overconfidence), and find a large residual gender effect when participants select tournament compensation for a future performance.” (Niederle & Vesterlund 2005)

Charness, Rustichini, and Van de Ven in 2018 investigated the relationship between self-confidence and strategic decision-making behavior. The authors experimentally tested the notion that overconfidence is motivated in part by strategic considerations. They found evidence in the behavior of participants who send and respond to others’ statements of confidence about how well they have scored on an IQ test. The authors concluded the following on the results of their study: “Stated confidence is inflated by males when deterrence is strategically optimal and is instead deflated by both males and females when encouraging entry is strategically optimal. This behavior is

consistent with the equilibrium of the corresponding signaling game. Overconfident statements are used in environments that seem familiar, and that this can occur on an unconscious level.” (Charness et al. 2018)

4.2.5 Effects of social status

Many studies document gender differences in decision-making and often attribute these differences to innate and stable factors, such as biological and hormonal differences. Carr & Steele in their 2010 study set out to research the effect of stereotype threat in regard to decision-making in both men and women. They found out that stereotype threat affected decision-making and led to gender differences in loss-aversion and risk-aversion behaviors. In their first study on this topic, women who were subjected to stereotype threats in academic and business settings were more loss-averse than both men and women who were not facing the threat of being viewed in light of negative stereotypes. They also found no gender differences in loss-aversion behavior in the absence of stereotype threat. These results suggest that individuals’ decision-making can be influenced by stereotype concerns. (Carr & Steele, 2010)

In Western cultures, risk-taking is perceived as a masculine characteristic. Meier-Pesti & Penz in their 2008 study hypothesized that the more people associate themselves with masculine attributes, the more financial risks they tend to take, regardless of biological sex. Results of the study showed that differences between men and women in financial risk-taking decreased when identification with masculine attributes remained constant. Femininity, on the other hand, was not related to financial risk-taking. Another finding in the study was that gender priming on masculinity and femininity affected the risk-taking of the male sample. (Meier-Pesti & Penz, 2008)

“White male effect” (WME) (Finucane et al. 2000) is a studied topic which refers to the observation that white men have relatively low perception of risks. This effect is often seen as a privileged position of white males in society. From this assumption it can thus be argued that perhaps inequality leads women and ethnic minorities to have higher risk perceptions than men and especially white men. Olofsson & Rashid in their

2011 study aimed to investigate the WME in one of the most gender-equal countries, Sweden, to see if a similar pattern can be found. The results showed that in Sweden there was no significant difference between men and women in risk perception. But interestingly, it was found that more risks are perceived by people with foreign backgrounds. The main finding is that there is appears there is no white male effect in Sweden but ethnicity does appear to serve as a marker of inequality and discrimination in Sweden. The foreign background appears to mediate inequality and result in high-risk perception. The study concludes: “Equality seems to be a fruitful concept with which to examine differences in risk perception between groups in society. The ‘societal inequality effect’ is a more proper description than the white male effect”. (Olofsson & Rashid 2011)

4.3 Summary

The following table, Table 1, summarizes the results of the examined literature of both 4.1 and 4.2 highlighting the main conclusion of each study in relation to gender difference. The authors, publishing year, the publication, and title of study are also included in the table. The results are further discussed in the discussion part of this paper.

Table 1: Summary of results of reviewed literature in chapters 4.1 and 4.2

Authors and year	Title of study and Publication	Main conclusion related to gender difference
Eckel and Grossman 2008	Men, Women, and Risk Aversion: Experimental Evidence. Handbook of Experimental Economics Results, 1, 1061-1073.	Question: What are the differences in risk aversion between men and women? Result: The gender gap, women being more risk-averse, can be examined in all three methods of research in scope.
Dohmen et al, 2011	Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences. Journal of the European Economic Association, 9(3), 522-550.	Question: How can individual risk attitudes be measured, and what are their determinants and behavioral consequences?

		Result: Women were found to be more risk-averse than men on average.
Fehr-Duda et al. 2006	Gender, Financial Risk, and Probability Weights. <i>Theory and Decision</i> , 60(2-3), 283-313.	Question: How does gender influence financial risk perception and probability weighting? Result: Women appear to be more risk-averse than men in specific circumstances
Daruvala 2007	Gender, Risk, and Stereotypes. <i>Journal of Economic Psychology</i> , 28(3), 324-340.	Question: How do gender and stereotypes impact risk-taking behavior? Result: The study showed no significant differences in risk preferences between men and women in the experiment.
Charness and Gneezy, 2007	Strong Evidence for Gender Differences in Investment. <i>Journal of Economic Behavior & Organization</i> , 83(1), 50-58.	Question: Is there strong evidence for gender differences in investment behavior? Result: A very consistent result was found that women invest less, and thus appear to be more financially risk-averse than men
Apicella et al., 2008	Testosterone and Financial Risk Preferences. <i>Evolution and Human Behavior</i> , 29(6), 384-390.	Question: What is the relationship between testosterone levels and financial risk preferences? Result: Risk-taking in an investment game with the potential for real monetary payoffs correlates positively with salivary testosterone levels and facial masculinity, with the latter being a proxy of pubertal hormone exposure.
Cronqvist et al., 2016	The Fetal Origins Hypothesis in Finance: Prenatal Environment, the Gender Gap, and Investor Behavior. <i>The Review of Financial Studies</i> , 29(3), 739-786.	Question: How does prenatal environment affect the gender gap in financial decision-making? Result: An exogenous increase in exposure to prenatal testosterone is associated with the masculinization of financial behavior, specifically with elevated risk-taking and trading in adulthood.
Sapienza et al., 2009	Gender Differences in Financial Risk Aversion and Career Choices are Affected by Testosterone. <i>Proceedings of the National Academy of Sciences</i> , 106(36), 15268-15273.	Question: Are gender differences in financial risk aversion and career choices influenced by testosterone levels? Result: Higher levels of circulating testosterone were linked to being less risk-averse among women, but not among men.

Coates, Gurnell & Rustichini, 2008	Second-to-Fourth Digit Ratio Predicts Success among High-Frequency Financial Traders. <i>Proceedings of the National Academy of Sciences</i> , 105(2), 6167-6172.	<p>Question: Can the second-to-fourth digit ratio predict success among high-frequency financial traders?</p> <p>Result: 2D:4D predicted the long-term profitability of the traders as well as the number of years they remained in the business. 2D:4D also predicted the sensitivity of their profitability to increases both in circulating testosterone and in market volatility.</p>
Stanton, Liening, and Schultheiss, 2010	Testosterone is Positively Associated with Risk Taking in the Iowa Gambling Task. <i>Hormones and Behavior</i> , 59(2), 252-256.	<p>Question: Is testosterone positively associated with risk-taking behavior in financial decision-making tasks?</p> <p>Result: High-testosterone women and high-testosterone men made riskier choices than their low-testosterone counterparts of the same sex, and this effect was pronounced in women in this study.</p>
Fisk, Miller & Overton, 2016	Why Social Status Matters for Understanding the Interrelationships between Testosterone, Economic Risk-taking, and Gender. <i>Journal of Behavioral and Experimental Economics</i> , 61, 21-29.	<p>Question: Why does social status matter for understanding the interrelationships between testosterone, economic risk-taking, and gender?</p> <p>Result: The aggregation of the reviewed studies suggests that there is a positive association between testosterone and economic risk-taking, although it is unlikely to be a large association given the abundance of null results.</p>
Ronay and Kim, 2006	Gender Differences in Explicit and Implicit Risk Attitudes: A Socially Facilitated Phenomenon. <i>Journal of Economic Psychology</i> , 27(4), 494-504.	<p>Question: How do explicit and implicit risk attitudes differ between genders, and is this difference socially facilitated?</p> <p>Result: There was no gender difference examined on an individual level.</p>
Booth and Nolen, 2012	Gender Differences in Risk Behaviour: Does Nurture Matter? <i>Economic Journal</i> , 122(558), 995-1021.	<p>Question: Do gender differences in risk behavior stem from nurture or biological factors?</p> <p>Result: Girls from single-sex schools are as likely to choose the real-stakes gamble as much as boys from either coed or single-sex schools, and more likely than coed girls.</p>
Booth and Nolen, 2009	Choosing to Compete: How Different are Girls and Boys? <i>Journal of Economic Behavior & Organization</i> , 71(3), 574-585.	<p>Question: How do girls and boys differ in their willingness to compete?</p> <p>Result: Girls from single-sex schools</p>

		behave more like boys even when randomly assigned to mixed-sex experimental groups.
Lee et al. 2014	Do Single-Sex Schools Make Girls More Competitive? Evidence from Jeopardy! American Economic Journal: Applied Economics, 6(3), 53-77.	Question: Do single-sex schools impact girls' competitiveness? Result: Single-sex schooling did not reduce the gender gap in competitiveness conditional on student and parental characteristics.
Lindquist & S�ave-S�oderbergh, 2011	Girls Will Be Girls, Especially among Boys: Risk-taking in the "Daily Double" on Jeopardy. Judgment and Decision Making, 6(5), 391-395.	Question: How does gender affect risk-taking behavior in game show contexts? Result: Women play more conservatively, particularly if they compete only against males and this is in spite of there being any strategic gain from this behavior.
Crosetto and Filippin, 2017	Safe Options Induce Gender Differences in Risk Attitudes. Journal of Economic Behavior & Organization, 135, 47-61.	Question: Do safe options induce gender differences in risk attitudes? Result: They found out that the availability of a safe option causally affects risk attitudes, and that the presence of a riskless alternative does not entirely explain the gender gap, but it has a significant effect in triggering or magnifying such differences.
Gong and Yang, 2011	Gender Differences in Risk Attitudes: Field Experiments on the Matrilineal Mosuo and the Patriarchal Yi. Journal of Economic Behavior & Organization, 78(3), 190-202.	Question: How do gender differences in risk attitudes manifest in matrilineal and patriarchal societies? Result: Women were more risk averse than men on both tasks within both ethnic groups. However, the gender difference was significantly smaller in the matrilinear Mosuo.
Gneezy, Leonard and List, 2008	Gender Differences in Competition: Evidence from a Matrilineal and a Patriarchal Society. Econometrica, 77(5), 1637-1664.	Question: How does gender influence competition behavior in different societal structures? Result: Although the Khasi and Maasai appear to have different risk preferences, there are no gender differences observed in either society.
Sunden and Surette, 1998	Gender Differences in the Allocation of Assets in Retirement Savings Plans. The American Economic Review, 88(2), 207-211.	Question: How do gender differences influence asset allocation in retirement savings plans? Result: Single men were more likely to allocate their assets to stocks when compared with single women and married men, which indicates more financial risk

Yao and Hanna, 2005	The Effect of Gender and Marital Status on Financial Risk Tolerance. <i>Financial Counseling and Planning</i> , 16(1), 73-82.	<p>Question: What is the effect of gender and marital status on financial risk tolerance?</p> <p>Result: Risk tolerance is highest for single males, followed by married males, then unmarried females, and then married females</p>
Fisher and Yao, 2017	Gender Differences in Financial Risk Tolerance. <i>Journal of Economic Psychology</i> , 61, 191-202.	<p>Question: Are there gender differences in financial risk tolerance, and if so, what are they?</p> <p>Result: Gender differences in financial risk tolerance are explained by gender differences in the individual determinants of financial risk tolerance and that the disparity does not result from gender in and of itself.</p>
Levin et al., 1988	How Consumers are Affected by the Framing of Attribute Information before and after Consuming the Product. <i>Journal of Consumer Research</i> , 15(3), 374-378.	<p>Question: How does the framing of attribute information influence consumer decision-making?</p> <p>Result: The more familiar a woman is with a specific type of decision problem and the more experienced she is in the corresponding domain, the more risk-loving she will be.</p>
Johnson & Powell, 1994	Decision Making, Risk and Gender: Are Managers Different? <i>British Journal of Management</i> , 5(2), 123-138.	<p>Question: Are there differences in decision-making and risk behavior between genders in managerial positions?</p> <p>Result: The 'managerial' sub-population males and females display similar risk propensity and make decisions of equal quality</p>
Booth & Nolen, 2012	Salience, Risky Choices and Gender. <i>Journal of Economic Behavior & Organization</i> , 83(1), 61-66.	<p>Question: How does salience affect risky choices and gender differences in decision-making?</p> <p>Result: Men are significantly more likely than women to switch from a certain to a risky choice once the upside of winning is made salient, even though the expected value of the choice remains the same.</p>
Carr & Steele, 2010	Stereotype Threat Affects Financial Decision Making. <i>Psychological Science</i> , 21(10), 1411-1416.	<p>Question: Does stereotype threat affect financial decision-making, and if so, how?</p> <p>Result: Stereotype threat affected decision-making and led to gender differences in loss-aversion and risk-aversion behaviors.</p>

Meier-Pesti & Penz, 2008	Sex or Gender? Expanding the Sex-Based View by Introducing Masculinity and Femininity as Predictors of Financial Risk Taking. <i>Journal of Economic Psychology</i> , 29(2), 180-196.	<p>Question: Can masculinity and femininity predict financial risk-taking behavior?</p> <p>Result: Differences between men and women in financial risk-taking decreased when identification with masculine attributes remained constant. Femininity, on the other hand, was not related to financial risk-taking.</p>
Olofsson & Rashid, 2011	The White (Male) Effect and Risk Perception: Can Equality Make a Difference? <i>Journal of Risk Research</i> , 14(9), 1105-1123.	<p>Question: Does the perception of risk differ based on gender and equality levels?</p> <p>Result: In Sweden there was no significant difference between men and women in risk perception, However, people with foreign backgrounds perceive more risks than native Swedish people.</p>

4.4 Criticism of Gender and Risk-Taking Research

Women being more risk-averse than men on average has become a stereotype in society and much of the literature, as discussed above, does appear to support that. However, there has been some pushback on the assumption that women are more risk-averse.

Maxfield and Shapiro (2010) published a paper to examine the stereotype that women are more risk averse than men to gain insight related to career development of women. Utilizing literature and concepts about risk appetite and decision making, the paper evaluated the results of the Simmons Gender and Risk Survey database of 661 female managers. The paper finds evidence of gender neutrality in risk propensity and decision-making in specific managerial contexts that are not portfolio allocation (Maxfield and Shapiro 2010).

Nelson 2018 published a book titled *Gender and Risk-Taking: Economics, Evidence, and Why the Answer Matters*. Author discusses whether the belief that men and women have different risk preferences has been appropriately proven in relevant literature. Nelson concludes: “It is not backed by evidence and attributes the biases arising from too-easy categorical thinking, widespread stereotyping, and a tendency to prefer publishable results that fit one’s prior beliefs.” Lastly, the book explores the economic implications of the conventional association of risk-taking with masculinity and risk-aversion with femininity (Nelson 2018).

Badunenko et al. in 2009 published a study that put to question the stereotype that women are more risk-averse than men in how they do their investment decisions. Households were surveyed in five European countries and the data was used for the analysis. The results were as follows: “Women are less likely to hold risky assets. However, female owners of risky assets allocate an equal or even a higher share of their wealth to these assets than men. The findings suggest that especially in the case of women, the declared attitude toward financial risks may be misleading as it does not necessarily reflect the actual willingness to bear risks.” (Badunenko et al. 2009)

Alexy et al. (2016) examined risk attitudes researched in three different procedures with the goal of analyzing how consistent the risk attitudes truly were. The authors used rank correlations to measure the degree of association of the choices the subjects made and looked for the main factors detailing the specific characteristics of risk attributes. They found some evidence that gender and cognitive abilities of the participants play a certain role in the consistency of risk attitudes. Additionally, they found that choices of the participants in the popular Holt and Laury method and the other two methods show nearly no relation. They conclude that gender differences in risk aversion vary significantly between studies and also vary heavily based on the elicitation method chosen (Alexy et al., 2016) Despite the pushback on the stereotype that women are more risk-averse than men, the evidence still strongly supports the stereotype. However, as the research on the topic develops, the more it appears that the stereotype is losing its dominant support among the scientific community.

Paper by Flippin and Crosetto from 2016 had the goal of examining the claim that women are more risk averse than men. The authors looked at the available

experimental literature and found that gender differences are less ubiquitous than how they are usually thought of. The authors gathered data and showed that the size of the gender differences, although significant, were quite unimportant economically speaking. The following is the conclusion by the authors: “Gender differences systematically correlate with the features of the elicitation method used and in particular the availability of a safe option and fixed probabilities.”

Despite the pushback on the stereotype that women are more risk-averse than men, the evidence still strongly supports the stereotype. However, as the research on the topic develops, the more it appears that the stereotype is losing its dominant support among the scientific community. Additionally, research on the topic that women are more risk-averse than men appears to be strongly context-dependent.

4.5 Nature vs Nurture

Currently, research has not been able to provide a definitive answer to whether gender differences in risk attitudes are primarily a result of biological factors (nature) or social and environmental influences (nurture).

Studies investigating hormonal influences have yielded mixed results. While some research has indicated that testosterone levels are correlated with increased risk-taking behavior, other studies have not found a strong association. However, the quality of the testosterone and gender gap in risk aversion research has been criticized for their design as they have been unable to demonstrate causation, and also for failing to account for the effects of social status (Fisk, Miller & Overton 2017).

Studies investigating the influence of culture and socialization have highlighted the importance of societal expectations and gender roles. Social phenomena appear to influence gender differences in risk-taking behavior through the effect of gendered expectations. Generally speaking, women are expected to be communal, as in kind and nurturing, and men are expected to be agentic, as in assertive, independent, confident, and dominant. (Anderson, 2010).

The nurture side argues that, for example, boys are encouraged to take risks and compete hard in sports, while girls are often encouraged to remain cautious and calm. This can cause differences in behavior between men and women, which could be falsely attributed to biological differences. Another claim by the nurture side is that gender differences are caused by the prevailing societal structure. They argue that the differences are determined by both the roles men and women have in society, and by the economic function men and women categorize into.

Studies related to societal structure were introduced in chapter 4.2.3 with somewhat mixed results but the role of nature was still present in all the studies introduced. However, those studies were related to societal structure and what happens if it is changed to the opposite. There is also the role of gender equality which can significantly relate to the nature versus nurture argument. Cárdenas et al. in their 2010 study examined the gender gap in preferences for competition and risk among children aged 9 to 12 in Colombia and Sweden. These two countries were chosen due to their near opposite levels of gender equality. The study setup allowed for an investigation of systematic differences in the gender gap between Colombia and Sweden. Gender differences in competitiveness were examined using four tasks: running, skipping rope, math, and word search. These tasks were selected to account for potential gender stereotyping effects, allowing for an examination of whether certain tasks were perceived as more suitable for either girls or boys. Competitiveness was assessed by analyzing the performance change between an individual setting and a forced competition in all four tasks. Additionally, the choice of whether to compete or not in math and word search tasks was included. The study also explored the gender gap in risk preferences by giving the children incentivized gambling choices. This gave insights into how risk preferences varied between genders among children in Colombia and Sweden. It was observed that boys and girls demonstrated equal levels of competitiveness across all tasks and measurements in Colombia. However, the outcomes were less consistent in Sweden, where there were some mixed results. Some indications suggested that girls displayed higher competitiveness than boys in specific tasks related to performance changes, while boys showed on average a greater inclination towards participating in competitions. Boys showed a higher preference towards risk-taking than girls in both countries, but with a narrower gender gap observed in Sweden (Cárdenas et al. 2010). These findings further suggest that nature

has a significant role in shaping the gender gap in risk attitude, but due the gender gap being smaller in the more gender equal Sweden, the findings also weakly support the notion that nurture has a significant effect on the gender gap.

5. DISCUSSION/CONCLUSION

This Master thesis contributes to the growing literature on several open questions regarding the gender gap in risk aversion between genders. The first research question of this paper seeks to verify the existence of the gender gap in risk aversion. The majority of the examined literature agrees that women are more risk-averse than men on average.

The secondary research question was to find out what are some of the determinants of the gender gap in risk aversion. Results of the analysis indicate that the gender gap does appear to be context-dependent, and it seems that there are multiple factors, both biological and sociocultural, that explain in some part the gender gap. However, considering that it is possible to significantly reduce the gender wage gap by manipulating variables such as social status (Booth & Nolen, 2012) or social equality (Olofsson & Rashid, 2011), it appears that the biological component of the gender gap could be smaller than previously hypothesized.

Examined studies mostly came to the conclusion that risk attitudes are generally task-specific and context-dependent (Crosetto and Filippin, 2017; Ronay and Kim, 2006; Booth and Nolen in 2009; Lee et al. 2014; Lindquist & Sävje-Söderbergh 2011) however, the results from a large-scale survey and field experiment study conducted by Dohmen et al (2011) suggested otherwise. According to Dohmen et al. risk attitudes are shown to be relatively stable across different contexts, shedding light on a deeper question about the stability of willingness to take risks as a personal trait. However, the research methods they used to conduct the survey and experiment can be criticized as the traditional lottery-type elicitation method has been observed to produce at times unreliable results (Crosetto and Filippin, 2016). Dohmen et al (2011) complemented the method with a self-assessment survey, which in theory improved the accuracy of the results. Still, to make claims about willingness to take risks as a personal trait is not credible at this point.

The introduction of a safe alternative appears to induce women to behave in a less risk-tolerant manner relative to men (Crosetto and Filippin, 2017). It appears that both loss aversion and certainty effects significantly affect the gender gap (Crosetto and

Filippin, 2017). However, more research is needed to further examine the different determinants in a situation when a safe option is present.

Gender differences in preferences for risk-taking are sensitive to the gender mix of the experimental group. For males, engaging in risky behaviors seems to increase within group contexts (Ronay and Kim, 2006). This phenomenon has been examined using the social identity theory, where groups of males seek to subscribe to a perceived gender-role norm. For women, single-sex environments appear to have a major impact on risk attitudes as well, as girls are more likely to choose risky outcomes when assigned to all-girl groups (Booth & Nolan 2008) (Lindquist & Säve-Söderbergh, 2011). These findings could be used as an argument regarding the benefits of having gender balance in decision-making bodies, as having a gender balance could mitigate some of the in-group effects.

The societal structure appears to affect the size of the gender gap in risk attitudes and possibly reverses it as well. The research offers mixed results at the moment of writing. Men can be found to be less risk-averse in both matrilineal and patriarchal societies. However, the gender gap appears to be significantly smaller in matrilineal societies (Gong and Yang, 2011). On the other hand, the matrilineal societal structure resulted in women choosing the competitive environment more often than men (Gneezy, Leonard & List 2008). Therefore, nurture does seem to have a significant impact on the gender gap, but even the case of a significantly matrilineal society does not appear to reverse the direction of the gap, but some competitive behaviors can also be reversed.

Framing and individual characteristics appear to have a significant effect on the gender gap. When research respondents are categorized into “managerial” and “non-managerial”, meaning the job position of the person, the ‘managerial’ sub-population males and females display similar risk propensity and make decisions of equal quality (Johnson & Powell 1994). Additionally, familiarity with the decision problem causes women especially to act in a more risk-loving way (Levin et al., 1988).

Risk attitudes can have a significant impact on an individual's important life decisions. One of these decisions where risk attitudes can have a large effect is career choice. Lower willingness to take risks among females may explain some part of the gender difference how men and women choose their fields of study and work. Sapienza et al. (2009) concluded "Testosterone has both organizational and activation effects on financial risk aversion in men and women and that these effects influence important career choices." However, more recent literature has challenged the claim. (Fisk, Miller & Overton 2016)

Developing our understanding of the determinants of the gender gap in risk attitudes can have important implications for policy development, especially regarding early childhood education. Risk attitude starts to develop early in children and the parents and other childhood educators play a crucial role in it. Intergenerational social mobility is a topic in which the research of the gender gap in risk attitudes can be one of the key components in understanding it and it can help us provide more effective guidance to childhood educators on how to protect and bring out advantageous characteristics in children supporting their well-being as they get older. Once we develop our understanding of the different determinants and their significance, we can create better models for policy development.

The nature versus nurture debate appears to be leaning more towards the nurture side as time goes on, and research on the topic develops through iterations. Testosterone's link to risk-taking appears to be somewhat strong still but taking into account how social status mediates economic risk-taking and testosterone (Fisk, Miller & Overton 2016) the nature argument starts to break down. Booth and Nolen (2009) discussed this topic making the case that if risk attitudes are inherent, the underrepresentation of women in specific domains might only be made better by altering the compensation structure. However, if risk attitudes are predominantly molded by the environment, adjusting the educational or training environment could aid in addressing this underrepresentation (Booth and Nolen 2009). Therefore they argued that the recommended policy approach to address the underrepresentation of women in high-paying positions will depend on whether the cause of the absence is inherent to gender or not.

The persistent label that women are more risk-averse than men can harm women's ability to succeed in their careers. From the side of the individual, it can cause women to not go for competitive positions with risky outcomes, and it can cause women to not have self-belief overall. From the organizational side, it can cause decision-makers at companies to overlook women for certain positions thinking that they lack the capabilities to make at times necessary high-risk high-reward decisions. The sooner the outdated label that women are more risk-averse is removed the better it is for society.

There are many limitations that affect this research. Firstly, the lack of comparability across studies is significantly limiting. Many of the examined papers operate in many different fields, use many different methods, and investigate risk attitudes in different ways. Risk attitudes is a generalized term and a construct, as such it makes comparing studies often challenging for researchers. Secondly, the methods used to measure risk attitudes, for example, different game experiments and surveys, do not necessarily translate into real-world risk-taking behavior of individuals.

There is much that remains to be discovered in the risk aversion gender gap topic. There has been limited research exploring whether the gender gap in risk tolerance stems from gender itself or from other factors that influence the relationship between risk tolerance and gender. In this regard, the most important factor yet to be untangled from the gender gap study is social status. Another possible topic could be to study how the biological and sociocultural factors are intertwined and how they affect the size of the gender gap in risk attitude. There is much to be learned about how, for example, social status, hormones, and cultural effects combine and affect the gender gap in risk attitudes. Lastly, a topic of interest could be to investigate how differences in risk aversion between genders explain the gender wage gap. In general terms risk is associated with higher returns, therefore, the gender gap in risk aversion could have interesting connections to the gender wage gap.

To conclude, women appear to be more risk-averse than men on average, although the difference is highly context-dependent. Gender difference in risk attitudes is multifaceted and the determinants that significantly affect the size of the gender gap can be both biological and sociocultural. However, recent research suggests that the

biological determinants are not as significant as previously believed. Examined determinants include, but are not limited to, the presence of a safe alternative, the presence of a gender-homogenous group, salivary testosterone levels, the societal structure regarding prevailing gender roles, the role of the women in the work environment, and the framing of the decision tasks used in the study.

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