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Risk aversion and fertility.
Evidence from a lottery question in Italy

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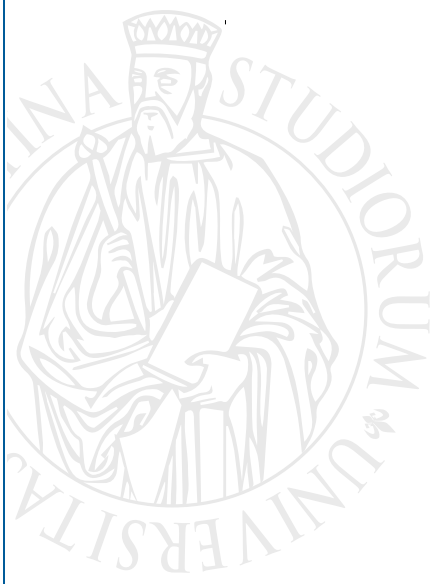

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Evidence from a lottery question in Italy

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Abstract

This article aims at contributing to the literature on fertility decision making process. The authors analyze an overlooked but potentially crucial factor, the preference for risk. A typology of fertility decision making process based on risk tolerance and attractiveness of parenthood is proposed. Empirically, the authors rely on a lottery question included in Italian longitudinal representative data. Results indicate that the most risk averse individuals have the highest probability to have a(n additional) child. This is consistent with the Hedger ideal type that considers children as an insurance. The most risk tolerant individuals, instead, in line with the Individualist type, seem to perceive fertility as incompatible with alternative risky and rewarding behaviors. This conflict results particularly strong for low-income individuals. Our findings point to the importance of considering risk tolerance in fertility research to gain a more complete understanding of heterogeneity in fertility behaviors.

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1. Introduction

The standard rational choice theory assumes that factors that drive *homo oeconomicus*' childbearing decision-making are grounded in the rational consideration regarding the pros and cons of having children (Becker 1981a; Coleman 1990; Lesthaeghe and Surkyn 1988). Under this framework, individuals are aware of the trade-off between the benefits of having children and the associated (direct and indirect) costs (Bourguignon 1999; Coleman 1990).

The adoption of a standard rational choice approach allows identifying the socio-economic groups that are more (or less) likely to have children (e.g., Hoem 1993), but fails to explain why only some individuals within these groups become parents while others do not. The missing elements here are represented by individual latent traits or preferences, i.e. 'individual profiles' that guide individuals' assessments about (im)material costs and rewards of certain choices (Hoffman and Hoffman 1973; Williams and Baláž 2012). When information about costs of some choices are unconvincing and incomplete, individuals further act on the bases of personal inclinations. In this sense, individual traits may influence life-course decisions through the formation of beliefs about likely outcomes (Yabiku, Axxin, and Thornton 1999; Williams and Baláž 2012).

In this paper, we argue that among the (latent) preferences that are likely to explain heterogeneity in fertility choices over and beyond standard socio-economic characteristics, risk preferences may play an important role. The reason behind this intuition is that individuals may feel threatened or, on the contrary, encouraged in their fertility choices by the stochastic dimension that characterizes childbearing consequences. Theories of fertility decision-making have since long time explicitly incorporated the notion that fertility decisions are subject to uncertainty (Cain 1981, 1982, 1983; Datta and Nugent 1984; Johnson-Hanks 2004, 2007; Trinitapoli and Yeatman 2011, 2018). Uncertainty can be experienced by some individuals as anxiety and by others as excitement (Greco and Roger 2001), depending on the individual level of risk preference. Indeed, risk-taking propensity significantly affects the expected utility of decisions characterized by uncertain outcomes, regardless of individual's socio-economic background (e.g., Breen and Goldthorpe 1997; Roth and Kroll 2007; Holm and Jaeger 2008; Schmidt 2008).

Following this argument, we aim at explaining differences in fertility choices that stem from the individual source of variation related to preferences about the extent one is willing to accept risk – the so-called *risk tolerance* (the reciprocal of risk aversion). We argue that for any given level of risk tolerance, individuals elaborate specific calculations of (non-)monetary costs and rewards of having children. In other words, we consider that reproductive choices depend (also) on the level of subjective inclination to risk-taking. The incorporation of risk tolerance as a specific individual preference in fertility decision making process can enhance the understanding of the determinants of childbearing choices. This can contribute explaining (a part of) the heterogeneity in fertility patterns not accounted for by socio-economic factors and other known determinants of fertility behavior.

To the best of our knowledge, the relationship between risk tolerance and human reproduction has been largely ignored - the only exception being Schmidt (2008). Schmidt (2008) examined whether risk tolerance of women influences fertility timing in the US using a question (included in the PSID data) on a hypothetical gamble aimed at obtaining a direct measure of risk aversion. The author found that the willingness to take risks influences the timing of first birth. Even if this finding is relevant, it does not consider crucial aspects of fertility behavior, such as parity transitions and socio-economic heterogeneity in fertility outcomes. Inspired by this isolated work, our contribution aims to provide a framework to better understand the link between risk tolerance and fertility outcomes.

Our study makes different contributions to Family Sociology. Family sociologists (and social demographers) have examined several individual and contextual factors influencing fertility, including socio-economic status, social networks, values and attitudes, norms, social policies as well as macro-level socio-economic conditions (e.g., Aksoy and Billari 2018; Brinton and Oh 2019; Esping-Andersen and Billari 2015; Nitsche et al 2018; Bellani 2020; see Balbo, Billari, and Mills 2013 for a review). Going beyond classical theories of fertility (e.g., Ajzen 1991), we incorporate risk tolerance as a crucial factor embedded in the fertility decision-making process. Given the lack of theorization about the consequences of individual preferences on socio-demographic choices (as also reported by Perrow 1997), in this article we provide a new conceptual framework that reveals connections between risk tolerance (as a latent preference), attractiveness of parenthood, and fertility behavior. The originality of our contribution lies also in the implementation of a hermeneutical instrument, the ideal types, as

benchmark of our theoretical considerations. Additionally, our study enriches previous literature in Family Sociology by empirically testing whether risk tolerance favors or hinders parity transitions, and whether the effect of risk tolerance varies by income levels.

Our empirical analyses are based on a dataset of unusual quality to connect objective risk preferences to fertility outcomes (first and second parity transitions). More specifically, we analyze fertility realizations between the mid-1990s and the mid-2010s in Italy using data from the Survey of Household Income and Wealth (SHIW) conducted by the Bank of Italy. The collected measure of risk tolerance, which is often used in incentivized-choice experiments in social sciences (e.g., Falk and Hermle 2018), is based on respondents' answers to a hypothetical lottery to elicit their risk tolerance/aversion. Our results indicate that individuals who are less tolerant to risk are more likely to have a first and a second child during the observation period compared to their more risk-tolerant counterparts. This result holds controlling for socio-economic and other standard determinants of fertility. Additionally, we find that the effect of risk tolerance is stronger for individuals in lower-income households. We implemented a number of robustness checks to deal with issues such as missing data and measurement error and found our results to be stable. Our findings point to the importance of considering risk tolerance to gain a more complete understanding of fertility behavior.

2. Risk tolerance and the decision-making process

Risk aversion/tolerance has been conceptualized as "a descriptive label of the degree to which an individual appears to avoid or seek out risky options or behaviors" (Weber, Blais, and Betz 2002:267). More formally, the level of risk aversion determines the preference for a bargain with a certain payoff over a bargain with uncertain but possibly higher payoff (Arrow 1971).[1] As the psychological risk preference theory and the sensation-seeking literature suggest (e.g., Tversky and Kahneman 1974), the level of risk tolerance represents a specific marker of the subjective perceived costs and returns from a given action, that also includes the excitement generated by its randomness (Miller and Hoffmann 1995; Zuckerman 1994). In this sense, individuals choose according to personal assessments on the way to assign a value to

[1] We are aware that risk aversion is here defined in the domain of gains and not in the domain of losses (Kahneman and Tversky 1979).

perceived material and immaterial rewards (e.g. Wennekers 2006). Hence, they maximize expected utility given also their risk preference (Boudon 2009; Goode 1997).

There is a broad agreement that risk tolerance is a trait that is formed early in life (Andersen et al. 2008; Baucells and Villasís 2010; Chiappori and Paiella 2011). Scholars have observed that, during adulthood, risk tolerance is largely a time invariant trait rather than a time varying or situational preference. For example, Guiso, Sapienza and Zingales (2018), using the same data we employ, found that risk tolerance does not vary with age. Haliassos and Bertaut (1995) obtained the same findings using US data. Similar results were obtained in other studies (Sahm 2007; Brunnermeier and Nagel 2008; Bucciol and Miniaci 2014; Callen et al. 2014).

A brunch of the literature has treated risk and uncertainty as dissimilar concepts. For instance, in economics, uncertainty has been defined as a lack of any quantifiable knowledge about the likelihood of some outcomes of a decision, as opposed to risk, characterized by a known probability distribution of the consequences of a decision (Knight 1921). While the distinction is clear in some settings (e.g., investments in financial markets) it is more blurred in decision making in other life domains (Guseva and Rona-Tas 2001). Recent work in sociology questions the notion of a tight distinction between uncertainty and risk (Trinitapoli and Yeatman 2011).[2] As noticed by De Groot and Thurik (2018: 5): "Looking even closer at how decision-making in real life is accomplished, it appears that the distinction between uncertainty and risk is continuous rather than binary."

Although life choices are often taken with a lack of knowledge about the probability of occurrence of their positive and negative consequences, individuals may have some knowledge from past experiences and from observing other individuals' behaviors to estimate the involved probabilities. Accordingly, subjective expected utility theory rejects the association between uncertainty and the absence of measurable probabilities (Dequech 2011). In the case of fertility decisions, one may argue that the probability of occurrence of its consequences (e.g., sleep deprivation, reduced time for work, increased happiness, etc.) can be subjectively estimated by individuals from peers' experiences (McMahan and Evans

[2] Also, Frye and Gheinhman (2018: 600) claim that "Although definitions of risk vary across disciplines, most involve individuals attempting to make connections between current behaviour and future consequences under conditions of uncertainty." Many refinements of the distinction between risk and uncertainty have been proposed (e.g., the review by Dequech 2011).

2018), which have been found to strongly influence one's fertility decisions (Balbo and Barban 2014).

Adopting implicitly or explicitly the view that many life choices are taken under uncertainty and that individuals subjectively form expectations about probability of occurrence of uncertain outcomes, the role of risk tolerance/aversion has been examined with respect to different life domains. Numerous scholars have found that risk tolerant people are more likely to incur in risky behaviors related to health, such as smoking and drinking alcohol, or to finance, such as holding stocks in their portfolio (e.g., Barsky et al. 1997; Gottfredson and Hirschi 1990; Dohmen et al. 2011; Kapteyn and Teppa 2011). A recent literature has shown that risk preferences are associated with other individual choices. Focusing on labor market, a number of studies have demonstrated the relevance of risk tolerance for being self-employed, which is generally considered a riskier occupational option than being an employee (Thornton 1999; Cramer et al. 2002; Ekelund et al. 2005).[3] Guiso and Paiella (2008) shown that risk tolerant individuals are less likely to have a job in the public sector and are more likely to change job. Studies based on traditional search model shown that more risk-averse individuals are less likely to be unemployed, because they have lower reservation wages compared to their risk tolerant counterpart (Diaz-Serrano and O'Neill 2004). Recently, Foster, Rzhetsky and Evans (2015) found that risk-taking scientists are those that adopt radical (and risky) strategies, thus stimulating innovation.

Risk tolerance has been shown to be also a predictor of educational attainment (e.g., Breen and Goldthorpe 1997). It is widely recognized that investments in human capital are positively associated with risk tolerance given that educational investments are subject to a substantial uncertainty (Becker 1964), for example in terms of performance. In this regard, Shaw (1996) and Brunello (2002) have empirically demonstrated that educational attainment is directly proportional to the degree of risk tolerance. Similarly, Brodaty, Gary-Bobo and Prieto (2014) have found that risk tolerance increases the likelihood of college enrolment (for the Italian case, see Checchi, Fiorio, and Leonardi 2014). Other scholars have identified a positive relationship between risk tolerance and income (e.g. Hartog, Ferrer-i-Carbonell, and Jonker 2002). It has also been shown that less risk tolerant individuals earn lower but less

[3] Caliendo, Fossen and Kritikos (2014), however, found a U-shape relationship between risk tolerance and survival in self-employment status.

variable wages (Guiso and Paiella 2008) because they self-select into less risky occupations and into less variable income jobs (Diaz-Serrano 2005; Brown et al. 2006; Fernandez-Mateo 2009). Finally, risk preferences also influence religiosity (Miller and Stark 2002; Roth and Kroll 2007) and migration (Paul 2011).

Although many studies have assessed the relevance of risk preferences for a wide range of health and socio-economic outcomes, the role of this trait in demographic choices has been largely overlooked.

Risk tolerance and fertility decision making process

In developed countries, a number of important fertility theories have argued that fertility decisions are based on predicted (economic and non-economic) rewards/costs of having a child and on expected sacrifice of other individual goals (Hoffman and Hoffman 1973; Kravdal 2014). Following the exchange theory framework (e.g., Nye 1979) one could assume that fertility is the outcome of decisions that are based on a comparison of alternatives. In this sense, the weighs assigned to the rewards/costs and to the sacrifices associated with childbearing are differently estimated by individuals (e.g., Duncan 1972). The decision to have a child is, in fact, influenced by the individual's processing of information guiding the formation of expectations around the outcomes of childbearing (Vignoli et al. 2020). Apart from the heterogeneity in individual computational and cognitive ability (Dosi and Egidi 1991), individuals may be more or less aware of the economic cycle (e.g., Agadjanian 2005) that influences the economic costs of raising a child (Becker 1981b). Additionally, people may weight differently the potential impact of childbearing on various social spheres, such as leisure time, working career, quality of relationship with the partner (e.g., Friedman, Hechter, and Kanazawa 1994). Parents-to-be probably expect a partial increase in their subjective wellbeing from having kids, but its predicted amount may be heterogeneous between individuals (Kravdal 2014; Balbo and Arpino 2018). In this study we state that risk preferences represent a relevant determinant of the heterogeneity in these expectations that, in turn, influences reproductive choices.

We propose a new conceptual framework that establishes connections between risk tolerance, subjective cost/benefits expectations of childbearing (that we label as "attractiveness of parenthood"), and fertility behaviors. We argue that individuals with different degree of

tolerance to risk will differ in their beliefs and expectations about fertility outcomes. This, in turn, should guide reproductive choices.

As well explained by the risk tolerance framework (Fox and Tversky 1995), risk tolerance can either increase or decrease the utility that an individual ascribes to certain choices, among which we may include childbearing. Thus, individual risk preferences together with different levels of attractiveness of childbearing are likely to yield to different fertility behaviors.

3. Theoretical considerations: a typology of childbearing decision-making processes under risk preference constraints

Inspired by the concept of Weberian ideal types, we construct a typology of fertility decision-making processes. In doing that, we explore contrasting approaches about the relationship between individuals' risk-preferences, attractiveness of childbearing and fertility behavior. This serves as a heuristic resource to represent ideal types that deliberately emphasize certain aspects of fertility decision making process, rather than something that is clearly found in empirical reality (Weber 1949). In particular, we synthesize multidisciplinary literature on two interconnected drivers of childbearing decisions, a) "risk preferences"; b) "attractiveness of parenthood". The first condition concerns different preferences for risk. The second relates to the individuals' level of attraction for parenthood in terms of perceived rewards and costs/sacrifices. There is an underlying assumption here. People are able to form a general idea about whether or not having a(n additional) child on the whole is valuable for them, but an assessment about the uncertain positive and negative consequences to expect from this decision is difficult to form. Risk tolerance is then supposed to enter heavily into fertility decision-making.

Combining the two drivers of fertility decisions a) and b), we identify a four-fold typology of ideal fertility decision-makers (Figure 1). Figure 1 is intended as an analytical tool for exploring basic assumptions of the most relevant theories in fertility research. We label the resulting ideal-types as 'the Hedger' (characterized by low risk tolerance and high attractiveness of parenthood), 'the Exit Strategist' (characterized by low risk tolerance and low attractiveness of parenthood), the 'Optimist' (characterized by high risk tolerance and high attractiveness of parenthood), and the 'Individualist' (characterized by high risk tolerance and low attractiveness of parenthood). In reality, of course, the boundaries between

these ideal types are blurred. We also do not aim at accounting for all factors that may determine the attractiveness of parenthood and focus on the role of risk tolerance in fertility decision making.

< Figure 1 about here >

The Hedger

The "Hedger", that belongs to the group of risk averse individuals, identifies childbearing as a valuable life-course outcome. Accordingly, children represent valuable goods for parents because they structure parents' future by closing off alternative pathways (Friedman, Hechter and Kanazawa 1994) and reduce their old-age insecurity (Myers 1993).

The Value of Children (VoC) theory addressed the value (or utility) of children (Friedman, Hechter, and Kanazawa 1994). According to VoC theory, childbearing is seen as an immanent good that increases both the individual's and couple's utility. The family, as other forms of association, may provide members with mutual insurance (Appelbaum and Katz 1991). People may invest in the family as a way of being protected from negative events (health, income, etc.) and as a source of help and wellbeing. Having children may then be a strategy for increasing the insurance benefits provided by the family club. Moreover, childbearing may also serve as a manner of "consolidating" the family (parenthood may increase the level of social integration into the community, Bühler 2008; Knoester and Eggebeen 2006; Nomaguchi and Milkie 2003) and reinforcing marital solidarity. In fact, such a long-term obligation, by bringing predictability and order to the parental life course, generates a higher marital capital (in the form of marital solidarity) that should decrease the likelihood of couple instability (Friedman, Hechter, and Kanazawa 1994). Previous studies have found that poor (perceived) partnership quality may increase fertility in order to reduce life uncertainty and to decrease the risk of union dissolution (Becker 1977; Friedman, Hechter, and Kanazawa 1994; Myers 1993; Wu 1996; Rijken and Liefbroer 2009). Therefore, children may be viewed as an immanent valuable investment.

Following this reasoning, it would be especially in the case of risk averse individuals that raising a child offers such an immanent value. Indeed, it potentially changes life from uncertain to relatively certain (Burton and Tucker 2009; Edin and Kefalas 2005). Risk averse

individuals are more needed to establish predictability to daily life. Children could preserve parents' well-being through the provision of a sort of continuity in their narrative.

Another strand of the literature also leads to the idea that children increase utility under risk, the children as an 'old age security' perspective. According to this theoretical framework, the value of offspring is originated by the belief that children, in the long-run, will give back (monetary or in-kind) transfers to parents getting older. Children are expected to improve parental wellbeing because they will contribute to the household production, and will guarantee help in case of parents' needs in later life (Burton and Tucker 2009). Thus, 'old age security' may represent a core-motivation for childbearing especially for risk averse parents, who might be likely to consider children, compared to other actors, as a more reliable source of emotional and economic support during the old age. Along these lines, investing in children may be motivated also by the anticipation of help (money, care, emotional support, etc.) that offspring may provide when parents will be old (Brandt, Haberkern, and Szydlik 2009; Wenger et al. 2007). Children as an old-age security is an argument used mostly for developing countries. However, there is large evidence for its validity also in developed countries, including Italy (Billari and Galasso 2009; Cigno and Rosati 1992; Galasso, Gatti, and Profeta 2009; Rendall and Bahchieva 1998), where informal care is an important part of the care received by older individuals (Dykstra and Fokkema 2011). If children are seen as an old-age security, benefits of childbearing may be expected to be higher than costs and risk averse individuals may want to "buy" this security by having children in order to reduce risks.

In finance, hedging is the practice of taking an action (i.e., investment) to counterbalance the risk assumed due to other actions (i.e., a previous investment). As explained by Stolzenberg and Margolis (2003: 861), "In the absence of concrete knowledge about the future, insurance provides a defense against disruptively large losses and, more generally, a hedge against variance in the distribution of losses." Inspired by these considerations, we name our first ideal type the 'Hedger'. The 'Hedger' considers children as a hedging strategy employed to manage life course risks, because children create structure in one's life and/or because they represent an old-age security.

The Exit Strategist

There is a long tradition in fertility research emphasizing the great uncertainty underlying the decision to have a child (e.g., Cain 1983; Johnson-Hanks 2004, 2007; Trinitapoli and Yeatman 2011, 2018). Given the possibility of *ex-post* negative shocks associated to children (i.e., in terms of wellbeing loss), theorists of "children as a risky investment" emphasize that childbearing represents an investment with uncertain "returns". Cain (1983: 695), for instance, stated that "children are neither costless nor risk-free investments. They may die or become disabled; and they may refuse to honor their obligations to parents."

In the same line of reasoning, the so-called Intergenerational Wealth Flows theory (Caldwell 1982) supports the thesis according to which children are "unproductive goods". This perspective posits that in modern societies, contrary to traditional ones, the wealth flows transfers go from parents to children, and not vice versa. Accordingly, the parental investment in economic and temporal resources for their offspring (e.g., for their education) is not expected to be recompensed via reciprocal altruism (Coleman 1990).

Given a negative calculus stemming from expected costs and rewards, the Exit Strategist, being risk averse, is likely to decline childbearing as an investment implying a 'potential loss' (Yates and Stone 1992). Transfers to children are seen as non-reciprocal either because benefits might not be received in the future or because the expected gratification might be substantially smaller than the efforts put in parenting. Children are considered at risk to produce economic or psychological distress, such as a negative influence on couple relation (Twenge, Campbell and Foster 2003) or short-term sleep problems (Dørheim et al. 2009). Parents could conceive that having children will reduce time for own leisure activities, and will generate instead worries about the children's well-being (Bittman and Wajcman 2000).

Furthermore, 'Exit Strategists', being risk averse, may suppose that childbearing does require a secure economic foundation. They may be aware, however, that childbirth could produce economic losses (Aassve, Iacovou, and Mencarini 2006) – such as lower income, also possibly due to reduced working hours, higher consumption expenditures, and limited work opportunities (e.g., Boushey 2008; Dommermuth, and Kitterød 2009; Lu, Wang and Han 2017). Thus, given that returns are considered to be highly unsure, the 'Exit Strategist'

identifies children as a risky investment. Thus, because of their higher level of risk aversion, they are likely to deter from investing in childbearing (Adler 1997; De la Rica and Iza 2005).

The Optimist

The third ideal type of childbearing strategist, the 'Optimist', is represented by those individuals that hold a positive preference for risk-taking and are more predisposed to seek novelty and excitement (Weber, Blais and Betz 2002: 28). Extending to fertility behavior the concept of edgework, that emphasizes the positive value of risk (Lyng 2008), we identify the 'Optimist' as those who expect to obtain satisfaction from the risks associated to fertility. In this sense, having children not only provides the emotion of novelty, adventure and challenges that the new born will give. It also potentially increases self-esteem for the ability of managing the associated risks of childrearing. Under these conditions, the benefits of having a(n additional) child is expected to outweigh the costs given that the child is expected to increase individual pleasure (Copping, Campbell, and Muncer 2013).

One of the reasons why the 'Optimists' are likely to have children is because becoming a parent offers them a selective benefit, that is excitement for new challenges. In this sense, risk tolerance is here declined as a latent trait that predispose individuals in seeking intense sensations and experiences and the willingness to take also risks for the sake of such experience (Zuckerman 2007).[4] 'Optimists' are thus likely to have high fertility because they derive emotional pleasure from seeing a child growing up and feeling needed (Eibach and Mock 2011; Nelson, Kushlev, and Lyubomirsky 2014; White and Dolan 2009), thus considering children as "investments" with high expected gains.

The Individualist

Those individuals that are predisposed to risk tolerance and that perceive childbearing as an unfavorable option fall under the category that we label as the 'Individualists'. Risk tolerance is declined by the 'Individualists' as a trait that favors the maximization of one's own utility (and not the utility of larger groups as the household, the family of origin, the community) through sensations seeking.

[4] Goffman (1967: 185) conceptualized a risky behaviour as an "action […] that has problematic outcomes, and that is undertaken for its own sake."

The literature on risk tolerance provides empirical evidence that a generalized orientation towards risky behavior may exist for some individuals, i.e. these individuals may tend to engage in risky behaviors in different spheres of life. Risk lovers or risk tolerant individuals are overrepresented among at-risk groups such as gamblers and drug users, high-risk sports players and risky sexual performers (Zuckerman 2007), all behaviors that give pleasure and are subject to risks which are more easily calculable than those implied by childbearing.
Along these lines, it has been found that risk takers are more likely to unfollow normative behaviors and roles and to prefer unconventional ways of handling stressful situations (Ferguson and Valenti 1991). Moreover, one could expect that they have individualistic and self-oriented attitudes (Güth, Levati, and Ploner 2008). Thus, one of the reasons more risk tolerant individuals may renounce to childbearing (or limit the number of children) is because childbearing is incompatible, in a sense, with actions that increase their individual utility and self-realization. In this case, perceived costs offset any presumed benefits from childbearing.

In sum, the 'Individualists' are inclined to take risks in different spheres of life, obtaining utility from risk-taking diversification. Thus, they are likely to have a low fertility because investing in children may imply renouncing to alternative risky and rewarding behaviors and choices. In evaluating whether to have a child or not, the 'Individualist' anticipates that, if he/she become parent, he/she will be intensely involved in child care for a period of time (Poortman and van der Lippe 2009). Thus, the 'Individualist' may perceive this activity as competing with other more rewarded and risky activities, preferring to avoid or limit childbearing.

Expected association between risk tolerance and fertility

Given the typology in Figure 1 and the previous discussion, theoretically there is not a univocal sign in the association between risk tolerance and fertility. This relationship may be positive, negative or null depending on the relative proportion of the different types of decision makers in the population. For example, if the types on the main diagonal of Figure 1 (the 'Hedger' and the 'Individualist') prevail over the other two, a negative relationship will exist: the higher risk aversion (lower risk tolerance), the higher fertility. On the contrary, if the types on the secondary diagonal of Figure 1 (the exit strategist and the optimist) prevail over the other two, a positive relationship will exist. Finally, the types displayed on the two

diagonals may compensate producing an overall null relation between risk tolerance and fertility.

4. Economic heterogeneity

In this section we extend our theory of the relationship between risk tolerance and fertility by considering economic status as a moderating factor of the relationship between risk preferences and fertility (*economic heterogeneity*).

The idea of an moderation effect between risk tolerance and economic resources recalls the view of Merton (1957) according to which preference for risk is seen as transformative factor that contributes to the achievement of higher status. This theoretical perspective has been recently enriched by the Relative Risk Aversion framework proposed by Breen and Goldthorpe (1997) in the field of sociology of education. Their intuition is that the relationship between socio-economic background and investments in human capital varies by the level of risk tolerance. Individuals from disadvantaged socio-economic backgrounds will invest in education only in the case they (or their parents) are risk tolerant. Following this intuition, one may argue that risk aversion could play a role in shaping the socio-economic gradient of fertility. Take the case that risk aversion will increases the awareness that having a child boots uncertainty because of the perceived high variation of its (economic and non-) costs. Under these circumstances, one would expect that risk aversion would represent an anti-natalist determinant for low-income individuals.

We now explain more in depth this idea. Given the previously introduced typology of fertility decision-makers, the way the interaction between economic resources and risk tolerance works may vary for each ideal type.

Assuming the perspective of the ‘Hedger’, one can expect that the value of children will be even higher for households at higher risk of economic instability. According to the Value of Children theory, children are expected to bring predictability and order to parental lives. As thus, parenthood should be more common for families characterized by a higher level of economic uncertainty, such as low-income households. Also, the argument of Children as an Old Age Security may be more valid for couples with precarious and/or lower status jobs, that are more likely to have poorer pension prospects. Therefore, following the Hedger’s

perspective, one would expect that having children would be even more appealing as a hedging strategy for low-income households.

From the point of view of the 'Exit Strategist', childbearing should be perceived as an even more risky choice by low-income households. The negative balance between expected costs and rewards from childbearing should be relatively more salient for individuals with lower income, that are less able to cope with potential income losses or expenses associated to children. Therefore, 'Exit Strategists' in low-income households would be even less likely to have children.

According to the Optimist's perspective, risk tolerant individuals would be even more likely to have a high fertility if they have limited economic resources. In fact, for the 'Optimist' the excitement to experience childbearing may trigger an underestimation of the potential direct costs of childbearing. Given that costs of having a child matter more for lower income individuals, risk tolerant individuals may be even more likely to have children in case they have poor economic resources.

Finally, we consider the 'Individualist'. As we have argued above, the individualist ideal type is oriented to self-fulfillment also through the adoption of risky behaviors. However, individuals with lower economic resources who may adopt individualistic values may find more challenging to combine parenthood and risky choices in other fields. Therefore, one may expect the individualists will have a low fertility especially if they have a low income, given that children may subtract economic resources that they would invest in sources of contingent gratification.

In a nutshell, differently from the direction of the relationship between risk tolerance and fertility *per se*, which may be either positive or negative, the moderating role of income is theoretically consistent for all ideal types: the positive or negative effect of risk tolerance will be even stronger for low income individuals.

5. The Italian case

Our empirical analyses rely on data from Italy, a country that, despite being characterized by familistic orientations (Dalla Zuanna 2001), belongs to the group of the "lowest-low fertility"

countries (Kohler, Billari, and Ortega 2002). In Italy, in fact, in the last decades, the levels of fertility have been persistently close to one child per woman (i.e., in 1989 the TFR was 1.33 and in 2008 it was 1.45) (Eurostat Statistics Database).

Italy is an ideal country where to investigate the effect of risk aversion on fertility. On the one hand, the institutional and cultural context makes having children a risky choice given uncertain consequences on its costs and parents' life style. First of all, the costs of childcare for children under three are difficult to predict given that the offer of publicly provided or financed services in the period we study ('90s and the '00s) covered only a small proportion of children, between 7% and 25% - depending on the source of data considered (Knijn and Saraceno 2010). Thus, childcare is largely delegated to the family and especially to women - and, partly, to grandparents. Childbearing can represent a risky choice for the working career of women engaged in the labor market and for the household's income given that raising a child could create an unsolvable incompatibility between domestic work and paid work (Ongaro 2001; Matysiak and Vignoli 2013). Second, in Italy, children tend to leave the parental home very late (Dalla Zuanna 2001; Manacorda and Moretti 2006). This potentially creates a further perception of risk for long-term economic sustainability of the household. These (material and immaterial) cost estimates of forgone benefits suggest that the childbearing in Italy could represent a risky choice.

On the other hand, considering a number of ideational and structural characteristics of the Italian context, childbearing could be seen an insurance for parents. First, given the lack of a minimum income provision regulated at the national level, family represents the safest institution to bear the burden of income support in case of need of its members (Saraceno 2016). Indeed, according to the Italian law, adult children have financial responsibility towards a parent in need. Second, given the characteristics of the welfare state and of family ties, having children in Italy may be also related to parents' expectations about care that children would provide at older ages (Alesina and Giuliano 2007). Such expected benefits become even more relevant in a context where the pension system is continuously evolving. In fact, due to the continued increase of life expectancy (and the reduction of the labor force), the size of future pension benefits become increasingly uncertain and pension entitlements are expected to be largely reduced. As Billari and Galasso (2009) shown for Italy, less generous future pensions is associated with an increase in fertility, because kids are seen as a security

for old age. Considering other potential expected benefits of childbearing in Italy, one should consider that, in such a social milieu, the expected happiness from childbearing (also at high parities) is relatively high (Aassve, Barbuscia, and Mencarini 2014).

Given the multifaceted nature of childbearing in Italy, risk preferences of individuals are likely to play an important role in determining the fertility choices in this country, but it is not obvious in which direction risk preferences may operate.

6. Data and methods

We use data from the Survey of Household Income and Wealth (SHIW) carried out by the Bank of Italy every two years since mid-sixties. The sample used in the most recent waves comprises about 8,000 households (20,000 individuals)[5]. SHIW collects information on consumption, income, labor marker participation in addition to several other household characteristics for a representative sample of Italian households drawn in two stages from population registers. From the 1989 wave, a rotating panel component has been introduced. The share of panel households on the total has been around 45-50% of the total since 1993.

Risk tolerance measure (explanatory variable)

A question designed to elicit risk tolerance has been included in the 1995 and 2000 waves. The question posed to each head of household asks the maximum price he/she would be willing to pay to participate in a hypothetical lottery (similar to the survey question proposed by Kruse and Thompson 2003). Specifically, the question was asked as follows: "*We would now like to ask you a hypothetical question that we would like you to answer as if the situation was a real one. You are offered the opportunity of participating in a lottery permitting you, with the same probability, either to gain a net amount of Lit. 10 millions (corresponding to about 5164 Euros) or to lose all the capital invested. What is the most you are prepared to pay to participate in this lottery?*" To help the respondent understand the question, the interviewers showed an illustrative card and were ready to provide explanations. We converted the original values in Italian Liras (Lit.) in Euros using the official conversion rate (Lit. 1936.27 = € 1).

[5] For more details on the SHIW see: http://www.bancaditalia.it.

We use all observations from households that participated in at least one of the 1995 or 2000 waves of SHIW. In this way, our data includes observations covering the period 1989-2008. In year 2000 the question was asked to half of the sampled households, i.e. to around 4000 households heads. As a convention, the SHIW considers the household head as the main earner. Thus, the number of female household heads is low (about 15.1%) - in a robustness check (see Section 8) we restrict the sample to male headed households. We select couples (married or cohabiting) where the man is aged 18-55 and the woman 18-45.

The SHIW data and risk tolerance question we use in this paper have been previously employed, for instance, to study educational investments (Belzil and Leonardi 2013; Checchi, Fiorio, and Leonardi 2014). We follow previous studies in the operationalization of our risk tolerance measure. As in Belzil and Leonardi (2007) the declared value of the bet is our explanatory variable in the main analyses. In the following, we will occasionally use the term "bet" to refer more concisely to our risk tolerance measure. Alternative operationalizations give very similar results (see Section 8 - Robustness Checks).

Control variables

Most of the control variables are individual-level characteristics that can be measured on both partners in the couple. Thus, we control for woman's characteristics and some measures of difference between the partners. Controlling, alternatively, for woman's and men's characteristics gives very similar results. More specifically, we control for woman's age, woman's age squared, age difference between the partners , woman's education (low = ISCED 0, 1 and 2, reference, medium=ISCED 3 and 4, high=ISCED 5 and 6), education homogamy (partners have the same education = reference, woman's education is higher than man's, woman's education is lower than man's), woman's employment status (employee = reference, self-employed, not employed), man's employment status (employee = reference, self-employed, not employed), logarithm of total household income, gender of the respondent (man = reference), region of residence (North = reference, Centre, South or Islands), year dummies.

Analytical approach

We model the probability of transition to the first and second child. We use separate probit models for each parity transition. For example, in the case of the transition to the first child,

childless individuals are included in the analyses and followed until they have their first child or until the last wave of observation. In all models we estimate robust standard errors to account for repeated observations for the same individual. We did not consider higher order parities because of the extremely low number of transitions during the observation period.

We tried different specifications for the explanatory variable of interest, i.e. risk tolerance: linear, quadratic, logarithmic transformation, categorization into terciles. The quadratic specification has been selected because it produced the best model fit, but results did not vary substantially for the other specifications. As an exemplification of this robustness check, in Section 8 we provide results for the logarithmic transformation (other results are available upon request).

We estimate two types of models that differ for the control variables included. The first model (M1 in Table 1, Table 2 and Table 3) only adjusts for woman's age, woman's age squared, age differences between the partners, region of residence and year dummies. The second model (M2 in Table 1, Table 2 and Table 3) adds woman's education, education homogamy, woman's and man's employment status, logarithm of total household income. The group of variables entered only in model M2 is composed by potentially mediating variables, i.e. variables that may be themselves affected by risk tolerance (e.g., Brodaty, Gary-Bobo, and Prieto 2014; Checchi, Fiorio, and Leonardi 2014; Hartog, Ferrer-i-Carbonell, and Jonker 2002). We include these variables separately to assess the robustness of our estimates to the inclusion of potential mediators.

We also implement a moderation analysis to examine economic heterogeneity, as discussed in Section 4. Moderation effects of risk tolerance are tested by introducing interactions between risk tolerance and income.

7. Results

Descriptives

Table 1 reports descriptive statistics on all independent variables separately for the two subsamples used in the multivariate analyses, i.e. for the probability of first and second birth, respectively. At the bottom of the table we also report the number of observations, individuals and events. The samples for the analysis for the first and second child include 752 and 1167

individuals (1272 and 2542 observations), respectively. The number of events (births) observed was 428 and 499, respectively.

The first row of Table 1 indicates that the answers to the lottery question were characterized by a high variability. For the first child sample, the average declared bet value (our risk tolerance measure) was 978.8€ with a standard deviation of 1716.3€. Similarly, for the second child sample the declared bet value was on average equal to 799.2€ with a standard deviation of 1926.8€.

About 20% of the household heads with non-missing answers to the lottery question declared a bet equal to zero (data not shown in Table 1). Bets equal to zero in this type of questions indicate an extremely low level of risk aversion. However, these values could also be alternatively considered as non-valid responses indicating that the respondent is not able to provide an answer. In our baseline model we include respondents with bet = 0 but in a robustness check we excluded them obtaining very similar results (see Section 8 - Robustness Checks).

About 21% of household heads did not answer to the lottery question. Non-responses on this type of questions are quite common and as a robustness check (see section 8), following Belzil and Leonardi (2013), we dealt with possible selection due to non-ignorable non-response using metadata from the interviewers' questionnaire. Table 1 also reports descriptive statistics on all control variables listed above.

< Table 1 about here >

The effect of risk tolerance on first and second births

In Table 2 we present our baseline estimates of probit regression models for the first and second births separately. As explained in Section 6 (Subsection “Analytical approach”), we considered two models that differ for the number of control variables included. Estimates in Table 2 show that adding potentially endogenous control variables (e.g., education) did not alter the magnitude and statistical significance of the risk tolerance coefficients. Therefore, in the following, we will focus on interpreting estimates from the complete models (Table 2 M2). We also implemented formal mediation analyses that confirmed the substantively small

and often statistically insignificant differences between estimates from models M1 and M2 of Table 2 (results upon request).

Because of the nonlinear nature of the probit model and the quadratic specification for the tolerance measure, the estimates in Table 2 for the variable of interest (risk tolerance) are not easy to be interpreted directly. To ease interpretation of results, in Figure 2 we plot the predicted probability of first and second birth, separately, for different values of the declared bet (our risk tolerance measure). As noticed above, estimates of coefficients and statistical significance were unaffected by the addition of potentially endogenous variables. This was also the case for predicted probabilities. Therefore, in Figure 2 we only plot predicted probabilities using estimates from the complete models (Table 2 M2).

< Table 2 about here >

The first plot in Figure 2 shows that there is a negative relationship between risk tolerance and the probability to have the first child during the observation period: individuals who are more risk tolerant (willing to pay more to participate in the lottery, i.e. they declare a higher bet value) show the lowest probability of having the first child as compared to remaining childless. The trend in the decline in the predicted probability of first birth as risk tolerance increases is almost perfectly linear as also confirmed by the small and not significant coefficient of risk tolerance squared (Table 2 M1 and M2). The effect of risk tolerance is not only statistically significant but also substantive: the predicted probability of first birth ranges from about 35% for the least risk tolerant (most risk averse) individuals (bet = 0€) to about 22% for the most risk tolerant (least risk averse) individuals in the considered range (bet of about 5,000€). Thus, a key finding from these results is that risk tolerance (aversion) is negatively (positively) associated with the likelihood of having the first child.

Similar results are found also for the transition to the second child as demonstrated in the second plot in Figure 2. The main difference between the models for the first and second birth is that in the latter case the predicted probabilities are, of course, lower for all values of risk tolerance. However, the relationship between risk tolerance and the probability of a second birth (as compared to remaining with one child) is again substantive: the predicted probabilities range between 21% (bet = 0 €) to about 12% (bet of about 5,000€). We can also

notice that the squared term in the model for the second birth (Table 2 M1 and M2) is statistically significant, and this is reflected in a mildly quadratic relationship in the second plot in Figure 2.

< Figure 2 about here >

Income as a moderator of the effect of risk tolerance on fertility

We have estimated probit models including an interaction between risk tolerance (and its square) with the logarithm of the total household income. Results are presented graphically in Figure 3 for the first and second births, separately. Figure 3 shows the predicted probability of having the first child (first plot) or second child (second plot) at different values of risk tolerance (x-axis) and at two different percentiles of (log) income (10^{th} and 90^{th} percentiles), that we label as "low" and "high" income. This produces two curves, representing how the relationship between risk tolerance and fertility varies for the two income levels considered.

The first plot in Figure 3 shows evidence of a moderation effect of income. The relationship between risk tolerance and the probability to have the first child is negative for both "low" and "high" income levels. However, consistent with our theoretical expectations the effect of risk tolerance is much stronger for low income levels. The moderation effect of income is also confirmed by the statistically significant interaction between income and risk tolerance as shown in the first column of Table 3.

Instead, the relationship between risk tolerance and the probability to have the second child is not moderated by income. The interactions between income and the risk tolerance variables are not significant for the second child model (second column in Table 3). This is evident in the second plot of Figure 3 where we can clearly see that the predicted probability of having the second child vary with risk tolerance almost in the same exact way for low- and high-income levels.

< Figure 3 about here >

8. Robustness checks

In this section we summarize several robustness checks that show the robustness of the baseline models presented in Figures 2 and 3. First, we considered alternative operationalizations and specifications for the risk tolerance measure. Second, we excluded respondents that declared a null value for the bet. Third, we used instrumental variables to adjust for possible bias due to missing answers to the lottery question. Fourth, we excluded female respondents. Fifth, we considered only observations for which risk tolerance was measured before the fertility events. Sixth, we added additional control variables. Finally, we used again an instrumental variable approach to adjust for measurement error in the risk tolerance measure.

On the whole, the robustness checks demonstrate that results were highly robust. Not only the statistical significance and sign were not altered, but also the magnitude of the effects was stable (as shown by the predicted probabilities). Thus, we do not comment in detail the result of each robustness check but we only notice the main deviations from the baseline estimates. All results are reported in tables and figures included in the Appendix A.

Alternative operationalizations of the risk tolerance measure

As a first robustness check we consider an alternative operationalization of risk tolerance. The answers to the lottery question (bet) can be used to derive an implied absolute measure of individual risk tolerance (aversion) within the utility maximization framework. One of the most common indicator of absolute risk aversion is the Arrow–Pratt measure which evaluates what is the "compensation" required for a risk averse agent to accept a gamble and it is defined as: $A(w) = -\frac{u''(w)}{u'(w)}$, where $u()$ and w denote the utility function and individuals' wealth, respectively. The Arrow-Pratt measure for the SHIW lottery question for each individual i has the following expression (see e.g., Belzil and Leonardi 2013):

$$A_i(w) = -\frac{u_i''(w_i)}{u_i'(w_i)} = 2\frac{5165 - bet_i}{5165^2 + bet_i^2} \qquad (1)$$

where *bet* indicates how much the respondent is willing to pay to participate to the lottery, i.e., her/his answer to the SHIW lottery question. This measure of risk aversion (tolerance) suffers from underestimation of the risk aversion for bets tending to 0. In fact, as *bet* tends to 0, $A_i(w_i)$ tends to 0.0004 while the true risk aversion tends to infinity. To avoid this, a functional form can be imposed to the utility function. Following Guiso and Paiella (2008), we can use an exponential utility function and define our absolute risk measure for each individual as R_i solving the equation:

$$-\exp(R_i w_i) = -\frac{1}{2}\exp\{-R_i(w_i + 5165)\} - \frac{1}{2}\exp\{-R_i(w_i - bet_i)\}. \qquad (2)$$

Therefore, as a robustness check we use *R* instead of *bet* as a measure of risk aversion (tolerance). Regression estimates are reported in Table A.1 and displayed graphically in Figure A.1.

We also considered a log transformation of the risk tolerance measure (*bet*) as an alternative functional form instead of the quadratic specification used in the baseline models. Regression estimates are reported in Table A.2 and the corresponding predicted probabilities in Figure A.2.

Excluding bet = 0

Respondents who declare a zero as the bet value can be considered as the least risk tolerant individuals because they are not willing to spend money to participate in a lottery, which has an uncertain outcome. However, this type of answers could alternatively be considered as non-valid values indicating that the respondent is not able to provide an answer (Checchi, Fiorio, and Leonardi 2014). Therefore, as a robustness check we excluded respondents that declared a value of bet equal to 0 (323 and 801 observations delated for the first and second birth models, respectively). Regression estimates are reported in Table A3 and the corresponding predicted probabilities in Figure A.3.

Nonresponse bias

As mentioned above, about 21% of respondents did not provide an answer to the lottery question. These missing data may be not random, e.g. they may be due to lower cognitive abilities not fully captured by education which in turn may be correlated with fertility

decisions. If this is the case ignoring these missing data may introduce a bias in our estimates. To adjust for this (possible) nonresponse bias we estimated a Heckman selection model (Heckman 1979). This method requires one or more instrumental variables that influence the probability of a missing response but have no direct effect on the outcome under study, i.e. fertility decisions. Typically, metadata on characteristics of the interviewers and/or of the interviews are used as instrumental variables (Arpino, De Cao, and Peracchi 2014). We used as instrumental variables two indicators of the quality of the interview given by the interviewer in the SHIW questionnaire. The first one measures, according to the interviewer, the level of understanding of the questionnaire by the respondent ("understanding"). The second one measures how easy, according to the interviewer, it was for the respondent to answer the questions ("easy"). Both items are measured on scales from 1 to 10 with higher values indicating better interviews' quality. Regression estimates for both the outcome and selection equations are reported in Table A.4 and the corresponding predicted probabilities in Figure A.4.

Keeping only male respondents

As noticed above, only 15.1% of household heads that answered to the lottery question were women. Our baseline models include both male and female respondents and adjust for a dummy variable for the gender of the respondent. As an additional robustness check we have re-run the analyses using only the sample of male respondents. We also considered analyses on the female respondents but the resulting sample was too small and, as a consequence, confidence intervals were very large. Regression estimates for the male sub-sample are reported in Table A.5 and the corresponding predicted probabilities in Figure A.5. We also tested interactions between gender and risk tolerance but they were never statistically significant (results available upon request).

Keeping only observations for which risk tolerance is measured before childbearing events

As we argued in Section 2, risk tolerance can be understood as a personality trait that is fairly stable throughout adulthood. Other studies using the same data we employ (Belzil and Leonardi 2007; Guiso, Sapienza, and Zingales 2018) have also considered risk tolerance as time invariant and also brought empirical support to it. Similar findings were obtained also for other datasets in other countries (Haliassos and Bertaut 1995; Sahm 2007; Brunnermeier and Nagel 2008; Bucciol and Miniaci 2014; Callen, Long, and Sprenger 2014). Nonetheless, as a

robustness check we have re-run the analyses using only those observations for which risk tolerance was measured before a childbearing event (for those who experienced an event). Regression estimates are reported in Table A.6 and the corresponding predicted probabilities in Figure A.6.

Additional control variables

We considered two additional control variables from the economic literature on risk tolerance. The hypothetical loss or gain from participating into the lottery does not have to impact necessarily on current consumption but instead it may be spread over lifetime consumption. The reported value of "bet" may be then affected by consumer lifetime endowment, which is typically unobservable but it may be better proxied by household consumption expenditure rather than by income (Guiso and Paiella 2008). Therefore, we added a control variable measuring total household consumption expenditures.

Additionally, the possibility to smooth consumption over the life cycle may be reduced by the presence of liquidity constraints, i.e. difficulties individuals may face in borrowing money. Thus, as in Belzil and Leonardi (2013), we also added as a control variable a dummy variable equal to one for discouraged borrowers and rejected loan applicants. Regression estimates are reported in Table A.7 and the corresponding predicted probabilities in Figure A.7.

Measurement error in risk tolerance

Risk tolerance was measured with a lottery question that can only proxy for the true individual's risk tolerance, in other words risk tolerance in measured with errors. Non-random measurement errors in an independent variable may bias regression estimates. A classical approach to deal with measurement error in an independent variable in a regression model is to use an Instrumental Variable approach and instrument the mis-measured variable using its rank, i.e. after ordering individuals based on the observed risk tolerance (bet), the instrument is defined as the rank order for each individual. A noted by Durbin (1954: 28), "if ranking is relatively unaffected by errors the rank should be a good instrumental variable. Even if the errors are large, the bias should be a good deal smaller than for the original observations". Regression estimates are reported in Table A.8 and the corresponding predicted probabilities in Figure A.8.

Summary of robustness checks results

All in all, the robustness checks demonstrate that results are not sensitive to the specification of risk tolerance, to the presence of missing data and measurement error, to the inclusion of respondents betting zero euros, to the inclusion of female respondents, to the assumption of time-invariance in risk tolerance and to adjusting for potential endogenous confounders and additional control variables. Not only the significance and sign were not altered but also the magnitude of the effects is stable as shown by the graphs reporting the predicted probabilities.

9. Discussion and conclusions

Family sociologists and social demographers have identified numerous individual-, meso- and macro-level factors influencing fertility choices. However, the role of risk tolerance has been overlooked. This is surprising, given that it is widely recognized that the decision to have a child is intrinsically characterized by uncertainty (e.g., Cain 1983; Johnson-Hanks 2004, 2007).

Individuals characterized by different levels of risk tolerance face uncertain situations differently. While uncertainty may cause anxiety in risk averse individuals, it may be experienced with excitement by risk tolerant people (Greco and Roger 2001). Thus, risk tolerance affects decision making by influencing the expected utility of decisions characterized by uncertain outcomes, regardless of individual's socio-economic background (e.g. Breen and Goldthorpe 1997; Roth and Kroll 2007; Holm and Jaeger 2008). On the basis of these premises, in this paper we argued that risk preferences may contribute explaining the heterogeneity in fertility choices over and beyond standard fertility determinants, and in particular, socio-economic characteristics, such as education, employment status and income on which a large part of theoretical and empirical fertility studies focused on.

In this study we aimed at demonstrating the role of risk preferences in theorization and empirical research on fertility. Our contribution is twofold. First, we provide a new conceptual framework that reveals connections between risk tolerance, attractiveness of parenthood, and fertility behavior. By bringing together different theoretical perspectives, we built a typology of fertility decision makers. We identified four ideal types. The 'Hedger', characterized by low risk tolerance and high attractiveness of parenthood, considers children as an insurance; being risk averse, the 'Hedger' is expected to display a high probability of

parity transition. The ‘Exit Strategist’ is also risk averse but assesses parenthood as not attractive. The ‘Exit Strategist’ values children as risky investments with potential negative returns, so it is expected to have few children. The ‘Optimist’ is risk tolerant and perceives a high value from parenthood, thus considering children as an investment with a potentially high gain; a high likelihood of having children is then predicted. Finally, the combination of risk tolerance and low attractiveness of parenthood identifies the ‘Individualist’, who perceives having children as a possible source of conflict with more rewarding investments; a low probability of having a(n additional) child is thus predicted. According to the theoretical discussion about the ideal types of fertility decision-makers, the overall effect of risk tolerance on fertility has not a univocal sign. This relationship may theoretically be positive, negative or null depending on the relative proportion of the different types of decision makers in the population.

Inspired by Merton (1957) view of risk preferences as transformative factor that contributes to the achievement of higher status and by the relative risk aversion framework (Breen and Goldthorpe 1997), we also extended our theory of the relationship between risk tolerance and fertility by considering economic status as a moderating factor of the relationship between risk preferences and fertility (*economic heterogeneity*). Our theoretical discussion consistently implied for each ideal type a stronger effect of risk tolerance (either positive or negative) for low income individuals.

A second contribution of our study is the empirical test of the effect of risk tolerance on fertility. With the exception of the work by Schmidt (2008), to the best of our knowledge, there is no empirical study examining the role of risk tolerance on fertility. Using data from the US, Schmidt (2008) focused on the timing of first births among women and found an effect of risk tolerance on the whole population only at young ages (among women younger than 20 years). This seems to provide evidence in favor of one of the predictions made by Schmidt (2008), that more risk tolerant women are more willing to accept high risks of an unplanned pregnancy and therefore contracept less effectively. Unplanned pregnancies, especially among teens, have received quite a deal of attention in the US for their consequences on subsequent life outcomes (e.g., Furstenberg, Brooks-Gunn and Morgan 1987), but this phenomenon has a considerably marginal incidence in other developed countries, such as Italy (Robson and Berthoud 2003). In fact, in our preliminary analyses we

did not find any evidence of moderation effects of age. In other words, the effect of risk tolerance did not seem to substantially vary with age. On the contrary, our results point to a negative effect of risk tolerance on the probability of having the first and second child - during the observation period.

Estimates from probit models, confirmed by numerous robustness checks, showed that the most risk averse individuals had the highest likelihood of having a(another) child, while the opposite was found for those individuals who are more risk tolerant. Additionally, we found that the effect of risk tolerance on fertility persisted (also in its magnitude) even after including other determinants of fertility, which may also be influenced by risk tolerance, such as education. This suggests that the effect of this individual preference on fertility is mostly direct, i.e. due to the trait *per se* and it is not (substantially) mediated by other factors that are influenced by risk tolerance. Our results were also robust to the presence of missing data and measurement errors. The estimated effect of risk tolerance was not only statistically significant but also substantially relevant. The predicted probability of first birth ranged from about 35% for the least risk tolerant (most risk averse) individuals to about 22% for the most risk tolerant (least risk averse) individuals. For the second birth, the predicted probabilities ranged between 21% to about 12% for the least and most risk tolerant individuals, respectively.

In terms of our classification, the fact that the highest fertility levels are observed for the most risk averse individuals is consistent with the 'Hedger' ideal type and with expectations from the Value of Children theory and the Old Age Security perspective. Based on the Value of Children theory (Friedman, Hechter, and Kanazawa 1994), childbearing can be considered as an immanent investment that increases both the individual's and couple's utility. Risk aversion may play a key role in influencing the expected utility of having a child. In fact, having a(nother) child may aim at achieving higher stability and predictability in one's couple and individual life. Previous studies have supported the idea of parenthood as a reinforcer of the quality of relationship with the partner (Stigler and Becker 1977; Friedman, Hechter, and Kanazawa 1994; Myers 1993; Wu 1996; Rijken and Liefbroer 2009) and of the social integration of the individual and the couple into the community (Bühler 2008; Knoester and Eggebeen 2006; Nomaguchi and Milkie 2003). By bringing stability and predictability in

one's life, fertility is particularly attractive for those individuals who wish to minimize risks, i.e. the risk averse.

The fact that fertility level is highest among the most risk averse individuals is also consistent with the Old Age Security perspective, which posits that fertility decisions are, in part, motivated by the expectation of receiving care and other forms of support from children in case of future need, especially at older ages (Burton and Tucker 2009). Several studies provided evidence for the validity of the Old Age Security perspective also in developed countries, including Italy (Billari and Galasso 2009; Cigno and Rosati 1992; Galasso, Gatti, and Profeta 2009; Rendall and Bahchieva 1998), where informal care is an important part of the care received by older individuals (De Roit 2007). If children are seen as an old-age security, childbearing is particularly attractive for risk averse individuals who may want to "buy" this security in order to reduce future risks.

In sum, risk averse individuals display a high level of fertility because having children is seen by them as a *hedging* strategy, a decision that does not expose them to more risks. In other words, it seems that fertility acts as a risk-reducer strategy that counterbalances the risks that may be associated with other life events, as for example health deterioration at older ages, or that may reduce the risks of negative events, such as divorce.

In a specular way, our results point at low fertility levels among individuals who are the most risk tolerant, or the least risk averse. In our typology, this is consistent with the 'Individualist' ideal type of fertility decision-maker. This group is constituted by risk tolerant individuals who do not consider childbearing as an attractive investment as compared to other risky behaviors - that are expected to provide higher utility. The decision-making process of the 'Individualist' is consistent with studies that found evidence of a generalized orientation towards risky behaviors for some risk tolerant individuals, who are simultaneously attracted by different risky choices such as gambling, uses of drugs, risky sports and sexual practices (Zuckerman 2007). People in this group are likely to hold individualistic and self-oriented attitudes (Güth, Levati, and Ploner 2008) and to deviate from normative behaviors and roles (Ferguson and Valenti 1991). Thus, our findings are in line with the idea that the most risk tolerant individuals have a low fertility because investing in children may be perceived as an

obstacle to their self-realization throughout a diversified source of excitement via risky life choices.

Our test of the economic heterogeneity hypothesis, confirms the expectation of a stronger effect of risk tolerance (either positive or negative) for low income individuals - only for the first child. More specifically, we found that the relationship between risk tolerance and the probability to have the first child is negative for both "low" and "high" income levels, but much stronger for the low-income individuals and rather weak for their richer counterpart. In other words, risk tolerance matters more for low income individuals in influencing their transition to the first child. This was not the case for the second child. In fact, the relationship between risk tolerance and the probability to have the second child was not moderated by income and the extent to which the predicted probability of having the second child varied with risk tolerance was almost the same for low- and high-income levels. Looking at predicted probabilities of having the first child more closely, we observe that the likelihood of becoming a parent tends to be similar for low- and high-income levels among the most risk averse individuals; they become increasingly different as risk tolerance increases. Therefore, these results suggest that low-income risk tolerant individuals face stronger constrains in choosing between having the first child and other decisions, as compared to high-income risk tolerant individuals who may combine fertility and other decisions more easily. However, this "income advantage" does not differentiate risk tolerant individuals when facing the decision to progressing to a second child. Higher parity progression seems to be similarly incompatible with risky behaviors for high-income and low-income risk tolerant individuals.

Our study is, of course, not without limitations. As discussed in Section 2, we followed the subjective expected utility (SEU) theory considering that fertility decisions are subject to uncertainty in the occurrence of negative and positive consequences and that the likelihood of these events may be subjectively estimated by individuals based on own and others' experiences. However, for some sub-groups of the population or in some countries, uncertainty may be "fundamental", meaning that the consequences of fertility may be completely impossible to be predicted, because "the future is yet to be created" (Dequech 2000). Johnson-Hanks (2004), for example, argues that in Africa, women face "radical" uncertainty in fertility decisions. Thus, uncertainty aversion may be more relevant than risk aversion in some contexts. Disentangling the effect of risk and uncertainty aversion is an

interesting avenue for future theoretical and empirical work, possibly based on survey or laboratory experiments.

Despite the rare availability of a risk aversion measure in a longitudinal dataset that allows studying fertility, the SHIW data we use present some limitations. First, we did not have a long prospective or retrospective dataset and it was not possible to implement an event history analysis. Second, it would have been ideal to account for time discounting preferences (TDP), a related, but very distinct concept from risk aversion. TDP indicate the extent to which individuals prefer immediate utility over delayed utility and it has been found to influence the timing of divorce (De Paola and Gioia, 2017). In SHIW, a measure of TDP was not included in the same waves in which risk tolerance was measured. Third, as mentioned above, a robustness check indicated that our results were not driven by the inclusion of female-headed household, that for the design of SHIW represented a minority of the sample. Future studies may examine whether reported risk preferences by the female and male partner and their degree of similarity within the couple have different effects on fertility.

Notwithstanding these limitations, the different empirical pieces presented in this study add up to an argument concerning the future of fertility. One of the key insights of this study is that risk averse individuals that perceive childbearing as an insurance or an immanent value are more likely to progress to a higher parity. We do not believe, however, that the rate of fertility in Italy will increase through an increment of the proportion of hedgers. The emphasis on uncertainty of life is not the right response to the lowest low equilibrium - as a simplistic interpretation of the result of our study could insinuate. Our analysis suggests instead that an effective strategy to increase fertility consists in stimulating the Optimists to have more children. In this sense, policy makers should implement policies that create a non-conflicting setting where individuals are able to enjoy familial and other life sphere at the same time. Our results on the economic heterogeneity, also suggest that these policies may be particularly relevant for low-income risk-tolerant individuals and for their decision to have the first child.

In conclusion, the upshot of this study is that finding solutions to the lowest low level of fertility requires a better understanding of how individuals react in terms of reproductive choices to their preferences and to what extent economic heterogeneity can strengthen this relationship. This article provides a relevant theoretical and empirical contribution in this

direction, but there is still need for future research to further clarify the mechanisms behind the link between risk tolerance and fertility.

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Fig. 1 - A typology of fertility decision-making processes under risk preferences.

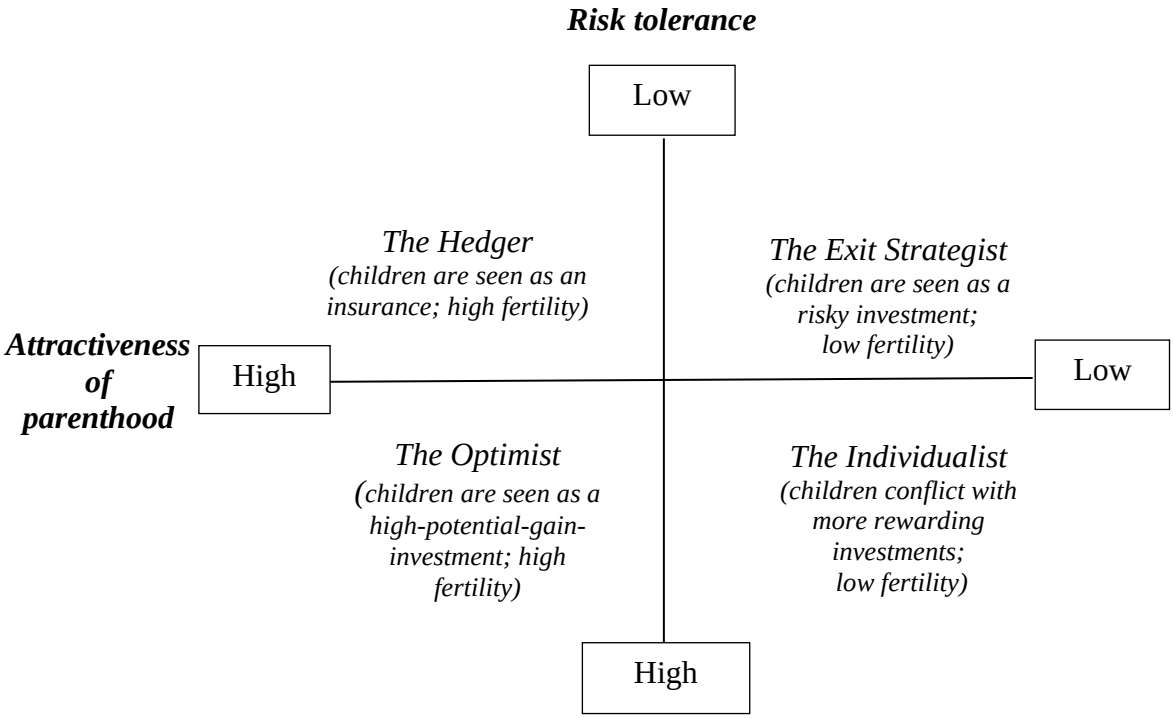
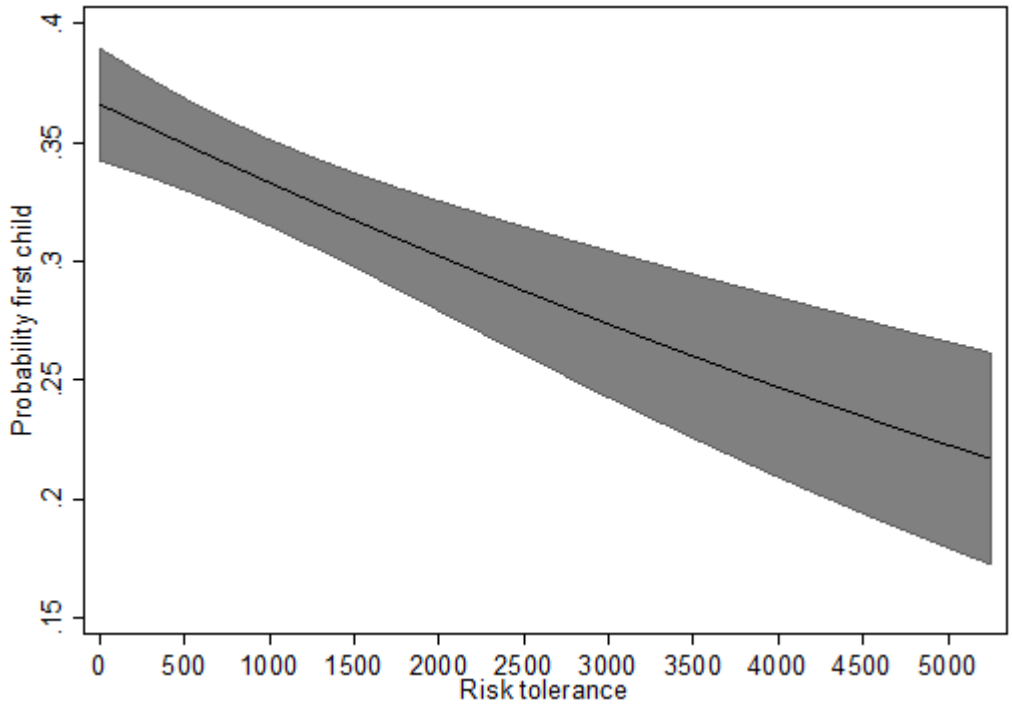
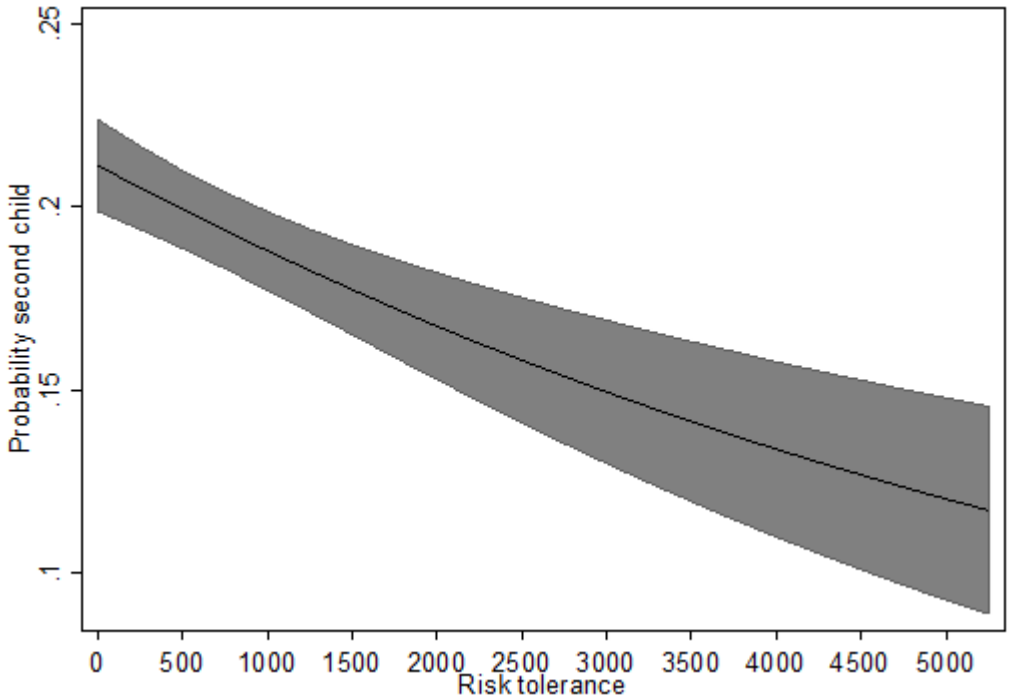


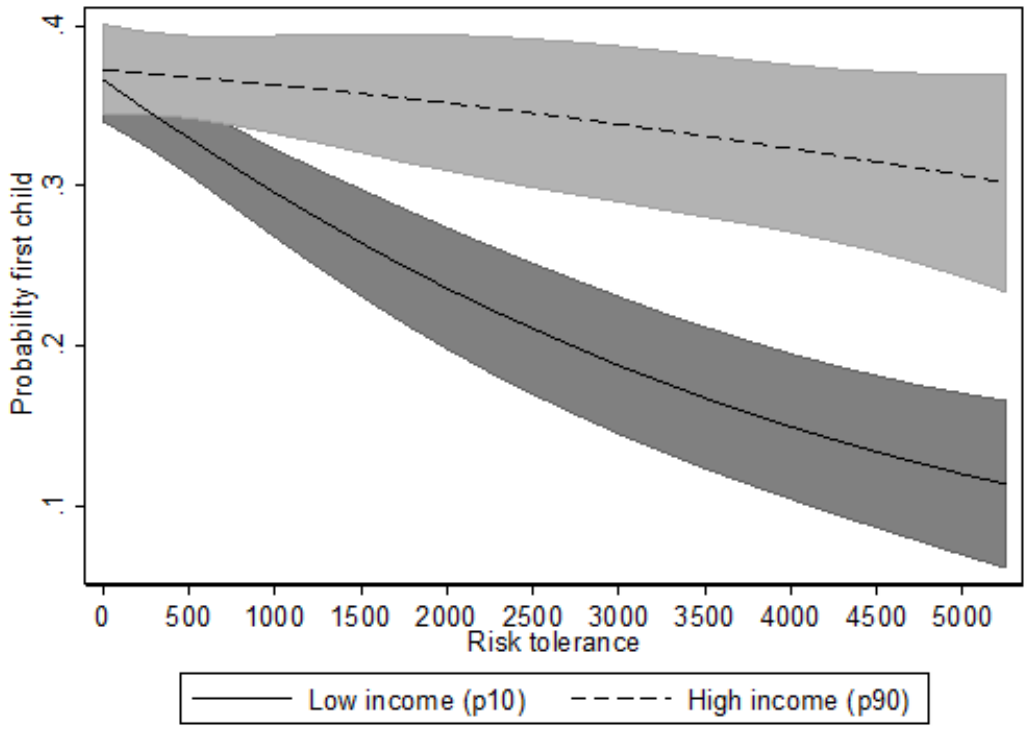
Fig. 2 - Predicted probability of first and second births by risk tolerance with confidence bands for 5%-level multiple comparisons.

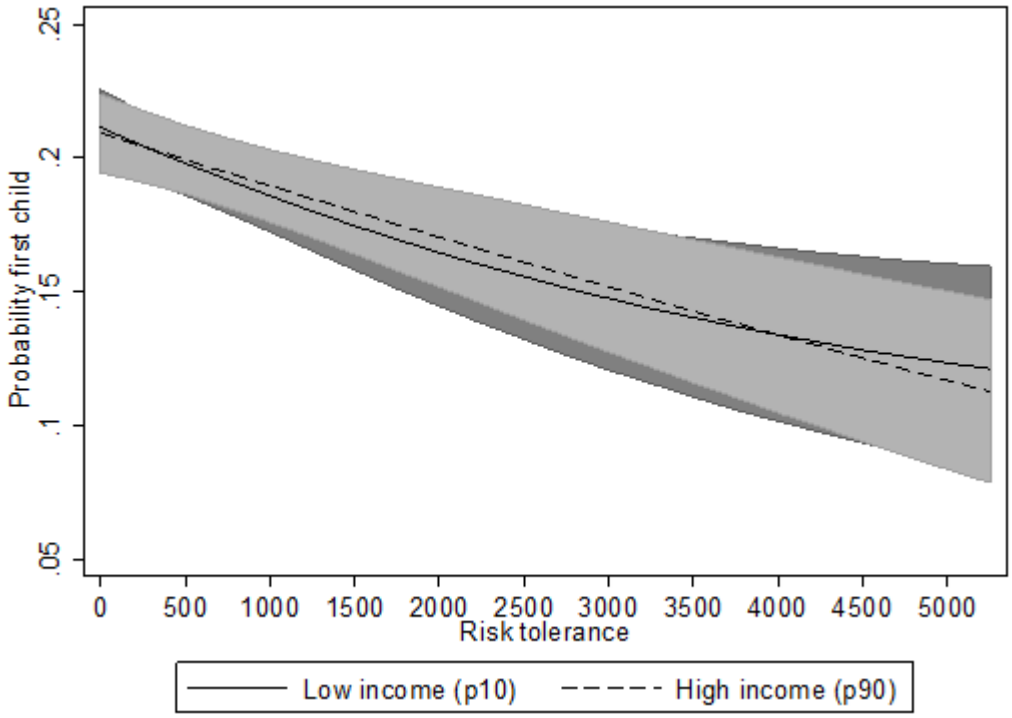




Note: The figures represent predicted probabilities obtained from probit models “M2” in Table 2.

Fig. 3 - Predicted probability of first and second births by risk tolerance and two levels of total household income (log) with confidence bands for 5%-level multiple comparisons.





Note: The figures represent predicted probabilities obtained from probit models in Table 3. Two levels of income are considered: low and high, corresponding to the 10th and 90th percentile of the income distribution, respectively.

Table 1 - Descriptive statistics and variable summary for the two samples used in the multivariate analyses.

Variables	%	First child				Second child		
	(Mean)	Sd.	Min	Max	Mean	Sd.	Min	Max
Risk tolerance	978.8	1716.3	0.0	25822.8	799.2	1926.8	0.0	51645.7
Age woman	31.5	6.2	18.0	45.0	35.4	6.0	18.0	45.0
Age difference partners	3.2	3.8	-10.0	18.0	3.4	3.5	-10.0	23.0
Woman's education								
low education woman	37.0				51.6			
medium education woman	45.3				38.0			
high education woman	17.7				10.4			
Education homogamy								
woman edu same as men	60.8				65.4			
woman edu higher than men	22.7				19.6			
woman edu lower than men	16.4				15.0			
Woman's employment status								
woman employee	52.8				49.3			
woman self-employed	11.9				9.4			
woman not employed	35.3				41.4			
Man's employment status								
man employee	72.2				73.4			
man self-employed	23.8				22.3			
man not employed	4.0				4.2			
Total income (log)	9.5	1.5	0.0	12.8	9.5	1.4	0.0	11.9
Gender of household head								
man is household head	82.5				86.1			
Region of residence								
Northern Italy	53.5				51.0			
Central Italy	17.5				21.0			
Southern Italy	29.1				28.0			
Number of observations		1,272				2,542		
Number of individuals		752				1,167		
Number of childbearing events		428				499		

Note: the first column reports the mean of continuous variables or the percentage of each category for categorical variables. For continuous variables we also report the standard deviation (Sd.), the minimum (Min) and the maximum (Max).

Table 2 - Estimates of probit models for first and second births as a function of risk tolerance and controls (standard error in parentheses).

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance	-0.099***	-0.099***	-0.087***	-0.095***
	(0.035)	(0.036)	(0.028)	(0.027)
risk tolerance squared	0.001	0.001	0.002***	0.003***
	(0.002)	(0.002)	(0.001)	(0.001)
age woman	-0.035***	-0.026***	-0.008	-0.012
	(0.009)	(0.010)	(0.008)	(0.009)
age woman squared	-0.005***	-0.005***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.012	-0.011	-0.007	-0.006
	(0.012)	(0.013)	(0.009)	(0.009)
medium education woman		-0.175*		0.122
		(0.099)		(0.077)
high education woman		-0.316**		0.340***
		(0.147)		(0.117)
woman edu higher than men		0.039		-0.140*
		(0.101)		(0.084)
woman edu lower than men		-0.179		-0.072
		(0.117)		(0.090)
woman self-employed		-0.071		-0.027
		(0.144)		(0.118)
woman not employed		0.238**		0.030
		(0.101)		(0.072)
man self-employed		-0.016		0.101
		(0.097)		(0.076)
man not employed		-0.231		0.066
		(0.213)		(0.165)
total income (log)		0.055		-0.002
		(0.035)		(0.025)
woman is household head	-0.330***	-0.276***	-0.041	-0.037
	(0.098)	(0.101)	(0.091)	(0.093)
Central Italy	0.038	0.001	0.194**	0.195**
	(0.105)	(0.108)	(0.083)	(0.083)
Southern Italy	0.153	0.093	0.383***	0.364***
	(0.094)	(0.104)	(0.070)	(0.075)
Constant	-0.031	-0.432	-0.612***	-0.681**
	(0.180)	(0.386)	(0.151)	(0.285)
N	1272	1272	2542	2542

Note: all models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table 3 - Estimates of probit models for first and second births as a function of risk tolerance interacted with income and controls (standard error in parentheses).

Independent variables	First child	Second child
risk tolerance	-0.132***	-0.090***
	(0.036)	(0.027)
risk tolerance squared	0.003	0.003***
	(0.003)	(0.001)
total income (log)	0.124**	0.009
	(0.061)	(0.031)
risk tolerance * income(log)	0.125**	0.013
	(0.064)	(0.032)
risk tolerance squared * income(log)	-0.008	-0.005
	(0.020)	(0.005)
age woman	-0.025***	-0.012
	(0.010)	(0.009)
age woman squared	-0.005***	-0.006***
	(0.001)	(0.001)
age difference partners	-0.013	-0.006
	(0.013)	(0.009)
medium edu woman	-0.198**	0.123
	(0.099)	(0.077)
high edu woman	-0.357**	0.341***
	(0.148)	(0.118)
woman edu higher than men	0.057	-0.139*
	(0.102)	(0.084)
woman edu lower than men	-0.191	-0.073
	(0.117)	(0.090)
woman self-employed	-0.089	-0.025
	(0.146)	(0.118)
woman not employed	0.236**	0.031
	(0.102)	(0.072)
man self-employed	-0.014	0.100
	(0.097)	(0.075)
man not employed	-0.256	0.066
	(0.218)	(0.166)
woman is household head	-0.283***	-0.037
	(0.102)	(0.094)
Central Italy	0.015	0.195**
	(0.109)	(0.083)
Southern Italy	0.110	0.363***
	(0.104)	(0.075)
Constant	0.013	-0.778***
	(0.200)	(0.163)
N	1272	2542

Note: all models also include year of survey fixed effects. Models are the same as models "M2" in Table 2 with the inclusion of interactions between risk tolerance and its square and income. *** p<0.001; ** p < 0.01; * 0.05.

Appendix A – Robustness checks

Table A.1 – Robustness check: Arrow-Pratt measure of risk tolerance.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance (Arrow Pratt)	-0.048***	-0.048***	-0.044**	-0.050***
	(0.016)	(0.017)	(0.019)	(0.019)
age woman	-0.037***	-0.027**	-0.001	-0.004
	(0.011)	(0.011)	(0.010)	(0.010)
age woman squared	-0.006***	-0.006***	-0.008***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.011	-0.010	-0.013	-0.010
	(0.014)	(0.014)	(0.011)	(0.012)
medium edu woman		-0.103		0.210**
		(0.113)		(0.089)
high edu woman		-0.281*		0.240
		(0.159)		(0.151)
woman edu higher than men		0.106		-0.141
		(0.114)		(0.097)
woman edu lower than men		-0.083		-0.115
		(0.135)		(0.105)
woman self-employed		-0.034		-0.070
		(0.157)		(0.140)
woman not employed		0.211*		0.006
		(0.119)		(0.084)
man self-employed		-0.003		0.089
		(0.108)		(0.090)
man not employed		-0.155		0.057
		(0.250)		(0.215)
total income (log)		0.035		-0.005
		(0.038)		(0.028)
woman is household head	-0.316***	-0.293**	0.063	0.076
	(0.121)	(0.126)	(0.117)	(0.120)
Central Italy	0.146	0.102	0.264***	0.270***
	(0.121)	(0.125)	(0.098)	(0.099)
Southern Italy	0.215**	0.149	0.410***	0.386***
	(0.108)	(0.120)	(0.083)	(0.090)
Constant	-0.601***	-0.881**	-0.993***	-1.081***
	(0.222)	(0.444)	(0.237)	(0.369)
N	949	949	1741	1741

Note: Sample sizes are lower because cases with bet = 0 are excluded. All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.2 – Robustness check: Logarithmic transformation of risk tolerance.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance (log)	-0.035***	-0.034***	-0.018*	-0.019*
	(0.013)	(0.013)	(0.010)	(0.010)
age woman	-0.037***	-0.028***	-0.009	-0.013
	(0.009)	(0.010)	(0.008)	(0.009)
age woman squared	-0.005***	-0.005***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.015	-0.014	-0.008	-0.007
	(0.012)	(0.013)	(0.009)	(0.009)
medium edu woman		-0.168*		0.108
		(0.098)		(0.077)
high edu woman		-0.319**		0.322***
		(0.148)		(0.117)
woman edu higher than men		0.049		-0.125
		(0.102)		(0.084)
woman edu lower than men		-0.176		-0.076
		(0.116)		(0.089)
woman self-employed		-0.082		-0.036
		(0.144)		(0.118)
woman not employed		0.234**		0.024
		(0.100)		(0.072)
man self-employed		-0.030		0.096
		(0.099)		(0.075)
man not employed		-0.249		0.058
		(0.215)		(0.166)
total income (log)		0.050		-0.003
		(0.035)		(0.025)
woman is household head	-0.307***	-0.257**	-0.028	-0.026
	(0.097)	(0.100)	(0.092)	(0.094)
Central Italy	0.040	0.006	0.205**	0.207**
	(0.105)	(0.107)	(0.082)	(0.083)
Southern Italy	0.160*	0.100	0.388***	0.371***
	(0.094)	(0.103)	(0.070)	(0.075)
Constant	-0.199	-0.555	-0.725***	-0.776***
	(0.174)	(0.383)	(0.150)	(0.283)
N	1272	1272	2542	2542

Note: 1 euro was added to the risk tolerance measure before it was log transformed to avoid losing observations with bet = 0. All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.3 – Robustness check: Excluding those betting 0 (bet = 0).

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance	-0.096**	-0.099**	-0.079***	-0.088***
	(0.039)	(0.039)	(0.030)	(0.030)
risk tolerance squared	0.001	0.002	0.002***	0.002***
	(0.002)	(0.002)	(0.001)	(0.001)
age woman	-0.037***	-0.028**	-0.001	-0.004
	(0.010)	(0.011)	(0.010)	(0.010)
age woman squared	-0.006***	-0.006***	-0.008***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.012	-0.011	-0.012	-0.009
	(0.014)	(0.014)	(0.011)	(0.012)
medium edu woman		-0.100		0.215**
		(0.112)		(0.089)
high edu woman		-0.278*		0.240
		(0.159)		(0.150)
woman edu higher than men		0.104		-0.145
		(0.114)		(0.097)
woman edu lower than men		-0.077		-0.109
		(0.134)		(0.105)
woman self-employed		-0.025		-0.070
		(0.156)		(0.141)
woman not employed		0.213*		-0.001
		(0.119)		(0.084)
man self-employed		-0.003		0.089
		(0.108)		(0.090)
man not employed		-0.160		0.053
		(0.249)		(0.215)
total income (log)		0.036		-0.005
		(0.038)		(0.028)
woman is household head	-0.324***	-0.300**	0.061	0.074
	(0.121)	(0.126)	(0.117)	(0.121)
Central Italy	0.152	0.109	0.261***	0.267***
	(0.120)	(0.124)	(0.098)	(0.099)
Southern Italy	0.212**	0.147	0.405***	0.383***
	(0.108)	(0.119)	(0.083)	(0.090)
Constant	-0.118	-0.410	-0.573***	-0.613*
	(0.207)	(0.428)	(0.177)	(0.330)
N	949	949	1741	1741

Note: sample sizes are lower because of the exclusion of bet = 0. All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.4 – Robustness check: Adjusting for non-response bias.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
Outcome equation				
risk tolerance	-0.094**	-0.099**	-0.081***	-0.088***
	(0.041)	(0.042)	(0.028)	(0.029)
risk tolerance squared	0.001	0.002	0.002***	0.002***
	(0.004)	(0.004)	(0.001)	(0.001)
age woman	-0.038***	-0.020	-0.001	-0.005
	(0.009)	(0.013)	(0.008)	(0.008)
age woman squared	-0.005***	-0.005***	-0.007***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.014	-0.009	-0.006	-0.006
	(0.010)	(0.011)	(0.008)	(0.008)
medium edu woman		-0.225*		0.133*
		(0.118)		(0.072)
high edu woman		-0.386**		0.312***
		(0.168)		(0.110)
woman edu higher than men		0.063		-0.148*
		(0.109)		(0.084)
woman edu lower than men		-0.209*		-0.051
		(0.117)		(0.086)
woman self-employed		-0.080		-0.033
		(0.134)		(0.111)
woman not employed		0.263***		0.005
		(0.099)		(0.068)
man self-employed		-0.021		0.093
		(0.093)		(0.071)
man not employed		-0.212		0.035
		(0.220)		(0.153)
total income (log)		0.051		0.010
		(0.033)		(0.021)
woman is household head	-0.314***	-0.283***	-0.059	-0.042
	(0.106)	(0.109)	(0.085)	(0.090)
Central Italy	0.036	-0.002	0.204***	0.206***
	(0.103)	(0.106)	(0.076)	(0.077)
Southern Italy	0.137	0.088	0.353***	0.351***
	(0.088)	(0.096)	(0.066)	(0.072)
Constant	-0.107	-0.301	-0.724***	-0.894***
	(0.187)	(0.415)	(0.140)	(0.258)
Selection equation				
age woman	-0.046***	-0.058***	0.027***	0.024***
	(0.008)	(0.008)	(0.007)	(0.008)
age woman squared	-0.000	0.001	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.028***	-0.028***	-0.003	-0.003
	(0.009)	(0.009)	(0.008)	(0.008)
medium edu woman		0.423***		0.079
		(0.089)		(0.075)
high edu woman		0.559***		-0.104
		(0.131)		(0.114)
woman edu higher than men		-0.247**		-0.097
		(0.100)		(0.086)
woman edu lower than men		0.232**		0.002
		(0.105)		(0.088)
woman self-employed		0.129		-0.056

		(0.126)		(0.108)
woman not employed		-0.259***		-0.097
		(0.082)		(0.066)
man self-employed		0.060		0.013
		(0.087)		(0.072)
man not employed		-0.145		-0.128
		(0.166)		(0.134)
total income (log)		0.010		0.038*
		(0.023)		(0.020)
woman is household head	0.026	0.063	-0.095	-0.043
	(0.092)	(0.099)	(0.079)	(0.084)
Central Italy	0.064	0.061	0.108	0.124
	(0.096)	(0.098)	(0.077)	(0.077)
Southern Italy	-0.008	0.093	0.054	0.120
	(0.081)	(0.089)	(0.069)	(0.074)
understanding	0.308***	0.230***	0.180***	0.172***
	(0.057)	(0.059)	(0.044)	(0.045)
easy	-0.158**	-0.134**	-0.015	-0.017
	(0.065)	(0.067)	(0.052)	(0.052)
Constant	-0.050	-0.070	0.411	0.119
	(0.377)	(0.442)	(0.301)	(0.359)
N	1734	1734	3004	3004

Note: all models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.5 – Robustness check: Keeping only male respondents.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance	-0.090**	-0.101***	-0.096***	-0.090***
	(0.036)	(0.037)	(0.027)	(0.028)
risk tolerance squared	0.001	0.001	0.003***	0.002***
	(0.003)	(0.002)	(0.001)	(0.001)
age woman	-0.037***	-0.031***	-0.007	-0.003
	(0.009)	(0.011)	(0.009)	(0.009)
age woman squared	-0.004***	-0.005***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners		-0.016		-0.006
		(0.013)		(0.010)
medium edu woman		-0.165		0.092
		(0.106)		(0.080)
high edu woman		-0.404**		0.273**
		(0.159)		(0.130)
woman edu higher than men		0.112		-0.112
		(0.111)		(0.090)
woman edu lower than men		-0.161		-0.110
		(0.125)		(0.094)
woman self-employed		-0.123		-0.040
		(0.148)		(0.129)
woman not employed		0.162		0.024
		(0.105)		(0.074)
man self-employed		0.003		0.073
		(0.104)		(0.079)
man not employed		-0.062		0.135
		(0.251)		(0.179)
total income (log)		0.248***		0.009
		(0.075)		(0.040)
Central Italy		-0.047		0.244***
		(0.113)		(0.086)
Southern Italy		0.170		0.412***
		(0.113)		(0.081)
Constant	-0.079	-2.315***	-0.426***	-0.778*
	(0.176)	(0.717)	(0.152)	(0.407)
N	1049	1049	2189	2189

Note: sample sizes are reduced because of the exclusion of female respondents. All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.6 – Robustness check: Keeping only observations for which risk tolerance is measured before childbearing events.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
risk tolerance	-0.055*	-0.056*	0.040**	0.046**
	(0.032)	(0.034)	(0.018)	(0.019)
risk tolerance squared	-0.000	-0.000	-0.043	-0.046
	(0.003)	(0.003)	(0.032)	(0.032)
age woman	-0.029**	-0.021*	-0.018*	-0.021*
	(0.012)	(0.012)	(0.011)	(0.011)
age woman squared	-0.006***	-0.007***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.013	-0.014	-0.014	-0.014
	(0.014)	(0.014)	(0.012)	(0.012)
medium edu woman		-0.148		0.237**
		(0.121)		(0.098)
high edu woman		-0.360**		0.474***
		(0.179)		(0.156)
woman edu higher than men		0.053		-0.113
		(0.128)		(0.112)
woman edu lower than men		-0.129		-0.046
		(0.142)		(0.116)
woman self-employed		0.041		-0.028
		(0.178)		(0.152)
woman not employed		0.285**		0.088
		(0.123)		(0.092)
man self-employed		-0.070		0.032
		(0.116)		(0.098)
man not employed		-0.476*		0.215
		(0.275)		(0.199)
total income (log)		0.058		0.002
		(0.044)		(0.028)
woman is household head	-0.381***	-0.322**	0.002	0.015
	(0.126)	(0.128)	(0.119)	(0.127)
Central Italy	0.006	-0.024	0.124	0.129
	(0.132)	(0.134)	(0.105)	(0.105)
Southern Italy	0.092	0.040	0.407***	0.367***
	(0.118)	(0.126)	(0.090)	(0.097)
Constant	-0.138	-0.600	-0.575***	-0.743**
	(0.108)	(0.438)	(0.096)	(0.294)
N	806	806	1503	1503

Note: sample sizes are reduced because these analyses are restricted only to those observations for which risk tolerance is measure before the childbearing events. All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Table A.7 – Robustness check: Adjusting also for household consumption and liquidity constraints.

	First child		Second child	
Independent variables	(M1)	(M2)	(M1)	(M2)
risk tolerance	-0.097***	-0.098***	-0.091***	-0.096***
	(0.036)	(0.036)	(0.028)	(0.028)
risk tolerance squared	0.001	0.001	0.003***	0.003***
	(0.002)	(0.002)	(0.001)	(0.001)
age woman	-0.034***	-0.026***	-0.011	-0.012
	(0.009)	(0.010)	(0.008)	(0.009)
age woman squared	-0.005***	-0.005***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.011	-0.011	-0.008	-0.007
	(0.012)	(0.013)	(0.009)	(0.009)
medium edu woman		-0.172*		0.100
		(0.100)		(0.078)
high edu woman		-0.307**		0.281**
		(0.151)		(0.123)
woman edu higher than men		0.035		-0.120
		(0.102)		(0.085)
woman edu lower than men		-0.176		-0.078
		(0.117)		(0.090)
woman self-employed		-0.068		-0.041
		(0.143)		(0.119)
woman not employed		0.234**		0.046
		(0.102)		(0.072)
man self-employed		-0.014		0.089
		(0.097)		(0.076)
man not employed		-0.233		0.078
		(0.214)		(0.166)
total income (log)		0.057		-0.010
		(0.036)		(0.025)
woman is household head	-0.328***	-0.274***	-0.040	-0.049
	(0.097)	(0.102)	(0.091)	(0.093)
household consumption	-0.004	-0.001	0.008***	0.006*
	(0.003)	(0.004)	(0.003)	(0.003)
liquidity constraints	-0.047	-0.064	0.023	0.017
	(0.214)	(0.216)	(0.168)	(0.172)
Central Italy	0.031	0.000	0.200**	0.195**
	(0.105)	(0.107)	(0.082)	(0.083)
Southern Italy	0.135	0.091	0.423***	0.383***
	(0.096)	(0.104)	(0.072)	(0.076)
Constant	0.026	-0.438	-0.740***	-0.686**
	(0.187)	(0.390)	(0.158)	(0.282)
N	1272	1272	2542	2542

Note: All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

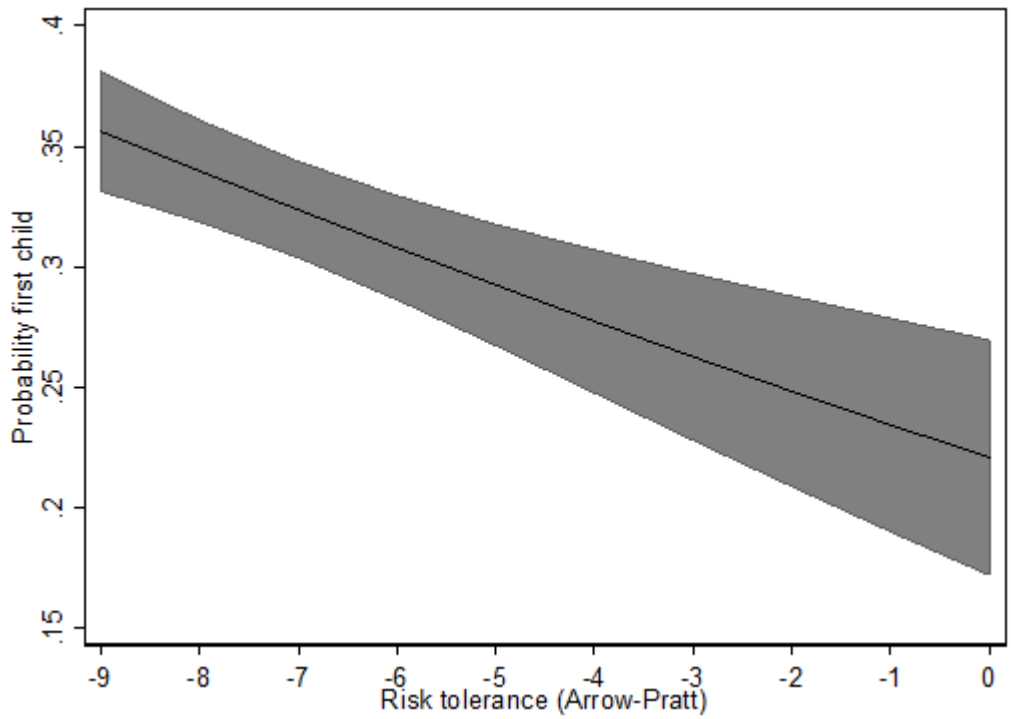
Table A.8 – Robustness check: Adjusting for measurement error in risk tolerance.

Independent variables	First child		Second child	
	(M1)	(M2)	(M1)	(M2)
Second stage				
risk tolerance	-0.102***	-0.100***	-0.062**	-0.067**
	(0.036)	(0.037)	(0.030)	(0.030)
age woman	-0.035***	-0.026***	-0.008	-0.011
	(0.009)	(0.009)	(0.008)	(0.009)
age woman squared	-0.005***	-0.005***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	-0.012	-0.012	-0.007	-0.007
	(0.010)	(0.011)	(0.009)	(0.009)
medium edu woman		-0.176*		0.109
		(0.095)		(0.075)
high edu woman		-0.314**		0.330***
		(0.135)		(0.116)
woman edu higher than men		0.039		-0.135
		(0.103)		(0.088)
woman edu lower than men		-0.178		-0.082
		(0.109)		(0.090)
woman self-employed		-0.067		-0.029
		(0.134)		(0.116)
woman not employed		0.238**		0.031
		(0.094)		(0.071)
man self-employed		-0.013		0.094
		(0.094)		(0.074)
man not employed		-0.232		0.070
		(0.219)		(0.166)
total income (log)		0.055*		-0.002
		(0.033)		(0.023)
woman is household head	-0.337***	-0.282**	-0.042	-0.039
	(0.106)	(0.111)	(0.090)	(0.095)
Central Italy	0.032	-0.004	0.199**	0.199**
	(0.105)	(0.107)	(0.079)	(0.080)
Southern Italy	0.148*	0.089	0.378***	0.357***
	(0.088)	(0.097)	(0.070)	(0.076)
Constant	-0.017	-0.423	-0.611***	-0.666**
	(0.178)	(0.367)	(0.149)	(0.279)
First stage				
age woman	0.018**	0.014	0.023**	0.024**
	(0.008)	(0.009)	(0.009)	(0.010)
age woman squared	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
age difference partners	0.019*	0.015	0.006	0.005
	(0.010)	(0.010)	(0.009)	(0.009)
medium edu woman		-0.114		-0.032
		(0.091)		(0.081)
high edu woman		0.058		0.105
		(0.125)		(0.126)
woman edu higher than men		-0.021		-0.108
		(0.098)		(0.095)
woman edu lower than men		-0.023		-0.114

		(0.105)		(0.093)
woman self-employed		0.217*		0.113
		(0.123)		(0.119)
woman not employed		0.037		0.099
		(0.091)		(0.076)
man self-employed		0.203**		-0.026
		(0.089)		(0.081)
man not employed		0.133		0.169
		(0.199)		(0.169)
total income (log)		0.034		0.014
		(0.028)		(0.027)
woman is household head	-0.296***	-0.255**	-0.171*	-0.162*
	(0.097)	(0.100)	(0.094)	(0.098)
Central Italy	-0.127	-0.145	-0.075	-0.082
	(0.102)	(0.103)	(0.084)	(0.085)
Southern Italy	-0.149*	-0.155*	-0.128	-0.163*
	(0.085)	(0.092)	(0.078)	(0.084)
rank	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.517***	-0.866***	-0.325*	-0.467
	(0.182)	(0.331)	(0.170)	(0.315)
N	1272	1272	2542	2542

Note: All models also include year of survey fixed effects. *** p<0.001; ** p < 0.01; * 0.05.

Figure A.1 – Robustness check: Arrow-Pratt measure of risk tolerance.



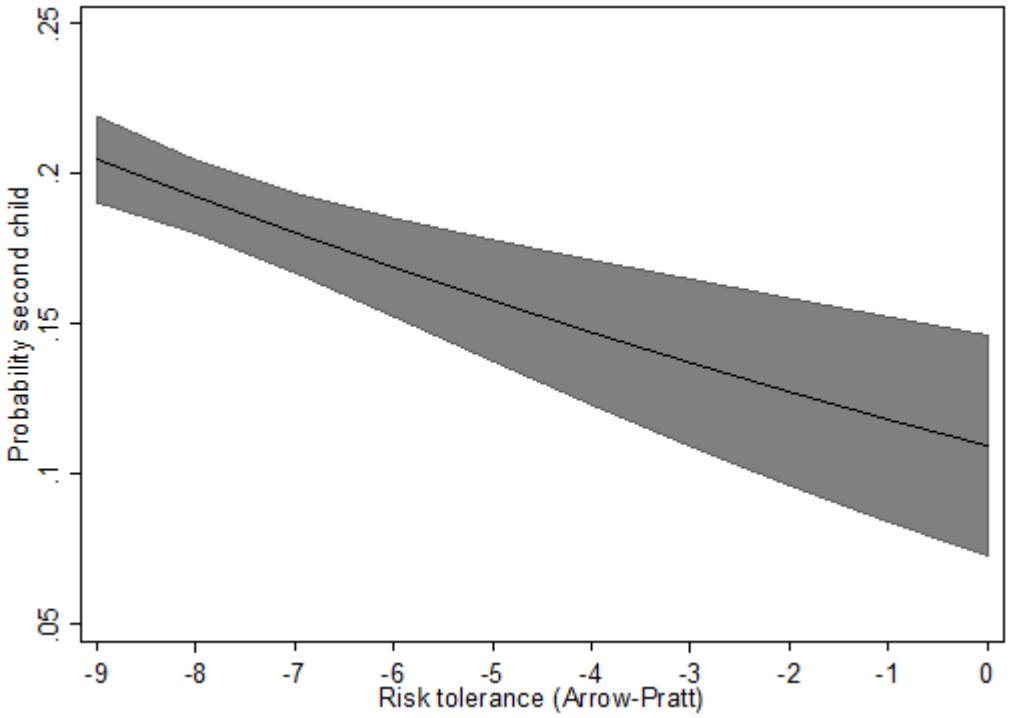
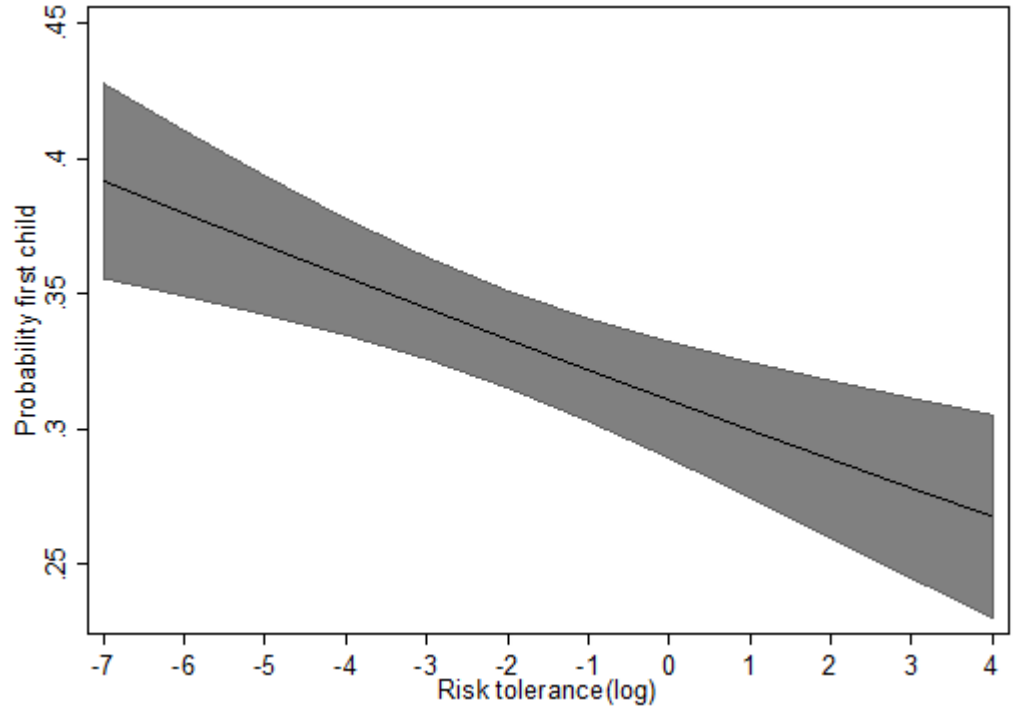


Figure A.2 – Robustness check: Logarithmic transformation of risk tolerance.



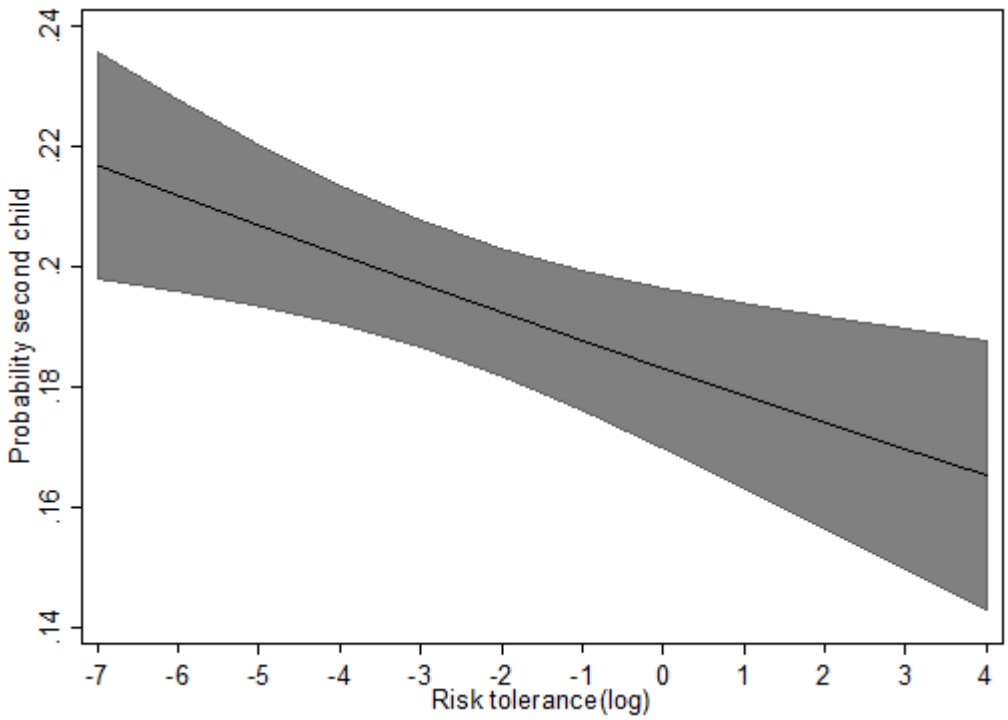


Figure A.3 – Robustness check: Excluding those betting 0 (bet = 0).

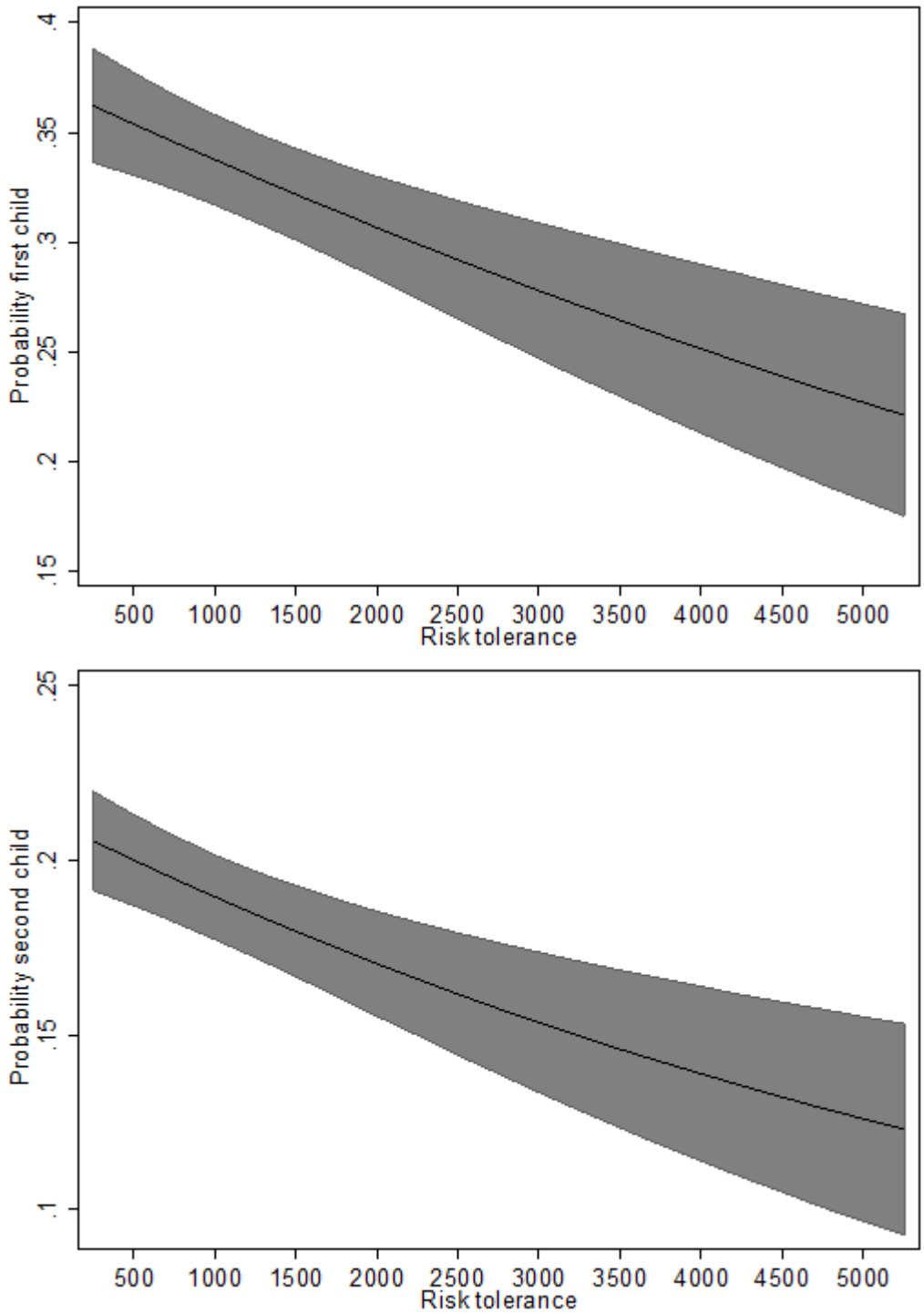


Figure A.4 – Robustness check: Adjusting for non-response bias.

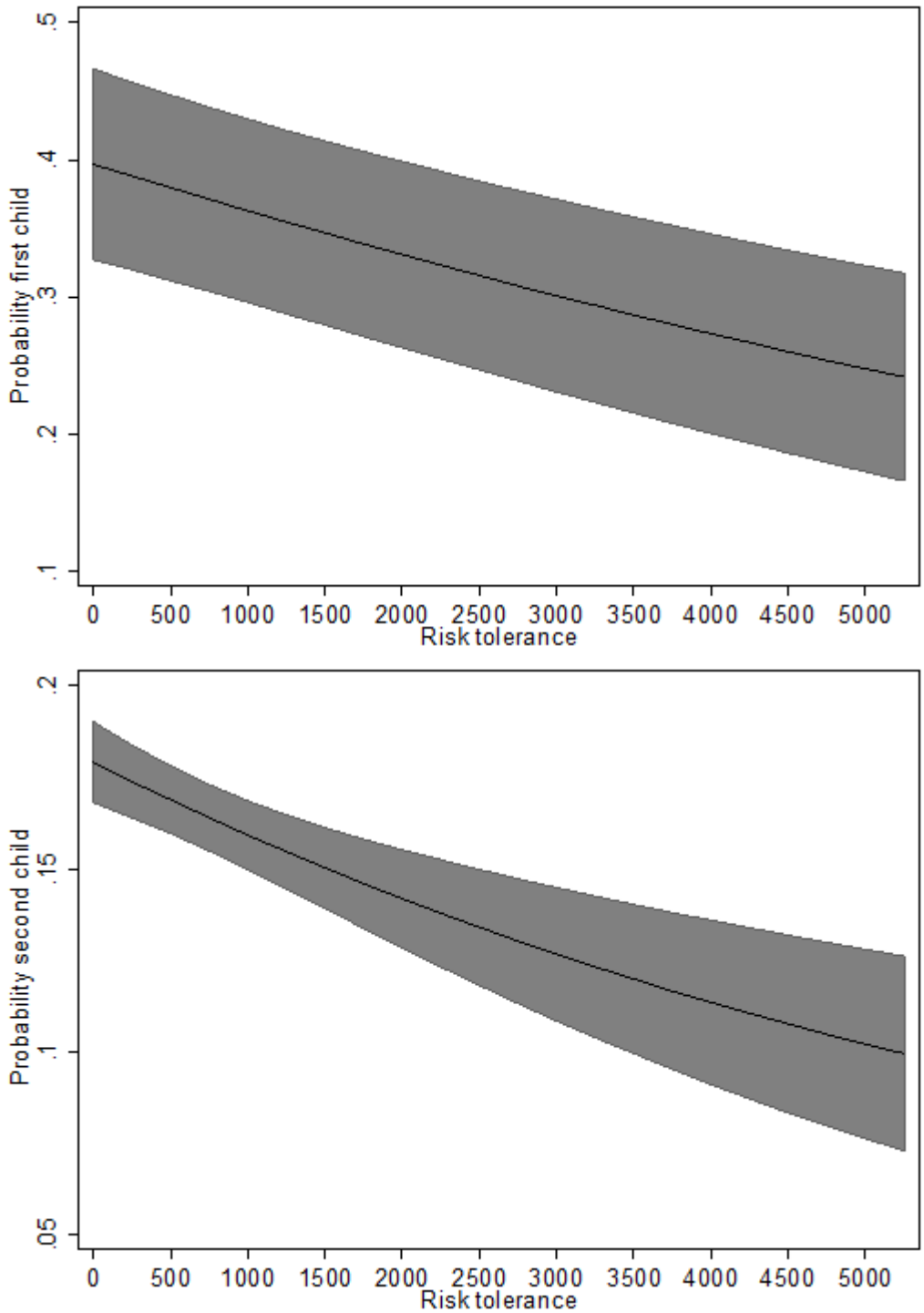
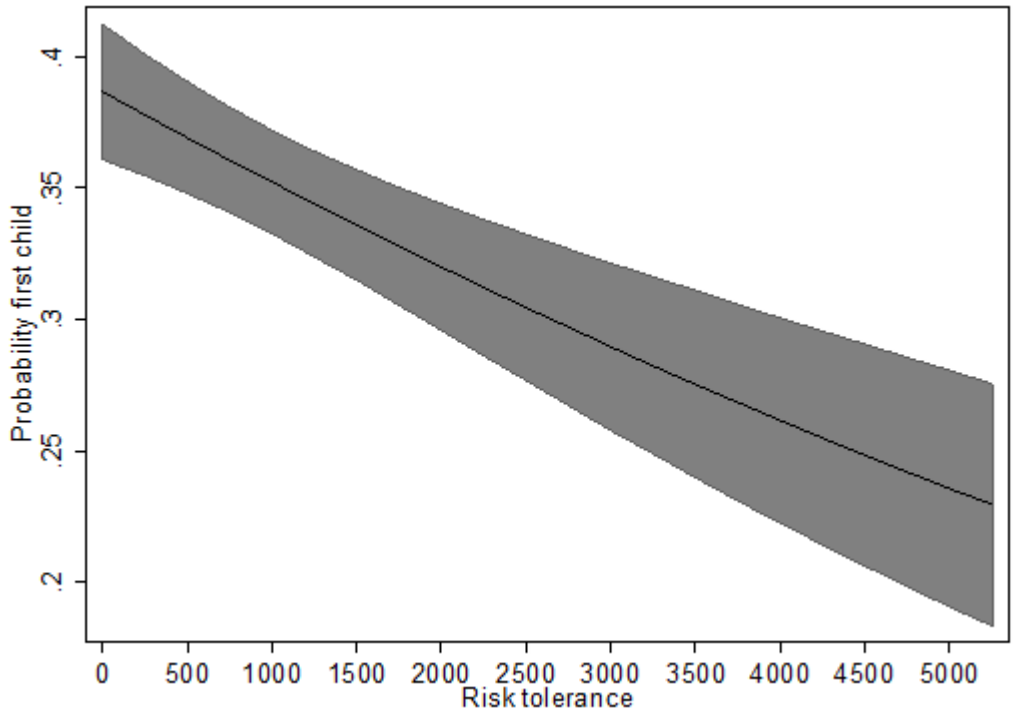


Figure A.5 – Robustness check: Keeping only male respondents.



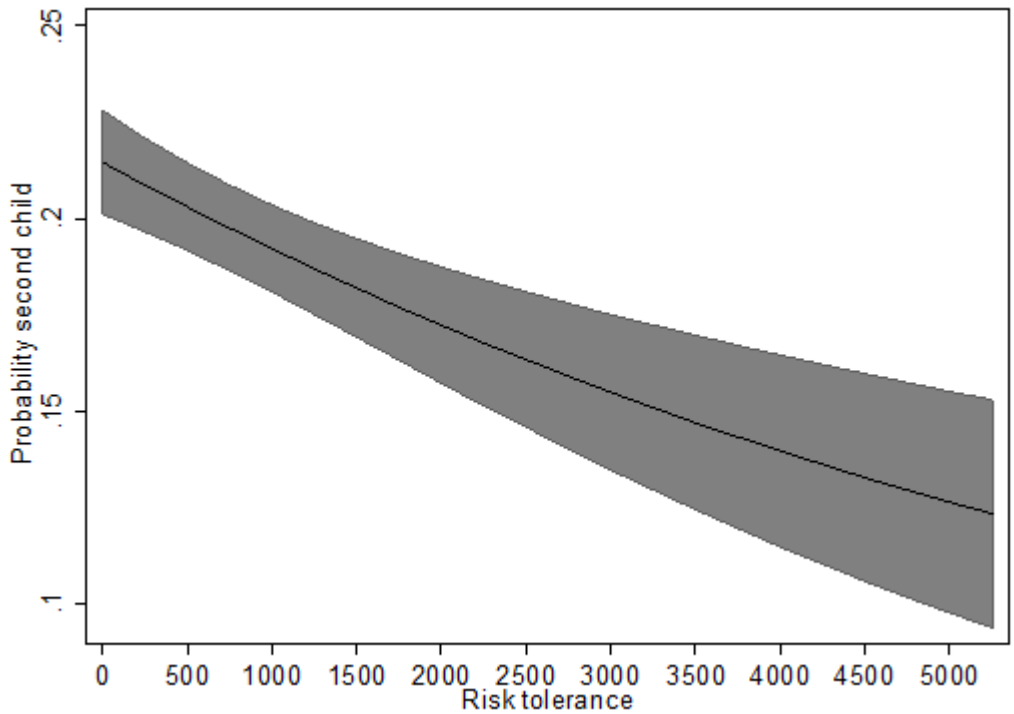


Figure A.6 – Robustness check: Keeping only observations for which risk tolerance is measured before childbearing events.

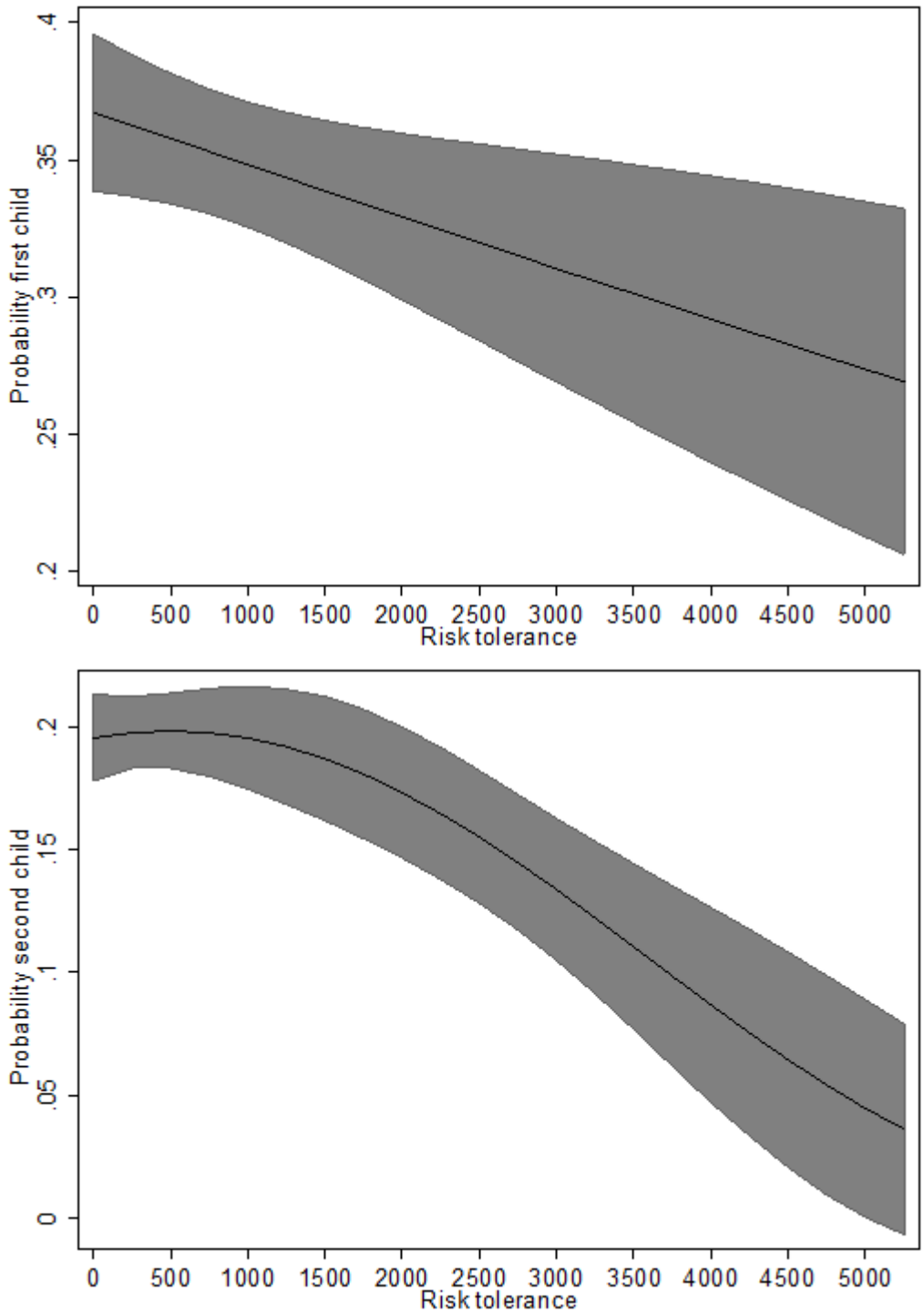


Figure A.7 – Robustness check: Adjusting also for household consumption and liquidity constraints.

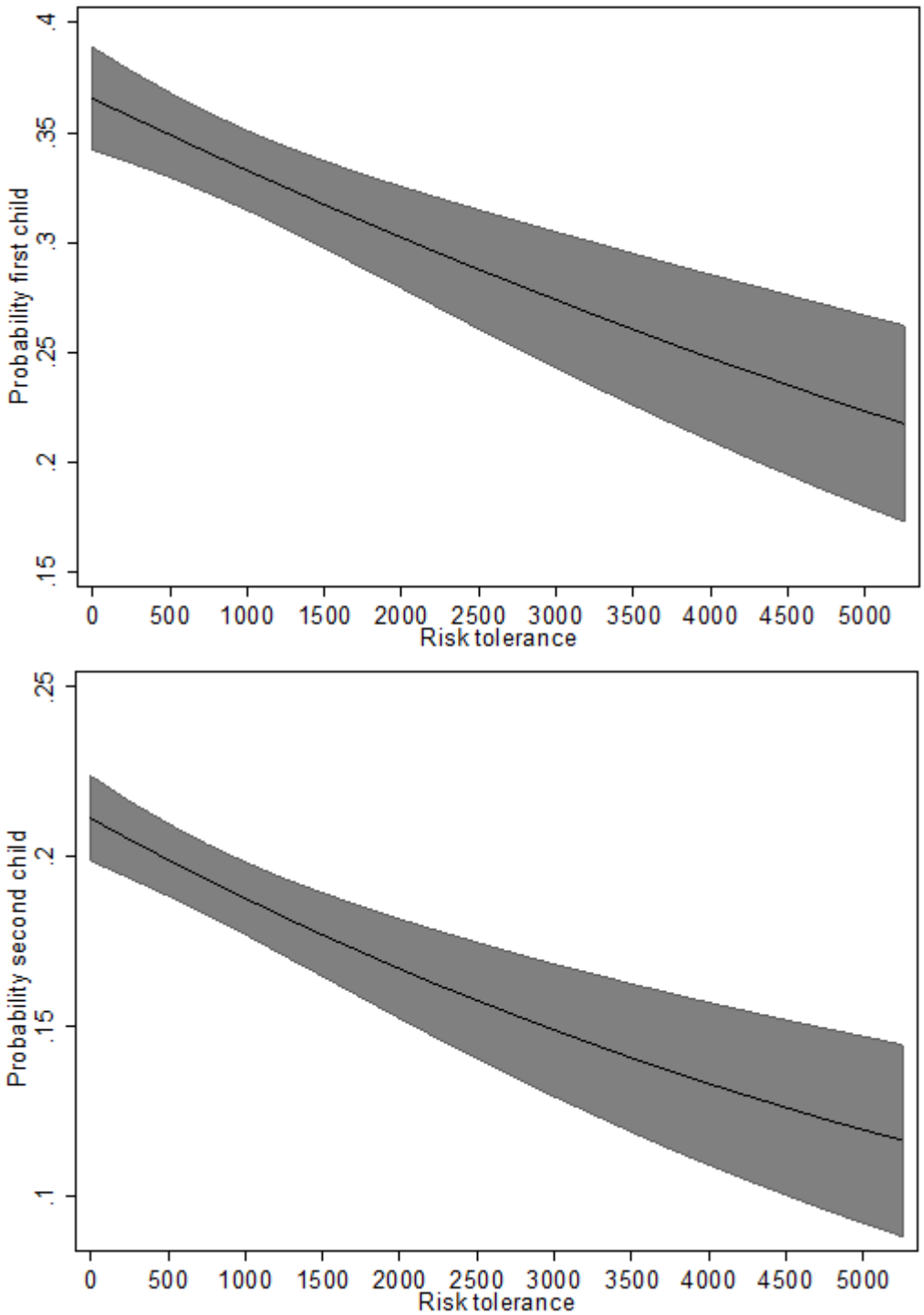


Figure A.8 – Robustness check: Adjusting for measurement error in risk tolerance.