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ABSTRACT

Given that risk attitudes influence many decisions, it is important to understand the factors that shape such attitudes in late adulthood, when individuals face important risky decisions. While research finds that parenthood tends to correlate with lower risk tolerance in western countries, there is a lacuna on whether such associations persist in late adulthood, and are applicable to the Asian context, where children are conventionally considered a linchpin of old age support. Data for middle aged and older individuals come from the nationwide Singapore Life Panel (N = 6,740). Multivariate statistical analyses are employed to estimate the associations between willingness to take risks (in the general, financial, and health domains) with parenthood status and the number of children. We control for potential confounders and employ a two-stage least squares approach to mitigate potential selection issues. Older mothers tend to be less risk tolerant than older childless women across the three risk domains. Conversely, mothers with more children tend to be more risk tolerant compared to mothers with fewer children. There is no evidence that older men's risk attitudes vary with parenthood status and family size.

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INTRODUCTION

Middle aged and older individuals often face risky decisions concerning their future finances and healthcare. Risk refers to the probability of occurrence of an undesired outcome that has the potential to significantly impact upon an individual's well-being (Olofsson & Zinn, 2019). How individuals react to high-stakes situations (e.g., choosing a financial investment for future retirement) is shaped by their orientation towards risk taking, which can range from risk aversion to risk seeking (Dohmen et al. 2011; Dohmen et al. 2017; Weber et al, 2002). Existing research has examined how various demographic and socioeconomic attributes such as age, gender, education, and wealth may influence risk perception (Chaulk et al., 2003). Importantly, a few studies have found parenthood to be associated with lowered risk tolerance, although evidence remains mixed regarding whether such associations persist into old age (Görlitz & Tamm, 2020; Kendig et al., 2007).

Understanding how the risk attitudes of middle aged and older adults relate to children is important for several reasons. At the micro level, risk attitudes play an important role in decision-making of men and women regarding finance and healthcare planning, which can in turn influence one's later-life well-being (Dohmen et al., 2011; Roalf et al., 2012). This may be particularly pertinent in the context of Asia, where many countries in the region are experiencing very low fertility levels and rapid population aging. At the macro level, cohort differences in risk attitudes (e.g., older persons tend to be more risk averse and thus make less financial investments than younger individuals) can contribute to the long-standing discussions regarding the extent to which population aging may dampen economic growth (Dohmen et al., 2017; Rolison et al., 2014).

To date, much of the literature on risk attitudes has been derived exclusively from western settings. Conversely, there is a lacuna in the literature about the predictors of risk attitudes among middle aged and older adults in Asian societies, where adult children are still considered a linchpin of old-age support and transfers tend to flow from children to older parents (Cai et al., 2006; Ho, 2019; Oliveira, 2016). Moreover, it remains largely unknown how risk attitudes may be shaped by parenthood (having at least one child) and family size (the total number of children), and whether these two margins (parenthood status and family size) may have different implications for the risk attitudes of women and men. The present study contributes to the literature by examining the following research questions in an Asian context: Do the risk attitudes of middle aged and older adults vary by parenthood status? Conditional on parenthood, do middle aged and older parents' risk attitudes vary by family size? Does the responsiveness of risk attitudes vary by the gender of middle aged and older adults?

To address these questions we make use of a nationwide dataset of middle aged and older adults in Singapore and employ multivariate analyses to estimate the associations between willingness to take risks (in the general, financial, and health domains) with parenthood status and family size. Singapore offers a compelling setting for this research inquiry, as it has one of Asia's highest rates of population aging and lowest rates of fertility. The country's share of population aged 65 and older is projected to reach 33% by 2050, while its total fertility rate was 1.10 in 2020 (Asian Development Bank, 2021; Department of Statistics, 2021). The vast majority of Singaporeans are of Chinese ethnicity while the remaining minority tend to be of other Asian descent (Malays and Indians). Building on its traditional values of filial piety, Singapore emphasizes the importance of family as the basic unit of society, whereby adult children are considered a potentially crucial resource for older parents (Tan, 2012). There may thus be important associations between the risk attitudes of middle aged and older individuals and their parenthood status and family size, which in turn, may have important implications for individual and societal well-being.

BACKGROUND

Transformative theories have been utilized to explain how parenthood may be associated with one's appetite for risks. For instance, family development theory argues that individuals become less risk tolerant when they become parents (Chaulk et al., 2003). Experiencing different family life events can elicit changes in one's belief. In particular, parents may internalize the responsibilities that come with their parental roles, and thus take cautious steps to protect their resources and secure their children's future. Likewise, social control theory posits that parenthood is associated with a decline in one's appetite for risks since social relationships (e.g., parent-child relationship) generally motivate individuals to conform to social norms and shift away from deviant behaviors (Umberson, 1987). For example, parents may adopt healthy habits to set a good example for their children and to avoid situations that could threaten their own and their family members' health (Kerr et al., 2011). By and large, empirical evidence supports the notion that parenthood is associated with a decline in risk-taking across different risk domains such as finance and health (Chaulk et al., 2003; Dohmen et al., 2011; Kerr et al., 2011).

While these existing studies are illustrative, there are at least a few pertinent gaps in the literature. First, little is known about whether parents' lowered appetite for risks persist in middle and later life. Early parenting experiences may still be relevant to parents' well-being after children have grown up. Indeed, early life experiences are consistently shown to have long-term implications for well-being throughout middle and later life (Umberson et al., 2010). Nevertheless, it is still rather unclear whether parents' risk attitudes remain different from those of childless individuals in late adulthood. Even among the few existing studies, evidence has thus far been mixed. On the one hand, a recent study in Germany shows that parents become less risk tolerant after the birth of the first child but return to their original tolerance levels as the child grows older (Görlitz & Tamm, 2020). On the other hand, a crossnational study in Finland, Netherlands, and Australia suggests that parents aged 65 and older have lower risk appetites than non-parents as evidenced in their lower tendency to engage in risky health behaviors (Dyrkstra et al., 2007). Such conflicting evidence calls for further investigation into risk attitudes among parents and non-parents in late adulthood, when individuals face important risky decisions concerning their retirement and healthcare planning.

Another important research gap is that past studies tend to dismiss the distinction between parenthood status and family size and how these two aspects of past fertility may be differentially linked to risk attitudes. Parenthood captures the extensive margin of fertility achieved earlier in life upon becoming a parent and having at least one child. Meanwhile, family size captures the intensive margin of fertility achieved during the reproductive years, that is, the total number of children that one has. These two margins may associate differently with risk attitudes through a number of channels. For instance, as an important source of support to older parents in Confucian societies, children may provide compensatory private transfers to parents when the latter face adverse financial shocks (Cai et al., 2006). Indeed, as opposed to western societies, transfers tend to flow predominantly from adult children to older parents in Asia (Oliveira, 2016). Therefore, given the greater insurance value of a larger family size, older parents with more children may have a higher risk tolerance than their counterparts with fewer children. Conversely, if parents care about preserving their wealth so as to leave an inheritance to children (Angel & Mudrazija, 2011), then parents with larger families may exhibit lower risk tolerance than parents with smaller families.

Furthermore, published research rarely pay attention to whether motherhood and fatherhood are differentially linked to risk attitudes, even though gender differences in appetites for risks have been widely documented. For instance, women are less likely to make risky financial investments compared to their male counterparts (Charness & Gneezy, 2012;

Lee & Kim, 2017). Moreover, women are more likely to adopt beneficial health habits, including wearing seat belts and getting regular health checks (Hersch, 1996), whereas men have a greater tendency for tobacco and alcohol consumption as well as drug abuse (Bauer, Göhlmann & Sinning, 2007; Osborne et al., 2017; Park et al., 2021). Several explanations have been put forth to address gender differentials in risk appetites such as male-female differences in testosterone levels, socialization, and financial literacy (Almenberg & Dreber, 2015; Koh et al., 2018; Sapienza et al., 2009). Given these pertinent differences in risk attitudes among men and women, it is important to further explore how their risk attitudes may differentially vary by motherhood or fatherhood.

Our study advances the current literature to examine how past fertility (parenthood status and family size) is associated with later-life risk attitudes among middle aged and older women and men in Singapore. As parenthood is gendered in Singapore, with fathers typically engaged in the role of main breadwinner while mothers handle the lion's share of childcare (Ho & Myong, 2021), we expect to see significant gender differences in the responsiveness of risk attitudes to parenthood and family size. First, the associations between risk attitudes and parenthood may be dampened for men since they played a smaller role in caring for children compared to women. Second, mothers may appreciate the insurance value of children more than fathers, as they spent less time on the labor market and thus, have generally lower savings for retirement. This is particularly relevant in the Singapore context, where individuals have self-funded employment-based pension accounts to finance their own retirement. Risk attitudes of mothers may, therefore, associate more strongly with parenthood status and family size than those of fathers.

METHODS

Data

The Singapore Life Panel (SLP) is a nationwide longitudinal survey with around 8,000 Singaporeans aged in their 50s to 70s, and their spouse (Vaithianathan et al., 2018). A special module was included in March 2020, when respondents were additionally surveyed on their willingness to take risks. We focus on this wave, which has approximately 7,600 respondents. We limit the sample to Singaporeans aged 50 and above (≈ 94% of respondents) and who do not have any stepchildren (≈ 3% of respondents) since we are interested in comparing the risk attitudes of childless individuals to those of parents who are likely to have raised their own children. After additionally dropping observations with missing values (3% of respondents), we have an analytic sample of 6,740 individuals.

Measures of Risk Attitudes

Willingness to take risks are measured on a scale of 0 to 10 in the SLP. The exact questions for general, financial and health risks are respectively:

"Are you generally a person who tries to avoid taking risks or one who is fully prepared to take risks? Please rate yourself from 0 to 10, where 0 means 'not willing to take risks' and 10 means 'very willing to take risks'."

"Some people have different willingness to take risks, depending on the context and situation. On the same scale from 0 to 10, how willing are you to take risks when it comes to financial decisions, like saving and investments? Reminder: 0 means 'not willing to take risks' and 10 means 'very willing to take risks'."

"How about your health? How willing are you to take risks involving your health? Reminder: 0 means 'not willing to take risks' and 10 means 'very willing to take risks'."

Such measures have been validated in other high-income countries such as Germany (Dohmen et al., 2011). This type of framing has been shown to predict risk-taking behavior across various domains (Grund & Sliwka, 2010; Jaeger et al., 2010).

Appendix Figure A1 reports the distribution of risk attitudes across the three domains in the SLP. Despite some bunching at 0 and 5, risk attitudes vary widely over the entire scale, with mass distributed over the entire support. There are moderate to strong correlations across the three measures: $\rho = 0.46$ between willingness to take general and financial risks, $\rho = 0.83$ between willingness to take general and health risks, and $\rho = 0.47$ between willingness to take financial and health risks.

Empirical Strategy

Our main analyses employ ordinary least squares (OLS) models:

$$y_i = \beta_0 + \beta_1 Any\ Child_i + \beta_2 (Any\ Child_i \times Male_i) + \beta_3 No.of\ Children_i + \beta_4 (No.of\ Children_i \times Male_i) + \boldsymbol{\theta}'\boldsymbol{X_i} + \varepsilon_i, \quad (1)$$

where *y* denotes the willingness to take risks across the general, financial, and health domains on a scale of 0 to 10, and ε is an idiosyncratic error term. In sensitivity analyses, we also estimate probit models by transforming *y* into an indicator that takes a value of 1 if willingness to take risks is 5 or greater (see Appendix 1 for details).

To capture the associations between risk attitudes and parenthood status by gender of the respondent, we include an indicator of whether the respondent has any living children, *Any Child*, and its interaction with $Male$, an indicator of whether the respondent is male. The associations between willingness to take risks and parenthood status for women and men are represented by β_1 and $(\beta_1 + \beta_2)$, respectively. To capture the associations between risk attitudes and family size by gender of the respondent, we include the number of children that a respondent has, *No. of Children*, and its interaction with $Male$. Conditional on parenthood,

β_3 and $(\beta_3 + \beta_4)$ denote the change in willingness to take risks in the presence of an additional child for women and men, respectively.

We control for potential confounders in the vector **X**. For example, older individuals may be less risk tolerant and also have more children; so not controlling for age may lead to omitted variable bias. We therefore control for basic covariates: male (yes/no), a second order polynomial in age, Chinese ethnicity (yes/no), and district of residence indicators. We also control for additional covariates: currently married (yes/no), indicators for education (secondary, diploma, undergraduate, postgraduate), self-reported good health (yes/no) and household net wealth.

The additional covariates may mediate the effects of children on risk attitudes. For example, parents with more children may have spent more on raising them, such that they have lower wealth. In such case, wealth would mediate the effect of family size, leading to the problem of bad controls (Angrist & Pischke, 2009). We, therefore, estimate two specifications: one controlling for basic covariates only and another controlling for additional covariates as well. Standard errors are clustered at the family level to allow for correlation between spouses in both specifications.

We seek to shed further light on the potentially non-linear associations between risk attitudes and parity. To do so, we estimate the following OLS models:

$$y_i = \alpha_0 + \boldsymbol{\alpha_1}'\boldsymbol{Parity_i} + \boldsymbol{\alpha_2}'(\boldsymbol{Parity_i} \times Male_i) + \boldsymbol{\Gamma}'\boldsymbol{X_i} + u_i, \qquad (2)$$

where $\boldsymbol{Parity}$ is a vector of indicators for parity 1, 2, 3, and 4 or more children (with the reference category being parity 0) and u is an idiosyncratic error term. This specification enables full flexibility on how the number of children may influence the risk attitudes of parents relative to the risk attitudes of childless individuals. As before, we allow for the interaction between the male dummy and $\boldsymbol{Parity}$ to capture any differing associations between fertility and risk attitudes by gender of the respondent. Standard errors are clustered at the family level.

Selection and Endogeneity Issues

Since we focus on older individuals, parenthood status and family size are pre-determined in our context, while risk attitudes are captured in later life. Yet, later-life risk attitudes may correlate with risk attitudes earlier in life, which are unobserved. Indeed, the literature has long debated whether risk-taking represents an innate and stable personality trait or whether it is context specific (Rolison et al., 2014). If innate risk attitudes also affect fertility choices (Schmidt, 2008), then the error terms would correlate with parenthood status and family size, thereby leading to selection and endogeneity biases in OLS estimation. For example, if women with higher innate risk tolerance are less likely to use contraceptives and more likely to face unplanned births, then the estimated OLS associations between risk tolerance in late adulthood and parity would be overestimated.

To address such concerns, we perform two-stage least squares (2SLS) estimation following Lewbel (2012). This method exploits the information contained in the covariance of certain variables with the error terms and has gained traction in recent literature where weak or no external instruments are available (Breschi & Lenzi, 2016; Brown & Murthy, 2020; Millimet & Roy, 2016). In the presence of heteroscedasticity in the endogenous explanatory variables, constructed instruments based on the product of the centered values of **X** and of the predicted residuals from an OLS regression of the endogenous predictors on **X** can be valid instruments. 2SLS may then identify consistent estimates. In Appendix 2, we discuss selection issues and the 2SLS methodology in greater detail, and present evidence to support the validity of our constructed instruments.

RESULTS

Descriptive Statistics

Table 1 reports the demographic and socioeconomic characteristics of women and men, without and with children. 52.9% of the sample are female and among them, 15.5% are childless. Conversely, 47.1% of the sample are male and among them, 11.5% are childless. Conditional on having children, both mothers and fathers have 2.2 children on average.

Table 1 Demographic and Socio-Economic Characteristics

	Women			**Men**		
	Childless	Parent	Diff.	Childless	Parent	Diff.
Age	63.14	63.20	-0.06	62.57	64.55	-1.98^{***}
	(0.23)	(0.11)		(0.29)	(0.11)	
Chinese	0.90	0.87	0.03^{**}	0.92	0.88	0.04^{**}
	(0.01)	(0.01)		(0.01)	(0.01)	
Married	0.23	0.78	-0.55^{***}	0.45	0.94	-0.48^{***}
	(0.02)	(0.01)		(0.03)	(0.00)	
Secondary	0.49	0.45	0.04	0.43	0.39	0.04
	(0.02)	(0.01)		(0.03)	(0.01)	
Diploma	0.24	0.17	0.07^{***}	0.23	0.24	-0.02
	(0.02)	(0.01)		(0.02)	(0.01)	
Undergraduate	0.10	0.05	0.04^{***}	0.11	0.11	0.00
	(0.01)	(0.00)		(0.02)	(0.01)	
Postgraduate	0.07	0.03	0.04^{***}	0.08	0.07	0.01
	(0.01)	(0.00)		(0.01)	(0.00)	
Good health	0.62	0.61	0.01	0.51	0.63	-0.12^{***}
	(0.02)	(0.01)		(0.03)	(0.01)	
Net wealth	919.22	1,137.61	-218.39^{***}	1,619.86	1,375.22	244.64
(S$'000)	(46.29)	(29.35)		(563.91)	(81.23)	
N	553	3,014		365	2,808	

Notes: Means or proportions and standard errors (in parentheses). Two-tailed t-test of differences between those without and with children are reported. $^{*}p<.10$, $^{**}p<.05$, $^{***}p<.01$.

From Table 1, women and men are in their early 60s on average. Two-tailed t-test of differences in means show that there are no statistically significant differences in age between childless women and mothers, while childless men tend to be slightly younger than fathers. For both genders, those who are childless are more likely to be of Chinese ethnicity (compared to Malays, Indians and others) and much less likely to be currently married (compared to never married, divorced, widowed and separated).

Highly educated women are more likely to be childless, while there are no statistically significant differences in education between childless men and fathers. Whereas there are no statistically significant differences in self-reported health between childless women and mothers, childless men tend to report worse health than fathers. Conversely, childless women tend to be less wealthy than mothers while there are no statistically significant differences in net household wealth between childless men and fathers.

Table 2 Descriptive Statistics on Willingness to Take Risks (0-10)

	Women			**Men**		
	Childless	Parent	Diff.	Childless	Parent	Diff.
General risk	3.33	2.91	0.42***	3.87	3.81	0.06
	(0.12)	(0.05)		(0.14)	(0.50)	
Financial risk	3.13	2.79	0.34***	3.65	3.65	-0.01
	(0.11)	(0.05)		(0.14)	(0.05)	
Health risk	2.66	2.39	0.28**	3.22	2.87	0.35**
	(0.12)	(0.05)		(0.15)	(0.05)	
N	553	3,014		365	2,808	

Notes: Means and standard errors (in parentheses). Two-tailed t-test of differences between those without and with children are reported. *p<.10, **p<.05, ***p<.01.

Table 2 reports descriptive statistics on the willingness to take risks by gender and parenthood status. Middle aged and older Singaporeans have relatively low risk tolerance, with average willingness to take risks ranging from 2.39 to 3.87 (out of 10). Two-tailed t-tests of differences in mean willingness to take risks between childless individuals and parents are more striking for women than for men. Mothers are less risk tolerant than childless women across all three risk domains: general, financial, and health. Conversely, fathers are less risk tolerant than childless men only concerning health, while there are no statistically significant differences in the willingness to take general or financial risks.

Associations Between Risk Attitudes and Parenthood and Family Size

Tables 3 reports the associations between the risk attitudes and parenthood and family size from OLS estimation of (1). The results when controlling for basic covariates only are similar to the results when controlling for both basic and additional covariates. In terms of parenthood status, captured by *Any Child*, mothers are less willing to take risks compared to childless women by around 18% to 22% for general and financial risks and 30% for health risks. The percentages are computed as the absolute value of the estimated coefficients divided by the outcome means, $\bar{y}$, times 100. Conversely, men's risk attitudes are much less responsive to parenthood status compared to women's. Whereas the estimated marginal effects are negative across all risk domains, they are statistically insignificant at the 5% level.

Turning our attention to the associations between risk attitudes and the number of children, we find that an additional child increases mothers' willingness to take risk by around 3.8% to 4.5% for general risks, 4.7% to 5.5% for financial risks, and 7.9% for health risks. Conversely, fathers' risk attitudes are much less responsive to family size compared to mothers'. Whereas the estimated marginal effects are positive for general and financial risks for fathers, they are not statistically significant at the 5% level.

In terms of other covariates, we find that women are less willing to take risks than men across all three risk domains, and that higher education, better self-reported health and greater household net wealth are associated with higher willingness to take risks in the general and financial domains. We do not find any significant association of risk attitudes with age while there is some indication that those of Chinese ethnicity are less willing to take risks in terms of their health.

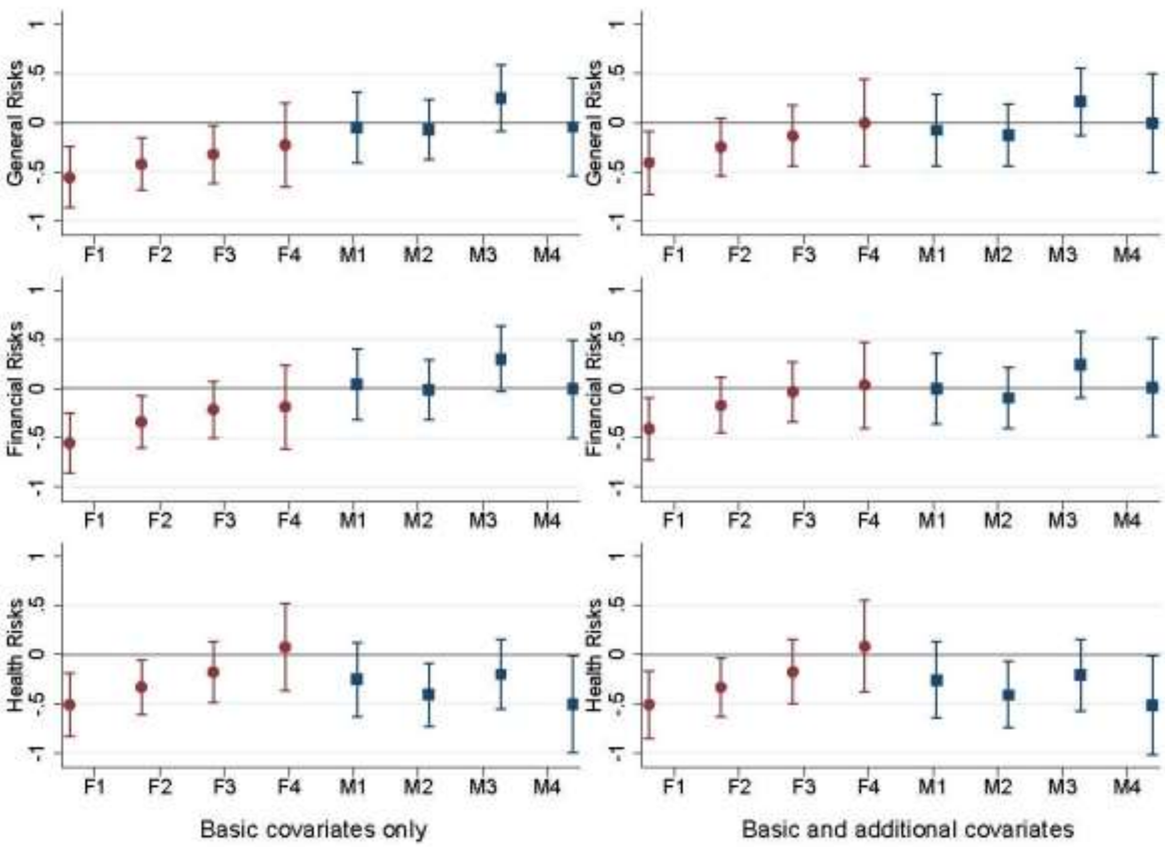
Table 3 Associations Between Risk Attitudes and Parenthood and Family Size

	Willingness to Take Risks (0-10)					
	General risks		Financial risks		Health risks	
	(1)	(2)	(3)	(4)	(5)	(6)
Women						
Any child	-0.659***	-0.529***	-0.638***	-0.517***	-0.724***	-0.725***
	(0.175)	(0.180)	(0.173)	(0.177)	(0.182)	(0.191)
# children	0.113**	0.133**	0.135**	0.157***	0.191***	0.193***
	(0.054)	(0.054)	(0.054)	(0.053)	(0.056)	(0.057)
Men						
Any child	-0.189	-0.255	-0.105	-0.195	-0.321	-0.323
	(0.199)	(0.201)	(0.200)	(0.201)	(0.207)	(0.213)
# children	0.094	0.105*	0.084	0.095	-0.004	-0.006
	(0.061)	(0.060)	(0.061)	(0.061)	(0.062)	(0.062)
Covariates						
Male	0.526***	0.539***	0.501***	0.510***	0.536***	0.548***
	(0.182)	(0.181)	(0.181)	(0.178)	(0.191)	(0.193)
Age	0.089	0.080	0.091	0.080	0.029	0.031
	(0.092)	(0.091)	(0.090)	(0.088)	(0.093)	(0.093)
Age squared	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Chinese	0.053	0.070	0.041	0.059	-0.355***	-0.350***
	(0.110)	(0.110)	(0.106)	(0.106)	(0.110)	(0.111)
Married		-0.023		0.013		0.007
		(0.091)		(0.090)		(0.095)
Secondary		0.245***		0.279***		0.045
		(0.088)		(0.085)		(0.091)
Diploma		0.847***		0.915***		0.056
		(0.101)		(0.099)		(0.106)
Undergraduate		1.216***		1.277***		-0.144
		(0.130)		(0.128)		(0.135)
Postgraduate		1.382***		1.490***		0.061
		(0.142)		(0.145)		(0.154)
Good health		0.420***		0.489***		0.020
		(0.065)		(0.064)		(0.068)
Net wealth		0.000***		0.000***		-0.000
(S$'000)		(0.000)		(0.000)		(0.000)
R-squared	0.04	0.08	0.04	0.08	0.02	0.02
$\bar{y}$ for women	2.976	2.976	2.844	2.844	2.429	2.429
$\bar{y}$ for men	3.918	3.918	3.654	3.654	2.907	2.907
N	6,740	6,740	6,740	6,740	6,740	6,740

Notes: Estimated marginal effects and clustered standard errors (in parentheses) are reported. Controls further include district dummies across all specifications. $\bar{y}$ denotes the mean of the dependent variable. *p<.10, **p<.05, ***p<.01.

Figure 1 reports the estimated associations between the willingness to take risks and parity from OLS estimation of (2). The results corroborate the above findings: Women's risk attitudes (circles) are generally more responsive than men's (squares). Mothers with one child are less willing to take risks compared to childless women across the three domains. The pattern of greater risk tolerance as mothers have more children seems present, although the differences are not statistically significant at the 5% level across most parities. In particular, parenthood seems to associate with lower willingness to take risks. However, as a mother has more children, her willingness to take risk gets closer and closer to that of a childless woman.

Figure 1 Associations Between Risk Attitudes and Parity



Notes: Estimated marginal effects and 95% confidence intervals are reported. The circles represent associations for females and the squares represent the associations for males. F1 to F4 denote parity 1 to 4+ children for females and M1 to M4 denote parity 1 to 4+ for males. Parity 0 is the reference category: the estimates denote the associations between willingness to take risks and parity relative to the childless. Basic covariates are controlled for in the panels on the left. Additional covariates are also controlled for in the panels on the right.

Sensitivity Analyses

Appendices 1 and 2 report results from probit and 2SLS models, respectively. The associations are qualitatively similar to those reported in Table 3, which provides further confidence in the main results. In particular, the findings that mothers are less willing to take risks than childless women but that mothers' willingness to take risks seem to increase in family size are robust across all specifications.

CONCLUSION

Based on multivariate analyses on a nationwide survey of middle aged and older Singaporeans, we find that women are less willing to take risks when they have children but that mothers are more willing to take risks when they have more children. In particular, the associations between willingness to take risks and parity seem to follow a U-shaped pattern relative to the childless: at low parity, mothers have lower tolerance towards risk than childless women (risk tolerance decreases from parity 0 to 1), while mothers' risk tolerance increases and converges to that of childless women at higher parity (risk tolerance increases from parity 1 onwards). The results hold across the general, financial, and health risk domains. Conversely, there is no evidence that middle aged and older men's risk attitudes respond to parenthood status and family size.

The findings that parenthood status is associated with lower risk tolerance in Singapore align with findings from the literature on western societies (Chaulk et al., 2003; Dohmen et al., 2011; Görlitz & Tamm, 2020; Kerr et al., 2011). Extending that literature, our results indicate that the lower risk tolerance associated with parenthood may persist into later adulthood among women (but not men) in the Singapore context. The findings are largely consistent with transformative theories combined with gendered social norms. Since women go through the birthing process and bear the lion's share of child care, they tend to internalize the influences of parenthood to a greater extent than men such that these influences persist into middle and older adulthood for women but not for men.

We further find that as a mother has more children, her willingness to take risks increases until it becomes similar to that of a childless woman. This is consistent with evidence from published literature that posits that children potentially serve as a form of insurance for older parents (Cai et al., 2006; Ho, 2019; Oliveira, 2016). Mothers may have sacrificed their economic opportunities earlier in life to take care of children and thus have lower retirement savings than fathers. Indeed, t-test of differences in means reveal that while childless Singaporean men and women had comparable balances in their individual pension accounts, fathers' pension accounts are on average twice larger than those of mothers. So, while fathers might be able to rely on their higher retirement savings, mothers may need to depend more on children. The number of children may, therefore, be particularly important as a form of insurance for older mothers in societies such as Singapore that rely heavily on self-funded individual retirement accounts.

Limitations

Our inferences are tempered by a few limitations. First, self-reported willingness to take risks may not necessarily capture risk perceptions or be reflected in risk behavior. Self-reported measures (Weber et al., 2002) and experimental measures (Liu, 2013) are common in the literature, although there is a lack of consensus regarding which measures best capture risk preferences (Anderson & Mellor, 2009). There is also mixed evidence on the associations between self-reported measures and risk behavior (Lönnqvist et al., 2015). Nevertheless, domain-specific self-assessment of risk attitudes exhibits greater ability to predict actual risky behavior. For instance, Dohmen et al. (2011) find that while the survey question on willingness to take general risks was a strong predictor of risky behavior in financial and health decisions, the survey question on willingness to take risks in financial matters was the best predictor of stock investment, while the survey question on willingness to take risks in health matters was the best predictor of smoking behavior. Measures of risk attitudes have been shown to predict risk-taking behavior across several domains (Grund & Sliwka, 2010; Jaeger et al., 2010).

Second, while our study reveals nuanced relationships between parenthood status, family size, and risk attitudes among middle aged and older adults, data limitation does not permit us to examine different pathways to fertility (such as unplanned births, miscarriages, early childhood environment, and occupational choice) that may influence such relationships. Furthermore, we could not study how other social aspects of aging (such as early retirement and early widowhood) may interact with past fertility to affect risk attitudes. Nevertheless, our study provides a first step towards understanding the potential ties between fertility and risk attitudes in later adulthood in an Asian context. It also highlights the differential associations between risk attitudes and fertility at the extensive and intensive margins (parenthood and family size). Finally, the study is among the first to provide evidence of gender differences in the associations between risk attitudes and parenthood (motherhood and fatherhood). Future research with a more comprehensive data set (e.g., including marital, fertility, and occupational histories) could explore a more complex research inquiry based on the life course framework and transformative theories.

Implications

Our study highlights how parenthood status and family size associate with risk attitudes of middle aged and older individuals in an Asian context. Whereas parenthood entails a major transition earlier in life, its influence later in life may have important implications for understanding the well-being of the older population. Similarly, the insurance value of a greater number of children may help compensate mothers for their labor market opportunity cost and time spent raising children. Altogether, our findings suggest that the decreased risk tolerance associated with motherhood may be partially offset when mothers have more children. As discussed above, the results seem consistent with transformative theories combined with gendered social norms in a society where retirement savings are predominantly self-funded and supplemented by filial support.

This study may have several implications for understanding individual and societal well-being in the context of rapidly falling fertility and population aging. At the individual level, it demonstrates potentially persistent motherhood penalty in an additional dimension that goes beyond loss of earnings and career opportunities explored extensively in the literature (Adda et al., 2017): lower risk tolerance. It is well known that a certain degree of risk tolerance is important to promote investment and grow one's assets (Pålsson, 1996). The lower risk tolerance among mothers may thus exacerbate the inequalities between the later-life financial well-being of non-mothers (fathers and childless women) and mothers beyond their differences in lifetime earnings.

At the societal level, two forces may be at play in influencing the aggregate risk profiles of the older population. On the one hand, the rising number of childless individuals may associate with greater aggregate risk tolerance. On the other hand, the falling number of children that parents have may associate with lower aggregate risk tolerance. If the first force dominates, then higher aggregate risk tolerance may help promote investments and economic growth. The converse holds if the second force dominates. Our study, therefore, extends existing debates on the potential negative impacts that population aging has on economic growth due to a declining workforce (Börsch-Supan et al., 2021; Otsu & Shibayama, 2016; Temple & McDonald, 2017). In particular, the economy may be indirectly affected through changing risk appetites as the population ages and fertility declines. For instance, a decrease in risk tolerance has the potential to increase the price of risk capital and consequently discourage investment in high risk projects, which may dampen economic growth (Pålsson, 1996). Given the changing demographics, it is crucial to understand the factors that could potentially drive aggregate risk-taking in the population to inform the design of age and gender appropriate policies related to, for instance, pension instruments. We leave these interesting considerations for future research.

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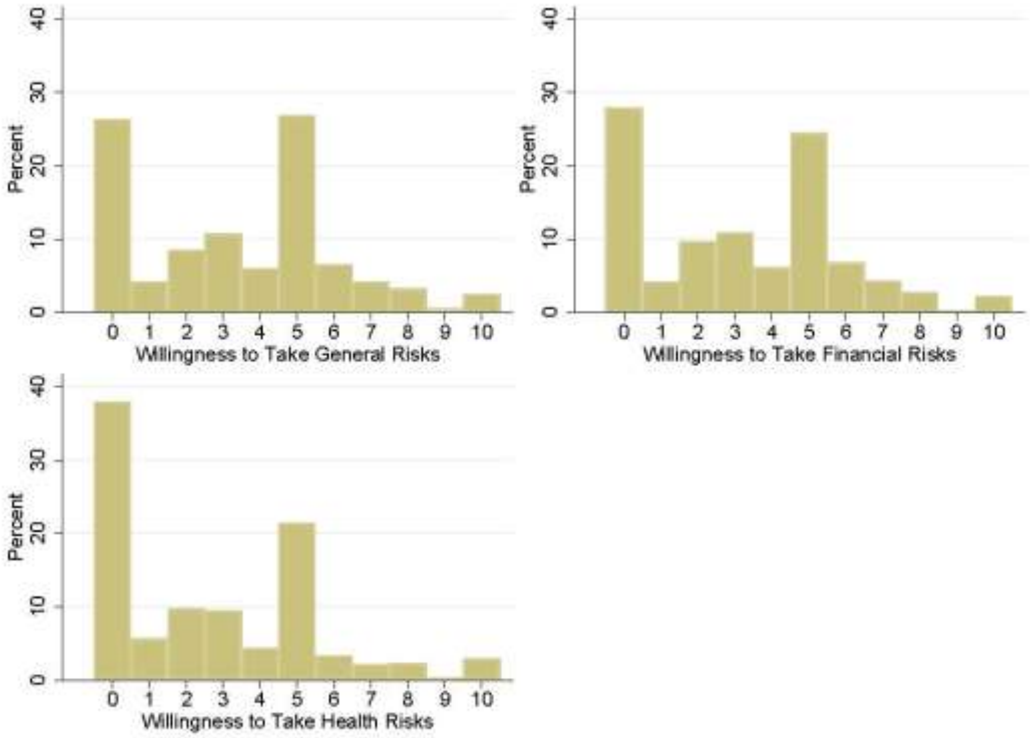
APPENDIX 1

Figure A1 Distribution of Willingness to Take Risks



As many respondents reported willingness to take risks of 0 or 5, we also estimate probit models. Recall the OLS model (1):

$$y_i = \beta_0 + \beta_1 Any\ Child_i + \beta_2(Any\ Child_i \times Male_i) + \beta_3 No.of\ Children_i + \beta_4(No.of\ Children_i \times Male_i) + \boldsymbol{\theta}'\boldsymbol{X_i} + \varepsilon_i.$$

The probit model uses a binary dependent variable and assumes that the error component follows a normal distribution:

$$y_i^* = \begin{cases} 1 & if\ y_i \geq 5 \\ 0 & otherwise. \end{cases}$$

Denote Φ as the normal cumulative density function and ϕ as the probability density function. Let $\boldsymbol{\Omega}'\boldsymbol{C}$ be the vector of all covariates in (1) including the main predictors and **X**. The average partial effects (APE) of parenthood status for women and men, are given by $\frac{1}{N}\sum_i[\Phi(\boldsymbol{\Omega}'\boldsymbol{C_i}\ |Any\ Child = 1, Male = 0) - \Phi(\boldsymbol{\Omega}'\boldsymbol{C_i}\ |Any\ Child = 0, Male = 0)]$ and

$\frac{1}{N}\sum_i[\Phi(\boldsymbol{\Omega}'\boldsymbol{C_i} \ |Any\ Child = 1, Male = 1) - \Phi(\boldsymbol{\Omega}'\boldsymbol{C_i} \ |Any\ Child = 0, Male = 1)]$,

respectively. Conditional on parenthood, $\beta_3 \frac{1}{N}\sum_i \phi(\boldsymbol{\Omega}'\boldsymbol{C_i})$ and $(\beta_3 + \beta_4)\frac{1}{N}\sum_i \phi(\boldsymbol{\Omega}'\boldsymbol{C_i})$ now denote the change in willingness to take risks in the presence of an additional child for women and men, respectively. The APE are reported in Table A1. Standard errors for the APE are computed using the delta method and are clustered at the family level

Table A1 Average Partial Effects from Probit Models

	y = 1 if Willingness to Take Risks ≥ 5; y = 0 otherwise					
	General risks		Financial risks		Health risks	
	(1)	(2)	(3)	(4)	(5)	(6)
Women						
Any child	-0.108***	-0.082**	-0.092***	-0.068**	-0.125***	-0.124***
	(0.032)	(0.033)	(0.032)	(0.032)	(0.031)	(0.031)
# children	0.024**	0.026***	0.024**	0.026***	0.039***	0.037***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
Men						
Any child	-0.024	-0.027	0.001	-0.008	-0.035	-0.032
	(0.036)	(0.037)	(0.035)	(0.037)	(0.034)	(0.036)
# children	0.011	0.012	0.006	0.008	-0.007	-0.008
	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)
Covariates						
Basic	x	x	x	x	x	x
Additional		x		x		x
Pseudo-R^2	0.02	0.05	0.02	0.06	0.01	0.02
N	6,740	6,740	6,740	6,740	6,740	6,740

Notes: Average partial effects and clustered standard errors (in parentheses) are reported. Controls further include district dummies across all specifications. *p<.10, **p<.05, ***p<.01.

The probit estimates displayed in Table A1 are in line with the OLS estimates from Table 3. In particular, mothers are less willing to take risks relative to childless women, even though each additional child is associated with a higher willingness to take risks among mothers. Neither fatherhood nor the number of children are significantly associated with men’s willingness to take risks.

APPENDIX 2

Unobserved innate risk attitudes may drive both willingness to take risks in late adulthood and fertility so that ε in Model (1) may correlate with parenthood status and family size, thereby leading to selection and endogeneity biases. A common econometric method of addressing such biases is through the use of instrumental variables. In standard two-stage least squares (2SLS) models, one would need at least two external instruments (and their interactions with *Male*) to instrument for *Any Child* and *No. of Children* (and their interactions with *Male*). The external instruments need to satisfy the exclusion restriction that they correlate with the endogenous variables but do not directly affect the dependent variable.

A major challenge in the context of this study is the lack of plausible external instruments. Whereas the literature has used gender of the first-born child or the presence of first-born twins as instruments for family size in other contexts, it is hard to argue that these would not directly affect risk attitudes in our context. We have explored population policies such as the legalization of abortion and the introduction of baby bonus in Singapore as potential instruments. However, such policies affect everyone simultaneously such that they may also correlate with cohort effects, which in turn may correlate with risk attitudes.

Given the lack of plausible external instruments, we perform 2SLS estimation following the method proposed by Lewbel (2012). This estimator replaces traditional exclusion restrictions with assumptions about the covariance of certain variables with the error terms. In other words, it exploits information contained in the heteroscedasticity of the error terms of the endogenous predictors. Consider the following (reduced-form) equations for the endogenous covariates:

$$f_i = \mathbf{\Psi}'\boldsymbol{X_i} + \eta_i \qquad \text{(A1)}$$

where f_i = {*Any Child, No. of Children, Any Child* x *Male, No. of Children* x *Male*}. The control variables, $\boldsymbol{X}$, are as defined above.

Let $\boldsymbol{Z} = \boldsymbol{X}$ be a vector of covariates that are uncorrelated with ε. In the presence of heteroscedastic error term, η, using $(\boldsymbol{Z} - \overline{\boldsymbol{Z}})\hat{\eta}$ as instruments for *f* would yield consistent estimates of the βs, where $\overline{\boldsymbol{Z}}$ is the sample mean of $\boldsymbol{Z}$ and $\hat{\eta}$ denote the predicted residuals from OLS regression of (A1). 2SLS estimation can then be applied: In the first stage, regress *f* on **X** and $(\boldsymbol{Z} - \overline{\boldsymbol{Z}})\hat{\eta}$ and predict $\hat{f}$; and in the second stage, regress *y* on the predicted $\hat{f}$ and **X** (*ivreg2h* command in STATA version 17).

More formally, identification requires that $cov(\boldsymbol{Z}, \varepsilon\, \eta) = 0$ and $cov(\boldsymbol{Z}, \eta^2) \neq 0$. Assumption $cov(\boldsymbol{Z}, \varepsilon\, \eta) = 0$ implies that the covariates **Z**, which are used to construct the instruments, are uncorrelated with the product of heteroscedastic errors. Assumption $cov(\boldsymbol{Z}, \eta^2) \neq 0$ implies that η is heteroscedastic with respect to **Z**. Lewbel (2012) shows that the assumptions are satisfied in models in which the correlation of errors is due to an unobserved common characteristic. Moreover, the larger the degree of heteroscedasticity, the more strongly the likely correlation of the instruments with the endogenous predictors.

From Table A2, Breusch-Pagan tests of heteroscedasticity always reject the homoscedasticity of η in (A1) at the 1% statistical level. To provide further confidence in the validity of the constructed instruments, we conduct Hansen overidentification tests and Kleibergen Papp Wald rk tests. From Table A3, we do not reject the hypothesis that the overidentifying restrictions are valid, while rejecting the hypothesis that the instruments are weak. Comparing Tables 3 and A3, the 2SLS estimates are very similar to the OLS estimates. In particular, mothers are less risk tolerant compared to childless women, although each additional child mitigates this difference between the two groups.

Table A2 Breusch-Pagan Tests of Heteroskedasticity

Specification	*Any Child*	*Any Child* x *Male*	*No. of Children*	*No. of Children* x *Male*
Basic covariates	447 [0.00]	3,439 [0.00]	10 [0.00]	3,611 [0.00]
Additional covariates	2,178 [0.00]	2,164 [0.00]	13 [0.00]	3,032 [0.00]

Notes: $\chi 2$ statistics and p-values [in parentheses] are reported. H_0: η has constant variances with respect to *Z*.

Table A3 Associations from Two-Stage Least Squares Estimation

	Willingness to Take Risks (0-10)					
	General risks		Financial risks		Health risks	
	(1)	(2)	(3)	(4)	(5)	(6)
Women						
Any child	-0.644***	-0.512***	-0.635***	-0.513***	-0.744***	-0.731***
	(0.176)	(0.183)	(0.173)	(0.179)	(0.183)	(0.194)
# children	0.111**	0.128**	0.136**	0.154***	0.197***	0.194***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.057)	(0.057)
Men						
Any child	-0.209	-0.295	-0.119	-0.209	-0.301	-0.315
	(0.199)	(0.202)	(0.201)	(0.202)	(0.208)	(0.214)
# children	0.095	0.109*	0.087	0.101*	-0.006	-0.005
	(0.061)	(0.060)	(0.062)	(0.061)	(0.062)	(0.062)
Covariates						
Male	0.550***	0.572***	0.511***	0.509***	0.515***	0.537***
	(0.183)	(0.183)	(0.182)	(0.181)	(0.193)	(0.195)
Age	0.089	0.080	0.091	0.080	0.029	0.031
	(0.092)	(0.091)	(0.090)	(0.088)	(0.093)	(0.093)
Age squared	-0.001	-0.001	-0.001	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Chinese	0.053	0.069	0.041	0.059	-0.354***	-0.349***
	(0.110)	(0.110)	(0.106)	(0.106)	(0.110)	(0.110)
Married		-0.020		0.014		0.006
		(0.091)		(0.090)		(0.095)
Secondary		0.245***		0.279***		0.045
		(0.088)		(0.085)		(0.091)
Diploma		0.847***		0.915***		0.056
		(0.100)		(0.098)		(0.105)
Undergraduate		1.216***		1.277***		-0.144
		(0.130)		(0.127)		(0.135)
Postgraduate		1.382***		1.490***		0.060
		(0.141)		(0.145)		(0.153)
Good health		0.421***		0.488***		0.019
		(0.065)		(0.064)		(0.067)
Net wealth		0.000***		0.000***		0.000
(S$'000)		(0.000)		(0.000)		(0.000)
R-squared	0.04	0.08	0.04	0.08	0.02	0.02
Overid p-val	0.61	0.28	0.78	0.20	0.05	0.19
First stage						
K-P rk F-stat	3,727	1,281	3,727	1,281	3,727	1,281
N	6,740	6,740	6,740	6,740	6,740	6,740

Notes: Estimated marginal effects and robust standard errors (in parentheses) are reported. Controls further include district dummies across all specifications. *p<.10, **p<.05, ***p<.01.