The Effect of Fertility on Household Risky Investment: Evidence from China

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ABSTRACT. In this paper, we show that fertility shapes the risky investment decisions of the rich and the poor in opposite ways. By exploiting the staggered adoption of two-child policy in place of one-child policy in China, we document that increased fertility encourages richer households to participate in risky stock market but deters such risk-taking behavior by poorer households. A simple two-asset portfolio choice model can explain the above facts through two channels: (i) increased fertility raises households' subsistence consumption and constrains their risky investment decisions; (ii) increased fertility implies higher demand for child investment, which encourages households to pursue higher returns by making risky investment. The relative strength of these two channels depend on household wealth, so that fertility changes generate opposite effects on risky investments between rich households and poor households.

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I. Introduction

Almost all major economies have experienced a substantial fall in human fertility in recent decades (Bloom and Luca, 2016), and this trend is projected to continue for at least the first half of the twenty-first century according to the United Nation World Population Prospects 2019. Many countries have adopted family policies to stimulate fertility rate (e.g. Luci-Greulich and Thévenon, 2013; Boling, 2008). Given this background, the role of fertility changes in the determination of household financial decisions is drawing growing attention from both researchers and policy makers (e.g. Braun et al., 2009).

In this paper, we explore how fertility changes shape the risky investment decisions of households. Such effects are likely to differ between rich households and poor households, which have important implications for wealth inequality. Despite the importance of this question, however, evidence in the literature is scarce, largely because fertility is potentially endogenous to household financial conditions.

To begin with, we present a simple two-asset portfolio choice model with entry costs, subsistence consumption and child investment to illustrate how changes in the number of children should affect parents' decision on risky investments. Our theoretical model highlights two channels. On one hand, higher fertility deters risky investment by tightening household liquidity constraint. Specifically, more children implies higher subsistence-level consumption, so that parents have to save more at safe assets to maintain their subsistence-level consumption in the future. This liquidity constraint distorts their risky asset holdings and reduces the welfare gains from entering the risky asset market. On the other hand, parents' demand for child investment leads to a positive effect of fertility on risky investment. For a couple, the marginal return to total child investment increases with the number of children. That is, investing 200 dollars on two children is better than investing the money on one child. Thus, having more children leads to higher demand for child investment. This encourages households to make risky investment to finance child investment. Our model shows that the relative strength of these two effects depends on the level of household wealth in that higher household wealth weakens the former liquidity-constraint channel and strengthens the latter child-investment channel.

To empirically examine our theory, we make use of the Chinese setting, which provides a unique opportunity to isolate exogenous movements in household fertility. In 1979, China introduced its unprecedented one-child policy (OCP), under which households exceeding the birth quota were penalized (Zhang, 2017). But in the 2010s, this policy was relaxed and gradually replaced by a two-child policy (TCP). The timing of TCP implementation varied across households, depending on whether the husband and the wife are the only child in their original families. Furthermore, the implementation may or may not affect a household, depending on the age of the wife and whether the household already has two kids (e.g., twins). As a consequence, the staggered implementation of TCP serves as a quasi-natural experiment that allows us to identify the causal relationship between fertility and households' risky investment decisions.

In our empirical work, we use stock market participation as the major testing ground. At macro level, stock market participation rate has a direct effect on equity premium (Hong et al., 2004), which plays a central role in the capital market. At micro level, it is commonly known that non-participation has negative consequences for household wealth accumulation, given the high equity premium (Vestman, 2019).

Our model's predictions are supported by empirical evidence. More specifically, we use the three waves of China Financial Household Survey (CHFS) in 2013, 2015, and 2017 to examine the effect of fertility on households' stock market participation, and how this effect depends on household wealth. To deal with the endogeneity of fertility, we exploit the staggered adoption of TCP in place of OCP. Our difference-in-difference estimates show that TCP is followed by a reduced propensity to participate in the stock market for poor households, but an increased propensity for rich households. It is worth noting that our theoretical predictions are not limited to stock market participation. To show this, we consider households' entrepreneurial activities, which plays an important role in economic growth (Andersen and Nielsen, 2012), instead of stock market participation as the dependent variable in our empirical specification and obtain similar findings.

We verify the two underlying channels highlighted in our model by conducting subsample analysis. In particular, we show that the positive effect of fertility on the stock market participation by the rich, relative to the poor, are more evident among couples who are more altruistic towards children. The effect is also more evident in provinces with fiercer competition in the college entrance examination (CEE) or with higher expected return to education. There results support the child-investment channel of our model. We also show that the negative effect on poor couples is more evident in provinces where credit allocation is less marketized (and thus household liquidity constraint is tighter), consistent with the liquidity-constraint channel in our model.

The findings of our paper have important implications for wealth inequality. There is a large literature on the relation between fertility and inequality, which mainly highlights the impact of fertility changes on human capital development and labor income (e.g.,De La Croix and Doepke, 2003; Sato et al., 2008). Our finding highlights that fertility may affect wealth inequality through households' risky investment decisions and thus capital income as well. Specifically, our findings indicate that increased fertility could widen the wealth gap by encouraging investment in high-yield risky asset by the rich and depressing such investment by the poor. We corroborate this implication with Chinese city-level data and show that higher birth rates do predict higher wealth inequality at the city level.

The rest of the paper is arranged as followed. Section II reviews the literature. Section III presents our theoretical model. Section IV describes our empirical strategy within the institutional background of China. It also introduces our data. Section V documents the main empirical findings, where we use stock market participation as a testing ground. In Section VI, we report the results regarding entrepreneurship. We also discuss about the implications of our findings for wealth inequality and for studies related to the role of asset portfolio in generating heterogeneous consumption responses across households. Section VII concludes.

II. Related literature

We are closely related to Love (2010), who studies the impact of demographic shocks on optimal saving and portfolio decisions in a life-cycle asset allocation model. His model predicts that young households with children hold riskier portfolio shares than those without children, because the former need to finance the expenditure on child investment. But the model misses the liquidity constraint arising from the need to maintain substance level of consumption, which likely distorts the risky investment of constrained households. In contrast, our model allows for the co-existence of both the child-investment channel and the liquidity-constraint channel, which plays an essential role in explaining why the relation between fertility and risky investment differs between richer households and poorer households.

Our work is also related to the studies on the role of family structure in shaping portfolio choice. Several studies examine the effect of siblings on risky investment, and most of them find a positive effect. For example, Wu and Zhao (2020) and Niu et al. (2020) find that having more sibling increases both the probability to participate in stock market and the asset share in stock investment, and highlight the role of risk-sharing in shaping this relation. Li and Wu (2018) considers entrepreneurial activities, which a special type of risky investment. They document a positive effect of the number of siblings on entrepreneurship, underscoring that a sibling serve as a substitute to formal financial institutions and alleviates credit constraint. Their findings imply increased risky investment following an increase in fertility, because future investors would have more siblings. Our work shows that this is not the whole story. In particular, we provide both solid empirical evidence and theoretical explanations for the negative effect of fertility on the risky investment by poor households.

More broadly, we contribute to the literature on the implications of fertility for household financial decisions. Most studies in this field have focused on the intertemporal consumption-saving decision and argued that lower fertility encounrages household saving. For instance, Ge et al. (2018) document that older households with fewer adult children saved more, middle-aged households with fewer dependent children experienced increase in savings, and younger households with fewer siblings also saved more. Similarly, Zhou (2014) documents that having an additional brother reduces an individual's household savings rate by at least 5 percentage points. Lugauer et al. (2019) find, both theoretically and empirically, that a negative relationship between the number of dependent children in the family and the household saving rate. İmrohoroğlu and Zhao (2018) theoretically show that the combination of the risks faced by the elderly and the deterioration of family insurance due to the one-child policy may account for approximately half of the increase in the saving rate between 1980 and 2010 in China. Consistently, the theoretical model of Curtis et al. (2015) indicates that demographic change alone accounts for over half of the saving rate increase in China over the past decades. But there are conflicting findings as well. Horioka and Wan (2007) find mixed evidence on the impact of population age structure, which is naturally related to fertility, on household saving rate. Song et al. (2021) find no evidence that the one-child policy can explain China's high saving rate. The theoretical model of Banerjee et al. (2014) also predicts that allowing fertility to rise will have little effect on household savings, because the partial equilibrium effect and the general equilibrium effect offset each other. Our analysis complements this literature by focusing on households' risky investment decisions rather than their intertemporal choice beween consumption and saving.

Finally, we add to the studies on the causes of limited market participation. Cao et al. (2005) demostrates that limited participation can arise endogenously in the presence of model uncertainty and heterogeneous uncertainty-averse investors. Vestman (2019) attributes limited stock market participation to preference heterogeneity. Alan (2006) explores the explanation based on fixed entry and/or transaction costs, and her structural estimation reveals that the one-time entry cost associated with the stock market is approximately two percent of the permanent component of the annual labor income. We complement this literature by showing that increased fertility, which leads to a tighter liquidity constraint, may interact with the entry cost and limits the stock market participation by poor households.

III. The model

III.1. **Model setup.** In this section, we investigate how fertility affects households' risky investment decisions in a simple two-asset portfolio choice model with entry costs, subsistence consumption and child investment. There are two periods: a trading period ($t = 0$) and a consumption period ($t = 1$).

In the trading period, two types of assets are traded competitively in the market, a riskless asset and a risky asset . The riskless asset has a predetermined gross rate of return of $R \geq 1$, The risky asset has a random gross rate of return R_s, where R_s follows a distribution with mean $E(R_s) = \mu_s > R$ and variance $var(R_s) = \sigma_s^2$ and is realized in the consumption period.

We consider a household that is endowed with an initial wealth of W_0. In the trading period, the household invests a fraction s of its initial wealth in the risky asset and the rest $1 - s$ to the riskless asset.

In the consumption period, the household spends c on the parents' consumption and $\kappa + e$ in each child, where $\kappa > 0$ denotes the minimum consumption required by each child to keep alive and is exogenously given, and $e \geq 0$ denotes education spending per child[1] and is endogenously chosen. The budget constraint of the household is given by,

$$c + n(\kappa + e) = [sR_s + (1 - s)R]W_0. \tag{1}$$

where n denotes the number of children in the household. We do not model the parents' decision to have children, but assume the household is endowed with an exogenous number of children n.

[1] e could also be interpretted as broader investments in children. In China, such broader investments are mainly composed of education expenditure, including private tutors, out-of-school classes, attending private schools, studying abroad, etc.

In the spirit of Peress (2005), we assume that there is an entry cost in participating the risky asset market.[2] In particular, the parents of the household incur a welfare loss of $\eta > 0$ if entering the risky asset market. There is no cost associated with holding the riskless assets.

We model the parents' preference following Becker and Barro (1988) and Barro and Becker (1989), who developed an intuitive and analytically tractable model based on dynastic altruism—parents have children because they themselves receive utility benefits from family size and child quality. In particular, we assume that the parents in the household maximize a log-linear utility function over their own consumption c and the human capital per child h net of possible entry costs of risky asset market:[3]

$$\alpha \ln(c) + (1-\alpha) n \ln(h) - \eta I(s > 0). \tag{2}$$

where $\eta I(s > 0)$ captures the cost of entering risky asset market, where $I(s > 0)$ is a sign variable that equals 1 if $s > 0$ and equals 0 if $s = 0$.[4] $\alpha \in (0, 1)$ denotes the weight the parents place on their own consumption relative to the human capital of children. Child quality, or human capital, is determined by,

$$h(e) = \theta_0 + \theta_1 e. \tag{3}$$

where $\theta_1 > 0$ measures the marginal increase in human capital for each unit of investment per child. $\theta_0 > 0$ denotes a child's human capital endowment. This form of human capital production function is commonly used in the theoretical models with endogenous fertility decisions (e.g. Becker and Tomes, 1976; Vogl, 2016). In our model with exogenous fertility levels, the presence of human capital endowment ($\theta_0 > 0$) also plays an important role in generating asymmetric impacts of fertility changes on risk-taking behavior between rich households and poor households.

We assume that the parents may face a liquidity constraint in that their wealth must be enough to pay for the minimum consumption ($\bar{c} > 0$ for the parents themselves and $\kappa > 0$ for each child). This type of assumption is standard in the large literature on habit formation (e.g., Constantinides, 1990; Dybvig, 1995) and implies the following

[2]For example, entry costs associated with stock markets include time spent filing tax forms, opening brokerage accounts, and understanding the principles of stocks.

[3]This utility function is a simplified form of a standard Barro-Becker type preference: $\alpha \ln(c) + (1-\alpha) g(n) \ln(h)$, where $g(n)$ denotes an increasing function of the number of children n.

[4]One caveat of our model is that we assume that the household cannot borrow or short risky assets. This assumption is a simplification that captures the insufficient development of the financial market in China and other developing economies.

liquidity constraint:

$$(1-s)RW_0 \geq \bar{c} + n\kappa. \tag{4}$$

In the above setup, we also impose the assumption that the household is able to afford the subsistence consumption if not entering risky asset market[5]:

Assumption III.1. $RW_0 \geq \bar{c} + n\kappa$.

III.2. **Solution.** In this section, we examines how household fertility affects the parents' risky investment decisions in the model. In particular, we focus on the impact of household feritlity on the parents' choice to enter the risky asset market. We provide detailed solutions to our model in Appendix A.1.

III.2.1. *Optimal risky investment decisions.* In our model, the parents choose whether to enter the risky asset market in the trading period ($t = 0$). If the parents choose not to enter the risky asset market ($s = 0$), the parents obtains $W_1 = RW_0$ in the consumption period and choose consumption c and education expenditure e subject to the budget constraint (1) in the consumption period ($t = 1$) to maximize the utility function (3). In this case, the parents' maximized utility is given by,

$$V^b(n, W_0) = U(n, RW_0). \tag{5}$$

where the function $U(n, W_1)$ denotes the parents' maximized utility before the entry cost η is deducted from the utility function (3), taking as given the number of the children n and the realized wealth W_1 in the consumption period:

$$\begin{aligned} U(n, W_1) = & \max_{c,e} \alpha \ln(c) + (1-\alpha) n \ln(\theta_0 + \theta_1 e), \\ s.t. \quad & W_1 = c + n\kappa + ne \\ & e \geq 0. \end{aligned} \tag{6}$$

If the parents choose to enter the risky asset market, the parents choose risky asset holdings s subject to the liquidity constraint (4) in the trading period ($t = 0$) and then obtains $W_1 = [sR_s + (1-s)R]W_0$ in the consumption period, with the risky asset return R_s unobserved in the trading period. The parents then choose consumption c and education expenditure e subject to the budget constraint (1) in the consumption period ($t = 1$) to maximize the utility function (3). In this case, the parents' expected

[5]This assumption is a simplification that helps focus on the households above the poverty line and keep the analysis tractable. It is also a reasonable assumption since the percentage of the population living below the national poverty line is only 0.9% in China, based on the estimates by the World Bank. Source: https://data.worldbank.org/indicator/SI.POV.NAHC?locations=IS-US-CN

utility before the entry cost η is deducted from the utility function with optimal choice of s in the trading period is given by,

$$V^s(n, W_0) = \max_s \mathrm{E}[U(n, [sR_s + (1-s)R]W_0)],$$
$$s.t. \quad (1-s)RW_0 \geq \bar{c} + n\kappa. \tag{7}$$

As a consequence, the parents are willing to enter the risky asset market ($s > 0$) if and only if the entry cost η satisfies $\eta \leq V(n, W_0) \equiv V^s(n, W_0) - V^b(n, W_0)$. Spefically, the value function $V(n, W_0)$ measures the welfare gains from investing in risky assets in the model. The higher $V(n, W_0)$, the more likely that the parents are willing to take risks and enter the risky asset market.

In what follows, we investigate the value function $V(n, W_0)$ both analytically and numerically to illustrate the implications of fertility for household risky investment decisions. Specifically, we show that fertility affects household risk-taking through two channels, one through liquidity constraint and the other through child investment.

III.2.2. *Channel of liquidity constraint.* To help develop intuition, we first focus on the channel through the liquidity constraint and begin with a special case in which parents have no incentive to spend on child education ($\theta_1 = 0$ and $e = 0$). In this case, the impact of household fertility on the parents' risky investment decisions, characterized by $V(n, W_0)$, works through the liquidity constraint (4) only for households with sufficiently low initial wealth W_0. Specifically, there exists a threshold $\bar{W}_0$ such that, if and only if $W_0 < \bar{W}_0$, the household is constrained by the liquidity constraint and chooses a portfolio share of risky assets given by,

$$s = \frac{RW_0}{\bar{c} + n\kappa} - 1. \tag{8}$$

To these relatively poor households, increased fertility tightens their liquidity constraint and distorts their risky asset holdings, thus reducing the welfare gains from investing in risky assets $V(n, W_0)$.

However, sufficiently rich households that satisfy $W_0 \geq \bar{W}_0$ are not constrained by the liquidity constraint (4) when investing in risky assets. Consequently, these households' choice of whether make risky investments are independent of fertility changes. The following proposition summarizes the relation between household wealth and the impact of fertility on household risky investment decisions:

Proposition III.2. *Assume $\theta_1 = 0$. There exists a threshold value $\bar{W}$ such that a marginal increase in household fertility depresses participation in risky asset market*

$(\frac{\partial V(n,W_0)}{\partial n} < 0)$ *if* $W_0 < \bar{W}$, *but has no impact on risky asset market participation* $(\frac{\partial V(n,W_0)}{\partial n} = 0)$ *if* $W_0 \geq \bar{W}$.

Proof. We provide a proof in Appendix A.2. □

III.2.3. *Channel of child investment.* We then focus on the channel through the child investment and consider a special case without consumption subsistence ($\kappa = \bar{c} = 0$). In this case, the household's optimal choice of child investment depends on the realized wealth in the consumption period. For convenience of reference, we denote W_1 as the realized wealth in the consumption period,

$$W_1 \equiv [sR_s + (1-s)R]W_0. \tag{9}$$

If the realized wealth is sufficiently high ($W_1 > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}$), the investment per child is strictly positive and is given by,

$$e^* = \frac{W_1 - \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}. \tag{10}$$

The above equation indicates that, although the optimal choice of investment per child (e^*) decreases with household fertility (n), the optimal total expenditure on child investment (ne^*) increases with household fertility (n).

For simplicity, we now focus on sufficiently rich households whose child investment is always positive regardless of the realization of risky returns R_s under optimal decisions. In this case, the welfare gains from investing in the risky assets $V(n, W_0)$ is given by,

$$\begin{aligned} V(n, W_0) &= V^s(n, W_0) - V^b(n, W_0) \\ &= \mathrm{E}[\alpha + (1-\alpha)n] \ln[\frac{(s^* R_s + (1-s^*)R)W_0 + n\frac{\theta_0}{\theta_1}}{RW_0 + n\frac{\theta_0}{\theta_1}}]. \end{aligned} \tag{11}$$

where s^* denotes the optimal share of risky assets that solves problem (7). The term $[\alpha + (1-\alpha)n]$ captures that increased fertility (n) improves the parents' welfare by making each unit of child investment more productive.

Solving for the partial derivative of $V(n, W_0)$ with respecitve to n, we obtain:

$$\frac{\partial V(n, W_0)}{\partial n} = \frac{1-\alpha}{\alpha + (1-\alpha)n} V(n, W_0) > 0, \tag{12}$$

The above equation implies that, increasing household fertility encourages risk taking because holding risky assets offer higher expected portfolio returns and thus raise child investment, which is more valuable for households with more children.

The following proposition summarizes the above results and proves that increased household fertility encourages risk taking through the child investment channel for sufficiently rich households:

Proposition III.3. *Assume $\kappa = \bar{c} = 0$. There exists a threshold value $\bar{W}$ such that, if and only if the initial wealth $W_0 > \bar{W}$, the child investment is always positive ($e > 0$) and a marginal increase in household fertility encourages participation in risky asset market ($\frac{\partial V(n, W_0)}{\partial n} > 0$).*

Proof. We provide a proof in Appendix A.3. □

In the more general case with poorer households ($W_0 \leq \bar{W}$), realized wealth might be low enough ($W_1 \leq \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}$) such that the parents are content with the human capital endownment θ_0 , choosing a corner solution with no child investment ($e = 0$). The possibility of such scenario would weaken the child investment channel. It is also notable that this weakening effect only exists in the presence of human capital endowment ($\theta_0 > 0$), because the child investment is always positive in the absence of human capital endowment ($\theta_0 = 0$).

III.3. **Numerical exercises.** In this section, we calibrate the model to fit Chinese data and quantitatively explore the implication of fertility for household risky investment decisions in our model.

III.3.1. *Calibration.* We consider an investment horizon of 23 years, which correspond to the time required to raise a child who finish undergraduate studies in China. For parameters associated with asset returns, we set $\mu_s = 0.05 \times 23$ and $\sigma_s = 0.4 \times \sqrt{23}$, consistent with an average annual log return of 0.05 and its standard deviation of 0.4 using Chinese stock market data from 2000 to 2020. We set the risk-free rate $R = 1.02^{23}$ to target Chinese average annual deposit interest rate of 2% from 2000 to 2020.

As to consumption subsistence, we set $\bar{c} = 0.6464$ and $\kappa = 0.3232$ in millions of RMB to target a pa poverty line of 5.5 dollars a day released by the World Bank for middle income countries.[6]

[6]The World Bank defines the poverty line as a monetary threshold below which a person's minimum basic needs cannot be met. Given an exchange rate of 7 RMB per dollar, we calculate the parents' consumption subsistence as $\bar{c} = 2 \times 5.5 \times 7 \times 365 \times 23/10^6 = 0.6464$ millions of RMB, and a child's consumption subsistence as $\bar{c} = 5.5 \times 7 \times 365 \times 23/10^6 = 0.3232$ millions of RMB over the investment horizon.

As to parameters in the utility function, we set the utility share of consumption to $\alpha = 0.9$ to target an average ratio of consumption expenditure to child investment of around 9 in Chinese household-level data released by China Household Finance Survey. We normalize $\theta_1 = 1$ and set $\theta_0 = 0.15$ so that the threshold for initial wealth below which increasing household fertility depresses risk taking equals 1.25 million RMB, which is motivated by our empirical evidence in Section V.[7]

III.3.2. *Quantitative results.* We solve for the calibrated version of the model and the quantitative results are summarized in Figure 1. Panel (a) compares welfare gains from investing in risky assets $V(n, W_0)$ among those with no child ($n = 0$, blue dotted lines), those with one child ($n = 1$, black solid line) and those with two children ($n = 2$, red dashed line) and across households with heterogeneous initial wealth W_0, varying over a range from a minimal level given by Assumption III.1 up to 3 millions of RMB. The horizontal axis shows the value of initial wealth (W_0). As is shown in Panel (a), increasing household fertility from one child ($n = 1$) to two children ($n = 2$) encourages sufficiently rich households ($W_0 \geq 1.25$) to enter the risky asset market by raising the welfare gains from investing in risky assets (higher $V(n, W_0)$) but depresses such risk-taking behavior (lower $V(n, W_0)$) for relatively poor households ($W_0 < 1.25$).

Panel (b) and Panel (c), respectively, provides a quantitative demonstration that household fertility affects stock market participation through the liquidity-constraint channel and through the child-investment channel. In particular, Panel (b) displays the optimal portfolio share of stocks s^* that solves the parents' problem (7) where the cost of entering the risky asset market is zero ($\eta = 0$), and the vertical line represents a threshold for initial wealth below which the parents are constrained by the liquidity constraint (4) when investing in risky assets. As is shown in Panel (b), this threshold becomes larger as household fertility increases (higher n), imply that increasing household fertility tightens the liquidity constraint and makes more households constrained. Increasing household fertility also lowers the portfolio share of risky assets s^* for both constrained and unconstrained households, although more acutely for constrained households.

Panel (c) displays the likelihood of positive child investment $P(e > 0)$ under optimal decisions when the cost of entering the risky asset market is zero ($\eta = 0$). As is discussed in Section III.2.3, in our model, increasing household fertility makes child investment more valuable and encourages risk taking because holding risky assets offer

[7]It is notable that, holding the ratio θ_0/θ_1 as constant, changes in θ_1 only affects the absolute level of the parents' utility but does not affect their optimal decisions.

higher expected portfolio returns and thus allow for higher child investment. However, this channel is only operative in scenarios of positive child investment ($e > 0$). Panel (c) shows that parents with higher initial wealth (W_0) expect higher likelihood of positive child investment and therefore more affected by the child-investment channel.

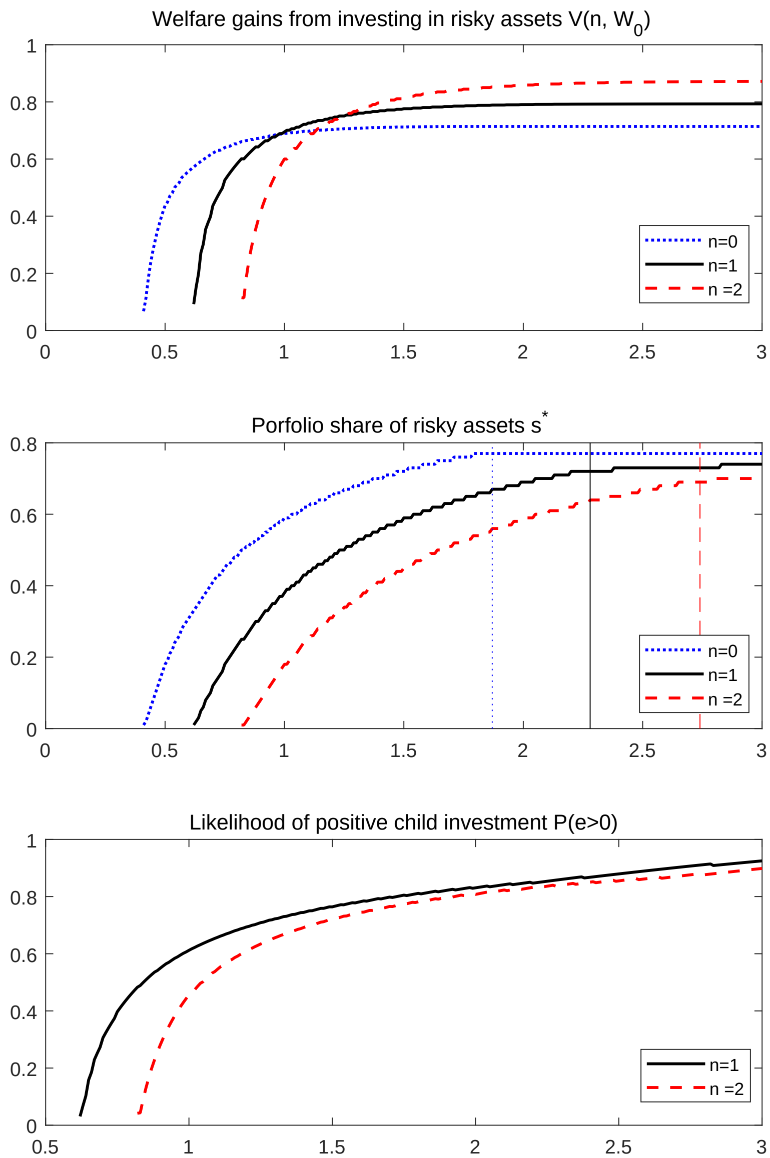

FIGURE 1. Impact of household fertility on risky investment decisions. The horizontal axes are household initial wealth. Blue dotted lines: households with no child ($n = 0$); black solid lines: households with one child ($n = 1$); red dashed lines: households with two children ($n = 2$). Vertical lines in Panel (b) show the threshold for initial wealth below which the parents are constrained by the liquidity constraint (4) when investing in risky assets.

To sum up, increasing household fertility encourages sufficiently rich households to enter the risky asset market but depresses risk taking by relatively poor households. These asymmetric effects are driven by two channels. On one hand, the liquidity-constraint channel implies a negative relation between household fertility and the welfare gains from making risky investments and is only operative for relatively poor households; on the other hand, the child-investment channel implies that increasing household fertility encourages risky investments, with a stronger effect on richer households.

IV. Empirical strategy and data

Our model predicts that increasing household fertility encourages risky investment by richer households but discourages the investment by poorer households, and that these asymmetric effects are driven by the liquidity-constraint channel and the child-investment channel. In what follows, we demonstrate that these model predictions are supported by empirical evidence. This section introduces the empirical strategy and the data.

IV.1. **Empirical strategy.** To begin with, we examine the relationship between households' risky investment decision and the number of kids. In the main analysis of this paper, the investment decision that we consider is stock market participation. We are particularly interested in how the relationship mentioned above varies with household wealth. So we estimate the following probit model (13):

$$\begin{aligned}\Pr(Participate_{h,t}=1) = \Phi(c &+ \beta_1 KidNum_{h,t} + \beta_2 KidNum_{h,t}\times Asset_{h,t} \\ &+ \beta_3 Asset_{h,t} + W_{h,t} + H_{h,t} + \mu_c + \tau_t + \epsilon_{h,t})\end{aligned} \tag{13}$$

where $\Phi(\cdot)$ denotes the cumulative distribution function of a standard normal distribution. The dependent variable is the dummy *Participate*, which indicates stock market participation of couple h in wave t. It equals 1 if the couple participates in the stock market directly or indirectly through mutual fundsm and 0 otherwise. The explanatory variables include $KidNum$, the number of kids[8]; *Asset*, the natural logarithm of household asset (yuan); and the interaction term $KidNum \times Asset$. As control variables, W and H respectively denote the wife's and the husband's characteristics, including age, the square of age, education level, employment status, hukou

[8]We obtain data on $KidNum$ from the CHFS database, which provides information of all kids that have economic ties with the parents, including those studying or living in another city.

type,[9] and health condition. We also include city fixed effects μ and wave fixed effects τ. The term ϵ denotes regreesion errors, assumed to be well behaved.

Our parameters of interest in the above regression (13) are β_1 and β_2, which, respectively, enables us to observe the correlation between household fertility and stock market participation, and how the correlation varies with total asset. However, since the number of kids is endogenous to the parents' characteristics, this regression cannot establish a causal relationship between the number of kids and the parents' stock market participation.

To establish a causal relationship between fertility and stock market participation, we exploit the staggered adoption of TCP. TCP is part of China's family planning policies, which started as early as in the 1960s. In 1979, China implemented the unprecedented OCP, under which households exceeding the birth quota were penalized (Zhang, 2017). As a result, birth rate sharply declined in the past decades, as shown in Figure 2. The persist decline in fertility rate leads to concerns on the aging population (Flaherty et al., 2007) and labor shortage (Cui et al., 2018). Accordingly, the OCP has been gradually replaced by the two-child policy. Since 2002, couples can apply to have two children, as long as both the husband and the wife are the only child in their original families. But locally, the timing of the implementation varied from province to province. The latest province to implement this policy was Henan Province, where the implementation occurred in November 2011. The implementation in other provinces occurred before 2010, and mostly around 2003. This is the starting of TCP.

In the 2010s, the updated version of TCP enables more couples to be qualified for TCP. In December 2013, couples with either the husband or the wife being the only child in their original families are allowed to have two children.[10] In December 2015, all couples are allowed to have two children.[11] As can be seen from Figure 3, the fertility rate regarding the second child has been rising since 2015.

The staggered adoption of TCP allows us to identify exogenous movements in household fertility and their effects on stock market participation. We define the treatment

[9]Please see more details about the "hukou" system in China in Afridi et al. (2015). In this paper, we focus on urban residents. Some of them hold urban hukou and others hold rural hukou. Rural hukou is associated with some land use right in the rural area, but does not prevent the holder from working and living in the urban area.

[10]See http://www.gov.cn/jrzg/2013-12/28/content_2556413.htm for government announcement of the policy change in Chinese.

[11]See http://www.gov.cn/gongbao/content/2016/content_5033853.htm for government announcement of the policy change in Chinese.

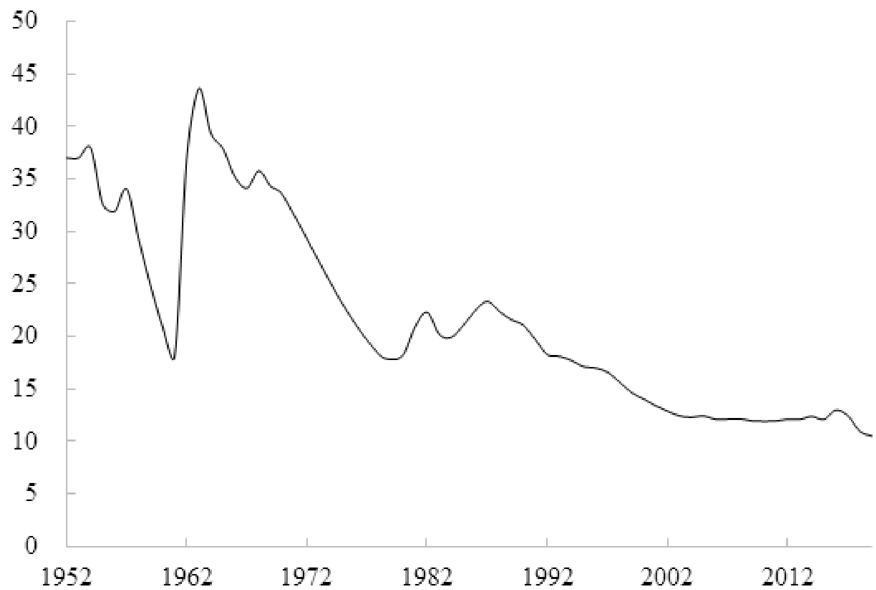

Figure 2. Chinese birth rates (‰). Birth rate refers to the number of newly-born infants divided by total population. The sample period is 1952-2019. *Source:* National Bureau of Statistics of China (NBS).

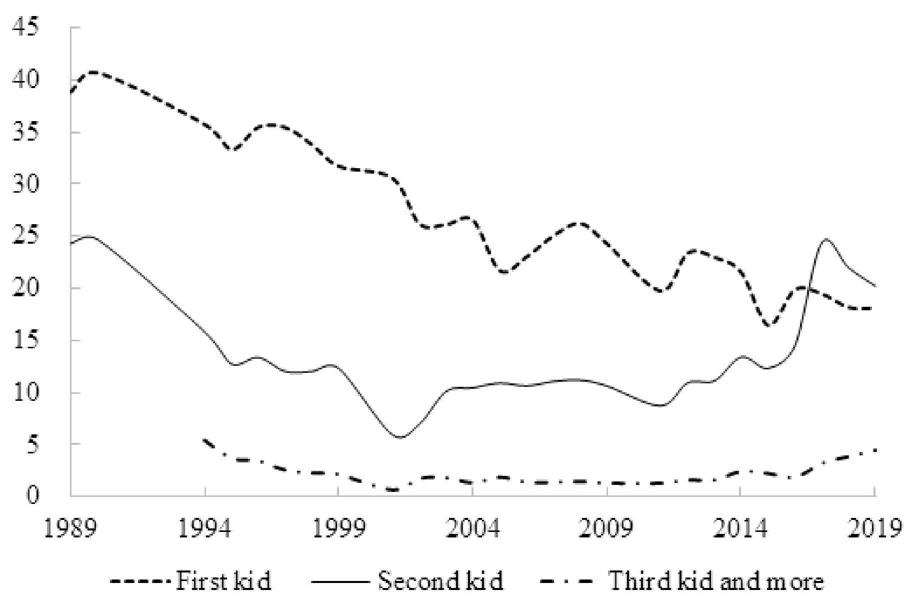

Figure 3. Chinese fertility rates (‰). Dash line: fertility rate regarding the first kid, i.e., the number of the first kids divided by the number of childbearing women. Solid line: fertility rate regarding the second kid. Dot-dash line: fertility rate regarding the kids with a third or lower ranking in their families. *Source:* National Bureau of Statistics of China (NBS).

group as the couples with the wife being no more than 45 years old and having zero or one kid.[12] The rest couples constitute the control group. Intuitively, fertility decisions in the treatment group are affected by OCP, whereas those of couples in the control group are not. Then we test how the staggered adoption of TCP affect the stock market participation of the treatment group versus the control group. Our baseline regression uses the following probit model:

$$\begin{aligned}\Pr(Participate_{h,t}=1) = \Phi(c + \beta_1 Treatment_{h,t} + \beta_2 Treatment_{h,t} \times Post_{h,t} \\ + \beta_3 Asset_{h,t} \times Treatment_{h,t} + \beta_4 Asset_{h,t} \times Treatment_{h,t} \times Post_{h,t} + \beta_5 Post_{h,t} \\ + \beta_6 Asset_{h,t} + \beta_7 Asset_{h,t} \times Post_{h,t} + W_{h,t} + H_{h,t} + \mu_c + \tau_t + \epsilon_{h,t}).\end{aligned} \tag{14}$$

where the dummy $Treatment$ equals 1 for the treatment group, and 0 for the control group, and the dummy $Post$ equals 1 if the couple h is already qualified for TCP in wave t, and 0 if not. The control variables include the characteristics of the wife W and the husband H, respectively, city fixed effects μ and wave fixed effects τ. The term ϵ denotes regression errors, assumed to be well behaved.

Our parameters of interest are β_2, the coefficient on $Treatment \times Post$, and β_4, the coefficient on $Asset \times Treatment \times Post$. The coefficient β_2 reflects the effect of TCP on the stock market participation of a couple whose $Asset = 0$.[13] The coefficient β_4 captures how the effect of fertility changes with household total asset.

To highlight that our theoretical prediction is not limited to stock market participation, we also investigate households' entrepreneurial activities. We define $OwnBusi$ as a dummy that equals 1 if a household owns a business, and 0 if not. Then we revise the baseline regression by replacing $Participate$ with $OwnBusi$.

IV.2. **Data.** The main datasets used in this paper are from China Household Finance Survey (CHFS). Established in 2010, CHFS provides micro-level data about household finance (Gan et al., 2014). Every two years, CHFS conducts a survey during the

[12]The treatment group includes couples with zero kid because TCP affects their family plan. With a sample period of 2013-2017, we focus on the short-term impacts of TCP, which mainly work through people's expectations. In B.1 of Appendix B, we show that our results are robust if we drop couples with no kids from the treatment group so that the treatment group only includes couples with exactly one kid. And consistent with a preference for son, our results (unreported) become even stronger if we drop couples with no kids as well as couples with a son from the treatment group so that the treatment group only includes couples with a daughter.

[13]Since $Asset_{h,t}$ is defined as the logarithm of asset value in RMB, $Asset_{h,t}$ implies an asset value of 1 RMB. Also note that the minimum value of assets among couples with non-zero asset value in our sample is 1 RMB, so that $Asset_{h,t}$ is non-negative.

summer holiday. The 2011 wave covers 8,438 households from 25 provinces. The 2013, 2015, and 2017 waves, respectively, cover 28,141, 37,289, and 40,011 households from more than 160 cities of 29 provinces. The questionnaires in these three waves are also more comprehensive than that in the 2011 wave. Hence, we use the three waves from 2013 to 2017 in our empirical work. [14]

We focus on urban couples. In the OCP era, the enforcement was strict in the urban area and somewhat relaxed in the rural area. For example, rural couples with only one daughter could have a second child. Hence, we expect that TCP has a larger effect in the urban area. The 2013, 2015, and 2017 waves cover 15,855, 21,387 and 22,125 urban couples, respectively.

Each wave consists of an individual-level dataset and a household-level dataset. The individual-level dataset provides information of individual characteristics. A respondent provides the information of all his/her family members, and each family member corresponds to one observation. The individual characteristics include the number of siblings, age, education, gender, marriage status, hukou type, employment status, health condition, etc.

We use the information on the number of siblings to calculate the dummy variable $Post$, which indicates whether a couple is qualified for TCP in a given year. More specifically, we count the number of persons in a couple who are the only child in their original families. This number determines the time when a couple becomes qualified for TCP. If the number is two, then $Post$ equals 1 in all the three waves. If the number is one, then $Post$ equals 1 in the 2015 and 2017 wave, and 0 in the 2013 wave. If the number is zero, then $Post$ equals 1 in the 2017 wave, and 0 in earlier waves. For the 2013 wave and the 2015 wave, a couple is dropped if the wife's or the husband's number of siblings is missing in the dataset. For the 2017 wave, such couples are retained, because $Post$ equals 1 for all couples and it is unnecessary to know the sibling information.

We use the information of wife's age and the number of children to compute the dummy variable $Treatment$. The number of children is counted from the individual-level dataset. CHFS only covers the children that have economic ties with the respondent. Thus, if a child no longer has economic ties with the respondent, then the child is not counted. This issue is unlikely to affect our results, because the children of couples in the bearing age mostly live together (and thus have economic ties) with

[14] Li and Wu (2018) provides a more comprehensive description for the design of CHFS. The data of all the four waves are available at: https://chfs.swufe.edu.cn/datas/DataCenter/Home/HomeIndex

the parents. We set $Treatment = 1$ if the wife is no more than 45 years old and the number of children is zero or one, and set $Treatment = 0$ if the wife is more than 45 years old or the couple already has two children. [15]

To avoiding having a control group that mainly consists of the elderly, who may be uncomparable to young couples in many aspects, we limit our analysis to couples with the husband being no more than 47 years old. This is motivated by the fact that a husband is, on average, two years older than the wife according to CHFS, and that the upper limit of the wife's age is 45 years old when we define the treatment group. Among the urban couples with the husband being no more than 47 years old, about 10.2% have a wife being more than 45 years old. By doing so, our sample couples are mostly in the childbearing age, and the control group consists of couples with relatively elderly wives and those with two or more kids.

Some may be concerned that the variable *Treatment* depends on couples' past fertility decisions and their age, both of which are possibly correlated to household wealth, and wealth may directly affect households' risky investment decisions. To confirm the robustness of our findings, we have conducted a battery of robustness checks, such as investigating the quantitative relationship between *Treatment* and total asset, as well as controlling for household fixed effects. To conserve space, we present those results in Appendix B.2.

Our measurement of household stock market participation, which defines the dummy variable *Participate*, takes into consideration both direct and indirect participation. That is, if a household has experience of investment in individual stocks, stock funds, or balanced funds, then it is regarded as participating in the stock market, and the dummy *Participate* equals 1. It equals 0 if the household does not have such experience.

Table 1 display the summary statistics of our sample couples. The average of *Treatment* ranges from 0.7 in 2013 to 0.6 in 2017, indicating that the fertility decision of more than half of our sample couples are potentially affected by TCP. The average of *Post* increases from 4% in 2013 to 17% in 2015 and 100% in 2017, reflecting the staggered adoption of TCP.

From the table, we can also see that the average value of *Participate* ranges from 14% to 21%, which is lower than the stock market participation rate in developed

[15] In the one-child policy era, some couples might have more than one kid. For example, the kids were twins. It is also possible that a couple had the second baby and paid the penalty. The transition from the one-child policy to the two-child policy do not affect such households.

countries (Gormley et al., 2010). If we only count direct participation and exclude indirect participation through mutual funds, then the participation is even lower, ranging from 12% to 18%. Some may be concerned that the low participation rate in China is possibly caused by the high entry cost of the stock market. If the cost is high enough, households would not participate anyway, which makes fertility an irrelevant factor. However, this is unlikely to be the case. According to China Securities Depository and Clearing Corporation Limited (CSDC), in 2013, nearly 38% of the retail accounts in the A-share market have a floating capital of less than 10 thousand yuan, which is about 38% of the annual per-capita disposable of urban residents. The large number of retail accounts with relatively low capital value indicates a low entry cost.

Finally, the average household asset growed from 1.13 million yuan in 2013 to 1.72 million yuan in 2017. This wealth level is representative for an ordinary Chinese household. Our sample does not cover extremely rich households. The 99th percentile and the maximum of household asset is 12.78 million and 30.00 million yuan, respectively (un-tabulated). Thus, it is plausible to assume that our sample households are not as rich as facing no contraints in child investment.

Table 1. Summary Statistics

	2013		2015		2017	
	Mean	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**
Treatment	0.7	6725	0.68	7896	0.59	7568
Post	0.04	6728	0.17	7912	1	7731
Participate	0.14	6548	0.21	6535	0.16	7713
ParticiIndStk	0.12	6556	0.18	6702	0.15	7719
KidNum	1.2	6728	1.16	7912	1.16	7731
Asset	1.13	6728	1.37	7912	1.72	7731
HusAge	38.05	6721	38.35	7869	38.63	7072
HusEdu	4.43	6721	4.55	7851	4.68	7069
HusRuralHK	0.41	6717	0.41	7804	0.4	7060
HusUnhealthy	0.05	6719	0.05	7870	0.05	7076
HusWork	0.92	6721	0.94	7869	0.9	7076
WifeAge	36.43	6724	36.97	7884	38.74	7555
WifeEdu	4.23	6722	4.36	7871	4.45	7554
WifeRuralHK	0.42	6717	0.42	7816	0.41	7539
WifeUnhealthy	0.07	6721	0.06	7886	0.06	7554
WifeWork	0.7	6724	0.74	7880	0.66	7556
OwnBusi	0.26	6727	0.28	7912	0.26	7731

Note: We consider urban couples with the husband being no more than 47 years old. *Treatment* is a dummy that equals 1 if the wife is no more than 45 years old and the couple has no more than 1 child, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 if not yet. *Participate* is a dummy that equals 1 if a couple participates in the stock market directly or indirectly through mutual funds, and 0 otherwise. *ParticiIndStk* is a dummy that equals 1 if a couple directly invests in individual stocks, and 0 otherwise. *KidNum* is the number of kids. *TotalAsset* is total household asset (in million). *HusAge* and *WifeAge* are the husband's age and the wife's age. *HusEdu* and *WifeEdu* are the husband's education level and the wife's education level; they range from 1 (illiteracy) to 9 (Ph.D.). *HusRuralHK* and *WifeRuralHK* are dummies that equal 1 if the husband and the wife, respectively, hold a rural hukou, and 0 otherwise. *HusUnhealthy* and *WifeUnhealthy* are dummies that equal 1 if the husband and the wife, respectively, are less healthy than their peers in the same age; the evaluation of health condition is made by the respondents. *HusWork* and *WifeWork* are dummies that equal 1 if the husband and the wife, respectively, are employed, and 0 otherwise. *OwnBusi* is a dummy that equals 1 if a household owns a business, and 0 if not.

V. Empirical results

This section uses stock market participation as a testing ground. We first examine the relationship among the number of kids, household asset, and stock market participation. Then, by exploiting the staggered adoption of TCP, we establish a causal relationship between household fertility and stock market participation. Finally, we conduct subsample analysis to examine the underlying channels highlighted in our theoretical model. Robustness checks and additional tests are summarized into Appendix B.

V.1. **Baseline regression results.** We start with the regression model (13), and report the results in Table 2 Column (1). The coefficient of $KidNum$ is negative, whereas the coefficient of its interaction with $Asset$ (which is the natural logarithm of household asset) is positive. These results, though statistically insignificant, suggests that an increased number of children is associated with a lower propensity to participate in the stock market for poor couples. But for rich couples, the participation propensity increases with the number of kids. These results must be interpreted cautiously, because the number of kids is endogenous and the relationships described above are not necessarily causal.

The (unreported) coefficients of controlling variables also deliver interesting information. For example, the propensity of participation has a hump-shape relationship with the husband's age, while its relationship with the wife' s age is insignificant. The propensity increases with both persons' education level, and is lower if either person holds a rural hukou. Its relationships with both persons' employment status and health condition are insignificant.

Then we exploit the staggered adoption of TCP and run the baseline regression (14). The results are reported in Table 2 Column (2). The coefficient of $Treatment \times Post$ is significantly negative, while the coefficient of $Asset \times Treatment \times Post$ is significantly positive. These results indicate that TCP facilitates the stock market participation of rich couples, while deterring the participation of poor couples.The breakpoint is 1.25 million (i.e., exp(1.3242/0.0943)). Some may be concerned that the coefficient of $Treatment$ and $Asset \times Treatment$ are signficant, which gives rise to the "Ashenfelter dip" problem (Ashenfelter, 1978). However, this problem is less of a concern in our setting, because TCP is not aimed at changing the participation gap between the rich and the poor. To further alleviate the concern on the mean reversion of participation trends, we conduct robustness checks in Section B.6 of Appendix B.

To facilitate the interpretation of the impact of TCP adoption on rich and poor households, we define *Rich* as a dummy that equals 1 if a household' s asset is more than 1.25 million, and 0 otherwise. Replacing *Asset* with *Rich*, we repeat the baseline regression. This time we use the linear probability model, with *Participation* being the dependent variable. As reported in Table 2 Column (3), the coefficient of $Treatment \times Post$ is significantly negative, and the coefficient of $Rich \times Treatment \times Post$ is significantly positive. Among poor couples, the adoption of TCP leads to a reduction of 1.8 percentage points in the stock market participation rate of the treatment group, relative to the control group. Among rich couples, in contrast, TCP leads to an increase of 1.8 percentage points (i.e., 3.6-1.8) in the participation rate of the treatment group, relative to the control group. These magnitudes are economically significant, given that the participation rate ranges from 14 to 21 percentage points in the three waves.

The economic significance of the TCP effects is even higher among younger couples. For example, if we only include the couples with the husband being no more than 40 years old and rerun the baseline regression (14), then the breakpoint of household asset is 2.31 million instead of 1.25 million. Redefining *Rich* with the new breakpoint, we repeat the analysis in Column (3). According to the (un-tabulated) results, the coefficients of $Treatment \times Post$ and $Rich \times Treatment \times Post$ are -0.0366 ($p<0.01$) and 0.0953 ($p=0.02$), respectively. That is, TCP reduces the stock market participation rate of poor couples by 3.7%, while increasing the participation rate of rich couples by 5.9%.

Some may be curious about the results on the share of risky asset among couples who participate in the stock market. However, as illustrated by Figure 1 Panel (b), the impact of household wealth on the relationship between fertility and optimal share of stocks is nonmonotonic. Our (un-tabulated) empirical results confirm this point. That is, we revise the baseline regression by using a linear model and replacing the dependent variable with households' risky asset as a percentage of all financial assets. Then, using couples with $Participate = 1$, we run the regression. The coeffcient of $Asset \times Treatment \times Post$ is insignificant.

V.2. **Examining the underlying channel.** Our model shows that fertility affects stock market participation through the liquidity-constraint channel and the child-investment channel. Now we test for these channels through subsample analysis.

V.2.1. *Child investment channel.* Our theoretical model predicts that increasing fertility encourages stock market participation for sufficiently rich couples through the

TABLE 2. Fertility and stock market participation

	(1) Probit	**(2) Probit**	**(3) OLS**
KidNum	−0.4145		
	(0.2806)		
KidNum × *Asset*	0.0253		
	(0.0205)		
Treatment		1.2611**	0.0192**
		(0.5265)	(0.008)
Treatment × *Post*		−1.3242**	−0.0177**
		(0.5822)	(0.0085)
Asset × *Treatment*		−0.0799**	
		(0.0374)	
Asset × *Treatment* × *Post*		0.0943**	
		(0.0419)	
Post		1.5481***	0.0213
		(0.5311)	(0.0164)
Asset	0.2457***	0.354***	
	(0.0268)	(0.0358)	
Asset × *Post*		−0.1114***	
		(0.0374)	
Rich × *Treatment*			0.0208
			(0.0181)
Rich × *Treatment* × *Post*			0.0356*
			(0.0214)
Rich			0.1351***
			(0.0153)
Rich × *Post*			−0.0435**
			(0.0175)
Controls	Y	Y	Y
City FE	Y	Y	Y
Wave FE	Y	Y	Y
Obs	19739	19739	19741

Note: The dependent variable *Participate* equals 1 if a couple participates in the stock market, and 0 otherwise. Column (1) and (2) use the probit model. Column (3) uses the linear probability model. *KidNum* is the number of kids. *Asset* is the natural logarithm of household asset. *Treatment* equals 1 if the wife is no more than 45 years old and the number of children is no more than one, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 otherwise. We control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with $***$, $**$, and $*$, respectively.

child investment channels. To examine this channel, we first look into couples' degree of altruism towards children. People bear and raise up children for various reasons. The child investment channel should be more important for couples who are more altruistic towards children. So we expect that the positive effect of fertility on the risky investment by the rich versus the poor are more evident among altruistic parents.

In the 2013 wave and 2015 wave, the respondents were asked "why do people bear and raise up children". They could choose from four answers: 1. Carry on the family name; 2. Love children; 3. Let children to take care of them when they get old; 4. Maintain marriage. The 2017 wave does not have this question in the questionnaire. So we use the answers from earlier waves, as long as the respondent was covered in the two earlier waves.

We classify the couples into two groups according to their answers for this question. If the answer is 1 or 2, then the couple belongs to the "Altruistic" group. If the answer is 3 or 4, then it belongs to the "Non-altruistic" group. Then we repeat the baseline regression (14) separately for the two groups.

As reported in Table 3, the coefficient of $Asset \times Treatment \times Post$ is significantly positive for the Altruistic group, but not for the Non-altruistic group. That is, among parents who are more altruistic towards children, a high level of household asset is more likely to result in a positive effect of fertility on stock market participation. This is consistent with the child investment channel.

To further highlight the child investment channel, we explore regional heterogeneity. We consider two aspects of regional heterogeneity: 1. Level of competition in the college entrance examination (CEE). 2. Expected return to education. Intuitively, the child investment channel should play a bigger role in places where CEE competition is fiercer, and where the expected return to education is higher.

We start with the analysis related to CEE competition. For a province, the intensity of CEE competition is measured as the lowest provincial ranking of the students enrolled in "C9" universities, divided by the number of students that graduated from senior high schools.[16]

To obtain the lowest provincial ranking of the students enrolled in C9 universities, we refer to the distribution of students' CEE score from China Education Online, which is China's largest educational portal. The portal collects the score distribution

[16]C9 is the nine top universities in China. It can be regarded as a Chinese counterpart of Ivy League in the U.S.

Table 3. Subsample analysis: By altruism towards children

	(1) Altruistic	**(2) Non-Altruistic**
Treatment	1.5086***	1.2834
	(0.5601)	(1.1297)
Treatment × *Post*	−2.0246**	−0.6995
	(0.838)	(1.7153)
Asset × *Treatment*	−0.0992**	−0.0869
	(0.04)	(0.0809)
Asset × *Treatment* × *Post*	0.1446**	0.0454
	(0.0608)	(0.1225)
Post	2.0786***	0.0451
	(0.7972)	(1.59)
Asset	0.3831***	0.2886***
	(0.0387)	(0.0825)
Asset × *Post*	−0.1491***	−0.01
	(0.0576)	(0.1133)
Controls	Y	Y
City FE	Y	Y
Wave FE	Y	Y
Obs	12735	4190

Note: We divide couples into two groups according to their altruism towards children. Then we repeat the baseline probit regression(14) separately for the two groups. The dependent variable *Participate* equals 1 if a couple participates in the stock market, and 0 otherwise. *Asset* is the natural logarithm of household asset. *Treatment* equals 1 if the wife is no more than 45 years old and the number of children is no more than one, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 otherwise. We control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with ∗∗∗, ∗∗, and ∗, respectively.

of CEE in each province from Education Examination Institutes.[17] The information is very detailed. For example, we know that there are x students with a score of y. The earliest available distribution corresponds to the year 2017. To the extent that the relative level of CEE competition is stable over years, especially given that our sample period is only four years, it is plausible to use the score distribution in 2017 for

[17]The distribution is available at the website of China Education Online: https://www.eol.cn/e_html/gk/gkfsd/index.shtml#beijing

the whole sample period. In addition to score distribution, the portal also disclose the score required by each university for each province-year combination. By comparing the score requirement of C9 universities and the distribution of students' scores, we get the lowest provincial ranking of the students enrolled in "C9" universities. The ranking is divided by the number of students that graduated from senior high schools, the information of which is from NBS. We denote the resulting ratio as $C9Ratio$; its average across provinces is 2.6%.

We classify couples into three groups (i.e., Hard/Medium/Easy) according to the $C9Ratio$ of their provinces, using the 25th percentile and the 75th percentile as the breakpoints. Then the East group include couples in Beijing, Shanghai, and Tianjin, all of which are province-level cities and highly developed. It also includes couples in Qinghai Province, which is located in western China and has low population density. The Hard group includes couples in Henan Province and Shandong province, which have high population density.

We repeat the baseline regression (14) separately for each group. As reported in Column (1) to (3) of Table 4, the coefficient of the triple interaction term is highly significant for the "Hard" group. For the rest two groups, the coefficient is still positive, but insignificant. These results are consistent with our expectation.

Then we explore the cross-city heterogeneity in people' s expectation for the return to education. For city c in wave t, we compute the income gap between individuals with versus without a bachelor's degree. Here income is the sum of after-tax salary, bonus, and subsidy (e.g., transportation and housing subsidy from the employer). The gap is our measure of expected return to education. It is worth noting that, though this gap does not distinguish the actual return to education from the return to individual capability, it is a reasonable measure of ordinary people' s expectation for the return to education.

We divide couples into three groups (i.e., High/Medium/Low) according to the expected return to education in their cities, using the 25th percentile and the 75th percentile as the breakpoints. We rerun the baseline regression (14) separately for each group. As reported in Column (4) to (6), the coefficient of the triple interaction term is significantly positive for the "High" group. For the rest two groups, the coefficient is still positive, but insignificant. These results are also consistent with our expectation.

TABLE 4. Subsample analysis: By the scarcity of education resources and expected return to education

	College entrance exam			Expected return to education		
	(1) Hard	(2) Medium	(3) Easy	(4) High	(5) Medium	(6) Low
Treatment	3.1671^{**}	1.0446	0.4727	1.0177	1.0695	1.5965
	(1.3049)	(0.6836)	(0.8872)	(0.7793)	(0.7446)	(1.2763)
Treatment × *Post*	-3.1036^{**}	−0.827	−1.4574	-2.0759^{***}	−0.7233	−2.8888
	(1.3527)	(0.8609)	(0.9979)	(0.7112)	(0.8608)	(1.7844)
Asset × *Treatment*	-0.2169^{**}	−0.0654	−0.0249	−0.0725	−0.0608	−0.1009
	(0.0922)	(0.0497)	(0.0611)	(0.0566)	(0.0527)	(0.0945)
Asset × *Treatment* × *Post*	0.2234^{**}	0.0597	0.1038	0.1537^{***}	0.0461	0.2095
	(0.0963)	(0.0632)	(0.0706)	(0.0508)	(0.0612)	(0.1311)
Post	2.9^{***}	1.5527^{**}	1.0057	1.9273^{***}	1.4765^{*}	1.4607
	(1.0099)	(0.7791)	(1.0433)	(0.7459)	(0.828)	(1.5185)
Asset	0.5017^{***}	0.3737^{***}	0.2472^{***}	0.3098^{***}	0.3794^{***}	0.3714^{***}
	(0.0828)	(0.0489)	(0.0515)	(0.0545)	(0.0504)	(0.082)
Asset × *Post*	-0.2102^{***}	-0.114^{**}	−0.0715	-0.1352^{**}	-0.1131^{*}	−0.0916
	(0.0737)	(0.055)	(0.072)	(0.0537)	(0.0585)	(0.1082)
Controls	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y	Y
Obs	5125	9906	4708	4535	9481	4670

Note: We run the baseline probit regression (14) for different subsamples. In Column (1) to (3), we divide couples into three groups according to the intensity of CEE competition. In Column (4) to (6), we divide them into three groups according to the expected return to education in their provinces. The dependent variable *Participate* equals 1 if a couple participates in the stock market, and 0 otherwise. *Asset* is the natural logarithm of household asset. *Treatment* equals 1 if the wife is no more than 45 years old and the number of children is no more than one, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 otherwise. We control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with $***$, $**$, and $*$, respectively.

V.2.2. *Liquidity constraint channel.* This subsection tests for the liquidity constraint channel. In particular, we asks whether the negative effect of fertility on the stock market participation of poor households is stronger in provinces with less marketized credit allocation. In provinces with a low level of credit allocation marketization, households should find it hard to obtain loans, which means a tight liquidity constraint. The Wind database, which is widely used by the finance industry and academics in China, provides the index of Credit Allocation Marketization (CAM). This is a province-level index that has been available since 1997. It measures the share of short-term loans allocated to the non-state sector, including township enterprises, private firms, and foreign companies. We expect that the liquidity constraint channel is more relevant in provinces with a low value of CAM index.

We divide couples into the "Low" group and the "High" group according to the CAM index value of their provinces. Then we repeat the baseline regression (14) separately for the two groups. As reported in Table 5, for the "Low" group, the coefficient of $Treatment \times Post$ is significantly negative. For the "High" group, the coefficients is insignificant. Thus, the negative effect of fertility on the risky investment of the poor is stronger in provinces with less marketized credit allocation. These results are consistent with the liquidity constraint channel.

VI. Further implications

We consider three implications of our findings. First, we consider the application of our theoretical predictions to entrepreneurial activities, which is an important aspect of households' risky investment. Second, we consider the implication for wealth inequality. Intuitively, the opposite effects of TCP on the risky investment by the poor versu the rich may increase wealth inequality, assuming a positive return to risky investment. Third, we discuss about the implications for the studies related to household-level impacts of monetary policies. Our findings lead to a solution to the endogeneity problem in such studies.

VI.1. **Entrepreneurial activities.** Now we show that our theoretical predictions can be extended to entrepreneurial activites. Relative to salary jobs, entrepreneurial activities usually involve higher risk and potentially higher returns. Entrepreneurial activities also have significant entry costs. Then our theoretical model predicts that TCP deters the entrepreneurial activities of the poor, while encouraging that of the rich.

TABLE 5. Subsample analysis: By index of Credit Allocation Marketization

	(1) Low	**(2) High**
Treatment	1.3964**	1.2442
	(0.614)	(0.8056)
$Treatment \times Post$	−2.3549***	−0.5864
	(0.8924)	(0.7339)
$Asset \times Treatment$	−0.0941**	−0.0758
	(0.0442)	(0.0567)
$Asset \times Treatment \times Post$	0.1758***	0.0382
	(0.0645)	(0.0507)
Post	2.5006***	0.8745
	(0.8744)	(0.7828)
Asset	0.3787***	0.3411***
	(0.0445)	(0.0521)
$Asset \times Post$	−0.1859***	−0.0608
	(0.0633)	(0.0548)
Controls	Y	Y
City FE	Y	Y
Wave FE	Y	Y
Obs	10139	9600

Note: We divide couples into two groups according to the index of Credit Allocation Marketization in their provinces. Then we repeat the baseline regression (14) separately for the two groups. The dependent variable *Participate* equals 1 if a couple participates in the stock market, and 0 otherwise. *Asset* is the natural logarithm of household asset. *Treatment* equals 1 if the wife is no more than 45 years old and the number of children is no more than one, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 otherwise. We control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with $***$, $**$, and $*$, respectively.

CHFs provides the information necessary for this analysis. In each wave, households were asked whether they own a business. We define the dummy *OwnBusi* as 1 if a household owns a business, and 0 if not. Replacing *Participate* with *OwnBusi*, we repeat the baseline regression. To avoid quasi-complete separation of data point, we relax the limitation of husband age to 50 years old. According to the (un-tabulated) results, the coefficient of $Treatment \times Post$ is -0.69 (p=0.12), and the coefficient of

$Treatment \times Post \times Asset$ is 0.05 (p=0.10). In general, the results are consistent with our theoretical prediction.

VI.2. **Wealth inequality.** The opposite effects of fertility on risky investment by the rich versus the poor may widen their wealth gap because of capital gains. Now, using aggregate level data, we test whether fertility rate positively predicts wealth inequality.

We consider two measures of wealth inequality. The first is Herfindahl-Hirschman Index (HHI), as defined below. N is the total number of urban households covered by CHFS in city c during wave t; w is household i's asset value divided by the total asset value of the N households.

$$HHI_{c,t} = \sum_{i=0}^{N} w_{i,c,t}^2, \tag{15}$$

Then we run the following regression. The dependent variable is HHI of city c in province p during wave t. Here t only takes three values: 2013, 2015, and 2017. One empirical challenge is that in cities with relatively few observations, HHI is volatile. For each city, we calculate the differences between its HHI in two consecutive waves. The 98th percentile of the absolute value of the difference is 0.19. There are 7 cities with HHI changing by more than 0.19 from 2013 to 2015 or from 2015 to 2017. We drop the 7 cities, which reduces the size of the panel from 468 city-wave units to 448 units. The average HHI for this sample is 0.04. On the right-hand side of the regression, $Birthrate$ is the average birthrate in province p between t-2 and t-1. NBS has disclosed province-level birthrates since 1949. The average of this variable is 0.01. We control for city fixed effects and year fixed effects by dummies. Standard errors are clustered by province-wave.

$$HHI_{c,p,t} = c + \beta Birthrate_{p,[t-2,t-1]} + \mu_c + \tau_t + \epsilon_{c,t}, \tag{16}$$

According to the (un-tabulated) results, the coefficient of $Birthrate$ is 2.91 (p=0.10). That is, higher birthrate is followed by higher wealth inequality. This is consistent with our conjecture.

Our second measure is the percentage of wealth owned by the top 20% of households. For city c in wave t, we rank the urban households according to their total asset value. We divide the value of assets owned by the households in the top quintile to the total asset value of all the urban households, denoting the ratio as $Top20asset$.

The average of this variable is 0.57. Replacing HHI with $Top20asset$, we rerun the above regression.

According to the (un-tabulated) results, the coefficient of $Birthrate$ is 9.93 (p=0.13). This indicates that higher birthrate is followed by higher wealth inequality, which is consistent with our conjecture.

VII. Conclusion

In this paper, we study the effect of fertility on households' risky investment decisions. Our theoretical model predicts that fertility deters risky investment through the liquidity-constraint channel, and encourages risky investment through the child-investment channel. The relative strength of these two channels depends on household wealth, so that ferility changes generate opposite effects on risky investment decisions between rich households and poor households.

The model predictions are well supported by our empirical results. We exploit the staggered adoption of two-child policy (TCP) to isolate the exogenous movements in household fertility. We find that TCP deters the stock market participation by poor couples, whereas facilitates the participation by rich couples. The results on entrepreneurial activities are similar.

We also corroborate the model's mechanism with subsample analysis on the data. We show that, the positive effect of fertility on the stock market participation by the rich relative to the poor is more evident among couples that are more altruistic towards children. The effect is also stronger in provinces with fiercer competition in the college entrance examination and higher expected return to education. These results support the child investment channel in our model. Meanwhile, the negative effect on the risky investment by the poor is more evident in provinces with less marketized credit allocation and thus tighter liquidity constraint, consistent with the liquidity constraint channel in the model.

Our findings have important implifications for wealth inequality. Our findings indicate that increased ferility could widen the wealth gap by encouraging risky investment by the rich and depressing risky investment by the poor. Consistent with this implication, we show that higher birth rates do predict higher wealth inequality using Chinese city-level data.

There are other possible extensions stemming from this paper. For example, the literature has documented that stock market participation rate and the age structure of investors are determinants of stock market features like the equity premium and funds outflow from the market (e.g., Hong et al., 2004; Goyal, 2004). It is interesting to investigate how the world-wide decline in fertility affects these important features of the stock market. We leave these issues to future research.

Appendix A. Model solution and proof

A.1. **Solution to the model.** We first solve for the parents' optimization problem in the consumption period. For convenience of references, we rewrite the parents' optimization problem (6) as follows,

$$U(n, W_1) = \max_{c,e} \alpha \ln(c) + (1-\alpha) n \ln(\theta_0 + \theta_1 e), \tag{A1}$$

subject to

$$[sR_s + (1-s)R]W_0 = c + n\kappa + ne, \tag{A2}$$

$$e \geq 0. \tag{A3}$$

The optimization conditions with respect to the parents' consumption c and child investment e are given by,

$$\frac{\alpha}{c} - \lambda_b = 0, \tag{A4}$$

$$\frac{(1-\alpha)n\theta_1}{\theta_0 + \theta_1 e} - n\lambda_b = 0, \tag{A5}$$

where $\lambda_b \geq 0$ denotes the Lagrange multiplier on the budget constraint (A2).

Using (A4), (A5) and the budget constraint (1), we could obtain the parents' optimal decisions on consumption and child investment as a fraction of the final wealth W_1 that realizes in the consumption period,

$$\begin{cases} c = W_1 - n\kappa, & e = 0, \qquad \text{if } W_1 \leq n\kappa + \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}, \\ c = \frac{\alpha}{1-\alpha}\frac{W_1 - n\kappa + n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}, & e = \frac{W_1 - n\kappa - \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}, \quad \text{if } W_1 > n\kappa + \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}. \end{cases} \tag{A6}$$

Substituting the parents' optimal decisions on consumption and child investment (A6) into (**??**), we could obtain the parents' utility as a function of the number of children n and the final wealth W_1,

$$U(n, W_1) = \begin{cases} \alpha \ln(W_1 - n\kappa) + (1-\alpha) n \ln\theta_0, & \text{if } W_1 \leq n\kappa + \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}, \\ \alpha \ln(\alpha) + [\alpha + (1-\alpha)n] \ln[\frac{W_1 - n\kappa + n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}] + (1-\alpha) n \ln[(1-\alpha)\theta_1], & \text{if } W_1 > n\kappa + \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}. \end{cases} \tag{A7}$$

We then solve for the parents' decision on risky asset investment in the trading period ($t = 0$). If the parents choose not to enter the risky asset market ($s = 0$), the parents' optimal choices and their utility function under optimal choices are, respectively, given by (A6) and (A7), with $W_1 = RW_0$. For convenience of references, we rewrite the parents' optimized utility in this case as follows,

$$V^b(n, W_0) = U(n, RW_0), \tag{A8}$$

where the function $U(\cdot, \cdot)$ is given by (A7).

If the parents choose to enter the risky asset market, the parents choose risky asset holdings s subject to the liquidity constraint (4) in the trading period ($t = 0$) to maximize their expected utility in the consumption period. In this case, the parents' optimization problem in the trading period is given by,

$$V^s(n, W_0) = \max_s \mathrm{E}[U(n, [sR_s + (1-s)R]W_0)], \tag{A9}$$

subject to the liquidity constraint,

$$(1-s)RW_0 \geq \bar{c} + n\kappa, \tag{A10}$$

And the optimal condition on risky asset share s is then given by,

$$\mathrm{E}(R_s - R)\frac{\partial U(n, W_1)}{\partial W_1}|_{W_1=[sR_s+(1-s)R]W_0} - \lambda_l RW_0 = 0 \tag{A11}$$

where $\lambda_l \geq 0$ denotes the Lagrange multiplier on the liquidity constraint (A10) and satisfies that,

$$\lambda_l[(1-s)RW_0 - \bar{c} - n\kappa] = 0. \tag{A12}$$

A.2. **Proof for Proposition III.2.**

Proof. For convenience of references, we take the assumption $\theta_1 = 0$ as given and rewrite the optimized utilities given by (A9) and (A8), respectively, as follows,

$$V^s(n, W_0) = \mathrm{E}\alpha \ln[(s^*R_s + (1-s^*)R)W_0 - n\kappa] + (1-\alpha)n \ln \theta_0, \tag{A13}$$

where s^* denotes the optimal risky asset share that satisfies (A11):

$$\mathrm{E}\frac{\alpha(R_s - R)}{[s^*R_s + (1-s^*)R]W_0 - n\kappa} - \lambda_l R = 0, \tag{A14}$$

where $\lambda_l \geq 0$ denotes the Lagrange multiplier on the liquidity constraint (A10) and satisfies (A12):

$$\lambda_l[(1-s^*)RW_0 - \bar{c} - n\kappa] = 0. \tag{A15}$$

and

$$V^b(n, W_0) = \alpha \ln[RW_0 - n\kappa] + (1-\alpha)n \ln \theta_0, \tag{A16}$$

The proof consists of two parts. We first prove that there exists a threshold value $\bar{W}$ such that the liquidity constraint (A10) is binding ($\lambda_l > 0$) if and only if $W_0 < \bar{W}$. We then prove that a marginal increase in household fertility reduces the welfare gains from investing in risky assets ($\frac{\partial V(n,W_0)}{\partial n} < 0$) if the liquidity constraint is binding, but has no impact ($\frac{\partial V(n,W_0)}{\partial n} = 0$) if the liquidity constraint is not binding.

Part 1. Denote s' as the optimal choice of risky asset share when the liquidity constraint is not binding ($\lambda_l = 0$), which is determined by (A14),

$$f(s') \equiv \mathrm{E}\frac{\alpha(R_s - R)}{[s'R_s + (1-s')R]W_0 - n\kappa} = 0, \tag{A17}$$

Also denote s_0 as the optimal choice of risky asset share when the liquidity constraint is binding ($\lambda_l > 0$), which is determined by (A15),

$$s_0 = 1 - \frac{\bar{c} + n\kappa}{RW_0}. \tag{A18}$$

Then, if $s' \leq s_0$, the liquidity constraint is not binding ($\lambda_l = 0$) and $s^* = s'$; and if $s' > s_0$, the liquidity constraint is binding ($\lambda_l > 0$) and $s^* = s_0$. **Therefore, the liquidity constraint** (A10) **is binding (**$\lambda_l > 0$**) if and only if** $s' > s_0$**.**

Note that, the derivative of the determination equation of the risky asset share s', given by (A17), is strictly negative:

$$f'(s') = -\mathrm{E}\frac{\alpha(R_s - R)^2 W_0}{\{[s'R_s + (1-s')R]W_0 - n\kappa\}^2} < 0,$$

and

$$f(0) = \mathrm{E}\frac{\alpha(R_s - R)}{RW_0 - n\kappa} = \frac{\alpha(\mathrm{E}R_s - R)}{RW_0 - n\kappa} > 0.$$

It follows that $s' > 0$ and there exists $s' \in (0, s_0]$ such that $f(s') = 0$ if and only if $f(s_0) \leq 0$. **Therefore,** $s' \leq s_0$ **if and only if** $f(s_0) \leq 0$**.**

We now prove that there exists a threshold value $\bar{W}$ **such that** $f(s_0) \leq 0$ **if and only if** $W_0 \geq \bar{W}$**.** Denote $g(W_0) \equiv f(s_0)$ as a function of W_0. Substituting (A18) into (A17), $g(W_0)$ is given by,

$$g(W_0) \equiv f(s_0) = \mathrm{E}\frac{\alpha(R_s - R)}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa}.$$

We first prove that $g(W_0)$ decreases with W_0 if $g(W_0) \geq 0$ and Assumption III.1 holds. In particular, given Assumption III.1, differentiating $g(W_0)$ with respect to W_0 gives,

$$\begin{aligned}
g'(W_0) =& -\mathrm{E}\frac{\alpha(R_s - R)}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa}\frac{R_s}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa} \\
=& -Cov(\frac{\alpha(R_s - R)}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa}, \frac{R_s}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa}) \\
& - f(s_0)\mathrm{E}\frac{R_s}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa} \\
& < 0 \quad if \quad f(s_0) \geq 0 \quad and \quad RW_0 \geq \bar{c} + n\kappa.
\end{aligned}$$

We then prove that $g(W_0) > 0$ when W_0 reaches its minimum implied by Assumption III.1. In particular, when $W_0 = \frac{\bar{c}+n\kappa}{R}$, then

$$s_0 = 1 - \frac{\bar{c}+n\kappa}{RW_0} = 0, \quad g(W_0) = f(s_0) = f(0) > 0.$$

Finally, with proof by contradiction, we show that there exists a threshold value $\bar{W}$ such that $g(W_0) \leq 0$ if and only if $W_0 \geq \bar{W}$. Otherwise, assuming that there exists $\bar{W}_2 > \bar{W}_1 > \frac{\bar{c}+n\kappa}{R}$ with $g(\bar{W}_1) < 0$ and $g(\bar{W}_2) > 0$, then, the intermediate value theorem implies that there exists $\bar{W}_3 \in (\bar{W}_1, \bar{W}_2)$ such that $g(\bar{W}_3) = 0$ and $g(W_0) < 0$ if $\bar{W}_1 < W_0 < \bar{W}_3$. Recall that, $g(W_0)$ decreases with W_0 if $g(W_0) \geq 0$. Then, $g'(\bar{W}_3) < 0$. Given a very small value $\epsilon > 0$, $g(\bar{W}_3 - \epsilon) \approx g(\bar{W}_3) - g'(\bar{W}_3)\epsilon > 0$. This is in contradiction with the fact that $g(W_0) < 0$ for $\bar{W}_1 < W_0 < \bar{W}_3$.

Part 2. We now focus on the effect of changes in household fertility on the welfare gains from investing in risky assets $V(n, W_0)$ in two cases: one case where the liquidity constraint is binding ($\lambda_l > 0$), and the other case where the liquidity constraint is not binding ($\lambda_l = 0$).

When the liquidity constraint is binding ($\lambda_l > 0$), the optimal risky asset share $s^* = s_0$, where s_0 is given by (A18). Substituting for s^* in (A16) and (A13), we could obtain the welfare gains from investing in risky assets, which is given by,

$$\begin{aligned} V(n, W_0) &= V^s(n, W_0) - V^b(n, W_0) \\ &= \{\mathrm{E}\alpha \ln[(s^* R_s + (1-s^*)R)W_0 - n\kappa] + (1-\alpha)n \ln\theta_0\} - \{\alpha \ln[RW_0 - n\kappa] + (1-\alpha)n\ln\theta_0\} \\ &= \mathrm{E}\alpha \ln[((1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R)W_0 - n\kappa] - \alpha\ln[RW_0 - n\kappa] \end{aligned} \tag{A19}$$

Differentiating $V(n, W_0)$ with respect to n gives,

$$\begin{aligned} \frac{\partial V(n, W_0)}{\partial n} &= -\mathrm{E}\alpha \frac{1}{((1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R)W_0 - n\kappa} \frac{R_s}{R}\kappa + \alpha \frac{1}{RW_0 - n\kappa}\kappa \\ &= -\mathrm{E}\alpha \frac{R_s - R}{[((1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R)W_0 - n\kappa](RW_0 - n\kappa)} \frac{\bar{c}\kappa}{R}. \end{aligned}$$

Recall that when the liquidity constraint is binding,

$$f(s_0) = \mathrm{E}\frac{\alpha(R_s - R)}{[(1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R]W_0 - n\kappa} > 0, \tag{A20}$$

Therefore,

$$\frac{\partial V(n, W_0)}{\partial n} = -\frac{\bar{c}\kappa}{R(RW_0 - n\kappa)} \mathrm{E}\frac{\alpha(R_s - R)}{[((1 - \frac{\bar{c}+n\kappa}{RW_0})R_s + \frac{\bar{c}+n\kappa}{RW_0}R)W_0 - n\kappa]} < 0.$$

When the liquidity constraint is not binding ($\lambda_l = 0$), the optimal risky asset share $s^* = s'$, where s' is given by (A17). Substituting for s^* in (A16) and (A13), we could obtain the welfare gains from investing in risky assets, which is given by,

$$\begin{aligned} V(n, W_0) &= V^s(n, W_0) - V^b(n, W_0) \\ &= \{\mathrm{E}\alpha \ln[(s^* R_s + (1-s^*)R)W_0 - n\kappa] + (1-\alpha)n \ln \theta_0\} - \{\alpha \ln[RW_0 - n\kappa] + (1-\alpha)n \ln \theta_0\} \\ &= \{\mathrm{E}\alpha \ln[(s' R_s + (1-s')R)W_0 - n\kappa]\} - \{\alpha \ln[RW_0 - n\kappa]\}, \end{aligned} \tag{A21}$$

where s' is given by (A17). Differentiating $V(n, W_0)$ with respect to n gives,

$$\begin{aligned} \frac{\partial V(n, W_0)}{\partial n} &= -\mathrm{E}\alpha \frac{\kappa}{(s' R_s + (1-s')R)W_0 - n\kappa} + \alpha \frac{\kappa}{RW_0 - n\kappa} \\ &= \mathrm{E}\alpha \frac{\kappa(R_s - R)s' W_0}{[(s' R_s + (1-s')R)W_0 - n\kappa](RW_0 - n\kappa)} \end{aligned}$$

Recall that (A17) gives,

$$f(s') \equiv \mathrm{E}\frac{\alpha(R_s - R)}{[s' R_s + (1-s')R]W_0 - n\kappa} = 0,$$

Therefore,

$$\frac{\partial V(n, W_0)}{\partial n} = \frac{\kappa s' W_0}{RW_0 - n\kappa} \mathrm{E}\frac{\alpha(R_s - R)}{(s' R_s + (1-s')R)W_0 - n\kappa} = 0.$$

□

A.3. **Proof for Proposition III.3.**

Proof. **The proof consists of two parts.** We first prove that there exists a threshold value $\bar{W}$ such that the child investment is always positive ($e > 0$) if and only if the initial wealth $W_0 > \bar{W}$. We then prove that, when the child investment is always positive ($e > 0$), a marginal increase in household fertility raises the welfare gains from entering the risky asset market ($\frac{\partial V(n, W_0)}{\partial n} > 0$).

Part 1. Consider the case where the child investment is always positive ($e > 0$). For convenience of references, we take the assumption $\kappa = \bar{c} = 0$ as given and rewrite the optimized utilities given by (A9) and (A8), respectively, as follows,

$$V^s(n, W_0) = \mathrm{E}\alpha \ln(\alpha) + [\alpha + (1-\alpha)n] \ln[\frac{[s^* R_s + (1-s^*)R]W_0 + n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}] + (1-\alpha)n \ln[(1-\alpha)\theta_1], \tag{A22}$$

where s^* denotes the optimal risky asset share and is given by (A11),

$$f(s^*) \equiv \mathrm{E}[\alpha + (1-\alpha)n] \frac{R_s - R}{[s^* R_s + (1-s^*)R]W_0 + n\frac{\theta_0}{\theta_1}} = 0 \tag{A23}$$

and

$$V^b(n, W_0) = \alpha \ln(\alpha) + [\alpha + (1-\alpha)n] \ln[\frac{RW_0 + n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha} + n}] + (1-\alpha)n \ln[(1-\alpha)\theta_1], \quad \text{(A24)}$$

Furthermore, the choice of $e > 0$ for any realization of R_s requires that.

$$(1 - s^*)RW_0 > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}, \quad \text{(A25)}$$

Since shorting is not allowed ($s^* \geq 0$), Condition (A25) holds only if

$$RW_0 > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}, \quad \text{(A26)}$$

Therefore, the condition (A26) **is a necessary condition of Condition** (A25)**.** In what follows, we prove that when Condition (A26) holds, there exists a threshold value $\bar{W} > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{R}$ such that the condition (A25) holds if and only if $W_0 > \bar{W}$.

Denote s_0 as the threshold for optimal risky asset share given by (A25),

$$s_0 = 1 - \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}. \quad \text{(A27)}$$

Then, Condition (A25) **holds if and only if** $s^* < s_0$**.**

Note that, the derivative of the first order condition of the risky asset share that determines s^*, given by (A23), is always negative:

$$f'(s^*) = -\mathrm{E}\frac{[\alpha + (1-\alpha)n](R_s - R)^2 W_0}{\{[s^* R_s + (1-s^*)R]W_0 + n\frac{\theta_0}{\theta_1}\}^2} < 0,$$

and

$$f(0) = \mathrm{E}[\alpha + (1-\alpha)n]\frac{R_s - R}{RW_0 + n\frac{\theta_0}{\theta_1}} = [\alpha + (1-\alpha)n]\frac{\mathrm{E}R_s - R}{RW_0 + n\frac{\theta_0}{\theta_1}} > 0.$$

It follows that $s^* > 0$ and there exists $s^* \in (0, s_0)$ such that $f(s^*) = 0$ if and only if $f(s_0) < 0$. **Therefore,**$s^* < s_0$ **if and only if** $f(s_0) < 0$**.**

We next prove that there exists a threshold value $\bar{W} > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{R}$ **such that** $f(s_0) < 0$ **if and only if** $W_0 > \bar{W}$**.** Denote $g(W_0) \equiv f(s_0)$ as a function of W_0. Substituting (A27) into (A23), $g(W_0)$ is given by,

$$g(W_0) \equiv f(s_0) = \mathrm{E}\frac{[\alpha + (1-\alpha)n](R_s - R)}{[(1 - \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s + \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0 + n\frac{\theta_0}{\theta_1}}.$$

We first prove that $g(W_0)$ decreases with W_0 if $g(W_0) \geq 0$ and (A26) holds. In particular, differentiating $g(W_0)$ with respect to W_0 gives,

$$\begin{aligned}
g'(W_0) = & -\mathrm{E}\frac{[\alpha+(1-\alpha)n](R_s-R)}{[(1-\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s+\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0+n\frac{\theta_0}{\theta_1}}\frac{R_s}{[(1-\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s+\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0+n\frac{\theta_0}{\theta_1}} \\
= & -Cov(\frac{\alpha(R_s-R)}{[(1-\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s+\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0+n\frac{\theta_0}{\theta_1}},\frac{R_s}{[(1-\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s+\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0+n\frac{\theta_0}{\theta_1}}) \\
& -f(s_0)\mathrm{E}\frac{R_s}{[(1-\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0})R_s+\frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0}R]W_0+n\frac{\theta_0}{\theta_1}} \\
& < 0 \quad if \quad f(s_0) \geq 0 \quad and \quad RW_0 > \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}.
\end{aligned}$$

We then prove that $g(W_0) > 0$ when W_0 reaches its minimum implied by Condition (A26). In particular, when $W_0 = \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{R}$,

$$s_0 = 1 - \frac{\alpha}{1-\alpha}\frac{\theta_0}{\theta_1}\frac{1}{RW_0} = 0, \quad g(W_0) = f(s_0) = f(0) > 0.$$

Finally, with proof by contradiction, we show that there exists a threshold value $\bar{W}$ such that $g(W_0) < 0$ if and only if $W_0 > \bar{W}$. Otherwise, assuming that there exists $\bar{W}_2 > \bar{W}_1 > \frac{\bar{c}+n\kappa}{R}$ with $g(\bar{W}_1) < 0$ and $g(\bar{W}_2) > 0$, then, the intermediate value theorem implies that there exists $\bar{W}_3 \in (\bar{W}_1, \bar{W}_2)$ such that $g(\bar{W}_3) = 0$ and $g(W_0) < 0$ if $\bar{W}_1 < W_0 < \bar{W}_3$. Recall that, $g(W_0)$ decreases with W_0 if $g(W_0) \geq 0$. Then, $g'(\bar{W}_3) < 0$. Given a very small value $\epsilon > 0$, $g(\bar{W}_3 - \epsilon) \approx g(\bar{W}_3) - g'(\bar{W}_3)\epsilon > 0$. This is in contradiction with the fact that $g(W_0) < 0$ for $\bar{W}_1 < W_0 < \bar{W}_3$.

Part 2. We now prove that, when the child investment is always positive ($e > 0$), a marginal increase in household fertility raises the welfare gains from investing in risky assets ($\frac{\partial V(n,W_0)}{\partial n} > 0$). Substituting for s^* in (A24) and (A22), we could obtain the welfare gain from investing in risky assets, which is given by,

$$\begin{aligned}
V(n,W_0) = & V^s(n,W_0) - V^b(n,W_0) \\
= & \{\mathrm{E}\alpha\ln(\frac{\alpha}{1-\alpha}) + [\alpha+(1-\alpha)n]\ln[\frac{[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha}+n}] + (1-\alpha)n\ln\theta_1\} \\
& -\{\alpha\ln(\frac{\alpha}{1-\alpha}) + [\alpha+(1-\alpha)n]\ln[\frac{RW_0+n\frac{\theta_0}{\theta_1}}{\frac{\alpha}{1-\alpha}+n}] + (1-\alpha)n\ln\theta_1\} \\
= & \mathrm{E}[\alpha+(1-\alpha)n]\ln[[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}] - [\alpha+(1-\alpha)n]\ln[RW_0+n\frac{\theta_0}{\theta_1}],
\end{aligned} \tag{A28}$$

where s^* is given by (A23). Differentiating $V(n, W_0)$ with respect to n gives,

$$\begin{aligned}\frac{\partial V(n,W_0)}{\partial n} &= \mathrm{E}[\alpha+(1-\alpha)n]\frac{\theta_0}{\theta_1}\frac{1}{[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}} + (1-\alpha)\ln[[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}] \\ &\quad - [\alpha+(1-\alpha)n]\frac{\theta_0}{\theta_1}\frac{1}{RW_0+n\frac{\theta_0}{\theta_1}} - (1-\alpha)\ln[RW_0+n\frac{\theta_0}{\theta_1}] \\ &= -[\alpha+(1-\alpha)n]\frac{\theta_0}{\theta_1}\frac{s^*W_0}{RW_0+n\frac{\theta_0}{\theta_1}}\mathrm{E}\frac{R_s-R}{[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}} + \frac{1-\alpha}{\alpha+(1-\alpha)n}V(n,W_0).\end{aligned}$$

Recall that (A23) gives,

$$f(s^*) \equiv \mathrm{E}\frac{R_s-R}{[s^*R_s+(1-s^*)R]W_0+n\frac{\theta_0}{\theta_1}} = 0,$$

Also since $V(n, W_0)$ measures the welfare gain from investing in the risky asset market and, as we have proven, the optimal stock share $s^* > 0$, then $V(n, W_0) > 0$. Therefore,

$$\frac{\partial V(n,W_0)}{\partial n} = \frac{1-\alpha}{\alpha+(1-\alpha)n}V(n,W_0) > 0.$$

□

Appendix B. Robustness checks for Empirics

We first show that TCP does not change people' s risk preference. Then we show that our results are robust if we use alternative samples and specifications, if we only consider direct participation in the stock market, and if we replace household asset with net asset. Finally, as a complementary analysis, we investigate how TCP affects rural couples, relative to urban couples.

B.1. **Risk preference.** Our theoretical model does not include a risk preference parameter, and some may be concerned that parenthood changes people' s risk attitudes (e.g., Görlitz and Tamm, 2020), which could be another channel through which fertility affects risky investment decisions. To examine this channel, we directly look at the respondents' risk attitude, which is denoted as $PreferRisk$. In each wave, they were asked whether they prefer investment projects with above-average risk and return or not. If a respondent prefers above-average risk and return, then the dummy $PreferRisk$ equals 1. If the respondent prefers average or below average risk and return, then the dummy equals 0.

Replacing the dependent variable in regression (14) with $PreferRisk$, we rerun the baseline regression (14). According to the (un-tabulate) results, the coefficient of $Treatment \times Post$ and $Asset \times Treatment \times Post$ are both insignificant. Hence, it is unlikely that fertility affects households' risky investment decisions by altering their risk preference.

B.2. **Alternative samples and specifications.** First, to ensure that our findings are not caused by some factors that coincided with a certain wave, we examine whether our major findings are robust in different sample periods. We rerun the baseline regression separately for the period 2013-2015 and 2015-2017. As displayed in Column (1) and (2) of Table B.1, the coefficient of $Treatment \times Post$ is significantly negative, and the coefficient of $Asset \times Treatment \times Post$ is signficantly positive. The significance level is a bit lower for the period 2015-2017 than for 2013-2015, which may be due to the delayed response in stock market participation by couples who were exposed to TCP early.

Second, we address the concern related to sample selection. Our baseline regression uses the couples with the husband being no more than 47 years old (while setting no requirement for the wife's age). Such selection is meant to avoid comparing couples in very different cohorts, but it may not be appropriate enough if the financial condition of a couple is highly correlated with the wife's age instead of the husband's age. To mitigate this concern, we use an alternative sample that only includes couples with the wife being no more than 40 years old. Then we repeat the baseline regression. As shown in Table B.1 Column (3), the coefficients of $Treatment$ and $Asset \times Treatment$ are insignificant, indicating parallel pre-TCP trends of stock market participation. More importantly, the coefficient of $Treatment \times Post$ is significantly negative, and the coefficient of $Asset \times Treatment \times Post$ is signficantly positive, which is consistent with our baseline results.

Third, we mitigate the concern that $Treatment$ is correlated with household wealth, which affects risky investment decisions. In particular, the value of this variable depends on whether a couple already has two kids, which may be endogenous to household wealth. In the OCP era, some rich couples were willing to have a second child and pay the penalty. To address this concern, we run a probit regression. The dependent variable is a dummy indicating whether the number of kids exceeds one. On the right-hand side, the variable of interest is $Asset$. We control for other household characteristics and fixed effects included in the baseline regression (14). The sample is the same as in Table B.1 Column (3). According to the (un-tabulated) results, the coefficient of $Asset$ is positive and statistically significant. But the economic magnitude is small. As total asset increases from the 25th percentile to the 75th percentile, the likelihood of having more than one kid only increases by 1.3%. As a reference, among the couples with the wife being no more than 40 years old, the unconditional likelihood is 24.5%. So the relationship between $Asset$ and $Treatment$ is relatively unimportant.

Another way to mitigate this and other concerns related to the different composition of the treatment group and the control group is the widely used reweighting approach (e.g. Han et al., 2021). In the first stage, we run a probit regression where the dependent variable is a dummy that equals 1 for control couples and 0 for treatment couples. Then we reweight the couples in the treatment group according to the predicted probability obtained in the first stage, while the weight of the treatment group as a whole relative to the control group depends on the size of the two groups. In the second stage, we run the weighted version of the baseline regression. By doing so, we essentially make the composition of the treatment group more analogous to the control group. According to the (un-tabulated) results, our main findings are robust.

Fourth, we alleviate the concern of not distinguishing between couples with 0 and 1 child when defining the treatment group. If the adoption of TCP only affects the couples with one child in the short term, the treatment group should only include such couples. So we drop the couples with the wife being no more than 45 years old and meanwhile having no kids, and rerun the baseline regression. As displayed in Column (4), the coefficient of $Treatment \times Post$ is -1.42 (p=0.02), and the coefficient of the triple interaction term is 0.10 (p=0.02). They are consistent with our baseline results.

Fifth, we attenuate the concerns regarding time-invariant household characteristics, such as cohorts. More specifically, we control for household fixed efffects and repeat the baseline regression. Since $Treatment$ varies across households and time, we still have the term $Treatment$ after controlling for household fixed effects. The results are reported in Column (5). The coefficient of $Treatment \times Post$ remains significantly negative, and the coefficient of $Asset \times Treatment \times Post$ remains significantly positive, which support our major findings. In another related test, we include all urban couples regardless of their age and control for household fixed effects. This enlarges our sample size to 31,153. Then we repeat the baseline regression. As displayed in Column (6), the results are consistent with our previous findings.

Table B.1. Alternative specifications and samples

	(1)2013-2015	**(2) 2015-2017**	**(3) WifeAge≤ 40**	**(4) 1-kid cps**	**(5) HH FE**	**(6) All HH**
$Treatment$	1.2837**	1.5689*	1.0493	1.1379**	−0.3892	−0.7157
	(0.5331)	(0.8314)	(0.7409)	(0.5266)	(0.611)	(0.4597)
$Treatment \times Post$	−6.5189***	−1.614*	−2.0394***	−1.4191**	−1.6912**	−0.9653*
	(1.5605)	(0.8373)	(0.709)	(0.5904)	(0.6776)	(0.5535)
$Asset \times Treatment$	−0.085**	−0.0987*	−0.057	−0.0699*	0.0278	0.0573
	(0.0379)	(0.0593)	(0.052)	(0.0374)	(0.0486)	(0.0352)
$Asset \times Treatment \times Post$	0.4721***	0.112*	0.1396***	0.1009**	0.128**	0.0747*
	(0.1081)	(0.0598)	(0.0509)	(0.0424)	(0.0538)	(0.0435)
$Post$	6.3244***	2.3244***	2.398***	1.5605***	1.7239***	0.9243***
	(1.3796)	(0.7989)	(0.646)	(0.5289)	(0.5674)	(0.1561)
$Asset$	0.3493***	0.42***	0.3254***	0.3559***	0.1445***	0.1398***
	(0.0355)	(0.0622)	(0.0435)	(0.0362)	(0.0374)	(0.0146)
$Asset \times Post$	−0.4608***	−0.1667***	−0.1667***	−0.1111***	−0.1155**	−0.0639***
	(0.0955)	(0.0559)	(0.0451)	(0.0372)	(0.0464)	(0.0134)
Controls	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y	Y
Household FE	N	N	N	N	Y	Y
Obs	12896	13213	13513	17710	11117	31153

Note: The dependent variable is *Participate*, which is a dummy that equals 1 if a household participates in the stock market, and 0 if not. We use probit models. Column (1) and (2) separately examine the period 2013-2015 and 2015-2017. Column (3) focus on couples with the wife being no more than 40 years old. Column (4) drop the couples with no kids and meanwhile the wife being no more than 45 years old. Column (5) controls for household fixed effects. Column (6) include all urban couples, controlling for household fixed effects. In all the regressions, we control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with $***$, $**$, and $*$, respectively.

B.3. **Direct stock market participation.** This subsection examines whether our findings hold if we only consider direct stock market participation. We define $ParticiIndStk$ as a dummy that equals 1 if a couple has experience of investing in individual stocks, and 0 if not. Replacing the dependent variable with $ParticiIndStk$, we repeat the baseline regression.

According to the (un-tabulated) results, the coefficient of $Treatment \times Post$ is -1.49 (p=0.03), and the coefficient of $Treatment \times Post \times Asset$ is 0.11 (p=0.03). These results are similar to our previous findings.

B.4. **Household net asset.** Now we investigate whether our findings are robust if we replace total asset with net asset. In the 2015 and 2017 waves, CHFS directly provides a variable $Debt$ that measures household debt. Then net asset equals the difference between total asset and total debt, which we denote as $NetAsset$. But in the 2013 wave, $Debt$ is not provided. So, following the definition of $Debt$ described in the complemental document of the 2015 and 2017 waves, we calculate $Debt$ for the 2013 wave. In particular, $Debt$ is the sum of family business loan, home mortgage, car mortgage, education loan, the debt related to financial products (e.g. borrowing money to invest in stocks), etc. Replacing $Asset$ with $NetAsset$, we rerun the baseline regression (14); $NetAsset$ is net asset (in million). We do not use the natural logarithm of it, so that we can take into account the couples with negative net asset.

According to the (un-tabulated) results, the coefficient of $Treatment \times Post$ is -0.07 (p=0.27), and the coefficient of $Treatment \times Post \times NetAsset$ is 0.03 (p=0.08). That is, while the evidence for the liquidity channel is relatively weak when we replace total asset with net asset, the evidence for the child investment channel is significant.

B.5. **Excluding households with infants.** Some may be concerned that the negative effect of TCP on stock market participation may be caused by factors other than liquidity. For example, if a young couple has a new baby soon after being qualified for TCP, then the new baby will occupy much of their time. This may crowd out other activities, including stock market participation. However, this is unlikely to be the driver of our findings. In the treatment group, only 3% (4%, respectively) of the couples who became qualified for TCP in 2013 had a second child by 2015 (2017, respectively), and only 3% of the couples who became qualified for TCP in 2015 had a second child by 2017.

To further mitigate this concern, for wave t, we exclude the households with babies newly born in year t. Since the survey was done in each summer, we essentially exclude the households with babies less than 0.5 years old. Then we repeat the baseline regression. According to the (un-tabulated) results, the coefficient of $Treatment \times Post$ is -1.27 (p=0.04), and the coefficient of $\times Post \times Asset$ is 0.09 (p=0.05). They are consistent with our previous findings.

B.6. **Non-parallel trends.** In our baseline regression (14), the coefficient of $Treatment$ is significantly positive, and the coefficient of $Asset \times Treatment$ is significantly negative. Some may be concerned that our results are driven by mean reversion of participation trends. However, this is unlikely. First, as reported in the last two columns of B.1, we have parallel pre-TCP trends once household fixed effects are controlled for, while our main results remain robust. Secondly, since $Post$ varies across households in any given year, we can explicitly control for the interactions between $Treatment$ and time dummies, as well as between $Asset$ and time dummies. These interaction terms absorb any time trends of participation by the treatment group relative to the control group, and by couples with various wealth levels. According to the (un-tabulated) results, our main findings remain robust after controlling for these interaction terms.

B.7. **Urban-rural difference.** This subsection investigates the effect of TCP on rural couples, and compare it with the effect on urban couples. We expect the effect to be weaker, because in the OCP era, the implementation of family planning policies was less strict in the rural area. In this analysis, we include all couples with the husband being no more than 47 years old. We classify them into the "Urban hukou" group and the "Rural hukou" group. If either the wife or the husband holds an urban hukou, then the couple belongs to the "Urban hukou" group. If both the wife and the husband hold a rural hukou, then the couple belongs to the "Rural hukou" group. So the sample used in this analysis is larger than then one used in the baseline regression. In the baseline regression, we only use the couples living in the urban area (including those with rural hukou). Now we add the couples living in the rural area into the "Rural hukou" group, together with those holding a rural hukou and living in the urban area.

We run the baseline regression (14) separately for the two groups. The results are reported in Table B.2. For the "Urban hukou" group, the coefficient of $Treatment \times Post$ is significantly negative, and the coefficient of the triple interaction is significantly positive. For the "Rural hukou" group, both coefficients are insignificant, though the signs are as expected. So the effect of fertility on risky investment decisions is mostly limited to urban couples, which is consistent with our expectation.

Table B.2. Urban-rural difference

	(1) Urban hukou	**(2) Rural hukou**
Treatment	1.6035**	1.379
	(0.6349)	(0.9588)
Treatment × *Post*	−3.2465***	−0.7966
	(0.9499)	(1.8034)
Asset × *Treatment*	−0.1016**	−0.0992
	(0.0455)	(0.0711)
Asset × *Treatment* × *Post*	0.2326***	0.0636
	(0.0654)	(0.1346)
Post	3.6442***	0.5015
	(0.8005)	(1.4378)
Asset	0.3841***	0.3263***
	(0.0434)	(0.0493)
Asset × *Post*	−0.2567***	−0.0494
	(0.0538)	(0.1049)
Controls	Y	Y
City FE	Y	Y
Wave FE	Y	Y
Obs	11215	10140

Note: For a couple, if either the wife or the husband holds an urban hukou, then the couple belongs to the "Urban hukou" group. If both the wife and the husband hold a rural hukou, then the couple belongs to the "Rural hukou" group. Unlike in the previous analysis, we now include the people living in the rural area and add them into the "Rural hukou" group. We repeat the baseline regression (14) separately for each group, using the probit model. The dependent variable *Participate* equals 1 if a couple participates in the stock market, and 0 otherwise. *Asset* is the natural logarithm of household asset. *Treatment* equals 1 if the wife is no more than 45 years old and the number of kids is no more than one, and 0 otherwise. *Post* equals 1 if a couple is qualified for TCP, and 0 otherwise. We control for the husband's and the wife's age, the square of age, education level, employment status, hukou type, and health condition; the definitions of these controlling variables are summarized in Appendix C. We also control for city fixed effects and wave fixed effects by dummies. Numbers in Parentheses are standard errors, which are clustered by city. Significance level of 1%, 5%, and 10% are marked with $***$, $**$, and $*$, respectively.

Appendix C. Variable definitions in the empirical work

Variable	Definition
Participate	A dummy that equals1 if a couple has experience of participating in the stock market (either directly or indirectly by holding mutual funds), and 0 otherwise.
Treatment	A dummy that equals 1 if a couple has no more than one child and the wife is no more than 45 years old, and 0 otherwise.
Post	A dummy that equals 1 if a couple is qualified for TCP, and 0 if not yet.
Asset	Natural logarithm of household asset
KidNum	The number of children
WifeAge	Wife's age
HusAge	Husband's age
WifeEdu	Wifes's education level, ranging from 1 (illteracy) to 9 (PhD)
HusEdu	Wifes's education level, ranging from 1 (illteracy) to 9 (PhD)
WifeWork	A dummy that equals 1 if the wife is employed, and 0 if not employed.
HusWork	A dummy that equals 1 if the husband is employed, and 0 if not employed.
WifeRuralHK	A dummy that equals 1 if the wife holds a rural hukou, and 0 if she holds an urban hukou.
HusRuralHK	A dummy that equals 1 if the husband holds a rural hukou, and 0 if he holds an urban hukou.
WifeUnhealthy	A dummy that equals 1 if the wife is less healthy than peers of the same age, and 0 otherwise. This evaluation is made by the respondent.
HusUnhealthy	A dummy that equals 1 if the husband is less healthy than peers of the same age, and 0 otherwise. This evaluation is made by the respondent.
OwnBusi	A dummy that equals 1 if a household owns a business, and 0 otherwise.

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