The Effect of Financial Resources on Fertility: Evidence from Administrative Data on Lottery Winners

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Abstract

This paper utilizes wealth shocks from winning lottery prizes to examine the causal effect of financial resources on fertility. We employ extensive panels of administrative data encompassing over 0.4 million lottery winners in Taiwan and implement a triple-differences design. Our analyses reveal that a substantial lottery win can significantly increase fertility, the implied wealth elasticity of which is around 0.06. Moreover, the primary channel through which fertility increases is by prompting first births among previously childless individuals. Finally, our analysis reveals that approximately 29% of the total fertility effect stems from increased marriage rates following a lottery win.

Keywords—Lottery winners, fertility, children quality-quantity trade-off

JEL Codes—H24, I22, J13

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1 Introduction

Global fertility rates have significantly declined over the past few decades (OECD, 2019b), raising concerns about aging populations and economic impacts (Bloom et al., 2010; Caldwell et al., 2006; Sleebos, 2003). In response, many countries have implemented programs that provide financial incentives for having children. On average, public spending on these pro-natality incentives accounts for 1.1% of GDP in OECD countries (OECD, 2019a). The rationale behind these policies lies in the premise that people often do not accumulate sufficient wealth to afford the costs of raising children. Therefore, the enhancement of individual financial resources should theoretically increase the desire for more children. A seminal paper by Becker (1960) incorporated fertility decisions into an economic model, suggesting children are “normal goods,” implying higher income should lead to increased fertility. However, cross-sectional evidence generally contradicts this prediction, indicating a negative relationship between income and fertility (L. E. Jones et al., 2011; Gauthier, 2007; L. E. Jones & Tertilt, 2008). The gap between theory and cross-sectional evidence is due to the fact that identifying the causal effect of lifetime income on fertility suffers from various challenges. These include potential reverse causality, as children can reduce maternal income (Kleven et al., 2019; Sieppi & Pehkonen, 2019; Cortes & Pan, 2020; de Quinto et al., 2021; Berniell et al., 2021), and an individual’s income and fertility decisions are often interdependent (Francesconi, 2002; Del Boca, 2002; Huttunen & Kellokumpu, 2016).

The ideal way to estimate the causal impact of financial resources is based on the fertility responses to randomly assigned changes in the lifetime income of individuals. Following this idea, we examine the fertility impact of large and unexpected wealth shocks induced by winning a lottery prize. Specifically, we exploit the richness of long panels of administrative data on more than 0.4 million lottery winners in Taiwan. This unique dataset enables us to track the same individuals over time, allowing us to investigate the effects of cash windfalls on completed fertility. Our empirical strategy is a triple-differences design that hinges on three variations: 1) the amount of prizes; 2) observation times (pre- and post-winning); and 3) the timing of the lottery win. We compare trends in fertility outcomes for current and future winners who won larger or smaller prizes.[1] By examining the differences in these trends before and after the lottery wins, we can isolate the causal effect of the cash windfalls on fertility behavior, while controlling for potential confounding factors that may differ between individuals who win smaller and larger prizes.

We obtain three key findings. First, our results show that a 5 million NT$ ($\approx$ 165,000 US$) lottery windfall can significantly increase fertility. On average, winners would have an additional 0.06 children within six years of winning, indicating a roughly 20% increase relative to the baseline mean. The implied wealth elasticity of fertility is around 0.16, which is close to the estimates from previous research utilizing other resource shocks (Ager & Herz, 2020; Alam & Pörtner, 2018; Huttunen & Kellokumpu, 2016; Lovenheim & Mumford, 2013; Black et al., 2013; Lindo, 2010). Moreover, we find that the fertility effect is more pronounced for individuals receiving larger windfall gains or those with lower pre-existing wealth levels. This observation suggests individuals appear to delay childbearing until they have accumulated sufficient financial resources to meet the anticipated costs of raising children, which posits that financial constraints play a significant role in reproductive decisions.

Second, large cash windfalls increase fertility primarily by inducing childless individuals to have their first child (the extensive margin). In contrast, lottery wins have a negligible impact on subsequent births for those who already have children (the intensive margin), which aligns with Becker (1960)'s supposition that income elasticity for the quantity of children should be small when parents trade-off between child quality and quantity. To test this idea, we restricted our sample to individuals who had children prior to winning the lottery, examining how they invested their winnings in child quality. We found that parents who won the lottery were more likely to purchase homes in neighborhoods with better education quality, indicating a preference for investing in their children's educational environment. Furthermore, our results show that lottery prizes significantly increased the likelihood of children studying abroad, which typically involves higher costs and is generally perceived as higher-quality education. Collectively, these findings suggest that par-

[1] Future winners are individuals who win large or small lottery prizes in their later years, so their current outcomes cannot be influenced by these future wins. Details on these future winners are provided in Section 3.

ents tend to invest their windfall gains in enhancing their children's educational opportunities and environment rather than having more children.

Lastly, given that fertility and marriage decisions are often interrelated (Upchurch et al., 2002; Baizán et al., 2003; Aassve et al., 2006; Marchetta & Sahn, 2016), especially in East Asian societies where people typically marry before having children (Myong et al., 2021), we also investigate how cash windfalls affect people's decision to get married. Our results suggest that a 5 million NT$ windfall increases marriage rates by 4 percentage points. To quantify how much of the fertility response is explained by changes in marriage, we implemented a causal mediation analysis (Hsia et al., 2021; Breivik & Costa-Ramón, 2022), which decomposes the total effect into direct and indirect components via the intermediate effect on marriage. Our findings reveal that approximately one-fourth of the overall fertility effect can be attributed to increased marriage rates. These results shed light on a mechanism whereby windfalls influence fertility decisions in part by making people more likely to get married, as theory suggests (Malthus, 1798; Becker, 1960; Ahn & Mira, 2002). Cash infusions help meet the financial prerequisites for family formation, both in terms of marriage and childbearing, demonstrating the important interplay between wealth, marriage, and fertility.

Our paper contributes to the existing literature in several ways. Firstly, we provide new evidence on the causal effect of family resources on fertility decisions by utilizing a different source of wealth shocks — lottery-induced cash windfalls. Recent studies have employed plausibly-exogenous changes to family wealth or income to investigate this issue (Ager & Herz, 2020; Alam & Pörtner, 2018; Huttunen & Kellokumpu, 2016; Lovenheim & Mumford, 2013; Black et al., 2013; Lindo, 2010). For instance, Lovenheim & Mumford (2013) and Daysal et al. (2021) found that a 12,000 US$ increase in home value leads to a 2.11% and 2.35% higher fertility rate in the US and Denmark, respectively. On the other hand, Lindo (2010) observed that a negative income shock from a husband losing his job significantly reduces total fertility. Our study advances this body of work in two key ways. First, lottery winnings offer a more direct estimate of income/wealth effects, with less concern about the influence of other mechanisms. For instance, as Daysal et al. (2021) noted, housing wealth can affect fertility through two main mechanisms with opposite effects: an increase in housing prices may encourage households to have more children due to a positive wealth effect, but it may also increase the cost of raising children (i.e., price effect) since housing is a major input to childbearing expenses, potentially discouraging fertility. For example, Liu et al. (2023) examine the impact of home value on fertility in the context of China and identify a negative response. Similarly, job displacement not only affects income but also increases future uncertainty and alters time availability, complicating the analysis of income effects on fertility decisions (Huttunen & Kellokumpu, 2016).[2] Since lottery winnings do not directly affect the cost of childbearing or time availability, the estimated effects from our study can be more confidently attributed to the pure income/wealth effect. Second, our study leverages comprehensive registry data, providing us with an advantage in tracking long-term outcomes. This rich dataset enables us to examine fertility decisions and other relevant outcomes (e.g., marriage, home buying, and college attendance) for many years post-lottery win, with minimal attrition.

Our study also contributes to the emerging literature on lottery-induced wealth shocks and fertility by offering new insights and expanding the scope of analysis. Two contemporary working papers using lottery wins from the US (Bulman et al., 2022) and Sweden (Cesarini et al., 2023) offer the most relevant comparisons to our work. Bulman et al. (2022) examined the impacts of lottery winnings on home ownership, marriage, and fertility, finding little effect on fertility. In contrast, Cesarini et al. (2023) demonstrated that Swedish lottery wins of approximately 100,000 US$ significantly increased cumulative fertility by 0.021 children within five years, aligning with our estimates. Our study advances this literature in several important ways. First, we broaden the analysis beyond fertility quantity to include child quality investments. We investigate how cash windfalls influence parents' choices not only in having more children but also in investing more in existing ones. Our results reveal that lottery winners who already have children might prioritize investing in child quality, such as purchasing homes in better school districts or funding overseas education, rather than having additional children. This finding not only complements the work of

[2] Huttunen & Kellokumpu (2016) found that female job displacement has a larger negative effect on fertility than male job displacement, despite male job displacement having a greater impact on family resources. This suggests that the negative effect of job displacement on fertility may not be solely driven by income effects.

Bulman et al. (2022) on home ownership but also extends it by linking housing decisions to child quality investments. Second, we provide a systematic comparison of lottery effects across different countries and explore potential explanations for these variations. Our research enhances the understanding of how family fertility decisions respond to lottery-induced wealth shocks across various contexts. Building on Daysal et al. (2021), we provide a framework to compare and interpret treatment effect heterogeneity across different settings. We highlight the significant role of liquidity constraints and marriage in explaining why changes in family resources have different effects on fertility across countries. For instance, in Taiwan and Sweden, approximately 20% to 40% of the fertility change is attributed to increased marriage rates, whereas in the US, there is no evidence of a marriage mediation effect on fertility.

2 Data and Sample

2.1 Data

We base our analysis on several administrative records: 1) Income registry file 2) Wealth registry file 3) Household registration file, and 4) College enrollment file, provided by Taiwan's Fiscal Information Agency (FIA). All files contain individual identifiers (i.e., scrambled personal ID), which allows us to merge them at the individual level.

Our lottery data is derived from the comprehensive income registry file, which records all payments made to individuals on an annual basis. This file encompasses both third-party reported income sources and self-reported information. Third-party reported sources include wage income, interest income, pension income, and crucially for our study, lottery income. Self-reported information covers rental income, business income, and agricultural income. Within this extensive dataset, our focus is on the lottery income, which provides a comprehensive view of Taiwanese lottery winners. The data captures all prizes exceeding 2,000 NT$ (approximately 66 US$), a threshold significant because it marks the point at which prizes become subject to a 20% tax rate and must be reported to the Fiscal Information Agency. During our sample period, the Taiwanese government operated three main lottery games: the Public Welfare Lottery, the Taiwan Receipt Lottery, and the Taiwan Sports Lottery. However, we exclude the Sports Lottery winners from our analysis, as their winnings may be influenced by experience and judgment rather than pure chance.[3] For those interested in more details about the Public Welfare Lottery and Taiwan Receipt Lottery, we provide additional information in the Online Appendix A.

For each lottery winner, the income registry file provides crucial information: their Taxpayer ID, the lottery prize amount, and the ID of the bank where the prize was redeemed. We utilize the bank ID to identify and exclude Sports Lottery winners, as each lottery game uses specific banks for prize redemption. Our data is structured to show the total annual lottery income for each individual, aggregating all prizes won within a year. It's important to note that we don't have information on the number of individual prizes or specific ticket details. For instance, if an individual redeems multiple tickets at a single agency, we only see the total amount rather than individual win data.

To measure individuals' financial resources, following Lien et al. (2021) and Chu et al. (2019), we utilize the income registry file and wealth registry file to construct individual-level wealth data. The details for constructing this wealth dataset are discussed in the Online Appendix B. The data on demographics originate from the household registration file, which is yearly-based and contains the individual's gender, year of birth, location of birth, place of residence, year of marriage, spouse's ID, and parents' IDs (father and mother). We use birth year and parents' IDs to construct the fertility outcome measure, i.e., the number of children that an individual has in a given year. Using the marriage year and spouse's ID, we obtain the marital outcome of whether an individual has ever been married.

We also utilize the wealth registry file to define home ownership. This file includes the location of houses, allowing us to connect home ownership with neighborhood quality. We define neighborhoods at the village level.[4] To measure the education quality of a neighborhood, we calculate

[3]The Taiwan Sports Lottery, introduced in 2008, is the sole legal form of sports gambling in Taiwan. It covers a range of national and international sports events, including those run by MLB, NBA, and FIFA, with betting options on winners/losers, total scores, and score gaps.

[4]Taiwan has around 7,800 villages, with an average population of 3,000 per village. The village level roughly corresponds to the census tract level in the US.

the likelihood of the college-age population in the village attending top-ranking colleges, including top 1, top 5, top 10, and top 20.[5] Previous studies highlight significant variations in the likelihood of attending top universities and educational performance across different regions in Taiwan (Luoh, 2002, 2018; Chen & Liu, 2008). These disparities persist even when controlling for parental education and family income (Luoh, 2002). Therefore, the likelihood of attending top universities serves as a comprehensive index of neighborhood quality, reflecting both the educational opportunities and the overall socio-economic environment of the area.

The college enrollment file includes two sources: 1) third-party reported college enrollment records from all domestic colleges in Taiwan and 2) self-reported college enrollment as listed as a deduction item on income tax returns.[6] The second source includes both college attendance at domestic and overseas colleges. We use these data to define college attendance outcomes. The third-party reported data on domestic college enrollment are more comprehensive and cover the whole population, including those who do not file a tax return. However, self-reporting on college enrollment, which is our primary source for overseas study, only covers people who file a tax return. Based on our definition, around 1.5% of college-aged people in our sample are categorized as studying abroad, which is quite close to the government statistics.[7]

2.2 Sample

We impose several restrictions to construct the estimation sample. First, individuals must be aged 20-44 at the time of winning—the primary childbearing years. Second, we limit the sample to those who first won lottery prizes of at least 5,000 NT$ in the study period. This restriction makes our estimation sample representative of the broader population, based on observable characteristics, and allows us to control for previous lottery winning amounts. Table C1 Online Appendix

[5] Taiwan has around 140 colleges. For top 1, top 5, top 10, and top 20 colleges, their enrollment accounts for roughly 1%, 3%, 5%, and 10% of the college-age population, respectively.

[6] College tuition payment for dependents is categorized as a special deduction item. That is, regardless of whether the taxpayers choose the standard deduction or itemized deductions, they can still list tuition costs as an extra deduction from their income.

[7] According to statistics from the Ministry of Education (MOE), Taiwan, around 57 thousand students are currently studying abroad, accounting for roughly 1.5% of the population of college students.

C compares the individual characteristics of different minimum winning amounts with those of the general population. By restricting our sample to those who first won lottery prizes of at least 5,000 NT$ during the study period, we achieve a gender distribution that more closely resembles the general population. Specifically, this restriction results in a sample with 52% female participants, which is very close to the 50% observed in the broader population. Additionally, other demographic characteristics of this restricted sample remain similar to those of the general population. In robustness checks, we eliminate this restriction, using a minimum win of 2,000 NT$, the smallest observable prize.

Third, since the number of children people can biologically have is bounded from above,[8] for sufficiently large windfall gains, the marginal effect on fertility of an additional dollar of lottery prize is likely to be very small. Previous studies based on lottery design also usually excluded extremely large prizes from the analysis (Hankins & Hoekstra, 2011; Hankins et al., 2011; Picchio et al., 2018; Bulman et al., 2022).[9] Therefore, we exclude winners who won an extremely large prize above 50 million NT$ (≈ US$ 1,670,000). This threshold is chosen because it allows us to compare our findings with other studies that explore the impact of financial resources on fertility using lottery designs.[10] In robustness checks, we use alternative cut-offs from 10 million to 150 million NT$ for the maximum prize amount.

Fourth, we exclude individuals who died during the study period, thus creating a balanced panel. Finally, we track these individuals over 10 years, from 3 years before to 6 years after winning. The sample period is from 2004 to 2018. The final sample contains over 406,922 prize winners across a wide range of windfall amounts. Table C2 in the Online Appendix C displays the distribution of lottery prizes. The amount of lottery wins is on a post-tax basis and adjusted to 2016 NT$ using the Consumer Price Index (CPI).

[8]Childbearing takes almost one year (i.e., ten months), and in most cases, only one child is born each time. Thus, the number of births an individual can have within a defined time period is inherently limited.

[9] For example, Hankins & Hoekstra (2011) exclude lottery prizes excess US$50,000, Hankins et al. (2011) exclude lottery prizes excess US$150,000, Picchio et al. (2018) exclude prizes over €500,000 (roughly US$ 535,000), and Bulman et al. (2022) exclude prizes above US$ 500,000. Cesarini et al. (2023), while they do not exclude large prizes, the maximum prize in their analysis is SEK 50,000 per month for 50 years—leading to a roughly US$ 1,800,000 total prizes given a 2% discount rate.

[10]For example, In Cesarini et al. (2023), their maximum prize is around US$ 1,800,000. See footnote 9 for details.

Table 1 compares the characteristics of the lottery winners estimation sample to the Taiwanese population aged 20–44 during the sample period. These characteristics are measured in the year before the lottery win, and all monetary values are adjusted to 2016 NT$ using the CPI. Overall, winners largely mirror major demographic attributes of the general public, albeit they are slightly older than the population. Consistent with this fact, a higher proportion are married (46% vs 41%) and have more children on average (0.88 vs 0.82). The average annual income of winners is not significantly different from that of the general population. Additionally, the average annual earnings of winners are only slightly higher (by 4,000 NT$ or 1.4%) than the general population. Winners are also less wealthy than the general population; however, these differences are minor. In a robustness check, we re-weight the sample to align these characteristics with those of the overall Taiwanese population and demonstrate that our main estimate remains robust despite this issue.

3 Empirical Strategy

In this section, we introduce our empirical strategies that establish causal inferences about how the receipt of lottery prizes affects people's fertility behaviors. First, following the previous literature (Cesarini et al., 2016, 2017; Briggs et al., 2021; Picchio et al., 2018), our specification exploits variations in the size of the lottery win by using prize amounts to measure treatment intensity. This helps us facilitate the interpretation of our findings in terms of the dollar value of the lottery winnings. In addition, we follow the same people over time and investigate their behaviors before and after the year of the lottery win. Therefore, one possible strategy is a difference-in-differences (DID) design, which examines whether people who won larger prizes (first difference) increased fertility after the lottery-winning year (second difference).

However, a design relying solely on variations in lottery prize amounts could exhibit bias if individuals winning larger and smaller prizes differ in terms of unobservable factors associated with changes in outcomes. To address this concern, inspired by Golosov et al. (2023), we further utilize variations in the timing of lottery wins and employ a control group comprised of individuals who first won large or small lottery prizes in later years. Thus, their current outcomes cannot be influenced by lottery wins, which helps account for potential unobserved differences between individuals who tend to win smaller and larger prizes. This empirical strategy is essentially a triple-differences (DDD) design that hinges on three variations in 1) the amount of prizes; 2) observation times (pre- and post-winning); and 3) the timing of the lottery win. Specifically, we compare temporal changes in outcomes for current and future winners who win smaller or larger prizes, following which we estimate the following regression.

$$\begin{aligned} B_{it} = {} & \alpha_0 Prize_i + \sum_{s \neq -1} \kappa_s \cdot \mathbf{I}[t = L_i + s] + \sum_{s \neq -1} \lambda_s \cdot Prize_i \times \mathbf{I}[t = L_i + s] \\ & + (\alpha_1 + \alpha_2 Prize_i + \sum_{s \neq -1} \beta_s \cdot \mathbf{I}[t = L_i + s] + \sum_{s \neq -1} \gamma_s \cdot Prize_i \times \mathbf{I}[t = L_i + s]) \times Current_i \\ & + a_{it} + \theta_t + \boldsymbol{X_i} \psi + \varepsilon_{it} \end{aligned} \tag{1}$$

The outcome of interest, represented by B_{it}, is the cumulative number of children that an individual i ever has at time t. $Prize_i$ denotes the amount of individual i's first lottery win, measured in units of 10 million NT$ (≈ 330,000 US$). Event time dummies $I[t = L_i + s]$ indicate observations before or after lottery wins, where L_i is the year of individual i's first lottery win. Thus, $I[t = L_i + s]$ represents an indicator for being s years away from the win, with $s = -3, -2, 0, 1, 2, 3, 4, 5, 6$. For instance, $I[t = L_i + 1]$ is a dummy for the first year after the lottery-winning year. Our sample comprises a balanced panel of individuals observed annually from 3 years ($s = -3$) pre-winning to 6 years ($s = 6$) post-winning. We normalize the event time dummy coefficients at the baseline year $s = -1$ to zero.

This specification includes $Current_i$, a dummy variable indicating that an individual i is either a current winner who first won lottery prizes in year L_i ($Current_i = 1$) or a future winner whose first lottery winning year is after $L_i + 6$ ($Current_i = 0$). We fully interact $Current_i$ with prize amount $Prize_i$ and event time dummies $I[t = L_i + s]$. For future winners, L_i is a "placebo" winning year determined by subtracting 6 from their actual first winning year. The key identification variables in the regression (1) are the following third-level interactions: event time dummies

$I[t = L_i + s]$ interacted with current winner dummy $Current_i$ and prize amount $Prize_i$. Its coefficients γ_s measure the effect of a 10 million NT$ windfall on the outcome of interest.

Since age is a key determinant of an individual's fertility behavior, all specifications include a winner's age-fixed effects a_{it}, to control non-parametrically for underlying life-cycle fertility trends. Year fixed effects θ_t capture macroeconomic impacts and general fertility patterns in Taiwan. We also incorporate pre-determined covariates $\boldsymbol{X}_i$ measured right before a lottery-winning year, such as the winner's residence, employment status, and financial resources.[11] The error term is represented by ε_{it}. As we follow individuals over time, standard errors in all regressions are clustered at the individual level to account for potential serial correlation.

Panel A and B of Table C3 in the Online Appendix C examine the relationship between prize amounts and pre-lottery characteristics for current and future winners, respectively. In Panel A, it is evident that most current winner's traits are not correlated with lottery prize amount. However, a few characteristics, such as gender and residence area, are associated with the lottery prize amount. We find that those living in urban areas and males are more likely to win larger prizes. This pattern implies that the amount of lottery winnings may not be entirely random. Interestingly, Panel B suggests that a similar pattern can be found in the sample of future winners. This similarity indicates that the observed relationships between prize amounts and certain characteristics are consistent across both current and future winners. The presence of these patterns in both groups supports the validity of using future winners as a control group, as it helps account for potential unobserved differences between individuals who tend to win smaller and larger prizes. Table C4 in the Online Appendix compares the characteristics of current and future winners. We find that most characteristics are similar between the two groups, further validating our empirical strategy. A no-

[11] We include the following variables: a set of dummy variables indicating cities/counties of residence, a dummy variable indicating whether the winner was married, a dummy variable indicating whether the winner or their spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married), the number of cumulative children in the year immediately prior to the lottery winning year, and the lottery winning amount from one, two, and three years before the current lottery winning year. Note that we define the lottery winning year as the year when the winner first won a lottery prize of at least 5,000 NT$. Therefore, winners could have won another prize below 5,000 NT$ before the current winning year we use to define treatment.

table difference, however, is age: current winners are, on average, older than future winners. This age discrepancy is consistent with the findings of Golosov et al. (2023). To address this potential concern, we conduct a robustness check where we re-weight the future winners by age to ensure the two groups have similar age distributions. Our estimates remain robust to this adjustment.

4 The Effect of Cash Windfalls on Fertility

4.1 Graphical Evidence

This section illustrates graphically variation sources identifying the causal effect of lottery wins on fertility. Our DDD design essentially compares the fertility trends between current winners and future winners of similar prize amounts. Figure 1a displays the evolution of total children ever born for current winners who won over 1 million NT$ (solid line, circle symbol) versus future winners who won over 1 million NT$ (dashed line, square symbol), from 3 years before to 6 years after winning.

Three key insights emerge in this regard. First, pre-winning fertility trends are nearly identical between the two groups. Second, an immediate divergence in trends is observed after current winners receive a significant financial windfall, since future winners had not yet won prizes. Third, the effect persists for at least 6 years after winning.

4.2 Main Results

In this section, we discuss the main results. Figure 2 shows the estimated γ_s of our DDD regression (Equation (1)), i.e., the effect of a 5 million NT$ windfall on cumulative fertility. First, we find that the estimated coefficients in the pre-winning period ($s = -3, -2$) are very small and statistically insignificant, thereby suggesting that pre-trends run parallel. Consistent with the graphical evidence in Figure 1, the estimated γ_s indicates that the receipt of a large cash windfall can stimulate fertility immediately, and the effects persist for at least 6 years.

As our primary focus lies on the total number of children, we use the estimate from the sixth year post-lottery win ($s = 6$) to encapsulate the effect of lottery wins on fertility. Table 2 documents the DDD estimates, respectively. We commence by introducing the estimate from a basic model without any controls (Column (1)). We then progressively introduce fixed effects for the winner's age, year-fixed effects, individual characteristics prior to the win, outcome variables prior to the win, and past lottery winning amounts (Columns (2) to (6)). The stability of the estimates across various specifications is reassuring and provides robustness to our results.

Our preferred specification is Column (6) in Table 2, which includes all covariates. It indicates that winning a prize of 5 million NT$ leads to a significant increase in the number of births by 0.06. This means that for every 100 winners of 5 million NT$, 6 more children were born by the sixth year following the win compared to what would have occurred without receiving a major prize. This represents a 20% increase over the baseline change in the number of children born between s=-1 and s=6 for the comparison group (i.e., future winners), which is 0.32.

To evaluate the sensitivity of fertility behaviors to wealth changes, we calculate the elasticity of fertility with respect to wealth. For consistency, we use the wealth change of future winners (i.e., comparison group) between one year before and six years after the lottery date as our baseline wealth change. This approach mirrors our method for measuring fertility changes, where we consider the cumulative number of births over the same period. The change in household wealth between s=-1 and s=6 for future winners is approximately 3.88 million NT$. We use this figure as the potential wealth accumulation for treated individuals had they not received a cash windfall. Consequently, winning a 5 million NT$ prize represents a 128% increase in potential wealth accumulation for current winners (the treatment group). Based on these calculations, our results suggest a total wealth elasticity of fertility of about 0.15. This means that a 1% increase in wealth leads to a 0.15% increase in fertility. The obtained elasticity from estimation is quite aligned with previous studies using various income or wealth shocks.[12]

[12] For example, Lovenheim & Mumford (2013) use shock in housing values in the US and find wealth elasticity in relation to the fertility of 0.13. Atalay et al. (2017) use shock in housing values in Australia and concludes a wealth elasticity of fertility of 0.24. G. Ang et al. (2024) use housing values shock driven by home mortgage policy in China and identifies a wealth elasticity of 0.18. Whittington et al. (1990) use income shock triggered by income tax cuts in

In the Online Appendix, we also utilize an alternative approach to compute wealth elasticity by comparing lottery wealth to lifetime income flows (from the age of lottery win to retirement age). This method yields a slightly larger elasticity of fertility with respect to the wealth of approximately 0.2 (see Figure D1). To sum up, our results demonstrate a positive effect of cash windfalls on fertility. The positive income/wealth effect is consistent with the central proposition made by the neoclassical economic theory of fertility, in that children are normal goods, as proposed by Gary Becker (Becker, 1960, 1965).

4.3 Falsification Tests and Robustness Checks

In this section, we first implement a series of falsification tests for our preferred specification (i.e., Column (6) in Table 2). Specifically, we randomly permute lottery prizes and attach them to each winner. Then, we use these "pseudo" prizes to define variable $Prize$ and estimate Equation (1). We repeat the above procedures 1,000 times to obtain the distribution of pseudo estimates. Figure 3a compares the real estimate (bold line with circle symbol) with these fake ones (thin lines, gray in color). The result suggests that the real estimates of γ_s are much larger than the pseudo ones in the post-winning period. As we mainly focus on the estimated coefficient of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$, which summarizes the effect of a lottery win on total fertility, Figure 3b illustrates real estimates (vertical line) and the distribution of pseudo ones (histogram) for γ_6. The result suggests that the real γ_6 estimate is exceptionally larger than any fake ones. Specifically, the permutation p-value is 0.003. In sum, the placebo test confirms that significant estimates in our main results are unlikely to be chance findings.

Next, we carry out a range of robustness checks for our main results, the outcomes of which we display in Table 3. Again, we use estimated effects at the sixth year post-lottery win ($s = 6$) to summarize the wealth effect on total fertility so that Table 3 only displays the estimated γ_6. Our main results are based on all lottery wins between 5,000 NT$ to 100 million NT$. In conducting the robustness checks, we confine our analysis to winnings amounting to 30,000 NT$ or more (see

the US and find an income elasticity in relation to the fertility ranges from 0.13 to 0.25.

Column (1)). This step is taken to verify that the main results are not driven by the large volume of individuals winning small prizes. We also lower the minimum win threshold to 2,000 NT$ (see Column (2)), which is the smallest win we can observe. Despite this alteration, our results prove to be robust.

In our main specification, we limit the maximum lottery win amount to 50 million NT$. To assess the sensitivity of our estimates to different prize ranges, we examine several alternative maximum win amounts. Specifically, we consider 80 million NT$ (Column (3)) and 120 million NT$ (Column (4)), and summarize estimates using other prize ranges in Figure C2. Generally, we observe that the estimate is larger when using smaller maximum win amounts. This pattern suggests that the marginal effect of each additional NT$ of lottery wealth on fertility is decreasing. In other words, as the lottery prize increases, the impact of each additional dollar on fertility becomes progressively smaller. We will discuss this nonlinear relationship between lottery wealth and fertility in more detail in Section 4.5. This analysis will provide insights into how the effect of wealth on fertility changes across different levels of lottery winnings, offering a more nuanced understanding of the wealth-fertility relationship.

Another concern for the main estimate is that our sample only consists of lottery winners, as the characteristics of these people could be different from those of the general population. Table 1 indicates that the lottery sample was slightly older. Consistent with this fact, they are more likely to be married and employed than the general population. In order to investigate this issue, we first re-weight the sample to make these characteristics similar to those of the general population in Taiwan.[13] After re-weighting, although differences in observable characteristics between the lottery sample and the population are still statistically significant due to the large sample size, the magnitudes become much smaller (see Table C5 in the Online Appendix C). The sizes of these differences, as the proportion of the population means, are mostly below 10%. Column (5) of Table

[13] We use the post-stratification weighting technique and match the marital status, age, earnings, and asset stratifications for our lottery sample and the population, the latter of which is defined as individuals aged 20 to 44 from 2007 to 2012 (same as our winning years) in Taiwan. This leads to 11 million observations, which is around half of the nation's population. We randomly assign a placebo-winning year to the population and use their characteristics as one year prior to the placebo-winning years.

3 suggests that the result based on population re-weighting is statistically significant but gives a slightly smaller estimate (i.e., 0.042).

One potential threat to our empirical strategy is that future winners might not serve as valid counterfactuals for current winners. Table C4 in the Online Appendix compares the demographic statistics of current and future winners. We find that their characteristics are generally similar, with the notable exception that current winners tend to be older. This age difference aligns with findings in previous literature (Golosov et al., 2023). To address this discrepancy, we conducted an additional analysis using future winners from the same age cohort as current winners. Specifically, we resampled (with replacement) within the age-by-cohort cluster among the future winners based on the number of observations in that cluster of current winners. This approach allows us to construct a future winner sample that mirrors the age distribution of the current winners (see the last column of Table C4). Column (6) of Table 3 reports the estimate based on this adjusted sample. The point estimate is 0.06, which closely aligns with our main findings.

In our main specification, we control for fixed effects based on the age of the winner. However, female age is more likely to be the key factor determining fertility behavior, so in this robustness check, we include fixed effects (separately) for male and female ages.[14] As indicated in Column (7) of Table 3, the estimate (0.050) does not deviate from our main results.

Additionally, we implement a robustness check, incorporating individual fixed effects to account for any unobserved, time-invariant disparities between individuals that may influence fertility decisions, such as the preference to have children and the ability to get pregnant. The resulting estimation (0.045), found in Column (8) of Table 3, aligns closely with our primary findings.

In the main specification, we define the winning year as the year of the first lottery win, thus allowing individuals to win multiple times. Since subsequent lottery wins could also influence fertility, we check the robustness of only including individuals who won the lottery once during the sample period. Column (9) of Table 3 reports estimates using the restricted sample of single-

[14]For male winners, the female age is defined as their pre-lottery spouse's (if present) age; for female winners, the male age is defined as their pre-lottery spouse's (if present) age; for female winners; for winners with no pre-lottery spouse, we create a dummy indicating the missing age for their spouse. Taiwan legalized same-sex marriage in 2019. The last observed year in our analysis is 2018, so there is no case when a winner and their spouse is of the same sex.

time winners. The estimate is 0.050, which is close to our main result.

Our data consists of six cohorts with different treatment timings, namely, treated individuals winning lottery prizes in a given year from 2007 to 2012. Several recent studies (De Chaisemartin & d'Haultfoeuille, 2020; Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Baker et al., 2022; Sun & Abraham, 2021) suggest that if treatment effects are heterogeneous across treated cohorts, conventional DID estimates could be biased. To address this concern, we individually estimate the lottery effect for each cohort and then average these estimates. In particular, we compare winners who secured the lottery prize in 2007 with the corresponding future winner cohort (those who won the lottery prize in 2014, with the placebo winning year set at 2007). We carry out a similar estimation separately for each cohort, and subsequently, we calculate the average estimate, weighted by the sample size of each cohort. We estimate the standard error through 1,000 times bootstrapping (re-sampling with a replacement within lottery cohorts). This approach ensures that we avoid comparing observations from different treatment timings and mitigates the bias that could arise from a staggered DID design. In the Online Appendix, we further validate our approach by replicating the empirical setting used by Golosov et al. (2021), who also addressed estimation problems highlighted by (De Chaisemartin & d'Haultfoeuille, 2020; Callaway & Sant'Anna, 2021; Sun & Abraham, 2021). Our results from this replication are consistent with our main findings. Column (10) of Table 3 presents the estimated effect as 0.046, which closely aligns with our main result. Overall, the evidence in this section demonstrates that our primary estimate remains robust across various sample selection criteria and empirical specifications.

4.4 Shift in Fertility Timing or a Change in Total Fertility

Our main results could reflect either shifts in fertility timing or changes in total lifetime fertility. To explore this distinction, we examine heterogeneous responses by age group in Figure 4. Young winners are defined as those aged 20-29 when they won the lottery prize (see Figure 4a). Middle-aged winners are those aged 30-44 at the time of winning (see Figure 4b).

Figures 4a and 4b present the estimated effect of winning a 10 million NT$ prize on fertility for young and middle-aged lottery winners. Both age groups exhibit significant increases in fertility, with young winners having 0.093 more children and middle-aged winners having 0.035 more children by the sixth year after winning the lottery. The larger effect for young winners aligns with expectations given declining fertility rates with age. Notably, the average age of middle-aged winners is 36 prior to winning the lottery and reaches 43, an age of low fertility probability, by the end of the sample period. Nonetheless, fertility continues to increase through the sixth year for middle-aged winners, implying that their lifetime fertility likely rises due to the lottery windfall.

Moreover, in Figure C3 of Online Appendix C, we replicate the core analysis using only four lottery-winning cohorts. This modification enables us to follow winners for up to eight years after their winning year. We find that the effect of lottery wins on fertility remains positive and persistent. Although the reduced sample size leads to larger standard errors, the estimates are still marginally statistically significant ($p < 0.10$). This suggests that the observed changes in fertility are more likely due to overall shifts in total fertility rather than temporary changes in fertility timing.

4.5 Heterogeneous Effects: Prize Amounts

In our main analysis, we examine the linear effect of cash windfalls (per 5 million NT$) on fertility, excluding extremely large prizes over 50 million NT$. This approach, while informative, assumes a constant marginal effect across all prize amounts. To provide a more nuanced understanding of the relationship between windfall size and fertility changes, we examine potential non-linear effects by implementing a design that classifies wins by prize amount, including the previously excluded extremely large prizes.

This analysis serves two purposes: First, it allows us to explore the threshold level of resources needed to impact fertility decisions. Second, it serves as an informal test of functional form. To implement this analysis, we modify Equation (1) by replacing the continuous measure of lottery wins ($Prize$) with a series of binary indicators $\mathbf{I}[Size = k]$ representing different prize ranges: 1) 10 to 50 thousand NT$; 2) 50 to 500 thousand NT$; 3) 500 thousand to 5 million NT$; 4) 5 to 100 million NT$ and 5) 100 million NT$ or more. We use winners of 5 to 10 thousand

NT$ as the reference group. This approach allows for varying effects across win ranges without imposing strong functional form assumptions, thereby capturing potential non-linearities in the wealth-fertility relationship.

Table 4 reports heterogeneity in fertility responses to windfall gains according to the size of a lottery win. For moderate resource shocks between 10 thousand and 5 million NT$, the impact on fertility is small, with coefficient estimates around 0.01–0.04. However, effects grow substantially once prize amounts reach 5–50 million NT$, with estimates increasing to approximately 0.1. The response continues to rise for windfalls and peaks at the highest level of 0.275 for Jackpot wins exceeding 50 million NT$.

To provide a more comprehensive analysis, we calculate the wealth elasticity for each prize bin. In general, we find a larger elasticity for the smaller prize group, consistent with the rationale of diminishing marginal utility. The price group-specific elasticity of size 5–50 million NT$ is 0.155, which is quite close to our main estimation using the whole sample. To further illustrate the non-linear relationship between windfall size and fertility effects, we present a figure in the Online Appendix. Figure C4 plots the estimated coefficients for each prize range dummy (y-axis) against the average prize in each range (x-axis). This visualization effectively demonstrates how the marginal impact of an additional Taiwanese dollar on fertility changes with the amount won.

4.6 Heterogeneous Effects: Financial Resources

In this section, we examine whether the effects of cash windfalls on fertility vary based on an individual's financial status. Table 5 presents heterogeneous effects relative to individual financial resources. The results in Columns (1) and (2) suggest that individuals with no deposits are primarily responsible for the positive fertility effect of cash windfalls. For winners without deposits, receiving a 5 million NT$ lottery prize significantly increases the cumulative number of children by 0.085 in the sixth year after winning (Column (1)). In contrast, the estimate in Column (2) indicates that fertility responses are small and statistically insignificant for those with cash on hand. Similar results are observed when we define financial resources by liquid assets (deposits plus stocks).

Columns (3) and (4) reveal that the positive fertility effect of windfalls is primarily driven by individuals with zero liquid assets prior to winning. Those with no liquid assets experienced a 0.11 increase in the number of children in the sixth year after winning (Column (3)). Conversely, those with some liquid assets showed no significant effect from receiving a lottery prize. Columns (5) and (6) yield consistent results when using total assets (liquid assets plus real estate minus house loan debt). Overall, the evidence demonstrates a pattern of larger fertility responses for individuals receiving larger cash windfalls and those with fewer pre-existing financial resources.

These findings support the hypothesis that liquidity constraints impact fertility decisions. The more pronounced effect of cash windfalls on fertility for individuals with no deposits or liquid assets suggests that these individuals likely face liquidity constraints that have been hindering their desired fertility plans.[15] Conversely, those who already possess deposits or liquid assets show smaller or insignificant fertility responses to cash windfalls, implying that they may have already overcome liquidity constraints. The consistency of this pattern across different measures of financial resources further reinforces the importance of liquidity constraints in shaping fertility decisions.

4.7 Heterogeneous Effects: Extensive vs. Intensive Margins

To examine whether cash windfalls influence fertility through either the extensive margin (having children or not) or the intensive margin (having additional children), we analyze parenthood status in Table 6 Columns (1) and (2), which compare individuals with and without children the year before winning ($s = -1$). The results show that the main effect is driven by the extensive margin, in that childless individuals receiving a 5 million NT$ windfall have 0.102 more children by the sixth year after winning. However, for individuals with children already, the windfall only increases their number of children by 0.032. The heterogeneity of these two groups is significant.

Parenthood and marital status are closely linked, as childless individuals are typically unmar-

[15] Liquidity constraints occur when individuals or households cannot freely make choices between current and future consumption, often due to a lack of readily available cash or easily liquidated assets. In the context of fertility, such constraints may prevent families from realizing their desired number of children due to insufficient financial resources.

ried. Thus, Columns (3) and (4) explore response differences by marital status. Aligning with the parenthood findings, the fertility increase mainly comes from single individuals (Column (3)). The effect size of the married couples (Column (4)) is only half of the single winners. The difference between these two estimates is significant. In the last two columns of Table 6, we combine parenthood and marital status and extend the heterogeneity analysis according to whether couples have pre-win children or not. Our results indicate that the fertility behaviors of childless couples are very responsive to lottery wins. Receiving a 5 million NT$ windfall significantly increases the number of children ever had by childless couples by 0.178 at the end of the sixth year following a win, albeit for couples with children already, the prize money does not influence fertility.

In summary, we find that a cash windfall raises fertility levels, mostly along the extensive margin. However, the receipt of a large cash amount triggers only childless individuals to give birth and has little impact on subsequent fertility for those who already have children. This implies that parents likely prioritize investing in their existing children rather than having more. Our finding aligns with Becker's conjecture that the quantity of income elasticity should be small when parents consider the quantity-quality trade-off (Becker, 1960, 1965; Becker & Lewis, 1973; Doepke, 2015; Li et al., 2008). To test this hypothesis further, in the next section, we examine whether parents spend their lottery winnings on investments in child quality, as measured by home purchases in neighborhoods with good educational environments and by their children's college attendance.

5 The Effect of Cash Windfalls on Other Related Outcomes

5.1 Investment in Children's Quality

Our findings so far suggest that lottery windfalls have a minimal impact on fertility among parents who already have children prior to winning. This raises a pertinent question: If these parents do not use their cash windfalls to have additional children, do they instead invest in the quality of their existing children? According to Becker's theory of fertility, parents often face a decision between quantity and quality when planning their families (Becker, 1960, 1965; Becker

& Lewis, 1973; Doepke, 2015; Li et al., 2008). When extra resources become available, parents might choose to enhance the quality of their existing children instead of expanding family size.

To explore this idea, we first analyze whether winning the lottery leads parents to invest in their children's educational environment. We measure this investment by examining whether lottery winners are more likely to purchase property in areas (specifically, villages) with a higher proportion of students attending top universities. We estimate the following regression model:

$$
\begin{aligned}
H_{it} = \; & \alpha_0 Prize_i + \kappa \cdot Post_{it} + \lambda \cdot Prize_i \times Post_t \\
& + (\alpha_1 + \alpha_2 Prize_i + \beta \cdot Post_{it} + \gamma \cdot Prize_i \times Post_{it}) \times Current_i \\
& + a_{it} + \theta_t + \boldsymbol{X_i}\psi + \varepsilon_{it}
\end{aligned}
\tag{2}
$$

The difference between Equation (1) and (2) is as follows. First, we change the outcome variable. Instead of measuring fertility, we now examine whether parents own a house in a neighborhood with a higher probability of students entering top universities, denoted as H_{it}. To define a "better" neighborhood, we employ the following methodology: We calculate the proportion of students from each village who gain admission to top universities and determine the median of these proportions across all villages. A "better" neighborhood is defined as a village where this proportion exceeds the median. We utilize multiple criteria to classify top universities, including the top 1, top 5, top 10, and top 20 universities in Taiwan. This approach allows us to identify areas that offer potentially better educational opportunities for children. Second, we modify our regression model from a dynamic DDD approach to a pre/post DDD model, focusing on the three years before and after lottery wins. Specifically, we replace the event-time dummies, $\mathbf{I}[t = L_i + s]$, with a binary indicator, $Post_{it}$, which denotes whether the observed periods are after lottery wins. We make this change because purchasing a house is typically a one-time event, unlike childbearing which can accumulate over time. This adjustment allows us to better capture the immediate impact of lottery winnings on housing decisions, which are more likely to occur as a single, discrete action rather than a series of recurring events. Third, we also limited the estimation sample to lottery winners who had children prior to their winnings.

Table 7 presents the results, suggesting that winning prizes of 5 million NT$ significantly increases the likelihood of purchasing houses in villages with better educational opportunities by 3 to 4 percentage points. This finding implies that substantial lottery winnings can indeed influence parents' decisions to invest in their children's educational environment, potentially enhancing their children's long-term prospects.

Another related way parents might invest in their children's quality is by financially supporting the children's high education, particularly through studying abroad, which is often considered to provide higher quality education (compared to domestic universities) but also requires substantial financial resources. To investigate this dimension of parental investment, we turn our attention to the impact of lottery winnings on children's college attendance. Following Bulman et al. (2021), we compare two groups: children whose parents won lottery prizes before the child finished high school (age 19), and those whose parents won after age 19 (i.e., children of future winners). The latter group serves as a control to absorb unobserved differences between households receiving larger and smaller windfalls.[16]

Therefore, the estimation sample includes only individuals with children turned 19 before or after a lottery win. The final sample size is 80,661 children within 58,432 winners. Utilizing this sample, we examine whether lottery windfalls increase subsequent college attendance for winners' pre-existing children. If windfalls improve college attendance, it would suggest that parents invest money into child quality when they opt not to have more children. Specifically, we compare differences in college attendance rates between children of current and future winners who won larger or smaller prizes by estimating the following regression:

$$E_{ij} = \delta_1 Current_j + \delta_2 Prize_j + \rho \cdot Current_j \times Prize_j + \gamma_c + \theta_t + \boldsymbol{X_j}\psi + \boldsymbol{Z_i}\nu + \varepsilon_{ijt} \quad (3)$$

where E_{ij} represents the outcome of interest for child i whose parent is a winner j—a series of dummy variables indicating whether child i has ever attended college and the type of college at-

[16]Because college attendance is typically a one-time event in a child's late teens, we cannot observe the same child's attendance both before and after their parent won the lottery. Thus, we are not able to use the DDD design as we did in the main analysis.

tended, measured at age 19. We examine three outcomes: 1) ever attending any college; 2) ever attending a domestic college; and 3) ever attending an overseas college.

$Current_j$ is a dummy indicating whether parent j is a current winner ($Current_j = 1$) or a future winner ($Current_j = 0$), meaning they won prizes before or after their child turned 19 years old. The variable $Prize_j$ is a continuous measure of the amount won by parent j. The coefficient δ_1 on $Current_j$ captures any fixed differences in college outcomes between children whose parents won prizes before versus after age 19. The coefficient δ_2 on $Prize_j$ controls for potential heterogeneity arising from parents winning different prize amounts. The coefficient of interest ρ on the interaction between $Current_j$ and $Prize_j$ represents the effect of lottery wins.

To isolate the impact of lottery prizes, the model includes fixed effects γ_c for the child's birth year, to absorb cohort differences. Calendar year fixed effects θ_t for when the child turns 19 are also included to account for contemporaneous factors affecting overall college attendance. We further control for winner (parent) characteristics X_j and child characteristics Z_i[17] to address outcome heterogeneity arising from these observable factors.

Table 8 presents the estimated effects of lottery wins on college attendance for the children of winners. Columns (1) suggest no significant impact of lottery wins on the likelihood of college attendance, though the estimates are all positive. In Taiwan, like other countries, some students may choose to study overseas (e.g., in the US) for higher-quality education, where tuition and living costs are much higher than domestic options. Receiving a cash windfall could enable parents to afford to send their children abroad to study. To examine this notion, we disaggregated college attendance into domestic (Columns (2) to (6)) and overseas (Columns (7)). The results indicate that winning the lottery has no significant impact on attending a domestic college.[18] Still, all estimates are positive. In contrast, we find a 5 million NT$ windfall significantly increases the probability of studying abroad for undergrads by 1.3 percentage points. This is a sizeable change, equivalent to a 93% increase relative to the baseline mean for studying abroad.

[17] Child characteristics include a child's gender, birthplace, birth order, and birth month.

[18] This insignificant impact could be explained by the relatively low cost of college attendance in Taiwan, i.e., on average, 58 thousand NT$ (around 2 thousand US$) for public universities and 110 thousand NT$ (around 3.6 thousand US$) for private universities per academic year.

In summary, while lottery prizes do not appear to influence overall college attendance, the winnings do significantly increase the likelihood of children studying overseas. This suggests that cash windfalls enable winners to afford the higher costs of international education for their children, which is perceived as higher quality.

5.2 Marriage Decisions

Our findings demonstrate that cash windfalls increase fertility, primarily through the extensive margin. This relationship between sudden wealth and family formation is complex, particularly in East Asian societies where marriage typically precedes childbearing (Myong et al., 2021). To explore this further, we examine whether lottery wins influence marriage decisions, hypothesizing that windfalls may induce marriage as a potential mechanism for the observed fertility effect.

To examine the impact of lottery wins on marriage decisions, we focus on individuals who were single prior to their lottery wins. We modify Equation (1) to use a dummy variable indicating "getting married" as the outcome. Table 9 presents the dynamic DDD estimates, summarized by the coefficient of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$. The results reveal a significant and persistent increase in the probability of first-time marriage following a substantial windfall. Our preferred estimate shows that a 5 million NT$ windfall increases the likelihood of marriage within six years by 3.8 percentage points — a notable 14% increase compared to the baseline trend.[19]

Interestingly, we observe pronounced gender differences in the impact of lottery wins on marriage decisions. The effect is primarily driven by male winners, with a 5 million NT$ win significantly increasing the marriage probability for single men (see Panel B of Table 9). In contrast, for single women, a win of the same magnitude does not significantly affect their likelihood of marriage (see Panel C of Table 9).

To facilitate cross-country comparisons with other lottery literature (Section 6.1), we also investigate the impact of lottery wins on divorce. Table 10 presents results for individuals who were

[19]The baseline trend refers to changes in the share of future winners who ever got married between $s = -1$ and $s = 6$, which is 29.4%.

married prior to their lottery wins, with the outcome in Equation (1) replaced by a dummy indicating "getting divorced." Unlike the marriage results, we find that lottery wins have no significant impact on divorce decisions for either men or women, with estimated effects being negligibly small.

To investigate how much of the observed effect on fertility can be attributed to changes in marriage behavior, we conducted a causal mediation analysis, following the approach of previous studies (Hsia et al., 2021; Breivik & Costa-Ramón, 2022). However, due to our reliance on a single source of exogenous variation (lottery wins), and the fact that both outcomes (marriage and fertility) were determined within the same period, we lacked the specific variation needed to clearly isolate the impact of marriage on fertility. Therefore, the mediation analysis should be interpreted cautiously, albeit it provides a useful insight into whether the marriage mechanism can potentially explain treatment effects.

Specifically, we assumed lottery wins have both direct effects on fertility and indirect effects through influencing marriage behavior. Indirect effects can be obtained by decomposing the effect of lottery wins on fertility γ_s in Equation (1) into three components: 1) the effect of marriage on fertility; 2) the effect of lottery wins on marriage; and 3) the unexplained part of the lottery effect (i.e., direct effect). The product of the first two components can be viewed as an increase in fertility caused by lottery wins through changing marriage behavior (Alwin & Hauser, 1975; Sobel & Becker, 2001). Following Hsia et al. (2021) and Breivik & Costa-Ramón (2022), we first estimate the impact of marriage on fertility while controlling for the effect of lottery wins by adding the marriage mediator variable M to Equation (1):

$$
\begin{aligned}
B_{it} = \pi M_i + \alpha_0 Prize_i + \sum_{s\neq -1} \kappa_s \cdot \mathbf{I}[t = L_i + s] + \sum_{s\neq -1} \lambda_s \cdot Prize_i \times \mathbf{I}[t = L_i + s] \\
+ (\alpha_1 + \alpha_2 Prize_i + \sum_{s\neq -1} \beta_s \cdot \mathbf{I}[t = L_i + s] + \sum_{s\neq -1} \gamma_s \cdot Prize_i \times \mathbf{I}[t = L_i + s]) \times Current_i \\
+ a_{it} + \theta_t + \boldsymbol{X_i}\psi + \varepsilon_{it} \qquad (4)
\end{aligned}
$$

where M indicates whether an individual has ever entered into marriage. Our estimation shows that the effect of being married on fertility was approximately 0.64. Next, we multiply this estimate by the estimated effect of lottery wins on marriage, as shown in Table 9 (0.038). This calculation indicates that the indirect effect of lottery wins on fertility through its influence on the marriage rate is approximately 0.024, thereby accounting for 29% of the total impact on fertility for single winners — 0.083 (see Table 6, Column (3)).[20]

Moreover, we extend our mediation analysis by implementing similar decompositions for male and female winners separately. Our findings reveal a striking gender difference: the mediation effect of lottery wins on fertility through its influence on marriage rates is substantially larger for male winners compared to female winners. Specifically, marriage mediates 42% of the overall lottery impact on fertility for males and has negligible mediation effect for females.[21] This result aligns with our earlier observations of gender-specific effects on marriage decisions and provides further evidence of the gendered nature of wealth's effects on family formation.

Finally, we conduct an analogous mediation analysis for divorce. Consistent with the results presented in Table 10, which showed no significant impact of lottery wins on divorce decisions, we find that the indirect effect of lottery wins on fertility through changes in divorce rates is negligible.[22] These results offer valuable insights into the mechanisms through which sudden wealth impacts fertility. They highlight the predominant role of marriage, particularly for male winners, in mediating the effect of lottery wins on fertility, while simultaneously demonstrating the limited role of divorce in this process.

6 Discussion

In this section, we discuss the relationship between our results and the findings from previous studies using lottery design. Furthermore, we discuss the policy implications of our findings.

[20] The effect of marriage on fertility is 0.064, and the effect of a lottery win on marriage is 0.038. The product of these two effects is $0.064 \times 0.038 = 0.024$.

[21] The mediation effect for females is negative as the lottery prize has a non-significant negative impact on marriage for females.

[22] Specifically, 3% of the total effect on fertility is mediated by decreasing in divorced rate.

6.1 Comparison to Lottery-based Studies

In this section, we compare our estimates with the results from two contemporaneous lottery-based studies conducted in the US (Bulman et al., 2022) and Sweden (Cesarini et al., 2023). To facilitate these comparisons, we rescale our estimates to reflect the effect of a windfall measured in units of $100,000 (in 2015 real dollar) and focus on the fertility effect up to five years ($s = 5$) after the lottery wins. However, it's important to note that the same nominal wealth change may result in different real wealth differences across countries. To address this, we follow the approach of Daysal et al. (2021) by adjusting the estimated effects using purchasing power parity (PPP) exchange rates.[23] Additionally, we consider the baseline mean when comparing the magnitude of effects across studies.

Based on these adjustments and using estimates from Figure 2, our results show that lottery prizes of 100,000 US$ increase the number of children by 0.020 within five years of winning, representing a 7.3% increase from the baseline mean. This finding aligns closely with Cesarini et al. (2023), who report that a 100,000 US$ lottery win significantly increases cumulative fertility by 0.025 children within five years (a 12.3% increase from baseline) in Sweden. In contrast, Bulman et al. (2022) find a much smaller and statistically insignificant effect in the United States, with a corresponding estimate of only 0.001 (a 0.3% increase from baseline).

To explain the heterogeneous impacts of cash windfalls on fertility across countries, we draw on the conceptual framework presented in Daysal et al. (2021). While their primary focus is on how housing prices influence fertility decisions, the mechanisms they discuss are also applicable to cash windfalls. This framework provides insights into how wealth shocks may differentially affect fertility in various contexts.

According to their analysis, the effect of a real wealth shock across countries is driven by differences in the marginal propensity to consume (MPC). Several factors determine variations in MPC, including: household preferences, the extent to which liquidity constraints bind, the liquidity of housing, and the transitory versus permanent nature of the shock. When considering the impact of

[23] In particular, the PPP exchange rate in 2015 was 1 for the US, 8.854 for Sweden, and 15.73 for Taiwan.

lottery winnings on fertility, some of these mechanisms become less relevant, simplifying the analysis compared to housing price shocks. For instance, unlike housing wealth, which may encounter obstacles in being liquidated, lottery winnings are inherently cash windfalls that can be readily accessed and utilized. As a result, the key factors that may explain the differences in the impact of cash windfalls on fertility across Taiwan, Sweden, and the US are likely to be related to the net price of having children, the degree to which families face liquidity constraints and preferences for family formation.

The net price of having children. When comparing Taiwan, Sweden, and the United States, we find significant differences in the net cost of raising children among these three countries. These differences are primarily reflected in cash subsidies, childcare allowances, parental leave, and healthcare. Sweden's social welfare system is generally more generous than those of the US and Taiwan. Sweden offers a "child allowance" of about 1,250 SEK (approximately 130 US$) per month for each child until they turn 18. In contrast, the US provides a child tax credit of up to 2,000 US$ per year for each child under 17. Taiwan has a "childcare subsidy" that offers between 2,500 to 5,000 NT$ (about 80–160 US$) per month for children under 5, with the exact amount depending on family income and region. Regarding childcare costs, the Swedish government bears most of the expense, with parents only paying about 7–20% of the actual cost. In the US, childcare costs are primarily borne by families, with the government offering limited tax credits. Taiwan's government has recently increased subsidies for childcare services, but families still bear a larger proportion of childcare costs compared to Sweden. Parental leave policies also differ significantly. Sweden provides 480 days of paid parental leave, with 390 days paid at 80% of the regular salary. The US has no federal paid parental leave policy, only mandating 12 weeks of unpaid leave, though many states and companies have their own policies. Taiwan offers 6 months of paid parental leave at 60% of the regular salary. In terms of healthcare, Sweden has a universal healthcare system where children's medical care is completely free. While the US provides medical coverage for children from low-income families through Medicaid and CHIP programs, most families still need to pay for insurance premiums and some medical expenses. Taiwan's National Health Insurance (NHI) system covers most of the population, with relatively low medical costs for children, and notably, children under three years old are exempt from co-payments. However, there are still some out-of-pocket expenses for older children and certain services. Table C7 of the Online Appendix compares public spending on family benefits across Taiwan, Sweden, and the United States.[24] The data reveals significant disparities in government support for families across these countries. Taiwan's government spends an average of 383 US$ per person annually on child-related expenditures, while the United States allocates slightly less at 374 US$ per person. In stark contrast, Sweden's investment in family benefits is substantially higher, with the government spending an average of 1,743 US$ per person annually on child-related support. These figures highlight a considerable gap in public support for families between Sweden and the other two countries. As a result, the net cost of raising children in Sweden is significantly lower than in the United States and Taiwan.

Liquidity constraints. The differences in the net cost of raising children across Sweden, the US, and Taiwan not only affect the overall financial burden on families but also potentially influence how liquidity constraints impact fertility decisions in response to cash windfalls. If families face liquidity constraints, lottery winnings can relax these constraints, allowing families to more easily smooth consumption and investments surrounding the birth of a child. Consequently, cash windfall effects on fertility may be more pronounced among constrained households relative to unconstrained ones, as the marginal propensity to consume (MPC) out of cash windfalls will be higher for constrained families. Our subgroup analysis reveals that the effect is significantly larger for households with low liquidity assets compared to those with high liquidity assets. This result suggests that liquidity constraints could play a significant role in shaping the impact of lottery winnings on fertility in Taiwan. In contrast, according to the heterogeneity analysis reported in Bulman et al. (2022), they did not find evidence of important heterogeneity in cumulative fertility by financial status in the United States. Furthermore, the study by Daysal et al. (2021) indicates that households in the US do not face significant liquidity constraints during their childbearing years. Thus, liquid-

[24] Public family benefits spending includes financial support that is exclusively for families and children. This encompasses child-related cash transfers, income support payments during parental leave, income support for sole-parent families, financing and subsidizing of providers of childcare and early education, and child-related tax spending.

ity constraints could explain the different magnitudes of effects observed across Taiwan and US. For Sweden, Cesarini et al. (2023) did not provide enough information about heterogeneity in fertility effects by financial status. Thus, we cannot determine whether liquidity constraints contribute to more pronounced effects found in their study. However, as mentioned before, the out-of-pocket expenditures on child care are much lower in Sweden than in Taiwan and the US. This implies that liquidity constraints might not play a significant role in fertility decisions in Sweden.

Preference for family formation. The divergent fertility responses to lottery wins observed in Taiwan and Sweden compared to the United States likely reflect differences in the relationship between marriage and fertility across these countries. In Taiwan and Sweden, significant increases in fertility following cash windfalls were observed, with approximately 20% to 40% of the fertility effect attributed to increased marriage rates. Interestingly, both countries found that the marriage mediation effect was primarily concentrated among male winners. In Taiwan, lottery wins primarily increased the likelihood of men getting married, without affecting divorce rates. This increase in marriages subsequently influenced fertility rates. In Sweden, lottery wins not only increased the probability of men getting married but also decreased their likelihood of divorce, with both effects being similar in magnitude. This suggests that the marriage mediation effect in Sweden operates through both increased marriage rates and decreased divorce rates, thus influencing fertility decisions through multiple pathways. However, the United States presents a contrasting scenario. While lottery wins did increase marriage probabilities, they did not significantly impact overall fertility. This indicates an absence of the marriage mediation effect on fertility that was observed in Taiwan and Sweden. This distinction is crucial in understanding the differential impacts of wealth shocks on fertility across these countries.

6.2 Policy Implications

Our results, consistent with previous literature, indicate that wealth has a positive effect on fertility. Every 5 million NT$ in lottery winnings increases the number of children by 0.06, and the estimated wealth elasticity of fertility is moderate (0.15). This finding has several policy implications. First, the positive income/wealth effect implies that unconditional cash transfers can lead to moderate increases in fertility rates. The 5 million NT$ lottery win in our study is approximately equivalent to an annual post-tax annuity payment of 183,665 NT$ (assuming a life expectancy of 80 years and an interest rate of 2.5%). This permanent change in annual income is comparable to several policy proposals discussed in the literature. For instance, in the context of Universal Basic Income (UBI) proposals, our lottery shock is equivalent to a monthly UBI of about 15,305 NT$ (506 US$). This falls within the range of popular UBI proposals in other countries, which typically suggest between 500 US$ to 1,000 US$ tax-free per month. The positive wealth effect we observe implies that unconditional cash transfers or UBI could lead to moderate increases in fertility rates. However, the effect might be smaller than the lottery effect due to the difference between a lump-sum windfall and regular payments.

Second, previous studies reveal that conditional child-related subsidies like baby bonuses and child allowances can influence fertility decisions (Milligan, 2005; Brewer et al., 2012; Cohen et al., 2013; Gonz'alez, 2013; Y.-I. Kim et al., 2014; Laroque & Salani'e, 2014; A. Ang, 2015; Garganta et al., 2017; Riphahn & Wiynck, 2017; Andersen & Bhattacharya, 2018; Malak et al., 2019; Malkova, 2018; Stichnoth, 2020; Chuard & Chuard-Keller, 2021; Gonz'alez & Trommlerov'a, 2021; Lyssiotou, 2021; W. Kim, 2022). Theoretically, these subsidies affect fertility through two channels: 1) The income/wealth effect, i.e., by increasing family financial resources, subsidies make it more affordable to have children, and 2) The substitution effect, whereby subsidies lower the relative cost of having children versus other goods, which encourages fertility.

Our subgroup analysis based on lottery prize amounts indicates that the winning amount needs to exceed 5 million NT$ to significantly increase the number of children born. However, this amount is considerably higher than many conditional child-related subsidies. For example, Taiwan's Child-rearing Allowance provides a monthly subsidy of 5,000 NT$ for children under 5 years old. Over the full 5-year period, this amounts to a total of 300,000 NT$ per child. This stark contrast suggests that the effectiveness of child subsidies likely operates primarily through the substitution effect rather than the income/wealth effect. In other words, such policies are unlikely to dramatically increase fertility through purely increasing a family's financial resources. Rather, their impact stems from lowering opportunity costs of childbearing, which has important implications for policy design.

7 Conclusion

This study employs longitudinal administrative data on lottery winners in Taiwan to investigate the effect of cash windfalls on fertility behaviors. We find that a lottery win of 10 million NT$ can significantly increase the number of children ever born by 0.05, which is equivalent to a 15% increase from the baseline. The implied wealth elasticity of fertility is 0.06, which is consistent with the central proposition in Gary Becker's neoclassical theory of fertility, in that children are normal goods, and so demand for the quantity of children should increase in line with individual financial resources (Becker, 1960, 1965).

Additionally, less wealthy individuals exhibit greater fertility responses, suggesting that people have children after accumulating sufficient wealth. Cash windfalls primarily raise fertility by inducing first births among previously childless individuals (i.e., extensive margin) rather than making parents have more children (i.e., intensive margin). Lastly, our analysis reveals that lottery wins boost marriage, and approximately 25% of the total fertility effect stems from increased marriage rates following lottery wins.

Our findings reveal several fruitful avenues for future work. We find that lottery wins do not impact higher-parity fertility but may improve child quality through increased overseas education. However, other quality measures like health status or child expenditures are unavailable in our administrative data. Understanding how cash windfalls affect the trade-off between child quantity and quality is an interesting research question for the future.

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Tables

Table 1: Descriptive Statistics for Lottery Winners and the Population

	Public Welfare Lottery	Taiwan Receipt Lottery	Pooled Sample	Population
Individual characteristics				
Age	31.99	31.62	31.90	31.36
	(6.69)	(6.88)	(6.74)	(7.90)
Living in urban area	0.68	0.70	0.69	0.69
	(0.47)	(0.46)	(0.46)	(0.46)
Female	0.47	0.66	0.52	0.50
	(0.50)	(0.47)	(0.50)	(0.50)
Married	0.46	0.48	0.46	0.41
	(0.50)	(0.50)	(0.50)	(0.49)
Winner's employment	0.75	0.73	0.75	0.69
	(0.43)	(0.44)	(0.43)	(0.46)
Winner's earnings (NT$1,000)	298	263	290	286
	(401)	(374)	(394)	(546)
Winner's income (NT$1,000)	317	282	308	308
	(444)	(452)	(445)	(657)
Winner's assets (NT$1,000)	2,090	1,911	2,041	2,320
	(8,605)	(9,263)	(8,702)	(13,292)
Winner's liquid assets (NT$1,000)	609	628	612	709
	(4,335)	(6,144)	(4,791)	(7,939)
Winner's savings (NT$1,000)	232	296	248	292
	(1,090)	(1,346)	(1,155)	(1,391)
Household earnings (NT$1,000)	489	488	490	458
	(637)	(709)	(656)	(870)
Household income (NT$1,000)	522	525	524	497
	(710)	(796)	(732)	(1,344)
Household assets (NT$1,000)	3,766	4,074	3,847	4,166
	(13,410)	(15,638)	(13,986)	(41,405)
Household liquid assets (NT$1,000)	1,047	1,122	1,065	1,209
	(6,862)	(7,010)	(6,840)	(38,198)
Household savings (NT$1,000)	394	503	421	478
	(1,603)	(1,942)	(1,689)	(2,440)
Fertility variables				
Cumulative number of children	0.86	0.95	0.88	0.82
	(1.09)	(1.13)	(1.10)	(1.11)
Gave birth in $s-1$	0.05	0.04	0.04	0.03
	(0.21)	(0.20)	(0.21)	(0.18)
Gave birth in $s-2$	0.05	0.04	0.05	0.03
	(0.21)	(0.21)	(0.21)	(0.18)
Gave birth in $s-3$	0.05	0.05	0.05	0.04
	(0.21)	(0.21)	(0.21)	(0.19)
# of Observations	297,640	97,612	406,922	11,205,868

Note: The Public Welfare (Taiwan Receipt) Lottery sample refers to individuals who only won the Public Welfare (Taiwan Receipt) Lottery in the treatment year. The sum of the sample sizes of the two subsamples would be slightly less than the total sample size, as a small proportion of the sample won both types of lottery in the treatment year. For the population sample, we utilize the all individuals aged 20-44 from 2007-2012 to construct population data. For each individual, we randomly assign one year between 2007-2012 as a placebo "winning year." We then use their individual characteristics from the year prior to this randomly assigned placebo winning year in our analysis. Urban areas refer to the 6 largest cities in Taiwan with special municipality status: Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City, and Kaohsiung City. These cities have the largest populations in Taiwan. Employment is defined as having positive annual labor earnings. Annual earnings are defined as the sum of annual wage income, business income, and professional income. Annual income is defined as the sum of annual labor earnings plus other annual income sources like interest, rents, farming, pensions etc, excluding lottery winnings. Assets are defined as the sum of real estate value, financial assets, and stocks, minus mortgage debt. Liquid assets are defined as the sum of financial assets and stocks. All monetary values like earnings, income, assets and liquid assets are measured in thousand New Taiwan Dollars (NT$) and adjusted to 2016 NT$ levels (1 NT$ $\approx$ 0.033 US$ in 2016). More details on the construction of asset data can be found in Appendix B. Standard deviations are in parentheses.

Table 2: Effect of a Five Million NT$ Lottery Prize on Fertility

Dependent Variable:	Number of Cumulative Children					
	(1)	(2)	(3)	(4)	(5)	(6)
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.061***	0.061***	0.062***	0.061***	0.063***	0.063***
	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Baseline trend	0.321					
Observations	4,069,220					
Basic controls	√	√	√	√	√	√
Age fixed effect		√	√	√	√	√
Year fixed effect			√	√	√	√
Individual characteristics				√	√	√
Pre-treatment fertility					√	√
Pre-treatment lottery redemption						√

Note: This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 5 Million NT$ lottery wins on fertility at the sixth year following the receipt of cash windfalls. The outcome of interest is the cumulative number of children that winner i has by the end of the sixth year after a lottery win. The baseline trend is the change in the cumulative number of children for the future winner between one year before and six years after the placebo lottery-winning year. Column (1) includes the amount of lottery prize, a full set of event time dummies, the interaction terms between the lottery prize and even time dummies, and the full interactions between $current$ (a dummy indicating a current winner) and the above variables. Column (2) further includes the age fixed effect. Column (3) further includes the calendar year fixed effects. Column (4) includes pre-determined covariates: a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married). Note that these covariates are measured in the year right before the lottery-winning year. Column (5) controls for the outcomes variable (the cumulative number of children) in the year right before the lottery-winning year. Column (6) includes the previous lottery redemption record (the number of lottery redemptions by type in one, two, and three previous to the lottery winning year). Standard errors are clustered at the winner level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 3: Robustness Checks

Dependent Variable:	Number of Cumulative Children									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Minimum Prize		Maxmimum Prize		Population Re-weighting	Age-matched Sample	Age FE by Gender	Individual FE	Single-time Winners	Cohort-by-Cohort
	30K	2K	80M	120M						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.057***	0.065***	0.067***	0.041**	0.065***	0.060***	0.065***	0.064***	0.056***	0.065***
	(0.014)	(0.017)	(0.024)	(0.017)	(0.014)	(0.015)	(0.015)	(0.015)	(0.017)	[0.016]
Baseline trend	0.295	0.320	0.321	0.321	0.278	0.301	0.321	0.321	0.323	0.320
Observations	967,770	12,685,790	4,069,400	4,069,680	4,069,160	4,458,740	4,069,214	4,069,220	3,408,070	4,069,220

Note: This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 10 Million NT$ lottery wins on fertility at the sixth year following the receipt of cash windfalls. The outcome of interest is the cumulative number of children that winner i has by the end of the sixth year after a lottery win. The baseline trend is the change in the cumulative number of children for the future winner between one year before and six years after the placebo lottery-winning year. Columns (1) and (2) report the estimate using different thresholds of "minimum prizes,"– the threshold we use to exclude observations—less than 30 thousand NT$ (Column (1)) or less than 2 thousand NT$ (Column (2)). Columns (3) and (4) report the estimate using different thresholds of "maximum prizes,"—the threshold we use to exclude observations—above 80 Million NT$ (Column (3)) or above 120 Million NT$ (Column (4)). Column (5) reports the estimate based on re-weighting the lottery winner sample to make these characteristics similar to those of the general population in Taiwan. Column (6) reports the estimate based on resampling within the future winner sample to make their age distribution match those of the current winner sample. Column (7) includes both male and female age fixed effects. For winners with no spouse, we include a dummy indicating a missing spouse (either male or female). Column (8) includes individual (winner) fixed effects to account for any individual time-invariant unobserved factors. Column (9) restricts samples to those who only win a lottery prize once in the sample period (2004 to 2018). Column (10) estimates the lottery impact within each cohort ([placebo] lottery winning years) separately and the average effect weighted by the number of observations in each cohort. The standard error is obtained by 1,000 times bootstrapping (resampling within replacement within the cohorts [winning years] cluster). Standard errors are clustered at the winner level and reported in parentheses. Bootstrapping standard errors are reported in squared brackets.
*** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 4: Subgroup Analysis—By Amount of Lottery Prize

Dependent Variable:	Number of Cumulative Children						
	(1)	(2)	(3)	(4)	(5)	(6)	Elasticity
$Current_i \times \mathbf{I}[Size_i = 10K - 50K]$	0.003	0.008*	0.007	0.003	0.008*	0.008*	4.715
$\times \mathbf{I}[t = L_i + 6]$	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	
$Current_i \times \mathbf{I}[Size_i = 50K - 500K]$	0.009	0.016**	0.017***	0.011	0.019***	0.019***	1.965
$\times \mathbf{I}[t = L_i + 6]$	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	
$Current_i \times \mathbf{I}[Size_i = 500K - 5M]$	0.025	0.030	0.031*	0.026	0.036*	0.036*	0.260
$\times \mathbf{I}[t = L_i + 6]$	(0.019)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	
$Current_i \times \mathbf{I}[Size_i = 5M - 50M]$	0.089***	0.096***	0.097***	0.090***	0.101***	0.101***	0.155
$\times \mathbf{I}[t = L_i + 6]$	(0.032)	(0.030)	(0.030)	(0.031)	(0.031)	(0.031)	
$Current_i \times \mathbf{I}[Size_i \geq 50M]$	0.271**	0.281***	0.283***	0.280***	0.275***	0.275***	0.015
$\times \mathbf{I}[t = L_i + 6]$	(0.111)	(0.105)	(0.104)	(0.106)	(0.106)	(0.106)	
Baseline trend	0.321						
Observations	4,069,220						
Basic controls	√	√	√	√	√	√	
Age fixed effect		√	√	√	√	√	
Year fixed effect			√	√	√	√	
Individual characteristics				√	√	√	
Pre-treatment fertility					√	√	
Pre-treatment lottery redemption						√	

Note: This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), but replacing the continuous measure of lottery wins ($Prize$) with a series of binary indicators $\mathbf{I}[Size = k]$ representing different prize ranges: 1) 10 to 50 thousand NT$; 2) 50 to 500 thousand NT$; 3) 500 thousand to 5 million NT$; 4) 5 to 50 million NT$ and 5) 50 million NT$ or more. We use winners of 5 to 10 thousand NT$ as the reference group. The outcome of interest is the cumulative number of children that winner i has by the end of the sixth year after a lottery win. The baseline trend is the change in the cumulative number of children for the future winner between one year before and six years after the placebo lottery-winning year. Column (1) includes the amount of lottery prize, a full set of event time dummies, the interaction terms between the lottery prize and even time dummies, and the full interactions between $current$ (a dummy indicating a current winner) and the above variables. Column (2) further includes the age fixed effect. Column (3) further includes the calendar year fixed effects. Column (4) includes pre-determined covariates: a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married). Note that these covariates are measured in the year right before the lottery-winning year. Column (5) controls for the outcomes variable (the cumulative number of children) in the year right before the lottery-winning year. Column (6) includes the previous lottery redemption record (the number of lottery redemptions by type in one, two, and three previous to the lottery winning year). Standard errors are clustered at the winner level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 5: Subgroup Analysis—By Financial Resources

Dependent Variable:	Cumulative Number of Children					
	(1)	(2)	(3)	(4)	(5)	(6)
	Deposit		Liquid Asset		Real Estate	
	= 0	> 0	= 0	> 0	= 0	> 0
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.085***	0.019	0.103***	0.028	0.092***	0.022
	(0.019)	(0.024)	(0.024)	(0.020)	(0.021)	(0.021)
$Difference$	0.066**		0.075**		0.070**	
	(0.031)		(0.031)		(0.030)	
Baseline Trend	0.313	0.345	0.313	0.332	0.333	0.288
Observations	3,047,900	1,021,320	2,259,580	1,809,640	2,887,980	1,181,240

Note: This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 5 Million NT$ lottery wins on fertility in the sixth year following the receipt of a cash windfall. The difference is estimated using Equation (1), with the group variable interacting with the treatment variable and all covariates and fixed effects. The outcome of interest is the cumulative number of children that winner i has by the end of the sixth year after the lottery win. The baseline trend is the change in the cumulative number of children for the future winner between one year before and six years after the placebo lottery-winning year. All regressions include the same set of covariates shown in Column (6) of Table 2. Columns (1) and (2) divide the sample into two groups based on whether the winner had any deposits one year previous to the (placebo) winning year. Column (1) reports the estimate based on winners with no deposits. Column (2) reports the estimate based on winners having a positive deposit. Columns (3) and (4) divide the sample into two groups based on whether the winner had liquid assets one year previous to the (placebo) winning year. Liquid assets is defined as the sum of market values of stock and capital savings. Column (3) reports the estimate for winners with no liquid assets. Column (4) reports the estimate for winners having liquid assets. Columns (5) and (6) divide the sample into two groups based on whether the winner has real estate one year previous to the (placebo) winning year. Real estate is defined as lands and houses. Column (5) reports the estimate for winners with no real estate. Column (6) reports the estimate for winners having real estate. Standard errors are clustered at the winner level and reported in parentheses.
*** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 6: Subgroup Analysis—By Parenthood Status and Household Status

Dependent Variable:	Cumulative Number of Children					
	(1)	(2)	(3)	(4)	(5)	(6)
	Parenthood Status		Household Status			
	w/o Child	w/ Child	Single	Couple	Couple w/o Child	Couple w/ Child
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.102***	0.032**	0.083***	0.046**	0.178**	0.023
	(0.025)	(0.014)	(0.023)	(0.019)	(0.078)	(0.015)
$Difference$	0.070**		0.037		0.155*	
	(0.029)		(0.030)		(0.079)	
Baseline Trend	0.313	0.345	0.313	0.332	0.333	0.288
Observations	2,194,390	1,874,830	2,188,060	1,881,160	298,740	1,582,420

Note: This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 10 Million NT$ lottery wins on fertility in the sixth year following the receipt of a cash windfall. The difference is estimated using Equation (1), with the group variable interacting with the treatment variable and all covariates and fixed effects. The outcome of interest is the cumulative number of children that winner i has by the end of the sixth year after the lottery win. The baseline trend is the change in the cumulative number of children for the future winner between one year before and six years after the placebo lottery-winning year. All regressions include the same set of covariates shown in Column (6) of Table 2. Columns (1) and (2) separate the sample into two groups based on the cumulative number of children before the winning year. Column (1) includes winners with no child before winning the lottery. Column (2) includes winners with at least one child before winning the lottery. Columns (3) to (6) separate households into four groups based on family types. Column (3) includes winners who were unmarried before winning the lottery. Column (4) includes winners who were married before winning the lottery Column (5) includes married winners without children before winning the lottery. Column (6) includes married winners with children before winning the lottery. Standard errors are clustered at the winner level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 7: Effect of a Five Million NT$ Lottery Prize on House Ownership in Good Neighborhood

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Pr(Top1) >Median		Pr(Top5) >Median		Pr(Top10) >Median		Pr(Top20) >Median	
Panel A: Continous Prize								
$Current_j \times Prize_j \times Post_t$	0.029	0.029	0.038*	0.038*	0.027	0.027	0.036*	0.036*
	(0.023)	(0.023)	(0.021)	(0.021)	(0.023)	(0.023)	(0.021)	(0.021)
Panel B: Prize Group								
$Current_i \times \mathbf{I}[Size_i = 10K - 50K] \times Post_t$	-0.003	-0.002	-0.004	-0.004	-0.003	-0.003	-0.002	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$Current_i \times \mathbf{I}[Size_i = 50K - 500K] \times Post_t$	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$Current_i \times \mathbf{I}[Size_i = 500K - 5M] \times Post_t$	0.021*	0.021*	0.022*	0.022*	0.022*	0.022*	0.022*	0.022*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
$Current_i \times \mathbf{I}[Size_i = 5M - 50M] \times Post_t$	0.009	0.009	0.026	0.026	0.011	0.011	0.022	0.022
	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)	(0.021)
$Current_i \times \mathbf{I}[Size_i =\geq 50M] \times Post_t$	0.383***	0.383***	0.433***	0.434***	0.428***	0.429***	0.382***	0.383***
	(0.082)	(0.082)	(0.086)	(0.086)	(0.085)	(0.086)	(0.081)	(0.081)
Baseline Mean	0.239	0.239	0.237	0.237	0.238	0.238	0.245	0.245
Observations				1,874,830				
Year fixed effect	√	√	√	√	√	√	√	√
Cohort fixed effect	√	√	√	√	√	√	√	√
Winner Control		√		√		√		√

Note: This table reports estimated coefficients of $Current_j \times Prize_j$ in Equation (3), which stands for the effect of 10 Million NT$ lottery wins on winners' children's college attendance. The outcomes of interest are dummies indicating the child ever attended any college (Columns (1) to (3)), domestic college (Columns (4) to (6)), or overseas college (Columns (7) to (9)) as of age 19. The baseline mean is the mean of the outcome variables for the future winners (those who won a lottery prize at a later period when their children were already greater than age 19). Columns (1), (4), and (7) include only basic DID variables—the amount of winnings, a dummy indicating the parent is a current winner, and the interaction term of the two —, the child's cohort fixed effect, and the calendar year fixed effect. Columns (2), (5), and (8) further include winners' (parental) covariates—a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married), the cumulative number of children in the year right before the lottery-winning year, and the prize amount won in one, two, and three years prior to the lottery-winning year. Columns (3), (6), and (9) further include children's covariates—gender, birthplace, birth order, and birth month. Standard errors are clustered at the winner level and reported in parentheses.
*** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 8: Effect of a Five Million NT$ Lottery Prize on Children's College Attendance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable:	Ever Attend ...						
	Any College	Domestic College					Oversea College
		Any	Top1	Top5	Top10	Top20	
$Current_j \times Prize_j$	0.007	0.005	0.005	0.006	0.008	0.009	0.013***
	(0.025)	(0.025)	(0.006)	(0.006)	(0.007)	(0.010)	(0.005)
Baseline mean	0.734	0.727	0.006	0.017	0.027	0.068	0.014
Observations	80,655	80,655	80,655	80,655	80,655	80,655	80,655

Note: This table reports estimated coefficients of $Current_j \times Prize_j$ in Equation (3), which stands for the effect of 10 Million NT$ lottery wins on winners' children's college attendance. The outcomes of interest are dummies indicating the child ever attended any college (Columns (1) to (3)), domestic college (Columns (4) to (6)), or overseas college (Columns (7) to (9)) as of age 19. The baseline mean is the mean of the outcome variables for the future winners (those who won a lottery prize at a later period when their children were already greater than age 19). Columns (1), (4), and (7) include only basic DID variables—the amount of winnings, a dummy indicating the parent is a current winner, and the interaction term of the two —, the child's cohort fixed effect, and the calendar year fixed effect. Columns (2), (5), and (8) further include winners' (parental) covariates—a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married), the cumulative number of children in the year right before the lottery-winning year, and the prize amount won in one, two, and three years prior to the lottery-winning year. Columns (3), (6), and (9) further include children's covariates—gender, birthplace, birth order, and birth month. Standard errors are clustered at the winner level and reported in parentheses.
*** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 9: Effect of a Five Million NT$ Lottery Prize on Getting Married

Dependent Variable:	Getting Married					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Male+Female						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.038	0.039**	0.038**	0.038**	0.038**	0.038**
	(0.000)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Baseline Trend	0.294					
Observations	2,188,060					
Panel B: Male						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	0.049**	0.051***	0.050***	0.050***	0.050***	0.050***
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Baseline Trend	0.265					
Observations	1,206,920					
Panel C: Female						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	-0.006	-0.012	-0.010	-0.010	-0.010	-0.010
	(0.000)	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)
Baseline Trend	0.327					
Observations	981,140					
Basic controls	√	√	√	√	√	√
Age fixed effect		√	√	√	√	√
Year fixed effect			√	√	√	√
Individual characteristics				√	√	√
Pre-treatment fertility					√	√
Pre-treatment lottery redemption						√

Note: The sample in this table only includes winners who were unmarried before winning the lottery. This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 5 Million NT$ lottery wins on marriage in the sixth year following the receipt of a cash windfall. The outcome of interest is getting married by the end of the sixth year after the lottery win. The baseline trend is the change in the proportion of individuals married for the future winner between one year before and six years after the placebo lottery-winning year. Column (1) includes the amount of winnings, a full set of event time dummies, the interaction terms between lottery prize and even time dummies, and the full interactions between $current$ (a dummy indicates current winner) and the above variables. Column (2) further includes the age fixed effect. Column (3) further includes the calendar year fixed effects. Column (4) includes pre-determined covariates, i.e., a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married). Note that these covariates are measured in the year right before the lottery-winning year. Column (5) controls for the pre-treatment fertility (the cumulative number of children) in the year right before the lottery-winning year. Column (6) includes the previous lottery redemption record (the number of lottery redemptions by type in one, two, and three previous to the lottery winning year). Standard errors are clustered at the winner level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

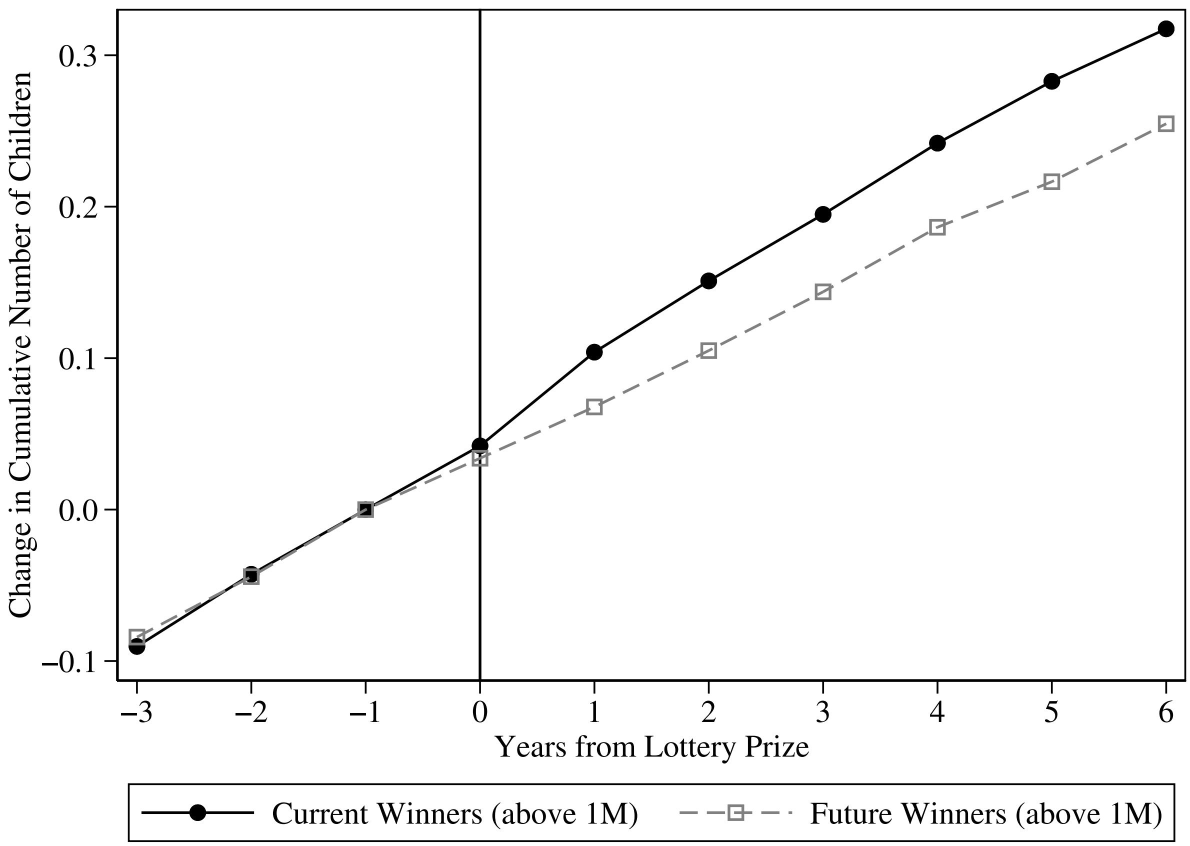
Table 10: Effect of a Five Million NT$ Lottery Prize on Getting Divorced

Dependent Variable:	Getting Divorced					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Male+Female						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	-0.006	-0.006	-0.007	-0.007	-0.007	-0.007
	(0.000)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Baseline Trend	0.092					
Observations	1,881,160					
Panel B: Male						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	-0.004	-0.003	-0.006	-0.006	-0.006	-0.006
	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Baseline Trend	0.094					
Observations	757,770					
Panel C: Female						
$Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009
	(0.000)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Baseline Trend	0.091					
Observations	1,123,390					
Basic controls	√	√	√	√	√	√
Age fixed effect		√	√	√	√	√
Year fixed effect			√	√	√	√
Individual characteristics				√	√	√
Pre-treatment fertility					√	√
Pre-treatment lottery redemption						√

Note: The sample in this table only includes winners who were married before winning the lottery. This table reports estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + 6]$ in Equation (1), which stands for the effect of 5 Million NT$ lottery wins on divorced in the sixth year following the receipt of a cash windfall. The outcome of interest is ever getting divorced by the end of the sixth year after the lottery win. The baseline trend is the change in the proportion of individuals unmarried for the future winner between one year before and six years after the placebo lottery-winning year. Column (1) includes the amount of winnings, a full set of event time dummies, the interaction terms between lottery prize and even time dummies, and the full interactions between $current$ (a dummy indicates current winner) and the above variables. Column (2) further includes the age fixed effect. Column (3) further includes the calendar year fixed effects. Column (4) includes pre-determined covariates, i.e., a set of dummies indicating cities/counties of residence, a dummy indicating the winner was married, a dummy indicating the winner or her spouse was employed, average household earnings per capita (evenly divided between spouses if married), average household income per capita (evenly divided between spouses if married), average household wealth per capita (evenly divided between spouses if married). Note that these covariates are measured in the year right before the lottery-winning year. Column (5) controls for the pre-treatment fertility (the cumulative number of children) in the year right before the lottery-winning year. Column (6) includes the previous lottery redemption record (the number of lottery redemptions by type in one, two, and three previous to the lottery winning year). Standard errors are clustered at the winner level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

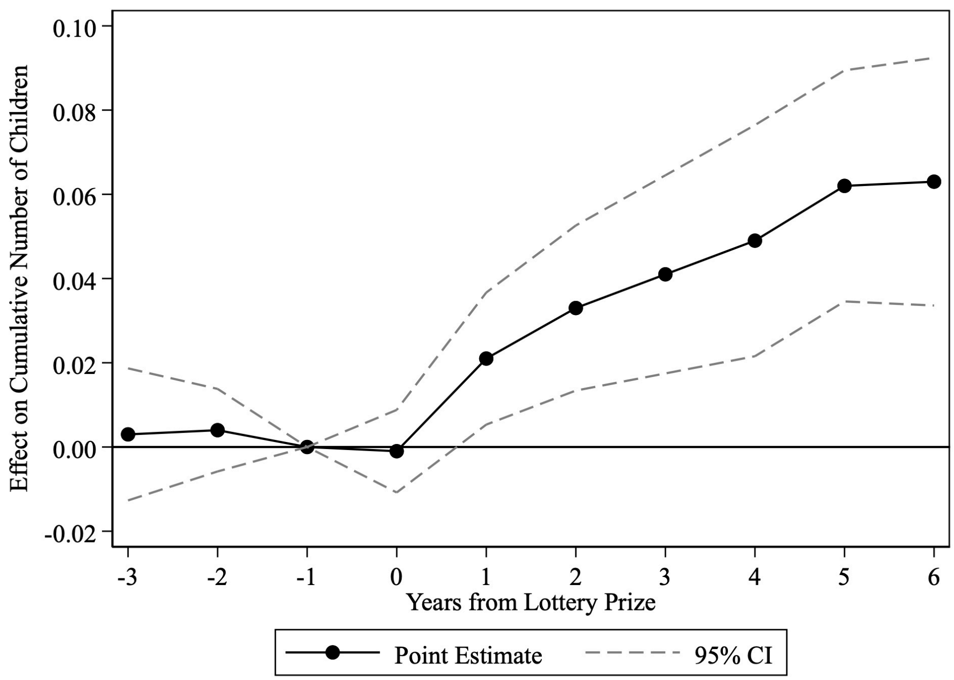
Figures

Figure 1: Trend in the Cumulative Number of Children: Current vs. Future Winners



Notes: This figure compares the trend in the number of cumulative children from three years before to six years after the time of winning a lottery prize. The solid line with circular symbols stands for current winners who won above NT$ 1M, and the dashed line with square symbols stands for future winners who won the same amount in prize money. The vertical axis displays the outcomes (the number of cumulative children) relative to the baseline year (one year previous to the (placebo) lottery-winning year) for each group. The horizontal axis refers to the number of years from the (placebo) lottery-winning year.

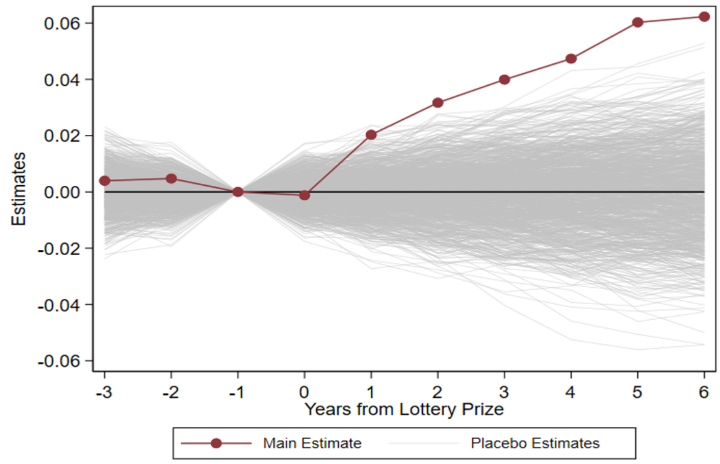
Figure 2: Effect of a Five Million NT$ Lottery Prize on Fertility



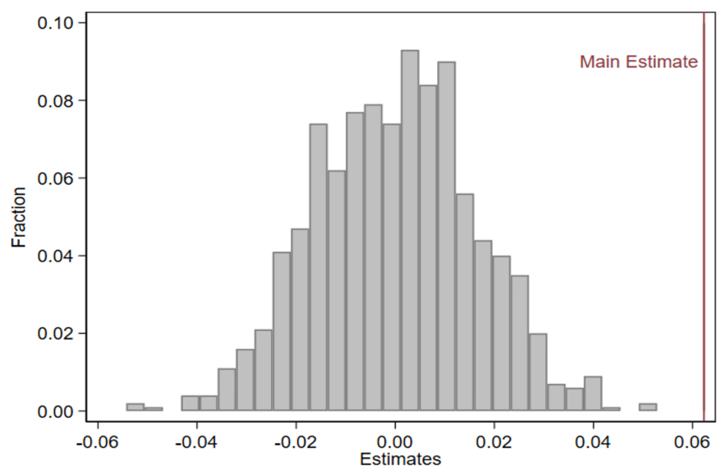
Notes: This figure displays the estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + s]$ from Equation (1). The outcome of interest is the cumulative number of children. The solid line denotes the point estimates. The dashed line denotes the 95% confidence interval. The horizontal axis refers to the number of years from the (placebo) lottery-winning year.

Figure 3: Permutation Test: Randomly Assigned Lottery Prize

(a) Main Results and Placebo Estimates



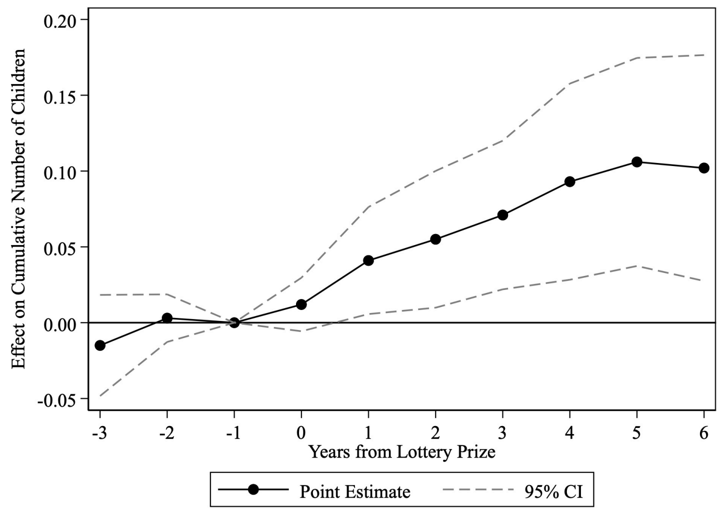
(b) The Estimated Coefficient of $Prize_i \times \mathbf{I}[t = 6]$ and Placebo Estimates



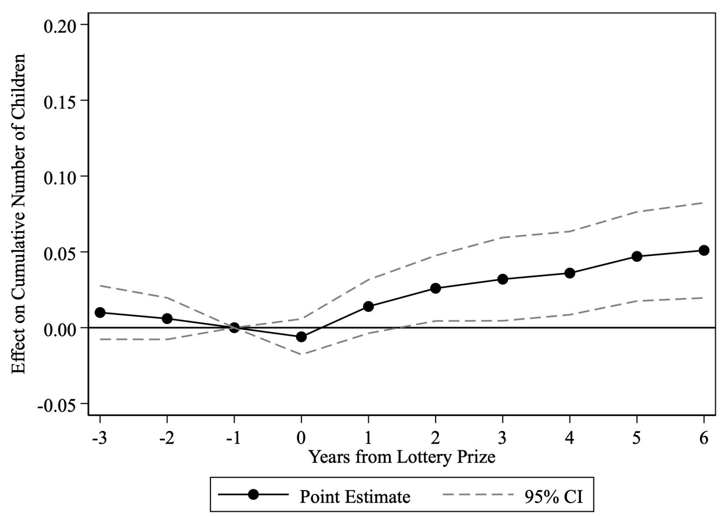
Notes: This figure shows the distribution of 1,000 placebo estimates. Specifically, we randomly permute lottery prizes and attach them to each winner. Then, we use these "pseudo" prizes to estimate Equation (1). We repeat the above procedures 1,000 times to obtain the distribution of pseudo estimates. Figure 3a compares the real estimate (bold line with a circular symbol) with these fake ones (thin lines, gray in color). As we mainly focus on the estimated coefficient of $Current_i \times Prize_i \times \mathbf{I}[L_i + 6]$, which summarizes the effect of the 10 Million NT$ lottery win on total fertility, Figure 3b shows the real estimates (vertical line) and distribution of pseudo ones (histogram) for γ_6.

Figure 4: Effect of a Five Million NT$ Lottery Prize on Fertility: Young and Middle-aged Winners

(a) Young Winners



(b) Middle-aged Winners



Notes: These two figures display the estimated coefficients of $Current_i \times Prize_i \times \mathbf{I}[t = L_i + s]$ from Equation (1). The outcome of interest is the cumulative number of children. The solid line denotes the point estimates. The dashed line denotes the 95% confidence interval. The horizontal axis refers to the number of years from the (placebo) lottery-winning year. Figure 4a shows the results for young winners (i.e., the age of the winner is below 30 years old). Figure 4b shows the results for middle-aged winners (i.e., the age of the winner is above 30 years old).

Online Appendix: For Online Publication