Do People have Children when they become Rich? Evidence from Lottery Winners in Taiwan

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Abstract

This paper examines fertility responses to windfall gains, using administrative data on Taiwanese lottery winners. We employ a difference-in-differences design by comparing the fertility decisions made by households winning more than 1 million NT$ from a lottery in a given year with those made by families winning less than 5,000 NT$. Our results suggest that receiving a large windfall gain increases the likelihood of having children by 57%, and the implied income elasticity of fertility is 0.16. In addition, we find that economically disadvantaged families and women of childbearing age are more responsive to windfall gains than wealthy families and elder women.

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1 Introduction

Over the last fifty years, fertility rates in all countries have faced a dramatic decline (OECD, 2019c), leading to the growth of an aging population, workforce participation shortages, and reductions in tax revenue (Bloom et al., 2010; Caldwell and Mcdonald, 2006; Sleebos, 2003). Many countries, therefore, have initiated child-related cash transfer policies to encourage childbearing. On average, the public spending of child-related cash benefits accounts for 1.1% of GDP in OECD countries (OECD, 2019b). However, previous studies have not reached a consensus on whether more household income could induce fertility (Jones et al., 2008; Gauthier, 2007), and the cross-sectional data even suggest a negative relationship between income and fertility (Jones and Tertilt, 2008). Becker (1960) argues that even though the demand for children responds to an increase in income, this principle does not guarantee an increase in the quantity thereof, due to the trade-off between quality and quantity. Income elasticity for the quantity of children, therefore, could be low, and even negative (Becker and Tomes, 1976). Given the global crisis relating to low birthrate, the great amount of public spending on family benefits, as well as ambiguity in theoretical implications, it is necessary to investigate how fertility responds to income change.

This paper studies households' fertility decisions in response to windfall gains, by employing data on lottery prize winners in Taiwan. Our empirical strategy, based on the random nature of lottery prizes, provides a great opportunity to understand pure wealth effects. By comparing the differences in fertility changes between households winning more than 1 million NT$ (i.e. around 33 thousand US$) and households that win less than 5,000 NT$ (i.e. around 165 US$), we utilize a difference-in-differences (DID) design to identify the effect of positive economic shocks on childbearing behavior. The administrative data we utilize herein allow us to link affluent individuals and household information on childbearing, marriage, income, and wealth, as well as track households two to three years before and after the positive wealth shock, thus providing clear evidence on how household fertility decisions respond to windfall gains.

We obtain three key findings from our research. First, we find that receiving a large wind-

fall gain greater than 1 million NT$ (i.e. around 33 thousands US$) leads to a 2 percentage-point (which is 57% compared to the baseline mean) increase in the likelihood of having children. The implied income elasticity of fertility is 0.16. This estimate is close to previous literature using different economic shocks (Lovenheim and Mumford, 2013; Black et al., 2013; Huttunen and Kellokumpu, 2016; Lindo, 2010).[1] Our results suggest that children are normal goods, and an increase in income/wealth does indeed lead to an increase in demand for the quantity thereof.

Second, our subgroup analysis suggests that only households winning a lottery prize greater than 5 million NT$ (i.e. around 165 thousand US$) will increase their fertility, implying that a considerable increase in income/wealth would be needed to encourage this act. However, the amount of child-related cash transfers provided by most of the countries is far lower than this level. Therefore, these policies might probably have little effect. In addition, our result suggests that the fertility decisions of economically disadvantaged households are quite sensitive to wealth shock. In contrast, receiving a large windfall gain has little impact on the fertility of high-income (high-wealth) households. Our results imply that the lack of financial resources could be one of the key reasons why economically disadvantaged households do not want to have children.

Lastly, we also find heterogeneous effects among different types of households. On average, windfall gains have a larger effect on households with a female below the age of 35 (i.e. in child-bearing age) than those with an older female. Besides, individuals who were unmarried before receiving a lottery prize also respond to windfall gains greater than married couples, implying that a windfall gain could indirectly stimulate fertility behavior via marriage. On the other hand, regardless of the number of children previous to the wealth shock, receiving a windfall gain leads to an increase in the likelihood of having a new child. This finding suggests that although a household may already have children, facing the trade-off between quantity and quality as proposed by Becker and Tomes (1976), an increase in income will still increase demand for the quantity of children.

Our paper contributes to the literature on relationships between income/wealth and fertility in

[1] Lovenheim and Mumford (2013) suggest that the housing wealth elasticity of fertility is 0.13; Black et al. (2013) estimate the husband's income elasticity of women's fertility at 0.18; Lindo (2010) finds husbands' earnings elasticity of fertility is 0.15; and Huttunen and Kellokumpu (2016) provide the family income elasticity of fertility at 0.14.

the following ways. First, the nature of our empirical strategy, based on a lottery win, provides a perfect exogenous variation in wealth and could help understand the wealth effect better, since lottery prizes only affect household financial resources and would not indirectly influence fertility behavior via other channels. Previous studies examining income/wealth effects on fertility usually base their investigations on economic shocks provided by a natural disaster (Ager and Herz, 2019; Alam and Pörtner, 2018), market price variations (Lovenheim and Mumford, 2013; Black et al., 2013), or other unexpected accidents (Huttunen and Kellokumpu, 2016). However, many of these events could be correlated with unobserved characteristics or affect fertility behavior via channels besides an increase in income. For example, Alam and Pörtner (2018) investigated the effect of negative income shock caused by accidental crop loss on contraceptive use and the timing of fertility, but they could not exclude all confounding factors of unobserved, time-varying household characteristics which may influence whether a household experiences a crop loss. Huttunen and Kellokumpu (2016), on the other hand, examined the effect of job displacement caused by plant closure on fertility decisions, and their results suggest that job displacement affects fertility not only through income effects, but also via future employment and career stability. The nature of the randomized assignment of lottery prizes provides our study with a good exogenous variation in life-time income (Briggs et al., 2015) and a great chance to identify pure income effects on fertility.

Second, the sample covered by our analysis includes households with different marriage statuses, parenting statuses, jobs, and employment statuses, so we can examine both intensive and extensive marginal effects and the results will be highly generalized to the public. Previous studies employing husbands' employment status or earnings as an exogenous variation of income usually limit their observed subjects to married or cohabiting couples (such as Huttunen and Kellokumpu (2016), Alam and Pörtner (2018), and Ager and Herz (2019)). Our analysis, in contrast, covers different households (married or unmarried, with or without a child), thereby helping us investigate the effect of windfall gains on both the intensive (increase in the number of children) and extensive (whether having children) margin effects. On the other hand, some other previous studies utilizing economic shock rely on observations' job or wealth ownership status. For example, Lovenheim and

Mumford (2013) employ housing market variation to evaluate the effect of wealth shock on fertility; therefore, their conclusion can only be applied to people who own a house. Other research, similarly, only provides information on people who are employed (Huttunen and Kellokumpu, 2016), who work as farmers (Alam and Pörtner, 2018; Ager and Herz, 2019), or who work as coal-miners (Black et al., 2013). Such designs probably bypass the situation of economically disadvantaged people, and they provide little information on income/wealth effects for people on low income and with no estate.

Finally, to our knowledge, we are the first to utilize a research design based on lottery prizes, in order to identify income/wealth effects on fertility behavior. Previous studies have applied research designs regarding lotteries or gambling to investigate income/wealth effects on labor supply (Furaker and Hedenus, 2009; Picchio et al., 2017), marriage decisions (Hankins and Hoekstra, 2011), consumer behavior (Kuhn et al., 2011; Imbens et al., 2001), and child development (Cesarini et al., 2016), and yet none has employed lottery winner data to examine fertility behavior. The closest literature is Cesarini et al. (2016), which uses Swedish lottery data to investigate the effect of substantial wealth shocks on childcare utilization and a child's academic performance. Their work provides some insight into windfall gain effects on demand for child quality but not quantity. Given the sub-replacement fertility faced by many countries in the world, investigating the income effect on the quantity of children is important. The present study could therefore fill in the gap in the current literature.

The remainder of this paper is organized as follows. In Section 2, we discuss our data and sample selection process. In Section 3, we explain our empirical strategy and provide the estimated results on windfall gain effects. Section 4 presents the results of the subgroup analysis, whilst section 5 discusses the theory and policy implications of our results and provides some future research recommendation.

2 Data and Sample

2.1 Data

We base our analysis on income registry files and personal information files provided by the Fiscal Information Agency (FIA) in Taiwan. All datasets contain scrambled IDs, which allows us to link them at the individual level. The income registry file records each taxpayer's annual income payment, which is categorized according to ten income types. Most are third-party reported information about labor income, interest income, rental income, professional income, pensions, and lottery/competition income, while the remaining are self-reported information such as profit-seeking enterprise income and agricultural income. We use information about lottery/competition income to define the treatment group and the control group, which will be discussed in the next section. The personal information file provides some basic demographic information, such as gender, year of birth, location of birth, year of marriage, spouse's ID, natural father, and mother. Using parents' IDs and birth year, we can construct the outcome variable: whether an individual or a couple has any new child in a given year. Note that since the dataset only holds information for June 2017 and does not contain marriage history records, it provides no information on couples who divorced previous to 2017. Finally, we merge the above files with the income registry file and individual wealth dataset to get household income and wealth information, which will be used in our subgroup analysis.

2.2 Lottery Games in Taiwan

In this section, we briefly discuss the institutional details of each lottery game in Taiwan. This background knowledge helps us construct the estimation sample for empirical analysis. Three lottery games were run by the Taiwanese government during our sample period (i.e. 2004-2015), namely, (1) Public Welfare Lottery, (2) Taiwan Receipt Lottery, and (3) Sport Lottery. Our empirical analysis only includes the first two lottery games, since Sport Lottery winners do not win it

by "luck" and it might be related to their professional ability.[2]

2.2.1 Public Welfare Lottery

Public Welfare Lottery was initiated by the Ministry of Finance in 1999. The government uses the revenue from selling lottery tickets to raise funds for public welfare schemes. During our sample period, there are three types of lottery games: (1) Computer-drawn games, (2) scratch-card games, and (3) Keno games. Each type of game has a variety of ways to play. For the computer-drawn games, in general, a player needs to choose a set of numbers, and the goal is to match those to the numbers drawn by the computer.[3] The scratch card games usually require a player to match a set of symbols from some slots to win the prize for that symbol. The common rule of Keno games is that a player chooses one of ten games and then selects 20 numbers, ranging from 1 through 80. The payouts are different depending on the game play and the numbers a player chooses.

2.2.2 Taiwan Receipt Lottery

Taiwan Receipt Lottery is a bi-monthly receipt invoice lottery, which was created to encourage legal tax reporting by giving consumers an incentive to purchase at stores that legally report sales taxes. Having purchased any form of goods or services, including paying electricity or telephone bills, the consumer receives an invoice with an eight-digit number printed along the top. Every two months, sets of numbers are randomly drawn, and each receipt invoice, no matter the amount paid for an item, has an even chance of winning the lottery by matching the drawn number. The probability of winning a prize is about 0.3%, and the total prize is about 4 billion NT$.

The smallest current prize is 200 NT$ and the largest is 10 million NT$, but the largest prize before 2011 was 2 million NT$. The lottery prize can be easily exchanged for money at a nearby

[2] Taiwan Sports Lottery started in 2008 and is the only source of legal betting on sports in Taiwan. There are over 10 types of sports and 20 kinds of methods, including MLB baseball and NBA basketball from the United States, the major European soccer leagues, Asian baseball, tennis, golf, and the Olympics. According to the games on which one chooses to bet, the odds will be different.

[3] For example, Lotto 6/49 is one of the richest computer-drawn games in Taiwan. Players choose six numbers (1-49) at a cost of NT$50 per bet. The jackpot is hit if all six numbers are matched by the player, so the probability of winning a jackpot is very low. The jackpots keep growing until someone wins.

convenience store with proof of identification (for amounts up to 1,000 NT$). Larger winnings can be redeemed at banks. The player has to make sure the winning receipt has been stamped by the shop from which the original purchase was made.

2.3 Sample

Our sample includes both single individuals and couples. We first use the income registry file to calculate the total amount of lottery prize that an individual or a couple receives in a given year. The treatment group is defined as an individual or a couple whose annual lottery prize is greater than 1 million NT$ (i.e. winning year), ranging from 2007 to 2012. In addition, to avoid other wealth shocks, except for the winning year, the treated individuals or couples cannot earn more than 5,000 NT$ from lottery prizes during the sample period. The control group includes those earning very little from playing lottery games, namely, their annual lottery prize is less than 5,000 NT$ but above 2,000 NT$ during the sample period (i.e. 2004-2015). To arrive at our estimation sample, we implement the following sample selection process: (1) We restrict samples between the ages of 20 and 45 and (2) we exclude individuals or couples whose member(s) were dead during the sample period. Finally, we track these individuals and couples from 2 years before to 3 years after winning the lottery. Table 1 displays the characteristics of the treatment and control groups. We find the proportion of married couples in the treatment group is higher than in the control group. However, both groups have similar household wealth and income. Finally, as expected, we find the treatment group members receive much more lottery prize money than the control group (i.e. 18 million NT$ v.s. 4 thousand NT$).

3 The Causal Effect of Income on Fertility

3.1 Empirical Strategy: Difference-in-Differences Design

Our identification strategy involves a difference-in-differences (DID) design. This method compares differences in fertility behaviors between a treatment group and a comparison group,

before and after winning a lottery prize. Since the comparison group earns very little money from lottery prizes, it is presumed acceptable to remove any shocks, other than the windfall gain, that might affect the fertility decision of the treatment group. Specifically, we estimate the following regression:

$$B_{it} = \alpha_0 + \alpha_1 Treated_i + \alpha_2 Post_t + \beta^{DD} Lottery_{it} + \nu_i + X_{it}\psi + \varepsilon_{it} \quad (1)$$

where B_{it} represents a dummy variable indicating whether households i have any new children in the period t. The definition of period is either one year before winning the lottery ($t = -1$) or one year after winning the lottery ($t = 1$). Since it takes at least 10 months for a woman to give birth, our analysis does not include the year when a household win a lottery prize. $Treated_i$ is a dummy variable indicating a household i belongs to the treatment group ($Treated_i = 1$) or the comparison group ($Treated_i = 0$). $Post_t$ denotes that a household i is observed in the period after the winning year (i.e. $Post_t = 1$).

The key variable $Lottery_{it}$ is a dummy indicating that a household i receives a large windfall gain by winning lottery prizes, which can be represented by the interaction between $Treated_i$ and $Post_t$ (i.e. $Treated_i \times Post_t$). Thus, $Lottery_{it} = 1$ means that a household i belongs to the treatment group and is observed after the winning year. Its coefficient β^{DD} is the standard DID estimator. Since we control for group and year-fixed effects, β^{DD} measures the differential trend in fertility behavior among the treatment group, relative to the control group, after receiving a large windfall gain. We can attribute the difference in the probability of having children between the two groups to the impact of a windfall gain by imposing the following identification assumptions. First, the treatment and comparison groups' fertility should follow a common trend in the absence of the windfall gain. This assumption ensures that our results do not come from different pre-trends in fertility between the treatment and control groups. In a later session, we will examine the validity of this assumption by using pre-trend data. Second, the composition of the two groups does not change over time. Since the estimated sample is a fixed panel that follows the same individuals or

couples across years, there is no change in group composition during our sample period.

In addition, the panel structure of the data allows for the inclusion of household fixed effects ν_i to control for any unobservable time-invariant differences in fertility preferences between households, such as the acceptance of traditional culture. Finally, to improve the precision of the estimates, we include a vector of covariates $\boldsymbol{X_{it}}$ that could affect a households' fertility decision: Age, family type, income, wealth, and number of children before the lottery-winning year. The variable ε_{it} represents an error term.

3.2 Main Results

Table 2 reports the effect of a windfall gain on the probability of having children, namely, the estimated coefficients of $Lottery_{it}$ from equation (1). We begin by presenting the estimate from a basic DID regression, controlling for $Treated_i$ and $Post_t$ (see Column (1)). Then, we gradually control year-fixed effects, household-fixed effects, and other covariates (see Columns (2) to (5)). The fact that the estimates are quite stable across different specifications is reassuring. All of the estimates are significantly different from zero at the 5% level.

Our preferred specification (column (5)) suggests that receiving a large windfall gain leads to a 2 percentage-point increase in the likelihood of having children. Compared to the baseline probability of 3.5 percent for a treatment group in our sample, this result is a sizable increase amounting to around 57% of the pre-treatment average. In order to calculate the wealth elasticity of fertility, we need to know the change in wealth induced by a windfall gain. Therefore, we use information on the average amount of major lottery prize money won by a treatment group (i.e. 19 million NT$) and the pre-treatment mean of wealth (i.e. 5.2 million NT$) to compute the wealth change. Our estimate suggests that the wealth elasticity of having children is around 0.16.

3.3 Robustness Checks

In this section, we implement a range of robustness checks for our main results. First, in order to examine the validity of common trend assumptions, we extend the DID design to the event-study

analysis by estimating the following regression:

$$B_{it} = \gamma_0 + \gamma_1 Treated + \sum_t \beta_t Treated \times After_t + \delta_t + \nu_i + X_{it}\psi + \varepsilon_{it} \quad (2)$$

where t refers to the year before and after the winning year, $t = -2, 0, 1, 2, 3$. B_{it} and $Treated$ are defined in the same way as equation (1). We use $After_t$ to denote dummy variables for the year before and after the winning year; for example, $After_1$ represents a dummy for the first year after winning the lottery. Note that we use one year before the winning year as the baseline year (i.e. $t = -1$). The key variables used for identification in regression (2) are a set of year dummies $After_t$ interacted with the treatment group dummy $Treated$. The coefficients on these interactions, β_t, can be the difference in the probability of having children in a given year between the treatment and control groups.

Figure 1 displays the evolution of differences in the probability of having children in a given year between the treatment and comparison groups. The vertical axis represents the estimated β_t in equation (2), and the horizontal axis denotes the year relative to when a household won the lottery, so zero means the winning year. Our result suggests that most fertility responses happened within one year after a household received a large windfall gain. The estimated coefficient β_1 indicates that a positive wealth shock of more than 1 million NT$ can increase the probability of having children in the first year after a lottery-winning year by 2.1 percentage points, which is the highest estimate among all estimated β_t. In addition, Figure 1 shows that the trends of the two outcome variables before receiving a large windfall gain are quite similar (i.e. β_{-2} is not significantly different from the baseline coefficient β_{-1}), thereby suggesting that the common trend assumption could be valid.

4 Subgroup Analysis

Our main result suggests that, on average, receiving a large windfall causes an increase in the likelihood of having children. However, the response of fertility to a positive wealth shock is most likely quite heterogeneous. In order to investigate several sources of heterogeneity, we estimate

equation (1) separately by the amount of lottery prize money, income, wealth, age, childbearing status, and marital status. The estimated coefficients of $Lottery_{it}$ are reported in Table 3 and Table 4.

4.1 Mechanism: Increasing Financial Resources

The first two columns of Table 3 report DID estimates based on the amount of lottery prize money that a household has won. Interestingly, we find the fertility responses only exist when a household receives a "sufficiently large" windfall gain. The probability of having children for people who received a windfall gain of more than 5 million NT$ (i.e. around 165 thousand US$) increases by 3.3 percentage points (i.e. 122% of baseline mean). However, for those receiving 1 to 5 million NT$, their fertility does not respond to a windfall gain.

Columns (3) and (4) of Table 3 display the estimates by income. We define households with less than the median pre-treatment income (i.e. 358,543 NT$) as 'low-income' households, otherwise as high-income ones. The result in Column (3) indicates that receiving a large windfall gain significantly raises a low-income household's probability of having children by 4.2 percentage points. Compared to the baseline mean of this group (i.e. 1.6 percent), the estimate represents around a 262% increase. In contrast, we find that there is no fertility response by high-income households.

In Columns (5) and (6) of Table 3, we use household wealth to define current household resources. We define households that have less than 5 million NT$ (i.e. an amount large enough to stimulate fertility behavior) as a low-wealth group, otherwise as a high-wealth one. Similar to the case of income, low-wealth households are greatly stimulated by a windfall gain, while high-wealth households are not sensitive to wealth shocks. Windfall gains increase the likelihood of having children for low-wealth households by 2.9 percentage points (i.e. 91% of the baseline mean). The above heterogeneous responses to windfall gain across the amount of lottery prize money and household resources imply that a lack of financial resources (i.e. liquidity constraints) could explain why some households are able to have a child.

4.2 Who needs Financial Resources?

In this section, we examine the effect of income on fertility across different demographic groups. Columns (1) and (2) of Table 4 display the estimates by age. We find that households with the female below the age of 35 (i.e. childbearing age) are more likely to have children than households with the female above 35 when they receive a large windfall gain. Our estimates suggest that a positive wealth shock of more than 1 million NT$ can result in 3.3 percentage points, or a 64%, increase in the fertility probability of young females. In contrast, the same amount of wealth shock has little impact on older females' fertility behavior. The point estimate (0.8 percentage point) is not significantly different from zero and only one-quarter of the estimate for young females.

Columns (3) and (4) of Table 4 display estimates by the number of children before the winning year. We find that receiving a large windfall gain can have an impact on both extensive and intensive margins of fertility. The probability of having children for childless households increases by 2.7 percentage points. For those who already have children, their probability of having another child also increases by around 2.3 percentage points after a positive income shock.

Columns (5) and (6) of Table 4 display the estimates by marital status before the winning year. Our results imply that most of the fertility responses are driven by individuals who were unmarried previous to the windfall gain. For unmarried individuals, receiving a windfall gain leads to a 3 percentage-point increase in fertility. Conversely, the effect for married couples is only 1.3 percentage points and is not significantly different from zero.

5 Discussion & Conclusion

This study employs panel data on lottery prize winners in Taiwan to investigate the effect of windfall gains on households' fertility behavior. We find a positive and significant effect of wealth shock on increasing the likelihood of having children. On average, winning a lottery prize of more than 1 million NT$ (i.e. around 33 thousand US$) leads to a 2 percentage-point increase in

the likelihood of having children, implying a wealth elasticity of 0.16. This result suggests that "child" is a normal good, and an increase in income/wealth results in an increase in demand for the quantity of the child, corresponding to what has been found by previous studies (Black et al., 2013; Lovenheim and Mumford, 2013; Cohen et al., 2013). However, our subgroup analysis suggests that only a sufficient amount of money (greater than 5 million NT$) will stimulate fertility.

On the other hand, we also find that economically disadvantaged families respond to a windfall gain in a stronger way than high-income and wealthy households. This finding is not aligned with what was predicted by Becker and Tomes (1976), or what was found by Cohen et al. (2013) and Lovenheim and Mumford (2013). However, Lovenheim and Mumford (2013) focused on people who were "home-owners," so they could not examine the effect for families who really suffer from a lack of financial resources. Cohen et al. (2013), on the other hand, limited their samples to women with two or more children. These people in some way already had the economic means to bear children. In contrast, our study covers the most underprivileged people, who probably cannot afford a house or bear any child without sufficient cash transfer. The evidence suggests that a large enough amount of cash could help these kinds of people overcome liquid constraints and become parents.

Our results suggest that households with a female below 35 are more responsive to wealth shocks than households with an older female, thus implying the heterogeneous effects of a windfall gain. The result is aligned with Cohen et al. (2013) and Lovenheim and Mumford (2013), both of whose works suggest that the effect of an increase in income or wealth on fertility is larger for women below aged 35 than for women above this age. The evidence is clear that the quantity of children consumed by a household is determined by not only their financial resources, but also their ability to have children.

Besides, we also find that windfall gains have an effect on having children regardless of whether or not the households already have children. While those households without a child only face the decision between zero or one child, those households who already have at least one child encounter the trade-off between the quantity and the quality of a child. Our result suggests that even for

those who face this trade-off, an increase in wealth still stimulates an increase in demand in terms of quantity. Since the point estimate for families that already have children is slightly lower than the one for childless families, some of the effects of wealth shock could probably move toward an increase in the quality of children.

Based on our findings, we can provide some policy recommendations. First, for most of the countries in the world, the amount of the child-related allowance provided by the government could be too small to take effect. For OECD countries, the average value of total family benefits for a two-parent, two-child, two-earner family is 4.9% of average full-time earnings (OECD, 2019d), which is equivalent to around 2,300 US$ per child, per year[4]. Compared to the amount we detected for a positive effect at 5 million NT$ (i.e. around 165,000 US$), it is not likely that the negligible cash benefit from the government would make people have children.

The finding does not mean that governments should largely increase their budgets for family-related benefits, since we also find some heterogeneous effects among different groups of people. Economically disadvantaged families and younger females responded stronger to cash transfers. Therefore, a policy targeting these people would be expected to have a better effect.

Lastly, we find that most of the fertility responses of wealth shock are driven by individuals who were unmarried previous to a windfall gain. The result implies that the great amount of lottery prize money leads these people to get married and then to have a child. If people are unmarried, they are highly likely not to have children. Therefore, if the government could provide some incentive for people to get married, this policy would probably also have some spillover effect on fertility.

This study contributes to the existing literature by employing an exogenous wealth shock provided by a lottery prize, which allows us to identify the pure income effect. On the other hand, we also exceed previous studies in terms of including a more general population, including unmarried individuals and the poorest people, the latter probably with no estate or stable employment. In addition, the circumstances currently happening in Taiwan, a place with the lowest birth rate, could

[4]according to OECD (2019a), the average full-time wage for OECD countries is 46.7 thousand US$ per employee, per year. Hence, the 4.9% of a two-earner family's annual earnings is 4,577 US$. The amount is for two children, so per-child benefit is 2,288 US$.

reflect a highly likely problem that may be faced by other countries in the nearly future. Overall, we obtain some distinguishing findings compared to other research and provide some suggestions for future studies.

First, we note that liquidity constants can be an important barrier for economically disadvantaged families having a child, but it is still worth further investigation as to what financial resources are needed. For example, would the key resources be a house with enough space, daily commodities for raising a child, or the money for childcare? Future research could try to investigate how households distribute the extra income they obtain, in order to afford one more child. Once we fully understand the crux of the matter, governments could initiate more specific policies to help these families.

Second, the result suggests that unmarried individuals are more likely to be stimulated by a wealth shock, thereby implying a strong connection between marriage and child-bearing. Besides, our event study also suggests that households have a positive response to fertility following a windfall gain, not only in the first year, but also in the third year, implying that people tend to give birth to the second child once they have had the first. Both of these results suggest that there are some interesting chain reactions in decisions regarding forming a family. Therefore, future research could pay attention to this topic.

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Tables

Table 1: Descriptive Statistics for the Treatment Group and the Control Group

	Treatment Group		Control Group	
	Before Windfall	After Windfall	Before Windfall	After Windfall
Household characteristics				
Family type				
Couple	0.474	0.474	0.427	0.427
Individual male	0.328	0.328	0.265	0.265
Individual female	0.198	0.198	0.308	0.308
Average age within household	33.822	35.822	32.263	34.263
	[6.689]	[6.689]	[7.157]	[7.157]
Amount of lottery prize	18,989,490	18,989,490	4,001	4,001
	[75,696,841]	[75,696,841]	[421]	[421]
Married	0.474	0.533	0.427	0.475
	[0.500]	[0.499]	[0.495]	[0.499]
Household income	582,521	639,289	556,110	584,331
(exclude prizes won by chance)	[725,598]	[819,508]	[879,698]	[908,883]
Household wealth	5,204,271	9,905,415	4,391,229	5,149,259
	[11,850,475]	[24,340,066]	[18,484,083]	[18,408,994]
Outcomes variables				
Having children	0.035	0.059	0.039	0.043
	[0.183]	[0.235]	[0.194]	[0.203]
Number of new children	0.035	0.061	0.040	0.044
	[0.183]	[0.249]	[0.198]	[0.207]

Note: The treatment group is defined as a household earning more than 1 million NT$ by winning lottery money in a given year during the sample period. The control group is defined as a household earning less than 5,000 NT$ by winning lottery money in any given year during sample period. The before windfall period is one year before winning lotteries, and the after windfall period is one year after winning. Income includes all sources of income, excluding income from prizes won by chance in a lottery held by the government. Wealth equals the sum of the value of house, land, stock, short-term bills wealth, and capital savings after subtracting subtract house loan debt. All dollar values are in 2016 real NT$. Standard deviations are reported in parentheses.

Table 2: The Effect of a Large Windfall Gain on Fertility

Dependent Variable:	Having children				
	(1)	(2)	(3)	(4)	(5)
Lottery	0.020**	0.020**	0.020**	0.020**	0.020**
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Baseline mean			.035		
# of households			539,060		
# of observations			1,078,120		
Basic DID controls	√	√	√	√	√
Year fixed effect		√	√	√	√
Time-variant characteristics			√	√	√
Time-invariant characteristics				√	√
Household fixed effect					√

Note: This table reports coefficients of *DID* based on equation (1). The outcome variable B_{it} is a dummy variable indicating whether household i has any new child in the period t. $B_{it} = 1$ if having a new child, and $B_{it} = 0$ if not having a new child. The baseline mean is the proportion of households having a new child in the treatment group one year before winning the lottery. Column 1 is a simple DID without covariates. Column 2 additionally includes year-fixed effects. Column 3 additionally includes time-variant household characteristics: Age. Column 4 additionally includes time-invariant household characteristics: Family type, birth year, the year of winning the lottery, household income, household assets, and number of males and female children before winning the lottery. Column 5 additionally includes household fixed effects. Standard errors are clustered at the household 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: Subgroup Analysis: By Amount of Prize, Income, and Wealth

Dependent Variable:	Having children					
	Amount of Lottery Prize		Income before Winning Lottery		Wealth before Winning Lottery	
	Below 5M (1)	Above 5M (2)	Low income (3)	High Income (4)	Low wealth (5)	High wealth (6)
Lottery	0.009	0.033***	0.042***	0.002	0.029***	-0.003
	[0.011]	[0.012]	[0.012]	[0.011]	[0.010]	[0.015]
Baseline mean	.041	.027	.016	.051	.032	.042
# of households	538,497	538,356	269,530	269,530	413,704	125,356
# of observations	1,076,994	1,076,712	539,060	539,060	827,408	250,712

Note: This table reports coefficients of *DID* based on equation (1). The outcome variable B_{it} is a dummy variable indicating whether household i has any new child in the period t. $B_{it} = 1$ if having a new child, $B_{it} = 0$ if not having a new child. The baseline mean is the proportion of households having a new child in the treatment group one year before winning the lottery. All regressions include the same set of covariates shown in column 5 of Table 2. Columns 1 and 2 separate households into two groups based on the amount of lottery prize money, Column 1 only includes households who win less than NT$ five million in the treatment group. Column 2 only includes households who win more than NT$ five million in the treatment group. Columns 3 and 4 separate households into two groups based on household income before winning the lottery. Income is defined as all categories of income excluding income from prizes and awards won by chance (in 2016 real dollars). Column 3 (low-income group) includes households who earn less than the median (NT$ 358,543/year). Column 4 (high-income group) includes households who earn more than the median. Columns 5 and 6 separate households into two groups based on household wealth before winning the lottery. Wealth is defined as the sum of market values of land, house, stock, capital savings, and debt. Column 5 (low-wealth group) includes households who have less than NT$ five million. Column 6 (high-wealth group) includes households who have more than NT$ five million. Wealth equals the sum of the value of house, land, stock, short-term bills wealth, and capital savings, after subtracting house loan debt. Standard errors are clustered at the person level and reported in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

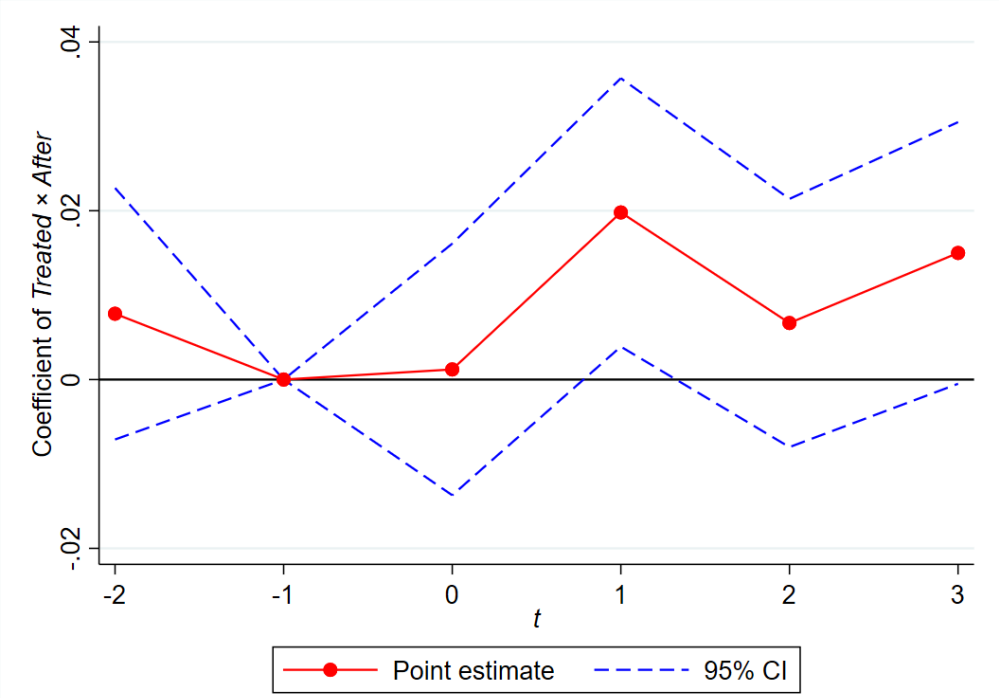
Table 4: Subgroup Analysis: By Age, number of children, and marital status

Dependent Variable:	Having children					
	Female Age before Winning Lottery		Childbearing Status before Winning Lottery		Marriage Status before Winning Lottery	
	Below 35 (1)	Above 35 (2)	No Child (3)	With Child (4)	Unmarried (5)	Married (6)
Lottery	0.033**	0.008	0.028***	0.023*	0.030***	0.013
	[0.014]	[0.007]	[0.011]	[0.012]	[0.009]	[0.014]
Baseline mean	.051	.017	0	.068	.002	.072
# of households	319,836	219,224	293,602	245,458	309,119	229,941
# of observations	639,672	438,448	587,204	490,916	618,238	459,882

Note: This table reports coefficients of *DID* based on equation (1). The outcome variable B_{it} is a dummy variable indicating whether household i has any new child in the period t. $B_{it} = 1$ if having a new child, $B_{it} = 0$ if not having a new child. The baseline mean is the proportion of households having a new child in the treatment group one year before winning the lottery. All regressions include the same set of covariates shown in column 5 of Table 2. Columns 1 and 2 separate households into two groups based on the age of the female in the household before winning the lottery (if the household has no female, use male age instead). Column 1 includes households whose female was below 35 years old. Column 2 includes households whose female was above 35 years old. Columns 3 and 4 separate households into two groups based on the number of children before the winning year. Column 3 includes households with no child before winning the lottery. Column 4 includes households with at least one child before winning the lottery. Columns 5 and 6 separate households into two groups based on marital status before winning the lottery. Column 5 includes unmarried individual households. Column 6 includes married couple households. Standard errors are clustered at the person 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: An Event Study of the Effect of Large Windfall Gains on Fertility



Notes: This figure provides a graphical illustration of the coefficients from the event study based on equation (2). The outcome variable B_{it} is a dummy variable indicating whether household i has any new child in the year t. The ordinate shows the coefficients of the term $Treated \times After_t$. The abscissa shows t, which denotes the years before and after winning lottery. We use one year before a lottery-winning year as the baseline year (i.e. $t = -1$). The red line denotes the point estimates. The blue dashed line denotes the 95 percent confidence interval.