Windfall Gains and Stock Market Participation: Evidence from Shopping Receipt Lottery*

Tzu-Chang Forrest Cheng[†], Hsuan-Hua Huang[‡], Tse-Chun Lin[§], Tzu-Ting Yang[¶], Jian-Da Zhu[‖]

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Abstract

This paper utilizes receipt lotteries in Taiwan along with comprehensive administrative data to examine the effect of cash windfalls on stock market participation and portfolio diversification. The results indicate that each million TWD (approximately 33,000 USD) windfall gain from winning receipt lotteries increases the probability of stock market participation by 1.09 percentage points. This effect is primarily driven by individuals who were not participating in the stock market prior to winning. For existing participants, each million TWD windfall increases the total value of stocks by 142,552 TWD, attributed to both an increase in their number of shares and higher average prices of the stocks they hold. Additionally, each million TWD windfall increases the total value of "new" stocks by 61,189 TWD, accounting for approximately 43% of the total increase in stock value. This demonstrates that cash windfalls can lead to portfolio diversification.

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[†] Department of Economics, National Central University; Email: tcforrest@ncu.edu.tw
[‡] Department of Economics, Washington University in St. Louis; Email: h.hsuan-hua@wustl.edu
[§] Faculty of Business and Economics, University of Hong Kong; E-mail: tsechunlin@hku.hk
[¶] Institute of Economics, Academia Sinica, Email: ttyang@econ.sinica.edu.tw.
[‖] Department of Economics, Fu Jen Catholic University; Email: jdzhu@mail.fju.edu.tw

1 Introduction

It is challenging to empirically test the effect of wealth on stock market participation as implied by life-cycle models of consumption and saving (e.g., Samuelson, 1969; Merton, 1971). The challenge lies in the endogenous relationship between wealth and stock market participation. Figure 1, based on our administrative data, illustrates cross-sectional evidence on the stock market participation rate and individual wealth percentile.[1] Our findings reveal that the probability of participating in the stock market increases with individual wealth levels. However, it's important to note that this positive correlation may not necessarily imply a causal relationship between wealth and stock market participation. Several factors may contribute to this observed relationship. For example, wealthy people tend to participate in stock markets, as the magnitudes of equity risk premiums earned from stock market participation increase with wealth (Vissing-Jorgensen, 2003). The stock markets may play an important role in increasing wealth (Favilukis, 2013). It could also be innate attributes of individuals, such as IQ or cognitive ability, that drive both stock market participation and wealth generated from investments (e.g., Grinblatt, Keloharju and Linnainmaa, 2011*a*, 2012; Conlin et al., 2015; Kuo, Lin and Zhao, 2015).

In addition, compared to the effect on stock market participation, the effect of wealth on stock holding diversity has been less explored in the literature (Goetzmann and Kumar, 2008; Calvet, Campbell and Sodini, 2007; Florentsen et al., 2019). The existing literature often uses variation across individuals to find the positive correlation between wealth and the level of diversification. However, this only shows a correlation, leaving open the question of whether individuals diversify their portfolios after receiving a certain amount of windfall. Therefore, this research aims to investigate the causal effect of cash windfalls on stock market participation and portfolio diversification, which helps us gain a comprehensive understanding of how wealth affects overall stock market behavior and investment decisions.

[1] The sample includes all individuals between the age of 20 and 60 in Taiwan in 2010.

To estimate the causal impact of wealth on stock market participation and stock holding diversity, an ideal approach is to observe individuals' stock market behavior in response to randomly assigned changes in their wealth. Following this idea, we exploit the richness of long panels of administrative data on more than 1.1 million winners of the Taiwan receipt lottery spanning 10 years. This unique dataset enables us to track the same individuals over time, allowing us to explore changes in stock market behavior after receiving cash windfalls.

However, individuals winning small and large prizes may not be comparable. Inspired by Golosov et al. (2023), we address potential biases in estimating the effects of cash windfalls by utilizing variations in the timing of lottery wins and employing a control group comprised of individuals who first won large or small lottery prizes in later years. Since their current outcomes cannot be influenced by future lottery wins, this approach helps account for potential unobserved differences between individuals who tend to win smaller and larger prizes. Our empirical strategy is essentially a triple-differences design that relies on three variations: 1) the amount of prizes; 2) observation times (pre- and post-winning); and 3) the timing of the lottery win. Under this design, individuals' time-varying characteristics, such as attention to collecting or requesting receipts, can be eliminated by comparing current and future winners. As long as winners have similar time-varying unobserved characteristics, this design can alleviate the omitted variable bias. Specifically, we compare trends in stock market participation and stock holding diversity between current and future winners who won larger or smaller prizes. By examining the differences in these trends before and after the lottery wins, we can identify the causal effect of the cash windfalls, while controlling for potential confounding factors that may differ among individuals who win smaller and larger prizes.

We obtain three key findings. First, winning a lottery prize of 1 million TWD (approximately 33,000 USD) significantly increases stock market participation by 1.09 percentage point. Not surprisingly, this effect is largely driven by individuals who were not participating in the stock market prior to their lottery win. In other words, the windfall gain from the lottery encourages people who were previously not investing in the stock market to start doing so. On the other hand, for individuals who were already stock market participants before winning the lottery, we find that receiving a large windfall has little impact on their decision to continue participating.

Second, since the causal effects appear to be driven entirely by positive impacts on individuals who did not participate in the stock market before winning the lottery, we conducted a series of heterogeneity analyses focusing on this subgroup. To begin with, our results suggest that the effect is mainly driven by those winning sufficiently large prizes (i.e., more than 1 million TWD, with an average amount of 4.09 million TWD). For those winning less than 1 million TWD, the windfall has a negligible impact on their decision to participate in the stock market. Furthermore, we find that the effect is more pronounced among individuals who own a house or have no debt. These patterns suggest that lottery winners might allocate their funds to other investment opportunities. For example, they may choose to invest their winnings in real estate or use the money to pay off debt, which could potentially crowd out the demand for stock investments.

Third, examining those who were already participating in the stock market in the year before winning, we observe significant increases on the intensive margin. Each million TWD windfall increases the total value of stocks by 142,552 TWD, implying that approximately 14.3% of the windfall is invested in the stock market. Based on the decomposition, lottery winners both increase their number of shares and hold stocks with higher average prices. Additionally, each million TWD windfall increases the total value of "new" stocks by 61,189 TWD, accounting for approximately 43% of the total increase in the value of stocks. This finding suggests that lottery winners tend to allocate their windfall gains relatively evenly between new and existing stocks, indicating that unexpected wealth can indeed lead to portfolio diversification.

Our paper makes several contributions to the existing literature. First, our study complements the limited research on the causal effect of wealth on stock market participation using exogenous wealth shocks. Previous studies, such as Andersen and Nielsen (2011) and Briggs et al. (2021), have used inheritances due to sudden parental deaths in Denmark and lottery winnings in Sweden, respectively, as sources of exogenous variation in wealth.[2] Our study complements these works by utilizing the unique Taiwan receipt lottery winnings in Taiwan as exogenous wealth shocks to individuals. The Taiwan receipt lottery is designed to encourage consumers to obtain receipts for every purchase, thereby reducing the avoidance of sales and corporate income taxes. Unlike typical lotteries, almost every individual in Taiwan participates in the receipt lottery since anyone who purchases any goods or services and receives an invoice has "participated" in the lottery. This feature mitigates concerns about selection bias due to lottery participation, which is an issue that Briggs et al. (2021) address by analyzing "big prize pools" with more widespread participation. However, it is important to acknowledge that individuals need to ask for receipts, keep them and check them. This attentiveness requirement may introduce other potential issues related to omitted variables. We address this issue using future winners as an additional control group. In addition, according to government statistics, about 70% of the winning invoices have been redeemed (FIA, 2023*a*,*b*), implying that the majority of the population keeps the invoices and regularly matches them with the announced winning numbers. Despite these differences in sample and research design, our estimates on stock market participation are broadly similar to those of Briggs et al. (2021).[3]

[2]Our paper also contributes to the literature on the determinants of stock market participation. For example, several recent studies find that cognitive abilities, IQ, and human capital play a role in explaining stock market participation (e.g., Christelis, Jappelli and Padula, 2010; Grinblatt, Keloharju and Linnainmaa, 2011*b*; Athreya, Ionescu and Neelakantan, 2015; Vestman, 2019; Georgarakos and Pasini, 2011). Asides from the individuals' characteristics, the previous literature also indicates that social interaction, trust, information sharing, and internet access affect stock market participation (e.g., Hong, Kubik and Stein, 2004; Guiso and Jappelli, 2005; Bogan, 2008; Brown et al., 2008; Guiso, Sapienza and Zingales, 2008; Georgarakos and Pasini, 2011; Kaustia and Knüpfer, 2012; Li, 2014; Banyen and Nkuah, 2015; Changwony, Campbell and Tabner, 2015). While these studies present plenty of endogenous characteristics related to stock market participation, our paper extends this line of research by examining the impact of wealth on stock investment decisions using the exogenous cash windfalls that almost every citizen would have a chance to win.

[3]Our study is related to a large volume of literature on decisions and choices after windfall gains, including labor supply, health and mortality, marriage and divorce, saving and consumption, mental health, voting behavior, and child development (e.g., Imbens, Rubin and Sacerdote, 2001; Lindahl, 2005; Hankins and Hoekstra, 2011; Kuhn et al., 2011; Apouey and Clark, 2015; Bagues and Esteve-Volart, 2016; Cesarini et al.,

Furthermore, our paper contributes to the studies that discuss the underdiversification behavior of individual investors (Blume and Friend, 1975; Kelly, 1995; Barber and Odean, 2000; Polkovnichenko, 2005; Goetzmann and Kumar, 2008). For instance, many studies demonstrate that the level of diversification increases with income or wealth across individual investors (Goetzmann and Kumar, 2008; Calvet, Campbell and Sodini, 2007; Florentsen et al., 2019). We expand on this literature by providing a causal perspective on how exogenous windfalls influence investors' diversification behavior. The results demonstrating that investors purchase new stocks after receiving the windfall are consistent with the relationship between wealth and portfolio diversification shown in the literature. In addition, investors also allocate a certain proportion to purchasing existing stocks, contributing to the literature that highlights people's tendency to invest in the familiar stocks (Grinblatt and Keloharju, 2001; Huberman, 2001).

Lastly, our study is the first to investigate how unexpected windfall gains affect individuals' decisions to invest in the stock market outside of Nordic countries. We provide insights from a different institutional setting – Taiwan, where the stock market is known to have a large number of individual investors. Between 1995 and 1999, individual investors accounted for approximately 90% of all trading volume in Taiwan (Barber et al., 2009). Although this proportion has decreased, individual investors still represented 58% of all transactions in 2023. Similar patterns are observed in China, Korea, and India, where individual investors also play a major role.[4] This contrasts with developed markets in the United States and Europe, where institutional traders predominate.[5] Thus, taken together with the existing

2017, 2016). We differ from these studies as we focus on stock market participation and utilize a windfall gain from a universal receipt lottery.

[4]Similarly, in China, individual investors make up nearly 90% of daily trading volume on the Shanghai Stock Exchange from 2013 to 2015 (Titman, Wei and Zhao, 2022). In Korea, from 2007 to 2010, individual investors accounted for an average of 83.5% of sell trades and 84.1% of buy trades (Wang, Lee and Woo, 2017). In India, their trading ranges from 35% to 45% of market turnover between 2003 and 2023 (NSE Market Pulse Report, 2023).

[5]In contrast, developed capital markets in the United States and Europe are predominantly fueled by institutional traders. For instance, Grinblatt and Keloharju (2000) find that individual investors constituted merely 7.3% of trading volume for the top 16 Finnish stocks, which collectively represented 52% of the Finnish stock market capitalization during 1995-1996.

literature, our research contributes to a broader understanding of how individual's stock investment respond to wealth shocks across different contexts.

The remainder of this paper is organized as follows. Section 2 provides background information on the Taiwan receipt lottery. In Section 3, we discuss our data and the sample selection process. Section 4 presents our empirical strategy. In Section 5, we present the main results, examine the robustness of our findings, and conduct a series of subgroup analyses. Section 6 compares our main results with the findings from typical lotteries, and Section 7 provides concluding remarks.

2 Background: Taiwan Receipt Lottery

In this section, we discuss the institutional details of the Taiwan Receipt Lottery (RL), also known as the Uniform Invoice Lottery. This background information serves two purposes: first, it outlines the key features of our sample used for empirical analysis; second, it highlights how this lottery system differs from typical lotteries.

To foster value-added tax (VAT) compliance among businesses, the RL was launched by the government on January 1, 1951.[6] This bimonthly lottery incentivizes consumers to request receipts when shopping at VAT-compliant stores, thereby discouraging tax evasion practices. Whenever a consumer purchases any goods or services, he or she receives a receipt with an eight-digit lottery number printed at the top. The numbers on the receipts are administered and distributed to businesses by the Ministry of Finance, and consumers have no choice in selecting their own. Figure A.1 in Online Appendix displays an example of a typical receipt with the lottery number highlighted. On the 25th of every odd month, the Ministry of Finance randomly draws winning numbers across different prize categories. Table A.1 details the prize rules for the RL.

It is worth mentioning that during our sample period (i.e. 2004-2018), two other lottery

[6]Taiwan's VAT rate is 5% and paid by sellers and service providers.

games were also operated by the Taiwanese government: the Public Welfare Lottery and the Taiwan Sports Lottery. The Public Welfare Lottery operates similarly to typical lotteries, where winning is based on chance and players can select tickets or numbers. The Taiwan Sports Lottery, however, differs in that its odds are not entirely random, as winning is influenced by players' ability to analyze sports data. Online Appendix B provides detailed background information about these two lottery games.

Unlike these two lotteries and many typical lotteries worldwide, the Receipt Lottery (RL) is uniquely featured by its universal reach, as almost all people in Taiwan can participate through their daily consumption receipts. The RL has several distinct characteristics that set it apart from typical lotteries. Firstly, participants cannot choose their numbers; instead, the lottery numbers are automatically generated on receipts issued for purchases. This eliminates the element of number selection strategy often associated with other lotteries. Secondly, participation is essentially free and tied to everyday transactions, as opposed to requiring a separate purchase of lottery tickets. Lastly, the RL serves a dual purpose of encouraging consumers to request receipts, thereby aiding in tax enforcement, while also providing a chance to win prizes. According to the survey from Pollster, 92% of people choose to keep their receipts for the RL prizes [7]. Moreover, government statistics reveals a high engagement rate with the RL, with approximately 70% of winning invoices being claimed (FIA, 2023*a*,*b*). This substantial redemption rate suggests that a majority of Taiwan's population actively participates in the lottery by retaining their receipts and regularly checking them against the published winning numbers. We mainly utilize the sample of RL winners for our empirical analysis. In Section 6, we analyze the stock market participation of Public Welfare Lottery (i.e., a typical lottery) winners and compare the findings with those from RL winners.

[7] The Pollster Online Survey is conducted by Pollster Technology Marketing Ltd. during the period from June 6 to June 9, 2009. The sample size is 9,929. The details can be referred to the following link: `https://www.pollster.com.tw/Aboutlook/lookview_item.aspx?ms_sn=308`

3 Data and Sample

3.1 Data

We implement our empirical analysis using several administrative records provided by the Financial Information Agency (FIA): (1) Income registry file, (2) Firm registry file, (3) Wealth registry file, and (4) Individual registration file. All files contain individual identifier (i.e. scrambled personal IDs), which allow the data to be linked at the individual level.

Our lottery data comes from the income registry file, which records all annual payments made to individuals. This file includes various income types, categorized into two main groups: 1) Self-reported information: Such as rental income, business income, and agricultural income; 2) Third-party reported information: Including wages, interest, pensions, and lottery winnings.

Importantly, our records only cover lottery winners who received prizes exceeding 2,000 TWD (approximately 60 USD). This threshold exists because only prizes above this amount are taxable (at a 20% rate) and must be reported to the FIA. The income registry file contains three key pieces of information: 1) The taxpayer's ID (i.e., the winner), 2) The amount of the lottery prize, and 3) The ID of the bank where the prize was redeemed. Since each lottery game has designated banks for prize redemption, we can use the bank ID to identify RL winners and calculate individuals' annual lottery income.

The wealth registry file provides detailed information on stock holdings, including the corporations individuals hold stocks in, the number of shares held, stock prices, and the total value of stocks.[8] It's important to note that this data only includes information on listed stocks held directly by individuals. Mutual funds, which represent a small portion of the securities market, are excluded.[9] Using this data, we can calculate an individual's

[8]We obtain stock market prices by merging the data from the Taiwan Economic Journal. `https://schplus.tej.com.tw`

[9]According to the Taiwan Stock Exchange Corporation's annual report, the market trading value of mutual funds (such as Exchange Traded Fund) accounted for 0.69% of the total market trading value in 2010, increasing to 5.70% by 2018 during our sample period. Detailed statistics can be found at the following

stock portfolio in terms of total value, number of shares held, and average price of stocks. This detailed stock holding information allows us to track changes in both stock market participation and portfolio composition among lottery winners. The wealth registry file also contains information on other forms of wealth, such as houses and land, which serves as a foundation for our subgroup analysis.

Furthermore, the firm registry file contains essential information about business ownership, including the owners' ID and the type of business. We use this file to determine an individual's status as a business owner, which is used for our subgroup analysis. Lastly, the individual registration file provides basic demographic information about the sample, such as gender, year of birth, birthplace, current residence, and year of marriage.

3.2 Sample

Several restrictions were implemented to construct the main sample. First, we selected individuals who first won RL lottery prizes of at least 2,000 TWD during our study period, which is the lowest prize amount observable in the FIA data. Second, we limited the sample to individuals aged 20-60 at the time of lottery winning to capture the primary age group likely to participate in the stock market. Finally, we tracked these individuals for 10 years, from 4 years before to 5 years after winning. The sample period spans from 2004 to 2018. The final sample contains over 1,058,944 prize winners, encompassing a wide range of windfall amounts.

Table 1 compares the characteristics of the RL lottery winners estimation sample to the Taiwanese population aged 20–60 during the sample period. These characteristics are measured in the year before the lottery win, and all monetary values are adjusted to 2016 TWD using the CPI. Winners are largely similar to the general population in major demographic attributes, such as age, residence, earnings, saving, and homeownership. A notable difference

link: `https://www.twse.com.tw/zh/trading/statistics/index07.html` is that a higher proportion of winners are female (66% vs 49%) compared to the general population. This could be because more females tend to claim RL prizes. Additionally, we find that slightly more winners are married (55% vs 50%). In a robustness check, we re-weight the sample to align these characteristics (i.e., age, gender, and marital status) with those of the overall Taiwanese population and demonstrates that the main estimate remains robust when using this re-weighted sample.

4 Empirical Specification

In this section, we introduce our empirical strategies that establish causal inferences about how the lottery win affects people's stock market participation. First, following the previous literature (Cesarini et al., 2016, 2017; Briggs et al., 2021; Picchio, Suetens and van Ours, 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 stock market participation 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. In the case of the RL, individuals' attention to collecting or requesting receipts could be potential unobserved factors that may cause omitted variable bias. If the unobserved attention varies over time, then bias might still exist even when individual fixed effects are controlled. Table A.3 in the Online Appendix examines the relationship between prize amounts and pre-lottery characteristics. In Panel A, it is evident that the lottery prize amount is correlated with several winner's traits, such as gender, marital status, and previous winning amounts.[10] The pattern implies that the amount of lottery winnings may not be entirely random.

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. Under the triple-differences design, individuals' time-varying characteristics, such as attention to collecting or requesting receipts, could be eliminated by the difference between current and future winners. As long as winners have similar time-varying unobserved characteristics, this design can alleviate the omitted variable bias. 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.

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

S_{it} is the outcome of interest that measures stock market participation or variables related to stock holdings for individual i in year t. $Prize_i$ denotes the amount of individual i's first lottery win, measured in units of one million TWD (approximately 33,000 USD). Event time dummies $\mathbf{I}[t = L_i + s]$ indicate observations before or after lottery wins, where L_i is the year

[10] The panel regresses the winner's characteristics on prize amounts, controlling for the age-fixed effect.

of individual i's first lottery win. Thus, $\mathbf{I}[t = L_i + s]$ represents an indicator for being s years away from the win, with $s = -4, -3, -2, 0, 1, 2, 3, 4, 5$. For instance, $\mathbf{I}[t = L_i + 1]$ is a dummy for the first year after the lottery-winning year. Our sample comprises a balanced panel of individuals observed annually from 4 years ($s = -4$) pre-winning to 5 years ($s = 5$) 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 $\mathbf{I}[t = L_i + s]$. 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 $\mathbf{I}[t = L_i + s]$ interacted with current winner dummy $Current_i$ and prize amount $Prize_i$. Its coefficients γ_s measure the effect of a one million TWD windfall on the outcome of interest.

As age is a key determinant of an individual's stock market participation, all specifications include winner age fixed effects, a_{it}, to control non-parametrically for underlying life-cycle trends in stock market behavior. Year fixed effects, θ_t, capture macroeconomic impacts and general patterns of stock market participation in Taiwan. We also incorporate pre-determined covariates, $\boldsymbol{X}_i$, measured immediately before the lottery-winning year, such as the winner's earnings, winner's wealth, marital status, gender, and cities/counties of residence. 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.

In order to summarize our results into a single number, we also estimate the following DDD regression by replacing event time dummies ($\mathbf{I}[t = L_i + s]$) with a dummy for the post-winning period $Post_t$.

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

This DDD regression allows us to estimate the average treatment effect of lottery winnings on our outcome of interest. The coefficient γ captures the differential effect of lottery prize amount on the outcome for current winners compared to future winners in the post-winning period, providing a concise measure of the impact of cash windfalls on the outcomes.

5 Results

In this section, we first present the main results on the effects of lottery wealth on stock market participation, followed by an examination of their robustness. Additionally, we split the sample to discuss the heterogeneous effects and analyze the impact of lottery wins on portfolio diversification for individuals who had invested in the stock market prior to winning the lottery.

5.1 Effects of Lottery Wealth on Stock Market Participation

We first illustrate the graphical results to demonstrate the parallel trend between current and future winners, as our DDD design relies on comparing these two groups with similar prize amounts. Figure 2a shows the stock market participation rates for current (square symbol) and future (triangle symbol) winners who won at least 2,000 TWD, spanning from 4 years before to 5 years after winning the lottery ($s = -4, ..., -1, 0, 1, ..., 5$). $s = 0$ refers to the winning year. Note that future winners did not receive the lottery prize in the winning year, as their winning year serves as a 'placebo' year. They win the lottery six years after this placebo year. The vertical axis shows the average stock market participation rate. As time goes by, stock market participation increases gradually. During the pre-lottery-winning period ($s < 0$), the trends are almost identical between these two groups. However, starting from the winning year, we observe an immediate divergence in these two lines, indicating the immediate windfall effect since the current winners start to receive the windfall after $s = 0$, while the future winners have not yet won the lottery. Additionally, these two groups exhibit similar patterns during the post-lottery-winning period ($s \geq 0$), and the effect persists for the following five years.

In Figure 2b, we focus on winners (both current and future) who won prizes of at least 10,000 TWD. The trends between these two groups are almost identical during the pre-lottery-winning period ($s < 0$). Moreover, the windfall effect is larger compared to that in Figure 2a. Since individuals may not invest their prizes in the stock market immediately, we observe that the gap widens over the first four years and then stabilizes. To sum up, both Figures 2a and 2b show the parallel trends between current and future winners, demonstrating the validity of our research design.

Figure 3a illustrates the dynamic pattern of estimates from equation (1). The outcome variable is a binary indicator of whether individual i participates in the stock market in year t. The estimated coefficients, $\hat{\gamma}_s$, for the pre-lottery-winning period ($s < 0$) are statistically insignificant. This finding supports the validity of the common trends assumption. The estimates become significant from the second year after winning ($s = 1$), ranging from 1 to 2 percentage points, and the effect persists for at least 4 years, until $s = 4$.

We divide the data into two groups based on stock market participation status one year before lottery wins (baseline year)[11]: participants and nonparticipants. The results reveal a striking contrast between these groups. Figure 3b demonstrates a pronounced dynamic pattern for nonparticipants, with effects substantially larger than those observed in the

[11]For future winners, we use the status from one year before their 'placebo' winning year to split the sample

overall sample (Figure 3a). In contrast, Figure 3c shows small and insignificant effects for participants. Notably, these findings indicate that nonparticipants are the primary drivers of the overall windfall effect.

To concisely summarizes our results, Table 2 presents estimated coefficients for $Prize_i \times Post_t \times Current_i$ from equation (2). We begin with Column (1), which presents the estimate from a basic DDD regression without controlling for fixed effects or covariates. Column (2) then incorporates year fixed effects to account for time-specific factors. Columns (3) and (4) progressively add more controls: Column (3) introduces fixed effects for the winner's age, while Column (4) further includes pre-winning characteristics. These additions aim to control for potential confounding factors related to individual demographics and baseline conditions. Finally, Column (5) includes individual fixed effects to control for time-invariant unobserved factors, providing the most comprehensive specification in our analysis.

Panel A of Table 2 presents results for the entire sample, including both stock market participants and nonparticipants prior to winning lottery prizes. The result in Column (5) indicates that a one million TWD (approximately 33,000 USD) windfall gain increases the probability of stock market participation by roughly 1.09 percentage points. The estimates in Columns (1)-(4) closely align with that in Column (5), suggesting that the DDD design effectively mitigates bias from unobserved individual factors, even without controlling for individual fixed effects in the regression.

Panels B and C of Table 2 present results for nonparticipants and participants, respectively. For individuals who did not participate in the stock market before winning the lottery, each million TWD (approximately 33,000 USD) increases the participation probability by 1.42 percentage points. In contrast, the windfall effect is statistically insignificant for individuals who were already participating in the stock market. These findings indicate that the overall effect shown in Panel A is primarily driven by nonparticipants. This result aligns with findings from Andersen and Nielsen (2011) and Briggs et al. (2021) using data from Nordic countries. In the subsequent analysis, we further explore the heterogeneous effects on nonparticipants in Section 5.3. For participants, we examine their diversification behavior after winning the lottery in Section 5.4.

5.2 Robustness Checks

In this subsection, we conduct several robustness checks on our main results. First, we examine whether the estimated windfall effect varies according to the range of lottery prizes. Our main results are based on a broad range, including individuals who won lottery prizes of at least 2,000 TWD, which is the smallest prize observable in our dataset. In Columns (1) and (2) of Table 3, we focus on winners of prizes of at least 5,000 TWD and 30,000 TWD, respectively. Despite the narrower range of lottery prizes, the estimates for the whole sample in Panel A are quite similar to those in Column (5) of Table 2. Similarly, for participants and nonparticipants, the estimates in Panels B and C of Table 3 closely align with those in Table 2. These results demonstrate that the estimated effect remains robust across various ranges of lottery prizes.

To further ensure our results are not chance findings, we conduct a series of falsification tests. Specifically, we randomly re-assign the lottery prizes to individuals in the original sample. Then, we use these "pseudo" prizes to redefine the variable $Prize_i$ in equations (1) and (2) and estimate them. We repeat the above permutation procedures 1,000 times to obtain the distribution of pseudo estimates. For the main results, Figure 4a shows the real estimates (red vertical line) and the histogram of pseudo estimates $\hat{\gamma}$ from equation (2) based on the permutation. This reveals that the real estimate is much larger than those obtained from the permutation, suggesting the significance of our results. Figure 4b shows the permutation for the dynamic DDD estimates in equation (1). Similarly, we observe that the real estimates (red line) are much larger than those from the permutation (grey lines) during the post-lottery-winning period ($s \geq 0$), demonstrating the significance of the dynamic DDD estimates. Additionally, the real estimates (red line) fall between those from the permutation (grey lines) during the pre-lottery-winning period ($s < 0$), demonstrating the validity of the control group. We also conduct falsification tests for both nonparticipants and participants. Figures 4c and 4d demonstrate that the results remain significant for nonparticipants, while Figures 4e and 4f indicate that the results are insignificant for participants.

Next, we reweight the population for estimation since the lottery winners in our sample could be different from those of the general population. Compared to the general population, Table 1 indicates that winners are slightly younger. Additionally, our sample of winners includes a higher proportion of females and married individuals. To address this concern, we adjust the sample weights to align these attributes more closely with those found in the general population of Taiwan[12]. Following the re-weighting process, the estimate in Column (3) of Table 3 remains consistent with those in the main results.

Furthermore, our sample includes individuals who received lottery prizes in various years. Recent studies (De Chaisemartin and d'Haultfoeuille, 2020; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Baker, Larcker and Wang, 2022; Sun and Abraham, 2021) suggest that conventional Difference-in-Differences (DID) estimates might be biased if treatment effects are heterogeneous among different treated cohorts. To address this concern, we apply a two-step estimation strategy with a bootstrap procedure proposed by Callaway and Sant'Anna (2021). Specifically, for each winner cohort, we compare the current winner cohort with the corresponding future winner cohort to obtain the estimate separately. For instance, for those who received the lottery prize in 2008, we compare them (current winners) with those who won the lottery prize in 2014 (corresponding future winners) and are assigned a 'placebo' winning year of 2008. Then, we calculate the average windfall effect across all winner cohorts, weighted by the sample size of each cohort. We estimate the standard error

[12]We use the post-stratification weighting technique and match the age, gender and marital status of population for our lottery sample and the population, the latter of which is defined as individuals aged 20 to 60 from 2008 to 2012 (same as our winning years for current winners and pseudo years for future winners) in Taiwan. This leads to 11 million observations during winning years. We use their characteristics as one year prior to the winning years.

using 1,000 bootstrap iterations (re-sampling with replacement within lottery cohorts). The results in Column (4) of Table 3 indicate that our main findings are robust to this concern. The estimated effect for the whole sample (Panel A) remains statistically significant and is even larger. This estimate also suggests that the effect of lottery wins is primarily driven by nonparticipants (Panel B).

5.3 Heterogeneous Effects

In this section, we only focus on nonparticipants and explore the heterogeneous effects of cash windfalls based on the following three aspects: (1) the amount of lottery prizes; (2) individuals' financial features; and (3) individuals' demographic features.

5.3.1 Effects by Prize Size

In our main results, we estimate the linear effect of windfall gains (per million TWD) on stock market participation. However, this approach assumes a constant marginal effect across all prize amounts, which may not accurately capture the relationship between windfall size and behavioral changes. To address this potential limitation and gain a more nuanced understanding of how different prize amounts influence stock market participation, we employ a discrete design with varying thresholds.

This approach allows us to investigate whether there are non-linear effects in the relationship between lottery winnings and stock market participation. For instance, smaller prizes might not be sufficient to overcome participation costs to entering the stock market, while larger prizes might have diminishing marginal effects. By examining different prize categories, we can identify potential threshold where the windfall effect becomes significant or changes in magnitude.

To implement this analysis, we modify equation (2) by replacing the continuous variable $Prize_i$ with a binary indicator, $Large_i$, representing a large prize. The revised regression model is as follows:

$$
\begin{aligned}
S_{it} = {} & \alpha_0 Large_i + \kappa \cdot Post_t + \lambda \cdot Large_i \times Post_t \\
& + (\alpha_1 + \alpha_2 Large_i + \beta \cdot Post_t + \gamma \cdot Large_i \times Post_t) \times Current_i \\
& + a_{it} + \theta_t + \boldsymbol{X_i}\psi + \varepsilon_{it}.
\end{aligned} \tag{3}
$$

We define individuals who won less than 5 thousand TWD as the baseline group and use various definitions of a large prize: 1) 5 thousand to 100 thousand TWD; 2) 100 thousand to 1 million TWD; 3) above 1 million TWD[13]. As in our main analysis, we employ future winners as control groups to mitigate potential biases.

The coefficient γ can be interpreted as the effect of winning a large prize (according to the specified definitions) on stock market participation, relative to those who won a small prize (less than 5 thousand TWD). This approach enables us to capture potential non-linearities and threshold effects in the relationship between lottery winnings and stock market participation, providing a more comprehensive understanding of how different levels of windfall gains influence financial behavior.

Table 4 illustrates the heterogeneous windfall effect on stock market participation based on the size of the lottery win. In Column (1), receiving a large prize amount between 5 thousand and 100 thousand TWD yields an almost negligible and insignificant windfall effect on stock market participation. In Column (2), when we consider a large prize ranging from 100 thousand to 1 million TWD, the windfall effect increases but remains insignificant. This suggests that smaller windfalls may not be sufficient to overcome the barriers to stock market entry. It is only when the prize exceeds 1 million TWD that we observe a significant effect. As shown in Column (3), receiving a prize larger than 1 million TWD, compared to winning a smaller prize of less than 5 thousand TWD, leads to an increase in the probability

[13]Since we only have two types of prizes above 1 million TWD—special prize (10 million) and grand prize (2 million)—and the variation in prizes is limited, it is difficult to define additional categories above 1 million TWD to explore the nonlinear effect of larger prizes.

of participating in the stock market by approximately 4.95 percentage points. The average prize for those receiving an amount larger than 1 million TWD is around 4.09 million TWD, which implies that the marginal effect of a 1 million TWD windfall is around 1.21 percentage points (= 4.95/4.09). Compared to the main results of 1.42 percentage points in Table 2, this is slightly smaller, suggesting that the marginal effect diminishes as the prize increases (Briggs et al., 2021).

5.3.2 Effects by Winners' Financial Characteristics

To further understand how individuals' financial characteristics affect the windfall effect, we analyze their financial features from one year before their lottery wins to split the sample[14]. These characteristics include homeownership, mortgage status, and business ownership. We employ the same framework as equation (2) for each subgroup, focusing solely on nonparticipants.

Columns (1) and (2) of Table 5 demonstrate that receiving cash windfalls significantly increases stock market participation for homeowners, while having an insignificant impact on non-homeowners. This finding suggests that non-homeowners may prioritize using windfall gains to invest in real estate, aligning with studies indicating that investing in real estate can crowd out stock market participation (Grossman and Laroque, 1990; Flavin and Yamashita, 2011; Vestman, 2019).

The impact of existing financial obligations is further highlighted in Columns (3) and (4). Here, we observe that lottery prizes significantly increase stock market participation among winners without mortgages, while having a negligible effect on those with outstanding home loans. This suggests that mortgage holders are more inclined to use their windfalls for debt reduction rather than entering the stock market, underscoring how current financial commitments can shape the allocation of unexpected gains. These results are largely consistent

[14] For future winners, we use their financial data from one year before their 'placebo' winning year to split the sample.

with the findings in Briggs et al. (2021).

Lastly, Columns (5) and (6) indicate that the estimated windfall effect on stock market participation is statistically insignificant among lottery winners who own businesses. This pattern suggests that business owners may require additional funds for their enterprises, potentially diverting windfall gains away from stock market investments. In summary, our findings reveal that individuals with alternative investment opportunities or financial obligations tend to experience a diminished windfall effect on stock market participation. Whether it's the opportunity to invest in real estate for non-homeowners, the obligation to repay mortgages, or the potential to reinvest in one's business, these competing financial priorities appear to moderate the impact of lottery winnings on stock market entry.

5.3.3 Effects by Winners' Demographic Characteristics

In addition to financial characteristics, we explore the windfall effect across various demographic features, including age, gender, marital status, and residential location (urban or rural). We apply the same identification strategy as before, focusing on nonparticipants.

Table 6 presents the results of each subgroup analysis. Columns (1) and (2) show that receiving cash windfalls significantly impacts stock market participation for both younger (below 40) and older (above 40) individuals. Although the effect on older individuals is slightly larger, the two estimates are not statistically distinguishable. The literature (Haliassos and Bertaut, 1995; Vissing-Jorgensen, 2003) explains stock market non-participation by two types of costs: fixed entry and ongoing participation costs. If fixed entry costs are significant, the effect on young people should be larger since they can benefit more from participating in the stock market over a longer life expectancy, given the one-time participation costs. However, if participation costs must be paid in each period, the effects should be similar across different age groups. Our results align more with the argument of each-period participation costs, rather than the theory of fixed entry costs.

For gender, Columns (3) and (4) interestingly demonstrate that female recipients show a significant increase in stock market participation, while males show no significant impact. This disparity could suggest either lower participation costs for women or, if costs are similar across genders, might be explained by unobserved spending patterns among men, such as increased expenditures on leisure activities or dining out, potentially diverting funds from stock market investments. According to Boertien (2012), consumption patterns following lottery wins differ significantly between males and females based on the British Household Panel Survey. Specifically, men showed a notable increase in spending on leisure activities and dining out, whereas women tended to save their prizes and allocate them towards purchasing consumer durables.

For marital status, Columns (5) and (6) suggest that single individuals exhibit a significant increase in stock market participation upon receiving windfalls, whereas married recipients show no significant change. This phenomenon could be explained by competing financial priorities for married people, such as saving for future education expenses for children (Bulman et al., 2021), which could limit the resources available for stock market investments.

Lastly, Columns (7) and (8) highlight the impact of residential location. Urban residents display a significant increase in stock market participation after receiving windfalls, while rural residents show no significant change. This difference can be attributed to lower participation costs in urban areas, where residents have easier access to stock exchanges and more convenient financial services, thereby facilitating stock market engagement. Hong, Kubik and Stein (2004) support this observation, finding that urban residents have higher stock market participation rates, which may suggest lower participation costs in urban areas.

5.4 Effects of Windfall Gains on Diversification of Stock Holdings

For lottery winners who were already participating in the stock market, cash windfalls do not significantly affect their decision to continue investing (the extensive margin). However, these windfalls may influence the intensity of their participation (the intensive margin), such as by altering the amount invested or diversifying their portfolio. We first examine how lottery winnings affect the amount participants decide to invest in the stock market. This analysis employs the same empirical framework as equation (2), but replaces the dependent variable with the total value of an individual's stock portfolio[15]. The estimate, $\hat{\gamma}$, represents the increase in the total stock portfolio value in response to a one million TWD lottery prize for current winners, compared to future winners. Results presented in Panel A of Table 7 indicate that each million TWD windfall increases the total value of stocks by 142,552 TWD. This implies that approximately 14.3% of the windfall is invested in the stock market.

We further analyze the increase in stock value by decomposing it into two components: changes in the number of shares held and changes in the average prices of the stocks[16]. Results presented in Panels B and C of Table 7 reveal that lottery winners both increase their number of shares and hold stocks with higher average prices. Specifically, each million TWD windfall leads to an average increase of 2,301 shares in the winner's portfolio. Concurrently, the average price of stocks in their portfolio rises by 3.14 TWD.

While an increase in the number of shares held by lottery winners is expected, the rise in average stock prices is particularly noteworthy. This increase may stem from two possible sources: 1) Winners may now have the financial capacity to invest in higher-priced stocks that were previously unaffordable. 2) They may choose to invest more in their existing stock holdings, but only in those showing an upward price trend. From a diversification perspective, these two strategies have opposing effects. The former enhances portfolio diversification by adding new, potentially higher-value stocks. In contrast, the latter may reduce diversification by concentrating investments in a smaller number of appreciated stocks.

Many studies have found that individual investors tend to under-diversify their portfo-

[15]The portfolio value is calculated by multiplying the market price of each stock by the number of shares an individual holds.

[16]The average price of stocks held by an individual is calculated as the weighted average price, with weights based on the value of each stock holding.

lios (Blume and Friend, 1975; Kelly, 1995; Barber and Odean, 2000; Polkovnichenko, 2005; Goetzmann and Kumar, 2008). Moreover, the literature shows that the level of diversification increases with income, wealth, and education (Goetzmann and Kumar, 2008; Calvet, Campbell and Sodini, 2007; Florentsen et al., 2019). However, the existing literature often examines this relationship across individual characteristics that could be correlated with some unobserved factors. For instance, individuals with higher wealth and education levels may be influenced by their parents' unobserved investments in education, which could also affect their investment attitudes, including their approach to diversifying in the stock market. This could introduce some bias. Differing from these comparisons across individuals, we provide an exogenous wealth shock to examine how wealth influences investors' diversification choices in their portfolios.

We then investigate the value, number of shares, and average price of new stocks added to winners' portfolios after winning the lottery. A new stock is defined as one not held by the individual in the year preceding their lottery win. Panel D of Table 7 shows that each million TWD in lottery winnings increases the total value of "new" stocks by 61,189 TWD, accounting for approximately 43% of the total increase in stock value. This finding suggests that lottery winners tend to allocate their windfall gains relatively evenly between new and existing stocks, indicating that unexpected wealth can indeed lead to portfolio diversification.

This behavior aligns with previous literature in two ways. First, it supports findings that high-wealth investors tend to increase portfolio diversification compared to those with lower wealth. Second, the continued investment in existing stocks is consistent with research demonstrating that people tend to invest in familiar stocks (Grinblatt and Keloharju, 2001; Huberman, 2001). Panels E and F of Table 7 provide further insights into the nature of new stock acquisitions following cash windfalls. These panels reveal increases in both the number of shares acquired and the average price of new stocks. This suggests that some of the newly acquired stocks may be higher-priced, indicating that lottery winners are able to access a broader range of investment opportunities.

Lastly, to further assess portfolio diversification, we calculate the Herfindahl-Hirschman Index (HHI) for each individual's portfolio and examine how it changes following a lottery win[17]. As shown in Panel D of Table 7, lottery winners tend to both purchase new stocks and increase their investment in existing stocks. These actions have opposing effects on portfolio concentration: adding new stocks decreases the HHI (indicating greater diversification), while increasing investment in existing stocks increases the HHI (indicating less diversification). As a result, the net effect of lottery winnings on portfolio concentration could theoretically be either positive or negative. Our analysis, presented in Panel G of Table 7, reveals a negative but statistically insignificant change in HHI following a lottery win. This suggests that, on average, the diversification effect slightly outweighs the concentration effect. In other words, while lottery winners do increase their holdings of existing stocks, the addition of new stocks to their portfolios appears to have a marginally stronger impact on overall portfolio diversification.

6 Comparison with Typical Lotteries

In this section, we compare our main results from receipt lotteries (RL) with estimates based on typical lotteries, incorporating findings from the Public Welfare Lottery (PWL) in Taiwan and existing literature. Specifically, we first utilize data from PWL winners and employ the same DDD design to estimate the impact of cash windfalls on stock market participation. Subsequently, we compare the main results in Table 2 with the findings from PWL and those from Briggs et al. (2021).

Table 8 presents the results for PWL winners. To ensure a fair comparison with RL, where the maximum prize is 10 million TWD, we excluded PWL winners with prizes exceeding this amount. The estimates in Panel A suggest that winning 1 million TWD in the PWL

[17] The HHI is calculated as $\sum_{i=1}^{N} s_i^2$, where s_i is the proportion of the portfolio value invested in stock i, and N is the total number of stocks in the portfolio. A lower HHI indicates greater diversification.

increases the probability of stock market participation by 0.64 percentage points, while the same amount won in the RL increases participation by 1.09 percentage points. Although the PWL effect is smaller, this difference is not statistically significant (p-value is 0.381), suggesting comparable impacts between the two lotteries. In both lotteries, we find that the effects of windfalls are primarily driven by individuals who were not participating in the stock market before winning (see Panels B and C in Tables 2 and 8). Figure 5 demonstrates that the cash windfalls from PWL have a similar persistent effect on stock market participation as those from RL. These results highlight the remarkable similarities between PWL and RL in terms of their effects on stock market participation, including the magnitude of the impact, the primary influence on nonparticipants, and the persistence of the effect over time.

Furthermore, our findings closely align with those of Briggs et al. (2021), who studied typical lottery winners. Despite differences in context (Sweden vs. Taiwan) and lottery types, the results are quite similar. Briggs et al. (2021) estimate that for every 150,000 USD won, stock market participation increases by 3.9 percentage points across their full sample. Our main estimate shows that winning 1 million TWD in the RL increases stock market participation by 1.09 percentage points. To facilitate a direct comparison, we rescale our estimates to reflect the effect of a windfall measured in units of 150,000 USD, suggesting an increase in stock market participation by 5.17 percentage points.[18] Notably, both studies find that the windfall effect is primarily driven by individuals who were not participating in the stock market before winning the lottery. This similarity in results, despite differences in cultural and economic contexts, suggests a robust relationship between lottery winnings and increased stock market participation across different settings.

[18] We adjusted our estimated coefficients using the 2010 average exchange rate of 31.64 TWD/USD for comparability, as Briggs et al. (2021) reported their prize effect using the 2010 exchange rate.

7 Conclusion

This study investigates the impact of cash windfalls from Taiwan's receipt lottery on stock market participation and portfolio diversification. Our findings reveal that each million TWD (approximately 33,000 USD) windfall gain significantly increases the probability of stock market participation by 1.09 percentage points, predominantly driven by individuals who were not previously participating in the stock market. For existing participants, the windfall results in a substantial increase in the total value of their stock holdings, attributed to both an increase in the number of shares and higher average stock prices. The effect of windfalls also extends to portfolio diversification, with winners allocating a considerable portion of their gains to new stocks.

Future research could explore whether financial constraints differentially affect the extent of underdiversification driven by familiarity bias and skewness preference. Biases contributing to underdiversification include overinvestment in company stocks (Benartzi, 2001; Poterba, 2003), profession-related stocks (Massa and Simonov, 2006), industry-related stocks (Døskeland and Hvide, 2011), and local stocks (Huberman, 2001; Ivković and Weisbenner, 2005; Feng and Seasholes, 2004; Seasholes and Zhu, 2010). Additionally, some investors underdiversify due to skewness preference (Mitton and Vorkink, 2007; Barberis and Huang, 2008; Kumar, 2009). The impact of financial constraints on these forms of underdiversification remains unclear.

Another avenue for future studies involves using the windfall gains from this study to evaluate how relaxing financial constraints affect household investment decisions and subsequent welfare outcomes. While easing financial constraints may encourage diversified portfolios and enhance household well-being, Calvet, Campbell and Sodini (2007) find that financially sophisticated households, characterized by income, wealth, and education, tend to invest more efficiently but also more aggressively, resulting in volatile portfolios and potentially increased welfare losses from suboptimal investments.

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Tables

Table 1: Descriptive Statistics for Lottery Winners and Population

	(1) Winners	(2) Population
Age	37.468	38.148
	(10.625)	(12.102)
Urban Residence	0.713	0.695
	(0.452)	(0.461)
Female	0.656	0.490
	(0.475)	(0.500)
Married	0.552	0.495
	(0.497)	(0.500)
Employed	0.796	0.757
	(0.403)	(0.429)
Earnings	273.991	287.994
	(450.921)	(2,106.499)
Stocks	446.753	682.429
	(8,601.559)	(46,009.059)
Savings	552.524	569.292
	(2,309.280)	(3,163.742)
Homeowner	0.351	0.324
	(0.477)	(0.468)
Have Mortgage	0.130	0.113
	(0.336)	(0.317)
Own Business	0.167	0.108
	(0.373)	(0.311)
Stock Participation Rate	0.305	0.270
	(0.461)	(0.444)
# of Observation	1,058,944	16,165,234

Note: This table displays the winners' and population's characteristics, as well as the outcome variables we are interested in: stock market participation. The population data are aged from 20 to 60 during 2008 to 2012, and we randomly assign one year of 2008-2012 as a placebo winning year in the analysis. Urban residence refers to individuals living in Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City, and Kaohsiung City, which are the most populous cities in Taiwan. Married is defined as having the status of being in a marital relationship. Employed is defined as having positive wage income. Earnings refer to the sum of wage income, business income, and professional income. Stocks represent the total value of an individual's stock portfolio. Earnings, income, stocks, and savings are measured in thousands of units, adjusted for CPI, and displayed in 2016 TWD (1 TWD $\approx$ 0.033 USD). Homeowner and Have Mortgage refer to those individuals have houses or housing loan, respectively. Own Business is defined as an individual who own a business. Stock Participation Rate is defined as an individual participates in the stock market in the year right before the lottery-winning year($L_i = t - 1$). Standard deviations are in parentheses.

Table 2: Effect of Windfall Gains on Stock Market Participation

	(1)	(2)	(3)	(4)	(5)
A. Whole Sample					
$Prizes \times Post \times Current$	0.0100**	0.0102**	0.0108**	0.0108**	0.0109**
	[0.0047]	[0.0047]	[0.0046]	[0.0046]	[0.0046]
# of observations			10,589,440		
B. Pre-lottery Nonparticipants					
$Prizes \times Post \times Current$	0.0144**	0.0133**	0.0137**	0.0137**	0.0142**
	[0.0060]	[0.0060]	[0.0060]	[0.0060]	[0.0060]
# of observations			7,355,940		
C. Pre-lottery Participants					
$Prizes \times Post \times Current$	0.0013	0.0047	0.0047	0.0047	0.0054
	[0.0067]	[0.0068]	[0.0066]	[0.0066]	[0.0066]
# of observations			3,233,500		
Basic Controls	√	√	√	√	√
Year Fixed Effect		√	√	√	√
Age Fixed Effect			√	√	√
Pre-winning Characteristics				√	
Individual Fixed Effect					√

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of lottery wins on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. Panel A includes all samples (average outcome: 0.305). Panel B includes individuals who did not participate in the stock market one year before winning the lottery (average outcome: 0). Panel C includes individuals who did participate in the stock market one year before winning the lottery (average outcome: 1). Column (1) includes a set of variables indicating individual winning prize amount $Prize_i$, a dummy for the post-winning period $Post_t$, the interaction between prize amount and the post-winning dummy, and the full set of interaction terms with the treatment group $Current_i$ and the above variables. Column (2) additionally includes calendar year fixed effects. Column (3) additionally includes individual age fixed effects. Column (4) additionally includes pre-winning characteristics: a set of variables indicating winner's earnings, winner's homeownership, marital status, gender, and cities/counties of residence. These covariates are measured in the year right before the lottery-winning year($L_i = t - 1$). Column (5) controls for individual fixed effects. Standard errors are clustered at the individual level and reported in squared brackets. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 3: Robustness Check

	(1) Above 5K TWD (165 USD)	(2) Above 30K TWD (1,000 USD)	(3) Population Reweighted	(4) CS DID
A. Whole Sample				
$Prizes \times Post \times Current$	0.0109***	0.0113**	0.0109**	0.0190***
	[0.0047]	[0.0048]	[0.0046]	[0.0070]
# of observations	1,249,700	121,720	10,589,440	10,589,440
B. Pre-lottery Nonparticipants				
$Prizes \times Post \times Current$	0.0140**	0.0141**	0.0142**	0.0280**
	[0.0060]	[0.0061]	[0.0060]	[0.0090]
# of observations	862,770	83,780	7,355,940	7,355,940
C. Pre-lottery Participants				
$Prizes \times Post \times Current$	0.0048	0.0054	0.0054	0.0014
	[0.0067]	[0.0069]	[0.0066]	[0.0059]
# of observations	386,930	37,940	3,233,500	3,233,500

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of lottery wins on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. All specifications include the same covariates and fixed effects shown in Column (5) of Table 2. Columns (1) and (2) report the estimates using different definitions of winning prizes: at least 5,000 TWD (approximately 165 USD) and 30,000 TWD (approximately 1,000 USD), respectively. Column (3) reports the estimate based on re-weighting the winners to match the distribution of age, gender, and marital status in the population. Column (4) reports the estimate based on a two-step estimation strategy with the bootstrap procedure (CS-DID) proposed by Callaway and Sant'Anna (2021). Standard errors are clustered at the individual level and 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: Effects by Amount of Prizes

	(1) 5K to 100K TWD (165 to 3,300 USD)	(2) 100K to 1M TWD (3,300 to 33,000 USD)	(3) Above 1M TWD (Above 33,000 USD)
$Large \times Post \times Current$	-0.0012	0.0039	0.0495**
	[0.0016]	[0.0150]	[0.0229]
# of Observations	7,342,160	6,501,870	6,498,250

Note: This table reports estimated coefficients γ of $Large_i \times Post_t \times Current_i$ based on equation (3), representing the effect of winning the large prize on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participate in stock market in a given year t. All specifications include the same covariates and fixed effects shown in Column (5) of Table 2. The baseline group is defined as those who won less than 5,000 TWD (approximately 165 USD). A large prize is defined as follows: 5 thousand to 100 thousand TWD (approximately 165 to 3,300 USD) with an average prize of 10.18 thousand TWD (approximately 340 USD) in Column (1), 100 thousand to 1 million TWD (approximately 3,300 to 33,000 USD) with an average prize of 225 thousand TWD (approximately 7,400 USD) in Column (2), and prizes exceeding 1 million TWD (33,000 USD) with an average prize of 4.09 million TWD (approximately 135,000 USD) in Column (3). 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 5: Subgroup Analysis: By Financial Features

	(1)	(2)	(3)	(4)	(5)	(6)
	Homeowner		Have Mortgages		Own Business	
	No	Yes	No	Yes	No	Yes
$Prizes \times Post \times Current$	0.0087	0.0235*	0.0268**	0.0102	0.0146**	0.0122
	[0.0061]	[0.0121]	[0.0121]	[0.0068]	[0.0066]	[0.0144]
# of Observations	5,560,190	1,795,750	1,078,470	6,277,470	6,253,360	1,102,580

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of lottery wins on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. All specifications include the same covariates and fixed effects shown in Column (5) of Table 2. Columns (1) and (2) classify individuals based on homeownership status before the lottery win: Column (1) includes non-homeowners, and Column (2) includes homeowners. Columns (3) and (4) categorize individuals based on mortgage status: Column (3) includes those without a mortgage, while Column (4) includes those with a mortgage. Columns (5) and (6) categorize individuals based on entrepreneurship status: Column (5) includes non-entrepreneurs, while Column (6) includes entrepreneurs. 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 6: Subgroup Analysis: By Demographic Features

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Age		Gender		Married		Urban Residence	
	Below 40	Above 40	Male	Female	No	Yes	No	Yes
$Prizes \times Post \times Current$	0.0132*	0.0154*	0.0016	0.0231***	0.0189**	0.0116	0.0041	0.0198**
	[0.0077]	[0.0093]	[0.0066]	[0.0087]	[0.0096]	[0.0079]	[0.0060]	[0.0082]
# of Observations	4,566,827	2,751,064	2,617,060	4,738,880	3,594,310	3,733,208	2,244,470	5,111,470

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of lottery wins on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. All specifications include the same covariates and fixed effects shown in Column (5) of Table 2. Columns (1) and (2) categorize individuals based on age in the year before a lottery win: Column (1) includes individuals under 40, while Column (2) includes individuals 40 and above. Columns (3) and (4) categorize individuals by gender: Column (3) includes males, while Column (4) includes females. Columns (5) and (6) categorize individuals based on marital status: Column (5) includes singles, while Column (6) includes married individuals. Columns (7) and (8) categorize individuals based on residence: Column (7) includes rural residents, while Column (8) includes urban residents. 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 7: Effects of Windfall Gains on Stock Investment and Diversification

	(1)	(2)	(3)	(4)	(5)
A. Value of an Individual's Stock Portfolio					
$Prizes \times Post \times Current$	138,936***	140,912***	142,243***	142,243***	142,552***
	[42,476]	[42,3996]	[42,3286]	[42,3286]	[42,4256]
B. Shares Held in an Individual's Portfolio					
$Prizes \times Post \times Current$	2,170**	2,225**	2,279**	2,279**	2,301**
	[1,060]	[1,063]	[1,058]	[1,058]	[1,064]
C. Average Share Price of an Individual's Stock Portfolio					
$Prizes \times Post \times Current$	3.0885***	3.0509***	3.0442***	3.0442***	3.1417***
	[1.0592]	[1.0587]	[1.0595]	[1.0595]	[1.0785]
D. Value of New Stock Investments in an Individual's Portfolio					
$Prizes \times Post \times Current$	63,441**	59,985*	60,441*	60,441*	61,189*
	[31,621]	[31,657]	[31,640]	[31,640]	[31,627]
E. Shares of New Stock Investments Held in an Individual's Portfolio					
$Prizes \times Post \times Current$	1,485*	1,222	1,262*	1,262*	1,296*
	[762]	[763]	[759]	[759]	[763]
F. Average Share Price of New Stock Investments in an Individual's Portfolio					
$Prizes \times Post \times Current$	2.3880***	2.1797**	2.1806**	1,262*	2.1583**
	[0.9140]	[0.9126]	[0.9125]	[0.9125]	[0.9177]
G. HHI of an Individual's Stock Portfolio					
$Prizes \times Post \times Current$	-16.9583	-24.6665	-28.1127	-28.1127	-39.0216
	[56.8551]	[57.3175]	[57.0668]	[57.0668]	[54.6822]
# of Observations			3,233,500		
Basic Controls	√	√	√	√	√
Year Fixed Effect		√	√	√	√
Age Fixed Effect			√	√	√
Pre-winning Characteristics				√	
Individual Fixed Effect					√

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of lottery wins on the outcome of interest. The outcome variables indicate various characteristics of the stock portfolio for individual i in a given year t. Panels A to C include the values, shares, and average prices of an individual's stock portfolio. Panels D to F include the values, shares, and average prices of new stock investments. Panel G shows the HHI of an individual's stock portfolio. Column (1) includes a set of variables indicating individual winning prize amount $Prize_i$, a dummy for the post-winning period $Post_t$, the interaction between prize amount and the post-winning dummy, and the full set of interaction terms with the treatment group $Current_i$ and the above variables. Column (2) additionally includes calendar year fixed effects. Column (3) additionally includes individual age fixed effects. Column (4) additionally includes pre-winning characteristics: a set of variables indicating winner's earnings, winner's homeownership, marital status, gender, and cities/counties of residence. These covariates are measured in the year right before the lottery-winning year($L_i = t - 1$). Column (5) controls for individual fixed effects. Standard errors are clustered at the individual level and reported in squared brackets. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

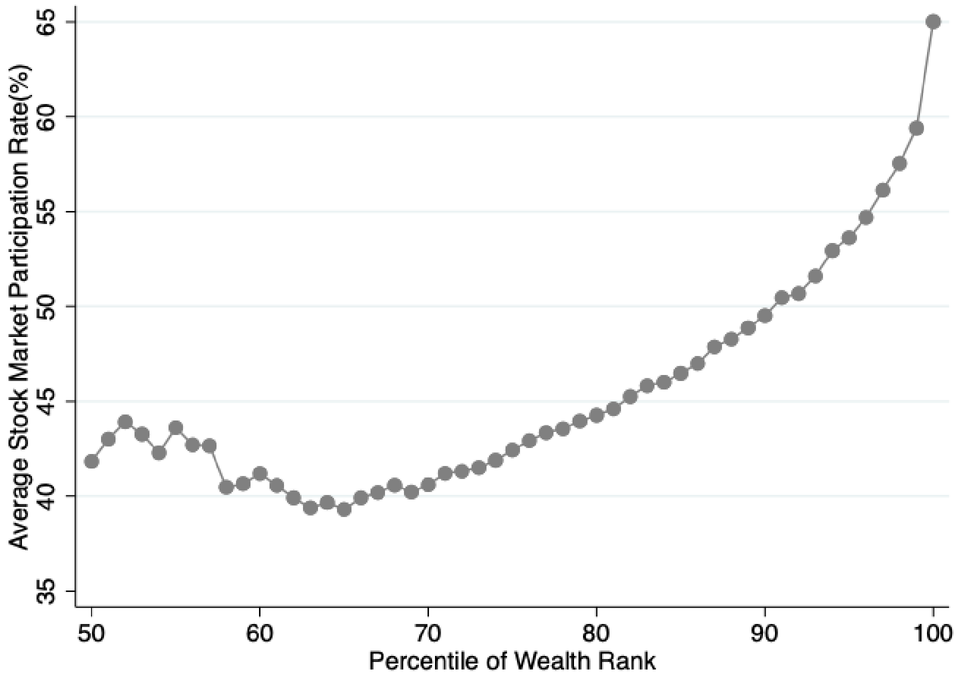
Table 8: Effect of Windfall Gains on Stock Market Participation: Public Welfare Lottery

	(1)	(2)	(3)	(4)	(5)
A. Whole Sample					
$Prizes \times Post \times Current$	0.0067***	0.0065***	0.0065***	0.0065***	0.0064***
	[0.0019]	[0.0019]	[0.0019]	[0.0019]	[0.0019]
# of observations			6,709,230		
B. Pre-lottery Nonparticipants					
$Prizes \times Post \times Current$	0.0078***	0.0090***	0.0089***	0.0089***	0.0091***
	[0.0022]	[0.0022]	[0.0022]	[0.0022]	[0.0022]
# of observations			4,547,440		
C. Pre-lottery Participants					
$Prizes \times Post \times Current$	0.0050	0.0021	0.0018	0.0018	0.0014
	[0.0038]	[0.0038]	[0.0038]	[0.0038]	[0.0037]
# of observations			2,161,790		
Basic Controls	√	√	√	√	√
Year Fixed Effect		√	√	√	√
Age Fixed Effect			√	√	√
Pre-winning Characteristics				√	
Individual Fixed Effect					√

Note: This table reports estimated coefficients γ of $Prize_i \times Post_t \times Current_i$ based on equation (2), representing the effect of PWL wins on the outcome of interest. The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. Panel A includes all samples (average outcome: 0.322). Panel B includes individuals who did not participate in the stock market one year before winning the lottery (average outcome: 0). Panel C includes individuals who did participate in the stock market one year before winning the lottery (average outcome: 1). Column (1) includes a set of variables indicating individual winning prize amount $Prize_i$, a dummy for the post-winning period $Post_t$, the interaction between prize amount and the post-winning dummy, and the full set of interaction terms with the treatment group $Current_i$ and the above variables. Column (2) additionally includes calendar year fixed effects. Column (3) additionally includes individual age fixed effects. Column (4) additionally includes pre-winning characteristics: a set of variables indicating winner's earnings, winner's homeownership, marital status, gender, and cities/counties of residence. These covariates are measured in the year right before the lottery-winning year($L_i = t-1$). Column (5) controls for individual fixed effects. Standard errors are clustered at the individual level and reported in squared brackets. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Figures

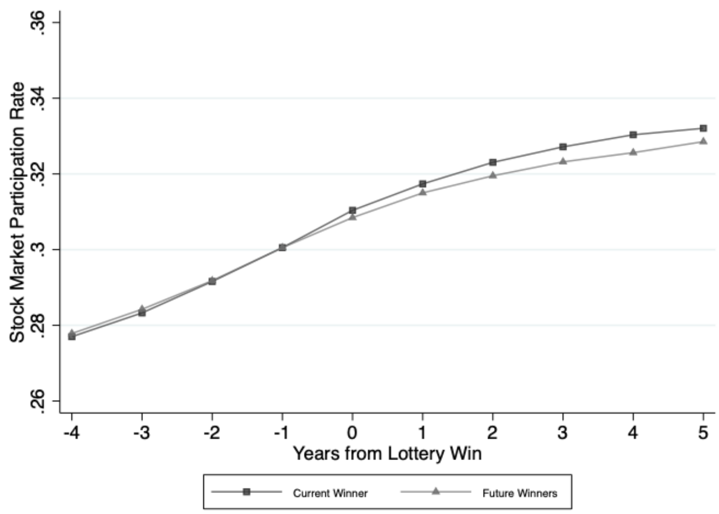
Figure 1: Stock Market Participation Rate by Wealth in Taiwan in 2010



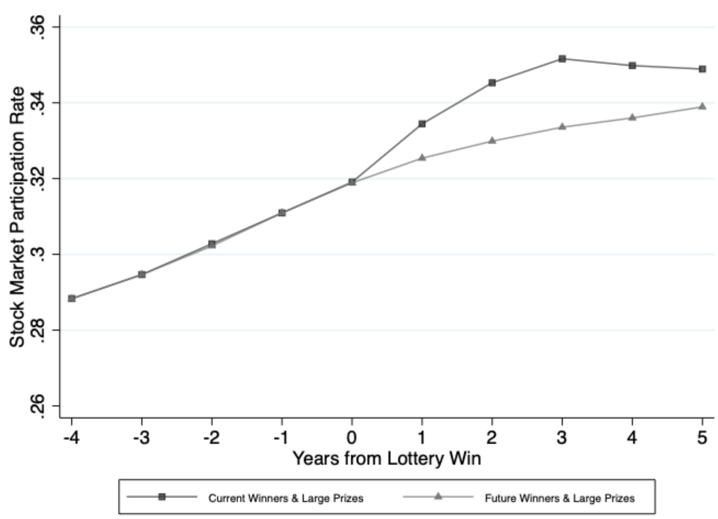
Notes: The figure displays the average population stock market participation rate by wealth group. The x-axis represents the percentile of wealth rank. The y-axis shows the participation rate for each wealth group.

Figure 2: Trend in Stock Market Participation: Current vs. Future Winners

(a) By Current and Future Winners



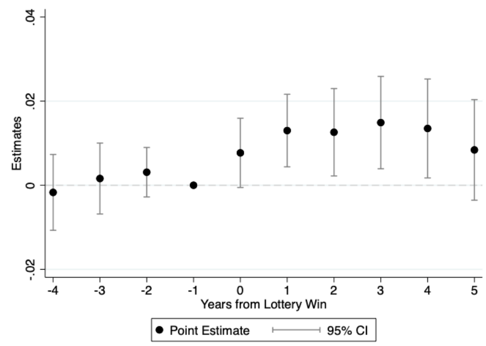
(b) By Current and Future Winners with Large Prizes



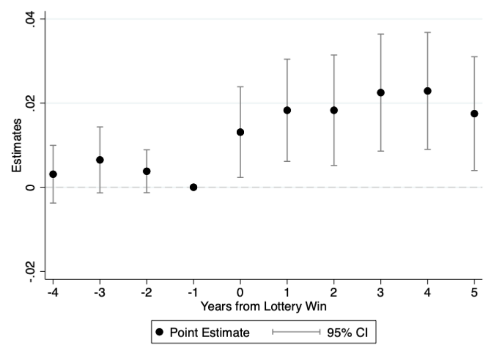
Note: The figure shows stock market participation rates for current (black squares) and future (grey triangles) winners. Panel A includes winners who won at least 2,000 TWD, and Panel B includes winners who won at least 10,000 TWD. The horizontal axis indicates years from the lottery win. For future winners, the winning year is considered a 'placebo' year; they actually first win the lottery six years later.

Figure 3: Dynamic DDD Estimates: Receipt Lottery

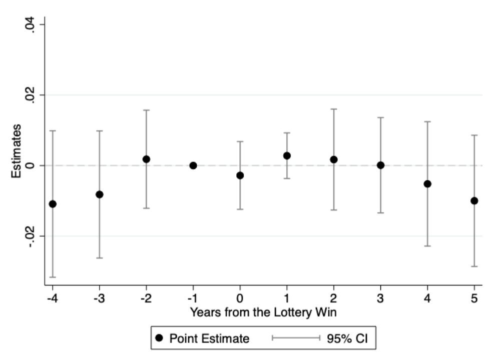
(a) Whole Samples



(b) Pre-lottery Nonparticipants



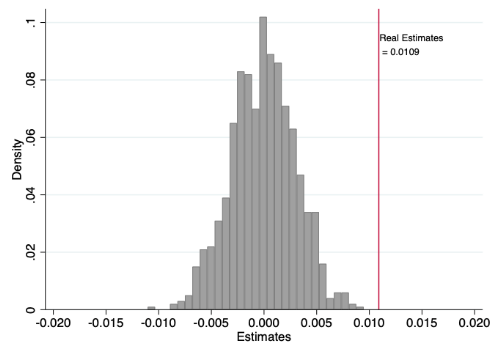
(c) Pre-lottery Participants



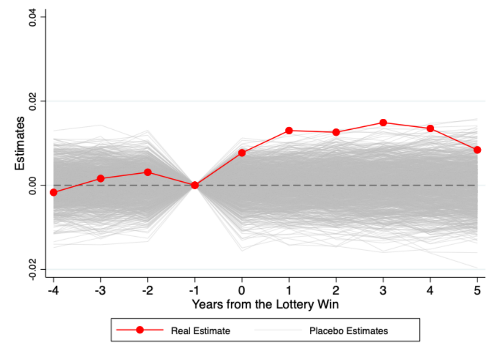
Note: This figure displays the estimated coefficient γ_s of $Prize_i \times \mathbf{I}[t = L_i + s]) \times Current_i$ based on equation (1) for the whole sample, pre-lottery nonparticipants, and pre-lottery participants. The estimates are shown from four years before to five years after the time of the lottery wins (s = -4 to 5). The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. The horizontal axis shows years from lottery wins. Circle symbols represent the point estimates, and the vertical lines overlaying the circle symbols denote the 95% confidence intervals.

Figure 4: Falsification Tests: Pre-Post and Dynamic DDD Estimates

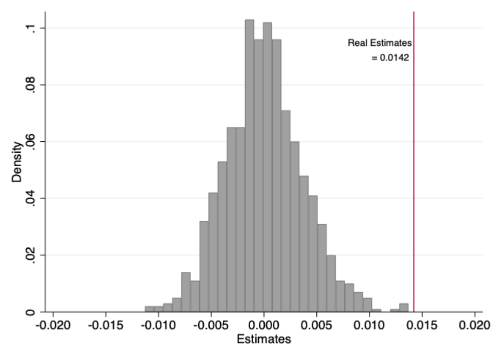
(a) Pre-Post Estimates: Whole Sample



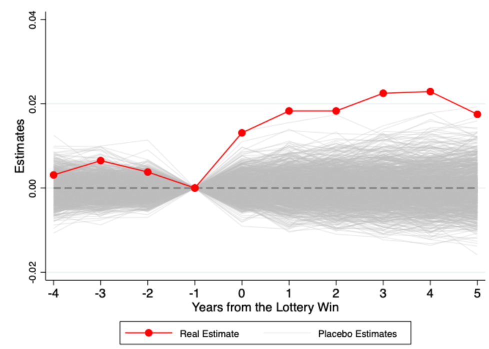
(b) Dynamic DDD Estimates: Whole Sample



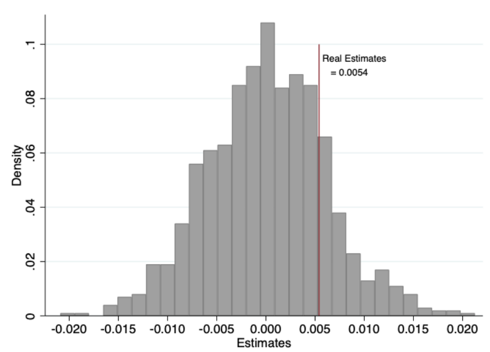
(c) Pre-Post Estimates: Nonparticipants



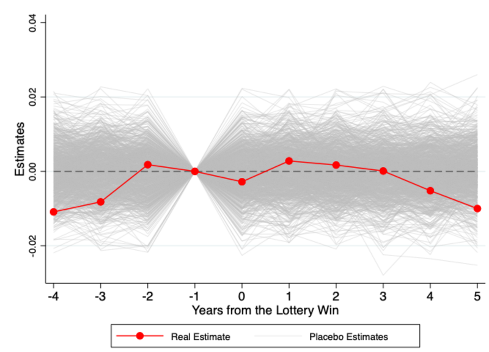
(d) Dynamic DDD Estimates: Nonparticipants



(e) Pre-Post Estimates: Participants



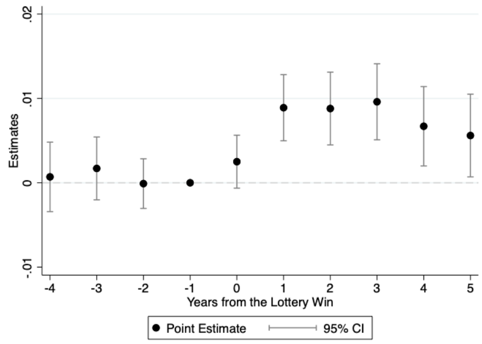
(f) Dynamic DDD Estimates: Participants



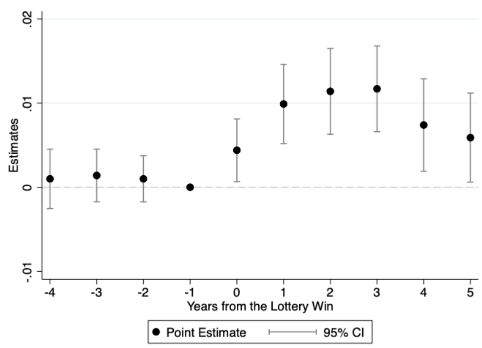
Note: These figures display the results of falsification tests. We randomly re-assign lottery prizes to individuals in the original sample and use these “pseudo” prizes to redefine the variable $Prize_i$ in equations (1) and (2). We repeat this permutation procedure 1,000 times to obtain the distribution of pseudo estimates. Figures 4a, 4c, and 4e show the real estimate (red vertical lines) and the distribution of 1,000 pseudo estimates from equation (1). Figures 4b, 4d, and 4f show the real estimates (red lines with circle symbols) and the pseudo estimates (grey lines) from equation (2) for the dynamic DDD setting.

Figure 5: Dynamic DDD Estimates: Public Welfare Lottery

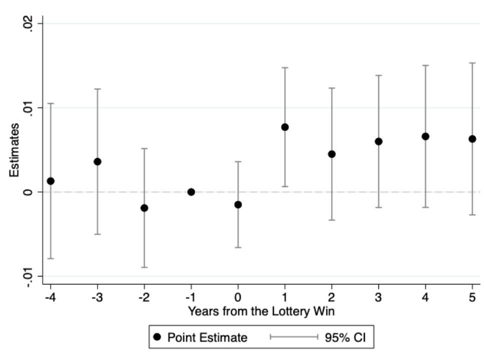
(a) Whole Sample



(b) Pre-lottery Nonparticipants



(c) Pre-lottery Participants



Note: This figure displays the estimated coefficient γ_s of $Prize_i \times \mathbf{I}[t = L_i + s]) \times Current_i$ based on equation (1) for the Public Welfare Lottery. The estimates are shown from four years before to five years after the time of the lottery wins (s = -4 to 5). The outcome variable is a dummy variable indicating whether an individual i participates in the stock market in a given year t. The horizontal axis shows years from lottery wins. Circle symbols represent the point estimates, and the vertical lines overlaying the circle symbols denote the 95% confidence intervals.

Online Appendix: For Online Publication

Section A	Additional Tables and Figures
Section B	Public Welfare Lottery and Taiwan Sports Lottery

A Additional Tables and Figures

Table A.1: Prize Rules for the Taiwan Receipt Lottery

Prizes (in TWD)		Matching Winning Number
Special Prize	10 million	all 8 digits from the special prize number
Grand Prize	2 million	all 8 digits from the grand prize number
First Prize	200,000	all 8 digits from any of the First Prize numbers
Second Prize	40,000	the last 7 digits from any of the First Prize numbers
Third Prize	10,000	the last 6 digits from any of the First Prize numbers
Fourth Prize	4,000	the last 5 digits from any of the First Prize numbers
Fifth Prize	1,000	the last 4 digits from any of the First Prize numbers
Sixth Prize	200	the last 3 digits from any of the First Prize numbers
Additional Sixth Prize	200	the last 3 digits from the Additional Sixth Prize number(s)

Note: This table displays the prizes rule of Taiwan Receipt Lottery. In Figure A.1, people can get a Taiwan Receipt Lottery when they purchased goods, which contains 8 numbers. They match those numbers on the receipt to the ones randomly drawn by Ministry of Finance every two month.

Table A.2: Frequencies and Average Prizes of Lottery

(1) Prizes	(2) Frequencies	(3) Min	(4) Max	(5) Mean	(6) Median
5K-100K	1,152,548	1.6	9.898	3.779	3.273
100K-500K	14,757	10.089	47.792	27.928	32.346
500K-1M	1,289	54.573	324.445	162.731	163.666
1M-5M	649	513.761	1,725.355	1,480.465	1,636.661
5M-10M	323	7,844.675	8,575.933	8,091.85	8,086.525

Note: This table shows the distribution of RL frequencies and mean prizes. The Columns (3) to (6) are in thousand unit.

Table A.3: Balance Test

Dependent Variable	(1) Urban	(2) Female	(3) Married	(4) Employed	(5) Earnings	(6) Stocks	(7) Savings	(8) Homeowner	(9) Have Mortgage	(10) Own Business	(11) Stock Participation
Panel A: Current Winners											
$Prize_i$	-0.015	-0.075***	0.018	0.030	54.329***	-87.403	-10.369	0.077***	0.033*	0.010	0.009
	(0.024)	(0.025)	(0.021)	(0.019)	(22.058)	(79.189)	(99.747)	(0.024)	(0.019)	(0.020)	(0.023)
Observations						501,822					
Panel B: Future Winners											
$Prize_i$	0.012	-0.062**	-0.021	0.016	48.097*	79.563	-53.978	0.056**	0.043**	0.027	0.022
	(0.023)	(0.025)	(0.022)	(0.020)	(27.429)	(172.223)	(78.037)	(0.023)	0.019	(0.019)	(0.023)
Observations						557,122					
Panel C: Difference-in-differences											
$Current_i \times Prize_i$	0.012	-0.013	0.040	0.012	5.868	-168.387	65.358	0.021	-0.027	-0.017	-0.013
	(0.033)	(0.036)	(0.031)	(0.027)	(35.194)	(189.433)	(126.634)	(0.033)	(0.027)	(0.027)	(0.032)
Observations						10,589,400					
Baseline mean	0.718	0.65	0.542	0.792	276.545	439.256	543.961	0.348	0.127	0.167	0.305

Note: This table displays the balance test of prizes and covariates. Panels A and B include the correlation of $Prize_i$ and covariates of current and future winners, respectively. Panel C displays the difference-in-difference between current and future winners. The baseline mean refers to covariates of the year right before the lottery-winning year($L_i = t - 1$) for current winners.

Table A.4: Descriptive Statistics for Lottery Winners(Reweighted) and Population

	(1) Winner	(2) Population
Age	38.116	38.148
	(11.567)	(12.102)
Urban Residence	0.715	0.695
	(0.451)	(0.461)
Female	0.490	0.490
	(0.500)	(0.500)
Married	0.495	0.495
	(0.500)	(0.500)
Employed	0.799	0.757
	(0.401)	(0.429)
Earnings	288.896	287.994
	(480.177)	(2,106.499)
Stocks	466.468	682.429
	(8,882.468)	(46,009.059)
Savings	603.829	569.292
	(2,515.038)	(3,163.742)
Homeowner	0.368	0.324
	(0.482)	(0.468)
Have Mortgage	0.126	0.113
	(0.322)	(0.317)
Own Business	0.157	0.108
	(0.364)	(0.311)
Stock Participation Rate	0.296	0.270
	(0.457)	(0.444)
# of Observation	1,058,944	16,165,234

Note: This table displays the winners' and population's characteristics, as well as the outcome variables we are interested in: stock market participation. The population data are aged from 20 to 60 during 2008 to 2012. We randomly assign one year of 2008-2012 as a placebo winning year in the analysis. Based on the Table 1, we re-weighting the winners to match the distribution of age, gender and marital status of population. Urban residence refers to individuals living in Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City, and Kaohsiung City, which are the most populous cities in Taiwan. Married is defined as having the status of being in a marital relationship. Employed is defined as having positive wage income. Earnings is the sum of wage income, business income, and professional income. Stocks is the total value of an individual's stock portfolio. Earnings, income, stocks, and savings are measured in thousands of units, adjusted for CPI, and displayed in 2016 TWD (1 TWD $\approx$ 0.033 USD). Homeowner and Have Mortgage refer to those individuals have houses or housing loan, respectively. Own Business is defined as an individual who own a business. Stock Participation Rate is defined as an individual participates in the stock market in the year right before the lottery-winning year($L_i = t-1$). Standard deviations are in parentheses.

Figure A.1: An Example of the Taiwan Receipt Lottery

Notes: The eight digits in the red square is receipt lottery number.

B Public Welfare Lottery and Taiwan Sports Lottery

In this section, we discuss two lotteries currently running alongside the Receipt Lottery in Taiwan: the Public Welfare Lottery and the Taiwan Sports Lottery. The Public Welfare Lottery operates similarly to typical lotteries, where the probability of winning prizes involves chance and includes a gambling flavor, as players derive utility from selecting tickets or numbers. In contrast, the Taiwan Sports Lottery differs from typical lotteries in that its prize odds are not entirely random. The likelihood of winning prizes in the Taiwan Sports Lottery is significantly influenced by players' abilities to gather and analyze extensive data on match players and teams.

B.1 Public Welfare Lottery

The 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, including social welfare, national health insurance, and cultural and educational programs. During our sample period, there are three types of lottery games: 1) computer-drawn games, 2) scratch-card games, and 3) Keno games.

Computer-drawn games include several variations, each with different number selection rules and prize structures. For instance, in Lotto 6/49, players choose six numbers from 1 to 49 at a cost of 50 TWD per bet, with the jackpot hit if all six numbers are matched. Big Lotto requires players to choose six numbers from 1 to 49 and an additional "special number" from 1 to 8. Super Lotto involves selecting six numbers from 1 to 38 and two "special numbers" from 1 to 8.

Scratch-card games are instant-win games requiring players to reveal hidden symbols or numbers by scratching off covered areas. These games offer various themes and prize structures to appeal to different player preferences. Keno games involve choosing numbers from a field of 1 to 80, with different game variations offering various payout structures based on the number of correct matches.

B.2 Taiwan Sports Lottery

The Taiwan Sports Lottery, launched in 2008, is the only legal form of sports betting in Taiwan. It offers betting opportunities on over 10 types of sports and 20 kinds of betting methods. The range of sports covered is extensive, including Major League Baseball (MLB) and National Basketball Association (NBA) from the United States, major European soccer leagues such as the English Premier League, Spanish La Liga, and German Bundesliga, Asian baseball leagues like Nippon Professional Baseball and the KBO League, tennis events including Grand Slam tournaments and ATP Tour events, golf competitions such as PGA Tour events and major championships, and Olympic events.

Betting types are diverse, catering to different preferences and strategies. These include single-game bets, parlays (multiple game bets), over/under bets, point spread bets, and prop bets on specific events within a game. This variety allows bettors to engage with sports events in multiple ways, from straightforward win/lose predictions to more complex combinations of outcomes. The odds for these bets are set by a team of experts who analyze various factors, including team and player statistics, historical performance, injuries, and other relevant information. This process requires significant expertise and resources from the organizers, distinguishing the Sports Lottery from more chance-based lotteries and offering a unique betting experience that combines sports knowledge with probability assessment.