Consumption Responses to Income Shocks through Lottery Winning

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Abstract

We study the effects of lottery winning on consumption spending using newly available household survey data in Singapore. We find strong consumption responses to a transitory income shock via lottery wins. Lottery winners spend about half of their prizes within 12 months of winning. We show that consumption responses are stronger among households with more binding liquidity constraints and less risk aversion, which is consistent with the standard life-cycle model. The strong consumption response suggests that fiscal stimulus policies or other public transfer programs could be an effective means of boosting consumption spending of the economy in the short run.

Keywords: lottery, consumption, marginal propensity to consume, liquidity constraint, risk preference

JEL codes: D12, D14, D15, D91

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Declaration of interest

Authors declare no competing interests.

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1. Introduction

Economic theory predicts that households adjust consumption spending in response to unanticipated income changes (Jappelli and Pistaferri, 2010; Fuchs-Schündeln and Hassan, 2016). Understanding the quantitative impacts of this consumption response is of great interest to policymakers and researchers, because it is critical in designing effective public policies to maximize social welfare. For example, many governments have implemented one-off cash transfer programs to stimulate their economies during recessions (e.g., the tax rebates of 2001 and 2008 in the US). If such an increase in household income does not translate into an increase in consumption spending, a government's attempt to boost its economy would not be as effective as intended.

Although cross-sectional gradients between income and spending show that those two variables are positively correlated (Jappelli and Pistaferri, 2010), this correlation cannot be interpreted as a causal relationship because of various confounding factors. The ideal approach to uncover the causal link between unexpected income changes and consumption spending would be to assign income across households randomly without announcement in advance. The use of randomized controlled trials is increasingly popular in economics, but it is extremely costly to conduct such experiments.

To overcome this identification challenge and investigate the consumption responses to unanticipated income changes, previous studies have used two major approaches. One approach has employed statistical decomposition or full-fledged structural estimation of lifecycle models by imposing a set of assumptions on income/consumption processes, preferences, constraints, and expectations (Hall and Mishkin, 1982; Blundell, 2008; Guvenen and Smith, 2014; Kaplan and Violante, 2014). The other approach has exploited quasi-experimental variations in income, such as changes in public transfer policies, disability, and layoffs (Stephens, 2001; Johnson et al., 2006; Agarwal et al., 2007; Browning and Crossley, 2009; Agarwal and Qian, 2014). A major limitation of the first approach is that it requires strong distributional assumptions about consumption growth and income shocks, while in the second approach, income changes generated by quasi-experimental events are often anticipated (Jappelli and Pistaferri, 2010).

An alternative approach to achieve unpredicted random assignments of income is to exploit lottery wins. By construction, the possibility of winning a lottery and how much to win are randomly determined. As such, lottery wins provide a suitable setting to estimate the marginal propensity to consume (MPC) out of unanticipated income changes. Several studies have exploited this advantage to recover the causal effect of income on a variety of outcomes

(Lindh and Ohlsson, 1996; Imbens et al., 2001; Doherty et al., 2006; Hankins and Hoekstra, 2011; Hankins et al., 2011; Kuhn et al., 2011; Apouey and Clark, 2015). In particular, recent studies on lottery use administrative data to conduct richer analyses of labor supply, health and healthcare utilization, child development, and stock market participation (Briggs et al., 2015; Cesarini et al., 2016, 2017; Picchio et al., 2018).

However, there is relatively incomplete evidence on how lottery winners' consumption spending is affected by lottery wins. To the best of our knowledge, only three studies have investigated the effects of lottery wins on consumption behavior.

First, Imbens et al. (2001) study the effects of the Massachusetts Megabucks lottery in the US on lottery players' spending on durables, such as vehicles and housing. The authors found that the MPC on durables out of lottery prizes won about 10 years ago is small (1.4–3.7%).[1] Second, Kuhn et al. (2011) study the effects of the Dutch Postcode Lottery (PCL) on both durables and non-durables spending. The PCL randomly assigns a cash prize of €12,500 per ticket to all lottery participants in the winning postal code and a brand-new BMW car to one of the winners. The authors find that PCL winning increases spending on durables, such as car purchases, but does not affect spending on non-durables.

Both studies use self-administered survey data that have the following limitations: First, Imbens et al. (2001) estimate the MPC using information on the asset values of durables (housing and vehicles) instead of actual spending. Next, these studies do not analyze how households' responses to an income shock differ by household characteristics owing to the lack of detailed information on household characteristics. Such information is important, because it could provide evidence on the mechanisms of consumption responses to an income shock (Parker, 2017). Lastly, the sample sizes of these studies are small, with 500–600 observations.

The most recent study, by Fagereng et al. (2021), uses administrative tax data in Norway, which include lottery prize information for winnings over US$1,100. The authors estimate that the MPC for every US$1 lottery prize won is about one-half within the calendar year of winning. A limitation of this study is that the authors could not directly control for lottery ticket spending owing to lack of data. Since individuals are more likely to win lottery prizes when they buy more tickets, the lack of information on lottery ticket spending could bias the estimation results (Picchio et al., 2018). Moreover, the authors impute spending as household income net of the first difference in asset values. Thus, their consumption measure could suffer from

[1] The lottery winner sample in Imbens et al. (2001) consists of 237 individuals, and they won a yearly prize of about US$ 55,000 (in 1986 prices) on average.

measurement error. This measure can capture only total spending, and thus, it cannot study heterogeneity in consumption responses by sub-categories of household consumption spending.

In this study, we use newly available household survey data in Singapore to extend our understanding of consumption response to lottery wins by directly addressing these limitations.

First, we use direct and detailed measures of consumption spending instead of values of commodities, such as vehicles and housing (Imbens et al., 2001), or imputing them from the changes in net worth net of annual income (Fagereng et al., 2021). Since we use household survey data, which include consumption spending information for over 30 categories, we can examine consumption responses by various dimensions, such as durables spending versus non-durables spending, and visible spending versus non-visible spending as well as total consumption responses.

Second, we document the MPC heterogeneity in relatively underexplored dimensions, such as risk preference and a measure of liquidity constraint. The rich information on household characteristics we use is understudied in the previous literature owing to lack of data.

Lastly, our data include lottery ticket spending information, absent in other major large-scale household surveys. For example, the British Household Panel Survey and the German Socio-Economic Panel provide information on both consumption spending and lottery prize amount in addition to other household characteristics. However, they do not have information on lottery ticket spending. Thus, lottery studies using these data could be subject to the aforementioned omitted variable bias.

In the baseline analysis, we estimate that a S$1 increase of a lottery prize in the last 12 months raises monthly spending by S$0.042 during the same period. This finding implies that about half of the income gain through the lottery prize is spent within the first year of winning. The increase in spending mainly arises from spending on non-durables and non-visible items. The strong consumption response on non-durables is consistent with the model of consumption commitments with a good that has a high transaction cost, like housing (Chetty and Szeidl, 2007).

To study whether our baseline findings can be reconciled through the standard lifecycle model, we examine how consumption responses vary by household characteristics. First, households with liquidity constraints could be more responsive to a temporary income shock because they could not spend as much as they want (Jappelli and Pistaferri, 2010). Using several measures for liquidity constraints, we find that households with stronger liquidity constraints are indeed more responsive in terms of spending than those with weaker liquidity constraints. Second, risk-averse households could show a weaker consumption response to an

unanticipated income shock, because they have stronger motives for consumption smoothing and precautionary saving. We find consistent evidence with these conjectures that more risk-averse households have weaker consumption responses to a lottery income shock.

In summary, the main findings of this study imply that an unanticipated introduction of fiscal stimulus policies or other public transfer programs can effectively boost consumption spending of the aggregate economy in the short run. The estimated consumption responses to unanticipated income changes are highly consistent with the predictions of the standard lifecycle model.

The remainder of this paper is structured as follows. Section 2 describes the data and presents summary statistics. Section 3 presents the empirical strategy. Section 4 reports the regression results, and Section 5 concludes the paper.

2. Data

We use data from the Singapore Life Panel (SLP) for the empirical analysis. The SLP is a monthly longitudinal survey of a nationally representative sample of Singaporeans who were mainly 50–70 years old when the survey was launched in July 2015. Core questions, such as on family structure, labor market activities, spending, health, healthcare utilization, and subjective well-being, are asked every month. Respondents are occasionally asked one-off questions, such as on subjective risk preference and health literacy.

Our treatment variable is self-reported amounts of lottery prizes in Singapore dollars. In November 2016 and November 2017, the SLP asked its respondents questions on whether a respondent had purchased a lottery ticket in the last 12 months (i.e., from December of the previous year to November of the current year), the total amount of lottery wins (in Singapore dollars), and the amount spent in lottery tickets (in Singapore dollars) in the last 12 months.[2]

Lottery tickets are mostly sold over the counter, and there is no subscription-based lottery product in Singapore.[3] Unlike the US and European countries, Singapore does not sell annuity-like lottery products that pay out prizes in the form of installments. In the empirical analysis, we calculate total lottery prize and spending at the household level.

[2] Since the lottery-related questions have been surveyed twice in the SLP to date, some households in the sample participated in the lottery-related questions twice. To adjust for potential correlation of lottery prizes within households, we cluster standard errors at the household level.

[3] There are three legalized lotteries in Singapore. The most popular one is 4D® in which a player has to pick a four-digit number, with draws for winning numbers taking place three times a week. The second most popular lottery is TOTO®, in which a player selects six numbers between 1 and 49, with draws taking place twice a week. The third and least popular lottery is Singapore Sweep®, in which a player buys a ticket with a given number, with draws taking place once a month. Lottery tickets can be also purchased online or by phone.

Table A1 reports the summary statistics of lottery-related variables among lottery playing households.[4] On average, they spend S$2,278 (US$1,663), which seems very large compared with previous lottery studies. For example, Picchio et al. (2018) report annual lottery expenditure of €224 (US$259) per player. However, Picchio et al. (2017) cover spending on only subscription-based lottery tickets, and thus underestimate lottery ticket spending to the extent that their sample individuals buy lottery tickets via other channels, such as over-the-counter purchases. The significant lottery ticket spending in the SLP is consistent with the fact that Singapore has the world's largest spending per capita on lotteries (Markle et al., 2014, 2018). La Fleur's World Lottery Almanac (Markle et al., 2018) reports that Singapore's per capita lottery sales in 2017 were US$914. This statistic is consistent with the average lottery ticket spending amount in the SLP data, considering that about 40% of the population does not play the lottery and the SLP sample is older than the general Singapore population. Official statistics on lottery-related characteristics are consistent with the SLP data.[5] In addition, the distribution of lottery spending amounts shows that most lottery-playing households spend relatively small amounts of money on playing the lottery. The median spending amount (S$600) is significantly smaller than the average spending amount.

In terms of lottery winning, about 51% of the players report that they had won a positive amount of lottery prizes in the last 12 months. The average prize size conditional on winning a prize is S$1,090. The distribution of lottery prizes conditional on winning a prize is also heavily skewed. The size of the lottery prize at the 5th percentile is about S$10 and the median value is about S$250. However, the 90th percentile prize is S$2,500, which is ten times larger than the median, and the 95th percentile value is S$5,000.

To define the dependent variables, we use the information available in the SLP on household spending. First, we calculate monthly total spending by summing all expenditures for over 30 categories. Second, we calculate the average of total spending during the last 12 months to make it comparable to lottery prize and spending variables.[6] Third, we decompose total spending into spending on durables and non-durables. Durable goods spending is defined as the sum of spending on furniture and furnishings, home repair and maintenance, vehicle

[4] S$1 was US$0.73 on September 7, 2018.

[5] The 2017 National Gambling Participation Survey reports that 58% and 57% of Singapore residents aged 50–59 years and 60 years and above, respectively, reported that they had participated in at least one form of gambling activity in the last 12 months (Singapore NCPG, 2018).

[6] Annual total spending might be an alternative spending measure. However, we cannot construct this measure by aggregating total spending over the last 12 months since not every household participates in the SLP survey every month. To circumvent this issue, we calculate the average monthly spending during the last 12 months instead of the annual total spending.

repair and maintenance, and home appliances (TV, refrigerator, washer, etc.). We do not include the consumption value of service flow of cars and housing, because it is difficult to compute the consumption value of such goods. Non-durables spending is defined as total spending net of durables spending. Finally, we decompose total spending into visible spending and non-visible spending to examine whether households spend a larger share of income gains for conspicuous, discretionary consumption.[7] Visible spending is defined as the sum of spending on personal care and products, clothing, jewelry, and footwear, following the definition of Charles et al. (2009). Non-visible spending is defined as total spending net of visible spending.

To construct the key control variables, we use information on household-level spending amounts of lottery ticket purchases in the last 12 months. It is noteworthy that the SLP sample comprises respondents and their spouses for married couples. However, our analysis is conducted at the household level. Hence, the individual- and household-specific characteristics used in the empirical analysis are based on the responses of the respondent within a household who is most confident about answering questions regarding the household's finances.[8]

As baseline control variables, we include other characteristics of the respondents, such as age, age squared/100, dummy variables indicating secondary education, post-secondary education, gender, ethnic Chinese, Malay, Indian, the number of children, and district fixed effects in the regression analysis.[9] Table A2 reports the summary statistics of our sample respondents. Columns (1) and (2) show the means and standard deviations of the explanatory and dependent variables of the households with lottery players and households without lottery players, respectively. In general, there are few differences between households with and without lottery players except for ethnicity and education.

Since there is no variation in the lottery prize amount among households without lottery players, we use only the sample of lottery-playing households to estimate the consumption responses to lottery wins on spending in the baseline analysis. Although lottery players consist of 58.9% of all SLP sample households, this sample selection could limit the generalizability of our findings. To minimize this issue, as a robustness check, we estimate consumption

[7] If a consumption response to lottery wins is driven mainly by the thrill of winning, we conjecture that the consumption response could concentrate on visible goods spending.

[8] Unlike some other surveys (e.g., the Panel Study of Income Dynamics or the Health and Retirement Study), the SLP does not designate a particular respondent as the household head. Instead, we use information on household consumption spending reported by the financial respondent, who is the most confident in answering household finance related questions.

[9] In the sample, there are 63 districts. A district in our study is defined as the first two digits of the six-digit postal code in Singapore.

responses to lottery wins by using the matched sample of lottery players and non-lottery players who have similar probabilities of playing lottery.

3. Empirical Strategy

To estimate the causal effects of income via lottery winning on household spending, we consider the following linear regression model by pooling data from November 2016 and November 2017:

$$CONSUMPTION_i = \beta_0 + \beta_1 PRIZE_i + \beta_2 TICKET_i + \gamma X_i + \varepsilon_i, \quad (1)$$

where *i* is a household; $CONSUMPTION_i$ indicates measures of the average monthly spending during the last 12 months; and $PRIZE_i$ and $TICKET_i$ indicate total amounts of lottery prize and lottery ticket spending, respectively, in the last 12 months surveyed. $CONSUMPTION_i$, $PRIZE_i$, and $TICKET_i$ are measured in Singaporean dollars. X includes the aforementioned characteristics of a financially representative person of household *i*, such as age and age squared; dummy variables indicating ethnic Chinese and post-secondary education; the number of children; and the calendar year 2017, as well as the district-fixed effects. Our parameter of interest is β_1, which captures the effects of a S$1 increase in a lottery prize during the last 12 months on average monthly consumption spending.

Our key identification assumption is that the size of lottery prizes is randomly determined. Figure A1, however, shows that a lottery-playing household can win more and/or larger prizes in Singapore dollar amounts if the household buys more tickets. We thus include $TICKET$ to control for this possible selection bias.

To test whether a lottery prize is randomly determined conditional on lottery ticket spending, we run the regression of lottery prize amounts on lottery ticket spending amounts and individual characteristics. If the lottery prize were randomly determined conditional on lottery ticket spending, no individual characteristic would be able to predict the lottery prize. Table 1 presents the regression results.[10] In column (1), we only include baseline control variables. In column (2), we additionally include the number of household members, and lagged information, measured prior to lottery wins, on such as household income, health status, home ownership status, employment status, full-time work status, and private transfer income,

[10] We also tested whether individual characteristics can predict the ratio between lottery prize and lottery ticket spending, and found that no characteristics have statistically significant relationships with the ratio. The results are available upon request.

which can be highly correlated with consumption spending.[11] None of the individual coefficient estimates in columns (1) and (2) is statistically significant at the 5% level except for the year dummy.[12] The statistically significant coefficient estimate of the year dummy is likely to reflect the different prize structures of lottery products in Singapore, which is also observed in Picchio et al. (2018, p.1722). The *p*-values of the *F*-test of joint significance of all covariates except for the year dummy are 0.15 and 0.20 in columns (1) and (2), respectively.[13] This result confirms that the variation in lottery prizes conditional on ticket spending in the SLP data is randomly determined. To further test whether our regression analysis is sensitive to the choice of control variables, we conduct regression analysis with and without those control variables.

Since we use survey data, our dependent and independent variables could be vulnerable to measurement error. If the recall bias is purely due to respondents' random mistakes, our estimates would provide a lower bound of the actual marginal propensity to consume due to the attenuation bias. However, it is possible that the measurement error might not be random. For example, lottery winners who use the prize to buy a particular good might more easily remember this purchase than do non-winners who bought the same good. Yet, we do not expect this issue to cause a significant bias in our estimation, because most of the variation in lottery prize comes from the winners in our regression model. Additionally, large prizes are much more surprising than small prizes. Thus, the recall bias could be more severe among small-prize winners than among large prize winners. However, we found that the magnitudes of estimation results are robust after excluding large prize winners.

[11] Lottery prizes can change household income via labor income (Cesarini et al., 2017; Picchio et al., 2018). If we include contemporaneous household income—a potentially endogenous variable—as a control variable, we may cause a bias in the estimation. To avoid the bad control issue, we use annual household income prior to lottery winning. For the same reason, we also include lagged information on health, home ownership, employment status, full-time work status, and private transfer income.

[12] Column (1) shows that the dummy variable indicating an Indian household is statistically significant at the 10 percent level. We argue that this is less likely to reject our identification assumption that lottery prizes are randomly assigned due to the following reasons. First, the F-statistics show that all control variables without the year dummy are not jointly significant, consistent with the results of Cesarini et al. (2016) and Picchio et al. (2018). Second, the dummy variable becomes statistically insignificant when including more controls in column (2). Lastly, our main estimation results are robust to the inclusion of the control variables.

[13] The p-values of the F-test of joint significance of all covariates including the year dummy are 0.09 and 0.13 in columns (1) and (2), respectively.

4. Results

4.1 Baseline Analyses

Table 2 reports the estimated consumption responses to lottery winning using regression specification (1). In panel A, column (1) shows that a S$1 increase in lottery prize in the last 12 months raises average monthly spending by S$0.042, which is statistically significant at the 5% level.

Columns (2)−(5) in panel A of Table 2 show the estimated effects of lottery winning on sub-categories of household spending. In column (2), we find that a S$1 increase in lottery prize winnings raises monthly spending on durables by S$0.001. The magnitude of the coefficient estimate is very small and statistically insignificant. Column (3) shows that a S$1 increase in lottery prize winnings raises monthly spending on non-durables by S$0.041, and the estimate is statistically significant at the 5% level. These results suggest that the impact of lottery winning on consumption spending operates mostly through non-durables.

Our finding that the consumption response is mainly observed in non-durables is similar to those of previous studies on public cash transfer programs (Agarwal and Qian, 2014; Kaplan and Violante, 2014). However, this result is inconsistent with Kuhn et al. (2011), who found a significant increase in durable goods spending, such as car purchases, upon winning a lottery prize, but found little impact on non-durable goods spending.

Chetty and Szeidl (2007) provide a useful theory to reconcile the observed differences in the results.[14] Commitment goods, such as housing or vehicles, are infrequently transacted only when there are relatively large wealth shocks due to high transaction costs. Thus, for small shocks, the consumption responses are concentrated on non-durables only. The average size of lottery prizes in our study is far too low to purchase a car in Singapore. Lottery winners earn on average about US$794, but a brand-new Toyota Camry in Singapore would cost around US$120,000 due to very stiff taxes, which is at least three times more expensive than in the US.[15] On the contrary, Dutch lottery winners in Kuhn et al. (2011) earn about €16,747 (US$19,406) on average.

[14] Chetty and Szeidl (2007) show that playing a lottery could be a rational choice to obtain the opportunity to purchase an expensive and indivisible good. For example, lottery players could have higher welfare by spending $1 on a lottery ticket with a small chance of winning a prize instead of spending the $1 on other goods, such as food.

[15] The price information of Camry in Singapore is from the following website: https://www.toyota.com.sg/showroom/new-models/camry (accessed on January 25, 2021). The US price is around US$35,5450 based on a search result from the US News (https://cars.usnews.com/cars-trucks/toyota/camry; accessed on January 25, 2021).

Columns (4) and (5) of Table 2 show that the effects of a lottery prize are larger for spending on non-visible items than for spending on visible items. Column (4) indicates that a S$ 1 increase in every prize won in the last 12 months increases visible consumption spending by S$0.002, which is small in magnitude and statistically insignificant. Column (5) shows that a S$1 increase in every prize won increases non-visible consumption spending by S$0.041, which is statistically significant at the 5% level. If the consumption response to lottery wins is driven by the thrill of winning, one might expect a larger increase in conspicuous, discretionary consumption spending than in non-visible spending. However, these results imply that the increase in total spending due to lottery winning mainly comes from the increase in non-visible spending.

To examine the sensitivity of the baseline results in panel A of Table 2, we conduct additional checks.

Our analytic standard errors might be inappropriate due to a finite-sample bias. To examine the small-sample bias with skewed data, we conduct Monte Carlo simulations following Cesarini et al. (2016) and Picchio et al. (2018). We first construct finite-sample distributions of our test statistics under the null hypothesis that the effect of lottery prize is zero. We generate 1,000 datasets in which the lottery prize data were randomly permuted. For each dependent variable and each permuted sample, we estimate equation (1) and store estimated coefficient values and *p*-values. Figure A2 indicates that the distributions of analytical *p*-values are fairly uniform. However, to calculate more conservative *p*-values, we construct empirical sampling distributions of coefficient values generated by the Monte Carlo simulation for each dependent variable. Figure 1 shows the distributions of the coefficient values under the null hypothesis. Our baseline estimates are represented by vertical lines. The baseline estimates—except for durable consumption spending—are located at the right tails of those distributions, which implies that the probability of observing the baseline estimates is very low if the null hypothesis is true. We also report the alternative *p*-values, calculated as $2 * min(1 - t, t)$, in which t is the percentile ranking of the baseline estimates in the empirical sampling distributions, on the bottom of each figure. These alternative *p*-values show that the baseline estimates are statistically significant when using the alternative standard errors robust to small sample bias.

In panel B, we additionally include other control variables used in Column (2) of Table 2. The results are robust, consistent with our argument—that is, lottery prizes may be randomly assigned. We report the regression results of panels A and B, including the full set of the parameter estimates for all regressors in Table A3.

In panel C, we drop all control variables, except for the lottery prize and lottery ticket spending variables. If the size of a lottery prize conditional on lottery ticket spending is randomly assigned, we would find similar estimates after excluding the control variables. Consistent with the findings from Table 2, our results are generally robust, although the estimates are slightly larger.

In panel D, we estimate the regression specification (1) using a median regression to examine the sensitivity of the baseline results under the presence of outliers in the dependent variables. The results are similar to the baseline results of panel A.

The linear relationship we impose between lottery prizes and consumption spending might be restrictive. To address this issue, we nonparametrically examine nonlinear relationships. Since lottery prizes might not be randomly determined if we do not control for its ticket spending, we calculate variations in lottery prizes and consumption spending by using the Frisch-Waugh-Lovell theorem. We first run separate regressions of lottery prizes and consumption spending on lottery spending. Then, we calculate residuals from each regression. To examine nonparametric relationships between lottery prizes and consumption spending after removing the effects of lottery ticket spending, we use a running-mean smoother with a bandwidth of 0.8. Figure A3 indicates that lottery prizes and consumption spending have non-linear relationships across all consumption measures.[16] We find that variations of total, nondurable, and nonvisible consumption spending are bigger than those of durable and visible spending, which are consistent with the baseline estimates. As a robustness check, we examine nonparametric relationships between lottery prizes and consumption spending after removing the effects of both lottery ticket spending and observable characteristics.

A potential criticism of the use of lottery winnings to isolate an exogenous variation of income is that the behavioral response to a lottery prize could be different from other sources of exogenous income variations, such as a public transfer program. For example, the thrill of winning makes lottery players exhibit a higher level of the MPC than that estimated from a public transfer program.

However, Agarwal and Qian (2014) estimated that an unexpected, one-off increase in unearned income via the public cash transfer program in Singapore leads to an increase of S$0.08 in monthly spending for every S$1 received during the 10-month period following disbursement. The magnitude of their estimate is bigger than ours is. In addition, our finding is similar to that of US studies estimating the effects of fiscal stimulus packages (tax rebates)

[16] It is noteworthy that monetary values could be negative as we consider residuals from linear regressions.

on household consumption responses. Johnson et al. (2006) found that households spend about 12–30% of the tax rebate on non-durables spending for the first 3 months after the receipt. Lastly, our finding is consistent with a US study documenting that lottery winners do not exhibit lavish spending behavior (Kaplan, 1987). Hence, we argue that the effects of a lottery prize on consumption spending might not be very different from the impacts of public transfer programs.

Another potential criticism of using only the lottery player sample is that lottery players and non-players could be systematically different in terms of consumption responses to unanticipated income changes. We cannot fully address this limitation, because lottery players and non-players might be different in terms of *unobservables*. Nevertheless, we attempt to address this limitation to some extent by re-estimating the effects of lottery wins on consumption spending using the matched sample of players and non-players with the similar probabilities of playing the lottery.[17] Table A4 shows that the results remain robust.

4.2 Heterogeneity Analyses

To examine possible mechanisms of consumption responses to an income shock, we study heterogeneous consumption responses by key components of the standard life-cycle model.

Liquidity Constraints

Under the standard life-cycle framework, households with liquidity constraints respond more strongly to unanticipated income gains than do their counterparts without liquidity constraints. However, it is difficult to measure the degree of household-level liquidity constraints in observational data. To overcome this limitation, we exploit a unique public pension wealth withdrawal policy in Singapore. Upon reaching their 55th birthday, most Singaporeans can withdraw some of their retirement savings account balance, called the Central Provident Fund, after setting aside the minimum amount pre-determined by the government, or at least S$5,000 if they cannot meet the minimum amount.[18] We consider that a household is relatively more liquidity constrained if (i) the respondent is younger than 55 years when she/he is single, or (ii) both husband and wife are younger than 55 years if the respondent is married. Columns (1) and (2) of Table 3 show that the estimated consumption response for households that cannot

[17] We assign zero to non-players' lottery prize amount and lottery ticket spending.

[18] In general, an employee contributes 20% of his/her gross salary and the employer contribution is 17%. The details can be found at https://www.cpf.gov.sg/.

withdraw pension wealth (i.e., aged below 55 years) is more than two times larger than that of households that can (i.e., aged 55 years and over).

We have shown that liquidity constraints measured by early access to public pension wealth play an important role in explaining households' consumption responses to a transitory income shock. We argue that the withdrawal eligibility of pension wealth is a cleaner measure of liquidity constraints than commonly used measures such as household income, because it is exogenously imposed by the government policy and has nothing to do with household characteristics other than the age cutoff. Nevertheless, we conduct a robustness check by presuming that households with lower income levels are more likely to have stronger liquidity constraints. If the heterogeneous consumption responses by the public pension withdrawal eligibility status are indeed due to the difference in liquidity constraints, we would observe that households with lower income levels exhibit stronger consumption responses. Consistent with our conjecture, columns (3) and (4) of Table 3 show that the MPC is larger among households with low income levels than those with high income levels.

In addition, we corroborate the above evidence on the role of liquidity constraints by using liquid wealth as another proxy of liquidity constraints. Kaplan and Violante (2014) show that households with no or little liquid wealth (stocks, bonds, checking account balance, etc.)—so-called *hand-to-mouth* (HtM) households—exhibit stronger consumption responses to a transitory income shock due to a large transaction cost to liquidate wealth. Following Kaplan et al. (2014), we define HtM households as households whose balance of financial wealth is less than half of the monthly household income. Consistent with the above findings, columns (5) and (6) of Table 3 indicate that HtM households exhibit stronger consumption responses to an income shock than do non-HtM households.

Risk Preference

The consumption responses can vary by preferences, such as risk aversion. Households' risk averseness is positively correlated with intertemporal elasticity of substitution. Thus, more risk-averse households could have a stronger incentive to smooth consumption over time. In addition, households' risk averseness is positively correlated with prudence. Under the precautionary saving theory, individuals with higher prudence have weaker consumption

responses to an income shock, as they have a stronger incentive to accumulate precautionary saving (Jappelli and Pistaferri, 2010).[19]

To proxy households' risk averseness, we use the subjective response to the following question about risk attitude in the SLP: "Are you generally a person who tries to avoid taking risks or one who is fully prepared to take risks? Please rate yourself from 0 to 10, where 0 means 'not at all willing to take risks' and 10 means 'very willing to take risks.'"[20] Consistent with the theoretical predictions, columns (1) and (2) of Table 4 show that more risk-averse households show much weaker consumption responses to an income shock.

Remaining Time Horizon

Under the life-cycle model that has a finite time horizon with an uncertain date of death, a household whose expected remaining time horizon (at a given age) is shorter exhibits stronger consumption responses to an unexpected income change. To proxy the length of an expected remaining time horizon, we use information on a respondent's subjective belief about his/her life expectancy. The SLP asks respondents the subjective probability of living past a certain age.[21] We divide the sample whose reported probability is 50% or less and more than 50% to obtain a similar sample size between the two groups. Columns (3) and (4) of Table 4 show little difference between households with shorter life expectancy and those with longer life expectancy.

5. Concluding Remarks

In this study, we estimated the causal effects of unanticipated income changes on consumption spending by exploiting random assignments of lottery prizes, which provide the closest setting to a randomized control trial. The baseline analysis shows that a S$1 increase in income through winning a lottery prize in the last 12 months increases average monthly consumption spending by S$0.042. This finding implies that about half of the income gain through the lottery prize is

[19] An implicit assumption we make is that risk preference is positively correlated with intertemporal elasticity of substitution and prudence, as in the case when the utility function has the constant relative risk aversion form.

[20] Dohmen et al. (2011) validated the use of this subjective general risk attitude question through a field experiment with real money at stake using a random subsample of German Socio-Economic Panel respondents. The authors show that the subjective general risk attitude question is highly predictive of actual risk-taking behavior. They conclude that the response to the subjective risk attitude question is the "best all-around measure" of risk preference.

[21] The wording of the question depends on the age of a respondent. For example, to those aged 50–65 years, the SLP asks "what is the percent chance that you will live to be 75 or more?"; to those aged 65–69 asks, it asks "what is the percent chance that you will live to be 80 or more?"; and to those aged 70–74 years, it asks "what is the percent chance that you will live to be 85 or more?"

spent within the year of winning, which, in turn, suggests that fiscal stimulus policies or other public transfer programs could be an effective means of boosting consumption spending of the economy in the short run.

The findings from our heterogeneity analyses provide additional policy implications. First, we documented the importance of liquidity constraints in determining the magnitude of the MPC. Our results suggest that the government should focus on liquidity-constrained households to maximize the effectiveness of cash transfer policies on spending. In addition, the consumption responses are stronger among households with less risk aversion. If households become more risk averse during economic downturns (Sahm, 2012), a government's cash transfer programs to increase aggregate spending may become less effective.

We acknowledge limitations that are not addressed in this study. First, cross-country heterogeneity could limit the external validity of the findings outside Singapore. Interestingly, our results are similar to those of a Norwegian lottery study (Fagereng et al., 2021) and US studies estimating the effects of fiscal stimulus payments on household consumption responses (Johnson et al., 2006). This similarity implies that our results are not necessarily confined to the specific context of Singapore. Second, our findings are based on the lottery player sample who are 50–70 years old.[22] The nature of our sample characteristics limits the external validity of the findings, too. Third, this study does not address the dynamic effects of lottery wins on consumption responses owing to the short survey history. Investigating dynamic consumption responses over longer periods would give more evidence about the extent to which households smooth consumption over time after an income shock.[23]

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[22] As of 2018, the fraction of individuals aged 50 years and above account for 49.8% of the resident population in Singapore (Singapore Department of Statistics, 2019).

[23] Since we cannot identify exactly which month a player won a lottery prize in the last 12 months, it is not feasible to document consumption profiles immediately after the winning. Agarwal and Qian (2014) found that consumption spending responses monotonically decrease over the 10-month period after an unexpected public cash transfer in Singapore. If consumption spending responses to winning a lottery prize follow a similar dynamic pattern to that of Agrwal and Qian (2014), we might miss stronger consumption responses immediately after lottery winning. This implies that the baseline estimate can be a lower bound of the true effect.

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Tables and Figures

TABLE 1. ESTIMATION RESULTS OF THE REGRESSION OF LOTTERY PRIZE ON COVARIATES

Dep. Var.: Lottery Prize	(1)	(2)
Lottery ticket spending	0.123***	0.122***
	(0.019)	(0.020)
Age	25.03	14.90
	(46.18)	(48.90)
Age squared	-29.30	-20.60
	(37.48)	(39.73)
Male	13.48	-12.22
	(61.56)	(66.63)
Completed secondary education	67.27	91.06
	(69.55)	(70.44)
Completed tertiary education	27.48	18.42
	(71.36)	(70.48)
Chinese	-141.3	-13.15
	(166.8)	(152.8)
Malay	-286.0	-142.7
	(187. 7)	(184.3)
Indian	-341.3*	-173.3
	(193. 5)	(188.3)
1[Year=2017]	128.2***	149.6***
	(49.43)	(52.47)
Number of children	4.512	-4.835
	(22.05)	(30.39)
Household income		0.0001
		(0.0001)
Health status		56.15
		(79.78)
Number of household members		11.95
		(25.84)
Home ownership		-16.00
		(19.80)
Employment status		76.59
		(88.27)
Full-time status		1.72
		(87.17)
Private transfers		0.004
		(0.051)
Constant	-137.9	-25.04
	(1,413)	(1,511)
Observations	6,212	5,610
R-squared	0.101	0.099
F-test of joint significance of all covariates except lottery ticket spending (p-value), w/o the year dummy	1.48	1.27
	(0.15)	(0.20)
F-test of joint significance of all covariates except lottery ticket spending (p-value), w/ the year dummy	1.64	1.39
	(0.09)	(0.13)

Notes: Standard errors reported in parentheses are clustered at the household level and corrected for heteroscedasticity. District fixed-effects are included but the coefficient estimates are not reported. * denotes significance at 0.10; ** at 0.05; *** at 0.01.

TABLE 2. EFFECTS OF LOTTERY PRIZE ON HOUSEHOLD CONSUMPTION SPENDING

Dep. Vars.	Average monthly consumption spending				
	Total	Durables	Non-Durables	Visible	Non-visible
	(1)	(2)	(3)	(4)	(5)
A. Baseline					
Lottery Prize	0.042**	0.001	0.041**	0.002	0.041**
	(0.018)	(0.002)	(0.018)	(0.001)	(0.018)
Observations	6,212	6,212	6,212	6,212	6,212
R-squared	0.325	0.117	0.327	0.173	0.325
B. Including Additional Control Variables					
Lottery Prize	0.038**	0.002	0.036**	0.002	0.037**
	(0.018)	(0.002)	(0.017)	(0.001)	(0.018)
Observations	5,610	5,610	5,610	5,610	5,610
R-squared	0.376	0.160	0.373	0.213	0.375
C. w/o Controls					
Lottery Prize	0.051**	0.002	0.049**	0.002	0.049**
	(0.021)	(0.002)	(0.020)	(0.001)	(0.020)
Observations	6,212	6,212	6,212	6,212	6,212
R-squared	0.004	0.003	0.003	0.002	0.004
D. Median Regression					
Lottery Prize	0.051***	0.001	0.048***	0.001	0.050***
	(0.008)	(0.001)	(0.009)	(0.002)	(0.008)
Observations	6,212	6,212	6,212	6,212	6,212
R-squared	0.307	0.103	0.308	0.158	0.308

Notes: All specifications include age, age squared, dummy variables indicating post-secondary education, Chinese household, and the calendar year 2017, number of children, district fixed effects, and spending on lottery tickets purchased. Standard errors clustered at the household level and corrected for heteroscedasticity are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE 3. EFFECTS OF LOTTERY PRIZE ON HOUSEHOLD CONSUMPTION SPENDING BY LIQUIDITY CONSTRAINTS

Dep. Var.	Average monthly total consumption spending					
Measures for Liquidity Constraint:	Pension wealth withdrawal eligibility		Household income		Share of Liquid Wealth	
	Age < 55th birthday	Age ≥55th birthday	Below median	Above median	Hand-to-Mouth (HtM)	Non HtM
	(1)	(2)	(3)	(4)	(5)	(6)
Lottery Prize	0.090**	0.034*	0.039*	0.029	0.083*	0.035*
	(0.035)	(0.019)	(0.020)	(0.025)	(0.048)	(0.021)
Observations	1,032	4,643	2,873	3,339	1,112	4,486
R-squared	0.357	0.353	0.216	0.308	0.284	0.342

Notes: All specifications include age, age squared, dummy variables indicating post-secondary education, Chinese household, and the calendar year 2017, number of children, district fixed effects, and spending on lottery tickets purchased. Standard errors clustered at the household level and corrected for heteroscedasticity are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

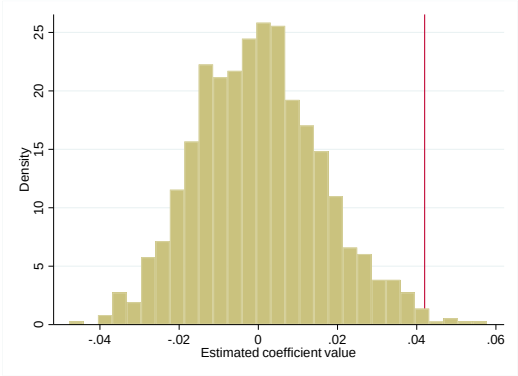
Table 4. EFFECTS OF LOTTERY PRIZE ON HOUSEHOLD CONSUMPTION SPENDING BY OTHER CHARACTERISTICS

Dep. Var.	Average monthly total consumption spending			
Characteristics:	Risk preference		Life expectancy	
	More risk averse (1)	Less risk averse (2)	50% and below (3)	Above 50% (4)
Lottery Prize	0.010	0.076**	0.044*	0.045
	(0.023)	(0.031)	(0.022)	(0.038)
Observations	2,950	2,681	3,693	2,057
R-squared	0.351	0.308	0.327	0.347

Notes: All specifications include age, age squared, dummy variables indicating post-secondary education, Chinese household, and the calendar year 2017, number of children, district fixed effects, and spending on lottery tickets purchased. Standard errors clustered at the household level and corrected for heteroscedasticity are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

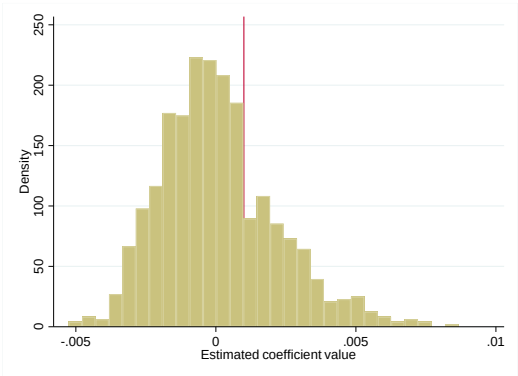
Figure 1. Distribution of Effects of Fake Lottery Prize on Household Consumption Spending

A. Total Consumption Spending



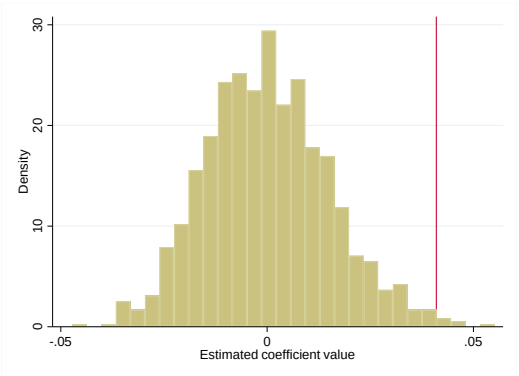
Permutation-based *p*-value = 0.011

B. Durables Consumption Spending



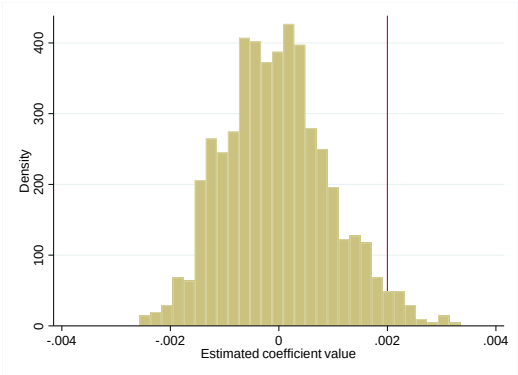
Permutation-based *p*-value = 0.589

C. Non-durables Consumption Spending



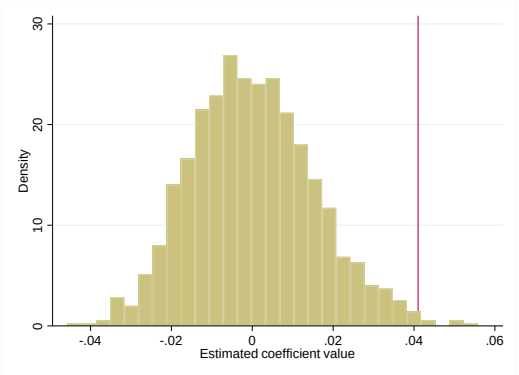
Permutation-based *p*-value = 0.007

D. Visible Consumption Spending



Permutation-based *p*-value = 0.041

E. Non-visible Consumption Spending



Permutation-based *p*-value = 0.008

Note: The histograms show the simulated distributions of permutation-based coefficient values under the null hypothesis of no effect of lottery prizes on consumption spending measures.

APPENDIX TABLES AND FIGURE

TABLE A1. LOTTERY-RELATED CHARACTERISTICS (LOTTERY PLAYERS ONLY)

A. Annual spending on lottery tickets	2,278
5th percentile	19.9
10th percentile	39.8
25th percentile	119
50th percentile	600
75th percentile	2,584
90th percentile	5,200
95th percentile	8,787
B. Pr(lottery prize>0)	50.7%
C. Annual lottery winnings (>0)	1,088
5th percentile	9.9
10th percentile	19.9
25th percentile	50.0
50th percentile	248.5
75th percentile	795
90th percentile	2,500
95th percentile	5,000
D. Ratio of lottery prize over lottery ticket spending	0.60
Observations	6,212

Note: Monetary units are in 2016 Singapore dollars.

TABLE A2. SUMMARY STATISTICS BY LOTTERY PARTICIPATION STATUS

	(1) With Players	(2) Without Players
Age	60.9 (6.34)	60.8 (6.16)
Chinese	0.94 (0.24)	0.74 (0.44)
Malay	0.007 (0.08)	0.15 (0.36)
Indian	0.04 (0.19)	0.08 (0.28)
Completed secondary education	0.43 (0.50)	0.37 (0.48)
Completed tertiary education	0.35 (0.48)	0.42 (0.49)
Number of children	2.83 (1.11)	2.93 (1.27)
Total consumption spending	3,197 (3,170)	3,063 (3,435)
Durables consumption spending	187 (357)	181 (413)
Non-durables consumption spending	3,009 (2,969)	2,882 (3,189)
Visible consumption spending	137 (467)	123 (468)
Non-visible consumption spending	3,304 (4,387)	3,192 (3,883)
Observations	6,212	4,332

Notes: Monetary units are in 2016 Singapore dollars. Standard deviations are reported in parentheses in column (1) and (2).

TABLE A3. EFFECTS OF LOTTERY PRIZE ON HOUSEHOLD CONSUMPTION SPENDING

Dep. Vars.	Average monthly consumption spending									
	Total		Durables		Non-durables		Visible		Non-visible	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lottery Prize	0.042**	0.038**	0.001	0.002	0.041**	0.036**	0.002	0.002	0.041**	0.037**
	(0.018)	(0.018)	(0.002)	(0.002)	(0.018)	(0.017)	(0.001)	(0.001)	(0.018)	(0.018)
Lottery Spending	0.023**	0.008	0.004***	0.003***	0.019*	0.005	0.001**	0.001	0.021**	0.007
	(0.011)	(0.009)	(0.001)	(0.001)	(0.010)	(0.009)	(0.001)	(0.001)	(0.010)	(0.009)
Age	269.34***	224.68***	9.883	6.283	259.45***	218.4***	15.022***	11.13***	254.4***	213.6***
	(69.37)	(66.81)	(6.259)	(6.205)	(65.27)	(63.04)	(3.904)	(3.996)	(66.55)	(64.05)
Age^2	-301.48***	-244.39***	-10.56**	-6.408	-290.9***	-238.0***	-15.62***	-11.25***	-285.9***	-233.2***
	(56.50)	(54.88)	(5.15)	(5.168)	(53.17)	(51.77)	(3.178)	(3.281)	(54.21)	(52.61)
Male	380.39***	269.57***	35.00***	31.04***	345.4***	238.6***	-26.22***	-32.17***	407.1***	302.2***
	(86.18)	(88.53)	(9.96)	(10.19)	(80.56)	(83.14)	(5.74)	(6.091)	(82.70)	(85.07)
Secondary education	813.7***	745.2***	54.24***	57.71***	759.42***	687.5***	50.06***	44.59***	763.32***	700.29***
	(76.93)	(80.61)	(9.69)	(9.59)	(72.04)	(76.10)	(4.94)	(5.19)	(73.88)	(77.43)
Tertiary education	2,905.2***	2,712.3***	180.7***	170.2***	2,724.6***	2,542.1***	140.0***	130.8***	2,764.9***	2,581.2***
	(113.51)	(115.14)	(12.20)	(11.57)	(106.7)	(109.2)	(7.17)	(7.48)	(109.2)	(110.7)
Chinese	502.7	506.46	41.33	43.985	461.3	462.5	33.219*	32.45*	470.9	474.3
	(409.9)	(383.54)	(35.21)	(32.113)	(386.9)	(366.1)	(18.666)	(18.20)	(395.15)	(370.1)
Malay	-323.8	-139.0	-45.06	-28.95	-278.7	-110.0	11.79	26.97	-333.3	-165.0
	(589.2)	(625.5)	(40.38)	(39.39)	(563.5)	(603.0)	(38.40)	(42.29)	(564.7)	(600.6)
Indian	725.9	623.08	88.97**	86.66**	636.9	536.4	52.15**	48.03**	675.0	575.02
	(463.8)	(446.3)	(42.98)	(41.60)	(437.8)	(425.4)	(23.90)	(24.23)	(446.4)	(429.81)
1[Year=2017]	-20.38	-65.23	-5.782	-9.951	-14.60	-55.28	-5.424**	-8.056***	-14.56	-56.94
	(41.30)	(41.91)	(7.401)	(7.219)	(38.45)	(39.43)	(2.696)	(2.785)	(39.84)	(40.47)
No. of children	396.3***	240.8***	16.290***	7.047	380.4***	233.7***	5.447**	1.768	390.8***	239.10***
	(38.47)	(48.69)	(4.040)	(4.764)	(36.18)	(46.21)	(2.390)	(3.018)	(37.04)	(46.91)
HH Income		0.001**		0.000***		0.001**		0.000***		0.001**
		(0.001)		(0.000)		(0.001)		(0.000)		(0.001)
Health Status		155.6		-10.78		166.4		8.741		146.12
		(125.7)		(12.90)		(118.5)		(8.164)		(121.23)
Family Size		203.4***		11.33**		192.1***		2.648		200.6***
		(44.77)		(4.44)		(42.31)		(2.403)		(43.44)
Home ownership		-107.9***		-5.903		-101.97***		-4.155*		-103.7***
		(36.42)		(4.177)		(34.67)		(2.15)		(35.15)

Employment status		66.13		4.294		61.83		9.55		56.55
		(121.2)		(14.12)		(113.8)		(7.60)		(116.5)
Full-time status		527.0***		20.221		506.7***		34.72***		492.4***
		(121.06)		(14.199)		(113.7)		(7.817)		(116.3)
Private transfers		0.085		0.006		0.079		0.004		0.082
		(0.074)		(0.010)		(0.069)		(0.004)		(0.072)
Constant	-5,128.2**	-4,974.2**	-215.6	-182.9	-4,912.6**	-4,791.4**	-299.4**	-236.5*	-4,833.0**	-4,739.6**
	(2,128.8)	(2,040.9)	(189.8)	(188.1)	(2,003.8)	(1,926.5)	(120.0)	(122.7)	(2,042.4)	(1,956.9)
Observations	6,212	5,610	6,212	5,610	6,212	5,610	6,212	5,610	6,212	5,610
R-squared	0.325	0.376	0.117	0.160	0.327	0.373	0.173	0.213	0.325	0.375

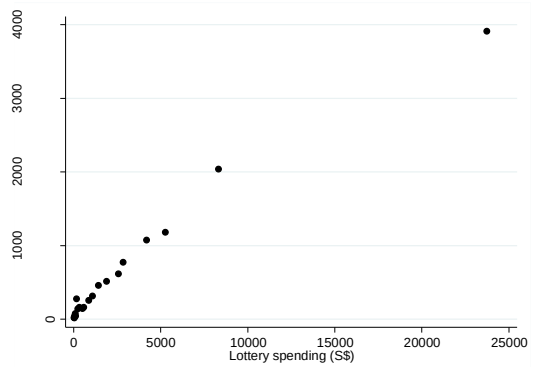
Notes: All specifications include district fixed effects while we do not report results to save spaces. Standard errors clustered at the household level and corrected for heteroscedasticity are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE A4. EFFECTS OF LOTTERY PRIZE ON HOUSEHOLD CONSUMPTION SPENDING INCLUDING HOUSEHOLDS WITHOUT LOTTERY PLAYERS

Dep. Vars.	Average monthly consumption spending				
	Total	Durables	Non-Durables	Visible	Non-visible
	(1)	(2)	(3)	(4)	(5)
Lottery Prize	0.048**	0.002	0.046**	0.002*	0.045**
	(0.019)	(0.002)	(0.019)	(0.001)	(0.019)
Observations	10,537	10,537	10,537	10,537	10,537
R-squared	0.296	0.093	0.299	0.146	0.296

Note: We include households both with and without lottery players. To construct the matched sample, we use the estimated propensity of playing lottery (p) as the probabilistic sampling weight. We assign 1 for households with lottery players and $p/(1-p)$ for households without lottery players as sampling weights. All specifications include age, age squared, dummy variables indicating post-secondary education, Chinese household, and the calendar year 2017, number of children, district fixed effects, and spending on lottery tickets purchased. Standard errors clustered at the household level and corrected for heteroscedasticity are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

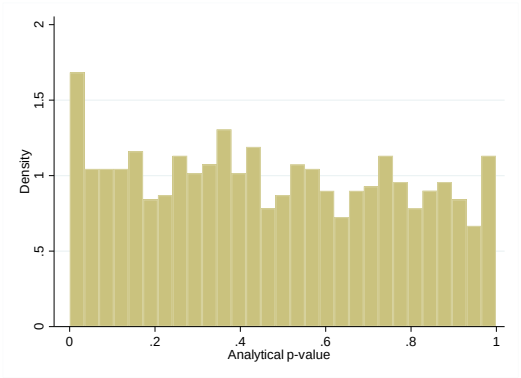
FIGURE A1. RELATIONSHIP BETWEEN LOTTERY TICKET SPENDING AMOUNT AND PRIZE AMOUNT



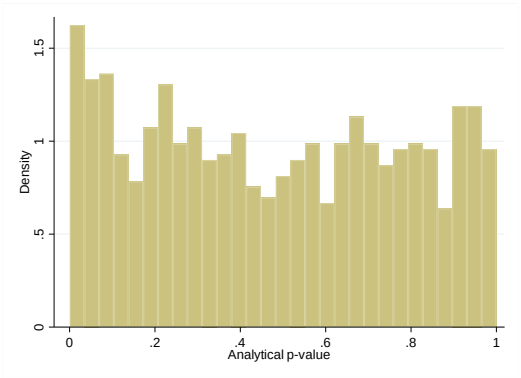
Note: To plot Figure 1, we constructed 20 equal-sized bins and calculated averages of the lottery ticket spending and lottery prize in each bin.

FIGURE A2. DISTRIBUTION OF ANALYTICAL P-VALUES

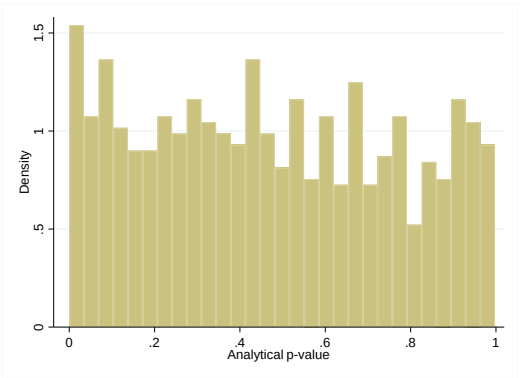
A. Total Consumption Spending



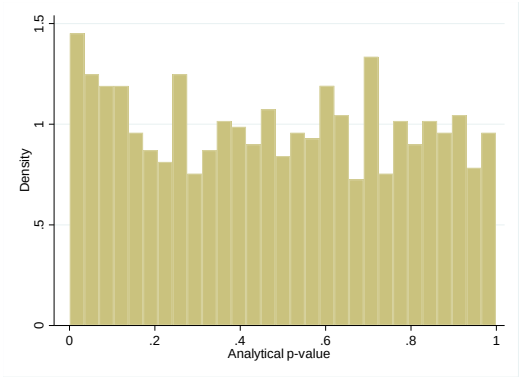
B. Durables Consumption Spending



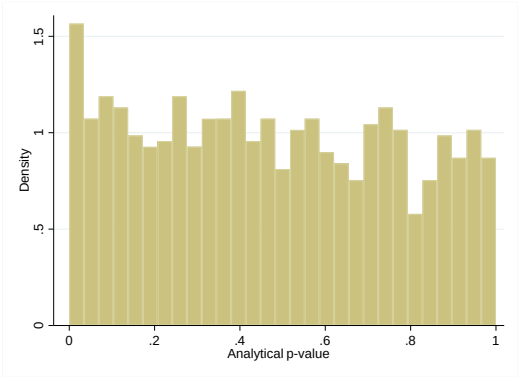
C. Non-durables Consumption Spending



D. Visible Consumption Spending



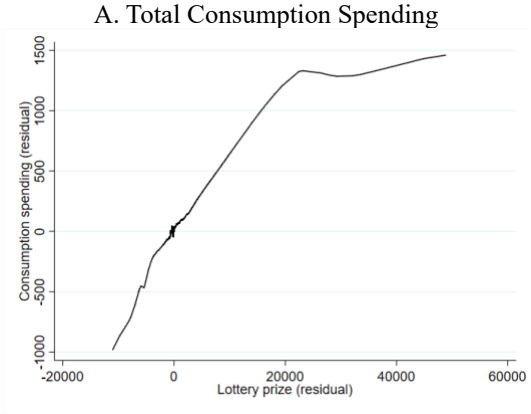
E. Non-visible Consumption Spending



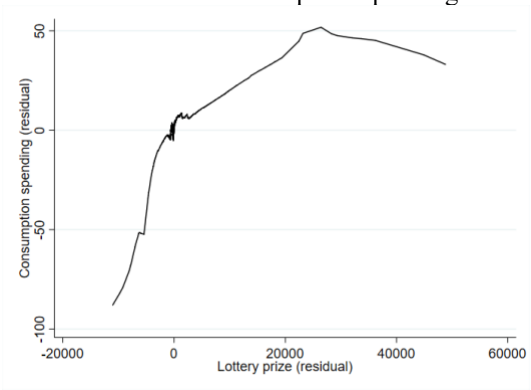
Note: The histograms show the simulated distributions of analytical p-values under the null hypothesis of no effect of lottery prizes on the respective consumption spending measure.

Figure A3. Nonlinear Relationships between Lottery Prize and Household Consumption Spending

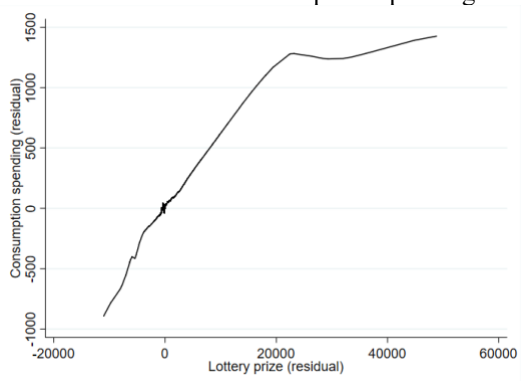
A. Total Consumption Spending



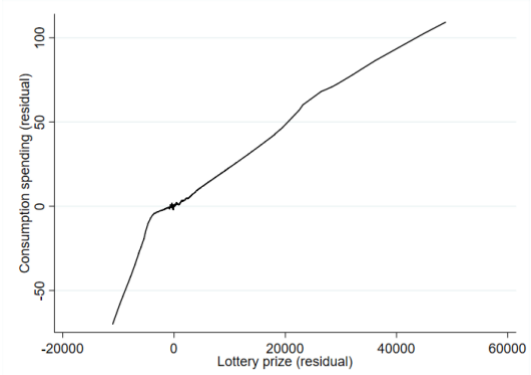
B. Durables Consumption Spending



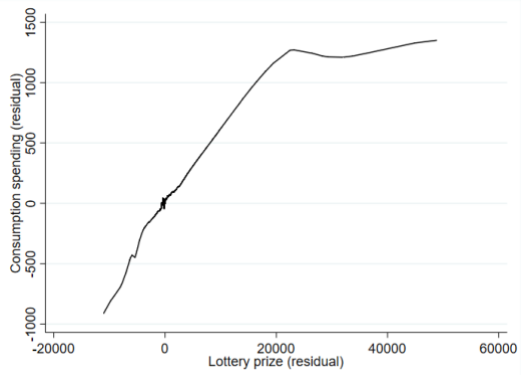
C. Non-durables Consumption Spending



D. Visible Consumption Spending



E. Non-visible Consumption Spending



Notes: We run separate regressions of lottery prize and consumption spending on lottery spending and calculate residuals from each regression. Then we plot smoothed relationships between residuals of lottery prizes and residuals of consumption spending using the running-mean smoother and a bandwidth of 0.8.