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**Abstract:** Many households have insufficient savings to handle moderate and routine consumption shocks. Many of these financially-fragile households also have the highest lottery expenditures as a proportion of income. This combination suggests that Prize-Linked Savings (PLS) accounts, combining security of principal with lottery-type jackpots, can increase savings among these at-risk households. Results from an online experiment show that the introduction of PLS accounts increase total savings and reduce lottery expenditures significantly, especially among individuals with the lowest levels of savings and income. The results imply that PLS accounts offer a plausible market-based solution to encourage individuals to increase savings.

**JEL Codes:** D14, G11, E21, C91, L83, D12.

**Key Words:** Personal Finance, Savings, Lotteries, Online Experiment, Individual Decision Making.

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## 1 Introduction

In a recent U.S. survey, Lusardi, Schneider and Tufano (2011) found that half of the respondents would be unable to come up with $2,000 if an unexpected emergency arose, and that two-thirds of respondents in the lowest income bracket had less than $2,000 in savings. Given that unpredictable consumption shocks exceeding $2,000 are routine (Blundell, Pistaferri and Preston, 2008), these low levels of savings and financial illiquidity place many households at risk and create negative externalities associated with financial distress. Substantial theoretical and empirical work has examined potential causes and solutions to the low savings problem (see, for example, Crossley et al. (2012) for a recent review), yet appropriate policy responses remain unclear.

This paper investigates whether Prize-Linked Savings (PLS) accounts, common outside of the U.S.,[1, 2] can encourage savings, especially among those who are more vulnerable to routine financial shocks. PLS accounts combine the feature of traditional savings accounts that guarantees the principal investment with a lottery that provides a chance for a life-changing payoff (Kearney, Tufano, Guryan and Hurst, 2011). High lottery expenditures (on average $540 per year in the U.S., and relatively higher as a proportion of income among households with lower income) suggests a potentially strong appeal for PLS accounts among people with low income (Kearney et al. 2011). Demand for PLS accounts has been found outside the U.S. (e.g., Lobe and Hölzl, 2007; Tufano, 2008). While these studies demonstrate demand for PLS accounts, they have a number of important shortcomings. First, these analyses are conducted at a high level of aggregation and as a consequence they are unable to examine the distribution of responses across incomes or different demographic groups. In addition, because of the high level of aggregation, their results at best reflect average households. Indeed since the average is calculated by income weights, these results are most informative about the behaviour of high income households (i.e. the households least targeted by saving policies). On the other hand, micro econometric studies on PLS have been limited to descriptive evidence. Tufano, De Neve and Maynard (2011) examined individuals' interest regarding the first U.S. PLS product introduced in 2006. Their survey results indicate that the PLS account appeals more to heavy lottery players, non-savers and those with low savings.

[1] PLS accounts are currently offered in over 20 countries and have been available since the 1694 "Million Adventure" in the United Kingdom (Murphy, 2005).

[2] Current laws prevent the introduction of PLS accounts (most states in the U.S prohibit privately-run lotteries), yet the PLS account opened in Indiana suggests the potential for legal means to introduce PLS short of changing laws.

The research on PLS accounts, focusing on demand, has thus far been unable to directly examine perhaps the two most important policy questions that we address in the current study. First, does the introduction of a PLS account increase total savings, or does it instead cause a reallocation of demand away from other forms of savings, thus not addressing the financial illiquidity problem and not creating new savers? Second, if the PLS account increases total savings, what are the sources of the expenditures?

We address these questions with an online experiment that involves both a representative sample of the population and a disproportionately larger sample of low income and low savings individuals. We first examine whether the introduction of PLS accounts increases total savings, and then the sources of the increased total savings. Given the disproportionately higher demand for lottery expenditures among those with lower income,[3] we further examine whether the demand for PLS accounts reduces lottery expenditures. Our results show that the introduction of a PLS account indeed increases total savings quite dramatically (on average by 12 percentage points), and that the demand for the PLS account comes from reductions in lottery expenditures as well as current consumption. We further show that these results are stronger among study participants with the lowest reported savings. Our results suggest that PLS accounts offer a plausible market-based solution to encourage individuals to increase savings.

The paper proceeds as follows. The following section presents the experimental design and hypotheses, section 3 presents the results and section 4 concludes.

## 2 Experimental design[4]

The experiment consisted of a series of individual portfolio allocation decisions in which each subject always had exactly $100. There were a maximum of four potential alternatives to which participants could allocate their $100 budget: (1) receiving cash within two weeks of participation (consumption), (2) traditional savings, (3) entering a lottery and (4) a PLS account. Money allocated to cash would be provided to subjects as soon as all the

[3] Extensive research has tried to explain the higher demand for lotteries and gambling among people with lower income. One approach allows individuals to use subjective probability weighting to over-weight low probability events (e.g., rank-dependent expected utility theory (Quiggin, 1982); cumulative prospect theory (Tversky and Kahneman, 1992). Another approach, skewness, allows utility to depend upon both absolute and relative wealth so that lotteries offer an opportunity to move up in terms of relative wealth (Shefrin and Statman, 2000). Crossley et al. (2011) suggest that people can use lotteries to convexify their budget sets.

[4] All experimental materials are presented in the supplemental material and online exactly as the subjects saw them at:
Study Response ($8 group): http://econusyd.qualtrics.com/SE/?SID=SV_cD4Kd9LjaSdJbNO
Study Response ($12 group): http://econusyd.qualtrics.com/SE/?SID=SV_0OsFuzJ5PtPVQxe
MTurk group: http://econusyd.qualtrics.com/SE/?SID=SV_5mXophbcOhYrPfK
MTurk control for 1/*N* heuristic (section 3.3.1): http://econusyd.qualtrics.com/SE/?SID=SV_bDVOCmead636g5v
MTurk with continuous choice set (section 3.3.3): http://econusyd.qualtrics.com/SE/?SID=SV_5jOmvhINzRCO8a9

experimental participants had completed the study. We refer to the date of this payoff, identical for everyone, as the Early Period. Money allocated to traditional savings was paid exactly 10 weeks after the Early Period (henceforth referred to as the Later Period) and included the principal investment plus interest. Across the decisions the simple interest rate $r$ was 5, 10 or 20 percent.

Money allocated to the lottery affected the odds that the subject would win a $1,000 jackpot; if the subject did not win the lottery they received nothing for the lottery payoff. Across the decisions, we varied the lottery odds to be either bad (each dollar spent on lottery tickets had an expected payoff of $0.90), fair (each dollar had an expected payoff of $1.00) or good (each dollar had an expected payoff of $1.10). The realization of the outcome of the lottery and subsequent payoff was at the same time as the payoff for the traditional savings account in the Later Period.[5] To ensure that subjects knew that the odds of the lottery were legitimate, we had the outcome be a function of information released publically on the day of the jackpot payoff that they could check.[6]

Money allocated to the PLS account provided a guaranteed payoff of the principal investment plus entry into a lottery that had a payoff of $1,000. To make the total payoff to the PLS account comparable to the traditional savings account, we set the expected value of the PLS account for each dollar invested ($1+p_{PLS}$*$1,000) equal to either $1+0.9r$ (*bad PLS odds*), $1+r$ (*fair PLS odds*) or $1+1.1r$ (*good PLS odds*). Thus, the bad, fair and good PLS odds ($p_{PLS}$) were 0.09%*$r$, 0.1%*$r$ and 0.11%*$r$, respectively. We varied the interest rate and the lottery and PLS odds in order to examine the demand for the PLS account under a variety of market conditions in which traditional savings, the lottery and the PLS account would each be more or less attractive relative to the other options.

The order of the decisions was the same for everyone. Before we had subjects make the decisions that we use for analysis, we had them make a series of decisions to give them experience with the different products, but with fewer allocation options. In the first three decisions subjects allocated their budget between only cash in the early period and traditional

[5] We made this choice to simplify the task for subjects and to have just one future payoff date to resolve all uncertainty. The fact that the lottery payoff is in the future also reflects the real world, in that state lotteries have a similar future payoff structure. Moreover, the empirical literature on household savings treats lottery expenditures in survey data as consumption when calculating savings, hence we also treat lottery expenditures as consumption.

[6] Specifically, subjects who allocated money to the lottery received a randomly determined range of numbers that was proportional to 1,000,000. For example, if a subject had a 5 percent chance of winning the $1,000 jackpot, then they were given a range that included 50,000 possible numbers. The individual would then win the $1,000 jackpot if their range of numbers included the number whose first two digits were the last two digits of the Dow Jones Index followed by the last two digits of the NASDAQ index followed by the last two digits of the S&P index. We estimated that all six digits were approximately random and equally likely to occur, thus all numbers between 0 and 999,999 were approximately equally likely. We also gave subjects a web address where the three index numbers would be available for them to check.

savings (one decision for each interest rate). In the next three decisions subjects allocated their budget between only cash and the lottery (one decision for each of the good, fair and bad lottery odds). These first six decisions provided subjects with experience making choices with all the potential options other than the PLS account.

The next nine decisions let subjects allocate their budget between cash, traditional savings and the lottery. The nine decisions examined every combination of the three interest rates and three lottery odds. These decisions provide a baseline for the portfolio allocation without the PLS account. The final fifteen decisions included the option to invest in the PLS account in addition to the three other options of cash, traditional savings and lottery. Table 1 indicates the fifteen portfolio allocation situations we gave to subjects and the corresponding PLS odds. The fifteen decisions included every combination of the interest rate and PLS odds when the lottery odds were fair. We also included three PLS odds conditions where the lottery odds were bad and the traditional savings account offered a 5% return, and three where the lottery odds were good and the traditional savings account offered a 20% return. We chose to not include all 27 potential combinations of interest, lottery odds and PLS odds not only to reduce the time and cognitive effort of the experiment to avoid subject fatigue, but also because the omitted decisions involved situations in which the lottery odds were bad and the traditional savings account paid a high interest rate or the lottery odds were good and the traditional savings account paid a low interest rate; we anticipated that in these conditions subjects would be least likely to allocate their budget to both the lottery and traditional savings, and so would not be as interesting to the question of how the PLS account affects reallocation.[7]

[Insert Table 1]

For each decision, subjects could allocate their portfolio in $20 increments to each of the available alternatives.[8] The amount allocated to each option had to add up to exactly $100 for each decision before the subject could continue to the next decision. While past experiments examining inter-temporal choice have more commonly required money to be allocated either all in the present or all in the future, the current approach allows subjects to smooth their asset portfolio. Andreoni and Sprenger (2012) introduced the method used here to "convexify" the portfolio allocation over time, while Andreoni, Kuhn and Sprenger (2013)

[7] Across the first nine decisions before the PLS introduction, 27% of our subjects allocated their money to all three possible options, and 65% allocated a positive amount to at least two of the three options. Detailed statistics are reported in Appendix Table 1.

[8] As a robustness check we also conduct a similar experiment with a continuous budget set. Results are presented in section (3.3.2).

implement a discretized version similar to the approach that we adopt here. Our approach further allows us to observe not only the likelihood that someone invests in a PLS account, but also the intensity of the investment (e.g., investing 20% or 100% of their budget).

After all the portfolio allocation decisions were completed, a short survey was given to collect demographic information as well as information on subjects' financial circumstances and savings behavior. The entire study took on average 45 minutes (standard deviation 4 hours and 38 minutes) to complete. The high standard deviation is due to a few outliers who took more than 4 hours to complete the survey. These long-time to complete outliers represent less than 1 percent of our sample ($n$=5) and excluding them reduces the mean to 24 minutes and standard deviation to 19 minutes.[9]

We used two sources to recruit subjects. The first was Study Response (SR), an online panel that has been used in past experimental work and whose subject characteristics reflect the U.S. population. For this population, we randomly chose one of each subject's decisions at the end of the experiment, and the subject was paid for this decision with a 10 percent chance, otherwise they received a fixed participation fee. We varied the fixed participation fee to be either $8 or $12. The advertisement for participation indicated either a $12 or $8 payment in order to observe whether the lower participation fee would attract a disproportionately lower income sample of participants. However, as shown below, the difference in the advertised participation payment had no effect on either the participation rate or any of the characteristics of the SR participants.

The second source for recruitment was Amazon Mechanical Turk (MTurk), an online labor market panel who sign up for short duration projects with a very low fixed participation fee (usually under $2 per hour). For these subjects, we were unable to vary the payment based on the decisions they made due to MTurk payment rules, so we ran the identical study except that we added one initial page that informed subjects they would get the standard MTurk fixed payment rate (and would not get paid for any of their decisions), but asked them to make decisions as if they would get paid according to the instructions. Otherwise, the experiment was identical for the two groups. We chose to include the MTurk population since, as we will show below, the MTurk population[10] has both lower income and less savings, which provides us with a larger sample of the at-risk population that we wish to

[9] One reason why subjects may take so long is that they may begin the study but then take a break and return to it later (we do not observe if this occurs, but is presumed to occur occasionally with online studies). The analysis presented in this paper includes all subjects including the long-time to complete outliers, however all of our results are robust to excluding these observations. Results are available upon request.

[10] We restrict our survey to only MTurk users from United States.

study. As we will show below, the behavior of the MTurk sample is remarkably similar to the incentivized SR participants. Moreover, Horton, Rand and Zeckhauser (2011) find that the results from three common laboratory experiments (a loss-gains experiment, a prisoners' dilemma game and dictator game) are replicated using an MTurk population, and Garbarino and Slonim's (2006, 2009) results from the SR population also replicate laboratory results.

Table 2 presents the population characteristics. Column 1 shows the MTurk sample, Column 2 shows the combined SR sample, and Columns 4 and 5 show the $8 and $12 SR samples separately. *t*-tests (Column 6) show that none of the characteristics differ between the SR $8 and $12 populations, and Column 3 indicates that the MTurk population differs systematically from the SR respondents as anticipated. MTurk respondents most importantly have lower income, are less likely to be employed, are younger and have less money in savings. Thus, the MTurk population includes a higher proportion of individuals with low reported savings who are thus at greater risk for routine consumption shocks. Throughout the analyses we will always control for the characteristics presented in Table 2.

[Insert Table 2]

At the end of the experiment, we asked respondents whether they would be interested in investing in PLS accounts.[11] Table 3 reports the descriptive statistics for this question. This analysis is a useful replication of Tufano et al. (2011), with the notable difference being that our respondents have experience with PLS accounts during the experiment and therefore have better knowledge about this saving product.

The first four columns of the table report univariate differences between respondents. In total, 26% of participants expressed no interest in PLS accounts, 7% responded "Don't know" and 12% of respondents expressed a positive interest in investing in PLS. The largest proportion of participants, 56%, responded that their decision to invest would be determined by the actual PLS product characteristics (prizes, odds of winning etc.). The cross tab also shows that men, younger persons, unemployed individuals, people with lottery expenditures greater than $150 and people with low savings (less than $10,000) show slightly higher demand for PLS accounts. These results are consistent with Tufano et al (2011). The last two columns of the table report the multivariate logistic regression of expressing an interest in PLS accounts on demographic and socio-economic characteristics. Odds ratios reported on Column 5 compare the interested individuals to all others (namely the individuals who

[11] The exact wording of the question is "Would you invest money in a prize linked savings (PLS) product if a financial institution offered it?"

responded “No”, “depends on the actual product offered” and “Don’t know”). Column 6 combines the individuals who responded “Yes” and “depends on the actual product offered”; the odds ratio compares these individuals with those who were not interested or did not know. The results are again similar to Tufano et al (2011) in that high lottery expenditure and low levels of savings are predictive of greater PLS interest. These results are also important to confirm that our working sample is similar to the ones studied in the field.

[Insert Table 3]

Assuming demand for the PLS, our aim is to shed light on three important policy questions that have not been addressed in the literature previously. First, does the introduction of PLS generate net new saving (rather than a re-allocation of savings that would have happened anyway)? Second, if the PLS account increases total savings, what are the sources of these expenditures? Third, are there heterogeneous impacts of PLS; in particular, is there an effect on low income households who are most at risk?

These are obviously important questions in the savings literature,[12] yet they have been difficult to answer. One obstacle is the need to find appropriate micro level data to evaluate the total savings and consumption of individuals across time. The ideal data should be longitudinal in order to determine whether the funds in PLS accounts are new savings or not. The longitudinal data would need to be very detailed and collected from a representative sample of the general population. To obtain such information from the field would be difficult and expensive whereas it is relatively easy and affordable in our online experiment.

The next section summarizes the predictions of neoclassical and behavioral economics on the potential effects of the introduction of PLS accounts on household portfolios.

### 2.1 Hypotheses

The introduction of the PLS alters the choice set for individuals, who now have the option of investing in a novel financial product which possesses the salient features of lottery tickets, with the appeal of skewness, and traditional savings, with liquidity and security of principal. Tufano (2008) and Pfiffelmann (2008) present thorough theoretical discussions of the appeal of such a hybrid financial product to savers. In order to understand the implications of these discussions on the household portfolio allocation decision, consider a generic utility maximization problem. Prior to the introduction of the PLS product, subjects

[12] For example, there is little consensus over whether tax-favored savings accounts led to real increases in net savings in U.S.: Poterba, Venti and Wise (2006) argue that savings in these accounts are largely new savings, whereas Engen, Gale and Scholz (1996) conclude the opposite.

can allocate shares $\alpha$, $\beta$, and $\theta$ of their budget to current consumption ($C$), traditional savings ($S$) or lottery expenditures ($L$) and obtain utility $U(\alpha C, \beta S, \theta L)$ subject to $\alpha+\beta+\theta=1$. With the option to invest in the PLS account, individuals can also allocate $\gamma$ into the PLS asset and obtain utility $U(\alpha^* C, \beta^* S, \theta^* L, \gamma^* PLS)$ subject to $\alpha^*+\beta^*+\theta^*+\gamma^*=1$. The hypotheses are:

*H1*: The PLS product may attract loss averse individuals, leading them to reallocate funds from the lottery and consumption to the PLS. *Hence, expenditure on lottery tickets and consumption may decrease:* $\theta^* \leq \theta$ *and/or* $\alpha^* \leq \alpha$.

Loss averse individuals (Tversky and Kahneman, 1992) may allocate some of their funds from lottery or consumption to PLS due to the security of principal offered by the PLS. In addition, individuals might choose to take a risk on small gambles but not on large ones (Pfiffelmann, 2008), hence we may observe a shift from consumption to the PLS, in which the risk is to the loss of potential interest but not the principal.

*H2:* After the introduction of PLS, individuals may reallocate some savings from traditional savings to PLS. *Therefore traditional savings may decrease:* $\beta^* \leq \beta$.

Savers who have a preference for skewness in returns may allocate some of their funds to PLS, which offers the same expected return but with a small chance of winning large amounts (Freidman and Savage, 1948).

*H3: Total savings may increase:* $\beta^* + \gamma^* \geq \beta$.

If the money allocated to the PLS is sourced from current consumption or lottery expenditure, then PLS increases total savings. There is also the possibility that the introduction of PLS may generate new savers (who would not have saved without PLS).

In order to determine whether the PLS leads to genuinely new savings, we need to confirm that (*H1*) is true. Moreover if the majority of demand for PLS comes from existing savings (*H2*), this may adversely affect individual's future welfare, since their future resources might have been lowered. We empirically investigate these issues using our experimental data.

## 3 Results

We first examine whether the introduction of PLS accounts increase total savings of subjects and then the sources of the increase in total savings. Specifically, we examine whether the PLS accounts reduce consumption and lottery expenditures, and hence generate new net savings. We present our results for the full sample as well as a restricted sample that includes only the participants with $0 reported savings on our survey, who are the target population for PLS. Finally, we do a series of robustness checks of our results.

### 3.1 Total savings

[Insert Figure 1]

Figure 1 shows the mean amount allocated to total savings before and after the introduction of the PLS. From this figure it is clear that across all groups, total savings increase substantially after the introduction of the PLS. In the full sample, participants on average increased their savings by 25 percent (by $12 from $48 to $60). Most importantly, we see the highest increase for subjects with reported savings of $0. For this group, total savings increased by $16.2 (approximately 40 percent given that the mean of their savings before PLS is $41). To test whether these differences are statistically significant, we estimate the following fixed effects model:

$$TS_j^i = X_j\beta + \alpha P_j + \delta^i + e_j^i \quad \textbf{(1)}$$

Note that $i$ indexes individual and $j$ indexes the decision; $e_j^i$ is a regression disturbance. The variable $TS_j^i$ represents the level of total savings of individual $i$ in decision $j$. This is the sum of money that is allocated to interest bearing savings and PLS. $P_j$ is a dummy variable which is equal to 1 when the PLS is introduced. $X_j$ is a vector containing the price variable indicators – *fair PLS odds and good PLS odds, fair lottery odds and good lottery odds,* and *10 percent interest rate and 20 percent interest rate* – where *bad PLS odds, bad lottery odds* and *5 percent interest rate* are taken as the base case. $\delta^i$ is an individual fixed-effect. We estimate this fixed effects model (equation (1)) by linear regression.[13] Since we are also interested in the effect of PLS on non-savers, we re-estimate equation (1), focusing on only

[13] A statistical issue arises from the fact that total savings are bounded between 0 and 100. To address this, one can employ two-limit Tobit estimation (with upper and lower limits at 100 and 0). However nonlinear panel data models with fixed effects are widely understood to be biased and inconsistent (Hahn and Newey, 2004 and Wooldridge, 2002). Further, random effects will not solve any of the problems of omitted variable bias. Nevertheless, we also estimated fixed effect Tobit models and Tobit models with additional controls, the marginal effects from these regressions are very close to our estimates. They are available upon request.

the extensive margin. In particular, we estimate a probit model for participation in savings to examine the effect of PLS while holding the personal characteristics constant.

[Insert Table 4]

Table 4 presents the estimates from equation (1). The top panel reports estimates for the full sample and the bottom panel reports estimates for the restricted sample that includes only participants with $0 reported savings. For each panel, Column 1 presents estimates without price variables; Column 2 adds these additional price controls. The probit estimates are reported in Column 3, and marginal effects calculated at the mean of the data are reported in Column 4. In both panels, and all three specifications, the dummy variable for the introduction of PLS is positive and significant at the 1 percent level of significance. Column 1 shows that PLS increases total savings in the full sample by $12 on average. The specification with the full price vector, Column 2, shows that (i) when lottery odds improve total savings decrease and (ii) when the interest rate increases from 5% total savings increase. More importantly, after controlling for these price variables, PLS still increases total savings by approximately $12 (or, since the mean of savings before PLS is about $48, by around 25 percent). In this specification, the coefficient for *Good PLS odds* is positive and significant at the 10 percent significance level, which indicates that the presence of a PLS product with a greater expected return than traditional interest-bearing savings increases total savings even further compared to the PLS with *bad* odds (which is the base case). However, this is only a small increase of less than a dollar. We also do not see any additional effect of offering *fair* odds for PLS compared to the base case of bad odds. This indicates that it is the availability of PLS products and not their expected return relative to lottery or traditional savings that encourages savings in our experiment.

The probit estimates are qualitatively similar to the OLS estimates. The marginal effects in the last column indicate that the introduction of the PLS reduces the likelihood of saving $0 by approximately 6 percent. The results are strongly statistically significant and in accord with the prediction that PLS induces savings amongst subjects who did not previously save, thus generating new savers.

As noted above, we also present results for a restricted sample that includes individuals with low level of reported savings. Panel B of Table 4 indicates that our basic results hold more strongly for the restricted sample.[14] In particular, the introduction of PLS increases total

[14] We test whether this difference is significant by estimating equation (1) with interactions for the PLS savers by $0 reported savings. The difference of the PLS interaction effect is $4.74 (P-value 0.110).

savings by approximately $15 in this group (or, since their mean experimental savings before PLS is about $41, 36 percent) and reduces the likelihood of not saving by 11 percentage points. The magnitude of this effect is comparable to that of the widely used policy instrument of the interest rate. For example, increasing the interest rate from 5% to 20% increases average total savings by a smaller amount ($14) than introducing the PLS. Thus, this is a strong effect.

### 3.2 Sourcing PLS demand

In section 3.1, we established that the introduction of the PLS account increases the average total savings of our participants and especially of low income participants (*H3*). The critical question left unanswered is what are the sources of these new funds? In other words, how much are consumption and lottery expenditures (*H1*) reduced, and how are traditional savings affected (*H2*)?

In order to address these questions, we analyzed the effect of the introduction of PLS on participants' portfolio allocation decisions for current consumption, lottery expenditures and traditional interest-bearing savings. We estimated the following fixed effects model:

$$Y_{jk}^{i} = X_{jk}\beta_k + \alpha_k P_j + \delta^i + e_{jk}^{i} \quad \textbf{(2)}$$

The variable $Y_{jk}^{i}$ represents the amount allocated to resource $k$ (current consumption, traditional savings or lottery) by individual $i$ in decision $j$, and the right-hand side variables are as defined in equation (1).

Table 5 shows that for both samples, the average allocation to all assets decreased after the introduction of PLS. Proportional to mean pre-PLS allocations, we observe the smallest decline in traditional savings. It decreased by only 9 percent, whereas current consumption and lottery expenditure both decreased by approximately 23 percent. The results are much stronger in the restricted sample. First, in this sample we do not observe any significant decline in traditional savings after the introduction of PLS. Second, both consumption and lottery expenditures are reduced by larger amounts, by 26 and 24 percent of their pre-PLS means respectively.

[Insert Table 5]

PLS price indicators show that subjects find the introduction of PLS sufficient to delay their consumption, as the price variables do not elicit a response significantly different from

zero for current consumption. Thus, when subjects' choice set is altered with the introduction of the PLS, they are "nudged" towards saving more regardless of the return of the PLS product. However both lottery expenditures and traditional savings are affected by the PLS odds. In the full sample, when the odds of winning the $1,000 PLS jackpot are good, subjects reduce their traditional savings by an additional $2.4 (or 4.5 percent of the pre-PLS mean), and their lottery ticket expenditure decreases by an additional $1. This is in accord with the idea that the PLS is considered an alternative to both savings and lottery.

Another important question is the effect of PLS on the future resources of subjects. This is of interest since our results show that subjects forego some of their certain interest income (by reducing their traditional savings) in favor of the PLS with a partially uncertain future income. We investigate this issue by computing the total amount of guaranteed future savings (that is, $Traditional\ Savings_i*(1+r_j) + PLS_i$) and examining the change in this measure with the introduction of the PLS. The results[15] show that the introduction of PLS again causes substantial increases in the guaranteed future savings measure by $11 and $14 in the full and restricted samples respectively. Overall, these results are compatible with the hypothesis that PLS generates new savings, and that most of the demand for the PLS comes from reductions in lottery expenditures, as well as current consumption. We further find that these results are again much stronger among participants with the lowest reported savings.

### 3.3 Further checks

There are some potential concerns with our results, which are as follows. First, since PLS accounts were only offered to subjects when the three other alternatives were also available, it is possible that the observed reallocation of funds toward PLS could be partly attributable to a 1/*N* heuristic. Second, our participants come from two different online panels, MTurk and Study Response. Since the payment mechanisms differ in these two panels, the introduction of PLS may have differential effects between the two groups. Third, the discretization of the choice set into increments of $20 may have caused the effect of PLS to be overstated. In this subsection we address these three issues.

#### 3.3.1 1/*N* heuristic

While our results suggest that there is a strong latent demand for prize-linked savings, one potential confounding explanation is that increasing the choice set from three to four

[15] In the interest of brevity we do not report these results, however they are available upon request.

options by introducing PLS accounts results in a reallocation into the fourth option (regardless of what it is) and that this reallocation comes from reduced demand for the other three options. There is some empirical evidence (see for example De Miguel et.al (2009)), suggesting that this naïve asset allocation rule, in which a fraction $1/N$ of wealth is allocated to each of the $N$ available assets, plays an important role in real world investment decisions. Although we show that the main source of PLS demand comes largely from one specific alternative (namely lottery), rather than the two others, we ran an additional experiment to investigate the effect of such a heuristic. In this experiment we compare three three-option choice sets: one with consumption, lottery, and savings, one with consumption, lottery, and a PLS account and one with consumption, savings, and a PLS account. These latter two choice sets replace the lottery or savings option in the first choice set with a PLS account. Given that the expected value of the PLS is constant,[16] comparing the first choice set with the latter two choice sets provides a clean test of the $1/N$ heuristic. If the $1/N$ heuristic plays an important role in our main result, then we should not observe a change in total savings across choice sets in the new experiment. On the other hand if the $1/N$ heuristic is not the main driving force, we should observe significant changes in total savings when the PLS is introduced. Specifically, in the case where the traditional savings account is replaced by a PLS account, we should not observe a reduction in total savings. This is because the jackpot attached to the PLS account provides a greater motivation to save than a fixed interest rate does, hence savings should be higher with a PLS as the only savings option than it is with a traditional savings account. If this is true, then it supports the interpretation that even in the absence of a $1/N$ heuristic, the introduction of PLS increases total savings.

The basic design and procedures are the same as the first MTurk experiment (section 2). We fix the interest rate at 10%, and thereby shorten the survey to fifteen decisions.[17] All subjects are initially asked to allocate their budget between cash, traditional savings and the lottery. Following these three decisions, subjects randomly face one of two choice set options, allocating their budget either to cash, traditional savings and the PLS account (three decisions), or to cash, lottery and the PLS account (nine decisions). In the last stage, subjects face the remaining choice set which that they did not see in the second stage, therefore all

[16] This means that when the savings option is not available, the PLS account has the same expected return as the savings account (and similarly when the lottery option is not available).

[17] As in our main experiments, prior to these fifteen decisions we provided six decisions in which subjects made choices with each of the potential options other than the PLS account.

subjects make decisions in all three choice sets. 110 subjects were recruited on MTurk, following the same procedures followed in our main experiment.[18]

[Insert Figure 2]

Figure 2 shows the mean allocations to total savings in the three choice sets, and in the base MTurk experiment. It is clear that the portfolio allocation in the pre-PLS stage is very similar between our base and new experiments. Across all choice sets, total savings increase after the introduction of the PLS. In the case where the lottery is replaced by PLS we see the largest increase ($19). More importantly, participants also increased their savings on average by 16 percent (by $7.7 from $45.6 to $53.3) when the savings account is replaced by a PLS account. It is important to note that in this case the average consumption stays the same, hence the main source of demand for PLS comes from lottery consumption.

To test whether these differences are statistically significant after controlling for lottery and PLS odds we estimate the fixed effects equation (1). Full results are presented in Appendix Table 3. In summary, the results show that even in the absence of any 1/*N* heuristic, the introduction of PLS still increases total savings by approximately $7.9 (*p*-value 0.07) when the traditional savings account is replaced by PLS, and by $17 (*p*-value 0.00) when the lottery is replaced by PLS. These findings confirm that our main results are not driven by a simple 1/*N* heuristic.

### 3.3.2 Payment mechanisms

MTurk subjects were compensated using a flat-fee system with subjects receiving a $1.50 fee for completing the experiment. For the Study Response (SR) population, at the end of the experiment one decision was randomly chosen and a subject was paid for this decision with a 10 percent chance, otherwise they received a fixed participation fee. We varied the fixed participation fee (in the event that a subject was not paid for one of their decisions) to be either $8 or $12. This raises the possibility of differential responses to the introduction of PLS between the MTurk and Study Response groups. To analyze this issue, we estimate following model:

$$TS_j^i = \beta_0 + \beta_1(SR8)^i + \beta_2(SR12)^i + \alpha_1 P_j + \alpha_2[P_j x(SR8)^i] + \alpha_3[P_j x(SR12)^i] + e_j^i \quad \textbf{(3)}$$

[18] We excluded 15 subjects who completed the experiment previously. Descriptive statistics for the sample are presented in Appendix Table 2.

where the group dummy variables indicate that an individual is recruited from the $8 or $12 SR groups (with MTurk as the omitted base case). We interact these dummy variables with the PLS dummy to capture the differential responses of the groups to the introduction of PLS.

Column 1 of Table 6 shows that the Study Response groups save less and respond more weakly to the introduction of PLS than the MTurk group, however none of these differences are statistically significant. There is also no statistically-significant difference between the savings behavior of the two Study Response groups ($p$-value of 0.75 for the $t$-test of difference in PLS response). For completeness we present results separately for the MTurk and Study response groups. Columns 3 and 4 show that in the Study Response groups, the introduction of PLS statistically significantly increases savings by $7 (15 percent of pre-PLS mean). The PLS increases MTurk participants' savings by more than the SR groups and by approximately the same amount as our restricted sample of low saving participants.

These results are not surprising: as we showed in Table 2, the two Study Response groups share similar characteristics and differ systematically from the MTurk population. Most importantly, MTurk respondents have less money in savings and are less likely to be employed. Thus, the MTurk population includes a higher proportion of individuals with low income and low savings, and is therefore similar to our restricted sample where we observed a larger response. Overall, we find significant effects of PLS regardless of the sample used.

[Insert Table 6]

### 3.3.3 Continuous choice set

In our main experiment, subjects are allowed to allocate their portfolio in $20 increments to each of the available choices. We chose this discretization to simplify the communication of the odds of winning the lottery and PLS, and hence make the task less cognitively demanding. This raises two potential concerns. First, our estimates may overstate the magnitude of the effect of the PLS. Second, the decisions on the intensive margins might be ignored and subjects might have been forced to make arrangements on the extensive margins (i.e. since they cannot shift $1, they may choose $0 on one allocation and $20 on another). In order to investigate these issues, we conduct a follow-up experiment in MTurk with continuous budget sets. The design and procedures of this experiment are the same as the main MTurk experiment (section 2). The only change is that we omit the 5% interest rate, and therefore shorten our survey to eighteen decisions. Subjects are allowed to allocate any

integer amount between 0 and 100 to each of their choices. 737 subjects were recruited on MTurk, following the same procedures followed in our main experiment.[19]

Appendix Table 4 presents the full results for our models of total savings (equation (1)) and portfolio allocation (equation (2)). In summary, the results indicate that our basic results hold (although slightly more weakly) in the continuous choice sets. In particular, the introduction of PLS increases total savings by approximately $9 and reduces the likelihood of not saving by 3 percentage points in the full sample. Both of these results are highly significant. The results for the restricted sample are also very similar to our base results. When we examine the portfolio allocations of participants, we see that lottery and consumption expenditures decrease more than traditional savings after the introduction of PLS. We thus conclude that our basic results are not driven by the use of a discrete choice set.

## 4 Conclusion

This paper explores the introduction of a novel financial product, PLS, which exploits the broad appeal of lottery tickets to influence individuals' choice to save. By using an online experiment, we examine the effect of the introduction of PLS on individuals' portfolio allocations. Our results show that the introduction of PLS indeed increases total savings quite dramatically (on average by 12 percentage points), and that the demand for the PLS account comes from reductions in lottery expenditures as well as current consumption. Hence PLS leads to genuinely new savings, and even generates new savers. We further show that these results are stronger among participants with the lowest levels of savings and income, who are targeted by savings policies**.**

The results suggest that PLS accounts offer a viable approach to increase savings generally, but especially among those who are most at risk for routine shocks. The availability of PLS products from the private sector could "nudge" households towards saving more in the same manner that the framing of choices and the setting of default options has been shown to have an effect on other household decisions (Thaler and Sunstein, 2008), without having to either mandate changes in savings behavior or involve potentially costly government programs.

[19] Descriptive statistics for this sample are presented in Appendix Table 2.

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**FIGURE 1. Mean Total Savings Before and After the Introduction of PLS**

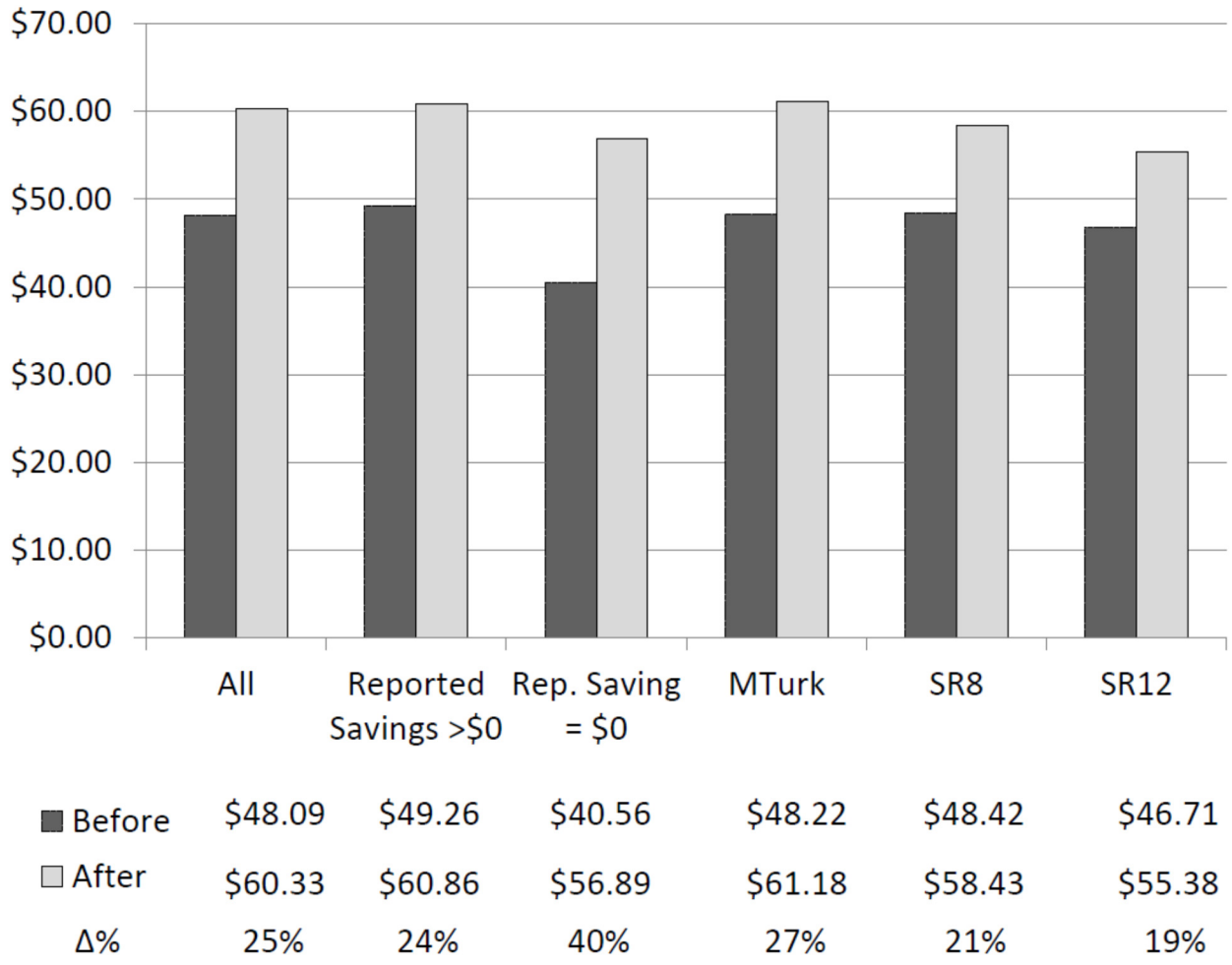
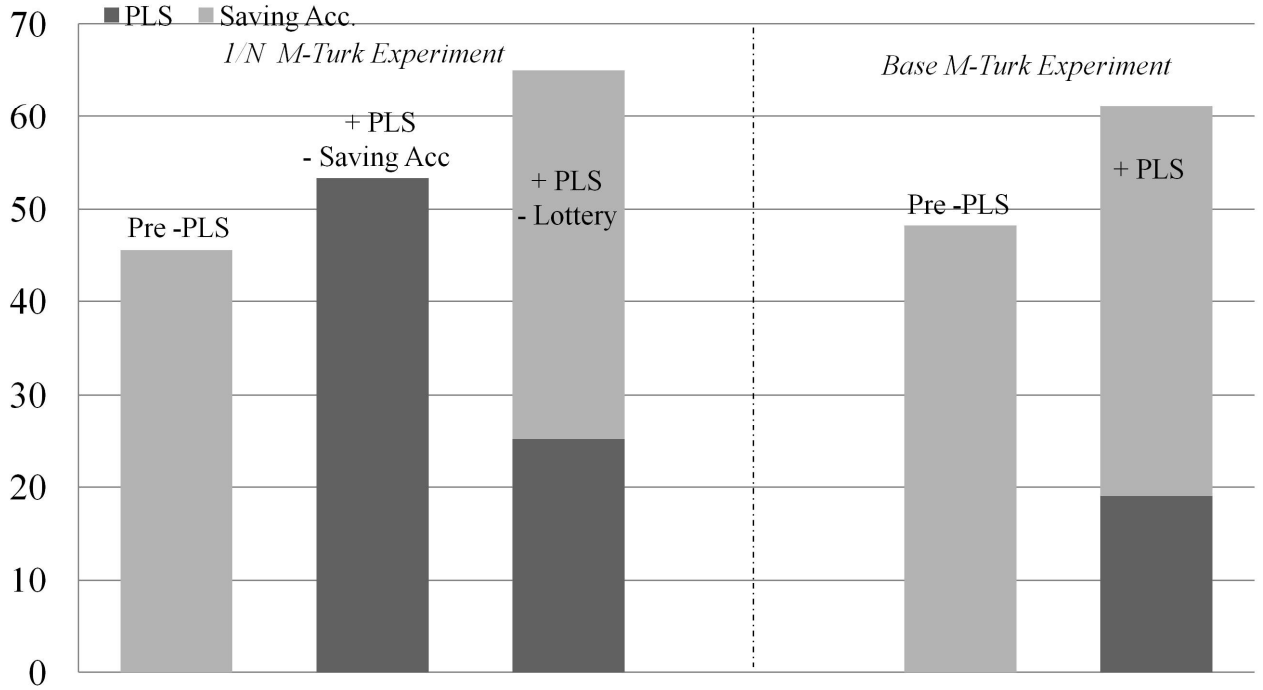


**FIGURE 2. Mean Total Savings Before and After the Introduction of PLS: 1/*N* Heuristic**




*Panel B: Mean Allocations ($)*

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Saving | 45.57 | *NA* | 39.87 | 48.22 | 42.13 |
| PLS | *NA* | 53.31 | 25.15 | *NA* | 19.05 |
| **Total Saving** | **45.57** | **53.31** | **65.02** | **48.22** | **61.18** |
| | | | | | |
| Consumption | 36.12 | 35.81 | 34.96 | 32.38 | 24.41 |
| Lottery | 17.81 | 10.88 | *NA* | 19.40 | 14.41 |

**Notes to Figure 2:**

Column 1 is the mean allocation of total savings when subjects' choice sets consist of consumption, lottery tickets, and savings account. Column 2 presents the mean allocation of savings when a PLS account replaces the savings account in the subjects' choice sets. Column 3 shows the allocation when a PLS account replaces the lottery in the subjects' choice sets. Columns 4 and 5 show the mean allocation of savings in our base MTurk experiment.

## TABLES

**Table 1. Experimental Conditions after PLS Introduction**

| | | **Lottery Odds Bad** | | | **Lottery Odds Fair** | | | **Lottery Odds Good** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ***r*=5%** | *r*=10% | *r*=20% | ***r*=5%** | ***r*=10%** | ***r*=20%** | *r*=5% | *r*=10% | ***r*=20%** |
| **PLS odds (%)** | **Bad** | .0045 | | | .0045 | .009 | .018 | | | .018 |
| | **Fair** | .005 | | | .005 | .01 | .020 | | | .020 |
| | **Good** | .0055 | | | .0055 | .011 | .022 | | | .022 |

**Notes to Table 1:**

1. Table 1 presents the combinations of interest rates, PLS odds and lottery odds used in the experiment. For example, the second row in the last column represents the scenario where the interest rate is 20%, lottery odds are good (each dollar spent on the lottery had an expected payoff of $1.10) and the PLS odds are 0.02%.
2. Bad lottery odds means that each dollar spent on lottery tickets had an expected payoff of $0.90, fair lottery odds means each dollar had an expected payoff of $1.00 and good means each dollar had an expected payoff of $1.10.

**Table 2. Descriptive Characteristics**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **MTurk** | **Study Response** | *Difference (1)-(2) t-test p-Value* | **$8 Group** | **$12 Group** | *Difference (4)-(5) t-test p-Value* |
| **Gender** | | | | | | |
| Male | 0.47 | 0.51 | 0.000 | 0.53 | 0.50 | 0.171 |
| Female | 0.53 | 0.49 | | 0.47 | 0.48 | |
| **Age** | | | | | | |
| 18-25 | 0.29 | 0.04 | 0.000 | 0.05 | 0.02 | 0.322 |
| 26-45 | 0.53 | 0.48 | 0.301 | 0.54 | 0.41 | 0.303 |
| 46-65 | 0.17 | 0.42 | 0.000 | 0.35 | 0.48 | 0.160 |
| Over 65 | 0.01 | 0.06 | 0.000 | 0.05 | 0.07 | 0.682 |
| **Marital Status** | | | | | | |
| Single | 0.52 | 0.30 | 0.001 | 0.33 | 0.27 | 0.730 |
| Married | 0.40 | 0.58 | 0.000 | 0.58 | 0.59 | 0.912 |
| Divorced | 0.08 | 0.12 | 0.178 | 0.11 | 0.13 | 0.745 |
| **Education** | | | | | | |
| Less than High School | 0.01 | 0.02 | 0.417 | 0.04 | 0.00 | 0.160 |
| High School | 0.38 | 0.27 | 0.038 | 0.28 | 0.25 | 0.715 |
| Bachelor's degree | 0.41 | 0.43 | 0.534 | 0.42 | 0.45 | 0.493 |
| Technical | 0.07 | 0.09 | 0.616 | 0.07 | 0.11 | 0.519 |
| Postgraduate | 0.14 | 0.19 | 0.000 | 0.21 | 0.18 | 0.036 |
| **Employment** | | | | | | |
| Full-time | 0.39 | 0.82 | 0.000 | 0.82 | 0.82 | 0.657 |
| Part-time | 0.20 | 0.09 | 0.007 | 0.11 | 0.07 | 0.531 |
| Unemployed | 0.24 | 0.02 | 0.007 | 0.02 | 0.02 | 0.990 |
| Retired | 0.02 | 0.05 | 0.060 | 0.02 | 0.07 | 0.167 |
| Other | 0.15 | 0.02 | 0.000 | 0.04 | 0.00 | 0.160 |
| **Born in the USA** | 0.93 | 0.92 | 0.424 | 0.90 | 0.93 | 0.531 |
| **Reported Saving** | | | | | | |
| $0 | 0.15 | 0.09 | 0.104 | 0.12 | 0.05 | 0.198 |
| $1-$1,000 | 0.44 | 0.29 | 0.005 | 0.28 | 0.30 | 0.791 |
| $1,001-$2,000 | 0.11 | 0.12 | 0.708 | 0.15 | 0.09 | 0.272 |
| $2,001-$5,000 | 0.14 | 0.16 | 0.608 | 0.16 | 0.16 | 0.968 |
| $5,001-$10,000 | 0.07 | 0.13 | 0.044 | 0.09 | 0.18 | 0.157 |
| $10,001-$30,000 | 0.05 | 0.10 | 0.066 | 0.11 | 0.09 | 0.777 |
| Over $30,000 | 0.04 | 0.11 | 0.005 | 0.09 | 0.13 | 0.524 |
| ***N*** | **449** | **113** | | **57** | **56** | |

**Table 3. Survey of Interest in PLS Accounts**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | "Would you invest money in a prize linked savings (PLS) product if a financial institution offered it?" *Descriptive Statistics* | | | | Multivariate Logistic Odds Ratio | |
| | Yes | Depends | No | Don't Know | Yes (1) vs. Rest | (1) + (2) vs. Rest |
| | *12%* | *56%* | *26%* | *7%* | | |
| **Reported Saving** | | | | | | |
| $0 | 11% | 52% | 25% | 12% | 2.63 | 0.99 |
| $1-$1,000 | 12% | 57% | 24% | 7% | 2.67 | 1.45 |
| $1,001-$2,000 | 16% | 50% | 25% | 9% | 1.15 | 0.79 |
| $2,001-$5,000 | 7% | 63% | 26% | 4% | 1.47 | 1.68 |
| $5,001-$10,000 | 21% | 44% | 31% | 4% | 4.21* | 1.37 |
| $10,001-$30,000 | 6% | 71% | 18% | 6% | 0.79 | 2.30 |
| Over $30,000 | 7% | 47% | 46% | 0% | Base Case | b.c. |
| **Lottery Expenditure** | | | | | | |
| $0 | 12% | 47% | 34% | 7% | b.c. | b.c. |
| $1-$150 | 11% | 60% | 22% | 7% | 1.25 | 1.79*** |
| >$150 | 15% | 73% | 8% | 4% | 1.66* | 5.71*** |
| **Gambling** | | | | | | |
| Never | 13% | 49% | 30% | 8% | 1.50 | 1.05 |
| Other | 11% | 58% | 24% | 6% | b.c. | b.c. |
| **Financial Risk Profile** | | | | | | |
| Safe | 12% | 57% | 26% | 5% | b.c. | b.c. |
| Neutral | 10% | 55% | 25% | 10% | 0.71 | 0.73 |
| Risky | 18% | 52% | 25% | 5% | 1.04 | 0.93 |
| **Relative Wealth** | | | | | | |
| Much worse off | 7% | 54% | 32% | 7% | 0.15 | 0.34 |
| Somewhat worse off | 11% | 59% | 22% | 8% | 0.32 | 0.55 |
| About the same as others | 11% | 56% | 25% | 8% | 0.29 | 0.38* |
| Somewhat better off | 14% | 51% | 32% | 3% | 0.40 | 0.38 |
| Much better off | 23% | 23% | 18% | 5% | b.c. | b.c. |
| **Gender** | | | | | | |
| Male | 16% | 54% | 26% | 4% | 2.56*** | 1.16 |
| Female | 8% | 57% | 26% | 9% | b.c. | b.c. |
| **Age** | | | | | | |
| 18-25 | 15% | 55% | 23% | 6% | 2.24 | 0.70 |
| 26-45 | 12% | 55% | 26% | 6% | 1.72 | 0.63 |
| 46-65 | 8% | 54% | 28% | 10% | b.c. | 0.45 |
| Over 65 | 0% | 82% | 18% | 0% | b.c. | b.c. |
| **Marital Status** | | | | | | |
| Single | 12% | 59% | 23% | 6% | b.c. | b.c. |
| Married | 13% | 51% | 29% | 7% | 1.87* | 0.78 |
| Divorced | 4% | 62% | 28% | 6% | 0.46 | 0.89 |
| **Education** | | | | | | |
| High School or Less | 10% | 61% | 19% | 10% | b.c. | b.c. |
| Bachelor's degree | 10% | 60% | 21% | 9% | 1.19 | 0.98 |
| Technical | 15% | 50% | 31% | 4% | 1.54 | 0.75 |
| Postgraduate | 8% | 56% | 30% | 6% | 0.68 | 0.73 |
| **Employment** | | | | | | |
| Full-time | 12% | 58% | 25% | 5% | 1.28 | 1.42 |
| Part-time | 11% | 54% | 28% | 7% | 1.37 | 1.18 |
| Unemployed | 15% | 50% | 22% | 12% | 2.04 | 1.40 |
| Retired & Other | 8% | 56% | 32% | 4% | b.c. | b.c. |

**Notes to Table 3:**

1. The first four columns report responses to the PLS question broken down by the characteristics of respondents. The question asked is "Would you invest money in a prize linked savings (PLS) product if a financial institution offered it?"
2. Columns 5 and 6 report multivariate logistic regressions of expressing an interest in PLS on demographic and socio-economic characteristics. The odds ratios reported in column 5 compare the interested individuals with all others (this includes individuals who responded "No", "Depends on the actual product offered" and "Don't know"). Column 6 combines the individuals who responded "Yes" and "Depends on the actual product offered"; the odds ratios in this column compare these individuals with those who either were not interested or did not know.
3. Number of observations is 562. Pseudo $R^2$ is 0.095 for column 5 and 0.057 for column 6.
4. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

| Table 4. The effect of PLS Introduction on Total Allocation to Savings | | | | |
|---|---|---|---|---|
| ***Panel A*** *: Full Sample – (562 Subjects-13,488 observations)* | | | | |
| | **Linear Regression** | | **Probit** | |
| | $TS_j^i = X_j\beta + \alpha P_j + \delta^i + e_j^i$ | | $P(TS_j^i > 0) = F(X_j\beta + \alpha P_j)$ | |
| | (1) | (2) | Coefficients | Marginal Effects |
| **PLS introduced** | 12.24*** | 11.99*** | 0.28*** | 0.07 |
| | (0.99) | (0.98) | (0.04) | |
| **Fair PLS odds** | | -0.14 | -0.02 | -0.00 |
| | | (0.44) | (0.04) | |
| **Good PLS odds** | | 0.98** | 0.03 | 0.01 |
| | | (0.50) | (0.04) | |
| **Fair lottery odds** | | -0.72* | 0.01 | 0.00 |
| | | (0.42) | (0.03) | |
| **Good lottery odds** | | -2.78*** | -0.04 | -0.01 |
| | | (0.55) | (0.03) | |
| **10% interest rate** | | 8.64*** | 0.24*** | 0.06 |
| | | (0.84) | (0.03) | |
| **20% interest rate** | | 17.52*** | 0.45*** | 0.11 |
| | | (1.17) | (0.04) | |
| **Adjusted $R^2$** | 0.58 | 0.61 | | |
| **Fixed Effects** | Yes | Yes | No | |
| **Additional Controls** | No | No | Yes | |
| *Mean Allocation before PLS* | | *48.08* | | |
| *% of non-savers before PLS* | | *22%* | | |
| ***Panel B****: Restricted Sample – Individuals with reported savings of $0- (76 Subjects; 1,824 observations)* | | | | |
| | (1) | (2) | (3) | |
| **PLS introduced** | 16.33*** | 15.02*** | 0.44*** | 0.11 |
| | (1.17) | (2.89) | (0.10) | |
| **Fair PLS odds** | | 0.61 | -0.02 | -0.01 |
| | | (1.03) | (0.12) | |
| **Good PLS odds** | | 1.74 | 0.01 | 0.00 |
| | | (1.23) | (0.12) | |
| **Fair lottery odds** | | -0.22 | 0.02 | 0.00 |
| | | (0.95) | (0.08) | |
| **Good lottery odds** | | -0.14 | 0.03 | 0.01 |
| | | (1.18) | (0.09) | |
| **10% interest rate** | | 9.14*** | 0.27*** | 0.07 |
| | | (2.52) | (0.08) | |
| **20% interest rate** | | 14.25*** | 0.39*** | 0.10 |
| | | (3.18) | (0.10) | |
| **Adjusted $R^2$** | 0.59 | 0.61 | | |
| **Fixed Effects** | Yes | Yes | No | |
| **Additional Controls** | No | No | Yes | |
| *Mean Allocation before PLS* | | *44.66* | | |
| *% of non-savers before PLS* | | *29%* | | |

**Notes to Table 4:**

1. Additional controls are dummy variables for age, education, marital status, employment status, reported savings levels, and birth place of subjects. These are summarized in Table 2.
2. Robust standard errors clustered by subjects are in parentheses.
3. The base case in columns 2 and 3 is *bad PLS odds, bad lottery odds* and *5 percent interest rate.*
4. * $p$<0.1, ** $p$<0.05, *** $p$<0.01.

**Table 5. The effect of PLS Introduction on Portfolio Allocation**

$$Y_{jk}^{i} = X_{jk}\beta_k + \alpha_k P_j + \delta^i + e_{jk}^{i}$$

***Panel A*** *: Full Sample – (562 Subjects-13,488 observations)*

| | **Current Consumption** | **Lottery Expenditure** | **Traditional Savings** |
|---|---|---|---|
| | (1) | (2) | (3) |
| **PLS introduced** | -7.13*** | -4.86*** | -4.95*** |
| | (0.85) | (0.68) | (1.05) |
| **Fair PLS odds** | 0.34 | -0.18 | -1.25*** |
| | (0.39) | (0.32) | (0.42) |
| **Good PLS odds** | 0.06 | -1.04*** | -2.43*** |
| | (0.47) | (0.36) | (0.60) |
| **Fair lottery odds** | -2.33*** | 3.06*** | -0.76* |
| | (0.34) | (0.43) | (0.40) |
| **Good lottery odds** | -3.11*** | 5.89*** | -3.17*** |
| | (0.43) | (0.58) | (0.49) |
| **10% interest rate** | -7.22*** | -1.44*** | 10.74*** |
| | (0.75) | (0.48) | (0.93) |
| **20% interest rate** | -14.00*** | -3.54*** | 19.56 |
| | (0.87) | (0.63) | (1.23) |
| **Adjusted $R^2$** | 0.62 | 0.53 | 0.60 |
| Fixed Effects | Yes | Yes | Yes |
| *Mean Allocation before PLS* | *31.5* | *20.42* | *48.08* |

***Panel B****: Restricted Sample – Individuals with reported savings of \$0- (76 Subjects; 1,824 observations)*

| | **Current Consumption** | **Lottery Expenditure** | **Traditional Savings** |
|---|---|---|---|
| **PLS introduced** | -9.53*** | -5.48*** | -3.08 |
| | (2.48) | (1.94) | (2.74) |
| **Fair PLS odds** | -0.12 | -0.50 | -0.45 |
| | (1.14) | (0.83) | (1.18) |
| **Good PLS odds** | -0.83 | -0.91 | -1.84 |
| | (1.38) | (1.12) | (1.72) |
| **Fair lottery odds** | -2.21** | 2.43** | -0.18 |
| | (0.81) | (0.91) | (0.98) |
| **Good lottery odds** | -3.31 | 3.45** | 0.00 |
| | (1.22) | (1.31) | (1.17) |
| **10% interest rate** | -8.85*** | -0.28 | 13.13*** |
| | (2.52) | (1.07) | (2.81) |
| **20% interest rate** | -13.77*** | -0.48 | 17.76*** |
| | (2.91) | (1.35) | (3.24) |
| **Adjusted $R^2$** | 0.60 | 0.58 | 0.61 |
| Fixed Effects | Yes | Yes | Yes |
| *Mean Allocation before PLS* | *34.14* | *21.20* | *44.66* |

**Notes to Table 5:**

1. Robust standard errors clustered by subjects are in parentheses.
2. Tobit models allow for censoring below and above (at \$0 and \$100).
3. The base case is *bad PLS odds, bad lottery odds* and *5 percent interest rate.*
4. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

**Table 6. Payment Mechanisms**

$$TS_j^i = \beta_0 + \beta_1(SR8)^i + \beta_2(SR12)^i + \alpha_1 P_j + \alpha_2[P_j x(SR8)^i] + +\alpha_3[P_j x(SR12)^i] + e_j^i$$

| | **Group Differences** | ***The effect of PLS Introduction on Total Allocation to Savings on*** $TS_j^i = X_j\beta^i + \alpha^i P_j + \delta^i + e_j^i$ | | |
|---|---|---|---|---|
| | Full Sample | **MTurk** | **$ 8 Study Response Group** | **$ 12 Study Response Group** |
| | (1) | (2) | (3) | (4) |
| **$ 8 Study Response Subject (SR8)** | 0.20 | | | |
| | (4.49) | | | |
| **$ 12 Study Response Subject (SR12)** | -1.51 | | | |
| | (4.32) | | | |
| **PLS Introduced** | 12.97*** | 12.73*** | 9.78*** | 8.29*** |
| | (1.10) | (1.12) | (2.83) | (0.39) |
| **PLS Introduced *SR8** | -2.95 | | | |
| | (3.02) | | | |
| **PLS Introduced *SR12** | -4.29 | | | |
| | (3.23) | | | |
| **Fair PLS odds** | | -0.02 | -1.50 | -0.32 |
| | | (0.51) | (1.42) | (1.11) |
| **Good PLS odds** | | 0.81 | 1.21 | 2.10* |
| | | (0.58) | (1.34) | (1.14) |
| **Fair lottery odds** | | -0.90* | 0.07 | -0.08 |
| | | (0.47) | (1.48) | (1.35) |
| **Good lottery odds** | | -2.94*** | -1.09 | -3.11 |
| | | (0.62) | (1.25) | (2.09) |
| **10% interest rate** | | 10.01*** | 3.02 | 3.35 |
| | | (0.95) | (2.13) | (2.88) |
| **20% interest rate** | | 20.24*** | 3.63 | 9.88** |
| | | (1.30) | (2.84) | (4.05) |
| **Adjusted $R^2$** | 0.03 | 0.61 | 0.63 | 0.58 |
| Fixed Effects | No | Yes | Yes | Yes |
| Additional Controls | Yes | | | |
| Number of Subjects | 592 | 449 | 57 | 56 |
| Mean Allocation before PLS | $48.08 | $48.22 | $48.21 | $46.71 |
| % of subjects with "$0" reported savings | 0.13 | 0.15 | 0.12 | 0.05 |

**Notes to Table 6:**

1. Additional controls are dummy variables for age, education, marital status, employment status, reported saving levels, and birth place of subjects. These are summarized in Table 2.
2. Robust standard errors clustered by subjects are in parentheses.
3. The base case in columns 2 and 3 is *bad PLS odds, bad lottery odds* and *5 percent interest rate.*
4. * $p$<0.1, ** $p$<0.05, *** $p$<0.01.

## APPENDIX A

| Table A1.<br>Participation Decision before PLS Introduction | |
|---|---|
| Percent of participants who allocated all budget to only | |
| **Consumption** | 9.2% |
| **Traditional Savings** | 22.3% |
| **Lottery** | 3.9% |
| Percent of participants who allocated positive amounts to | |
| **Consumption & Traditional Savings** | 13.3% |
| **Consumption & Lottery** | 8.6% |
| **Traditional Savings & Lottery** | 15.8% |
| **All three** | 26.9% |

**Notes to Table A1:**

Table A1 reports allocation decisions of participants for the first nine decisions where PLS has not been introduced.

## Table A2. Descriptive Characteristics of Additional MTurk Experiments

| | Exp. 1 | Exp. 2 | | Exp. 1 | Exp. 2 |
|---|---|---|---|---|---|
| **Gender** | | | **Lottery Expenditure** | | |
| Male | 0.48 | 0.43 | $0 | 0.39 | 0.41 |
| Female | 0.52 | 0.57 | $1-$150 | 0.58 | 0.53 |
| | | | >$150 | 0.02 | 0.06 |
| **Age** | | | | | |
| 18-25 | 0.19 | 0.17 | **Gambling** | | |
| 26-45 | 0.64 | 0.59 | Never | 0.49 | 0.41 |
| 46-65 | 0.14 | 0.15 | Other | 0.51 | 0.59 |
| Over 65 | 0.03 | 0.09 | | | |
| | | | **Financial Risk Profile** | | |
| **Marital Status** | | | Safe | 0.86 | 0.68 |
| Single | 0.37 | 0.43 | Neutral | 0.11 | 0.15 |
| Married | 0.55 | 0.50 | Risky | 0.03 | 0.17 |
| Divorced | 0.08 | 0.07 | | | |
| | | | **Relative Wealth** | | |
| **Education** | | | Much worse off | 0.08 | 0.11 |
| Less than High School | 0.02 | 0.01 | Somewhat worse off | 0.40 | 0.35 |
| High School | 0.32 | 0.38 | About the same as others | 0.37 | 0.33 |
| Bachelor's degree | 0.46 | 0.47 | Somewhat better off | 0.16 | 0.19 |
| Technical | 0.02 | 0.01 | Much better off | 0.01 | 0.02 |
| Postgraduate | 0.10 | 0.14 | | | |
| | | | | | |
| **Employment** | | | | | |
| Full-time | 0.46 | 0.46 | | | |
| Part-time | 0.21 | 0.19 | | | |
| Unemployed | 0.23 | 0.16 | | | |
| Retired | 0.04 | 0.04 | | | |
| Other | 0.06 | 0.15 | | | |
| | | | | | |
| **Born in the USA** | 0.96 | 0.94 | | | |
| | | | | | |
| **Reported Saving** | | | | | |
| $0 | 0.10 | 0.11 | | | |
| $1-$1,000 | 0.44 | 0.43 | | | |
| $1,001-$2,000 | 0.10 | 0.13 | | | |
| $2,001-$5,000 | 0.10 | 0.08 | | | |
| $5,001-$10,000 | 0.06 | 0.08 | | | |
| $10,001-$30,000 | 0.08 | 0.06 | | | |
| Over $30,000 | 0.11 | 0.11 | | | |
| | | | | | |
| ***N*** | 110 | 737 | | | |

**Notes to Table A2:**

1. Experiment 1 is described in subsection 3.3.1, and was conducted to test the 1/*N* heuristic.
2. Experiment 2 is described in subsection 3.3.3, and was conducted to test the robustness of the main findings with respect to a continuous budget set.

**Table A3. 1//*N* Heuristic Check**

Fixed Effect Model (1): Changes in total savings

$$TS_j^i = X_j\beta + \alpha P_j + \delta^i + e_j^i$$

| | **PLS replaces Traditional Savings Account** | **PLS replaces Lotteries** |
|---|---|---|
| | **(1)** | **(2)** |
| **PLS introduced** | 7.94* | 17.63*** |
| | (4.30) | (4.72) |
| Fair PLS odds | -1.45 | -4.36 |
| | (2.13) | (3.09) |
| Good PLS odds | 0.85 | 1.09 |
| | (2.27) | (2.38) |
| Fair lottery odds | -1.95 | -3.63 |
| | (1.49) | (3.28) |
| Good lottery odds | -2.09 | -4.72 |
| | (1.56) | (3.48) |
| Fixed Effects | Yes | Yes |
| **Adjusted $R^2$** | 0.54 | 0.57 |
| **Number of Subjects** | 110 (1320 Observations) | 110 (660 Observations) |
| Mean Allocation Total Saving before PLS | 45.57 | |
| *Mean Allocation Total Saving after PLS* | 53.31 | 64.90 |

**Notes to Table A3:**

1. The experiment is described in subsection 3.3.1. In column 1 we compare total savings in the pre-PLS world with the world in which the traditional savings account is replaced by a PLS account. Column 2 compares total savings in the pre-PLS world with the world in which the lottery is replaced by a PLS account.
2. The base case is *bad PLS odds, bad lottery odds.*
3. Robust standard errors clustered by subjects are in parentheses.
4. * $p$<0.1, ** $p$<0.05, *** $p$<0.01.

**Table A4. Continuous Budget Set**

***Panel A***: Full Sample

| | Total Savings | | | Consumption | Lottery Expenditure | Traditional Savings |
|---|---|---|---|---|---|---|
| | | Probit | | | | |
| | OLS | Coefficients | Marginal Effects | OLS | OLS | OLS |
| **PLS introduced** | 9.25*** | 0.20*** | 0.03 | -4.10*** | -5.14*** | -7.10*** |
| | (0.68) | (0.05) | | (0.55) | (0.50) | (0.81) |
| **Fair PLS odds** | -0.69** | 0.01 | 0.00 | 0.78*** | -0.04 | -1.43*** |
| | (0.29) | (0.03) | | (0.27) | (0.21) | (0.30) |
| **Good PLS odds** | 1.12*** | 0.06** | 0.01 | -0.75*** | -0.37 | -2.18*** |
| | (0.28) | (0.02) | | (0.22) | (0.24) | (0.35) |
| **Fair lottery odds** | -0.45** | 0.01 | 0.00 | -0.03 | 0.44*** | -0.68*** |
| | (0.23) | (0.02) | | (0.19) | (0.26) | (0.23) |
| **Good lottery odds** | -1.47*** | -0.00 | -0.00 | -0.85*** | 2.28*** | -2.57*** |
| | (0.31) | (0.02) | | (0.22) | (0.29) | (0.35) |
| **20% interest rate** | 8.05*** | 0.20 | 0.03 | -6.56 | -1.48*** | 8.90*** |
| | (0.55) | (0.04) | | (0.51) | (0.25) | (0.60) |
| **Adjusted $R^2$** | 0.83 | | | 0.85 | 0.69 | 0.80 |
| **Number of Subjects** | | | | 737 (13,266 Observations) | | |
| *Mean Allocation before PLS* | 62.36 | | | 25.57 | 12.07 | 62.36 |
| ***Panel B***: *Restricted Sample – Individuals with reported savings of $0* | | | | | | |
| **PLS introduced** | 8.90*** | 0.27** | 0.06 | -3.64* | -5.23*** | -4.76** |
| | (2.26) | (0.13) | | (2.09) | (1.72) | (1.78) |
| **Fair PLS odds** | 0.54 | -0.06 | -0.01 | 0.80 | -1.32* | -0.42 |
| | (0.88) | (0.07) | | (0.93) | (0.66) | (0.89) |
| **Good PLS odds** | 2.66*** | 0.06 | 0.01 | -1.47* | -1.19* | -1.42 |
| | (0.90) | (0.05) | | (0.86) | (0.63) | (1.37) |
| **Fair lottery odds** | 0.14 | -0.03 | -0.01 | 0.13 | -0.27 | -0.70 |
| | (0.76) | (0.03) | | (0.81) | (0.68) | (0.68) |
| **Good lottery odds** | -0.02 | 0.02 | 0.00 | -2.17 | 2.24*** | -0.96 |
| | (1.01) | (0.04) | | (0.98) | (0.84) | (1.01) |
| **20% interest rate** | 6.52 | 0.18* | 0.04 | -6.24*** | -0.23 | 6.52*** |
| | (1.90) | (0.10) | | (1.87) | (0.68) | (1.73) |
| **Adjusted $R^2$** | 0.79 | | | 0.81 | 0.71 | 0.84 |
| **Number of Subjects /Observations** | | | | 84 (1,512 Observations) | | |
| *Mean Allocation before PLS* | 41.72 | | | 43.67 | 14.61 | 41.72 |
| **Fixed Effects** | Yes | No | | Yes | Yes | Yes |
| **Additional Controls** | | Yes | | | | |

**Notes to Table A4:**

1. Sample characteristics are described in Appendix Table 1.
2. Additional controls are dummy variables for age, education, marital status, employment status, reported saving levels, and birth place of subjects.
3. Robust standard errors clustered by subjects are in parentheses.
4. The base case is *bad PLS odds, bad lottery odds* and *10 percent interest rate.*
5. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.