Can Gambling Increase Savings?
Empirical Evidence on Prize-linked Savings Accounts

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Abstract

This paper studies the adoption and impact of prize-linked savings (PLS) accounts, which offer random, lottery-like payouts to individual account holders in lieu of interest. Using micro-level data from a bank offering these products in South Africa, we show that PLS is attractive to a broad group of individuals, across all age, race, and income levels. Financially constrained individuals and those with no existing deposit accounts are particularly likely to open a PLS account. Participants in the PLS program increase their total savings on average by 1% of annual income, a 38% increase from the mean level of savings. Deposits in PLS do not appear to cannibalize same-bank savings in standard savings products, on average. Instead, PLS serves as a substitute for lottery gambling. Exploiting the random assignment of prizes, we also present evidence that prize winners increase their investment in PLS, sometimes by more than the amount of the prize won, and that large prizes generate a local "buzz" that leads to an 11.6% increase in demand for PLS at a winning branch.

I. Introduction

Personal savings often serve as the first available buffer for households when faced with job loss, healthcare costs, or other financial shocks. However, recent evidence suggests that a large percentage of households maintain little to no savings, despite potentially high returns to saving (Dupas and Robinson 2013) and significant costs of financial fragility (Lusardi, Schneider, and Tufano 2011; FDIC 2012). In light of this, economists and policymakers have considered financial innovations to encourage savings, such as default options, commitment devices, or savings reminders.[1] This paper examines prize-linked savings (PLS) products, which provide participants the chance to win prizes by saving money. The promise of PLS is that it can deliver the utility of lottery play while simultaneously encouraging individuals to substitute toward higher financial security.

While PLS programs have existed for hundreds of years and are prevalent around the world, including their recent legalization in the U.S.,[2] they have received little academic attention. Studies to this point have focused on either high-level macro data (Tufano 2008), small-scale surveys (Tufano, Maynard, and De Neve 2008), or laboratory experiments (Atalay et al. 2014; Filiz-Ozbay et al. 2015).[3] In this paper, we use account-level data from a PLS program run by one of the largest banks in South Africa to demonstrate that PLS is particularly attractive to individuals with no traditional savings accounts and those with high debt levels. Importantly, we show that PLS participants tend to significantly increase overall savings rates and that at least some of this increase in net savings comes from reduced lottery play.

PLS accounts differ from standard savings accounts in that they offer individual savers a stochastic, heavily-skewed return as opposed to a predetermined interest rate. Depositors in a PLS account are entered periodically into a drawing in which their chance at winning a potentially large prize (or smaller prizes) is

[1] See, for example, Carroll et al. (2009), Thaler and Benartzi (2004), Ashraf, Karlan, and Yin (2006) and Karlan et al. (2012). Tufano and Schneider (2008) provide an overview of policy proposals.
[2] In December 2014, the American Savings Promotion Act legalized no-risk cash-prize savings raffles, making PLS legal in the U.S. for the first time.
[3] One exception is Cookson (2016), who uses micro-level data from casinos to examine the impact of PLS on gambling expenditures.

a function of the amount they have deposited. In aggregate, all savers receive a total amount of prizes (interest payments) that may approximate market rates, but this lottery-like system changes the payoff structure for saving, adding an element of risk and, possibly, excitement to holding money in the account.

Given the widespread demand for lottery gambling, it has been hypothesized that the lottery-like incentive structure of PLS could be attractive to large numbers of participants (Kearney et al., 2010). Indeed, participation rates in the UK's Premium Bond program, a PLS product, are estimated to be between 22 and 40 percent of UK citizens (Tufano 2008). The PLS account examined in this paper—the "Million-a-Month Account," or MaMa, offered by First National Bank (FNB), a large South African retail bank—saw similarly robust demand: within 18 months of the start date of the program, there were more PLS accounts than regular savings accounts at the bank, and within three years, PLS deposits amounted to R1.4 billion at the bank, as compared to total savings of R4.5 billion in the comparable standard savings account.

A more vital question, however, is whether PLS can increase savings for individuals who avoid traditional saving products. In particular, the 2013 Survey of Consumer Finances shows that only 31.7% of households in the lowest income quintile regularly save. At the same time, low-income households account for a disproportionate share of lottery expenditures in the U.S., with lottery expenditures totaling over 5% of income for those in the lowest income brackets (Clotfelter et al. 1999). Further, Lusardi et al. (2011) show that gamblers are particularly prone to lack precautionary savings. This suggests that PLS may be uniquely positioned to attract savings from individuals who are less likely to maintain emergency savings in the formal banking sector. Using account-level data on employees of FNB, we find that individuals who had no standard savings accounts were 12.2 percentage points more likely to open a PLS account than those with accounts. In addition, employees who were the largest net borrowers from the bank were most likely to open a PLS account, while those with moderate savings amounts were least likely. Corroborating this, we also use survey data from individuals that live near FNB branches and find that usage of PLS was especially strong in areas with low take-up of standard financial products and where a high percentage of individuals felt unable to repay their debts.

It is also important to evaluate whether PLS accounts attract new savings or merely cannibalize regular savings. We show that bank employees who open a PLS account tend to increase their net savings at First National Bank by about 1% of their annual income, a 38% increase from the mean level of savings. Because neither MaMa (nor any other PLS product of which we are aware) has been introduced in a randomized manner, this relationship between PLS usage and overall savings rates is not necessarily causal. However, we present three additional findings which support the hypothesis that PLS increases net savings at FNB. First, we find that employees who open PLS accounts also tend to increase deposits in regular savings accounts as well. This is surprising, as one might have expected a substitution of savings from other accounts to PLS.

Second, using random variation in the size of jackpots in the South African National Lottery, we present causal evidence that demand for the PLS program nationwide was especially strong in periods when the jackpot of the national lottery was small. This suggests that at least some of the increase in net savings comes from individuals substituting lottery gambling for PLS.[4]

Third, we use the random prizes awarded to winning account holders to provide causal evidence that PLS and standard savings are complements. In the PLS program run by First National Bank, each month a total of 113 prizes were awarded, including a grand prize of R1,000,000 (approximately $150,000) and R500,000 in smaller prizes. Similar to Guryan and Kearney (2008), who show that stores who sell winning lottery tickets experience subsequent excess demand for lottery tickets, we find that the award of large prizes appears to create a "buzz," and we observe greater demand for PLS in the local area. In particular, bank branches that had a R1,000,000 prize winner experienced 11.6% excess growth in PLS deposits in the month after the win, relative to all other bank branches. While this finding is interesting in its own right, it also provides a natural experiment in which PLS demand increases at randomly assigned bank branches. If PLS cannibalizes standard savings, we should find that regular savings deposits decrease

[4] This is consistent with evidence in Atalay et al. (2014) and Filiz-Ozbay et al. (2015), which use experiments to show that PLS demand is especially strong among lottery players, and Cookson (2016) who shows that casino gambling decreases when PLS products are introduced in the U.S.

at branches with a MaMa jackpot winner as individuals shift savings from standard account to PLS. Instead, we find that bank branches with jackpot winners experience 4% higher growth in standard savings deposits as well. This provides causal evidence that reinforces our findings that PLS and standard savings are, on average, complements rather than substitutes.

We also exploit the randomly awarded prizes to test whether prize winners are more likely to close their accounts after winning, or whether winning a prize induces them to invest more in PLS. Relative to non-winners, winners of small R1,000 prizes are 4.2 percentage points more likely to close their accounts within one year of winning their prize, while winners of larger prizes are no more likely to close their accounts. Despite being slightly more likely to close their accounts, however, prize winners on average keep substantially more in their accounts than those who did not win prizes. In some cases, prize winners increase their account balances in PLS by more than the amount won, indicating that this increased investment in PLS is more than just a wealth effect. This increased savings is persistent for at least one year after winning. Overall, then, prizes in PLS serve as a natural self-generating savings mechanism both for prize winners and their peers.

Prior literature has shown that PLS demand is widespread (Tufano 2008) and, in laboratory experiments, that PLS leads to higher savings levels (Filiz-Ozbay et al. 2015; Atalay et al. 2014). Importantly, our findings corroborate this evidence using a large sample of individuals in the field and show for the first time that these effects appear to be long-lived. In addition, we provide detailed evidence on *who* chooses to use PLS from a large cross-section of individuals, showing that demand is particularly strong among financially fragile individuals and those who do not use traditional savings accounts. Further, our account-level data allows us to show that usage of PLS is correlated with an increase in savings balances in standard accounts, a finding that we corroborate using randomly assigned prizes. Instead of cannibalizing standard savings, we find that PLS is a substitute for lottery expenditure, consistent with the evidence from Cookson (2016), who shows that the introduction of PLS reduces casino gambling. Finally, a key and novel

contribution of our paper is showing that PLS prizes create positive externalities by encouraging savings by prize winners and those near them.

More broadly, a large body of research has proposed explanations for the relatively low levels of formal savings observed empirically. The popularity of PLS could derive from overcoming several of these barriers.[5] First, lack of financial sophistication could explain PLS demand if individuals misunderstand interest rates (Stango and Zinman 2009; Lusardi and Tufano 2009) and choose instead to invest in lottery-like payouts. However, we find that PLS demand is not correlated with education levels and is strong even among highly-paid bank employees, which suggests that a knowledge gap is not the main driver of PLS demand. Second, households may find it difficult to accumulate savings due to a lack of self-control (Laibson 1997; Fudenberg and Levine 2006)[6] or societal pressure to share income with family and friends (Jakiela and Ozier 2016). PLS could help to overcome this by providing large prizes all at once instead of gradual interest, thereby providing liquidity for larger purchases or investments.[7] Our evidence that PLS demand is especially strong among financially constrained individuals is in line with this theory. Finally, significant prior work shows that the popularity of lotteries, and PLS, is linked to nonlinear probability weighting, in which individuals subjectively overestimate the small likelihood of winning a large prize (Clotfelter and Cook 1990). In the context of PLS, Filiz-Ozbay et al. (2015) show that a model that allows for nonlinear probability weighting fits their experimental data better than linear probability weighting. To the extent that this tendency is widespread across many individuals (Bruhin, Fehr-Duda, and Epper 2010), our evidence of high demand for PLS across all demographics and among all FNB branches is consistent with this explanation for PLS demand. However, because it is difficult to determine which individuals are

[5] Karlan, Ratan, and Zinman (2014) categorize barriers to savings in five groups: transaction costs, lack of trust and regulatory barriers, information and knowledge gaps, social constraints, and behavioral biases. The MaMa product had similar transaction costs and trust/regulatory barriers, so these are unlikely to explain the popularity of PLS in our context.

[6] PLS may provide a novel solution to present-bias by giving immediate consumption of the dream of winning a prize and excitement of playing (Thaler and Ziemba 1988) while simultaneously encouraging savings for the future.

[7] Of course, receiving a large prize does not remove the pressure to share that prize with family or neighbors, but it could allow an individual to purchase large durable goods or significantly reduce debt while simultaneously sharing some of the money with others.

more likely to overweight small probabilities, our cross-sectional tests have little to say about the importance of probability weighing in explaining PLS demand.[8]

While it appears that PLS can serve as an effective way to promote savings behavior for many, including low-wealth individuals, we do not mean to suggest that our findings indicate PLS is a panacea. Although we show that this increased saving is funded at least partially from reduced lottery expenditure, it is also possible that individuals reduce consumption or investment in other areas in order to fund their PLS account. Thus, similar to other studies that show increases in household savings, the welfare implications of PLS are difficult to test.[9]

II. Background and Data

A. First National Bank's Prize-Linked Savings Product

The data for this paper come from First National Bank, the retail and commercial bank subsidiary of FirstRand Bank Limited, the third largest bank in South Africa.[10] First National Bank introduced a PLS account in January 2005 in an effort to expand its deposit base among low-income and unbanked individuals (see Cole et al. 2008, who also discuss the informal savings programs that exist in South Africa).

First National called its PLS account the "Million-a-Month Account," or MaMa, and awarded a grand prize of R1,000,000 to one random account holder each month, with the winning account number announced on national television. In addition to the grand prize, the bank initially also awarded two prizes of R100,000, 10 prizes of R20,000, and 100 prizes of R1,000 each month. In September, 2007, the bank doubled the number of smaller prizes given each month, awarding four R100,000 prizes, 20 R20,000 prizes, and 200 R1,000 prizes. Throughout the program, each account holder received one entry into the lottery

[8] Interestingly, Shefrin and Statman (2000) show that financial instruments that resemble a combination of bonds and lottery tickets (such as PLS) are optimal for investors with prospect theoretic preferences.
[9] We discuss welfare further in the conclusion of the paper.
[10] There were a total of 17 banks functioning in South Africa in 2008, of which the four largest accounted for 91% of total assets (South African Reserve Bank 2008).

for each R100 held in her account.[11] MaMa accounts were 32-day notice accounts, meaning that if a customer wished to withdraw some of her funds, she had to notify the bank 32 days in advance of the withdrawal. The most comparable account at First National to MaMa was a standard 32-day notice account, which paid interest on a variable scale depending on the customer's balance in the account. As of November 2004, for balances below R10,000, the 32-day account paid 4% annual interest; for balances between R10,000 and R25,000, it paid 4.25% APR; and for balances from R25,000 to R250,000, the APR ranged from 4.5% to 4.75% (Cole et al. 2008).

In contrast to the regular 32-day account, the expected return to holding MaMa balances depended on the amount of deposits held in the accounts. As the total amount of deposits increased, the expected return on a 100 Rand deposit decreased, because the chance of winning a prize declined. The new MaMa accounts proved to be quite popular, and deposits increased dramatically in the first months (Figure 1). Although the total amount held in MaMa accounts never approached the aggregate balance of the regular 32-day accounts, the number of MaMa accounts exceeded that of regular 32-day accounts by June 2006, a mere 18 months after the product was launched. Because of this growth, the expected interest rate on MaMa accounts declined rapidly. When the first drawing was held in March 2005 (three months after the start date of the program), the expected annualized interest rate for holding R100 in a MaMa account was about 12.2%, due to the relatively small amount of total deposits. However, as the popularity of the program grew, the expected return quickly dropped, and by December 2005 the rate was 3.64%, slightly lower than that offered by the regular 32-day account.[12] At its lowest, the expected interest rate on MaMa accounts was 1.59% in August 2007, just before the number of prizes was doubled.[13]

[11] Initially, the accounts paid no interest at all, but in September 2005, the bank began paying a 0.25% interest rate on deposits in addition to the random prizes. There was no discontinuous increase in PLS demand when this change was made.

[12] Barberis and Huang (2008) show that an asset with lottery-like payoffs can earn negative excess returns when investors overweight small probabilities, as in cumulative prospect theory (Tversky and Kahneman 1992).

[13] One would expect that MaMa demand would fall as the PLS expected return decreases relative to the interest rate in regular 32-day accounts. In unreported regressions, we have tested whether this is the case. We find that the coefficients are in the expected direction, but that the effect is impossible to separate from a linear time trend, due to the fact that MaMa usage was quickly growing throughout our sample period.

[FIGURE 1]

An individual with a preference for lottery-like returns could duplicate the PLS structure by depositing funds in a regular 32-day account and then using the interest earned from this account to purchase lottery tickets. This strategy imitates the MaMa account by combining two other readily available alternatives, and is thus a useful comparison to the MaMa expected return. From 2005 to 2008, the expected return on the South African National Lottery was about 46 cents per Rand invested.[14] An individual seeking a skewed return could have deposited, say, R100 (the amount needed for one entry in the MaMa program) in a regular 32-day account and earned R4 of interest in a given year. If he then used the R4 to purchase lottery tickets, his expected winnings would amount to about R1.86, giving a net return of 1.86% on his investment of R100. As noted above, expected returns in the MaMa program were significantly higher than this amount early on, but dropped to an amount quite close to this as the popularity of the program grew. In MaMa's final year, expected returns averaged 1.81% and were quite stable, suggesting that equilibrium PLS returns settled near what could have been earned via this synthetic PLS-like investment.

The MaMa program only lasted until March 2008, when it was deemed a violation of the Lottery Act of 1997 by the Supreme Court of Appeals (FirstRand Bank v. National Lotteries Board 2008). In South Africa, as has historically been the case in the U.S., the government holds a monopoly on lotteries. Although First National argued that its program wasn't technically a lottery, as all principal was preserved, it failed to convince the courts and was forced to end the program. At the end of March, all MaMa accounts were converted to regular 32-day accounts, and account holders were allowed to withdraw their deposits if they chose to do so. The data provided by First National ends in July 2008, four months after the program ended. During that time period, aggregate MaMa balances fell 16.2% in April 2008, and an additional 11.8% in May. However, balances held steady in June and July, at which point our data end. Thus, while some participants in the program did withdraw their funds, over 77% of all PLS deposits remained in the bank for at least four months after the accounts converted to standard savings products.

[14] This negative 54% return is similar to that found for other lotteries (e.g. Thaler and Ziemba, 1988).

B. Data

Most of the data for this paper come directly from First National Bank, which provided three main datasets: branch-level data for all bank branches, anonymized account-level data for all bank employees, and anonymized account-level data for all prize winners. The bank also provided us with bank-wide data on total accounts and total deposits held in MaMa accounts at a daily frequency. We augment the data from First National Bank with the 2005 FinScope financial survey of South Africa, provided by FinMark Trust. Details of each dataset are described below.

B.1. First National Bank Data

First National provided both branch-level and account-level data for this paper. At the branch level, we have monthly observations for each of 604 bank branches from January 2003 through July 2008. For each month, we observe the total number of accounts and total Rand balance held at the branch in both standard 32-day accounts and MaMa accounts. Table I provides summary statistics of the total number of accounts and total deposits at each branch as of March 2008, when the MaMa program ended.

[TABLE I]

In addition to branch-level time series data, we also observe branch-level demographic characteristics of depositors in both 32-day and MaMa products for one snapshot taken in June 2008, 3 months after the MaMa program ended. This allows us to compare the characteristics of MaMa participants to those of typical savers, which we do in Table I. With respect to race, MaMa depositors are less likely to be white and more likely to be Asian or of mixed race.[15] Men account for a total of 52% of MaMa deposits, as compared to only 46% of regular 32-day deposits, suggesting that the lottery payoff structure might be more attractive to men than women, perhaps due to lower risk aversion (Eckel and Grossman 2008) or overconfidence (Barber and Odean 2001). MaMa participants also tend to be younger than standard 32-day account holders (Figure 2, Panel A). This is important, as younger individuals also tend to be those who maintain less precautionary savings (Lusardi, Schneider, and Tufano 2011).

[15] Black persons are those of native African descent. Asian persons include those of Indian descent.

[FIGURE 2]

The income profile of MaMa savers appears to be similar to that of regular savers (Figure 2, Panel B). Specifically, those in the lowest income bracket account for a similar share of total 32-day balances (45%) as MaMa balances (42%). However, more detailed analysis presented in Section III shows that those with lower income are somewhat more likely to use PLS. More importantly, evidence in Section III shows that, after controlling for income, bank employees with lower net savings (or higher debt) at FNB are more likely to use MaMa. Thus, despite similar income profiles, it is likely that the wealth levels of PLS users differ from those of regular savings account users.

In addition to the relatively coarse branch-level data, we also analyze account-level data for employees of First National Bank. This dataset contains month-by-month information on the account balances of 38,256 employees of First National Bank for the time period from January 2005 to March 2008. For each employee, we observe the month-end balance of their 32-day savings, checking, money market[16], and MaMa accounts. In addition, we also have a snapshot of the employee's race, gender, age, income estimate[17], and the region of South Africa in which they work. Summary statistics of employee account balances are provided in Table I, Panel C. [18]

Take-up of PLS was high among First National employees. In our sample, 63.2% opened a MaMa account, as opposed to only 44.7% that held a 32-day or money market account during this period. For the average employee, PLS deposits accounted for 17.4% of total net savings at the bank. As we discuss more fully in Section III.A, take-up of PLS was higher than that of standard savings products across all income categories, including the lowest-paid employees.

[16] The money market account was a special account available only to staff of the bank that was launched in July 2007, towards the end of the sample period.
[17] Income data was not directly available from First National and was instead estimated by the bank according to an internal model.
[18] 12,237 employees had their employment terminated at some point during the sample period. In all regressions, we include an *ex-staff* dummy to control for these individuals, but our results are unchanged if these individuals are removed completely.

There are both advantages and disadvantages to working with staff data. Using account-level data, we get much finer estimates of the effects of PLS. However, as the staff of the bank is not a representative sample of the South African population, this subsample may limit external validity. For example, only 41% of bank employees are black as compared to 73% in the population at large. Of more particular concern is the fact that bank employees are likely better educated and earn more than the population in general. The average First National employee earns R175,963 per year, while in 2006, average household income in South Africa was estimated to be R74,589 (Statistics South Africa 2008). Finally, just over 22% of the staff in our sample have no checking, money market, 32-day, or PLS account at FNB. Nationwide, about 47% of individuals were completely unbanked in South Africa in 2005. To the extent possible, we control for staff characteristics in our analysis, but we do note that there are large differences between the staff sample and the general population.

Another potential limitation of the staff dataset is that we can only observe deposit accounts held at FNB, and thus we do not observe their total portfolio if they hold savings elsewhere. However, based on FinScope Survey data (described below), we estimate that only 3.3% of South Africans have accounts at multiple banks, conditional on having at least one account. Meanwhile, of survey respondents that reported having no bank accounts, only 6.3% maintain any savings at home. In addition, one would expect that the majority of First National employees would do most or all of their banking at First National due to familiarity with the products, the ease of banking where you work, extra benefits of banking at work (in particular, the ability to utilize overdraft facilities, as discussed below), and likely encouragement to use the products. Thus, although we cannot observe the entire portfolio of all employees, we likely have a relatively comprehensive view of staff banking behavior.

An important aspect of the staff data is that it contains information on checking account balances, which are often negative. Bank staff can easily obtain an overdraft facility on their checking accounts; this facility offers flexible repayment possibilities. These negative balances can be interpreted as unsecured consumer credit obtained from the bank. Table I shows that a significant number of bank staff have negative

balances in their checking accounts. Net of these negative balances, the average employee had about R4,930 in savings across all accounts at the bank in March 2008, or about 3.5% of their annual income. A total of 29% of employees are net borrowers from the bank, while just over 22% have no active accounts at the bank at all. To prevent undue influence of a few outlier employees with either large savings or large borrowings, in all of our analysis using the staff dataset we winsorize account balances at the 1% and 99% levels.

Finally, we also have account-level information on prize winners. In the winners dataset, we have month-by-month information on MaMa account balances and demographic information only; account balances in other products were not provided. In total, there were 4,965 prizes given out to 4,341 account holders (some account holders won more than once) between March 2005, when the first drawing was held, and March 2008, when the program closed.

B.2. FinScope Data

We augment the data obtained from First National Bank with geographic, demographic, and socioeconomic data collected in the 2005 FinScope Survey. FinScope surveys are nationally representative surveys carried out annually by FinMark Trust, and are designed to measure the use of financial products by consumers in South Africa.[19] The 2005 survey contains responses from 3,885 individuals and has in-depth information on each respondent's financial sophistication, use of financial products, attitudes towards financial service providers, income and employment status, demographic information, and indicators of their general well-being.

We relate these characteristics to MaMa demand at individual First National Bank branches by calculating the average response of individuals who live near each branch. Specifically, we use the latitude and longitude of each bank branch and the latitude and longitude of the center of the city or town of each FinScope respondent to measure the distance between the two locations using the Haversine formula. For

[19] Finscope survey statistics are cited in several academic papers, but have not typically been used as a principal source of data. One exception is Honohan and King (2013), who study how access to financial services is related to poverty across Africa.

each branch, we average the values for all respondents within a 50km (31.1 miles) radius of the branch, thereby giving the general characteristics of individuals who are likely to use that particular bank branch.

Table II provides summary statistics of the collapsed survey data at the branch level. For 62 of the bank branches, there were no survey responses within 50 km, and an additional 37 branches had fewer than 10 respondents, dropping the number of observations to a total of 505 branches.[20] In addition, there are 11 private branches which we remove from the sample, leaving a total of 494 observations. Of particular note is the high share of individuals with no bank accounts at all (49%) as well as very elevated unemployment rates (26%).

In the analysis in Section III, we correlate FinScope's Financial Segmentation Model (FSM) with demand for MaMa. The FSM places individuals in one of eight tiers based on answers to a set of questions in the survey. The model is made up of five components, each of which is meant to capture a specific aspect of each individual's access and use of financial services, along with how people manage their money and what drives their financial behavior:

- Financial penetration: take-up of available financial products
- Financial access: physical access to financial services[21]
- Financial discipline
- Financial knowledge
- Connectedness and optimism: individual's overall feeling of fulfillment, of being connected to their community, and of having hope of achieving their lifetime goals[22]

The respondent's combined score across these five categories is used to segment the population into eight tiers, with higher tiers signifying individuals who have more access to take-up of and access to financial products, have more financial discipline and knowledge, and feel more connected and optimistic.

[20] Results are similar if we use a radius of 30km (18.6 miles). Also, including branches with fewer than 10 respondents does not affect our main results. However, these branches tend to have more extreme values that skew some OLS coefficients. For example, including these branches suggests a significant negative relationship between income and PLS usage, but this relationship is driven by two branches with very high income estimates. For this reason, we omit these branches from the sample.

[21] By definition, individuals in our sample are within 50 km of an FNB branch, so this component of the FSM is less relevant in our setting.

[22] For more information on the FSM and how it is calculated, see the FinScope 2005 brochure at http://www.finscope.co.za/documents/2005/SA05_brochure.pdf.

[TABLE II]

III. MaMa Product Adoption

The widespread growth of MaMa was remarkable. By June 2008, the number of MaMa accounts at First National Bank exceeded the number of 32-day savings accounts at First National for every age, gender, income, and race subgroup.[23] Among employees of the bank, just 27% used a regular 32-day savings account (we define this as having had a positive balance for at least one month) during January 2005 to March 2008, while 63% used a MaMa account during the sample period. Why was MaMa so popular? In this section, we analyze the characteristics that are associated with opening a PLS account using both account-level data of First National employees as well as FinScope survey data. Knowledge of what drives demand for PLS can help academics and policymakers alike understand how consumers think about savings and gambling, as well as assess the potential for PLS to encourage precautionary savings.

A. MaMa demand among bank employees

Because of its lottery-like payoff, it has been hypothesized that PLS might be attractive to low-wealth individuals, those with less education, or perhaps to particular racial groups, as these groups have been shown to spend a larger percentage of their income on lottery gambling in other settings (Kearney et al. 2010). We test these intuitions by using account-level data on First National Bank employees to associate MaMa demand with individual characteristics. Table III presents results from linear probability models in which we estimate the relationship between income, age, gender, race, and past saving behavior with the propensity to open a MaMa account for 38,262 employees of the bank.[24] In all models, we include 34 regional fixed effects to account for geographic differences in MaMa take-up, where regions are as defined by First National Bank.

[TABLE III]

[23] However, average account balances were much lower in MaMa accounts than regular 32-day savings.
[24] Tables III and VI present linear probability models estimated by OLS, but essentially identical results are found if the models are estimated using probit or logit models.

Panel A of Table III compares demand for standard savings products and demand for MaMa across different demographic characteristics. The dependent variable in the first column is a dummy variable equal to one if the employee had a positive balance in a standard 32-day savings account at FNB at any time between January 2005 and March 2008, when the MaMa product was available. The second column is similar, except it equals one if there was a positive balance in either a standard 32-day savings account or a special employee-only money market account that the bank made available in July 2007. The estimates in these first two columns can then be directly compared to the coefficient reported in the third column, in which the dependent variable equals one if the employee at any time had a positive balance in a MaMa account.

Given previous literature suggesting that PLS could be particularly attractive for low-income individuals, results on the relationship between income and the propensity to save in a MaMa account are of interest. In the regression results in Table III, we estimate the relationship between income and MaMa usage non-parametrically using income deciles. By comparing coefficient estimates across deciles, it is apparent that demand for both regular savings and PLS is hump-shaped in income, such that the lowest and highest deciles are least likely to have an account.[25] This pattern can be more easily seen in Figure 3, where we divide all employees of the bank by income decile and plot the share of employees that had a standard savings product and the share that had a MaMa account at any point during the sample period for each decile. Although the results in Figure 3 are unconditional probabilities of having an account, they paint the same picture as the coefficient estimates in Table III. While the propensity to have an account is hump-shaped in income for both regular savings and PLS accounts, MaMa usage appears to be somewhat less sensitive to income than regular savings. Further, while the lowest-income employees were the least likely to use MaMa, a substantially higher portion had MaMa accounts (46%) than had standard savings products (31%). The share with MaMa accounts exceeds the share with regular savings across all income deciles.

[25] This pattern is likely due to the lowest income groups being less likely to save at all and the highest income groups being less likely to save in standard bank products because they have access to alternatives.

[FIGURE 3]

When evaluating the relationship between income and demand for MaMa, it is important to keep in mind that the majority of bank employees earn substantially more than the median income in South Africa. Because of this, the first income decile of our sample includes salaries up to R60,000 per year, while the average household income in South Africa in 2006 was about R74,600 per year. However, even limiting to employees with the lowest salaries, the same patterns persist: 33% of those who make less than R38,000 per year opened a MaMa account, while only 19% had a 32-day or money market account. It appears that, after controlling for other demographic characteristics, low income individuals are more likely to use a PLS account than a standard savings account.

With regards to gender, we find that males are 8.8% less likely than women to have a standard savings account, but this gap narrows to only 4.2% for MaMa accounts. Thus, relative to standard savings, MaMa appears more attractive to men in particular, which is in line with Donkers, Melenberg, & van Soest (2001), who find that men are more likely to play the lottery, and Filiz-Ozbay et al. (2015), who find that men are more likely to save when a PLS option is available in a laboratory experiment. We also find substantial differences in MaMa demand across racial groups. While black employees are substantially more likely to have a savings account than other ethnicities, they are equally likely to have a MaMa account as whites and Asians. Meanwhile, individuals of mixed race are about 4.4% more likely to open a MaMa account than other racial groups.[26]

Panel B of Table III tests whether previous banking behavior is related to the propensity to open a MaMa account after controlling for demographic and geographic characteristics of employees. The regressions in this panel are identical to those in the final column of Panel A, except here we test whether the prior banking behavior of the employees is related to the propensity to open a PLS account. We find that employees who did not have any saving or checking accounts at FNB were 4.6 percentage points more

[26] It is difficult to connect our results on race to previous literature due to cultural differences within race across countries. For example, Stinchfield & Winters (1998) find that Hispanic and African American youths have a higher propensity to gamble, but it is by no means clear that Africans would have a similar propensity to gamble.

likely to open a MaMa account than those who already had active bank accounts at FNB. In the next column, we control separately for whether the employee lacked a savings or checking account prior to opening a MaMa account. Relative to employees with both savings and checking accounts, we find that employees without a standard savings account were 12.2 percentage points more likely to use MaMa, while employees without checking accounts were equally likely. Thus, the MaMa account was particularly attractive to individuals who chose not to use a regular savings account. It is important to note that we cannot observe whether these employees had active accounts at other banks. However, given that they are employed by FNB it seems reasonable to assume that they would be likely to bank at FNB if they have bank accounts anywhere. If that is the case, this suggests that PLS-type products may attract new savers who were previously sitting outside the formal banking sector.

The final column of Panel B separates bank employees not by whether they have active accounts, but rather by their net financial position at FNB, defined as the sum of their checking, 32-day, and money market accounts at the bank. Because employees were allowed to maintain negative balances in their checking accounts, a significant portion (28%) are net borrowers from the bank, while 42% of employees have net positive balances, and the remaining 30% had no accounts at the bank. We split the group who are net savers into "high savers" and "low savers" depending on whether they had above- or below-median net savings at the bank as a percentage of annual income. Similarly, we split the net borrowers into two groups, and thus end up with five groups of employees: above-median savers, below-median savers, those with no accounts, below-median borrowers, and above-median borrowers. Of these five groups, employees who have borrowed the most from the bank are the most likely to open a MaMa account. Next most likely are those with no accounts and those with above-median savings. Staff with small amounts of borrowing or small amounts of saving are the least likely to use MaMa. This striking pattern is consistent with the hypothesis that PLS is particularly attractive to low-wealth individuals. Under the assumption that net savings at FNB is a reasonable proxy for individual wealth, we find that the lowest-wealth group are nearly 18 percentage points more likely to open a MaMa account than those with a small amount of savings. These

individuals are those for whom a large financial prize is a significant incentive, even if the chances of winning are small, as it represents a chance to significantly change their economic situation.

B. Geographic characteristics and MaMa demand

In this section, we correlate FinScope survey response data to branch-level PLS usage as additional evidence on the determinants of PLS demand. While the FinScope data is not as detailed as the FNB employee data, it has the advantage of being nationally representative. Thus, we use it as an additional data source to confirm the findings in Section III.A above.[27] Panel A of Table IV presents OLS regression results in which we correlate take-up of the MaMa product at each bank branch to demographic and socioeconomic characteristics of individuals who live within 50 km of the branch, using responses to the 2005 FinScope survey. In these regressions, the dependent variable is either the log of the total balances held in MaMa accounts at the branch or the log of the total number of MaMa accounts as of March 2008. To determine whether demand for MaMa products differs from the demand for regular 32-day savings, we control for the log of the total balance held in 32-day savings accounts in the first column or the log of the total number of accounts in the second column.[28] We also control for whether the branch is located in a rural area to account for branch size differences.

[TABLE IV]

After controlling for regular savings demand, we do not find a strong relationship between demographic characteristics and MaMa demand. Of particular note, we do not find that branches in high-income areas have lower PLS demand. This mirrors the results in Section III.A above that show that PLS demand does not vary much by income level for branch employees (instead, PLS demand is higher for every income level). In addition, there is no relationship between education and PLS demand, suggesting

[27] Ideally, we would use multiple waves of FinScope surveys to run diff-in-diff regressions testing whether individuals who live near FNB branches increase savings by more than individuals living near other bank branches. Unfortunately, the FinScope data does not allow this because it lacks information on distance to bank branches, making it impossible to create suitable control groups.

[28] Similar results are found if the dependent variable is defined as the ratio of MaMa balances to savings balances, instead of including the total savings balance as a right-hand side variable. In addition, results are unchanged if we estimate using negative binomial regressions to account for the fact that our dependent variables are non-negative.

that PLS demand does not derive from a lack of understanding of standard interest-bearing accounts. Indeed, the only demographic variable that is strongly associated with MaMa usage is race, where we find that areas with a higher percentage of black residents have lower PLS demand while areas with more Asian individuals have higher PLS demand.

Panel B of Table IV tests whether additional financial characteristics are associated with MaMa demand. To be concise, we only report results for the total amount of MaMa deposits as the dependent variable, but results are similar if we instead use the number of MaMa accounts. We find that areas with more banked households had lower MaMa demand, but the relationship is not statistically strong. In the next two columns, we use FinScope's Financial Segmentation Model as an independent variable and test its association with PLS demand. The FSM categorizes individuals according to their financial access, knowledge, discipline, and usage of financial products, as well as their overall optimism and connectedness. When we include the average overall FSM tier for the area, we again fail to find a strong relationship between FSM and MaMa demand. However, in the third column, we split the FSM by its components and find that MaMa demand was significantly lower in areas with higher financial penetration and higher connectedness and optimism scores.

The FSM financial penetration score is designed to capture the extent to which individuals utilize available financial products. We estimate that a one standard deviation increase in financial penetration is associated with an 18.8 percentage point decline in MaMa deposits, significant at the 5% level. This is consistent with the FNB employee results that show that employees without savings accounts were particularly likely to open MaMa accounts, and suggests that individuals who do not use standard savings products even when they are available are substantially more likely to use PLS.

Meanwhile, the optimism and connectedness FSM score is derived from a set of survey questions that are designed to measure an individual's satisfaction with their life, how hopeful they are of reaching

their life dreams, and how connected they feel to others around them.[29] It is striking that it is in areas in which individuals feel *least* hopeful that we see the highest usage of the MaMa product. As mentioned above, optimism—in particular, over-weighting of small probabilities—has been found to be a significant driver of demand for lotteries and PLS; it is, however, not necessarily the case that individuals who are attracted to lotteries are overly optimistic in all areas of their lives. Rather, depressed or pessimistic individuals are likely to value the "dream" of winning the jackpot the most (Thaler and Ziemba 1988; Brunnermeier and Parker 2005), and these results suggest that this desire is perhaps a significant driver of PLS demand (Tufano 2008). This finding is also related to evidence from the Consumer Federation of America and The Financial Planning Association (2006), which found that 21% of Americans and 38% of those with incomes below $25,000 thought that winning the lottery represents the most practical way for them to accumulate several hundred thousand dollars. Individuals who feel that their dreams are extremely difficult to reach may feel as if the only way possible for them even to have a chance at reaching those goals is by winning a large prize. PLS differs from standard savings accounts by offering highly skewed payouts, making large wealth accumulation possible.[30]

In the final two columns of Panel B, we more directly test whether individuals who are struggling financially are more likely to use PLS. The key independent variable in these regressions is the percentage of individuals living near a bank branch who agreed with the statement, "You never seem to be able to pay off your debt; your debt just keeps getting worse." Individuals who feel this way may be more likely to use PLS because it represents a chance for them to pay off their debts and escape a "poverty trap," while standard savings products do not accumulate enough interest to do so (Banerjee and Mullainathan 2010). In addition, financial constraints themselves could lead individuals to play the lottery (Shah, Mullainathan, and Shafir 2012; Haisley, Mostafa, and Loewenstein 2008).

[29] For example, respondents are asked whether they agree with statements such as, "I have many dreams in life but will never achieve them," "My life has meaning and purpose," "I feel lonely," and "In many ways, my life is ideal."
[30] This finding is somewhat inconsistent with Tufano, De Neve, and Maynard (2011), who find that more optimistic individuals express more interest in PLS, based on survey evidence in the U.S. One possible reason for the difference is that their measure of optimism is directly tied to future income expectations, while our measure is more broadly defined as general optimism.

We find that branches in more indebted areas experienced higher MaMa demand, but the relationship is statistically insignificant (second to last column). However, there are a few outlier branches that had an extremely high percentage of respondents who were unable to repay their debts. In the final column of Panel B, we remove branches above the 98th percentile (a total of seven branches), corresponding to areas where greater than 40% of individuals are unable to pay off their debts. When these branches are removed, the relationship becomes much stronger and is significant at the 1% level. In terms of economic magnitude, a one standard deviation increase in the share of individuals who feel unable to pay their debts (increase of 8.7%) is associated with a 14.3 percentage point increase in MaMa demand. This evidence corresponds closely with that of the FNB employees presented in Section III.A above. In both cases, individuals with large amounts of debt are most likely to use PLS, suggesting that the large prizes offered by PLS are particularly attractive to individuals who are looking for a way to significantly change their economic circumstances.

Taken together, our findings are indicative that demand for PLS comes from a broad range of consumers across all income levels, age brackets, and ethnicities, consistent with previous research showing broad-based preferences for skewness (Scott and Horvath 1980; Mitton and Vorkink 2007; Barberis and Huang 2008). In addition, the financial position and experience of an individual are important predictors of PLS demand. In particular, demand for the MaMa product was strongest among financially constrained individuals and those who do not use regular savings products, as evidenced both by the FinScope survey results as well as high demand by bank staff who had borrowed heavily from the bank.

IV. Banking behavior of PLS participants

A. Did MaMa attract new savings?

While the evidence in Section III shows that MaMa attracted new *savers* into the banking system, it is also important to test whether PLS can generate significant new net *savings*, rather than just cannibalizing existing savings. We note two important data limitations of this portion of our analysis. First, our individual-level data on FNB employees only contains information on their accounts held at FNB, and

thus we cannot observe if these individuals have savings at home, in other banks, or in savings clubs or other informal institutions. Thus, we can test whether individuals who open MaMa accounts reduce savings held in other FNB accounts, but we cannot observe whether they are reducing savings held elsewhere. However, data from the FinScope survey shows that only 2.96% of South Africans had deposit accounts at multiple banks in 2005. In addition, only 1.73% of unbanked South Africans report that they regularly save any of their income either at home or in savings clubs. These figures suggest that it is unlikely that many of the individuals in our sample hold significant savings elsewhere.

A second important caveat is that the MaMa program was not a randomized experiment, and we therefore cannot draw unambiguous causal inference between usage of MaMa and increases in overall savings. Thus, we first present correlations between PLS take-up and overall savings levels. We then discuss additional evidence, some of which exploits random assignment, which provides evidence in support of the view that PLS and standard savings are indeed complements, while PLS and lottery gambling are substitutes.

Figure 4 provides a first look at the correlation between MaMa take-up and regular 32-day account balances. In this figure, we plot the average monthly growth rate of regular 32-day balances for two sets of bank branches: those that had above-median growth in MaMa account balances and those with below-median MaMa growth. Prior to the introduction of MaMa, average savings growth rates were very similar between the two sets of branches. After the MaMa program became active, those branches that had high average MaMa account growth also saw significantly higher growth in regular 32-day balances. If significant cannibalization of standard savings were occurring, one would expect just the opposite pattern.

[FIGURE 4]

Account-level evidence from bank employees presents the same result. Figure 5 plots the change in net savings over time for employees that opened MaMa accounts relative to employees that did not open accounts. We define net savings as the sum of all deposit accounts, including 32-day, money market,

checking, and MaMa, and then scale this amount by the annual income of the employee. We then estimate the following regression:

$$S_{i,t} = \beta X_i + \gamma_{r,t} + \sum_{k=-12}^{24} D_{i,t}^{k} \delta_k + \varepsilon_{i,t},$$

where i indicates employees and t indicates months. $S_{i,t}$ is the worker's level of total net savings at the bank as a percent of income at time t, X_i is a vector of worker characteristics including age, race, income, and gender, and $\gamma_{r,t}$ denotes region-by-time fixed effects. $D_{i,t}^{k}$ are dummy variables equal to one if month t is k months after (or before, if $k < 0$) the employee opened a MaMa account, and zero otherwise. The main coefficients of interest are δ_k, which show whether employees who opened MaMa accounts tended to have more or less savings k months after opening MaMa. Employees that never open an account will have $D_{i,t}^{k} = 0$ for all observations and serve as the control group.

[FIGURE 5]

In Figure 5, Panel A, we plot our estimates of δ_k as well as 95% confidence intervals based on the above regression.[31] As shown in Section III, prior to opening MaMa, these individuals tend to have lower-than-average savings levels relative to employees that never opened a MaMa account. About two months prior to opening a PLS account, total net savings begins to increase, with a large jump in savings occurring on the month that the MaMa account is opened. From this point onwards, MaMa participants maintain roughly 1% of annual income more in total net savings at the bank, relative to non-participants.[32] This represents a 38% increase from the average savings level of 2.9% of annual income.

It is important to note that the choice to open a MaMa account is endogenous, and so we cannot ascribe a causal relationship between opening a MaMa account and higher overall savings. Indeed, the fact that savings balances tend to increase in the two months *prior* to opening a MaMa account suggests that

[31] Confidence intervals are calculated using standard errors that are clustered at the individual level. The regressions have a total of 1.56 million observations.

[32] This effect size sits squarely in the middle of that found from other savings interventions reviewed by Bachas et al. (2017). An increase of 1% of annual income is larger than the effects of financial education, interest rate subsidies, and reminders to save, but smaller than providing individuals with debit cards or commitment devices.

some of those who chose to open a MaMa account likely did so because of a desire to save more (e.g., a positive wealth or income shock) and thus increased their balances in standard savings accounts as well. Because of this, we caution that the evidence does not necessarily support a claim that the MaMa program alone caused the full 38% increase in net savings. However, both Atalay et al. (2014) and Filiz-Ozbay et al. (2015) use lab experiments to show that PLS accounts tend to increase overall savings rates, and our results are in line with this evidence.

We examine how PLS usage is associated with savings in regular 32-day accounts in Panel B of Figure 5. This chart is created in exactly the same way as Panel A, except that here, the dependent variable in the regression is deposits in regular 32-day accounts as a percentage of annual income rather than total net savings at the bank. If PLS is cannibalizing regular savings, one would expect to see regular savings balances decreasing when PLS accounts are opened. Instead, we find that employees who opened MaMa accounts tended also to increase their balances in regular 32-day accounts by about 0.3% of income. Put differently, about 30% of the increase in total savings held by MaMa participants was in standard 32-day accounts, not the PLS product.[33] While this finding is only correlational, rather than causal, it is consistent with PLS and standard savings acting as complements rather than substitutes for the average participant. We discuss causal evidence of this relationship in Section V.B below.

In Panels C and D of Figure 5 we further explore the trends in net savings prior to opening a MaMa account by focusing on two subsamples of FNB employees: those who are, on average, net savers prior to opening a MaMa account and those who are net borrowers. Employees who on average are net savers or borrowers across the full time period but never open a MaMa account serve as the comparison group in each panel. We find starkly different trends in net savings prior to opening MaMa accounts for these two groups. In Panel C, we see that savers who open MaMa accounts are typically accumulating savings well before obtaining a MaMa account relative to other savers. Meanwhile, net borrowers who choose to use

[33] Importantly, we find similar results if we limit the sample to employees who had regular 32-day savings accounts prior to opening a MaMa account. Thus, the effect is driven partly by new account openings but also by individuals increasing deposits in pre-existing standard accounts.

MaMa typically have deteriorating financing positions (relative to other borrowers) prior to opening the PLS account. These results highlight the idea that an individual's wealth can affect her demand for PLS. For example, our findings are consistent with poverty trap theories in which a financially fragile household – e.g. the net borrowers in Panel D – that experiences a negative wealth shock will seek a highly skewed payoff (such as a lottery ticket or PLS) in order to escape the poverty trap. Importantly, Panel D also shows that on average, those borrowers who choose to open PLS accounts are able to accumulate savings (or decrease net borrowing) by about 1% of annual income over a two-year period. Meanwhile, Panel C shows that savers experience a large increase in net savings *prior* to using PLS, but on average, their net savings slowly decrease after opening a MaMa account relative to non-MaMa users such that they also hold about 1% more in net savings after two years.

B. MaMa demand and lottery gambling

Kearney et al. (2010) hypothesize that "the introduction of prize-linked savings products could provide an alternative to lottery tickets that offers a higher (and certainly less negative) return on one's 'investment.'" Given the similar payoff structure and previously documented substitutions between gambling and saving (Consumer Federation of America and The Financial Planning Association 2006; Lusardi, Schneider, and Tufano 2011), PLS could act as a natural substitute for lottery gambling. Further, evidence in Atalay et al. (2014) and Cookson (2016) shows that the introduction of a PLS program can reduce gambling expenditure.

We use random variation in the size of the jackpot of the National Lottery to test whether PLS demand and lottery demand are linked. Lottery prize winners in South Africa are drawn each Wednesday and Saturday, and the size of the jackpot is a function of the number of lottery tickets sold in each period. However, when a grand prize winner is not drawn, the jackpot rolls over to the next period, creating random periods in which jackpots are substantially larger than others. If MaMa is a substitute for lottery gambling, one would expect that MaMa demand should be lower in periods when the lottery jackpot is particularly high. We use daily data on both the amount of new deposits placed in MaMa accounts and the number of

new MaMa accounts created to calculate the total amount of new balances and number of new accounts at the bank during each draw period. We then use a time series regression to test whether MaMa demand (i.e., the number of new accounts created or amount of new funds deposited) was lower during draw periods with larger lottery jackpots.

Table V presents results from this estimation. The main independent variables in these regressions are dummies for the estimated size of the jackpot for each particular draw. These estimates were published by the National Lottery at the beginning of each draw period to generate demand for the lottery and were hence readily available for potential consumers.[34] We include a number of controls to account for other factors that may affect MaMa demand, including an indicator of whether the draw took place on a Saturday or a Wednesday and also an indicator of draw periods which offered less opportunity for customers to open MaMa accounts because of bank holidays. Between March and October 2007, the National Lottery was shut down due to disputes over the ownership of the license to run the lottery, and so there are no jackpot draws for this time period (and these months are not included in the regressions). We include broad time dummies which split the sample into four time periods of roughly nine months in length each: January – September 2005, October 2005 – June 2006, July 2006 – March 2007, and October 2007- March 2008. Including these time dummies controls for changes in the MaMa program—specifically, the introduction of a 0.25% interest rate in September 2005 and the doubling of prizes in September 2007—and helps take account of long-run trends in the growth of MaMa accounts. We also control for the growth in regular 32-day savings balances and accounts at the bank, to account for factors that might be driving savings in general at the bank. Lastly, we include a lag of the dependent variable to help remove serial correlation. Newey-West standard errors, which account for up to two weeks of serial correlation, are reported.

[TABLE V]

[34] Actual jackpots are very close to estimates. Estimated jackpots are derived from estimates of lottery ticket sales combined with any jackpot which was rolled over from previous periods or any special promotions (such as a guaranteed jackpot).

In support of the hypothesis that PLS can act as a substitute for lottery gambling, we show that MaMa demand was lower in draw periods with larger jackpots. When the anticipated jackpot was between R4 million and R7 million (the third quartile) or over R7 million (the fourth quartile), there was a reduction in total new deposits in MaMa accounts of 14.9% and 15.5%, respectively. Similarly, when jackpots are in the third (fourth) quartile, total new MaMa accounts created decreased by about 383 (316), a decrease of 11.0% (9.1%) from the mean of 3,483 new accounts created per draw period.[35]

These results strongly suggest that MaMa was indeed acting as a substitute for lottery gambling, meaning that reduced lottery expenditure is likely one of the main sources for additional savings deposited in PLS accounts. Paradoxically, however, we find no discontinuous increase in MaMa demand when the National Lottery was shut down in March 2007, nor do we find a decrease in demand when it re-opened in October of 2007. While these are only two data points and there are other possible factors that could be affecting MaMa demand during this period[36], it is surprising that there was not a discontinuous or even noticeable increase in MaMa usage during this period. Further work, with individual-level data on PLS usage and lottery expenditure may help fully resolve this question.

V. Prize winning and saving

A. Prize winner's own behavior

The behavior of PLS users after winning prizes can be indicative of their purpose in using the product in the first place, and in addition may be informative of how the prize structure can affect overall savings levels. In this section, we use account-level data for the 4,965 prize winners to test whether winning a prize increases or decreases demand for PLS.

[35] It is somewhat odd that the relationship between new MaMa accounts created and jackpot size is non-monotonic, as the estimated impact of jackpots in the third quartile is larger than that of the fourth quartile. However, standard errors are large enough that we cannot statistically rule out that the true coefficient for the fourth quartile is indeed larger than that of the third quartile, leaving open the possibility that this anomaly is simply due to statistical noise.

[36] Several concurrent events could also have affected MaMa demand around the lottery shutdown, including a series of appeals in the ongoing lawsuit between FNB and the National Lottery Board regarding the legality of the MaMa program in April and June 2007, as well as the doubling of MaMa prizes in September 2007.

Because prizes were awarded randomly, conditional on the MaMa account balance prior to the win, a prize is an exogenous shock to the financial situation of an account holder. We can examine whether that individual continues to invest in PLS and, if so, how much she holds in her account. Ex ante, it is unclear whether winning a prize will increase or decrease an individual's demand for PLS. On one hand, if an individual has invested in PLS with the hopes of dramatically improving his socioeconomic status, once a large prize has been won, he might be expected to close his account and invest in more standard investment products, as his goal has been achieved. This effect should be especially prevalent for larger prizes. On the other hand, it is also possible that lottery play has an addictive aspect to it (Guryan and Kearney 2010) and that winning a prize serves to strengthen this tie. Further, if individuals have a preference for skewed returns (Barberis and Huang 2008; Filiz-Ozbay et al. 2015), we might expect that they will choose to re-invest some of their winnings in PLS.

In Figure 6, we display estimates of the effect of winning a prize on the probability that an individual has a MaMa account open from three months before winning a prize until 12 months after. These estimates are relative to employees of the bank who did not win prizes.[37] The estimates are derived from regressions in which the dependent variable is an indicator equal to one if an individual had an open MaMa account *k* months after a prize is awarded, where *k* ranges from -3 to 12. We include in each regression all prize winners as well as all bank employees who had an open MaMa account in the month prior to the prize being awarded (and were thus eligible to win a prize as well). The regressions include demographic controls as well as year-month fixed effects so that we are comparing employees and prize winners in the same months to each other. Most importantly, we non-parametrically control for the MaMa balance prior to winning by including dummies for each decile of the distribution. These controls allow a causal

[37] Using bank employees as a control group is not ideal, as they are not necessarily directly comparable to prize winners who were not employees, but these are the only account-level data available to us that contain individuals that did not win prizes. There were only 59 employees who also won prizes, out of a total of 4,965 total prizes awarded, so we lack sufficient sample size to limit to only employee winners. However, all regressions include demographic controls as well as controls for MaMa balances one month prior to the prize month, which should account for any systematic differences.

interpretation of the estimates because winning a prize is random and conditional on the amount held in the account.

[FIGURE 6]

Panel A of Figure 6 shows coefficient estimates and 95% confidence intervals for a dummy indicating if an individual won a prize of R1,000 *k* months ago. Consistent with random assignment, prize winners are equally likely to have an open MaMa account as non-winners in the months prior to winning.[38] Immediately after winning, however, winners are about one percentage point more likely to close their account, and this effect grows gradually over the 12-month horizon. A year after winning a prize, winners are 4.2 percentage points less likely to have an open MaMa account relative to otherwise-identical non-winners. For reference, 79.7% of non-winners keep their accounts open for at least year after the prize is awarded, so this is a 5.3% reduction from the mean, significant at the 1% level.

Meanwhile, Panels B and C of Figure 6 show the effect of winning larger prizes on the probability of maintaining a MaMa account. Because there are substantially fewer large prizes awarded each month, estimates of these coefficients tend to be less precise than those of the R1,000 prize dummy. Regardless, we fail to find evidence of large changes in the probability of closing an account for R20,000 prize winners (Panel B) or those that won R100,000 or R1,000,000 prizes (Panel C).[39] One possible explanation for this fact could be that these large-prize winners feel that they have enough money that they can afford to gamble a bit, although standard errors are large enough that we cannot reject that these estimates are similar to those of the R1,000 prize winners in Panel A.[40]

[38] By definition, all individuals in the sample have an open MaMa account in month k=-1 because this is required to be eligible to win a prize. This is why this estimate=0 in all panels of Figure 6.
[39] In total, there were 35 R1,000,000 prize winners and 84 R100,000 winners. Because these groups are small, we group them together in these regressions, but we find similar results for each group if they are kept separate. Meanwhile, there were 421 R20,000 prize winners and 3,876 R1,000 prize winners.
[40] We find similar results when using a Cox proportional hazard model instead of linear probability regressions. Specifically, R1,000 prize winners have a higher hazard of closing their MaMa accounts, while winners of larger prizes do not, relative to non-winners.

Perhaps of greater interest is the effect of prize winning on MaMa account balances over time. We test this with a similar regressions, except here we replace the dependent variable with the MaMa account balance *k* months after a prize is awarded, a figure which we winsorize at the 95th percentile to avoid undue influence of outliers.[41] The results are shown in Figure 7. As before, in the three months prior to winning, prize winners have similar account balances as non-winners. In month 0, the prize is directly deposited into the winning MaMa account and, accordingly, we see an immediate increase in prize winners' account balances. Thus, from this point on, we track whether prize winners leave these amounts in their accounts or even increase their investment, or whether they take their winnings out of the accounts for other uses.

[FIGURE 7]

Panel A focuses on the effects of winning R1,000. We find that R1,000 prize winners increase their MaMa balances *beyond* the initial prize amount. Indeed, by month six they hold on average R4,190 more in their accounts than non-winners. That difference appears to hold constant through month 12. Because the increased savings is larger than the prize amount, this increased investment in PLS is more than a pure wealth effect due to the prize. Instead, R1,000 prize winners must actively substitute away from other investment or consumption in order to dramatically increase MaMa holdings. Combining this with Panel A of Figure 6, which shows that R1,000 prize winners are also more likely to close their accounts, we conclude that winning a small prize induces a small number of individuals to close their accounts, while those who keep their PLS accounts open tend to increase balances substantially.[42] This is potentially consistent with the idea that prize winning may add to the excitement of PLS and hence lead to increased demand for the average winner.

We see similar, but larger, effects among R20,000 prize winners (Panel B). Specifically, in month 0, we observe the initial shock of R20,000 due to the prize, but in subsequent months MaMa balances rise

[41] We also obtain similar results if we use ln(MaMa Balance) as the dependent variable.
[42] Estimates in Figure 7 are unconditional, in that they include prize winners who close their accounts. Given that 4.2% of R1,000 prize winners close their accounts (Panel A, Figure 6), which is equivalent to a zero balance, the average increase in MaMa balance conditional on keeping the account open is 4,190/(1-0.042)=4,373.

to about R30,000 higher than those of non-winners. Thus, even with a significantly larger prize, winners increased PLS deposits by more than the prize amount on average. Meanwhile, for the largest prize winners (Panel C), there is a large initial spike in MaMa balances due to the very large prizes, following which winners withdraw some, but not all, of the winnings. A year after winning, R100,000 and R1 million prize winners held on average about R20,000 more in their accounts than non-winners, an amount roughly equivalent to increased holdings by winners of R20,000 prizes. [43]

Taken together, these results show that while prize winners were somewhat more likely to close their accounts after winning, prize-winning leads to significantly higher PLS demand overall. Interestingly, the estimated effects for all three prize levels are similar across income, gender, race, and age categories, suggesting that there is little heterogeneity in these effects.

B. Effect of prize on other's behavior

A growing empirical literature has shown that peers can affect savings and investment behavior.[44] PLS, in particular, could naturally have large peer effects due to large prizes that are awarded, which may create a "buzz" that sparks further demand for PLS within a peer network. In this way, prize winning may create spillover effects that encourage savings among non-winners as well. Indeed, Guryan & Kearney (2008) show that these spillover effects exist for lottery ticket sales, finding that stores that sell winning lottery tickets experience increased lottery ticket sales in the following week. We follow their methodology and test whether bank branches where the jackpot winner holds an account experience excess demand for MaMa in the month following the win. To do so, we estimate the following specification:

$$MaMaGrowth_{bt} = \alpha_k + \gamma_k w_{b(t-k)} + \delta_k \ln(MaMaBal_{b(t-k)}) + \mu_{k,t} + \varepsilon_{k,bt}$$

where b indexes bank branches, t indexes months, k indexes months since the drawing, $MaMaGrowth$ is the monthly log growth rate of MaMa balances at the branch, w is a dummy variable equal to one if the

[43] Results are unchanged if we limit to "active" accounts, defined as those with some changes in balances after winning a prize. Thus, it does not appear that these higher balances are due to inattention.
[44] See, for example, Duflo and Saez (2002), Duflo and Saez (2003), Hong, Kubik, and Stein (2004), Brown et al. (2008), and Beshears et al. (2015).

jackpot winner's account was at branch b, $\ln(MaMaBal)$ is the natural log of total MaMa deposits held at the branch, and μ is a fixed month effect. With this setup, γ_k is the estimated effect of having a R1 million winner at the branch k months after the drawing relative to all other branches. This specification is estimated once for each value of k. It is crucial in these specifications to condition on the amount of MaMa deposits held at the branch, as each branch only has the same chance of having a jackpot winner conditional on the amount of MaMa deposits held at the branch that month. In addition, when calculating the growth rate of MaMa balances, we remove the jackpot winner's account from the total balance because the winner receives R1 million in her account in the month following the win, which has a drastic impact on growth rates.

Panel A of Figure 8 plots estimates of γ_k for values of k ranging from three months prior to the drawing to three months after, giving seven coefficient estimates in total (from seven different regressions) in the chart. As expected, coefficient estimates are statistically indistinguishable from zero for all months prior to the drawing, which verifies the identifying assumption that the assignment of the prize was truly random and conditional on MaMa deposits held at the branch. In the month following the drawing, we find that MaMa deposits grow by an excess of 11.6% at the branch that had the winning MaMa account. Note that this is a monthly growth rate. Across the whole sample, the average monthly growth rate of MaMa balances was 13.3%, and so having a jackpot-winning account holder increases the growth rate of deposits by 87%. However, the effect does not persist past one month. In the following month, growth at the winning branch is again indistinguishable from that of other branches. At the same time, the growth rate does not shrink below that of non-winning branches, such that this one-time shock results in a permanent *level* change in the amount of MaMa deposits at the branch.[45]

[FIGURE 8]

[45] In unreported results, we also find that branches with a higher-than-expected number of prizes experience abnormally high growth in MaMa balances in the following month. In addition, our results also hold if we change *w* to be a dummy equal to 1 if any large prize (i.e., greater than R1,000) was won by an account holder at a particular branch, although the estimated impact is smaller at 2.9% excess growth in MaMa balances.

In Panel B of Figure 8, we plot a similar picture, except in this case the dependent variable in the regression is the change in the number of MaMa accounts in month t. In this case, the estimated effect one month after the prize is not quite statistically significant (p-value=0.07), but the point estimate is similarly large. Specifically, having a jackpot winner increases the number of new MaMa accounts at the winning branch by about 36 accounts, a 70.5% increase from the mean increase of 51 new accounts.

While the fact that jackpot prizes generate more demand for PLS savings is interesting in its own right, it also provides a natural experiment to test whether PLS cannibalizes standard savings. As discussed in Section IV.A, we find that individuals who open MaMa accounts also tend to increase savings in regular 32-day accounts, but because the introduction of MaMa was not a randomly assigned, we cannot determine whether PLS *causes* higher standard savings. The awarding of jackpot prizes and subsequent increase in PLS demand at particular branches provides a natural experiment where we can test whether these same branches experience an increase in standard savings in the month following the prize. Panel C of Figure 6 shows that bank branches with jackpot winners do in fact experience a 4.2% higher growth in standard 32-day balances in the month following the win. This suggests that the shock to demand in PLS can generate spillovers into standard savings products as well, thereby reinforcing the correlations shown in Section IV.A and providing causal evidence that PLS and standard savings are complements rather than substitutes.

Finally, we test whether there is a spillover effect to other nearby First National branches. Here, we alter the definition of w such that it is a dummy equal to 1 if a branch within 10km (6.2 miles) has an account holder that wins the jackpot. In these regressions, we drop the winning branches from the sample, so as to focus entirely on estimating the spillover effect by itself. Results are presented in Figure 6, Panel D. We find weak evidence that branches experience excess MaMa deposit growth of about 1.7% in the month after a nearby branch has a jackpot-winning account. This result is just outside of the range of statistical significance (p-value=0.056), which is perhaps unsurprising given that the effect is an order of magnitude smaller.

While this empirical result is similar to Guryan & Kearney (2008), who find strong same-store effects for selling a winning lottery ticket, our study also provides several unique insights in the PLS setting. First, as opposed to lottery ticket purchases, there are many potential barriers which may lead to under-saving in formal financial institutions, such as transaction costs, lack of trust, and behavioral biases (Karlan, Ratan, and Zinman 2014). Thus, it is not obvious that PLS prizes will actually have similar spillover effects as lottery prizes. Second, as discussed above, PLS prizes lead to increases in *standard* savings deposits as well. Thus, the overall increase in savings is not due solely to a "lucky store effect," as proposed in Guryan and Kearney (2008), in which the increase in demand is due to the misperception that some bank branches are lucky. Instead, this result highlights that PLS and standard savings are, on average, complements. But, as opposed to interest earned in standard savings, the prizes in PLS naturally create a "buzz" that can flow through peer networks and thus act as a self-contained mechanism to generate savings, similar to the process modeled by Han and Hirshleifer (2015).

VI. Conclusions

The raw growth of the MaMa program confirms that, in South Africa at least, there was strong "unmet consumer demand…for saving products that offer the (remote) prospect of changing current wealth status, rather than incrementally building wealth with certainty" (Kearney et al. 2010). By relating personal characteristics to PLS usage, we find that demand for MaMa came in particular from financially constrained individuals – consumers who reported feeling unable to repay their debt. Relatedly, we find evidence that lower levels of optimism are also positively related to PLS demand. These results are in line with the idea that the attraction of "winning big" is strongest for individuals who have the greatest desire to obtain a life-changing amount of money, such as low-wealth or depressed individuals. Further, we did not find a relationship between financial knowledge and PLS take-up, suggesting that the relatively low observed levels of precautionary savings and high amounts spent on lottery gambling are not due to a lack of financial sophistication.

Building on this, our evidence suggests that prize-linked savings increase net savings. We do not see any evidence that the MaMa program cannibalized savings, and instead find the reverse: branches with higher MaMa usage also saw expansion of regular savings, and individuals who opened MaMa accounts typically increased their balances in standard savings accounts (although these relationships are not necessarily causal). Meanwhile, demand for MaMa was highest when the jackpot of the National Lottery was lowest, suggesting that the two acted as substitutes.

The welfare impact of PLS depends crucially on the relative benefits of consumption today versus savings for tomorrow. By ruling out cannibalization of savings, our evidence shows that increased savings in PLS is likely to come at the expense of reduced consumption. Some of that reduction comes from a decline in lottery expenditure (and in that sense can be seen as a shift in investment from the lottery to PLS), but our data do not allow us to pin down exactly how individuals adjust consumption in order to invest in PLS. While other evidence suggests that there are potentially large benefits to increasing savings and that many individuals express a desire to save more (Lusardi, Schneider, and Tufano 2011; Dupas and Robinson 2013), the exact benefits of PLS must be weighed against a decrease in current consumption. Another key component for an evaluation of welfare is determining whether PLS can serve as a gateway to other financial products that may be beneficial to individuals who do not currently use them. While our evidence shows that many PLS users remained at FNB even after the PLS program ended, more evidence is needed to know if individuals would eventually make this change voluntarily.

We also show that prize-winning has a material effect on the saving behavior of both the winner as well as those nearby. Prize winners tend to increase balances held in PLS by substantial amounts, in some cases by even more than the amount of the prize won. Further, large prizes create a local "buzz," leading to dramatically increased demand for PLS at the winning branch in the month following the win.

These findings are important for academic researchers seeking to understand saving and gambling behavior, as well as policy makers and practitioners who are considering alternative policies geared toward increasing savings. Prize-based incentives such as those offered in PLS products can successfully attract

new savers and new savings, and would also likely decrease the amount of lottery gambling. Our evidence shows that there is a potentially large group of consumers whose savings patterns might be enhanced if given a chance, however remote, of winning a life-altering prize.

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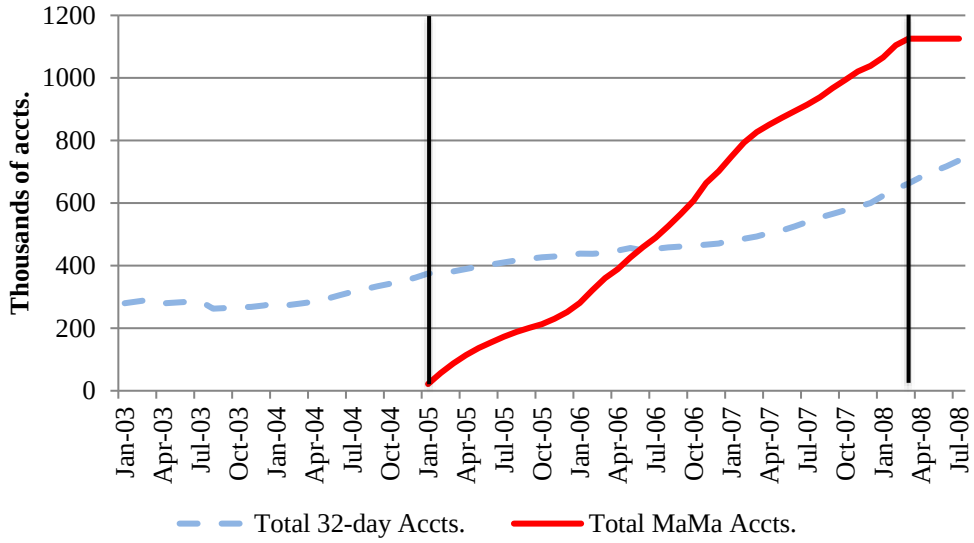
FIGURE 1
GROWTH OF THE MAMA PROGRAM

Panel A shows the total number of standard 32-day notice accounts and MaMa prize-linked accounts at First National Bank from January 2003 – July 2008, while Panel B shows the total balances held in these accounts (in Rand billions). In both charts, the vertical lines identify the beginning and end of the MaMa program, in January 2005 and March 2008, respectively.

Panel A: Total number of 32-day and MaMa accounts, bank-wide (thousands of accounts)



Panel B: Total deposits in 32-day and MaMa accounts, bank-wide (Rand billions)

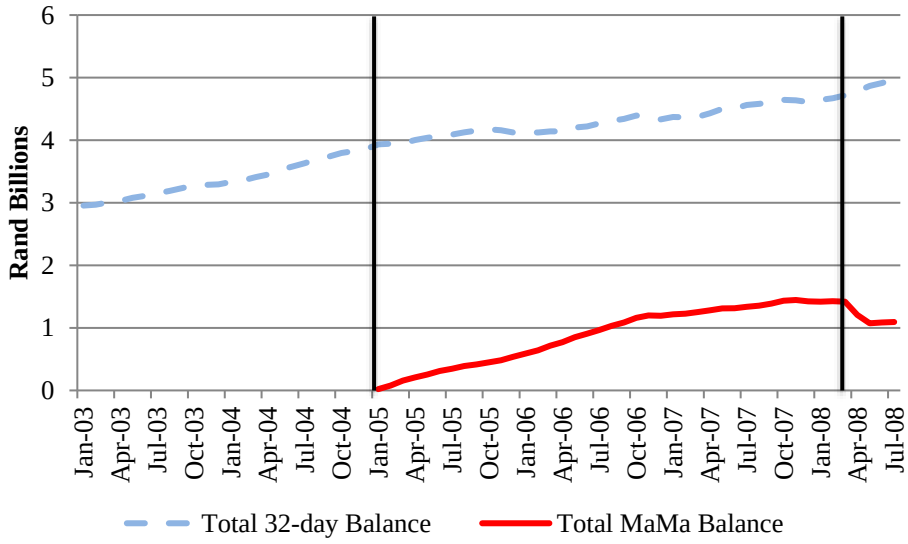
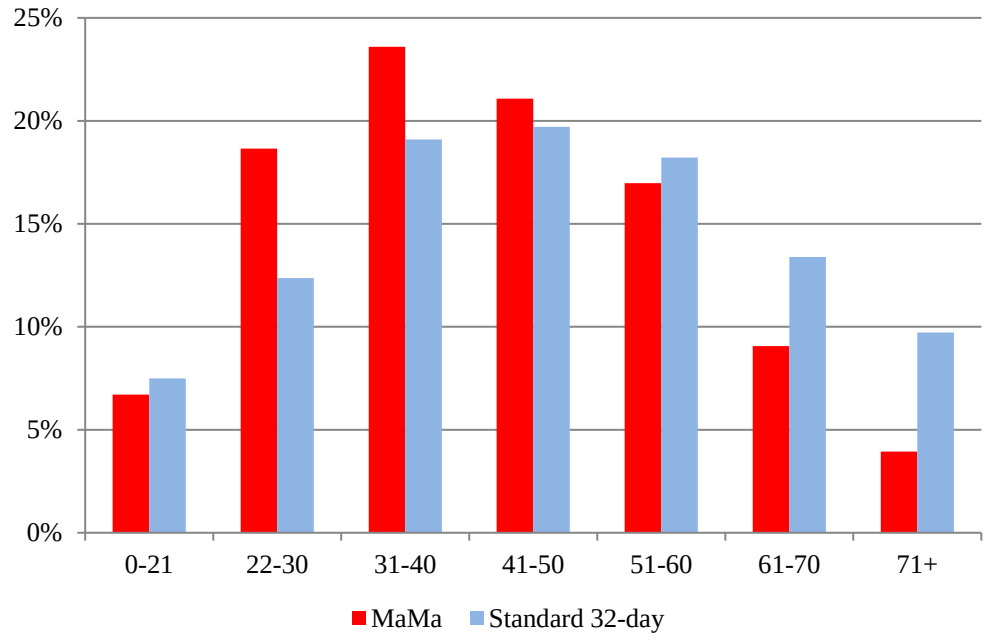


FIGURE 2

SHARE OF DEPOSITS HELD IN STANDARD SAVINGS AND PLS, BY AGE AND INCOME

Panel A of this figure displays the share of total deposits held by individuals in different age brackets for both standard 32-day and MaMa accounts. Panel B shows the share of total balances held by individuals across income brackets. For reference, the 25th, 50th, 75th, and 95th percentiles of income in South Africa in 2005 were R13,314, R26,559, R68,527, and R290,253, respectively. Data reflect account balances as of June 2008, three months after the MaMa program ended.

Panel A: Share of deposits held, by age bracket



Panel B: Share of deposits held, by income bracket

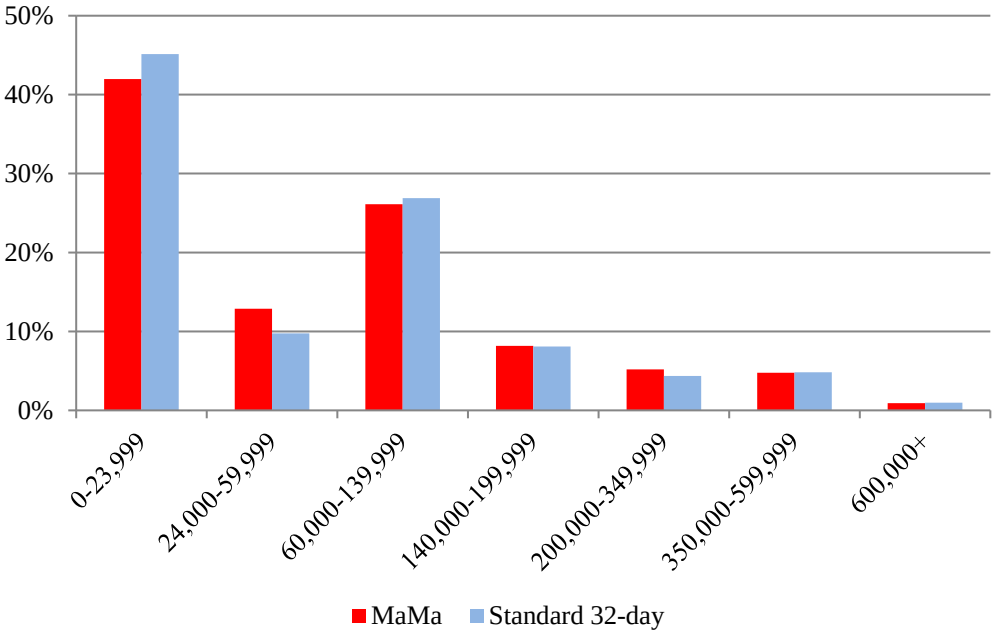


FIGURE 3

SHARE OF EMPLOYEES WITH STANDARD SAVINGS OR PLS ACCOUNTS, BY INCOME

This figure plots the share of bank employees that have a standard savings account or MaMa account across ten income deciles. Employees are classified as having a standard savings account if they have either a regular 32-day notice account or a money market account. Income deciles divide the 38,262 employees into ten groups of 3,826 employees each based on estimated income.

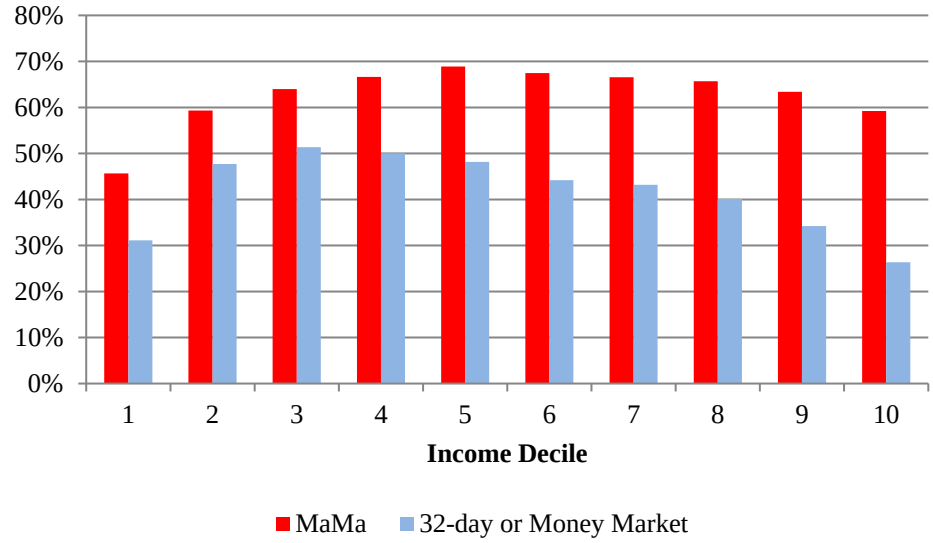


FIGURE 4

GROWTH RATES OF STANDARD 32-DAY SAVINGS BEFORE AND AFTER MAMA

This figure displays the average monthly growth rate of standard 32-day savings balances for two groups of First National's branches. Branches are divided based on their average monthly MaMa balance growth rate from Jan. 2005 to Mar. 2008. Those branches that had below-median MaMa growth are in the *low MaMa growth* group, while the remaining branches are placed in the *high MaMa growth* group. The figure shows average growth rates of standard 32-day balances both before and after the MaMa program, with the vertical line denoting the start of the program. While *high MaMa growth* branches averaged 0.57% higher 32-day savings growth than *low MaMa growth* branches prior to the introduction of the MaMa account, after this date the difference grew to an average of 2.01%. A t-test that the difference-in-differences is different from zero is significant at the 1% level.

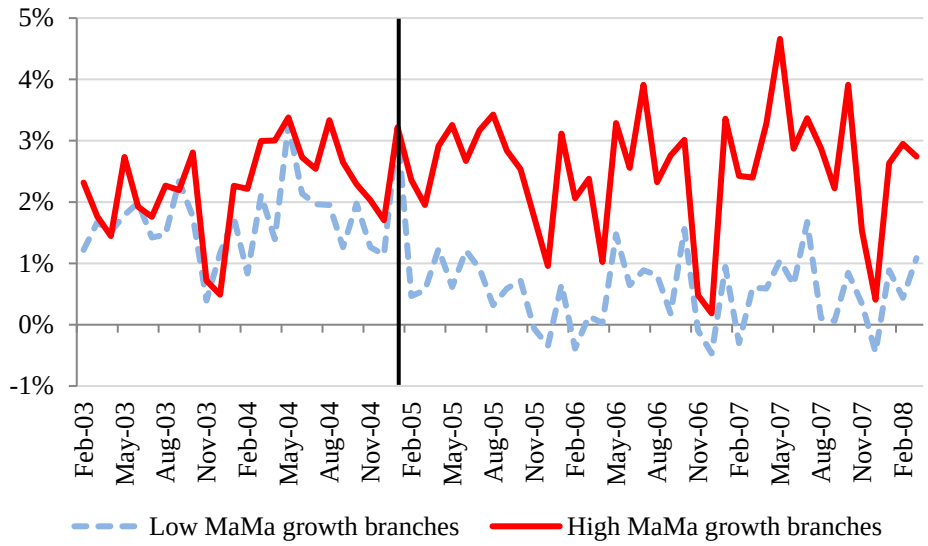
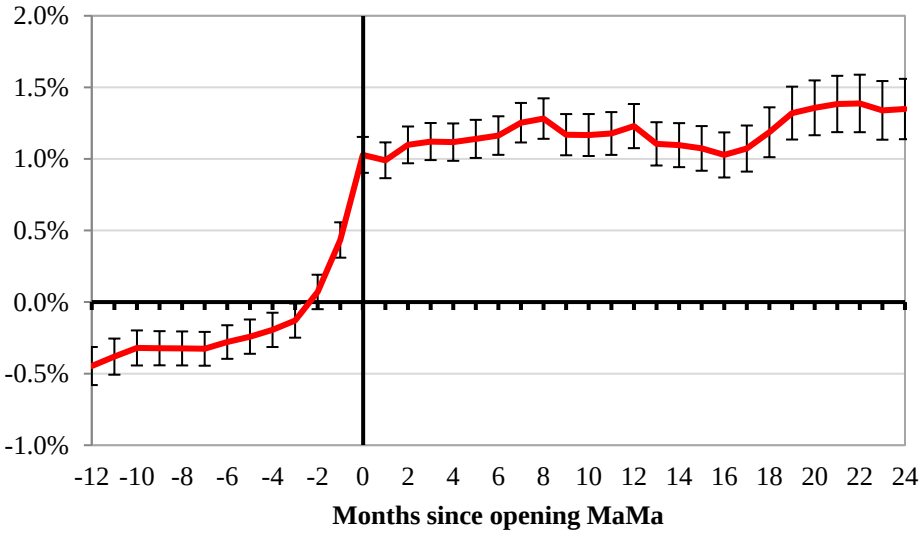


FIGURE 5

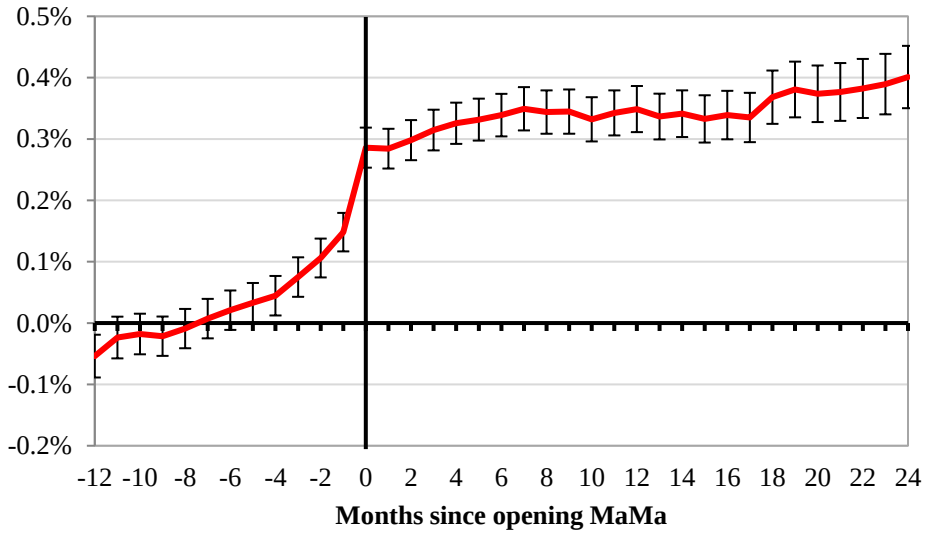
SAVINGS BALANCES OF BANK EMPLOYEES: MAMA USERS VS. NON-USERS

This figure shows the evolution of savings balances for bank employees who opened MaMa accounts, as compared to employees who never used MaMa. Each panel displays coefficient point estimates and 95% confidence bands for dummy variables in regressions that test whether MaMa users savings balances were significantly different from those of non-users. In both panels, the x-axis measures the number of months since opening MaMa, ranging from one year prior to two years after opening the account, and the vertical line indicates the month in which a MaMa account was first opened. Panel A shows the evolution of total net savings balances, defined as the sum of all deposit accounts held by the employee in a given month. Panel B examines balances of standard 32-day accounts by themselves and checks whether employees decreased their regular savings balances when opening MaMa accounts. Panels C & D repeat the estimates from Panel A on the subsample of employees who, on average, were net savers or net borrowers from FNB, respectively. Regressions are estimated by OLS, and exact specifications are described in detail in the text. Confidence intervals are based on robust standard errors that are clustered at the individual employee level.

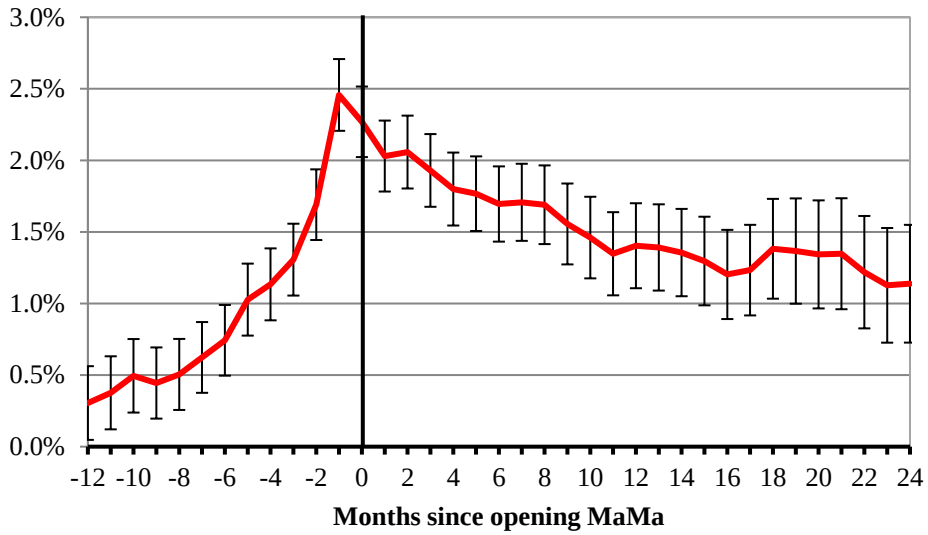
Panel A: Evolution of net savings of MaMa users relative to non-users



Panel B: Evolution of regular 32-day account balances of MaMa users relative to non-users



Panel C: Evolution of net savings of MaMa users relative to non-users, employees who are net savers only



Panel D: Evolution of net savings of MaMa users relative to non-users, employees who are net borrowers only

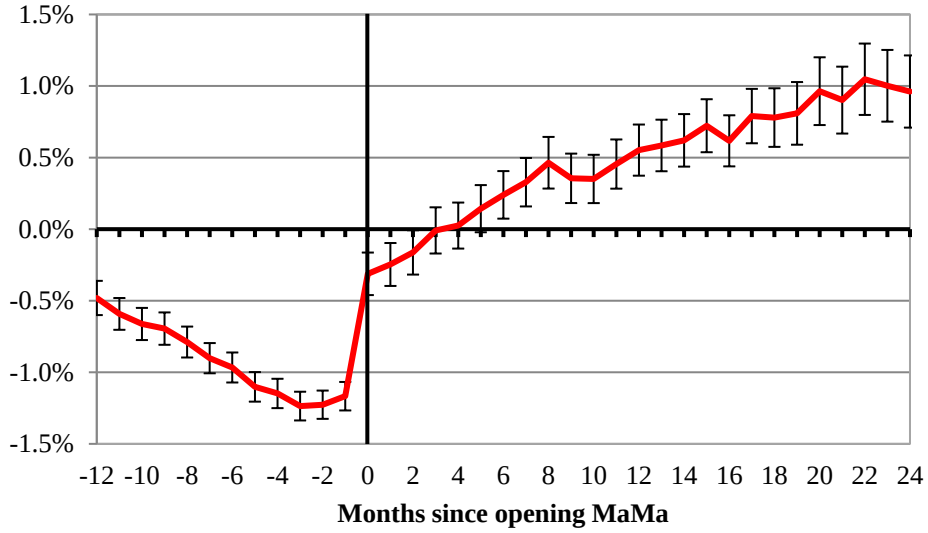
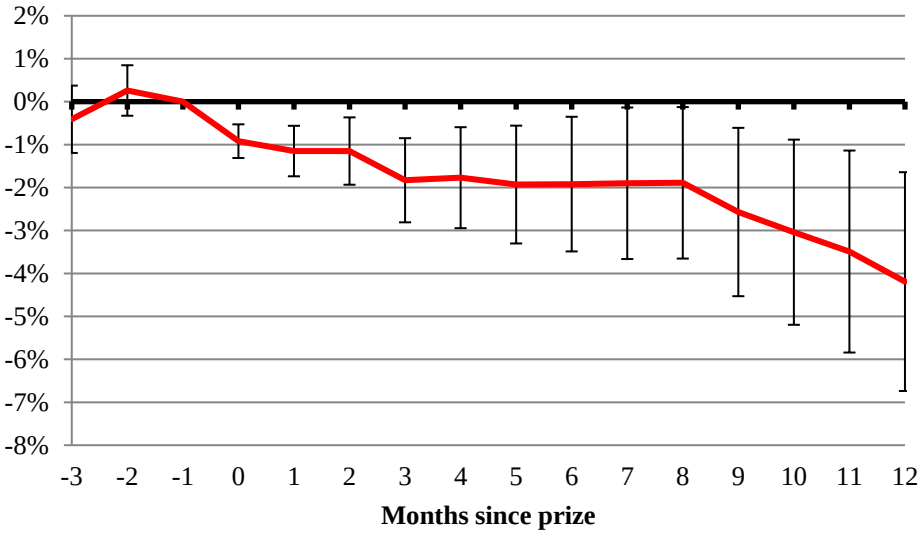


FIGURE 6

EFFECT OF WINNING PRIZE ON WINNER'S PROBABILITY OF KEEPING MAMA

This figure shows the impact of winning a prize on the likelihood of keeping a MaMa account open over time, as compared to bank staff. Each point displays the coefficient estimate and 95% confidence interval from separate OLS regressions based on individual-month level data. The dependent variable is an indicator equal to 1 if the individual has a MaMa account open *k* months after a prize was awarded, where *k* ranges from -3 to 12. In each regression, we control non-parametrically for the decile of MaMa balances one month prior to winning, as well as all demographic controls contained in Table IV, thus focusing only on the random event of winning a prize. Prize winners are included in each regression once, while each month of observation for bank staff is included in the sample if that employee has a MaMa account *k* months ago, such that all bank employees who had active accounts in the month of the win act as the control group. All regressions include year-month fixed effects. 95% confidence intervals are based on robust standard errors clustered at the individual level. The effect of winning R1,000 or R20,000 is shown in Panels A and B, respectively. In Panel C we group R100,000 and R1,000,000 prize winners together.

Panel A: Effect of R1,000 prize on probability of keeping MaMa account



Panel B: Effect of R20,000 prize on probability of keeping MaMa account

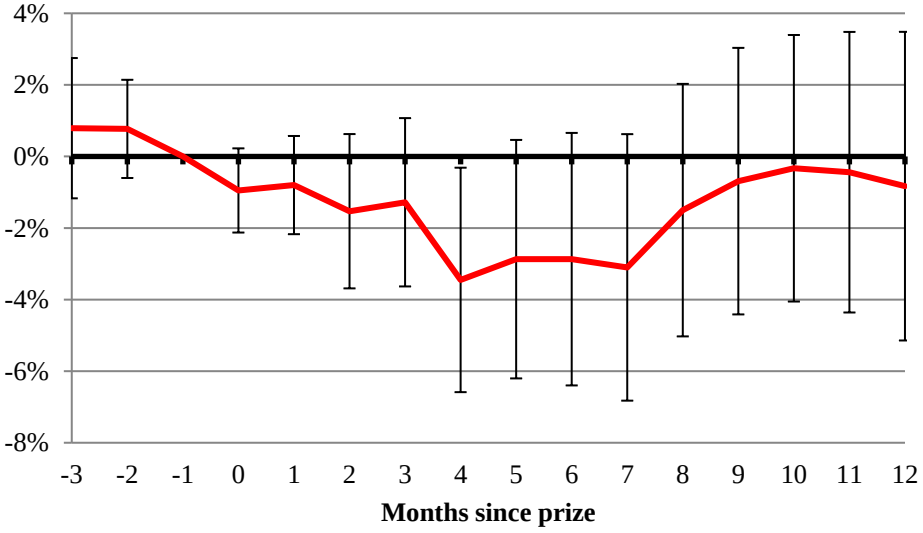


FIGURE 6 - *continued*

Panel C: Effect of >R100,000 prize on probability of keeping MaMa account

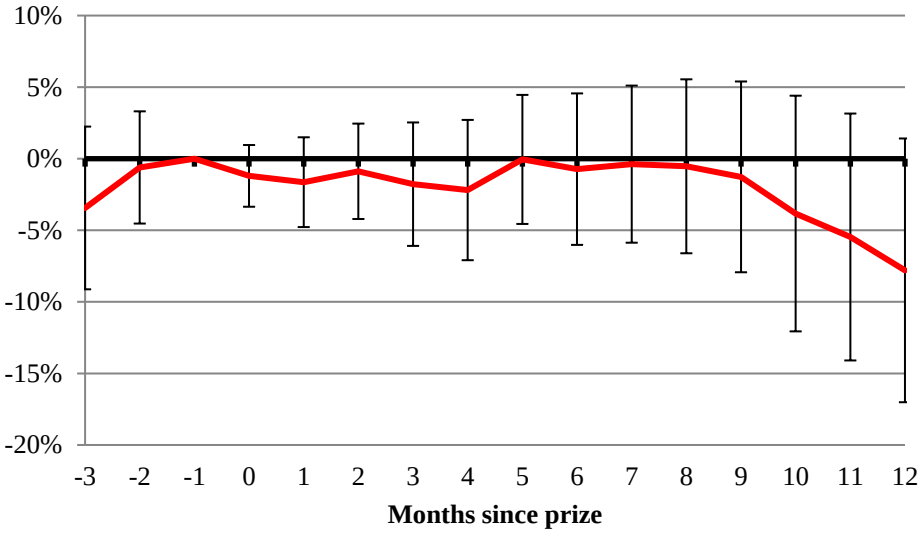
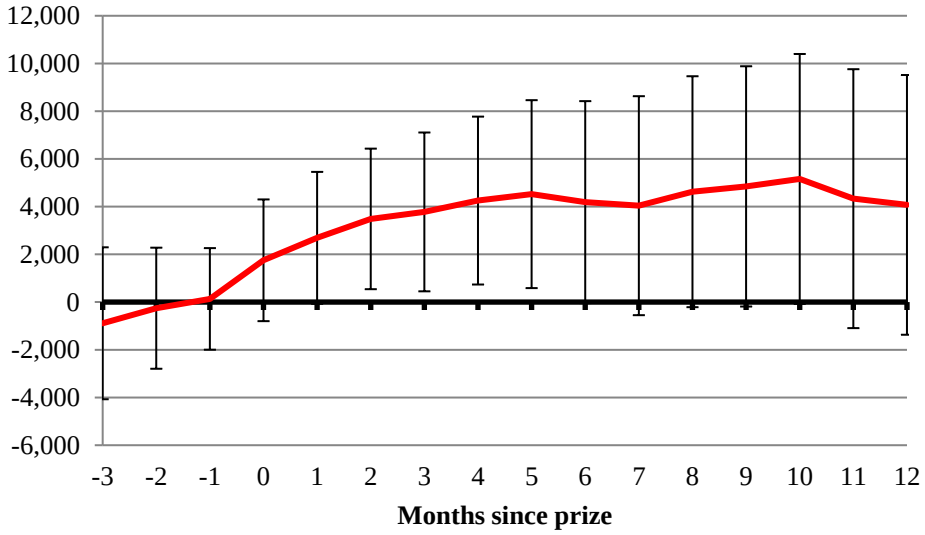


FIGURE 7
EFFECT OF WINNING PRIZE ON WINNER'S MAMA DEPOSITS

This figure shows the impact of winning a prize on MaMa account balances over time, as compared to bank staff. Each point displays the coefficient estimate and 95% confidence interval from separate OLS regressions based on individual-month level data. The dependent variable is the total MaMa balance in month *k*, where *k* ranges from -3 to 12. Balances are winsorized at the 95th percentile. In each regression, we control non-parametrically for the decile of MaMa balances one month prior to winning, as well as all demographic controls contained in Table IV, thus focusing only on the random event of winning a prize. Prize winners are included in each regression once, while each month of observation for bank staff is included in the sample if that employee has a MaMa account *k* months ago, such that all bank employees who had active accounts in the month of the win act as the control group. All regressions include year-month fixed effects. 95% confidence intervals are based on robust standard errors clustered at the individual level. The effect of winning R1,000 or R20,000 is shown in Panels A and B, respectively. In Panel C we group R100,000 and R1,000,000 prize winners together.

Panel A: Effect of R1,000 prize on MaMa balance



Panel B: Effect of R20,000 prize on MaMa balance

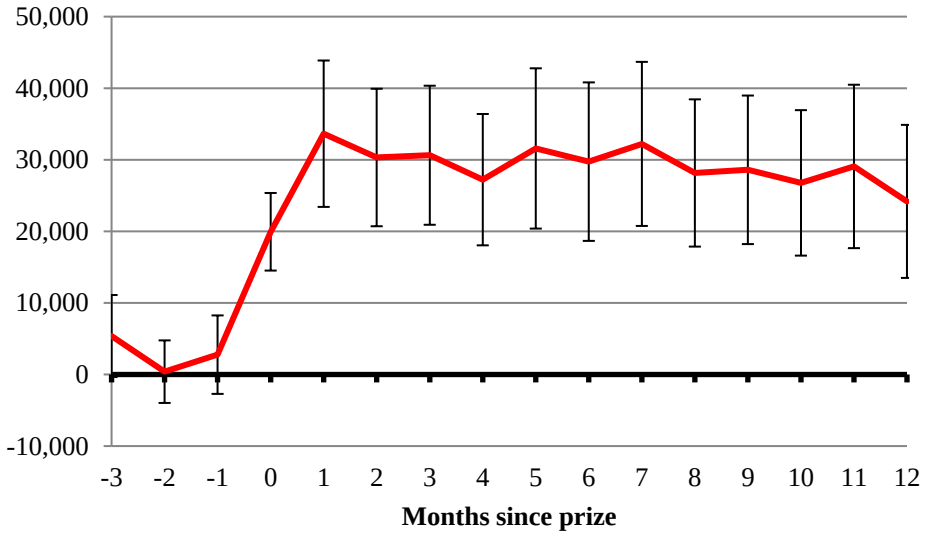


FIGURE 7 – *continued*

Panel C: Effect of >R100,000 prize on MaMa balance

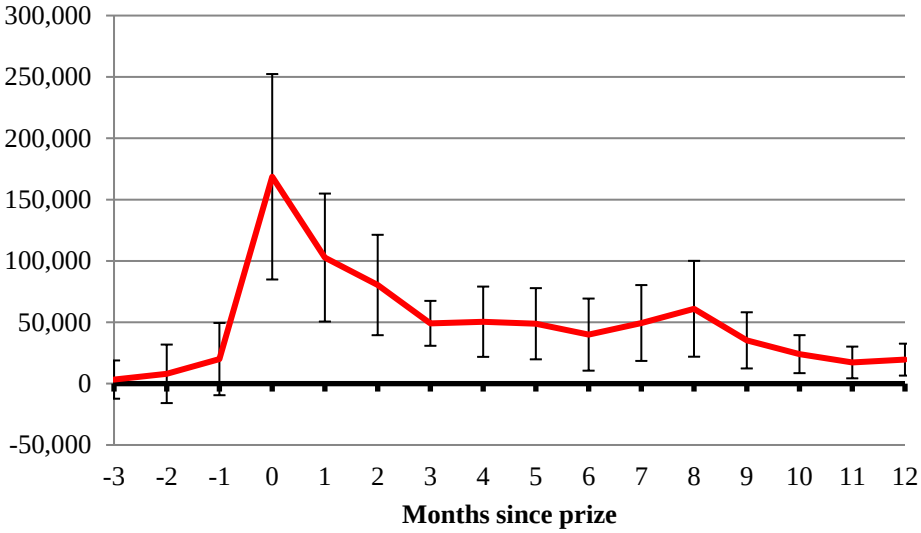
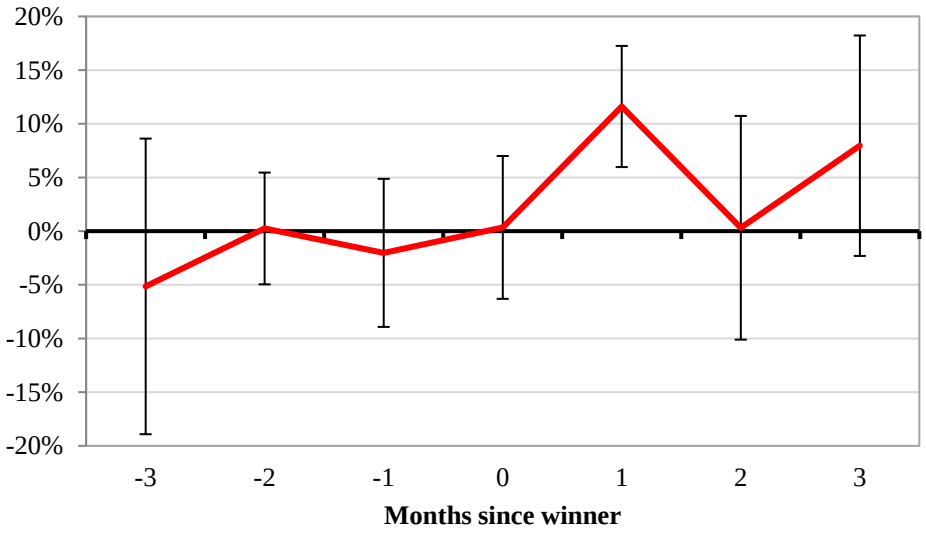


FIGURE 8

EFFECT OF JACKPOT PRIZE WINNER ON LOCAL MAMA DEMAND

This figure shows the impact of having a million-Rand prize winner on local MaMa demand. Each panel displays coefficient point estimates and 95% confidence bands from seven separate regressions corresponding to the effect of a jackpot win three months prior until three months after the prize is awarded. Panel A shows the effect of having a million-Rand winner on the excess monthly growth rate of MaMa balances at the same branch, relative to all other bank branches. Panels B and C are similar, except they show the impact of a jackpot win on the change in the number of MaMa accounts and the total standard 32-day deposits at the branch, respectively. Panel D displays the spillover effect of a jackpot win on the growth rate of MaMa balances at branches that are within 10km of the winning branch. Regressions are estimated by OLS, and exact specifications are described in detail in the text. 95% confidence intervals are based on robust standard errors which are clustered at the branch level.

Panel A: Excess growth of total MaMa deposits at winning branch



Panel B: Change in number of MaMa accounts at winning branch

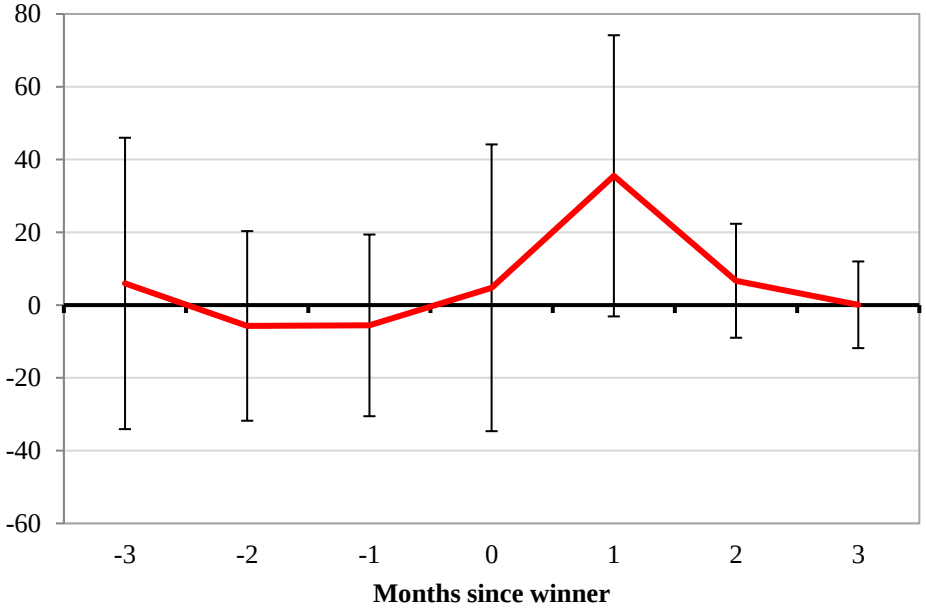
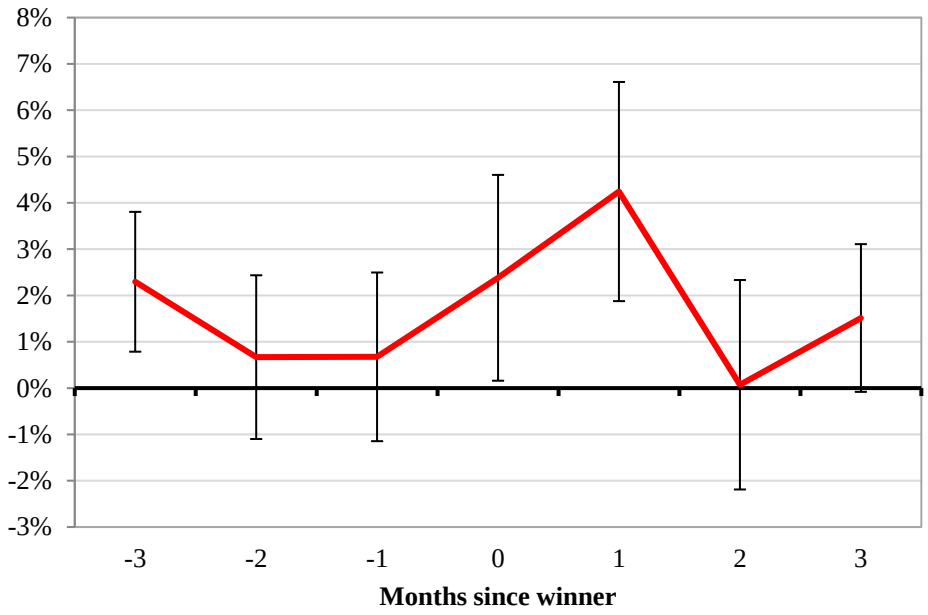


FIGURE 8 - *continued*

Panel C: Excess growth of total 32-day deposits at winning branch



Panel D: Excess growth of total MaMa deposits at nearby branches

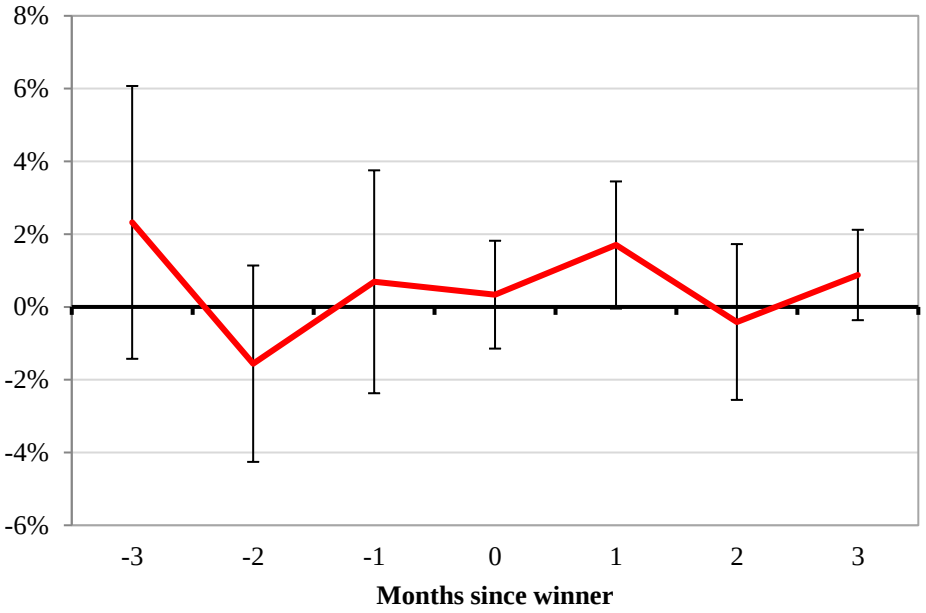


TABLE I

SUMMARY STATISTICS OF FIRST NATIONAL BANK DATA

This table reports summary statistics for data obtained from First National Bank. Panel A presents summary statistics on the total number of accounts and total deposits in standard 32-day and MaMa accounts at 604 bank branches as of March 2008, when the MaMa program ended. Panel B compares the share of balances owned by race and gender for 32-day and MaMa accounts. Panel C contains account-level summary statistics for bank employees.

Panel A: Branch-level summary statistics as of March 2008

	Product	*N*	*Mean*	*Std. Dev.*	*10th percentile*	*Median*	*90th percentile*
Total No. of Accounts	32-day	604	1,097	1,064	148	826	2,273
	MaMa	604	1,863	2,505	211	1,408	3,797
Total balance (Rand millions)	32-day	604	R 7.81	R 8.08	R 0.89	R 5.29	R 18.00
	MaMa	604	R 2.35	R 3.25	R 0.23	R 1.70	R 5.00

Panel B: Share of balances owned by race and gender

	MaMa	32-day
Race:		
Black	0.45	0.45
White	0.37	0.41
Asian	0.09	0.07
Mixed race	0.08	0.07
Males	0.52	0.46

Panel C: Account-level summary statistics of bank employees as of March 2008

							% with non-zero balance	
	N	*Mean*	*Std. Dev.*	*10th %tile*	*Median*	*90th %tile*	*Jan. 2005*	*Mar. 2008*
Total balance:								
32-day saving	38,301	872	9,989	0	0	322	9.9%	15.4%
Money market	38,301	3,285	31,091	0	0	841	--	22.9%
Checking	38,301	206	17,507	-5,833	0	2,703	39.0%	62.6%
MaMa	38,301	567	5,510	0	0	723	5.5%	45.5%
Combined	38,301	4,930	39,921	-5,065	0	10,043	41.4%	77.9%
Income Estimate	38,301	175,920	203,408	60,000	112,297	360,000	--	--
Combined bal. (% income)	38,301	3.41	62.44	-4.4	0	6.9	--	--

TABLE II
FINSCOPE SUMMARY STATISTICS

This table reports summary statistics of demographic characteristics derived from the FinScope 2005 survey. Each item represents the mean or median of all survey respondents within 50km of each bank branch. This table reports summary statistics across the distribution of the 494 branches that had at least 12 respondents within the 50km radius. Financial segmentation model (FSM) tier and FSM components are calculated by FinScope based on responses to a battery of questions. Each respondent is segmented for each component separately on a scale from 1 to 8, and then the overall tier is a combination of those components (and also ranges from 1 to 8). For all components, a higher tier signifies more of that component (e.g., higher financial penetration score signifies that an individual has adopted more financial products). *% can't pay debt* is the percentage of respondents within 50km of the branch who agreed with the statement "you never seem to be able to pay off your debt; your debt just keeps getting worse." *% can't pay debt (outliers removed)* reports summary stats when branches above the 98th percentile have been removed.

	N	*Mean*	*Std. Dev.*	*10th %tile*	*Median*	*90th %tile*
Number of respondents in 50km radius	494	218.98	199.89	18	132	528
Demographics						
Race:						
Black	494	70.5%	23.3%	34.6%	72.3%	98.3%
White	494	15.0%	10.3%	0.0%	17.2%	25.4%
Asian	494	2.9%	4.1%	0.0%	1.2%	8.2%
Coloured	494	11.5%	19.4%	0.0%	4.2%	39.7%
% Male	494	48.8%	1.7%	47.3%	48.8%	50.1%
% Married	494	41.8%	10.9%	29.7%	45.3%	50.2%
Median Age	494	33.45	4.67	27	32	37
Median Household Income	494	28,804	12,063	15,000	27,000	42,000
% Rural	494	30.2%	32.5%	1.2%	14.6%	84.7%
% with at least High School Education	494	40.4%	14.1%	19.1%	39.9%	55.6%
% unemployed	494	25.7%	9.8%	17.3%	23.0%	38.9%
Homeownership rate	494	75.3%	11.3%	67.4%	73.3%	91.0%
Financial Indicators						
% Banked	494	51.1%	15.4%	28.8%	54.7%	66.8%
FSM Tier	494	3.46	0.68	2.48	3.57	4.15
FSM Components:						
Financial Penetration	494	2.28	0.49	1.63	2.35	2.94
Financial Access	494	3.86	0.88	2.62	4.06	4.72
Financial Discipline	494	4.95	0.38	4.52	4.99	5.25
Financial Knowledge	494	3.49	0.56	2.69	3.56	4.07
Connectedness and Optimism	494	6.67	0.27	6.30	6.75	6.94
% can't pay debt	494	15.0%	9.3%	2.7%	14.4%	23.9%
% can't pay debt (outliers removed)	487	14.5%	8.4%	2.7%	14.4%	23.8%

TABLE III
INDIVIDUAL-LEVEL MAMA TAKE-UP AMONG BANK STAFF

This table presents estimates from OLS regressions run on the First National Bank staff dataset. In each regression, the dependent variable equals one if the employee has a positive balance in a particular savings product at any time during the sample period (Jan. 2005 - Mar. 2008). In Panel A, we correlate demographic characteristics with the propensity to have either a standard 32-day savings account, a money market or standard 32-day account, or a MaMa account. *Ex-staff* indicate employees whose employment terminated at some point during the sample period. In Panel B, we test whether previous banking behavior is correlated with the propensity to open a MaMa account, after controlling for all demographic characteristics contained in Panel A. *High* and *low savings before MaMa* are dummy variables indicating employees with above- and below-median savings, respectively, as a percent of income prior to opening a MaMa account. *High* and *low borrowing before MaMa* are defined similarly for net borrowers (and thus those with no accounts are the omitted group). All regressions contain 34 bank region fixed effects (regions are defined internally by First National Bank). Robust standard errors (reported in parentheses) are clustered at the region level. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Demographic characteristics

Dependent Variable:	*Has 32-day Savings Account*	*Has 32-day or MM account*	*Has MaMa Account*
Age (<30 omitted):			
30-39	-0.074***	-0.093***	0.056***
	(0.005)	(0.005)	(0.011)
40+	-0.096***	-0.104***	0.146***
	(0.009)	(0.007)	(0.017)
Income decile (1st omitted):			
2nd	0.058***	0.095***	0.105***
	(0.011)	(0.010)	(0.013)
3rd	0.087***	0.141***	0.153***
	(0.013)	(0.013)	(0.016)
4th	0.106***	0.148***	0.190***
	(0.015)	(0.011)	(0.010)
5th	0.107***	0.143***	0.203***
	(0.015)	(0.014)	(0.012)
6th	0.082***	0.129***	0.182***
	(0.009)	(0.011)	(0.013)
7th	0.083***	0.141***	0.178***
	(0.018)	(0.015)	(0.012)
8th	0.058***	0.126***	0.174***
	(0.010)	(0.012)	(0.012)
9th	0.046***	0.099***	0.168***
	(0.016)	(0.017)	(0.014)
10th	0.018	0.064***	0.145***
	(0.015)	(0.017)	(0.019)
Male	-0.061***	-0.088***	-0.042***
	(0.004)	(0.005)	(0.005)

TABLE III – *continued*

Race (mixed race omitted):			
Black	0.093***	0.074***	-0.044***
	(0.011)	(0.014)	(0.011)
White	0.003	0.022**	-0.042***
	(0.007)	(0.009)	(0.009)
Asian	-0.012**	-0.004	-0.044***
	(0.006)	(0.009)	(0.006)
Ex-staff	-0.018**	-0.145***	-0.104***
	(0.007)	(0.019)	(0.009)
Region Fixed Effects	Y	Y	Y
Observations	38,262	38,262	38,262
R-squared	0.036	0.055	0.046

Panel B: Previous banking behavior

Dependent Variable:	*Opened a MaMa Account*		
No saving or checking acct. before opening MaMa	0.046**		
	(0.022)		
No saving account before opening MaMa		0.122***	
		(0.008)	
No checking account before opening MaMa		0.019	
		(0.021)	
High savings before MaMa			-0.012
			(0.025)
Low savings before MaMa			-0.124***
			(0.026)
Low borrowing before MaMa			-0.051***
			(0.017)
High borrowing before MaMa			0.054***
			(0.019)
Demographic controls	Y	Y	Y
Region Fixed Effects	Y	Y	Y
Observations	38,262	38,262	38,262
R-squared	0.048	0.058	0.060

TABLE IV

BRANCH-LEVEL MAMA TAKE-UP AS A FUNCTION OF DEMOGRAPHIC AND FINANCIAL CHARACTERISTICS

This table presents results of OLS regressions where the dependent variable is the log total usage of MaMa in March 2008 (at the close of the program) for each bank branch. Panel A shows the relationship between demographic characteristics and MaMa usage, as measured both by log total MaMa deposits and by the log number of MaMa accounts. Panel B adds financial characteristics to these demographic controls to test whether banking attitudes have an additional impact on MaMa usage. To be concise, we present only results relating to log total MaMa deposits in Panel B, but similar results are found using log number of MaMa accounts. Independent variables come from the FinScope 2005 survey, and are averages (or medians, if specified) for all respondents within a 50km radius of the bank branch. *FSM Tier* is a classification created by FinScope that categorizes respondents by various financial segments, and is based on five separate components that are identified separately in Panel B. See text for a complete explanation of how the FSM tiers were created. The final column of Panel B removes branches above the 98th percentile of *% can't pay debt*. In all regressions, we control for the size of the branch by including the log total amount of regular 32-day deposits as an independent variable. Standard errors are clustered by 54 district municipalities and are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Demographic characteristics

Dependent variable:	*Ln(MaMa deposits)*	*Ln(No. of MaMa accts.)*
Race (% Coloured omitted):		
% Black	-0.560**	-0.869***
	(0.267)	(0.205)
% White	-0.188	-0.753
	(0.660)	(0.591)
% Asian	3.343***	3.986***
	(0.748)	(0.682)
% Male	1.500	0.423
	(1.771)	(1.748)
% Married	-0.169	-0.158
	(0.279)	(0.317)
Median Age	-0.009	-0.004
	(0.007)	(0.009)
Median Household Income	-0.005	-0.003
	(0.004)	(0.003)
% with at least High School education	0.510	0.236
	(0.362)	(0.367)
Unemployment rate	-0.572	-0.169
	(0.472)	(0.407)
Homeownership rate	-0.594*	-0.490
	(0.299)	(0.315)
Rural Area	-0.342	-0.291
	(0.212)	(0.207)
Ln(Regular savings demand)	0.796***	0.856***
	(0.034)	(0.037)
Observations	494	494
R-squared	0.772	0.754

TABLE IV - *continued*

Panel B: Financial characteristics

	Full Sample				Outliers removed
Dependent variable:	*Ln(MaMa deposits)*				
% banked	-0.495				
	(0.411)				
FSM Tier		-0.122			
		(0.158)			
FSM Components:					
Financial Penetration			-0.385**		
			(0.191)		
Financial Access			0.080		
			(0.081)		
Financial Discipline			-0.131		
			(0.114)		
Financial Knowledge			0.255		
			(0.156)		
Connectedness and Optimism			-0.350***		
			(0.126)		
% can't pay off debt				0.742	1.685***
				(0.550)	(0.433)
Demographic controls	Y	Y	Y	Y	Y
Observations	494	494	494	494	487
R-squared	0.773	0.773	0.781	0.775	0.777

TABLE V
BANK-WIDE MAMA GROWTH AND THE NATIONAL LOTTERY

This table relates overall MaMa demand to the size of the jackpot available in the South African National Lottery. Each week, winning lotto numbers are drawn on Wednesday and Saturday. For each regression, the dependent variable is an indicator of growth in MaMa usage over the three-day period (M-W or Th-S) preceding the draw. *ln(New funds deposited)* is the log of total Rand deposited in new accounts during the draw period, and *# of new accts. opened* is the total number of new MaMa accounts opened over the draw period. Jackpot sizes were estimated and published by the National Lottery prior to the draw. We non-parametrically divide jackpots into four quartiles, where the largest jackpots are typically due to rollovers or guaranteed prizes. *Saturday* indicates draws that were done on Saturday, and controls for time-of-week fixed effects. *Few business days* controls for draw periods that covered less than three business days due to holidays. *Savings growth* controls for the growth in regular 32-day deposit balances (1st column) and accounts (2nd column) at First National during the draw period. To remove serial correlation, we include lagged values of the dependent variable. In addition, four time fixed effects are included to control for different periods of the MaMa program: Jan-Sept. 2005, Oct. 2005-Jun. 2006, Jul. 2006-Mar. 2007, and the period after the lottery re-opened from Oct. 2007 to Mar. 2008. Newey-West standard errors that account for up to two weeks of remaining serial correlation are reported. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	*ln(New funds deposited)*	*# of new accts. opened*
Estimated Jackpot size (< R3 million omitted)		
R3 million - R4 million	-0.0140	-121.0
	(0.0705)	(151.9)
R4 million - R7 million	-0.149***	-382.6***
	(0.0473)	(130.7)
> R7 million	-0.155***	-315.8**
	(0.0589)	(159.1)
Saturday	-0.0602	74.67
	(0.0460)	(99.79)
Few Business days	-0.409***	-1,189***
	(0.0893)	(170.2)
Savings Growth (%)	3.045	13,347**
	(2.564)	(5,794)
Lagged dependent variable	0.672***	0.693***
	(0.0578)	(0.0567)
Time period fixed effects	Y	Y
Observations	276	276

TABLE VI
INDIVIDUAL-LEVEL MaMa DEMAND AFTER WINNING A PRIZE

This table presents OLS regressions that test the effect of winning on MaMa account holders, as compared to bank staff. Data is at the individual-month level. In each regression, we control non-parametrically for the decile of MaMa balances one month prior to winning, as well as all demographic controls contained in Table IV, thus focusing only on the random event of winning a prize. Prize-winners are included in each regression once, while each month of observation for bank staff is included in the sample if that employee has a MaMa account six months or 12 months prior to that month, such that all bank employees who had active accounts in the month of the win act as the control group. The first two columns present results from linear probability models which test whether winning a prize affects one's propensity to continue to use a MaMa account six months or a year after winning. The second two columns test whether winners have higher or lower balances in those accounts than bank employees who did not win. All regressions include year-month fixed effects. MaMa account balances used as dependent variables in the last two columns are winsorized at the 95th percentile to avoid outlier bias. Robust standard errors are in parentheses and are clustered at the individual level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Has MaMa Indicator*		*MaMa Acct. Balance*	
Snapshot - No. months after win:	6	12	6	12
Prize Category				
R1,000 to R19,999	-0.017**	-0.042***	5,842.63***	4,071.15
	(0.008)	(0.013)	(2,176.12)	(2,778.05)
R20,000 to R99,999	-0.021	-0.008	30,553.72***	24,184.53***
	(0.016)	(0.022)	(5,285.80)	(5,454.80)
R100,000 to R999,999	-0.037	-0.137**	26,142.40***	20,662.28***
	(0.038)	(0.065)	(6,527.38)	(7,866.34)
R1,000,000	0.054***	0.041	100,586.04**	17,349.30
	(0.014)	(0.042)	(45,553.33)	(10,560.09)
Prior MaMa balance decile fixed effect	Y	Y	Y	Y
Demographic controls	Y	Y	Y	Y
Year-Month Fixed Effect	Y	Y	Y	Y
Observations	439,152	323,714	439,152	323,714
R-squared	0.152	0.150	0.317	0.189