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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 lottery-like payouts to individual account holders in lieu of interest. Using microlevel data from a bank in South Africa, we show that PLS is attractive to a broad group of individuals, with financially constrained individuals and those with no other deposit accounts particularly likely to participate. Individuals who choose to use PLS increase their total savings on average by 1% of annual income. Exploiting the random assignment of prizes, we present causal evidence that PLS substitutes for lottery gambling but is a complement to standard savings.

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1. Introduction

This paper examines the introduction of a prize-linked savings product (PLS) by First National Bank (FNB) in South Africa, which offered depositors lottery-like prizes in lieu of interest. The top monthly prize of 1 million Rand was roughly 587 times the median monthly income of a Black household. The product was very popular, and within 18 months of its launch, FNB, one of the largest banks in South Africa, had more PLS accounts than traditional savings accounts. We evaluate the hypothesis that PLS can generate both new formal savers and new savings while diverting spending on lottery products.

Our study takes place in a context where formal savings is low, but where some evidence suggests returns to formal savings may be high (Dupas and Robinson 2013). In fact, both the PLS product and the phenomenon of little or no precautionary savings are widespread around the world, suggesting that the lessons from South Africa may be more general. The product we study was a significant commercial success, attracting millions of new accounts and growing in 18 months to constitute 24% of the bank's savings deposits.

As is typical in real-world settings, PLS accounts are not randomly assigned, requiring us to pay careful attention to potential confounding factors. Our empirical approach benefits from high-frequency, microlevel data on both total savings at the branch level for the entire bank and individual, account-level data on savings decisions by thousands of employees. We exploit both the timing of the introduction of the product, the random nature of prize awards, and variation in the size of national government lottery jackpot to explore how savings behavior responds to the availability of prizes.

Our data-rich setting allows us to confirm and expand on a number of findings related to PLS. First, we corroborate the finding of Tufano (2008) and Kearney et al. (2010), which shows that PLS-style products are popular.[1] Our microdata show that this is true for most of the population we study, including various racial groups and across a wide range of income levels. Relative to individuals who open standard savings accounts during the same period,[2] customers who opened PLS accounts were more likely to be male, older, and be in the middle to high end of the income distribution. In addition, the product is most popular among those who did not previously have a savings account and among those who had higher levels of debt.

Second, we help answer the important question of whether product design can generate higher levels of savings, a question posed by a growing literature on security design (Simsek 2013, Célérier and Vallée 2017, Calvet et al. 2019, Keys and Wang 2019, Iachan et al. 2021). Studying microdata on savings behavior of FNB employees, we find that adoption of PLS is

associated with savings increase of approximately 1% of annual income, or 38% relative to baseline savings. Measuring total savings (rather than savings in a single account) is particularly challenging. Although we do not have household survey data to measure total savings across multiple financial institutions, we do have data on all FNB accounts held by FNB employees; only a tiny fraction of South Africans (3.3%) report having multiple banking relationships. We complement these individual-level findings with aggregate branch-level analysis. Account-level data allow us to measure whether PLS cannibalizes regular savings. Surprisingly, we find that customers opening PLS accounts also increase regular savings account balances. This is true in raw correlations in the data and when we use random variation in PLS demand. Specifically, we find that the award of a jackpot 1 million Rand prize creates a *buzz* at the branch level, leading to 11.6% growth in PLS deposits at the branch.[3] This random shock to PLS usage also leads to a 4.2% higher growth in regular savings at the same branch, demonstrating that PLS did not cannibalize regular savings.

Third, we quantify determinants of consumer demand for PLS by exploiting random variation inherent in lotteries. The size of jackpot of the South African National Lottery varies over time, and we show demand for PLS is especially high when the jackpot size is low. The finding that PLS is a substitute for gambling is consistent with evidence in Atalay et al. (2014) and Filiz-Ozbay et al. (2015), who use experiments to show that PLS demand is especially strong among lottery players.[4] Our results complement a laboratory-in-the field approach by Dizon and Lybbert (2021), which finds that PLS is more effective at increasing savings than high interest rates, and that contributions in PLS accounts are financed by reductions in lottery spending, traditional savings, and consumption.

Similarly, we use the random award of prizes in the PLS product to understand to what extent the prizes themselves lead to further savings or result in winners "cashing out" and closing their accounts. We find that, on average, individuals who win small prizes (R1,000 or R20,000) increase savings by an amount over and above the size of the prize, although winners are also about 4.2% points more likely to close their account following a win (a 5.3% reduction from the mean). Winners of larger prizes (R100,000) also increase savings by a substantial amount.

Our results build on a growing literature on prize-linked savings, which has to date included mostly high-level macro data (Tufano 2008), small-scale surveys (Tufano et al. 2008), laboratory experiments (Atalay et al. 2014), or has lacked microdata on savings (Cookson 2018). Our results complement recent advances in understanding the microfoundation of demand for these products, such as Filiz-Ozbay (2015), who shows that nonlinear probability weighting can explain demand. To the extent that this tendency is widespread across many individuals (Bruhin et al. 2010), our evidence of high demand for PLS across all demographics and among all FNB branches is consistent with this explanation for PLS demand.[5]

These questions are particularly important in the context of low-income households, where a growing body of evidence suggests that a large percentage of households in developed and developing countries alike maintain little to no savings (Lusardi et al. 2011, FDIC 2012).[6] A broad literature has identified several important constraints, including behavioral biases, to saving (Karlan et al. 2014). PLS may deserve attention as an additional tool in a kit that already includes default options, commitment devices, or savings reminders.[7]

Finally, we note that, although 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. For example, although we show that 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. Lacking detailed data on household consumption, we are unable to test the complete welfare implications of PLS but find it a promising product that might motivate some individuals to save.

2. Background and Data

2.1. FNB's Prize-Linked Savings Product

The data for this paper come from FNB, the retail and commercial bank subsidiary of FirstRand Bank Limited, the third largest bank in South Africa.[8] FNB 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). The time period of our study is one of relative macro-economic stability, with real GDP growth rates ranging from 2.95% to 5.5% over the period of 2003–2008.

FNB 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

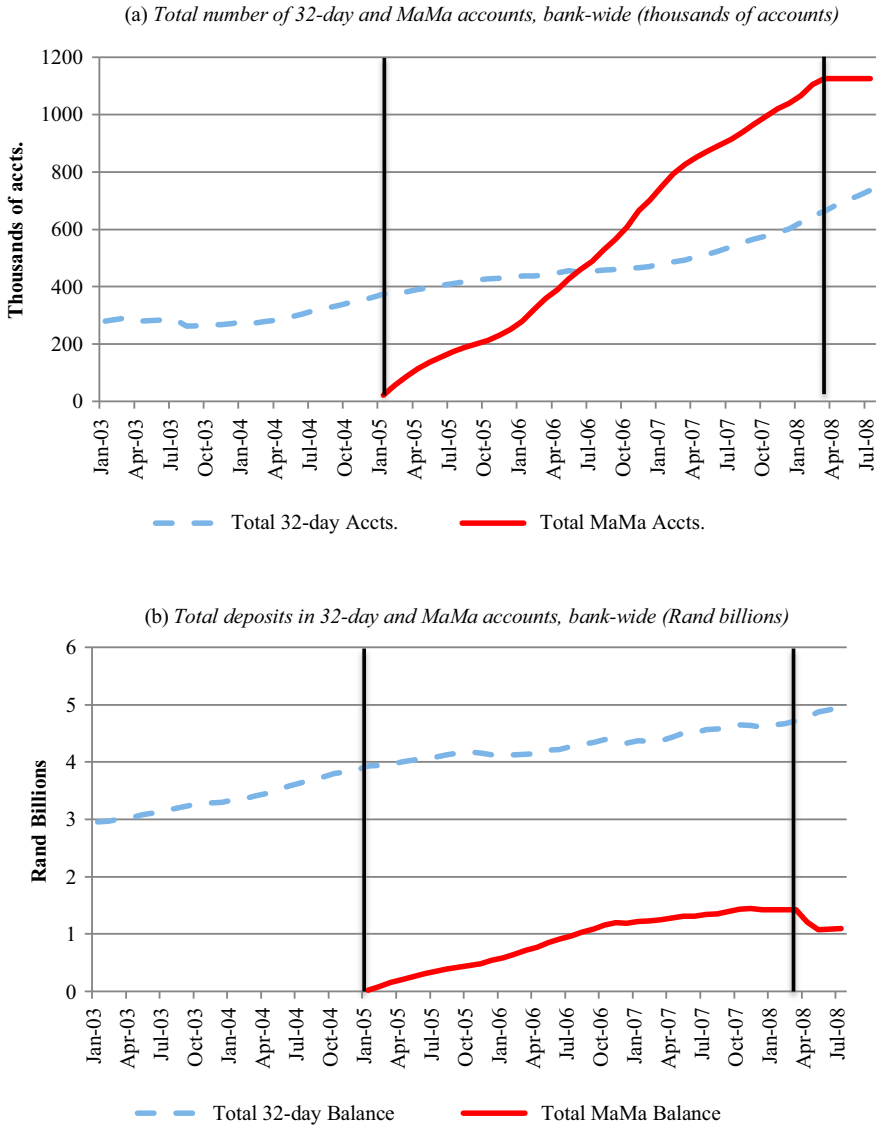
R100,000 prizes, 20 R20,000 prizes, and 200 R1,000 prizes. The size of the prizes was substantial: an R1,000 prize compares with a median Black household monthly income of R1,890 and a median white household income of R13,112. Throughout the program, each account holder received one entry into the lottery for each R100 held in her account.[9] MaMa accounts were 32-day notice accounts, meaning that if a customer wished to withdraw some of her funds without a fee, she had to notify the bank 32 days in advance of the withdrawal. Customers who wished to withdraw funds earlier paid a withdrawal fee of 5% of the amount withdrawn. The most comparable account at FNB 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% annual percentage rate (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 number 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%, because of the relatively small number 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.[10] At its lowest, the expected interest rate on MaMa accounts was 1.59% in August 2007, just before the number of prizes was doubled.[11]

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 use 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 with the MaMa expected return. From 2005 to 2008, the expected return on the South African National Lottery was about 46 cents per Rand invested.[12] 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 previously, 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. Even though returns were very similar between these two alternatives, they are not exact substitutes as the synthetic investment has much higher skewness of returns because of much larger jackpots and higher chances of not winning a prize in the National Lottery. Preferences for skewness might lead one individual to invest in the lottery, whereas more risk-averse individuals might prefer MaMa. However, FNB certainly focused its advertising on the lottery aspects of the MaMa program. Indeed, the very name "Million-a-Month Account" highlights the jackpot potential of the product. In addition, advertising done by the bank in newspapers and television commercials highlighted the benefits of winning a jackpot (ability to travel or purchase big-ticket items) as opposed to more traditional benefits of savings accounts. Furthermore, the national television broadcasts of the winning account being announced would have served to further the focus on prize winning.

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; ZASCA 2008). In South Africa, as has historically been the case in the United States, the government holds a monopoly on lotteries. Although FNB argued that its program was not 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 FNB 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, although some participants in the program did withdraw their funds, more than 77% of all PLS deposits remained in the bank for at least four months after the accounts converted to standard savings products.

Figure 1. (Color online) Growth of the MaMa Product



Notes. (a) Total number of standard 32-day notice accounts and MaMa prize-linked accounts at the First National Bank from January 2003 to July 2008. (b) 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.

The high share of deposits that remained at First National after MaMa ended could reflect a simple lack of attention by depositors or an active decision to leave the funds at the bank. Using account-level data, we identify "high activity" individuals as those with above-median mean absolute percent changes in MaMa balances leading up to March 2008. We find that on average, high activity users kept 50.9% of their funds in MaMa after its closure, whereas low activity users kept 83.9% of deposits. Assuming that high activity individuals are those that pay the most attention, the difference between the two groups indicates that inattention plays an important role. However, the fact that high activity users left half of their deposits at FNB after MaMa ended suggests that many users actively chose to leave their deposits at FNB after the accounts were converted to standard savings products.

2.2. 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

Table 1. Summary Statistics of FNB Data: Branch-Level Summary Statistics as of March 2008

	Product	*N*	Mean	Standard deviation	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	R7.81	R8.08	R0.89	R5.29	R18.00
	MaMa	604	R2.35	R3.25	R0.23	R1.70	R5.00

Note. This table reports summary statistics on the total number of accounts and total deposits in standard 32-day and MaMa accounts at 604 First National Bank (FNB) branches as of March 2008, when the MaMa program ended.

Table 2. Summary Statistics of FNB Data: 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

Note. This table reports summary statistics for data obtained from the First National Bank (FNB) and compares the share of balances owned by race and gender for 32-day and MaMa accounts.

National Bank with the 2005 FinScope financial survey of South Africa, provided by FinMark Trust. Details of each data set are described below.

2.2.1. FNB Data. FNB 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. Tables 1–3 provides summary statistics of the total number of accounts and total deposits at each branch as of March 2008, when the MaMa program ended.

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, three 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 2. With respect to race, MaMa depositors are less likely to be white and more likely to be Asian or of mixed race.[13] Men account for a total of 52% of MaMa deposits compared with only 46% of regular 32-day deposits, suggesting that the lottery payoff structure might be more attractive to men than women, perhaps because of lower risk aversion (Eckel and Grossman 2008) or overconfidence (Barber and Odean 2001). We examine the relationship between personal characteristics and PLS demand more closely in Section 3.

In addition to the relatively coarse branch-level data, we also analyze account-level data for employees of FNB. This data set contains month-by-month information on the account balances of 38,256 employees of FNB 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,[14] and MaMa accounts. In addition, we also have a snapshot of the employee's race, gender, age, income estimate,[15] and the region of South Africa in which they work. Summary statistics of employee account balances are provided in Table 3.[16]

Take-up of PLS was high among FNB 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 3.1, take-up of PLS was higher than that of standard savings products across all income categories, including the lowest-paid employees.

There are both advantages and disadvantages to working with staff data. Perhaps the largest advantage is that employees of the bank are much less likely to be affected by MaMa advertising. It is possible that MaMa affects regular savings levels because its introduction serves as broad advertising for First National Bank. However, this advertising channel is unlikely to be at play for employees at First National, who are already well aware of First National Bank and its products. Focusing on this data set helps rule out an advertising channel, one of the key alternative explanations for our findings.

One downside of the staff data set is that this is not a representative sample of the South African population, and so this subsample may limit external validity. For example, only 41% of bank employees are black compared with 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 FNB employee earns R175,963 per year, whereas 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,

Table 3. Summary Statistics of FNB Data: Account-Level Summary Statistics of Bank Employees as of March 2008

							Percent with nonzero balance	
	N	Mean	Standard deviation	10th percentile	Median	90th percentile	January 2005	March 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 balance (% income)	38,301	3.41	62.44	−4.4	0	6.9	—	—

Note. This table reports summary statistics for data obtained from the First National Bank (FNB) and contains account-level summary statistics for bank employees.

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 data set 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 later), we estimate that only 3.3% of South Africans have accounts at multiple banks, conditional on having at least one account. Similarly, only 6.7% of households in the survey report maintaining cash savings at home. Of course, as discussed above, FNB employees earn more than most South Africans, and thus there is a possibility that they are more likely to have accounts at multiple financial institutions. However, FinScope data show that high-income individuals are only marginally more likely to have accounts at multiple banks. Specifically, when limiting to income levels above the median, 75th percentile, and 90th percentile, only 4.2%, 4.9%, and 5.2% of individuals have savings at multiple institutions, respectively.[17] In addition, one would expect that the majority of FNB employees would do most or all of their banking at FNB because of 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 later), 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 accounts that have an overdraft facility that allows customers to maintain negative balances with relatively flexible repayment possibilities. Bank staff paid competitive interest rates similar to those of regular customers on overdrawn accounts. These negative balances can be interpreted as unsecured consumer credit obtained from the bank. Tables 1–3 show 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, whereas 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 our analyses using the staff data set, we winsorize account balances at the 1% and 99% levels.

Finally, we also have account-level information on prize winners. In the winners data set, 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.

2.2.2. FinScope Data. We augment the data obtained from FNB 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.[18] 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 toward 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 FNB 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 each branch, we average the values for all respondents within a 50-km (31.1-mile) radius of the branch, thereby giving the general characteristics of individuals who are likely to be exposed to that particular bank branch.

Online appendix Table A.I 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.[19] In addition, there are 11 private branches that 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%). To validate that FinScope respondents are similar to FNB customers, in unreported results, we verify that FinScope demographic variables (age, income, and race) correlate strongly with average demographic characteristics of FNB customers at each bank branch.

In the analysis in Section 3, 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[20]
- 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[21]

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.

3. MaMa Product Adoption

The widespread growth of MaMa was remarkable. By June 2008, the number of MaMa accounts at FNB exceeded the number of 32-day savings accounts at FNB for every age, gender, income, and race subgroup.[22] 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, whereas 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 FNB employees and 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.

In addition, these results can help with identification concerns. We find that those who open MaMa accounts increase net savings, but it could be that these individuals would have opened regular savings accounts had MaMa not been available. Results in this section show that those who opened MaMa accounts are significantly different from individuals who open regular savings accounts. Because MaMa brought different individuals into the banking system, it is unlikely that our results are driven entirely by individuals who would have increased savings regardless of the PLS option.

Before discussing our empirical results, we first note that the marketing efforts of FNB may have had an important influence on uptake of the MaMa product and thus the ability to extrapolate our findings to other contexts will depend on similarities in promotional efforts. In particular, given that our focus is on the characteristics of individuals who choose to save in PLS products, the key issue we face is whether marketing influenced a particular type of customer to begin using the MaMa product. If, for example, marketing was targeted at unbanked individuals, then it is impossible to determine whether the unbanked adopted MaMa because the product itself is attractive or because the marketing was effective. As is typically done with new products, FNB promoted the MaMa account with a combination of national television, radio, and press advertising, as well as ATM messages, screen savers, brochures, and promotional merchandise. From the bank's perspective, their goal is to get as many individuals to invest in MaMa as possible, as this decreases the effective interest rate of the product. Thus, marketing was based on attracting the mass market, with much of the ad campaign focused on jackpot winners and the skewed payoffs.[23] Importantly, the concern that MaMa's marketing might affect our results is largely mitigated among bank employees, because most, if not all, bank employees would have known about the product and were exposed to similar advertising within bank branches. For this reason, our main analysis focuses on product adoption among employees, where marketing is less likely to influence our results, and we then supplement this analysis with broader data from FinScope.

Table 4. Individual-Level MaMa Take-Up Among Bank Staff: Nonsavers in January 2005

	Dependent Variable: *Opened a MaMa Account*	
Sample	No savings account in Jan. 2005	No savings account in Jan. 2005 and opened savings by Mar. 2008
Borrower in January 2005	0.120***	0.039***
	(0.008)	(0.004)
Male	−0.045***	0.017***
	(0.005)	(0.005)
Race (mixed race omitted)		
Black	−0.041***	−0.064***
	(0.011)	(0.007)
White	−0.040***	−0.035***
	(0.008)	(0.006)
Asian	−0.035***	−0.007
	(0.006)	(0.006)
Ex-staff	−0.108***	0.018***
	(0.009)	(0.006)
Age and income decile fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Observations	34,476	24,102
R^2	0.054	0.052

Notes. This table presents estimates from OLS regressions run on the First National Bank (FNB) staff data set. The dependent variable is *Opened a MaMa account*. In each regression, the dependent variable equals one if the employee has a positive balance in the MaMa product at any time during the sample period (January 2005 to March 2008). This table focuses on employees who did not have any type of savings account in January 2005, when the MaMa product launched. The first column includes all staff without any savings account, whereas the second column further limits the sample to employees who opened any type of savings account during the period. *Borrower in Jan. 2005* identifies employees with debt at FNB at the start of the sample period. Coefficients for age and income deciles are displayed in Figure 2. *Ex-staff* indicates employees whose employment terminated at some point during the sample period.

***, **, and *Significance at the 1%, 5%, and 10% level, respectively.

3.1. 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, because 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 FNB employees to associate MaMa demand with individual characteristics. Tables 4 and 5 present 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 bank employees.[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 FNB.

Table 4 focuses on bank employees who did not have any savings accounts at FNB in Janaury 2005, when MaMa was introduced. This sample contains the set of individuals who may potentially choose to open either a regular 32-day account or a MaMa account. In the first column, we see that individuals of mixed race are about four percentage points more likely to open a MaMa account than other races and that men are less likely to open MaMa accounts than women. We also include an indicator for whether the individual was borrowing from FNB in January 2005. These individuals are 12% points more likely to open a MaMa account. This relationship could be because of indebted individuals looking for a prize to help them repay their debt, but it also likely reflects that individuals who are actively borrowing from FNB are more likely to open new accounts at FNB.

In the second column, we further restrict the sample to employees who had no savings accounts in January 2005 and who opened either a 32-day account or a MaMa account before March 2008. These are the main regressions of interest, because they allow us to directly compare the characteristics of MaMa users to employees who open a regular savings account without opening a MaMa account. Significant coefficients in this regression show that employees who chose to open MaMa accounts differed from those who chose to open regular accounts. For example, in this subsample, we find that men are 1.7% points more likely to open a MaMa account than women. This is in line with Donkers et al. (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 that individuals of mixed race or of Asian descent are most likely to use PLS.[25] More importantly, we show that individuals who were borrowing from FNB in January 2005 were 3.9% points more likely to open a MaMa account. It is important

Table 5. Individual-Level MaMa Take-Up Among Bank Staff: All Bank Employees

Variables	Dependent Variable: *Opened a MaMa Account*		
No saving or checking acct. before opening MaMa	0.049**		
	(0.022)		
No saving account before opening MaMa		0.121***	
		(0.008)	
No checking account before opening MaMa		0.022	
		(0.021)	
High savings before MaMa			−0.018
			(0.025)
Low savings before MaMa			−0.120***
			(0.026)
Low borrowing before MaMa			−0.054***
			(0.017)
High borrowing before MaMa			0.048***
			(0.019)
Demographic controls	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
Observations	38,262	38,262	38,262
R^2	0.051	0.061	0.061

Notes. This table presents estimates from OLS regressions run on the FNB staff data set. The dependent variable is *Opened a MaMa account*. In each regression, the dependent variable equals one if the employee has a positive balance in the MaMa product at any time during the sample period (January 2005 to March 2008). In this table, we include the full sample of bank employees and test whether previous banking behavior is correlated with the propensity to open a MaMa account, after controlling for all demographic characteristics contained in Table 4. *High* and *low savings before MaMa* are dummy variables indicating employees with above- and below-median savings, respectively, as a percent of income before 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 FNB). Robust standard errors (reported in parentheses) are clustered at the region level.

***, **, and *Significance at the 1%, 5%, and 10% level, respectively.

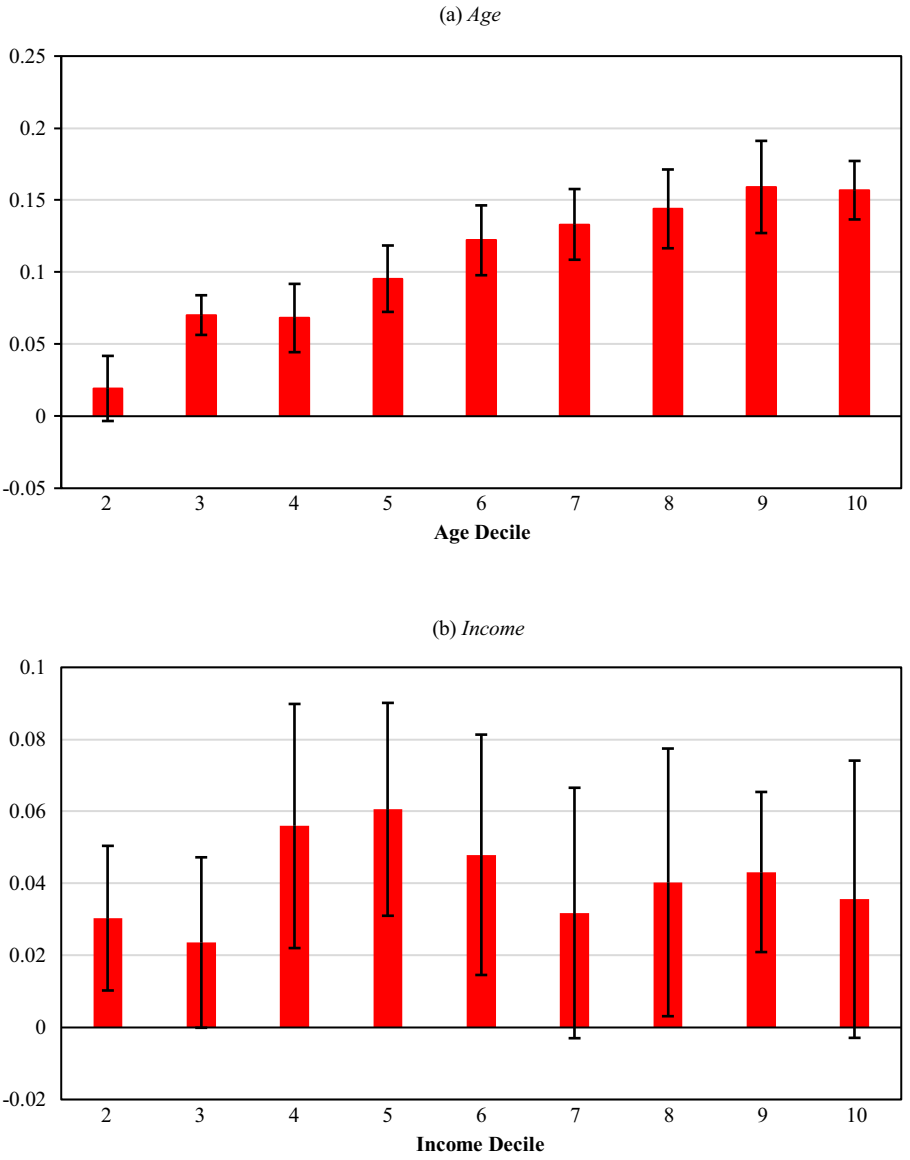
to recall that this effect is relative to other employees who opened standard savings accounts and so does not reflect a joint propensity to borrow and subsequently open a savings account. Instead, we find an additional effect beyond the joint propensity. This suggests a link between indebtedness and PLS use. We further explore this relationship later.

In addition to the coefficients displayed in Table 4, we include fixed effects for age and income deciles. We display these coefficient estimates, taken from the second column of Table 4, in Figure 2. We drop the lowest decile for both age and income, so displayed effects are relative to this group. Among individuals who started using savings accounts during the sample period, older individuals and those with higher incomes are more likely to open MaMa accounts as opposed to standard savings accounts. The increase in MaMa uptake is roughly monotonic in age (Figure 2(a)). Meanwhile, middle-income employees have the highest likelihood to use MaMa (Figure 2(b)), although all deciles have higher point estimates than the lowest income decile. To interpret these results, it is important to keep in mind that a significantly higher percentage of employees used MaMa than used regular savings in all income deciles, as shown in online appendix Figure A.2. The MaMa product experienced high demand across the income spectrum. However, the marginal propensity to open a MaMa account was between two and six percentage points higher in high-income deciles relative to the lowest income decile. It is also important to keep in mind that most 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, whereas the average household income in South Africa in 2006 was about R74,600 per year. It is difficult for us to evaluate truly low-income individuals because they are not bank employees.

A key takeaway from Figure 2 and Table 4 is that the characteristics of individuals who choose to use PLS differ from those of individuals who open regular savings accounts. One possible endogeneity concern with our results is that PLS demand simply reflects a concomitant decision to start saving, such that funds deposited in PLS would have been deposited in an account regardless. If this was the case, we should find that individuals who open MaMa accounts do not look different from those who open regular accounts. Instead, our results show that the characteristics of MaMa users differ significantly from regular savers, adding credence to the idea that PLS can bring new savers into the formal banking system.

There are two interesting facts that come out of the regressions in Table 4. First, we do not find high demand for MaMa among low-income bank employees.

Figure 2. (Color online) Adoption of PLS Account by Age and Income



Notes. This figure displays coefficient estimates for age and income decile fixed effects from OLS regressions described in the second column of Table 4. The sample for the regressions is bank employees who did not have any savings account in January 2005 and who opened some kind of savings account during the sample period. The first decile is omitted for both age and income, so effects are relative to those deciles. Thus, coefficient estimates show marginal propensity to open a MaMa account for individuals in each decile relative to the lowest decile, among employees who opened savings accounts during the sample period. For reference, the minimum age in deciles 2 through 10, respectively, is 24, 25, 27, 28, 30, 32, 35, 39, and 45. Similarly, the minimum income for each decile, in Rand thousands, is 60.0, 66.0, 75.5, 85.0, 100.0, 120.5, 156.6, 220.9, and 356.2. (a) Age. (b) Income.

Second, we see a positive relationship between indebtedness and MaMa demand. These facts suggest that perhaps total wealth and past banking behavior influence PLS uptake in important ways. Table 5 explores this further. In these regressions, we include all age, income, gender, race, and region controls from Table 4. We include all bank employees in these regressions so that the sample includes individuals who were already actively saving at FNB. The dependent variable remains a dummy indicating that the employee opened a MaMa account at any time during the sample period. In the first column, we find that employees who did not have any saving or checking accounts at FNB were 4.9% points more 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 before opening a MaMa account. Relative to employees with both savings and checking accounts, we find that employees without a standard savings account were 12.0% points more likely to use MaMa, whereas 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.[26] 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.

To more directly look at how wealth affects PLS adoption, the final column of Table 5 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, whereas 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. The high use of MaMa by employees who have borrowed the most 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 17% 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.

3.2. Geographic Characteristics and MaMa Demand

In this section, we correlate FinScope survey response data to branch-level PLS use as additional evidence on the determinants of PLS demand. Although the FinScope data are 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 3.1.[27] Table 6 presents ordinary least squares (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.[28] 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 account for branch size differences, and 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.[29] We also control for whether the branch is located in a rural area to adjust for branch size.

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 3.1 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 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 use is race, where we find that areas with a higher percentage of black residents have lower PLS demand, whereas areas with more Asian individuals have higher PLS demand.

Table 7 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 FSM as an independent variable and test its association with PLS demand. The FSM categorizes individuals according to their financial access, knowledge, discipline, and use 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 use available

Table 6. Branch-Level MaMa Take-Up as a Function of Demographic Characteristics

	Dependent variable	
Variables	*ln(MaMa deposits)*	*ln(no. of MaMa accounts)*
Race (% colored 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^2	0.772	0.754

Note. This table presents results of OLS regressions where the dependent variable is the log total use of MaMa in March 2008 (at the close of the program) for each bank branch and shows the relationship between demographic characteristics and MaMa use, as measured both by log total MaMa deposits and by the log number of MaMa accounts.

***, **, and *Significance at the 1%, 5%, and 10% level, respectively.

financial products. We estimate that a one standard deviation increase in financial penetration is associated with an 18.8% 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.[30] It is striking that it is in areas in which individuals feel *least* hopeful that we see the highest use of the MaMa product. As mentioned previously, optimism—in particular, overweighting 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.[31]

In the final two columns of Table 7, 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

Table 7. Branch-Level MaMa Take-Up as a Function of Financial Characteristics

Variables	Dependent variable: *ln(MaMa deposits)*				
% banked	−0.495				
	(0.411)				
FSM tier		−0.122			
		(0.158)			
FSM components					
Financial penetration			−0.385**		−0.430**
			(0.191)		(0.173)
Financial access			0.080		0.065
			(0.081)		(0.085)
Financial discipline			−0.131		−0.092
			(0.114)		(0.110)
Financial knowledge			0.255		0.172
			(0.156)		(0.152)
Connectedness and optimism			−0.350***		−0.291**
			(0.126)		(0.124)
% can't pay off debt					
Middle tercile				0.229***	0.241***
				(0.074)	(0.075)
Top tercile				0.265**	0.240*
				(0.115)	(0.120)
Demographic controls	Y	Y	Y	Y	Y
Observations	494	494	494	494	494
R^2	0.773	0.773	0.781	0.779	0.787

Notes. This table presents results of OLS regressions where the dependent variable is the log total use of MaMa in March 2008 (at the close of the program) for each bank branch and adds financial characteristics to these demographic controls to test whether banking attitudes have an additional impact on MaMa use. To be concise, we present only results relating to log total MaMa deposits here 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 50-km 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. See text for a complete explanation of how the FSM tiers were created. The final column 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 *Significance at the 1%, 5%, and 10% level, respectively.

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*, whereas 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 (Haisley et al. 2008, Shah et al. 2012). Herskowitz (2021) reports evidence in Uganda that gambling supports the purchase of durable goods. We test this channel by including dummy variables for branches in the second and third terciles of the percentage of individuals who feel they cannot pay off their debt.[32]

We find that branches in the second and third terciles of indebtedness experienced significantly higher MaMa demand than those in the first tercile. The economic magnitude of this relationship is large: branches in the second and third terciles have roughly 25% higher MaMa deposits relative to branches in the first tercile, after controlling for demographic characteristics and regular savings demand at the branch. In the final column we show that including the FSM components and the indebtedness variables simultaneously does not affect our conclusions. This evidence corresponds closely with that of the FNB employees presented in Section 3.1. 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.

4. Savings of PLS Participants

Although the evidence in Section 3 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 informal savings 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, representative survey data from FinScope shows that only 2.96% of South Africans had deposit accounts at multiple banks in 2005, and 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 are consistent across multiple years of FinScope surveys. Given these low rates, it is unlikely that unobserved savings constitute a large portion of MaMa deposits.

A second important caveat is that the MaMa program was not a randomized experiment. We address this issue in three steps. We first present noncausal correlations between PLS take-up and overall savings levels. We then exploit random shocks to the salience of MaMa via jackpot prizes and show that this random variation leads to significant increases in savings at affected bank branches, similar to the noncausal correlations. Finally, we provide evidence that random increases to lottery jackpots reduce MaMa demand, suggesting that some of the PLS deposits come from reduced gambling expenditure.

4.1. Correlations Between PLS and Regular Savings

Figure 3 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. Before 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.

Account-level evidence from bank employees presents the same result. We use a regression framework to estimate how net savings evolve for employees who open MaMa accounts relative to those that do not. 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:

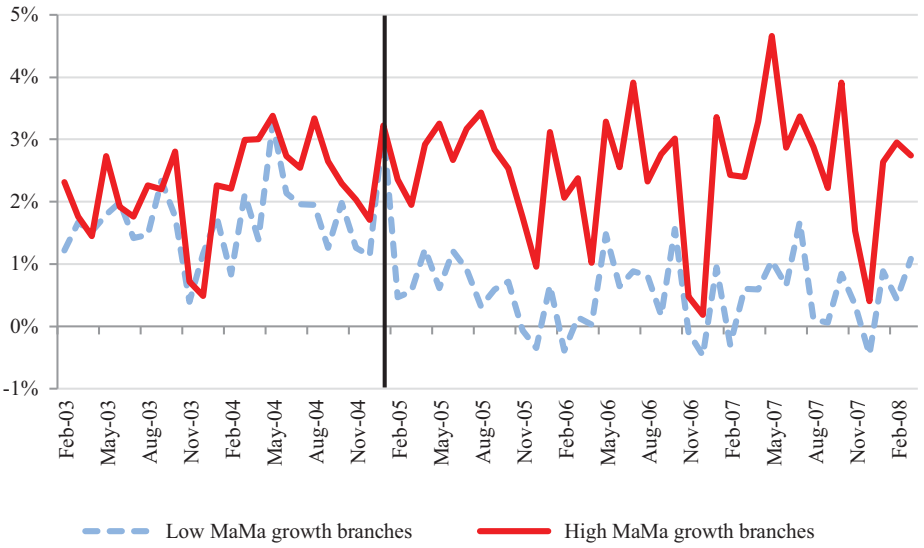
$$S_{i,t} = \beta X_i + \gamma_{r,t} + \sum_{k=-12}^{24} D_{i,t}^{k} \delta_k + \varepsilon_{i,t},$$

where i indicates employees and t indicates months. The tem $S_{i,t}$ 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. The term $D_{i,t}^{k}$ 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. In Figure 4, we plot the main coefficients of interest 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 4(a) plots our estimates of δ_k as well as 95% confidence intervals based on the above regression.[33] As shown in Section 3, before opening MaMa, these individuals tend to have lower-than-average savings levels relative to employees that never opened a MaMa account. About two months before 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 onward, MaMa participants maintain roughly 1% of annual income more in total net savings at the bank, relative to nonparticipants.[34] This represents a 38% increase from the average savings level of 2.9% of annual income.

As noted previously, the choice to open a MaMa account is endogenous, and therefore 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 before opening a MaMa account suggests that 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

Figure 3. (Color online) Growth Rates of Standard 32-Day Savings Before and After MaMa



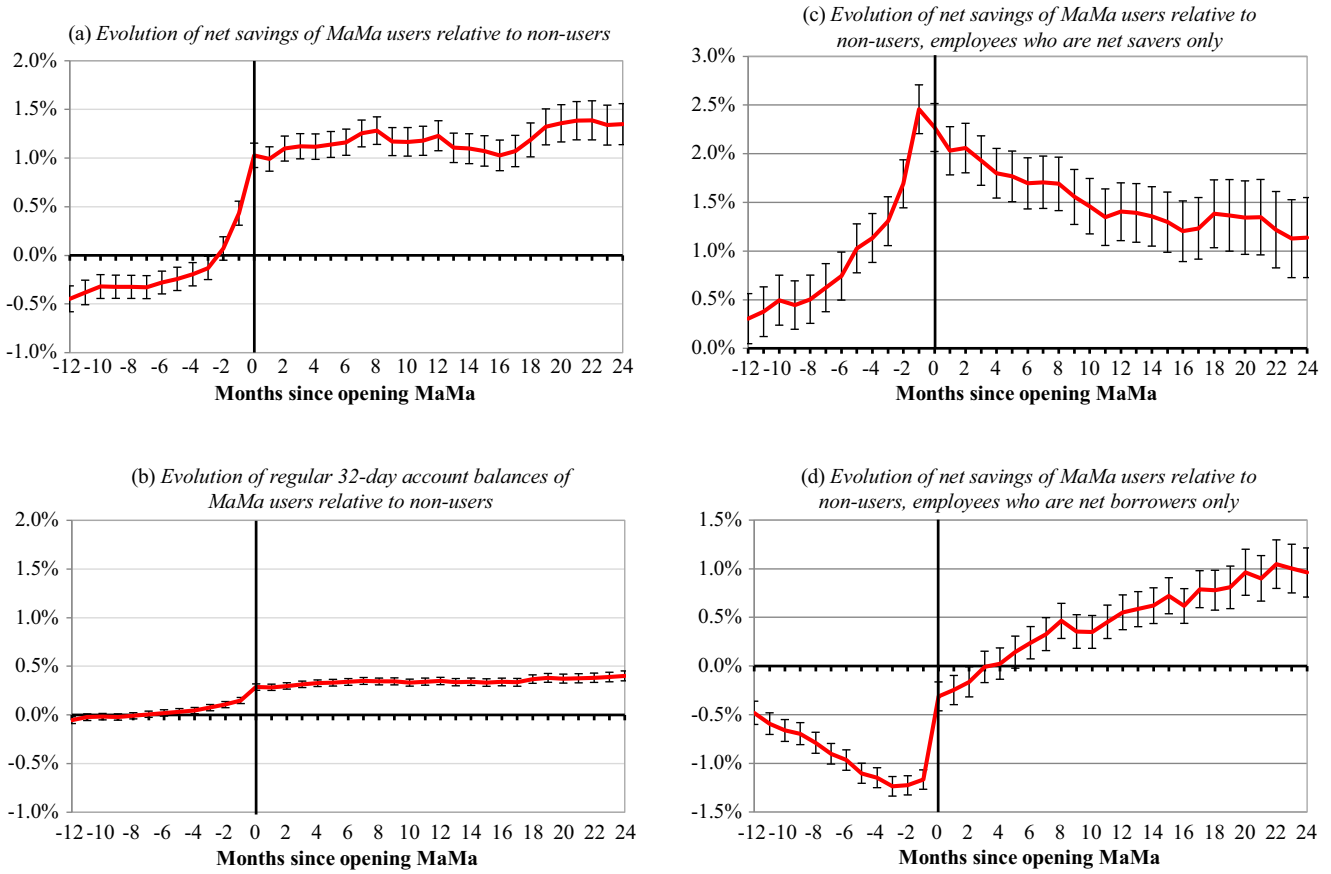
Notes. This figure displays the average monthly growth rate of standard 32-day savings balances for two groups of First National's branches. Branches are divided based on their average monthly MaMa balance growth rate from January 2005 to March 2008. Those branches that had below-median MaMa growth are in the *low MaMa growth* group, whereas 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. Although *high MaMa growth* branches averaged 0.57% higher 32-day savings growth than *low MaMa growth* branches before 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.

Atalay et al. (2014) and Filiz-Ozbay et al. (2015) use laboratory experiments to show that PLS accounts tend to increase overall savings rates. Furthermore, we estimate causal regressions below that support the correlations shown here.

If PLS is cannibalizing regular savings, we might expect to see a decrease in regular savings balances when MaMa accounts are opened. We test for this in Figure 4(b). This chart is created in exactly the same way as Figure 4(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. We find that employees who open MaMa accounts tend 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. Importantly, we find similar results if we limit the sample to employees who had regular 32-day accounts before opening a MaMa account. Thus, this effect is not driven purely by employees opening regular and PLS account simultaneously. This finding is consistent with PLS and standard savings acting as complements rather than substitutes for the average participant. Furthermore, we note that the increase in regular savings observed here is unlikely to be caused by advertising, because these estimates come from employees of FNB who are already fully aware of FNB products. We do not have the data to fully understand *why* regular savings increases with PLS, but one possibility is that there is latent demand for regular savings but also a fixed cost of depositing funds. If the allure of PLS is enough to overcome this fixed cost, it is possible that individuals will deposit funds into a regular savings account simultaneously.

In Figure 4, (c) and (d), we further explore the trends in net savings before opening a MaMa account by focusing on two subsamples of FNB employees: those who are, on average, net savers before 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 before opening MaMa accounts for these two groups. In Figure 4(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 MaMa typically have deteriorating financing positions (relative to other borrowers) before 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, for example, the net borrowers in Figure 4(d), that experiences a negative wealth shock will seek a highly

Figure 4. (Color online) Savings Balances of Bank Employees: MaMa Users vs. Nonusers



Notes. This figure shows the evolution of savings balances for bank employees who opened MaMa accounts compared with 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 nonusers. In both panels, the x axis measures the number of months since opening MaMa, ranging from one year before to two years after opening the account, and the vertical line indicates the month in which a MaMa account was first opened. (a) Evolution of total net savings balances, defined as the sum of all deposit accounts held by the employee in a given month. (b) Balances of standard 32-day accounts by themselves and checks whether employees decreased their regular savings balances when opening MaMa accounts. (c) and (d) Estimates from (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.

skewed payoff (such as a lottery ticket or PLS) in order to escape the poverty trap. Importantly, Figure 4(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, Figure 4(c) shows that savers experience a large increase in net savings before 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.

4.2. PLS Demand After Jackpot Wins

Results in the previous section show a strong correlation between overall savings growth and PLS usage. We now present evidence that this relationship is causal. To do so, we leverage the random allocation of jackpot prizes across FNB branches, which create a natural experiment in which the salience or buzz surrounding the MaMa program is higher for specific bank branches. Previous work by Guryan and Kearney (2008) show 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 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.

Figure 5(a) plots estimates of γ_k for values of k ranging from three months before 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 before the drawing, which verifies the identifying assumption that the assignment of the prize was truly random 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. 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 nonwinning branches, such that this one-time shock results in a permanent *level* change in the amount of MaMa deposits at the branch.[35]

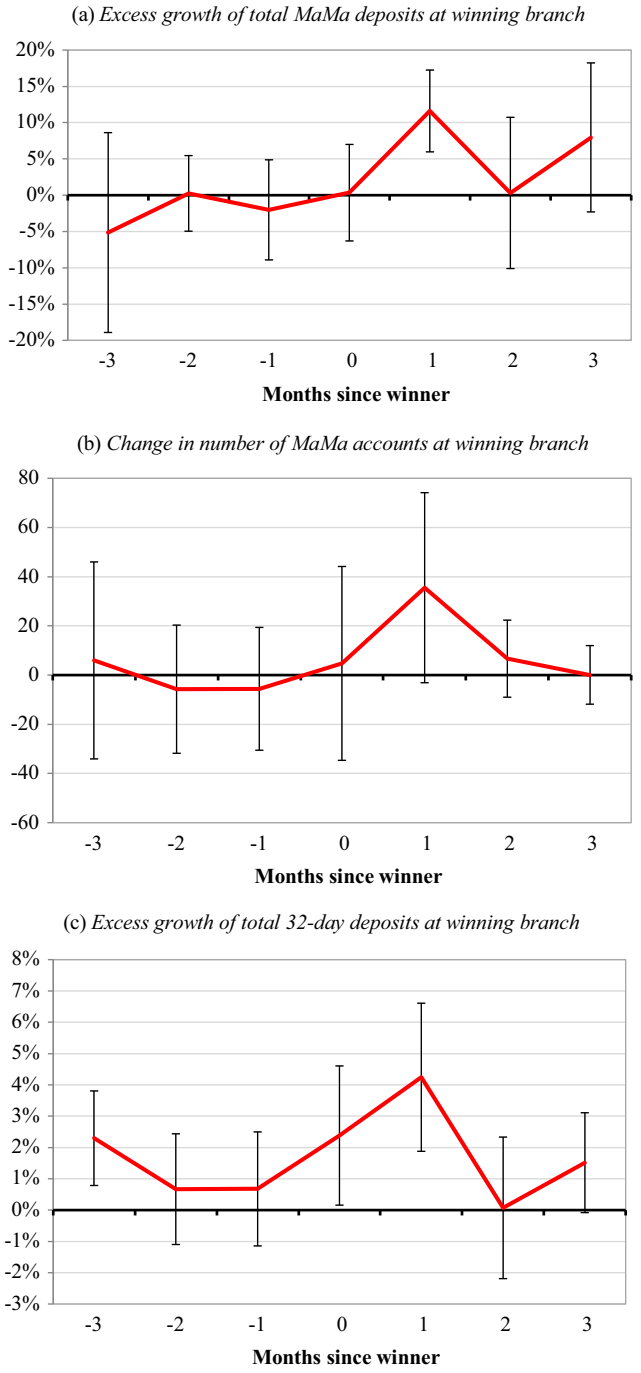
In Figure 5(b), we plot a similar picture, except in this case the dependent variable in the regression is the change in the number of MaMa accounts in month t. In this case, the estimated effect one month after the prize is not quite statistically significant ($p = 0.07$), but the point estimate is 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.

The fact that jackpot prizes generate more demand for PLS savings is interesting in its own right, mirroring the results in Guryan and Kearney (2008). Our main focus, however, is on whether PLS cannibalizes 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. Figure 5(c) shows that bank branches with jackpot winners do in fact experience 4.2% excess growth in standard 32-day balances in the month following the win. This is excess growth above the average 2.00% point monthly growth rate in 32-day accounts. Thus, a random shock that increases PLS demand also leads to substantial increases in regular savings. This reinforces the correlations shown in the previous section and provides causal evidence that PLS and standard savings are complements rather than substitutes.[36]

It is possible that these findings could still be caused by cannibalization if the increase in deposits at FNB come from customers transferring deposits from other financial institutions. If this is the case, we would expect that the effect of a jackpot prize would be largest in areas where there are many other financial institutions from which customers might withdraw savings. We explore this possibility in Table 8. In particular, we use FinScope data to identify the top quartile of most rural FNB branches, where there are likely few other financial institutions at which customers might hold savings. We also identify branches located in areas with bottom-quartile *financial access*, which identifies areas where it takes a long time for respondents to get to a bank.[37] Table 8 presents our baseline results in the top section of each panel for reference, and then tests for differential effects in rural areas and in areas with low financial access by interacting w with *rural* or *low financial access*. We do not find differential effects across regions either for the effect of a jackpot win on MaMa deposits (Panel A) or regular 32-day deposits (Panel B). This cuts against the hypothesis that transfers from other banks are driving a large portion of the increase in deposits following a large prize. This is not surprising, given that only 3.3% of South Africans have savings at multiple financial institutions (as noted previously). Instead, it appears that prize winning generates new formal savings in both MaMa and standard 32-day accounts.[38]

This exercise shows that exogenous changes to PLS savings, as a result of the buzz following a jackpot prize, lead to higher overall savings. These increases in savings come in both PLS and regular deposit accounts. Importantly, this result highlights that, 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,

Figure 5. (Color online) Effect of Jackpot Prize Winner on Local MaMa Demand



Notes. 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 before until three months after the prize is awarded. (a) 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. (b) and (c) Similar information, 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. 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.

similar to the process modeled by Han and Hirshleifer (2015).

4.3. MaMa Demand and Lottery Gambling

Kearney et al. (2010, p. 5) 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 et al. 2011), PLS could act as a natural substitute for lottery gambling.[39] Furthermore, evidence in Atalay et al. (2014) and Cookson (2018) 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 draw 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 aggregate 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 9 presents results from this estimation. The unit of observation is a 3- or 4-day lottery draw period ending on a Wednesday or Saturday. 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. Although actual jackpots are very close to the estimates, it is important to use the estimated jackpot, which does not depend on the actual number of tickets sold. Instead, the estimated jackpot depends on expectations of tickets sold and whether there was a winner or not in the previous draw (in which case the jackpot is rolled over) or a special promotion such as a guaranteed jackpot. When there is no rollover or promotion, week-to-week there is almost no variation in the estimated

jackpot. Thus, by using quartile dummies for jackpot size we are focusing only on large, quasi-random variation in jackpot sizes. 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 because of disputes over the ownership of the license to run the lottery, and therefore there are no jackpot draws for this time period (and these months are not included in the regressions). We include broad time dummies that 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. Last, 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.

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.[40] These results are comparable to Gao and Lin (2015), who find a reduction in trading volume of 6.8%–8.6% in lottery-like stocks when the lottery jackpot is large.

These results strongly suggest that MaMa was indeed 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 reopened in October of 2007. Although these are only two data points and there are other possible factors that could be affecting MaMa demand during this period,[41] it is surprising that there was not a discontinuous or even noticeable increase in MaMa use during this period. Further work with individual-level data on PLS use and lottery expenditure may help fully resolve this question.

5. Prize Winning and Saving

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.[42]

Because prizes were awarded randomly, conditional on the MaMa account balance before 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. Furthermore, 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 reinvest some of their winnings in PLS.

Online appendix Figure A.3 examines how winning a prize affects the probability of keeping a PLS account open over time. We find that small prizes (R1,000) lead to a modest level of closures (four percentage points over 12 months, relative to accounts that do not win a prize). Larger prizes do not appear to have a systematic effect on account closure.

Perhaps of greater interest is the effect of prize winning on MaMa account balances over time. We test this in regressions in which the dependent variable is the MaMa account balance k months after a prize is awarded, where k ranges from −3 to 12.[43] We include in each regression all prize winners and all bank employees who had an open MaMa account in the month before the prize being awarded (and were thus eligible to win a prize as well); hence, the control group is all bank employees that did not win prizes.[44] The regressions include demographic controls and year-month fixed effects so that we are comparing employees and prize winners in the same months to each other. Most importantly, we nonparametrically control

Table 8. Effect of Jackpot on Local Savings: Testing for Cannibalization from Other Banks

	Months since winner						
	−3	−2	−1	0	1	2	3
Panel A: Growth in MaMa deposits (dependent variable: *Growth in MaMa deposits*)							
Jackpot winner	−0.051	0.002	−0.020	0.003	0.116***	0.003	0.080
	(0.070)	(0.027)	(0.035)	(0.034)	(0.029)	(0.053)	(0.052)
Observations	19,842	20,467	21,093	21,726	21,726	21,093	20,468
R^2	0.486	0.484	0.482	0.480	0.628	0.359	0.205
Jackpot winner	−0.030	0.003	−0.024	0.009	0.107***	0.048**	0.029
	(0.081)	(0.029)	(0.038)	(0.038)	(0.032)	(0.024)	(0.027)
Jackpot winner × Rural	−0.155	−0.027	0.057	0.040	−0.009	−0.421	0.496
	(0.117)	(0.051)	(0.068)	(0.045)	(0.046)	(0.358)	(0.417)
Observations	17,930	18,490	19,052	19,617	19,617	19,052	18,491
R^2	0.509	0.507	0.505	0.503	0.648	0.394	0.228
Jackpot winner	−0.049	0.000	−0.017	0.012	0.108***	−0.009	0.080
	(0.077)	(0.028)	(0.037)	(0.036)	(0.030)	(0.058)	(0.057)
Jackpot winner × Low financial access	0.012	−0.001	−0.006	0.034	−0.038	0.091	−0.063
	(0.083)	(0.063)	(0.038)	(0.044)	(0.059)	(0.058)	(0.064)
Observations	17,930	18,490	19,052	19,617	19,617	19,052	18,491
R^2	0.509	0.507	0.505	0.503	0.648	0.394	0.227
Controls in all regressions							
ln(Total MaMa deposits)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Branch fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Growth in standard 32-day deposits (dependent variable: *Growth in Standard 32-day deposits*)							
Jackpot winner	0.023***	0.007	0.007	0.024**	0.042***	0.001	0.015*
	(0.008)	(0.009)	(0.009)	(0.011)	(0.012)	(0.012)	(0.008)
Observations	20,162	20,773	21,388	22,000	21,462	20,859	20,251
R^2	0.022	0.026	0.036	0.050	0.086	0.042	0.032
Jackpot winner	0.023***	0.008	0.007	0.028**	0.043***	−0.002	0.012
	(0.009)	(0.010)	(0.010)	(0.012)	(0.013)	(0.013)	(0.008)
Jackpot winner × Rural	−0.005	−0.005	0.003	0.005	−0.014	0.018	0.017
	(0.010)	(0.019)	(0.018)	(0.018)	(0.025)	(0.015)	(0.037)
Observations	18,295	18,847	19,402	19,956	19,472	18,926	18,375
R^2	0.025	0.029	0.041	0.055	0.104	0.048	0.036
Jackpot winner	0.023***	0.007	0.006	0.027**	0.043***	−0.001	0.016*
	(0.008)	(0.010)	(0.010)	(0.012)	(0.013)	(0.012)	(0.009)
Jackpot winner × Low financial access	−0.002	−0.002	0.012	0.017	−0.023	0.011	−0.030**
	(0.009)	(0.015)	(0.017)	(0.017)	(0.042)	(0.019)	(0.014)
Observations	18,295	18,847	19,402	19,956	19,472	18,926	18,375
R^2	0.025	0.029	0.041	0.055	0.104	0.048	0.036
Controls in all regressions							
ln(Total MaMa Deposits)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Branch fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. This table tests whether the effect of a jackpot prize differs across areas where individuals have more or less access to other financial institutions. We identify areas with few other financial institutions in two ways using FinScope survey data. First, we identify rural bank branches as those in the top quartile of percent of respondents within 50 km that are classified living in a village, as opposed to a town or city. Second, we use the FinScope FSM variable *financial access*, which measures the time necessary to get to financial services, to identify the quartile of banks located in areas with least access to financial services. We interact these variables with *Jackpot winner*, which identifies bank branches that had a R1 million prize winner in a given month, to test whether results differ in these areas. In Panel A, the dependent variable is the monthly growth rate of MaMa deposits at a given bank branch from 3 months before the prize was awarded to 3 months after. In Panel B, the dependent variable is the monthly growth rate of standard 32-day deposits at the branch. Both panels display results from three separate regressions. In the top section, we display the baseline results which are presented graphically in Figure 5. The middle section tests for differential effects in rural areas, and the bottom sections tests for differential effects in areas with low financial access. All regressions include the log of MaMa deposits at the branch in the month of the win to control for the ex ante probability the branch would have a jackpot winner. Regressions also include year-month fixed effects and branch fixed effects. Regressions are estimated by OLS with standard errors clustered at the branch level reported in parentheses.

Table 9. Bank-Wide MaMa Growth and the National Lottery

	Dependent variable	
Variables	*ln(New funds deposited)*	*No. of new accts. opened*
Estimated jackpot size (<R3 million omitted)		
R3 million to R4 million	−0.0140	−121.0
	(0.0705)	(151.9)
R4 million to 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	Yes	Yes
Observations	276	276

Notes. 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 use 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 *No. 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 nonparametrically 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 (first column) and accounts (second 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 reopened from Oct. 2007 to Mar. 2008. Newey-West standard errors that account for up to two weeks of remaining serial correlation are reported.

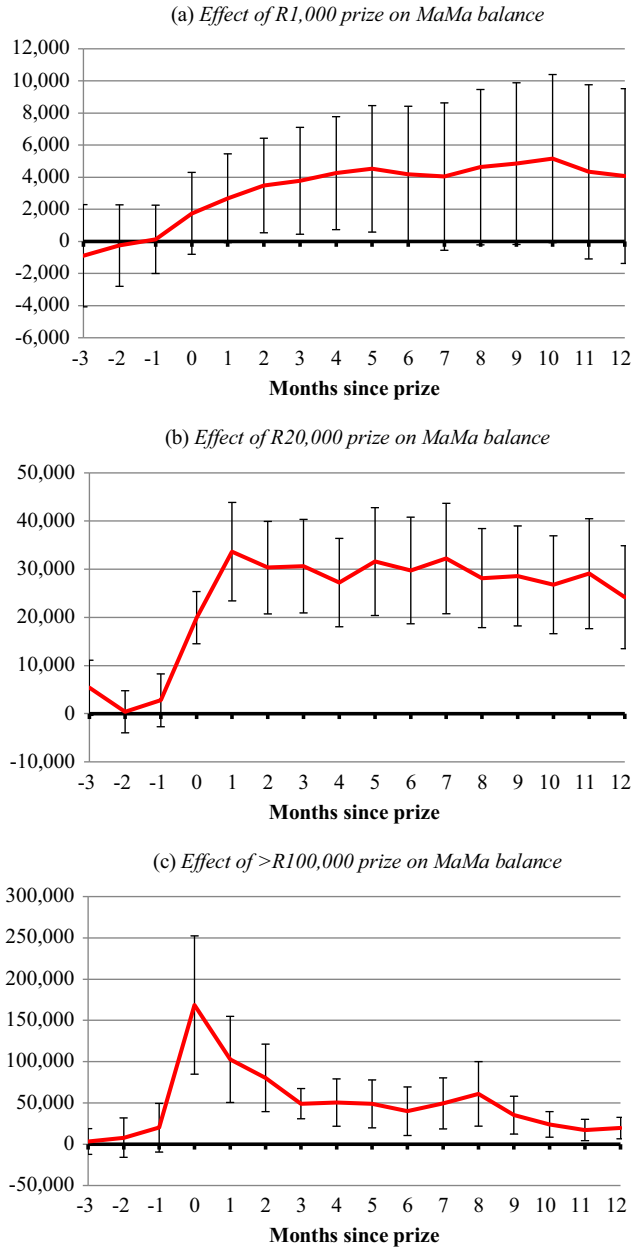
***, **, and *Significance at the 1%, 5%, and 10% level, respectively.

for the MaMa balance before winning by including dummies for each decile of the distribution. These controls allow a causal interpretation of the estimates because winning a prize is random conditional on the amount held in the account. In addition, we cluster standard errors at the individual level and drop all months after the MaMa product was closed. Coefficient estimates and 95% confidence intervals for each month are shown in Figure 6. Consistent with random assignment, in the three months before winning prize winners have similar account balances as nonwinners. 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 6(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 6 they hold on average R4,190 more in their accounts than nonwinners. 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 because of 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 online appendix Figure A.3(a), 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, whereas those who keep their PLS accounts open tend to increase balances substantially.[45] 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 (Figure 6(b)). Specifically, in month 0, we observe the initial shock of R20,000 because of the prize, but in subsequent months, MaMa balances rise to about R30,000 higher than those of nonwinners. Thus, even with a significantly larger prize, winners increased PLS deposits by more than the prize amount on average. Meanwhile, for R100,000 and R1 million prize winners[46] (Figure 6(c)), there is a large initial spike in MaMa balances because of the very large prizes, following which winners

Figure 6. (Color online) Effect of Winning Prize on Winner's MaMa Deposits



Notes. This figure shows the impact of winning a prize on MaMa account balances over time compared with 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. Prize-winner balances are winsorized at the 95th percentile. In each regression, we control nonparametrically for the decile of MaMa balances one month before winning, as well as all demographic controls contained in Table 2, 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 (a) and (b), respectively. In (c), we group R100,000 and R1,000,000 prize winners together. (a) Effect of R1,000 prize on MaMa balance. (b) Effect of R20,000 prize on MaMa balance. (c) Effect of >R100,000 prize on MaMa balance.

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 nonwinners, an amount roughly equivalent to increased holdings by winners of R20,000 prizes.[47]

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.

As shown in Section 4.2, we also find that prize winning has a substantial effect on peers who are located close to the winning branch. Although the main purpose of this analysis is to provide identification for the key results in the paper, we also note here that these findings demonstrate that PLS prizes have large spillover effects. As opposed to standard savings, PLS creates a buzz that can serve to spread demand for savings across a wider group of individuals.

6. 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, p. 2). By relating personal characteristics to PLS use, 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. Furthermore, 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 because of a lack of financial sophistication.

A key message of our paper is that prize-linked savings increased net savings in our setting. We do not see any evidence that the MaMa program cannibalized savings and instead find the reverse: branches with higher MaMa use also saw expansion of regular savings, and individuals who opened MaMa accounts typically increased their balances in standard savings accounts. Evidence from the random awarding of prizes shows that these relationships may be 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. Although other evidence suggests that there are potentially large benefits to increasing savings and that many individuals express a desire to save more (Lusardi et al. 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. Although 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, or if engagement with the formal financial sector eventually led to greater uptake of insurance or credit products.

We also show that prize winning has a material effect on the saving behavior of both the winner and 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. Furthermore, large prizes create a local buzz, leading to dramatically increased demand for PLS at the winning branch in the month following the win; are unique in that FNB instituted relatively large prizes directly from the launch of the product, which possibly created a lot of initial interest and momentum; and South Africa has a very large population of unbanked individuals who could possibly be attracted into the banking system. It is possible that these conditions make the MaMa product particularly successful at attracting demand and creating positive savings spillovers in other products, making the product especially profitable for FNB.

We note two limitations of our work, which suggest directions for future research. The first is external validity, which could be limited because we study a single product in a single setting. However, we note that South Africa has significant populations that resemble both the developed world (e.g., well-educated, middle-class), and mass market (informally employed, low levels of education); we find the product popular across all groups, which suggests that many of our results may extend to other settings. In addition, the MaMa product is similar to many offerings around the world. An interesting additional data point comes from Walmart in the United States, which introduced a PLS with very modest prizes ($1,000 grand prize and 499 $25 prizes) and managed to generate $2 billion in savings. The second limitation is that our results are not experimental. We would see great value in studies which randomly enrolled individuals in a similar product and tracked savings over the medium and long run.

Collectively, we see our findings as 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 may also decrease expenditure on 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.

Endnotes

[1] Several other papers also demonstrate broad-based preferences for skewed returns (Scott and Horvath 1980, Mitton and Vorkink 2007, Barberis and Huang 2008, Green and Hwang 2011). Meanwhile, Green and Ryndqvist (1997) use Swedish lottery bonds to show that individual lottery bonds are underpriced relative to a portfolio of lottery bonds that guarantee a minimum payoff. These findings suggest that aversion to idiosyncratic risk—in particular, aversion to receiving no payoff at all—can negatively affect demand for PLS. However, their study is focused on comparing individual lottery bonds with portfolios of lottery bonds, which both have highly skewed returns, and therefore does not provide evidence on demand for skewness more generally. Indeed, Green and Rydqvist (1997) also report that lottery bonds constitute 8% of total Swedish government debt, and thus one would suspect that at least some investors have a preference for skewness even in the Swedish bond market.

[2] Because the introduction of the PLS product was not randomized, there is endogeneity in who chooses to open a PLS account. We compare individuals who opened PLS accounts to those who opened regular savings accounts to have a similar control group and remove as much endogeneity as possible.

[3] Our approach here is similar Guryan and Kearney (2008), who show stores that sell winning lotter tickets experience subsequent greater sales.

[4] This strategy is also similar to Gao and Lin (2015), who show that the size of lottery jackpots is negatively related to individual trading in lottery-like stocks.

[5] 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.

[6] Under-savings is a larger issue in South Africa in particular. A 2005 FinScope survey shows that 67% of individuals do not have any type of formal savings account.

[7] See, for example, Carroll et al. (2009), Thaler and Benartzi (2004), Ashraf et al. (2006), and Karlan et al. (2012). Tufano and Schneider (2008) provide an overview of policy proposals.

[8] 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). Cole et al. (2008) provide more context on the South African banking sector.

[9] 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.

[10] 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).

[11] 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, because MaMa use was quickly growing throughout our sample period.

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

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

[14] The money market account was a special account available only to staff of the bank that was launched in July 2007, toward the end of the sample period.

[15] Income data were not directly available from FNB and was instead estimated by the bank according to an internal model.

[16] A total of 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.

[17] Furthermore, only 6.3% of unbanked households maintain any savings at home, so non-bank savings appear to be a small part of total portfolios as well.

[18] 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.

[19] Results are similar if we use a radius of 30 km (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 use, but this relationship is driven by two branches with very high income estimates. For this reason, we omit these branches from the sample.

[20] 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.

[21] 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.

[22] However, average account balances were much lower in MaMa accounts than regular 32-day savings.

[23] Based on discussions with FNB, anticipated marketing expenses was 12M Rand per year, but data on actual marketing expenses are unavailable from the bank. As an alternative, we examined marketing expenses as reported in FNB's financial statements. However, FNB is a subsidiary of FirstRand Bank Limited, and detailed financial statements are only available for FirstRand as a whole. FNB's banking deposits constitute about 47% of FirstRand's total deposits. We do find that FirstRand's marketing expenses increased in 2005, when MaMa was introduced, and then declined in 2008, when MaMa was terminated. However, it is impossible to determine how much of this was attributable to MaMa. Indeed, the 2005 increase was $156M Rand (a 44% increase), which is much too large to be attributable solely to MaMa. Meanwhile, the 2008 decline was 15M Rand.

[24] Table 2 presents linear probability models estimated by OLS, but essentially identical results are found if the models are estimated using probit or logit models. In addition, we find similar results if we use ln(MaMa balance) as the dependent variable instead of an indicator for opening a MaMa account.

[25] It is difficult to connect our results on race to previous literature because of cultural differences within race across countries. For example, Stinchfield and 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.

[26] We assume that all bank employees had easy access to opening a regular savings account and thus those without accounts do not have them by choice. An alternative hypothesis is that those without savings accounts are more likely to open MaMa accounts simply because they do not already have an account. This alternative seems unlikely at least for the FNB employee sample.

[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] A survey respondent who lives within 50 km of multiple FNB branches will be included in the averaged characteristics of each branch, which may create some correlation in the error term across branches. We account for this by clustering standard errors by district municipality, thereby allowing for correlation within these areas.

[29] 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.

[30] 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."

[31] This finding is somewhat inconsistent with Tufano et al. (2011), who find that more optimistic individuals express more interest in PLS, based on survey evidence in the United States. 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.

[32] There are seven branches with extremely high percentages of respondents who were unable to repay their debts. We use tercile dummies so that these outlier branches do not have a large influence on the regressions. We find similar results if we drop these seven branches and use the continuous measure of percentage of respondents who cannot repay their debt instead of the tercile dummies.

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

[34] 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.

[35] 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.

[36] The increase in PLS demand could be because fo prize winners themselves telling others of the PLS program or increased advertising at the branch that had the winning account holder. Either way, jackpot prizes generate increased demand for PLS and thus provide a natural experiment to test whether PLS cannibalizes standard savings.

[37] Results are essentially identical if we instead split by terciles instead of quartiles.

[38] Yet another possibility is that deposits increase because winners share the jackpot with others. However, even under the generous assumption that all prize money that does not remain in the winner's account is transferred to other accounts at FNB it could only account for 17% of the total effect.

[39] In addition, Dorn et al. (2015) and Gao and Lin (2015) use a similar empirical set-up to ours to show that investors substitute between playing the lottery and participating in the stock market.

[40] It is somewhat odd that the relationship between new MaMa accounts created and jackpot size is nonmonotonic, 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.

[41] 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.

[42] Unfortunately, FNB only provided PLS account balances for prize winners, so we cannot test the effect of winning a prize on standard savings balances.

[43] A few prize winners keep extremely large balances in their accounts after winning. To prevent undue influence of these observations, we winsorize the winning account balances at the 95th percentile of the MaMa balance distribution of prize winners. We obtain similar results if we use ln(MaMa Balance) as the dependent variable instead.

[44] Using bank employees as a control group is not ideal, because 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, 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 before the prize month, which should account for any systematic differences.

[45] Estimates in Figure 6 are unconditional, in that they include prize winners who close their accounts. Given that 4.2% of R1,000 prize winners close their accounts (online appendix Figure A.3(a)), which is equivalent to a zero balance, the average increase in MaMa balance conditional on keeping the account open is $4{,}190/(1 - 0.042) = 4{,}373$.

[46] 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.

[47] 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 because of inattention.

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