

**Do smallholder farmers prefer commitment or flexibility in pensions savings accounts? A
randomized experiment of cocoa farmers in Ghana**

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Abstract

The aim of this paper is to examine the intertemporal choice preference for long term savings of cocoa farmers in Ghana. We test the uptake of two pension products: with one, farmers are free to withdraw 50% of their savings with no penalties prior to retirement age; with the other, only 30%. Neo-classical economists argue that rational individuals want to even out consumption over their lifespan, thus having preference for flexible saving, especially in the face of high income fluctuation. Behavioural economists argue that individuals have hyperbolic preferences and would prefer to lock their savings to avoid their own spending or spending by family members. Using a randomized controlled trial (RCT), we test the difference in uptake of two pensions products where we vary the flexibility of cash withdrawals from the pension account.

We find an overall higher uptake of the more flexible pensions account, especially for *women*, who cannot inherit land titles in Ghana and thus cannot use it as retirement income; and farmers who are able to diversify their income through *non-farming activities*. We find a significantly lower uptake of the less flexible account for farmers who have experienced a severe financial shock in the last year, and those who receive no remittances from their family members. We conclude that the more flexible savings allow farmers a better balance between current and future consumption needs, as well as locking savings away from other household members. We explain the low uptake of rigid accounts in line with neo-classical assumptions – farmers who are financially constrained in the present cannot be expected to lock a higher proportion of their income for retirement than what they consume today.

I. Introduction

An extensive body of development economics literature has stressed the importance of savings. An increase in savings could provide good opportunities to improve the welfare of the poor (Roodman, 2012; Karlan et al. 2014). Furthermore, savings are not only considered less risky than credit, but they can also provide insurance against unexpected expenditure shocks, such as those caused by disasters, health problems, and seasonal shortfalls. Therefore, several studies have examined different possibilities to increase the uptake of savings. In the informal finance sector, for instance, the take-up of savings accounts by rural and urban dwellers has been addressed through a number of randomized controlled trials (see literature review of Karlan et al. 2014). Another stream of literature shows that committing, or locking, a part of savings was found to be an effective way of increasing savings rates (Ashraf et al. 2006, Bryan et al, 2010). We find very few studies on the take-up of long-term or pension savings. This is surprising in the light of increased social change with stronger reliance on nuclear family, as opposed to wider family or community.

The aim of this paper is to compare the uptake of two pension savings products which differ in the degree of flexibility for cocoa farmers in Ghana. To the best of our knowledge, our study is the first that considers the take-up of any commitment long-term savings product for a homogeneous group of small-holder cocoa farmers. Focusing on the “pension behavior” of cocoa farmers is particularly interesting as cocoa farmers are faced with extremely high income fluctuation. Moreover, cocoa is a biannual crop, yielding income only twice a year. Farmers are faced with a challenge of leveling consumption needs in the present with future consumption needs when they are no longer able to work on farms.

Our study compares the uptake of two pension products that differ in the degree of flexibility of withdrawals of savings: one pension product locks half the savings until retirement age so agents are not allowed to access it until a future date, and allows withdrawals of the other half with no financial consequences. The other product locks 70% of savings until retirement age, thereby allowing flexible withdrawals for only 30% of savings. By varying the degree of flexibility of withdrawals of savings, our study addresses the question whether committing, or locking a part of savings may be an effective approach to increase savings. The literature is still ambiguous with regards to the relevance of commitments in increasing long-term savings rates.

The literature points out two reasons why commitment savings may be relevant. First, commitments may be preferred by agents with hyperbolic preferences (Ashraf et al. 2006). Agents with a hyperbolic discount function, unlike agents with an exponential discount function, have a high discount rate at present, and low discount rate over longer horizons (Laibson, 1997). As such, they have a preference for immediate rewards, and consequently are more likely to make “wrong” consumption choices that they would have not made for their future self. This is because they fall into the temptation and opt for unwise choices of instant gratification. Examples include opting to save more next year, but overspending when the next year comes. Among those agents with hyperbolic preferences, we distinguish sophisticated hyperbolic discounters - those who are aware of their preference bias and tendency to overspend today. Sophisticated discounters may prefer to lock savings until a fixed future date to avoid immediate temptation. The second reason why agents may also prefer to lock savings, is to prevent spending of their spouses, family members and neighbours (Anderson & Baland 2002, Ashraf 2009, Plateau 2001), which is especially common for women in developing countries.

There are, however, many reasons as to why locking savings would not be a preferred strategy. First, neo-classical economics assumes that agents have an exponential discount function, where it is irrational to lock savings, because all agents have perfect foresight, and will automatically save so as to smooth consumption over their lifetime. Second, if agents face severe financial market constraints, such as e.g. credit constraints and/or missing (insurance) markets, it is important that savings can be used as an insurance device, as we will explain later in more detail.

We compare preference for commitments for cocoa farmers in Ghana, who are known for uneven income distribution throughout the year (cocoa is a biannual crop). Their savings have to cover expenses that incur between two income seasons. On the other hand, they have to fend off the present bias and ensure their long-term well-being. Managing these two opposing demands is a balancing act of managing the problems of self-control while having high income fluctuation and uncertainty of expenditures. Designing a pensions’ savings product suitable for seasonality of income of cocoa farmers thus needs to combine tailoring for farmers’ current financial needs and the financial needs of the old age.

Finding the right balance between managing current cashflow needs and the future cash needs is challenging for agents themselves, but even more so for institutions that are trying to encourage agents to save. For this reason we aim to compare uptake of two types of pensions savings products, which only

differ in the percentage of savings that can be withdrawn freely without penalties. More specifically, we offer a randomly selected group of cocoa farmers in Ghana the possibility to open a long-term savings account where they can withdraw 50% of the savings at each moment of time without any penalties, and another randomly selected group which can withdraw only 30% without penalties. In addition, we will conduct heterogeneous treatment analyses and thus test which groups of farmers value flexibility over commitments.

In the following section, section II, we will elaborate on the existing elderly care mechanisms in Ghana. Section III elaborates on theory of exponential versus hyperbolic discounting, and theory behind commitments savings. Section IV describes the methodology of the intervention itself and the relevant findings from our baseline survey. Section V summarizes the results. Finally, section VI shows conclusions, limitations and ideas for future research.

II Literature review: existing social security systems for elderly in Ghana

Kpessa (2010) studied how the state, the market and pre-existing social norms interact to ensure old age income support in Sub-Saharan countries. The social protection plans supporting old age can broadly be divided into 4 categories: state, market, family, and community. Throughout the last century, Ghana has gone through various stages of these four support structures. The traditional social support system is structured around the family and the community. Dating back to pre-colonial times, the family was the epicenter of social support, where the nature of social interactions was collective and reciprocal, and extensive family members and community were the only source of risk and resource pooling in times of need or in old age (Hyden, 2005). Throughout history, as well as today in the informal and rural sector, people typically rely on rotating schemes for wealth accumulation against old age income insecurity, or protection against adversities such as illness, unemployment and hardship (Boon, 2007).

On the opposite end of family- and community-based social security systems, we have the state- and market- social schemes. These formal schemes were initially designed to reward 'loyal' civil servants and employees during colonial times (Darkwa, 1997). However, anyone within the informal economy, which includes the agricultural and the mining sector, was excluded from the colonial pensions scheme. In the 1990s, Ghana has moved towards *pay-as-you-go (PAYG)* defined social security schemes under which

benefits are directly linked to contributions¹. In 2000s, Ghanaian social security has officially progressed towards a three-tier pension system comprising a mixture of PAYG benefit and state-defined benefit arrangements (Dorkenoo, 2006). Some blue collar workers and the urban middle class enjoy access to this protectionist arrangements, while the rural inhabitants continue to rely on informal social mechanisms (Maclean, 2002). However, Ghana's social security falls short in meeting any formal retirement plans (Darkwa, 1997), because an estimated 80% of the population works in the informal economy (Baah-Boateng and Turkson, 2005; Tsekpo, 2005). Elderly find themselves in a vulnerable position where their children no longer feel obliged to support them (Collard, 2000). This is a direct result of migration, the breakdown of extended family structures and a cultural shift towards self-reliance in Sub-Saharan countries (Apt, 2002).

Putting that in the context of cocoa farmers in Ghana, multiple studies have reported a drastic problem of aging farmers, where children of cocoa farmers are moving to towns in search for better paid work opportunities (Bymolt et al, 2018). There are very few studies known to authors which address retirement income of cocoa farmers in Ghana. Echeverri (2011) and Roekel (2016) have shown that older farmers in Ghana usually have land, but above the age of 60, they are not very active on farms nor do they make any farm investments. Some aged cocoa farmers view cocoa farming as a cash crop and use it as retirement income, without making farm investments. They are referred to as 'harvesters' because they are inactive on their farms (Bymolt et al. 2018). Typically, their children have migrated to towns, so in absence of the younger generations, they often engage in sharecropping contracts where land is leased to a younger farmer who can manage and harvest the cocoa plantation (Bymolt et al 2018). Proceeds from these sharecropping arrangements are then shared between the land owner and the sharecropper, and the harvest is used as a source of retirement income for land owners (Roekel, 2016).

Offering farmers an option between flexible and less flexible pension savings accounts helps us evaluate the extent of trade-off of current consumption needs of the farmer and his family/network, versus his long-term consumption needs. In the following section, we look at the theory behind present versus future consumption preferences.

¹ For a delicate summary of the social security system in Ghana since the colonial days, refer to Boon, 2007.

III. Theory

There are a number of factors that influence people's uptake of savings accounts in general, including transaction costs, travel costs to the bank branch, information and knowledge gaps and trust in the financial institution (Karlan et al. 2014). Furthermore, Ashraf (2009) finds that intrahousehold power dynamics likewise define the uptake of savings accounts in general. However, the focus of this study is on uptake of *commitment* savings.

A commitment device is an arrangement entered into by an agent which helps him or her fulfil a goal in future that is otherwise difficult due to intrapersonal conflict stemming from lack of self-control or instant gratification (Bryan et al, 2010). Bryan et al. (2010) distinguish between soft and hard commitments, though they are not always mutually exclusive. Soft commitments refer to psychological consequences of breaking commitments, such as shame or loss of self-esteem. Hard commitments on the other hand, refer to economic consequences with financial repercussions such as paying a fine, getting no interest on savings etc.

There is little literature so far on commitment pension savings in any context, especially not in the context of farming of a biannual crop with high income fluctuations, such as the cocoa farming. Grameen introduced a hard commitment mid-term savings scheme in Bangladesh in the early 2000's where no interest was paid on accounts with withdrawals within five years of opening an account. The program was a huge success, generating millions of users (Rutherford, 2006). Ashraf et al (2006), and Basu & Bisht (2015) among others, have found that commitment savings products with penalties for early withdrawals had a significantly higher uptake than savings accounts with no penalties, a finding that likewise applies to urban context with high financial literacy (Thaler & Benartzi, 2004).

So, why is it that we test the effect of two different commitment savings products? Because from a theoretical perspective, commitment savings are suboptimal and irrational choice according to neoclassical economics, and possibly a very justified and optimal choice of behavioral economics. Classical and behavioural economists differ significantly in the way they view choices agents make in relation to consumption today versus future consumption. We now compare how they differ.

III.1 Neo-classical economics perspective on consumption and saving

Neo-classical theory assumes that people discount a future reward exponentially – by a fixed percentage for each unit of time they must wait. Exponential discounting reduces a future reward by a factor of $\frac{1}{(1+\delta)^t}$ where δ is the constant discount rate per time unit over a given time frame t . According to a standard neo-classical model, households devise a consumption plan that maximizes utility over its lifetime, subject to an intertemporal budget constraint. The first-order condition, in the case where there are no (liquidity or savings) constraints and there is perfect foresight would ensure that the marginal benefits of an increase in current consumption equals the marginal costs of an increase in consumption now (reflected by lower consumption in the next period). Formally this would lead to the following condition:

$$u'(c_t) = \frac{1+r}{1+\rho} u'(c_{t+1}) \quad \text{with } u'(c_t) > 0 \quad \text{and } u''(c_t) < 0 \quad (1)$$

Where $u'(c_t)$, and $u'(c_{t+1})$ reflect the marginal utility of consumption in period t and the marginal utility of consumption in a later period, $t+1$; r the interest rate (which is assumed to be the same for borrowing and/or saving) and the constant rate of time preference, ρ . The condition implies that the higher the interest rate relative to the rate of time preference, the more it pays off to reduce the current level of consumption (save) in order to enjoy higher consumption later. Formally, an increase in r vis-à-vis ρ is reflected in an increase in $u'(c_t)$, which is brought about by a decrease in c , assuming that $u''(c_t) < 0$. The neo-classical consumption/ savings function implies that consumption and savings patterns fully depend on prices (interest and discount rates) and preferences.

Ando & Modigliani (1963) show that an individual is expected to maintain a more-or-less constant level of consumption throughout life. Typically, one has an income stream which is relatively low at the beginning and the end of his life, and high during the middle of his life. The model suggests that in the early years of a person's life, an agent is a net borrower; in the middle years, she saves to repay debt and provide for retirement. In the late years, she dissaves. Thus, the standard neo-classical model of consumption/saving implies perfect consumption smoothing every period.

The analysis above assumes perfect foresight. However, what would happen, according to the neo-classical model, if future income would be uncertain? In that case, $u'(c_{t+1})$ in the condition above would be replaced by $Eu'(c_{t+1})$, the expected marginal value of consumption in a later period. A well-known

result applies that, in the case where the marginal utility of income function is convex, greater uncertainty in income would increase current savings (Leland, 1968). Intuitively, pre-cautionary savings counteract possible future fluctuations in income.

The neo-classical model, however, is based on several stringent assumptions, which often do not hold in practice. An important assumption is that transaction costs are zero. However, (formal) savings accounts often involve substantial costs, such as opening fees, minimum balance requirements and withdrawal fees. An increase in these costs, e.g. due to commitments, would discourage savings.

The standard neo-classical model also assumes that there are no liquidity constraints. It is easy to show that adding a liquidity constraint to the neo-classical framework would boost the incentive to save. Intuitively, if there is a liquidity constraint, households will be prevented from borrowing in any future period if income would turn out to be too low. The only possibility to encounter this constraint is to save more now.

However, in practice it often appears difficult for poor people to save their way out of credit constraints. There are different reasons for this (Armendariz and Aghion, 2010, Chapter 6). It may be the case, that risk and persistent negative shocks are so high that asset accumulation becomes almost impossible as assets are wiped out continuously, which somehow contradicts the neo-classical insight that more uncertainty may actually boost savings. Moreover, there may be social impediments to save, if there is a need to support family and friend when they need assistance. Another important reason for under-saving is the lack of reliable saving possibilities, or the existence of saving constraints. The unavailability of convenient savings possibilities may be reflected in a low effective interest rate on savings, which would in terms of our simple condition above imply that $r < \rho$. More importantly, In terms of the savings function, an important implication of liquidity constraints as well as saving constraints may be that the neo-classical first order condition as given above would break down and change into (see Armendariz and Morduch, 2010, p. 181): $u'(c_t) = \frac{1+r}{1+\rho} u'(c_{t+1}) + \lambda$ where λ reflects the extent of borrowing and savings constraints. The implication will be that perfect consumption smoothing is not possible anymore, and that consumption (and savings) patterns would be dependent on current income. However, agents with an exponential discount rate may still try to smooth consumption as much as possible.

III.2 Behavioural economics perspective on consumption

An obvious reason for suboptimal saving may be that agents are simply too impatient to save enough. In the neo-classical framework, this may be reflected by $\rho > r$. Behavioral economists also refer to impatience as a possible reason for undersaving, but via another channel. Behavioral economists point at problems related to self-discipline as a potential reason for undersaving. They assume that agents have hyperbolic preferences, meaning that they want rewards sooner rather than later. Hyperbolic discounting implies, in its most simple form, a discount function represented by: $D(t) = \frac{1}{1+\alpha t}$, which results in a discount rate that is, contrary to exponential discounting, declining over time: $-\frac{D'(t)}{D(t)} = \frac{\alpha}{1+\alpha t}$. The hyperbolic discounting function implies that the longer the time horizon before a reward is received, the lower is the per-period discount rate (the more patient is the person). One of the main implications of hyperbolic discounting is that, in contrast to the model with exponential discounting, perfect consumption smoothing doesn't take place: there will be more immediate consumption (and hence lower savings), and lower future consumption. Moreover, the pre-cautionary savings effect, that is the impact of income uncertainty on savings, is much smaller for hyperbolic discounters than for exponential discounters. This is intuitive as the present bias of hyperbolic discounters will prevent agents to conduct the necessary precautionary savings.

III.3 Implications for commitments

The analysis above does not say anything regarding preferences for commitments. While the neo-classical model doesn't explicitly consider the relevance of commitments, it seems clear that, if anything, locking savings would prevent an individual from maintaining a constant level of consumption throughout lifetime, and hence be valued negatively. Moreover, commitments, in the form of withdrawal fees or minimum balance requirements, imply an increase in transaction costs. Commitments also reduce liquidity for the borrowers, which may not be compensated by higher returns, which would especially be problematic for poor credit constrained households, faced with uncertain future income flows. Therefore, it seems obvious that rational agents, who, in line with the neo-classical theory, discount the future exponentially, would always prefer the most flexible savings possibilities available: a savings product with whatever form of commitment attached, which is not compensated by higher returns, would always be inferior to a similar savings product without commitments attached.

However, there are two potential reasons as to why somebody might prefer commitment devices. First, a commitment device that restricts possibilities to save and dissave may be welfare improving for somebody who is a hyperbolic discounter. The easiest way to explain this counterintuitive outcome is to assume that a decision maker consists of multiple selves, one for each period. If all selves have present-biased preferences, a taste for immediate gratification may result in self-control problems. A feature of the multiple selves models is that future selves cannot be fully controlled by current selves. This may cause problems for the current self if, for instance, the future self undersaves, leading to a too small pension for the current self, something which cannot happen in the neo-classical world where everybody has time consistent preferences. However, the current self may take actions that restrict behaviour of the future self, for instance by using commitments. Fudenberg & Levine (2006) argue that decision problems should be viewed as a game between the short-run impulsive self and the long-run patient self. Actions of dual-selves even stem from different parts of the brain according to some MRI studies (e.g. McClure et al., 2004). Important in this respect is the degree of awareness the current self has about the amount of self-control problems of the future self. It is common to differentiate between *Sophisticates*, who are aware of the fact that they (the current selves) as well as the future selves have equal degrees of present-bias and *Naifs* who are aware of their own present-bias but, incorrectly, assume that the future selves are time consistent (Bauer et al. 2012, Gul & Pesendorfer, 2001, Laibson, 1997). Especially in the case where the current self believes that the future self has self-control problems, which will be the case for a *sophisticated* hyperbolic discounter, commitment devices may be attractive as they may restrict behaviour of the future self. Locking savings would help people make wiser choices by directly specifying the actions of future selves, which are then binding with financial consequences. Savings rates for sophisticated agents with hyperbolic preferences are expected to increase given the choice to opt into commitments and limit withdrawals (Ashraf et al. 2006, Bauer et al. 2012). Basu & Bisht (2015) find that this type of committed savings motivated rural entrepreneurs in India to take up long term (pensions) savings accounts.

Besides self-control issues, literature emphasizes that individuals may prefer commitment devices because of spousal, familial, and neighbour bargaining (e.g., see, Plateau 2001). This is especially the case in a developing country context. In relationships where husbands have relatively more decision power than wives, women may prefer commitments (such as savings via rotating savings accounts - ROSCAs). Anderson & Baland (2002) find that using group rotating savings commitment accounts (ROSCAs), even

without any interest over those savings, is a strategy wives in Kenya employ to protect savings against claims by husbands for immediate consumption. This was especially the case for women who have some but not too much or too little autonomy. Consequently, we can assume that women with a lot of autonomy would prefer lower restrictions or commitments due to spousal relations – such as for instance female household heads. There are a few factors that are positively associated to the take-up of commitment savings. Some of these include higher education level, being female and having limited spousal control (Karlan et al. 2014).

The discussion above suggests that it is not clear beforehand whether somebody prefers more or less flexible savings possibilities. The savings experiment we will explain below provides new evidence on this important question.

IV Methodology

IV. 1 Pension product design

In order to test the relevance of commitments vs flexibility in the context of a long-term savings product, we set up an intervention with Pension Trust Ghana, a Ghanaian subsidiary of a Dutch insurance company Achmea, which introduced a retirement savings program for micro-entrepreneurs in Ghana. The product is a combination of a pensions and a savings account, where consumers are allowed to withdraw a part of their savings at any point in time to allow for some flexibility for financing emergencies, whereas the other part is locked until their retirement – 60 years of age. Pension Trust Ghana (PTG) introduced two pension products. With Pension 1, farmers are allowed to withdraw 50% of their savings at any point in time, whereas the other 50% are saved until their retirement age. With Pension 2, they are only allowed to withdraw 30% of their savings, whereas the other 70% are saved until their retirement age. Thus, the only difference between Pension 1 and Pension 2 is that the latter offers reduced liquidity, which is not compensated by higher returns. One would expect that Pension 1 is always preferred over Pension 2. However, as we have explained in the former section, this may not be the case.

In our study, there is a commissioned agent that keeps record of every farmers' pensions contribution in a ledger-booklet received from Pension Trust. The information recorded includes farmer names, the amount of savings he got from each farmer, and the date when the savings were collected. This assigned

agent would then walk to the nearest bank and deposit that money on a collective account of the pensions company.

IV. 2 Experiment design and model specification

We conducted a baseline survey of 1500 farmers in 2016, which were dispersed over 22 communities. Later that year one community was expelled from the cooperative, leaving us with 21 communities, with 1169 farmers. To study the take up and the use of the two committed pension products with a control group, we used an experimental approach. More specifically, we randomly determined three groups: 1) all farmers in group 1 were introduced to and allowed to open Pension 1, which gives farmers an opportunity to open a free savings account where 50% of the savings were locked until retirement age, and the other 50% could be taken out of the account at any point in time with no penalties; 2) all farmers in group 2 were introduced to and allowed given Pension 2, which is the same product, except that 70% of savings were locked, and 30% were flexible; 3) finally group 3 was used as a control group, where only cooperative directors were introduced to Pension 1 product, and they were allowed to introduce this product to farmers in their community. However, farmers in group 3 were not exposed to any direct promotion or encouragement of opening accounts. We randomized these 3 groups at the community level.

We had randomly selected 3 groups of 7 communities each. For Group one, a representative from the Pension Trust went to 7 selected communities and introduced Pension 1 (50% locked, 50% flexible savings) to all farmers. For group 2, the same Pension Trust representative went to another 7 other communities to introduce Pension 2 (70% locked, 30% flexible savings). In addition, we defined a third group. For Group 3, the pension product was not introduced directly to farmers. Rather, the Pension 1 was explained at a cooperative assembly meeting, which was attended by community leaders from all 21 communities. We deliberately introduced this intervention in order to test whether promotion of the product can also been done at the cooperative level (general assembly meeting), because this had the potential to reduce transaction costs considerably for the Pension Trust. We examine uptake by running simple linear probability regressions, of the following form:

$$Y = \sum \beta_i P_i + \gamma X + \varepsilon,$$

where Y is a binary uptake dummy, with a one if an account has been opened, a zero otherwise; P refers to the three treatments (long-term savings product i). The subscript i. refers to pension product 1, 2 or 3; X is a vector of controls; ϵ is an error term. We cluster all standard errors at the community level to control for within community level correlation of error terms.

We are primarily interested in the comparison of uptake of Groups 1, 2 and 3. In principle, due to the randomization, it would suffice to simply compare means of the three groups. However, in order to improve precision of the estimates, we add controls. This also enables us to test to what extent uptake is affected by different controls.

To avoid ethical issues, and spillover effects, we randomized at the community level, rather than individual level. In order to improve balance and power, we first ranked the 21 communities based on weighted averages of a number of relevant independent variables: Number of Farmers per Community, Average Years of Education, Age, Gender, whether they have a bank account already, Cocoa income, Income in Good vs Bad month, Total savings (formal and informal), whether farmers have income from other farming activities, or from non-farming activities, and finally any outstanding debts. After raking communities based on the normalized score of these variables, we assigned 21 communities into 7 strata, which were then randomly assigned to one of the 3 treatments – 2 pension products and a control per every stratum. We verified whether the randomization resulted in equal groups by performing balancing tests (see Appendix). Our balance tests show that the groups are well balanced. The only two variables that were not so well balanced are Years_education and Total_savings. Even though perfectly balanced groups are not a prerequisite for making valid statistical references (Mutz et al., 2019), we will include these variables as control variables in our regression analysis, to avoid potential issues with endogeneity.

IV. 3 Study context: cocoa farmers in this study

The demographics obtained from our baseline survey show that about 67% respondents were male, and that the average education level is 10 years. Both the mean and median age of farmers in this cooperative is around 54, with around 25% of the total respondents above the official retirement age of 60. Considering that Ghana's median age is 21², we can indeed confirm that cocoa farming is an aging business.

² https://www.indexmundi.com/ghana/median_age.html

Cocoa is a biannual crop, where the main cropping season in Ghana is from August to January and the light-crop season from April to June. Farms which are not properly maintained only have harvest during the main season. Savings and diversification into other farm or non-farm activities enables farmers to better cope with income fluctuations resulting from unpredictable production of this biannual crop.

Our survey shows that 82% (1227 farmers) have other farming activities, whereas 45% (670) farmers are involved in non-farming activities. According to our baseline, income diversification into both other farming or non-farming activities is more common among young farmers than old farmers.

IV. 4 Variables description

Table 1 below summarizes variables used in this study and shows how they are balanced across the 3 groups of farmers used in this study: for farmers in group for Pension1, Pension2 and Control group.

Table 1: Balance Tests: demographic variables, interest in pension and shocks

VARs	(1) Nr inhabit. in community	(2) Gender	(3) Age	(4) Yrs of schooling	(5) Interest in Pension	(6) Shocks ¹	(7) Shocks ²
pension1	-335.3 (1,050)	0.0815 (0.0558)	-0.884 (1.628)	0.649* (0.336)	-0.00391 (0.0109)	-0.0674 (0.110)	-0.0514 (0.0580)
pension2	861.0 (2,245)	-0.0178 (0.0780)	-0.421 (1.125)	0.428 (0.308)	0.00543 (0.0195)	0.0893 (0.0659)	-0.0745 (0.0775)
Constant	3,068*** (826.7)	0.266*** (0.0453)	55.71*** (0.446)	10.70*** (0.194)	0.917*** (0.00852)	0.412*** (0.0543)	0.506*** (0.0422)
Observations	1,169	1,161	1,155	1,169	1,151	1,169	1,169
Adjusted R-squared	0.015	0.007	-0.001	0.003	-0.002	0.013	0.002

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10. Note, we also tested balance between pension1 and pension2. It appears that for all variables presented in this table there is balance between pension1 and pension2. Gender = gender dummy with a one for female. Interest in pension = dummy variable with a one if respondent indicated to be interested in a pension product.

¹ Shocks related to drought, floods, bushfire or landslides; dummy with a one if respondent experienced these shocks in last 12 months.

² Shocks related to unusually high levels of pests and diseases on farm. Dummy with a one if respondent experienced these shocks in last 12 months

Table 1a: Balance Tests (continued): income fluctuations management variables

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
VARS	Income from other farming	Income from good month	Income from bad month	Existing loans	Bank savings	Total savings	Receive remittances
pension1	0.00840 (0.0619)	215.5 (455.0)	-8.050 (118.2)	0.00765 (0.0309)	-0.0580 (0.0339)	141.9 (340.9)	0.00575 (0.0459)
pension2	0.0530 (0.0440)	43.47 (263.1)	45.12 (90.60)	-0.0278 (0.0214)	-0.0140 (0.0426)	654.5* (374.5)	0.0252 (0.0334)
Constant	0.814*** (0.0339)	2,278*** (128.6)	794.4*** (61.48)	0.177*** (0.0186)	0.585*** (0.0172)	2,749*** (230.8)	0.387*** (0.0144)
Observations	1,169	1,169	1,169	1,169	1,169	1,169	1,169
Adjusted R-squared	0.002	-0.001	-0.001	-0.000	0.001	0.001	-0.001

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.

Note 1: we also tested balance between pension1 and pension2. It appears that for all variables presented in this table there is balance between pension1 and pension2.

Note 2: we also tested some other variables, such as income from non-farming activities here, and health insurance, and they were all balanced. However because of space limitations, they are not presented here. These results can be obtained on request.

Table 2 summarizes annual income from cocoa production of the farmers we surveyed, and how it compares to alternative jobs in towns. This is quite important to consider given that the ability to commit to savings will depend on current income earned. We created income categories comparable to a local minimum wage in Ghana, a low-wage equivalent in town based on 2016 exchange rate (\$100/month), and a taxi driver wage equivalent in town (\$200/month). Looking at cocoa income alone, almost 40% of farmers live below the minimum wage equivalent (US\$1.9 per day). It is hard to expect that anyone from this group of farmers will be able to commit to any savings account. To make a more substantial living above absolute poverty levels, farmers have to diversify their income with other farming or non-farming activities.

Table 2: Total annual income from cocoa (in Ghana Cedis, GhC)

	<i>Income equivalence</i>	<i>Frequency</i>	<i>Percent</i>
< 2851	Below minimum wage (\$1,8/day)	562	37.39
2851 – 5,244	Min. wage - \$100/month	347	23.09
5,244 – 10,944	\$100/month - \$200/month	325	21.62
> 10,944	> \$200/month	186	12.38
0	Missing responses	83	5.52

Looking at our data, we also find that 55% of farmers already have a bank savings account, from which

89% (44% of total) have savings on it³. When asked about their interest in taking up pensions, a great majority (92%) said they were interested in saving for retirement. However, we also found that old farmers are less likely to be interested in pensions, especially old farmers with low income.

Looking at our own baseline survey data, 71% are land owners. About 22% (332 farmers) are Abunu farmers, sharecroppers who take over a farm, make all the investments to replant trees, apply input supplies etc., and they give 1/3 of proceeds to the landowner. Another sharecropping arrangement is Abusa farmers, who are simply farm care-takers, and they give 2/3 of their proceeds to the landowners. We have less than 7% (99 farmers) of Abusa farmers in our sample.

V. Results

The summary of our OLS regression analysis is shown in Table 5. Dummies for strata, as explained earlier, are taken into account in all regressions. Regressions 1, 2 and 3 use the entire sample, whereas regressions 4 and 5 use a restricted sample (sample of farmers who were offered Pension 1 and Pension 2 only).

Table 5: OLS regression: Uptake of two pensions accounts

VARIABLES	(1) without controls	(2) with 2 controls ¹	(3) all controls ²	(4) restricted sample ³	(5) restricted sample ³ with 2 controls ¹
pension1	0.140 (0.124)	0.141 (0.124)	0.141 (0.117)		
pension2	0.0169 (0.0697)	0.0179 (0.0696)	-0.0128 (0.0632)	-0.147 (0.110)	-0.146 (0.110)
Constant	0.108 (0.0947)	0.121 (0.109)	0.0893 (0.175)	0.302*** (0.0454)	0.304*** (0.0642)
Observations	1,169	1,169	1,137	701	701
Adjusted R-squared	0.139	0.138	0.172	0.101	0.100

Cluster (communities) robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10. If we did not cluster standard errors, we would get significant results. However, clustering increased standard errors, thereby reducing our t-values.

¹ We use Total_savings and Education_Years as controls here, because balance tests showed that these 2 variables are not in balance across groups.

² All variables presented in balance tests tables were added to this regression. We also tested whether pension1 and pension2 differed significantly from each other: they do not.

³ Restricted sample: Pension 1 and Pension 2 only, without control group.

³ We assume that these accounts are flexible, only they usually have a minimum savings balance.

From column 1 of table 5 we see that the uptake of Pension 1 is higher than Pension 2 and Pension 3 (the latter is reflected by the constant). Almost 25% of farmers have taken up pension 1 (reflected by the constant and Pension 1 uptake), whereas only 13% take up Pension 2. Even though this difference is large, it is not statistically significant. Because we only have 7 communities per pension product group, we ran into power problems and most likely made a Type II error. We incorrectly dismiss significance because we had too few communities to draw any significant statistical inferences from. Adding controls in columns 2 and 3 does not change the results much. A larger sample of communities is needed to make statistically significant inferences about the difference in uptake between the 3 pension products.

In columns 4 and 5 we ignore farmers from group 3 who were offered Pension 1 through community leaders and not directly through the pension trust. Here Pension 1 uptake is 30%, reflected by the constant, and is significantly higher than the uptake of Pension 2, which is less than 16%. The finding is confirmed when control variables are added.

V.1 Heterogeneity effects

In addition to these simple linear regressions, we test whether there are heterogeneous treatment effects by interacting the treatment dummies with different variables. That is, we test whether the uptake for different subgroups of the more restricted long-term savings product differs significantly from the uptake of the group with the more flexible pension⁴. These regressions are specified as follows:

$$Y = \alpha + \beta_1(1 - I) * P_2 + \beta_2 * I * P_2 + \beta_3 * I * P_1 + \mu X + \varepsilon$$

where α represents the constant, P_2 pension 2 uptake, P_1 pension 1 uptake; X a vector of controls (including the strata dummies) and I a vector of interaction terms (always binary, that they define “groups”). Note that the constant reflects the uptake of pension 1 by the group defined by $1-I$. For instance, if I denotes the binary variable gender, with a 1 for female, and 0 otherwise, then the constant reflects uptake by men of pension product 1. β_1, β_2 measure the increase/ decrease in uptake of pension 2 for groups denoted by I or $1-I$ compared to the uptake of pension 1 for the group denoted by $1-I$; β_3 measures the additional increase/ decrease in uptake of pension 1 for group I compared to the uptake of pension 1 by group $1-I$.

⁴ Here we only present estimates for the restricted sample of those who were assigned either Pension 1 or Pension 2, without the control group. However, all regressions are also done with the entire sample. These results are qualitatively similar to the results present in the main text. More details available upon request.

The individual characteristics include the existence of income diversification strategies or financial shocks management strategies (see balance tests in section 4.4 for a summary of all variables considered). Examples of the latter two include income from non-farming activities, other savings, health insurance, and remittances.

Table 6 finally summarizes our findings of the heterogenous effects regressions. The constant in each regression column above reflects the group not represented in that regression.⁵ The balance tests showed a significant difference in means between the two pension groups for gender and education level, so we will start with describing these control variables. In column 1 we test the difference between men and women. Recall, one reason for a preference of commitment devices, may be related to bargaining power. Women may prefer commitments to be able to counteract claims by husbands for immediate consumption. However, our results do not provide support for this view as the results suggest that women have a significantly higher uptake of the more flexible pension (column 1) relative to men. Moreover, women have a higher uptake of pension 1 relative to pension 2, which shows that they prefer a higher level of flexibility or liquidity. We also find no evidence of higher uptake of either pension product related to the level of education (column 3).

There are a number of income fluctuation management strategies which influence farmers' preference for commitment versus flexibility, namely, existing savings, income diversification, remittances and a larger number of laborers within a household. Firstly, we test whether access to alternative savings matters for the choice of one of the two pension products. Intuitively, if somebody already has savings (or is more financially included), the lower liquidity associated with pension 2 is less of a risk. Thus, we would expect that demand for pension 2 to be higher for farmers with access to other savings products. We however, find no evidence for this (column 2). Remittances are another strategy farmers use to manage income fluctuation risks. For the group of farmers who get no remittances, the most flexible pension product is taken up significantly more (column 6). This is in line with our expectation that farmers prefer to have more flexibility if they have fewer sources of income. Higher number of household members is also a way to diversify income, given that more household members means more laborers and thus income per household. However, if a greater number of those household members are children, there are also greater income expenditures on education and health care. We however find no evidence

⁵ For example, constant in regression 1 is represented by Pension 1 males; regression 2 by take-up of Pension 1 by farmers without existing savings.

that the number of household members influences the adoption of either pension product (column 7). Finally, income diversification through non-farming activities is another way of managing income fluctuation. Wald tests indicate that the uptake of the flexible pension product is also higher for farmers with income generating activities other than farming; in other words, for those farmers who can diversify income through non-weather-dependent activities (column 7).

Besides income diversification, the analysis also considers the effect of income shocks on adoption of pension accounts. Farmers who have experienced an unexpected shock with financial repercussions in the last year are significantly less likely to take up the more rigid pension product. We also expected farmers who have health insurance to be less exposed to some of these income shocks and thus more open to less flexible accounts. However, we found no significant uptake of either pension account for farmers with health insurance (column 5).

Our findings show that there is generally a stronger preference for Pension 1, especially for women and farmers with income from non-farming activities. We do, however, find a significantly lower uptake of Pension 2 for farmers who have experienced an unexpected expenditure shock in the last year and for those farmers who receive no remittances from others. That means that 50% locked savings accounts attract farmers with uncertainty in income and expenditures, but it puts off farmers with too much uncertainty from locking 70% of their savings (Pension 2).

Table 6: Heterogeneous treatment effects

VARIABLES	(1) Gender	(2) Access savings	(3) Education	(4) Shocks	(5) Health insurance	(6) Remittances	(7) Hhnumber	(8) Nonfarmactivities
Female*pension2	-0.0900 (0.0906)							
(1-female)*pension2	-0.124 (0.118)							
Female*pension1	0.0890*** (0.0281)							
Sav*pension2		-0.141 (0.111)						
(1-Sav)*pension2		-0.136 (0.105)						
Sav*pension1		0.0122 (0.0513)						
Educ*pension2			-0.0451 (0.135)					
(1-Educ)*pension2			-0.121 (0.0942)					
Educ*pension1			0.0991 (0.0605)					
Shock*pension2				-0.162* (0.0890)				
(1-shock)*pension2				-0.154 (0.0938)				
Shock*pension1				-0.0328 (0.0693)				
Hins*pension2					-0.145 (0.120)			
(1-hins)pension2					-0.0859 (0.140)			
Hins*pension1					0.00751 (0.0388)			
Remit*pension2						-0.125 (0.130)		
(1-remit)*pension2						-0.189* (0.106)		
Remit*pension1						-0.0434 (0.0460)		
Hhnumhigh*pension2							-0.144 (0.128)	
(1-hhnumhigh)*pension2							-0.181 (0.105)	
Hhnumhigh*pension1							-0.0395 (0.0355)	
Nonfarma*pension2								-0.126 (0.112)
(1-nonfarma)*pension2								-0.108 (0.108)
Nonfarma*pension1								0.0706** (0.0253)
Constant	0.273*** (0.0571)	0.297*** (0.0869)	0.198 (0.114)	0.310*** (0.0576)	0.296** (0.0987)	0.327*** (0.0608)	0.324*** (0.0774)	0.276*** (0.0684)
Observations	695	701	701	701	701	701	701	701
Adjusted R-squared	0.106	0.098	0.102	0.098	0.098	0.102	0.100	0.103

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10. Variables: female=gender dummy with one for

female. Sav = savings dummy with a one for farmers who do have access to a formal savings account; Educ = education dummy with a one if respondent's education level is higher than primary; Shock: dummy variable with a one if the respondent experience in the last 12 months drought, floods, bushfire, or landslides. Hins: binary dummy with a one if the respondent has health insurance; Remit: binary dummy if the respondent obtained remittances; Hhnumhigh = binary dummy if household of respondent contains more than 5 members; Nonfarma= binary dummy with a one if the respondent has non-farm business activities. The different dummies are interacted with either pension1 or pension2, which leads to different groups. The “missing “group is reflected by the constant. OLS regressions; Dummies for the strata and sav_total and Education_years1 are taken into account in all regressions

V. Discussion and conclusions

Although the uptake of the two pension products on average does not differ significantly at the usual significance levels, our analysis suggests that a more flexible long-term savings product is preferred over the less flexible savings account. This conclusion is confirmed by the heterogeneity analysis we have performed, where women and farmers with non-farming income generating activities have a higher preference for Pension 1. Better income diversification, on the other hand, does not translate into a higher uptake of the more rigid account, Pension 2. If anything, farmers who have experienced a financial shock within the last year and those who receive no remittances have a significantly lower uptake of the more rigid pension account, Pension 2.

From these findings we can conclude a couple of things. Primarily, if any pension flexibility is valued, it would be the more flexible account. Farmers who have sufficient income to save for pensions, or in other words, balance long term consumption despite income fluctuations, are those who simply have more sources of income. The implications of this finding are that a 50% flexible product generally creates a better balance between current and future consumption needs. The more rigid savings become impossible for farmers who have fewer sources of income, such as those farmers who receive no remittances, or those who are still recovering from financial shocks from last year. These subgroups of farmers are less likely to be able to balance current expenditure versus long-term expenditure. Perhaps rigid pension savings are more desirable in Western countries where income fluctuation is generally less severe, partially because of the existing government social security systems that are in place to protect their citizens. In Ghana on the other hand, locking 70% of pensions savings is simply not optimal for balancing either current consumption or future consumption. This is not a matter of hyperbolic discounting versus exponential discounting discussed earlier – perhaps locking 70% of savings creates an opposite scenario of hyperbolic discounting, where consumers would not discount future rewards, but the contrary – they would have to value their future rewards *more* than they value their current rewards. Such a scenario is simply not realistic, which is how we explain lower uptake of

pension 2 product. Even under relatively “ideal” circumstances where farmers have income diversification strategies, receive remittances, and have not experienced any financial shocks in the last year, they still have a preference for the more flexible savings account. This is an indication that locking 50% of savings is more realistic in balancing current consumption with temptation.

Secondly, women are usually the ones who take care of long-term well-being of all family members. The flexible pension accounts allows them to balance consumption demands of family and community members with long-term care for the household. Women in developing countries have historically been known to be responsible for the well-being of the family as a whole. It is normally women who make sure that children’s school fees are paid and that there is enough food on the table for the whole household. This indicates high current expenditure costs. On the other hand, women in a lot of African countries, including Ghana, are still not allowed to inherit land titles. This means that they cannot lease out their land in sharecropping agreements and use farm proceeds as retirement income, like other older cocoa farmers do. Because of the nature of land titles, women are not in a position to do that. Therefore pensions savings allows them to tailor for their own old age income as well as tailor to current household needs and unexpected expenses.

A limitation of our study is that the amount of communities in our sample is relatively small. Recall that for ethical reasons, we had to randomise at the community level. This also has advantages in terms of avoiding spill-over effects. However, due to the small amount of communities, we may face problems in terms of only being able to pick up small effect sizes, and thus incorrectly fail to reject the null or no significant differences. Fruitful future research should therefore be done on a larger group of communities.

Another limitation is that due to the relatively small number of communities, we were not able to compare a larger variety of pension products, as this would have resulted in additional power problems. Yet, it should be noted once again that our study compares only two commitment products. In order to better assess “optimal” commitment levels, a larger variety of pension products (including one without any restrictions) should be taken into account. Finally, this study only measures the take-up of different pension savings products, but future research is needed to identify the retention of long term savings, and how this changes over time.

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