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The role of financial literacy in households' asset accumulation process: evidence from Ghana

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Abstract

This paper examines the impact of financial literacy training on household asset accumulation using data collected from a randomised controlled trial implemented in Ghana. Financial assets are measured using account holdings and savings while durable assets and their decomposed components are captured using their total values. After testing for baseline balance, impact is estimated using treatment effect models. We find that financial literacy training plays a significant role in accumulation of both financial and durable assets, but the impact is more evident in the accumulation of productive durable assets. Our overall findings on productive and non-productive assets are robust to alternative conceptualisations of what constitutes productive and non-productive assets. Our results also show that financial literacy training has an impact on the accumulation of both total and productive assets in female-beneficiary households, as well as enhancing account holdings for females, although this effect was larger for males. The analyses for different age cohorts also revealed that financial literacy training results in higher asset accumulation among younger household heads.

Keywords Financial literacy · Asset accumulation · Welfare · Gender · Ghana

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1 Introduction

Financial literacy is considered to be positively associated with asset building and retirement planning (Atkinson & Messy, 2011; Lusardi & Mitchell, 2011; Van Rooij

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et al., 2012). Some studies have also linked financial literacy to household consumption, financial inclusion and other household welfare indicators (Agarwalla et al., 2015; Dinkova et al., 2016; Hilgert et al., 2003; Koomson et al., 2020a; Letkiewicz & Fox, 2014; Millimet et al., 2015). There is ample evidence on the use of income and consumption as indicators of well-being, with some studies recommending the use of a mix of well-being indicators (Bavier, 2008; Koomson et al., 2021; Orkoh et al., 2020). Others also assert that consumption-based measures represent welfare better than do income-based measures (Meyer & Sullivan, 2012; World Bank, 2001). Etim and Edet (2014) and Sahn and Stifel (2003) have also indicated that asset accumulation is to be preferred as a measure of poverty or welfare over other measures (such as income and expenditure) due to its relative stability.

The objective of the research presented in this paper is to better understand the role that financial literacy plays in the asset accumulation process. We review the existing literature in this area below and from this we identify five issues where this work can contribute to advancing our existing knowledge and expanding the evidence base. These are: (i) the need to provide further evidence of the processes underlying the accumulation of durable assets in developing countries, which is especially relevant in this setting given the high opportunity cost of accumulating financial assets; (ii) there are gaps in the level of financial literacy and asset accumulation between genders in both developed and developing countries (albeit that the gap is more pronounced in the latter). This paper provides more evidence regarding the gender aspects of these issues; (iii) previous research has noted that policy that encourages households, and women especially, to accumulate more productive assets should be implemented; (iv) the establishment of causality has been limited in prior research, since most estimates have been produced using methodologies from which causality cannot be determined. This paper employs a randomised controlled trial (RCT) to fully establish causality; and (v) we use data from Ghana; a developing country with country-level evidence of low levels of household asset accumulation. Few prior studies have explored these questions from a developing country perspective.

Previous studies have largely focused on the relationship between financial literacy and accumulation of financial assets in general and not specifically upon durable household assets (Caskey, 2006; Lusardi et al., 2015). Hirad and Zorn (2002) do consider durable asset ownership in the United States but limit their examination to mortgages. Studies that have considered both financial and durable assets have, for the most part, used data from developed or European countries; for example, Chile (Behrman et al., 2012), the United States (Bernheim & Garrett, 2003; Letkiewicz & Fox, 2014), the Netherlands (Van Rooij et al., 2012), and across 11 European countries (Jappelli & Padula, 2013). Steel et al. (1997) make the point that while financial assets are likely to yield high returns, the opportunity cost of holding them may be too high for poor people in the short term and where there is an absence of proper institutional arrangements in the financial sector. This observation is likely to be true for an entire economy in which the financial sector is not highly developed, as is the case in many countries in sub-Saharan Africa (SSA).

Prior research indicates the existence of a gender asset gap across the globe (Deere & Doss, 2006; Doss et al., 2011; Oduro et al., 2011; Grabka et al., 2015; Meriküll et al., 20201; Peprah & Koomson, 2017). Although there has been an improvement in account ownership globally, evidence from the Global Findex database indicates

that there is still a 7% gender gap (65% female, 72% male) in account ownership (Demirgüç-Kunt et al., 2018). An innovative form of account ownership and savings in developing countries is mobile money, which is considered a key driver of the fintech revolution in developing countries (Demirgüç-Kunt et al., 2018). Recent levels of financial inclusion in Africa have been largely driven by government policies targeted at improving mobile- and internet-based access to financial services and payments (Bukari & Koomson, 2020; Demirgüç-Kunt et al., 2018; Koomson et al., 2020a). Although mobile money adoption in SSA stands at 24% and continues to increase, there is a significant gap in adoption rates between genders; adoption rates are 6.1% lower for females (Demirgüç-Kunt et al., 2018).

At the spousal level, Lee and Pocock (2007) have shown that women have a higher propensity to save than men. Deere and Doss (2006) suggest that marital and inheritance regimes play a role in affecting the ability of women to accumulate assets. They also point out that relatively little has been done to determine how asset distribution influences the gendered pattern of overall wealth ownership and, further, how this impacts household decision-making and female wellbeing. A study by Haussen (2019) has shown that women are poorer, on average, compared to men. According to Hannan (2000) sustainable and effective development can only be achieved if the interests and needs of all groups in society are taken into account and calls for the inclusion of gender perspectives as vital components of research, analysis, policy making, planning and institutional development in all areas of development. The UNDP (2012) also backs this call and has stated that the capacity of economic policy interventions to achieve efficiency and equity objectives can be strongly affected by gender relations. With this backdrop, we explore the gender dimensions inherent in the impact of financial literacy training on asset accumulation, with the objective of suggesting gender-informed policy interventions.

A number of commentators (Aryeetey, 2004; Doss et al., 2011) have noted that the accumulation of productive durable assets should specifically be encouraged, particularly for women. The suggestion is that this can encourage female-led business start-ups and enhance household welfare since women in developing economies are considered more entrepreneurial than men (Fairlie & Krashinsky, 2012; GSS, 2014; Peprah & Koomson, 2015; Perl-Kot, 2011). Accumulation of productive durable assets has been shown to enhance access to credit and can improve rural households' welfare because rural households have been noted to invest more in productive assets (Aryeetey, 2004; Kelkar, 2009). Kelkar (2009) notes that lack of control and ownership of productive assets hinders inclusive economic growth and results in gender inequality (Kelkar, 2009) and further, urges for the development of research-based programmes to help advance the accumulation of productive assets by women. The results presented in this paper demonstrate the differences in the impact of financial literacy training on productive and non-productive asset accumulation and hence provide further evidence in establishing whether financial literacy can enhance household welfare in sustainable ways through income generation.

Several studies have found that improvement in financial literacy enhances household wealth and wellbeing (Behrman et al., 2012), savings and investment practices (Hilgert et al., 2003) and, the accumulation of illiquid and liquid assets among the young (Letkiewicz & Fox, 2014). This results in the spread of household wealth over a diverse class of assets, including the holding of more diversified

portfolios for retirement purposes (Van Rooij Lusardi & Alessie, 2012). This evidence notwithstanding, Lusardi and Mitchell (2011) and Caskey (2006) have questioned whether studies that report a positive relationship between financial literacy and asset accumulation establish a causal relationship. Their doubt is based on the fact that existing studies make limited use of experimental methods to assess the link between financial literacy and asset accumulation. To establish a causal link between two variables, the use of an RCT is considered the 'gold standard' since the method follows a carefully structured process to assign respondents to treatment and control groups (Kondo et al., 2008). Our results are derived from an RCT and so provide robust empirical evidence of the impact of financial literacy training on asset accumulation. We also establish the effect of financial literacy training on asset accumulation across different age cohorts.

The rest of the paper is structured as follows. The next section describes our adapted model, which integrates financial literacy into a life cycle model. We also explain why we focus on Ghana. Section 3 describes the data, randomisation process, measure of variables and the estimation techniques used for the analyses. Section 4 presents and discusses the results and Section 5 concludes the paper, with some policy recommendations.

2 Financial literacy in a life cycle model

We adapt and modify the model proposed by Lusardi et al. (2015) that employs a stochastic life cycle model. We replace the endogenous financial knowledge with a binary exogenous financial literacy variable determined through an RCT. We use both financial and durable assets as our indicators of asset accumulation. Our model enables us to determine how financial literacy impacts asset accumulation for different consumers and beneficiaries of financial literacy training. We begin our modelling by representing a beneficiary of financial literacy training with a randomly generated binary variable, FL_{it}. The provision of financial literacy training reduces the beneficiaries' cost of acquiring financial literacy; this is expressed as $\pi_p = (i_t) = \vartheta\pi(i_t)$, where $\vartheta < 1$ captures the efficiency of the financial literacy programme and where participants are incentivised to participate and acquire more knowledge if the training is of high quality. Cost also matters because it influences an individual's decision to participate or not. In a special case of experimentation, we use randomisation to set the beneficiaries (the treatment group) apart from the non-beneficiaries (the control group). The participation cost (π_p) of the programme is captured in time or monetary terms.

The participation in the training is examined using the model specified as shown in Eq. (1):

$$p_{it} = I[v(s_t) + \zeta_{it} > 0] \tag{1}$$

where $V_p(s_t)(p = 0, 1)$ is defined to capture any potential beneficiary, who is eligible for the training. This also represents the potential indirect utility function associated with beneficiary (1), and non-beneficiary (0) statuses respectively. The potential beneficiary only participates in the training if $v(s_t) = V_1(s_t) - V_0(s_t)$ is greater than

zero. The participation equation is obtained after adding a zero-mean disturbance term to the difference $[v(s_t)]$, $\zeta_{it} \sim N(0, \sigma_v)$,

To determine the impact of financial literacy training on the asset accumulation of beneficiary-households, we specify a general form of the model (Eq. (1)) that controls for household-level characteristics and financial literacy training status of the household head as:[1]

$$Asset_i = X_i\beta + \Delta FL_i + \varepsilon_i \tag{2}$$

where *Asset* represents account ownership, savings accumulation and the total value of household durable assets. *FL* is a binary variable representing whether the household head has received financial literacy training, *X* is a matrix of observable household head and household level characteristics and ε is the error term. In this paper, we examine the impact of the financial literacy training programme for different age groups which captures the cohort effects.

2.1 Why Ghana?

Ghana is an ideal case study for examining the link between financial literacy and asset accumulation. Asset accumulation among Ghanaian households is generally low (Aryeetey, 2004; Doss et al., 2011). For example, only 13.2% of households own land and only 0.5% own shares (GSS, 2019). Over the period 2005/06 to 2016/17, there has been some increase in asset accumulation (specifically of durable goods) (GSS, 2018). For example, ownership of fans increased from 54 to 73% while that of televisions improved from 53 to 77% (GSS, 2018). There are also rural-urban differences in asset accumulation in Ghana. Ownership of houses/buildings is higher in rural localities (27.1%) than it is in urban areas (14.0%) (GSS, 2018). Between 2005/06 to 2016/17, ownership of mobile phones increased more markedly in rural areas (by 83%) than in urban Ghana (62%) (GSS, 2018). This can largely be attributed to the role of mobile phones as tools for financial inclusion among most rural households in developing countries (Bukari & Koomson, 2020; Jack & Suri, 2011; Koomson et al., 2021; Koomson & Ibrahim, 2018; Ouma et al., 2017). Ghana is considered one of the countries at the forefront of mobile money account ownership in SSA; increasing from 13% of the population in 2014 to 39% in 2017 (Mattern & McKay, 2018).

In addition to rural–urban disparities, there are also gender differences in asset accumulation. Oduro et al. (2011) found that, males owned 61% of places of residence, 62% of agricultural land and 53% of agricultural equipment. Overall, total asset value, as well as the mean value of gross wealth, was greater for men than for women for all categories of assets (Oduro et al., 2011).

Financial literacy rate in Ghana is 32%, which is considered low. In a global study that ranked 144 countries based on their financial literacy levels, Ghana was ranked 90 (Klapper et al., 2015). From the gender perspective, financial literacy rate among men is 33% while that of women is 30% (Hasler & Lusardi, 2017). There are also locational disparities in levels of financial literacy among rural adults. While the rate of financial in Northern Ghana is 44%, financial literacy rate in the Middle and

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[1] For random experiments, we have $\varepsilon_i \perp FL_i$.

Southern Ghana is 51% (Kunateh, 2009; Mireku, 2015). The government of Ghana, commercial banks and NGOs have made some efforts to improve financial literacy via training programmes; however, there is little evidence that these programmes are having a positive impact on household welfare. Studies undertaken in Ghana by Berry et al. (2018), Chowa et al. (2015), Koomson et al. (2020b, 2021), and Nunoo and Andoh (2012) indicate that improvements in financial literacy influence savings and improve household financial resilience. Little research has yet been done in Ghana, or in other sub-Saharan Africa (SSA) countries, to explore the role that improved financial literacy plays in fostering asset accumulation within households. Given the above background our use of Ghanaian data in this paper provides an appropriate context within which to explore the issues outlined in the introduction.

2.2 Data

We use data that was collected as part of the Rural and Agricultural Finance Programme (RAFiP) project: *Impact Assessment of Experimental Enhanced Financial Literacy Training for beneficiaries of Northern Rural Growth Programme (NRGP), Roots and Tuber Improvements and Marketing Programme (RTIMP) and Rural Enterprise Programme (REP).*[2] The sampling for the project was performed using an RCT of beneficiaries of NRGP, RTIMP and REP. Non-beneficiaries of these three poverty reduction programmes were also included to deal with potential selection bias. The Directorate of Research, Innovation and Consultancy (DRIC-UCC) at the University of Cape Coast (UCC), Ghana, was the data collection agency.

NRGP, RTIMP and REP have been supporting farmers with rural finance, training, commodity chain development, rural infrastructure and other assistance. Beneficiaries of these programmes were targeted because they had already been assessed as being poor households before their selection into the three programmes.

The detailed process involved in the RCT and the numbers drawn from and included in each group is discussed below while the CONSORT flow diagram is displayed in Appendix 1.

2.2.1 Sampling and recruitment

The sampling process started with the generation of a sampling frame of respondents with common characteristics made up of beneficiaries of the three poverty reduction programmes (NRGP, RTIMP and REP) and non-beneficiaries. The lists of beneficiaries were obtained from the schedule officers of NRGP, RTIMP and REP while that of non-beneficiaries was generated from documents obtained from their respective District Assemblies. The inclusion criteria were based on commonality of characteristics (such as economic activities and location) between the two groups. Potential spill-over effect (contamination) was resolved by dropping one out of every two respondents who belonged to the same social/economic network. These networks were defined by respondents' membership of agriculture, milk or other cooperatives; credit or savings groups; youth clubs or sports groups; trade union,

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business or professional groups; and other minor groupings. The eligible respondents were spread across 10 districts chosen from seven regions of Ghana. These districts were West Gonja, Central Gonja and Savelugu (from the Northern Region); Bawku West (Upper East Region); Wa West (Western Region); Wenchi and Kintampo (Brong Ahafo Region); Nkwanta south (Volta Region); Adansi (Ashanti Region); and Abura-Asebu-Kwamankese (Central region). Across all districts, a total of 801,111 eligible respondents were selected: 66,911 beneficiaries and 741,200 non-beneficiaries (see Appendix 1 for details). A second-stage eligibility filter was applied to both beneficiaries and non-beneficiaries, after which the remaining 1500 were enumerated to be part of the study. The sample was stratified by programme, region, district and gender.

2.2.2 Randomisation process

After enumeration, respondents were randomly assigned to the treatment and control groups. Specifically, 300 were randomly assigned to the financial literacy training (105 males and 195 females) in March 2016 while the remainder (1200) made up the control group.

2.2.3 Intervention components

The financial literacy training covered three main modules. Module 1 dealt with financial goals such as meaning of goals, setting financial goals, types of financial goals and prioritising financial goals. Module 2 was concerned with financial management and included the meaning of money, handling money, good borrowing behaviour, savings, insurance, remittances, transfers, financial products, financial concepts and others. Module 3 concentrated on business finance and business management and included steps to managing finances and business, the development of a work plan, budgeting, and record keeping, among others.

The financial literacy training which was delivered in person was based on the experiential learning methods anchored on the principles of adult learning. With the use of different structured learning exercises, such as case studies and role-plays, the modules were delivered in a participatory and interactive approach. For example, in Module 1 each participant was tasked to identify a partner with whom they spent 5 to 10 min listing their goals for a happy future. They were asked to share their goals with the rest of the participants. After participants identified the goals not achievable in the short term, they were exposed to strategies on how to prioritise and set achievable financial goals while identifying those that are achievable in the short and long terms. The key principles that underlined the training were goal and relevance orientations and the recognition of participants as independent and self-directed adults.

Financial literacy training was provided in all districts in March 2016 by professionals from the University for Development Studies, Tamale (an accredited training provider). The training, which took two days to provide, was delivered in participants' local language to achieve effectiveness. Those in the southern sector (Adansi South and Abura Asebu Kwamankese and Nkwanta South) used the Akan language, whereas those in the northern part of the country used Mole Dagbani as the

medium. The number of days of the training is consistent with days of training in previous studies which have been delivered in either two days or two and a half days (Bruhn & Zia, 2013; Field et al., 2010). Opting for shorter days is noted as being effective in encouraging participation and increasing response rate because it does not require business owners and farmers to be away from their economic activities for too long (McKenzie & Woodruff, 2014).

2.2.4 Data collection procedures

On 25 November 2015, baseline data was collected on 1441 respondents because 59 people were withdrawn from the study, for reasons including declined, no response, relocation and other (see Appendix 1 for a breakdown). Males made up 532 (37%) of the baseline sample while females made up 909 (63%). The sample bias towards women is due to the existence of gender gaps in asset ownership, income, poverty, wealth, education, inheritance, access to healthcare and household decision-making in Ghana (Akotia & Anum, 2015). Data collection was undertaken by 40 field assistants and supervisors who were recruited based on their educational level and proficiency in at least two Ghanaian languages.

Endline data collection was undertaken on 1–20 September 2016 after revising the instruments to incorporate questions on the training intervention. The sample size for the endline survey was 1415 (37% male and 63% female) because of a 13 percent attrition rate; this had to be resolved through replacement, which was done randomly. The replacement reduced the initial 13 percent gap to 1.8 percent. Specifically, the beneficiaries' population reduced to 261 (108 males and 153 females) while the control group reduced to 1154 people (418 males and 736 females). In sum, beneficiaries of NRGP, RTIMP and REP were included in both treatment and control groups. Same was the case of participants who were non-members of these three programmes. Details of numbers drawn from members and non-members of each programme and their group allocation can be found in the CONSORT flow diagram presented in Appendix 1. Although the period between baseline and endline data collection may seem short, it is in line with Berry et al. (2018) analysis of a financial literacy education programme for a youth project in Ghana, which started in October 2010 and ended in July 2011. Similarly, a study that offered business training in Vietnam collected endline data 5–6 months after training to capture short-term effects of that training (Bulte et al., 2016). The revised instruments were studied and approved by RAFiP and validated by DRIC-UCC.

2.2.5 Ethical issues

To ensure adherence to ethical standards, the research instruments were submitted to the Institutional Review Board (IRB) of UCC for ethical clearance. Informed consent was sought from each respondent before administering the instrument.

2.3 Measuring asset accumulation

We measure financial asset accumulation following Ansong et al. (2020); and Honohan (2006) using formal account holdings and savings accumulation which is

captured as engaging in the behaviour of depositing money into a savings account within the past 12 months. Although the values of these financial assets are considered as ideal measures, an attempt to obtain them is associated with under-reporting and non-responses (Honohan, 2006). The non-responses in developing countries is likely the cause because most households keep durable assets rather than financial assets (Steel et al., 1997). To avoid missing observations and under-reporting, many studies from both low and high income countries focus on the question of access and ownership rather than quantifying asset magnitudes (Ansong et al., 2020; Honohan, 2006; Murendo & Mutsonziwa, 2017). This is the approach that was used in this study to capture both financial assets as binary indicators (see Appendix 2 for details of the questions). Although this approach helped, we still had 0.92% and 3% missing data for account ownership and savings accumulation respectively as depicted in Table 2. Finally, although mobile money account ownership is not captured as a separate variable in our data, the savings behaviour variable encompasses all financial savings in any form of account, so it implicitly captures mobile money savings.

Asset accumulation was measured as the total value of all household durable assets valued at current market prices. The definition of durable asset used covered a range of items and included: mobile phones, refrigerators, radios, furniture, cars, televisions, land etc. (for a complete list, see Appendix 2). This approach is similar to that used by the Ghana Statistical Service in evaluating living standard surveys (GSS, 2014); the World Bank's Living Standards Measurement Study – LSMS (Grosh & Glewwe, 1995; Pouw & Elbers, 2012). The total value of household assets was further decomposed into productive and non-productive assets. Following previous studies, we identify durable productive assets as those that are used for production of goods and services for income generation (Kelkar, 2009; Stoeffler & Mills, 2014; Takeshima & Yamauchi, 2012). The productive assets identified in this study include sewing machines, land/plot, boats and outboard motors. The remaining assets were classified as non-productive (see Appendix 2).

To check the robustness of the results, we used an extended and more flexible definition of productive assets which recognises the potential of households to use them for the production of goods and services for income generation, and include sewing machines, land/plot, boats and outboard motors, computers (desktop and laptop), printers, and other computer accessories, generators, bicycle, motorcycle and cars as forms of transportation. All other assets were designated as non-productive. The analyses for these extended definitions can be found in Section 4.4.

2.4 Testing for baseline balance

As a test of baseline balance (see Table 1), we present summary statistics generated from data collected in November 2015. Reported in Table 1 are mean differences across treatment and control groups for a series of outcome variables including account ownership and savings accumulation and the value of total, productive and non-productive assets. It also includes demographic and household characteristics. Consistent with the approach suggested and applied in the existing literature (Banerjee et al., 2015; Bruhn & McKenzie, 2009; Duflo et al., 2017; Koomson et al., 2020b), we use a treatment effect model of the form

Table 1 Baseline summary statistics

Variables	(1) Full	(2) Male	(3) Female
Account ownership			
Treatment-control difference	0.057	0.102	0.009
p value	(0.103)	(0.259)	(0.835)
Comparison/control mean	0.399	0.500	0.342
Savings accumulation			
Treatment-control difference	0.040	0.085	−0.010
p value	(0.413)	(0.207)	(0.887)
Comparison/control mean	0.661	0.649	0.671
Value of total assets			
Treatment-control difference	0.143	0.107	0.155
p value	(0.147)	(0.212)	(0.314)
Comparison/control mean	2.625	2.706	2.580
Value of productive assets			
Treatment-control difference	0.283	0.382	0.197
p value	(0.162)	(0.112)	(0.212)
Comparison/control mean	1.030	1.138	0.969
Value of non-productive assets			
Treatment-control difference	0.124	0.086	0.140
p value	(0.203)	(0.160)	(0.124)
Comparison/control mean	2.543	2.615	2.503
Age			
Treatment-control difference	−2.232	−4.506	−0.981
p value	(0.411)	(0. 235)	(0.366)
Comparison/control mean	44.624	47.052	43.264
Education			
Treatment-control difference	0.137	0.119	0.132
p value	(0.206)	(0.253)	(0.186)
Comparison/control mean	0.311	0.427	0.246
Marital status			
Treatment-control difference	−0.074	−0.028	−0.080
p value	(0.199)	(0.551)	(0.220)
Comparison/control mean	2.174	2.000	2.271
Household size			
Treatment-control difference	0.309	0.929**	−0.151
p value	(0.168)	(0. 021)	(0.461)
Comparison/control mean	5.945	6.071	5.875
Religious affiliation			
Treatment-control difference	−0.115	−0.128	−0.112**
p value	(0.410)	(0.579)	(0.047)
Comparison/control mean	2.634	2.675	2.612

Table 1 continued

Variables	(1)	(2)	(3)
	Full	Male	Female
Rural			
Treatment-control difference	−0.069**	−0.094**	−0.056*
p value	(0.024)	(0.045)	(0.051)
Comparison/control mean	0.911	0.945	0.892
Observations	1441	532	909

p value in parentheses *$p < 0.1$; **$p < 0.05$

specified in Eq. (3):

$$Y_i = \alpha + \beta Treat_i + \varepsilon_i \tag{3}$$

where Y represents any of the outcomes of interest—account ownership and savings accumulation, value of total, productive and non-productive assets, and *Treat* is whether or not the household head benefitted from financial literacy training. For each of the variables, we present β, which is the difference in average outcome between treatment and control groups and its p value. We also show the mean outcome in the control group (α). We do not cluster the standard errors since the randomisation was at the household level and is represented by one person (Duflo et al., 2017).

Table 1 reports estimated regression output with means for the full sample in column 1. Columns 2 and 3 report similar results for the male and female subsamples respectively. It is expected that randomisation will achieve balance, but there are few instances where some measures will not be balanced (Banerjee et al., 2015; Duflo et al., 2017; Koomson et al., 2020b). With regard to household size in this study, male-beneficiary households in the treatment group had one fewer people, on average (significant at 5%) than male-beneficiary households in the control group. The number of rural-located respondents in the treatment group is 6.9 percent lesser than the number of their counterparts in the control group. This control and treatment group difference is also seen as being wider among males than females in rural areas. This is due to the gender stratification of the sampling, which was done to include more females because of their limited economic empowerment (see section 3.1.4). Similar to Duflo et al. (2017), we test for balance using eleven variables across two groups, so isolated cases of variables being significant by chance is to be expected.

Concerning the outcome variables of interest, there is no statistical difference between the proportion of formal accounts owned, savings made, and the average value of total, productive and non-productive assets owned by the treatment and control groups in general. This is also true for the male and female subsamples. Other control variables such as age, education and marital status exhibited balance at the baseline for the full and male–female subsamples. Household size and religion were balanced for the full sample and showed balance for both the male and the female subsamples. It can be seen that the age of respondents averaged 45 years at the

beginning of the study. In gender-specific terms, the age of males averaged 47 years and that of females 43 years. On average, participants had a household size of about six people; about 31 percent had obtained some form of formal education; and rural participants made up about 91 percent of the respondents.

2.5 Impact of financial literacy training on asset accumulation

In line with previous studies (Banerjee et al., 2015; Bruhn & McKenzie, 2009; Duflo et al., 2017; Gertler et al., 2016), we determine the impact of financial literacy training on asset accumulation by estimating average treatment effect. At this point, we included all other variables that were used in testing for baseline balance as control variables (Bruhn & McKenzie, 2009; Koomson et al., 2020b; Scott et al., 2002). Since we control for all covariates during the endline analysis, the treatment effect model is modified and stated as Eq. (4):

$$Y_i = \alpha + \beta Treat_i + \gamma X_i + \varepsilon_i \qquad (4)$$

where Y refers to any of the asset accumulation variables of interest, $Treat$ is an indicator for whether or not the household head benefitted from financial literacy training and β is the treatment effect. X is a vector of all control variables including age, education, marital status, household size, religious affiliation and regional fixed effects. As posited by Bruhn and McKenzie (2009), accounting for variables used in testing balance helps to improve precision of estimates.

Since we have two indicators of financial asset accumulation, and decompose household assets into productive and non-productive components, we test and report p-values that are adjusted for multiple hypothesis testing across indicators. This helps to avoid the risk of over-interpreting any single significant result (Banerjee et al., 2015; Duflo et al., 2017). This is done using the Bonferroni correction (see Tables 2–4) (Armstrong, 2014). In situations where we estimate a single outcome variable but for separate male- and female-beneficiary households, the test of equality of coefficients represents a Chow test (see Tables 3 and 4) (Chow, 1960). In both tests, the null hypothesis indicates that the estimated coefficients are equal in both models while the alternative hypothesis states otherwise.

In the ensuing subsections, we report results relating to the impact of financial literacy training on asset accumulation. Section 4.2 shows the effect on financial assets, and the value of total, productive and non-productive household assets, while section 4.2.1 presents the gender differences in the effect of financial literacy training on asset accumulation. Section 4.3 presents the effect of financial literacy training on asset accumulation across different age cohorts. In Section 4.4, we test for robustness of our findings on productive and non-productive assets using the alternative measures.

2.6 Impact of financial literacy training on financial and durable asset accumulation

Table 2 reports findings from the impact assessment of financial literacy training on accumulation of financial assets (Panel A) and durable assets (Panel B). The p-values of all the tests of equality (i.e., Bonferroni tests) are significant. These indicate that

Table 2 Effect of financial literacy training on asset accumulation

Variables	(1)	(2)	(3)
	Account holding	Savings accumulation	
Panel A: Financial assets			
Treatment effect	**0.072**** (0.028)	**0.082***** (0.009)	
Comparison/control mean	0.128	0.372	
p value on equality of effects $(1) = (2) = 0.000$***			
Observations	1401	1377	
R-squared	0.161	0.085	
	Log(value of household assets)		
	Total assets	Productive	Non-productive
Panel B: Durable assets			
Treatment effect	**0.070**** (0.047)	**0.211***** (0.010)	0.039 (0.303)
Comparison/control mean	2.331	1.393	2.036
p value on equality of effects $(2) = (3) = 0.028$**			
Observations	1413	1413	1413
R-squared	0.162	0.171	0.143

Bolded figures: these represent statistically significant treatment effects

p value in parentheses **$p < 0.05$; ***$p < 0.01$

Table 3 Gender differences in effect of financial literacy training on asset accumulation

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Account ownership		Savings accumulation			
	Male	Female	Male	Female		
Panel A: Financial assets						
Treatment effect	0.050 (0.330)	**0.083*** (0.059)	**0.134***** (0.008)	0.043 (0.305)		
Comparison/control mean	0.230	0.244	0.280	0.454		
p value on equality of effects $(1) = (3)$: 0.002*** $(2) = (4)$: 0.0623*						
p value on equality of effects $(1) = (2)$: 0.004*** $(3) = (4)$: 0.038**						
Observations	524	877	516	861		
R-squared	0.238	0.140	0.115	0.095		
Log(value of household assets)	Total assets		Productive		Non-Productive_	
	Male	Female	Male	Female	Male	Male
Panel B: Durable assets						
Treatment effect	0.063 (0.174)	**0.095*** (0.059)	0.045 (0.728)	**0.295***** (0.007)	0.062 (0.227)	0.041 (0.448)
Comparison/control mean	2.270	2.250	1.092	1.473	1.962	1.990
p value on equality of effects $(1) = (3) = (5)$: 0.000*** $(2) = (4) = (6)$: 0.0625*						
p value on equality of effects: $(1) = (2)$: 0.003*** $(3) = (4)$: 0.036** $(3) = (4)$: 0.080*						
Observations	526	887	526	887	526	887
R-squared	0.178	0.151	0.202	0.149	0.134	0.148

Bolded figures: these represent statistically significant treatment effects

p value in parentheses *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

the estimated treatment effects are statistically different between models, thereby making it possible to compare coefficients. In column 1 of Panel A, we see that at the end of the survey, account ownership for beneficiaries was 7.2 percentage points more likely than it was for non-beneficiaries. Similarly (column 2), beneficiaries who

Table 4 Effect of financial literacy training on asset accumulation across age cohorts

Variables	(1) ≤35 years	(2) 36–50 years	(3) ≥51 years
Panel A: Account ownership			
Treatment effect	0.058 (0.349)	**0.106**** (0.032)	0.012 (0.858)
Comparison/control mean	0.156	0.312	–0.145
p value on equality of effects (1) = (2) (3): 0.031**			
Observations	415	584	402
R-squared	0.236	0.160	0.168
Panel B: Savings accumulation			
Treatment effect	**0.103*** (0.095)	**0.111**** (0.016)	–0.013 (0.837)
Comparison/control mean	0.633**	0.141	0.551*
p value on equality of effects (1) = (2) (3): 0.000***			
Observations	410	574	393
R-squared	0.080	0.124	0.117
Panel C: Total household asset			
Treatment effect	**0.126**** (0.049)	0.065 (0.176)	0.044 (0.605)
Comparison/control mean	2.516	2.634	2.605
p value on equality of effects (1) = (2) = (3): 0.027**			
Observations	419	587	407
R-squared	0.121	0.084	0.122
Panel D: Productive assets			
Treatment effect	**0.325*** (0.058)	0.074 (0.546)	**0.294*** (0.063)
Comparison/control mean	1.270 (0.000)	1.111 (0.065)	1.319 (0.038)
p value on equality of effects (1) = (2) = (3): 0.072*			
Observations	419	587	407
R-squared	0.067	0.086	0.086
Panel E: Non-productive assets			
Treatment effect	0.090 (0.165)	0.036 (0.496)	0.003 (0.974)
Comparison/control mean	2.428 (0.000)	2.486 (0.000)	2.357 (0.000)
p value on equality of effects (1) = (2) = (3): 0.075*			
Observations	419	587	407
R-squared	0.116	0.053	0.120

Bolded figures: these represent statistically significant treatment effects

p value in parentheses *p < 0.1; **p < 0.05; ***p < 0.01

accumulated savings were 8.2 percentage points more than non-beneficiary households. These two outcomes can be linked to content of the training that introduced participants to the need to save monies and safer ways and locations to keep money outside the households and workplaces. Our findings support that of Atkinson and Messy (2011) and Berry et al. (2018) who found that financial literacy training increased account ownership and improved savings accumulation.

Panel B displays the estimated outcomes for the value of total, productive and non-productive assets in columns 1, 2 and 3 respectively. At the end of the survey, we see that the total value of accumulated assets for beneficiary households was about 7.0 percent higher than that of non-beneficiary households (significant at 5%). With regard to the decomposed components of household asset, we see that financial literacy training had an impact on the accumulation of productive durable assets but not on non-productive assets.

Specifically, we find that households that benefitted from the financial literacy training accumulated productive durable assets at a rate about 21 percent greater than that of non-beneficiary households. We can deduce that the provision of financial literacy training enhances the accumulation of durable assets and that the impact is mainly driven by households' desire to invest in the accumulation of productive assets and not non-productive ones. Our results corroborate the findings of Lusardi and Mitchell (2011) but, while our study uses a measure of durable assets and an RCT, theirs used a measure of financial assets and a non-experimental design. The insights provided by this study pertain to the conspicuous impact of financial literacy training in enhancing the accumulation of productive durable assets. This is because accumulation of non-productive durable assets can serve an insurance purpose, by storing value and in its potential for conversion into cash in times of financial stress, whereas most household durable assets (e.g., furniture, radio, television, washing machine, bicycle, motorcycle etc) depreciate in value over time and result in net losses. In contrast, productive household assets can perform the insurance role in addition to their peculiar benefit of helping to enhance household income mobilisation and improving household wealth in sustainable ways.

2.6.1 Gender differences in the impact of financial literacy training on asset accumulation

Table 3 presents results for the gender dimension of the analysis. Columns 1 to 4 of Panel A display the results for financial assets. All the equality tests (i.e., Bonferroni and Chow tests) have significant p-values. These show that the predicted treatment effects differ statistically between models or between male and female subsamples, enabling coefficients to be compared. We see that the likelihood of female beneficiaries owning more accounts is 8.3 percentage points. Due to the existing gap in account ownership (Demirgüç-Kunt et al., 2018), this study shows how financial literacy can be used to bridge the current gender gap globally. Male beneficiaries are 13.4 percentage points more likely to accumulate savings, but the outcome was not significant for females. This supports the finding of Mireku (2015) which shows a positive link between financial literacy and savings.

Columns 1, 3 and 5 (Panel B) display male-specific estimates of the impact of financial literacy training on the value of accumulated total, productive and non-productive assets respectively. Columns 2, 4 and 6 (Panel B) present the female-specific versions of the results. When it comes to total assets, female-beneficiary households accumulated assets at a rate about 9.5 percent higher than their non-beneficiary counterparts did. Regarding productive assets, accumulation among female-beneficiary households was about 29.5 percent higher than among non-beneficiary households. It is evident that financial literacy training has an impact on asset accumulation; this impact is seen as being significant for the value of women's accumulated total and productive assets, but not non-productive assets. With respect to productive assets, the drive to possess them is mainly significant for female-beneficiary households. This outcome can be linked to evidence that women in developing countries are more entrepreneurial than men. The results also demonstrate that financial literacy training can be used as a tool to bridge the gender asset gap (Deere & Doss, 2006; Doss et al., 2011; Oduro et al., 2011). Although marital and inheritance regimes provide males with greater chances of accumulating wealth (Deere & Doss, 2006), financial literacy training is a potent tool that can be used to enhance asset

accumulation among women. Serving the needs of women can also result in effective and sustainable development as identified by Hannan (2000) and the UNDP (2012).

2.7 Financial literacy training and asset accumulation across age cohorts

The effect of financial literacy training on asset accumulation across different age cohorts is displayed in Table 4 (Panels A to E). The p values of all the Chow tests are significant which suggest that there are significant differences in the estimated treatment effects across different age cohorts. It also implies that the magnitude of the estimated treatment effects for the different age cohorts can be compared. Results for account ownership and savings accumulation are presented in Panels A and B. Panel C of Table 4 reports results for effect of financial literacy training on the total value of household assets. Panel D reports similar results for productive assets while Panel E does so for non-productive assets. Panel A shows that the impact of financial literacy training on account ownership is mainly significant for beneficiaries who are within the ages of 36 to 50 years. Panel B also shows that financial literacy training enhances savings accumulation for beneficiaries who are 50 years and below and not those above 51 years. The analyses across different age cohort in Panel C indicates that, when it comes to total household assets, the role of financial literacy training in the accumulation process is significant when household heads are aged 35 years or below. With respect to productive assets, the effect of financial literacy training in the accumulation process is significant for household heads who are 35 years and below and for those who are 51 years and above. This is expected because the young are more interested in productive assets to start businesses, while those aged 51 years and above are nearer to retirement and so become more interested in the accumulation of productive assets. Of these two categories, the financial literacy training had a bigger impact among those who aged 35 years and below (0.325) than on those who are aged 51 years and above (0.294). This is likely because financial concepts and products are increasingly mediated by technological innovations, which generally have a higher uptake among the young rather than the elderly. In general, our findings support the accepted notion that financial literacy training has an effect on asset accumulation across different age cohorts (Jappelli & Padula, 2013; Lusardi et al., 2015) but with different outcomes. Unlike Jappelli and Padula (2013), who find the effect of financial literacy to be stronger among those who aged 56 years and above, we find it to be stronger among the young. The possible reason is that this study focuses on durable assets and does not include retirement portfolios.

2.8 Robustness checks

In this section (see Table 5), we test for the robustness of our findings on the effect of financial training on accumulation of productive and non-productive assets by using alternative conceptualisations of which assets are considered productive or non-productive. We observe that financial literacy training had an impact on the accumulation of productive durable assets but not on non-productive assets. Particularly, we find that households that benefitted from the financial literacy training accumulated productive durable assets at a rate about 11.3 percent greater than that of non-beneficiary households. We can infer that the differential impact of financial literacy training on productive and non-productive assets is generally consistent with those found in Columns 2 and 3 of

Table 5 Effect of financial literacy training on asset accumulation (alternative measures)

Variables	(1)	(2)
	Log(value of household assets)	
	Productive	Non-productive
Treatment effect	**0.113*** (0.067)	0.050 (0.215)
Comparison/control mean	1.433	2.030
p value on equality of effects (1) = (2) = 0.032**		
Observations	1413	1413
R-squared	0.119	0.142

Bolded figures: these represent statistically significant treatment effects

p value in parentheses *p < 0.1; **p < 0.05

Panel B in Table 2, but with some variations in the size of the coefficient and level of significance as expected. Overall, we conclude that the impact of financial literacy training on accumulation of productive and non-productive assets is robust to different conceptualisations of what constitutes productive and non-productive asset.

2.9 Conclusions and recommendation

Existing studies on the effects of financial literacy training on asset accumulation have largely measured accumulation of financial assets and focused less on durable assets. Those that measure durable assets do so for only a subset of the possible wide array of durable assets accumulated by households. Additionally, these studies mainly use data collected in developed countries with well-developed financial systems. In the developing world, and particularly in sub-Saharan Africa, where financial systems are less developed, the opportunity cost of accumulating financial assets is high. This means that attempting to measure financial asset accumulation in a developing country setting by quantifying balances would generate data containing a large number of missing observations. By inference, one has to focus more on durable assets if the desire is to quantify asset values. Missing data issues are likely to have an even greater impact when the study has a rural focus, as this one does. Although the approach using indicator variables partly resolved the problem of missing data associated with financial assets, we still had 0.92% and 3% missing observations for account ownership and savings accumulation respectively. Secondly, the existing literature on this topic have called for randomised studies to adequately address counter-factual questions regarding the impact of financial literacy on household assets/wealth accumulation. Here, we employ an RCT to examine both financial and durable assets as measures of wealth to decompose durable asset values into productive and non-productive components.

Consistent with previous studies (Banerjee et al., 2015; Duflo et al., 2017; Gertler et al., 2016; Koomson et al., 2020b), we followed a two-step approach to test for impact. First, we tested for baseline balance among a series of variables; this was followed up with the treatment effect model, which controlled for variables used in testing for balance. In addition to the total value of durable assets, we analysed the effect of financial literacy training on productive and non-productive durable assets. Gender different and age cohort effects of financial literacy training on asset accumulation were also examined.

We found that financial literacy training plays a role in households' asset accumulation process, but the impact is bigger for savings accumulation than account ownership. The impact is also more evident in the accumulation of productive durable assets than it is for non-productive assets. Our overall findings on productive and non-productive assets are robust to alternative conceptualisations of what constitutes productive and non-productive asset. The analysis revealed that although financial literacy training has an impact on asset accumulation, the impact is mainly experienced by female-beneficiary households. This implies that equipping women with the financial knowledge they require can boost their capacity to accumulate more productive assets and more broadly, that financial literacy training can be employed as a policy tool to bridge the gender asset gap in Ghana and in other developing countries. The age cohort analysis also showed that the financial literacy training–asset accumulation nexus is more significant among the young than the aged.

This study is limited in scope and duration. In terms of scope, the sampling focused more on women and rural households. Future studies can widen the scope to representatively include both rural and urban households. The period could also be extended to capture both the short- and long-term impacts of training. Given that financial sectors in developing countries are structured differently to those in the developed world, with significant savings being kept in mobile money accounts we would encourage future researchers to capture ownership of and savings in mobile money accounts as separate variables.
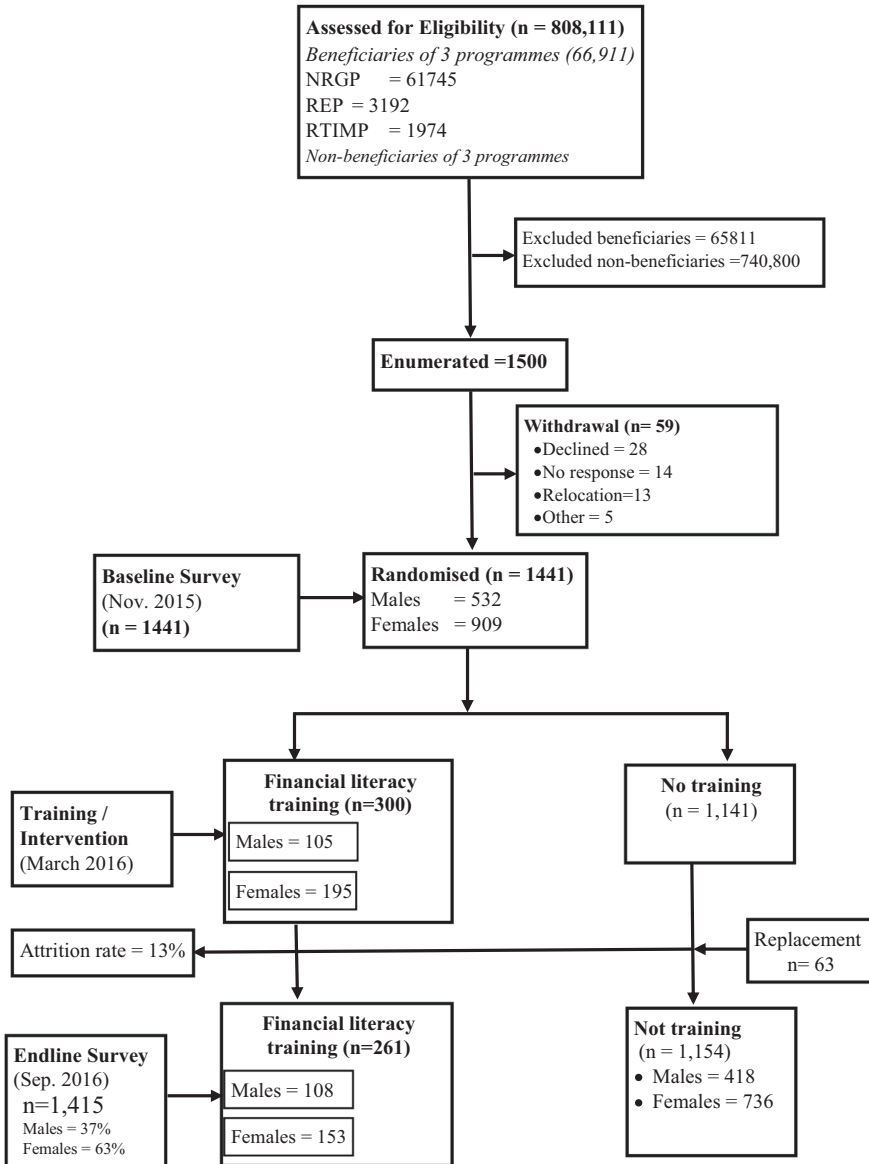
Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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3 Appendix 1: CONSORT flow diagram for this study

Assessed for Eligibility (n = 808,111)
Beneficiaries of 3 programmes (66,911)
NRGP   = 61745
REP = 3192
RTIMP   = 1974
Non-beneficiaries of 3 programmes

Excluded beneficiaries = 65811
Excluded non-beneficiaries =740,800

Enumerated =1500

Withdrawal (n= 59)
•Declined = 28
•No response = 14
•Relocation=13
•Other = 5

Baseline Survey
(Nov. 2015)
(n = 1441)

Randomised (n = 1441)
Males   = 532
Females   = 909

Financial literacy training (n=300)
Males = 105
Females = 195

No training
(n = 1,141)

Training / Intervention
(March 2016)

Attrition rate = 13%

Replacement
n= 63

Financial literacy training (n=261)
Males = 108
Females = 153

Endline Survey
(Sep. 2016)
n=1,415
Males = 37%
Females = 63%

Not training
(n = 1,154)
• Males = 418
• Females = 736

Source: Authors' construct (2018)

4 Appendix 2: Questions used in measuring asset accumulation

SECTION H: HOUSEHOLD ASSETS
This section seeks to obtain information on household durable assets, age of the assets and current value of all assets whether in use or not in use

H1 Item	Item code	Does any member of the household own...............? 1-Yes, working 2-Yes, not working 3-No			How long ago was .... obtained? LESS THAN ONE YEAR: 00 ITEM			How much could you sell it now in Ghana Cedis? I T E M		
		A	B	C	A	B	C	A	B	C
Furniture	01									
Sewing machine	02									
Stove (Kerosene)	03									
Stove (Electric)	04									
Refrigerator	05									
Freezer	06									
Air conditioner	07									
Fan	08									
Radio	09									
Radio cassette	10									
CD-player	11									
3-in-one-radio system/home theatre	12									
Video cassette player	13									
Desktop computer	14									
Laptop computer	15									
Printer	16									
Computer accessories	17									
Camera/ digital camera	18									
Satellite dish	19									
Washing machine	20									
Television	21									

Table continued

Camera/Video	22
Iron (Electric)	23
Bicycle	24
Motorcycle	25
Car	26
House	27
Land/Plot	28
Boat	29
Outboard motors	30
Microwave	31
Food Processor/blender	32
Hoover/Vacuum Cleaner	33
Rice cooker	34
Toaster	35
Electric kettle	36
Water heater (bathroom)	37
Box iron	38
Mobile phone	39
Tablet PC (e.g., iPad, galaxy tab, etc.)	40
Generator	41
Jewellery	42

Questions used in measuring financial asset accumulation
D7. Do you have a bank account? Yes/No
D8. Have you been saving for the past 12 months? Yes/No

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