

## Wealth Effects of an Asset-Building Intervention Among Rural Households in Sub-Saharan Africa

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Asset development is a key strategy to promote economic and social development in Sub-Saharan Africa. Research has found associations between asset ownership and household well-being. However, to date there has been little rigorous research on impacts of asset-building interventions for families in Sub-Saharan Africa. Data were obtained from *AssetsAfrica*, a demonstration and research initiative designed to test asset-building innovations in Masindi, Uganda. The study sample consists of 393 individuals assigned to the intervention group ( $n = 203$ ) or the comparison group ( $n = 190$ ). The intervention is a structured, matched-savings account offered to the intervention group for a 3-year period. In addition, the program participants were offered financial education and asset-management training. Participants who successfully reach their savings goals receive matched funds at a 1:1 ratio. Propensity score optimal matching and matching estimators are used to investigate the impact of the intervention on financial and productive assets. Results indicate a positive effect of the intervention on family financial assets; that is, individuals who receive the asset-building intervention have almost \$39 more in financial assets than those in the comparison group. Further, the matching estimators indicate a statistically significant larger treatment effect on the treated group. However, the impact of the intervention on ownership of productive assets is less conclusive. Overall, results of this study show that asset-building interventions have potential utility as a policy solution for improving the economic well-being of poor households in Sub-Saharan Africa.

*Key words:* asset ownership, financial assets, productive assets, treatment effects, asset-building interventions, Sub-Saharan Africa, Uganda

Asset development is a key strategy to promote economic and social development. Asset-building strategies have been at the helm of much of the development in Sub-Saharan Africa (McPeak, 2004; Sachs, 2005; Sanchez et al., 2007). The growing interest in asset building as a development tool can be attributed to the emerging body of research on poverty dynamics, asset development, and asset-based poverty in the continent (see, for example, Barrett, Carter, & Little 2006). Researchers have increasingly highlighted the significance of using an asset-based approach to better understand and measure poverty in Sub-Saharan Africa (Carter & Barrett, 2006; Carter & May, 1999, 2001). Using the assets framework to analyze the well-being of Sub-Saharan Africa households has shown that poor households have a limited capacity to confront development challenges (Zimmerman & Carter, 2003). Even when the poor have assets, their options for using those assets are highly constrained, thus, effectively preventing the use of those assets to generate income (Adato, Carter, & May 2006; Carter & May, 1999). Barriers and constraints that limit poor households' access to the assets they own and that limit the returns on such assets include lack of

education, lack of formal employment, lack of access to financial services, as well as gender-biased inheritance and strict traditional laws.

Assets may be tangible in the form of dwellings, farmland, livestock, and equipment, or intangible in the form of knowledge, skills, and social capital. These assets are important because, unlike income, they are what individuals and families accumulate and hold over time. Assets also generate returns that generally increase lifetime consumption and improve a family's well-being over several generations. Assets provide a cushion to fall back on during hard times and emergencies. Although assets can be defined broadly, our study focuses on a more narrow definition of assets, that is, tangible financial and productive assets.

Theoretical models suggest that asset ownership can lead to better economic, psychological, social, civic, political, and intergenerational outcomes (Sherraden, 1991). Empirical research has provided some evidence to support these propositions. Households with assets are better able to provide for basic needs and to make investments in future generations

through health care, education, and training (see Fafchamps, Udry, & Czukas, 1998; Lombe, Nebbitt, & Buerlein, 2007; Zhan & Sherraden, 2003). In addition, assets buffer the impact of the all too common natural disasters of drought, flooding, and disease that afflict most African countries (Hoddinot, 2006; McPeak, 2004).

The purpose of this article is to analyze the impacts of an asset-development intervention on the financial and productive asset outcomes of poor households in Masindi, Uganda. The article begins with a literature review on the effects of asset ownership and pathways to accumulating assets in Sub-Saharan Africa. Next, we present an overview of the *AssetsAfrica* project to provide the context for the intervention. We then present the methodology used for the investigation, including propensity score matching used to balance the data given the selection bias introduced through nonrandom assignment to conditions (Guo & Fraser, 2010). In the absence of random assignment, more rigorous methods than the traditional covariance control approach should be used to draw causal inference. To our knowledge, this is the first study that evaluates a quasi-experimental asset-building intervention using propensity score methods to account for selection bias due to nonrandom assignment and to provide a rigorous assessment of treatment effects. The study used propensity score optimal matching (Haviland, Nagin, & Rosenbaum, 2007; Rosenbaum, 2002), and matching estimators (Abadie & Imbens, 2002, 2006) to evaluate treatment effects on financial and productive assets. We then present and discuss findings and conclude by highlighting limitations and stating implications for policy and future research.

### Effects of Asset Ownership

In *Assets and the Poor*, Sherraden (1991) suggested that assets have a wide range of positive personal and social effects on well-being beyond consumption. These asset effects include improved household economic stability, increased personal efficacy and future orientation, and improved well-being of children. Two decades of experimentation and research on asset building have suggested that linking low-income families with asset-building strategies has the potential to positively influence family well-being outcomes, including economic, educational, and health outcomes (Schreiner & Sherraden, 2007; Sherraden & Stevens, 2010; Ssewamala & Ismayilova, 2009; see also, Chowa, Ansong, & Masa, 2010; Lerman & McKernan, 2009; Williams Shanks, Kim, Loke, & Destin, 2010). Empirical research has suggested that asset ownership is associated with increased income (Bynner & Despotidou, 2001;

Moore et al., 2001), increased wealth (Schreiner et al., 2001), and improved consumption “smoothing” when faced with unexpected events (Hoddinot, 2006; Sullivan, 2005). Aside from economic benefits, empirical research has also found an association of asset ownership with civic engagement (DiPasquale & Glaeser, 1999; Nembhard & Blasingame, 2006), good relationships with family members (Moore et al., 2001), future orientation (Shobe & Page-Adams, 2001; Yadama & Sherraden, 1996), and political participation (McBride, Lombe, & Beverly, 2003).

A growing number of asset-building interventions have provided further evidence on the potential impacts of asset ownership on family well-being. Evidence suggests that participation in asset-building programs improves the economic well-being of families (Mills et al., 2008; Schreiner & Sherraden, 2007). Asset-building interventions for children have also shown that assets, particularly savings, improve a range of children’s developmental outcomes, including education (Curley, Ssewamala, & Han, 2010), financial and economic (Erulkar & Chong, 2005; Mason, Nam, Clancy, Kim, & Loke, 2010; Ssewamala & Ismayilova, 2009), and health status (Ssewamala, Han, & Nielsands, 2009), among others.

Although evidence suggests that assets positively influence family well-being, most of what we know about assets has come from research in the United States and other developed countries. We are aware of only one asset-building intervention conducted in Sub-Saharan Africa (SEED/SUUBI Uganda) that has been rigorously evaluated and published. Although the evidence suggested that an asset-building program had positive effects on the financial, educational, and health outcomes of low-income individuals and households in Sub-Saharan Africa (Curley et al., 2010; Ssewamala et al., 2009; Ssewamala & Ismayilova, 2009) few studies have explored the impact of asset building on productive, nonfinancial assets—particularly the types of assets that are more salient to rural, low-income families in Sub-Saharan Africa. The present study aimed to address the knowledge gap on the impact of asset-building programs on productive assets, specifically livestock ownership. In addition, the study aimed to contribute to the growing literature on the impact of asset-building programs on financial assets of low-income families in Sub-Saharan Africa. In sum, this study sought to increase the understanding of how asset building impacts poor families with have limited or no access to social safety nets like those in developing countries. Purposefully, the study aimed to develop a better understanding of the impacts of an asset-building intervention on the economic outcomes of rural, low-income households in Uganda.

### Asset-Accumulation Pathways in Sub-Saharan Africa

Throughout the Sub-Saharan Africa region, common pathways out of poverty include land improvement (e.g., access to land and start-up capital), higher education and skills, having multiple income sources, and business gains (e.g., improved production of cash crops and livestock; Krishna, 2010). Most income sources and business gains in Sub-Saharan Africa involve asset ownership. For example, improved production of cash crops involves land and, similarly, livestock farming involves animals. In some cases, households might be able to rent land and generate income. However, depending on the amount of rent, the profits seen from such arrangements might be minimal. Asset ownership in most cases is a good foundation for generating income and yielding high returns from good harvests.

A complementary pathway to building assets involves building savings. *Savings* is defined as either the postponement of consumption or moving resources through time (Schreiner, 2004). Access to financial services, including savings products, is an important pathway to asset accumulation. However, competitive and regulatory changes have led to substantial rollback of retail banking services in Sub-Saharan Africa (Bauman, 2001). Service reduction primarily affects low-income customers, and high transaction costs further restrict low-income households' access to financial services. In Uganda, 80% of the population is unbanked (Honohan, 2007) and only 10% of the rural population has access to basic financial services (Chemonics International, 2007).

Most poor households in Sub-Saharan Africa tend to save using informal savings groups, primarily because formal savings institutions have failed to extend services to lower-income households (Bauman, 2001). Informal savings groups are social organizations formed to help members save money for specific purposes. Common examples of these informal savings groups in Sub-Saharan Africa include rotating savings and credit associations, accumulating savings and credit associations, reciprocal lending, and burial funds. Although informal savings groups are often convenient, these groups might be unreliable, insecure, and/or illiquid. In addition to these informal savings groups, microfinance has become an important player in providing financial services to poor households in Sub-Saharan Africa. Microfinance adherents hope that much poverty can be alleviated by providing financial services to households that have been excluded from the formal banking sector (Morduch, 1999; Rutherford, 1998).

Increased recognition of the critical role played by assets in enhancing the well-being of households has spurred efforts to increase assets of individuals, households, and communities in Sub-Saharan Africa. International social development programs and policies are beginning to address asset ownership as a vehicle for household development and well-being. Central to asset-building interventions has been the design and testing of assisted-savings accounts. Assisted-savings accounts are financial products that have been deliberately tailored to facilitate savings accumulation by/for poor individuals and households who would normally shy away from saving in formal financial institutions due to economic, psychological, cultural, and institutional barriers. A growing body of research has suggested a positive influence of savings account features on savings performance, including deposit collection (Ashraf, Karlan, & Yin, 2005), withdrawal restrictions (Ashraf, Karlan, & Yin, 2006), financial incentives (Duflo, Gale, Liebman, Orszag, & Saez, 2006), saving reminders (Karlan, McConnell, Mullainathan, & Zinman, 2010), and automatic deposit programs that increase deductions from paychecks over time (Thaler & Benartzi, 2004). However, little is known about the effects of savings and asset-building interventions on net worth and well-being of families in Sub-Saharan Africa.

### Project Overview

Data used in this study were obtained from *AssetsAfrica*, a demonstration and research initiative designed to test asset-building interventions in Africa. This research was approved by the Institutional Review Board of Washington University in St. Louis. A Ugandan pilot project was implemented in Masindi, Uganda between 2004 and 2008; the pilot project used a quasi-experimental design to compare the intervention and comparison villages. In part, this research design was chosen because of the high risk of treatment diffusion between treatment and control participants living in the same village. The Center for Social Development at Washington University in St. Louis designed and carried out the research, whereas Build Africa Uganda implemented the pilot. Build Africa Uganda is a national nongovernmental organization (NGO) that has implemented numerous multisector programs since its founding in 1996.

### Research Setting

Uganda is one of the five countries that comprise the East African Community (EAC; Other EAC countries include Burundi, Kenya, Rwanda, and Tanzania.). Based on the Uganda Bureau of Statistics (UBOS) estimates, the country's population in 2011 was approximately 32.9 million persons (UBOS, 2011), of whom 37.7% (nearly 12.5 million people)

lived on less than \$1.25 a day (World Bank, 2009). The population of Uganda is predominantly rural, with more than 80% of the population living in rural areas (UBOS 2006). In 2010, the gross national income per capita purchasing power parity was \$1,250 (World Bank, 2010). Uganda is divided into 111 districts and one city (i.e., Kampala) across four administrative regions. One of the districts, Masindi, was the project site. Each district is further divided into subdistricts, counties, subcounties, parishes, and villages.

The project site, Masindi District, is in Western Uganda. The district has one town council, four counties, 13 subcounties, 43 parishes, about 156 villages, and 90,706 households. The average household size is about 4.86 persons, which is lower than the regional average of 5.2 persons. In 2002, the district had a population of 459,490 persons, of which 49% were females (UBOS, 2006). In comparison with the 2002 national average of 123 persons per square kilometer, the Masindi District had a population density of 54 persons per square kilometer (UBOS, 2006). Masindi is characterized by low household incomes and a limited revenue base, and is relatively poor compared with other districts in Uganda. Nearly 94.5% of the district's population is employed in agriculture; Masindi is Uganda's leading producer of maize.

### Project Intervention

The intervention implemented in this project was a structured asset-building program offered to approximately half of the study sample for a 3-year period. The intervention comprised a comprehensive program that provided participants with matched funds for their savings, financial education, and training on how to manage the asset they planned to acquire with their savings. Participants assigned to the intervention group (i.e., treatment participants) opened savings accounts in a commercial bank. To be eligible to receive the matched funds, deposits had to meet several criteria: (a) deposits had to remain in the accounts for a minimum of 6 months, and (b) matched funds had to be used for the purchase of qualified assets. In addition, to encourage sustainability and viability of the assets, qualified asset purchases were limited to *productive assets* (i.e., those that would generate income). Acceptable livestock assets included chickens, goats, cows, and oxen. Other acceptable assets included means of transportation, such as bicycles or motorcycles, which could be used to transport others for a fee; land for growing crops or building a home; materials to build commercial structures or personal houses; and items to start a small business, such as sewing machines or grinding mills. The match cap, which was the maximum of participant savings eligible to receive matched funds,

was 500,000 Ugandan shillings or 285 US dollars. In terms of livestock, the match cap of 285 US dollars can buy two to three cows, or eight to 12 goats, or five to 10 pigs, or 40 to 60 chickens. The match cap is also enough to purchase one to three sewing machines, or one small size grinding mill. Participants who successfully reached their savings goals received matched funds at a 1:1 ratio. In addition, to encourage participants to develop a habit of saving by making regular deposits, program administrators placed restrictions on deposits of large sums.

### Project Partners

The project incorporated local community institutions, called local parish councils (LPCs), which are similar to village committees. LPCs selected the participants for the project in consultation with a local NGO. The project did not use random assignment of participants. Instead, LPCs consulted with the partner NGO to ensure compliance with the sampling criteria set by the Center for Social Development. The criteria for selection were based on economic need. Families or individuals who had struggled in the past to feed their families or send their children to school, and had solicited help from both LPCs and partner NGO qualified for the study. The poorer members of the community were selected and offered the opportunity to participate in the project.

Given the absence of banks in the six intervention-site villages and the distance to the bank in the business district of Masindi, a South African-based bank established a mobile bank that visited the villages every week to collect savings. Participants who wanted to complete their own banking transactions could either wait for the weekly mobile bank visit or travel to the bank in the Masindi business district.

## Methodology

### Research Design

The research design was a nonequivalent groups design (Shadish, Cook, & Campbell, 2002). The study had a treatment group and an untreated control group, with both pretest and posttest data gathered on the same individuals. The study sample consisted of 393 individuals, with 203 participants assigned to the intervention group and 190 participants assigned to the control group. Participants in the intervention group came from six villages. The control group consisted of 190 economically similar individuals selected from six other Masindi villages that were located approximately 20 miles from the six intervention-site villages. The control group was a no-treatment condition and did not participate in the intervention. Individuals in both the intervention group and control group had participated in prior agricultural develop-

ment projects conducted by the partner NGO. At the time of enrollment in the asset-building project, all participants signed a letter of consent indicating their commitment to participate in the research for a period of 5 years. Four participants assigned to the treatment condition decided not to participate. Seven participants in the control group were lost to follow-up. Thus, the study sample was reduced to 382, with 199 participants in the intervention group and 183 participants in the control group.

Intervention group participants attended 8 hours of mandatory financial education. This training provided general banking information such as guidance on making deposits and withdrawals, reading bank statements, and understanding interest and fees. In addition, the educational component of the intervention included specific training related to the asset goal the participant was planning to purchase. The aim of this asset-specific training was to provide participants with the skill sets needed to manage their individual assets. The asset-specific training included business planning and management, bookkeeping, and training in livestock and modern farming techniques.

#### Data Collection

Data were collected by 12 locally trained interviewers who conducted face-to-face surveys. Questionnaires were administered twice to the treatment and control groups over a 13-month interval. Wave 1 was baseline data collected before all study sample participants ( $N = 393$ ) began the intervention. Wave 2 was follow-up data collected 13 months after baseline. Wave 2 data were collected during the intervention. Both waves used the same survey questions. The survey consisted of more than 100 items that were adapted from two instruments used in previous research: American Dream Demonstration survey (Sherraden et al., 1995), which measured wealth accumulation and wealth effects; and the World Bank's Living Standard Measurement Survey (Grosh & Glewwe, 1995), which measured asset thresholds for families.

#### Measures: Covariates of Asset Ownership in Sub-Saharan Africa

The choice of covariates hypothesized to affect asset ownership included age, gender, marital status, education, and prior wealth ownership (i.e., productive and financial assets). Several studies have shown that gender has an effect on asset accumulation (Bajtelsmit & Bernasek, 1996; Blumberg, 1988; LeBeau, Iiping, & Conteh, 2004). In Sub-Saharan Africa, women own fewer assets than men (Deere & Doss, 2006; Doss, 2006) and the assets women own tend to be non-income-producing assets such as pans, cups, brooms,

and hoes. In contrast, men tend to own income-producing assets such as plows, boats, nets, land, and livestock (Muzora et al., 2002). Further, women's ability to accumulate assets is governed by norms that historically have favored men, and these legal systems limit the extent of women's control over assets (Fafchamps & Quisumbing, 2002, 2005). For example, even though a woman may have used her savings to begin and maintain a small business, her husband has legal standing in making decisions regarding that business.

In developed countries, education is closely associated with wage employment that, in turn, provides income for asset accumulation. However, many rural areas of Sub-Saharan Africa have limited employment opportunities, further constraining the scope of any association between education and paid employment. However, in developing countries, education is associated with assets but via different pathways than employment. Schultz (1989) suggested that in developing countries, education improves a household's ability to efficiently adjust production decisions during periods of change. In this instance, farmers with greater educational attainment achieved higher crop yields by selecting the most effective mix of crops and methods. As a result, in times of drought, farmers with more education were better able to manage risk and vulnerability than their less-educated counterparts.

Marital status also affects asset accumulation (Wilmoth & Koso, 2002). Historically, marriage has been considered a source of financial security (Waite & Gallagher, 2000), and it continues to be a determining factor for economic well-being, particularly for women. The pooled resources of a married couple might provide a financial cushion that enables their household to buffer crises and accumulate assets over time.

Prior wealth and current economic resources appear to be important determinants of additional asset ownership. When assets are at a minimum, income generation is at its lowest, and therefore, saving to acquire more assets becomes difficult. This barrier to saving is particularly pronounced in Sub-Saharan Africa where assets serve as the production base for many families. Moreover, individuals' current asset ownership can affect their attitudes and beliefs about lifetime asset accumulation (Sherraden, 1991). Current ownership of resources appears to foster better planning, to promote anticipation of life's variables, and to encourage higher personal aspirations. In general, people who have resources report they feel more capable of accumulating assets because they can plan better and have concrete resources on which to base their plans. Finally, as proposed by neoclassical

economic theories (Friedman, 1957; Modigliani & Ando, 1957), differences in asset ownership are attributed to variation in age. For instance, the life cycle hypothesis posits that working people are savers, whereas children and retired people are dissavers. Thus, differences in saving are attributed to age differences (Modigliani & Ando, 1957). Inclusion of key covariates in the data analysis is important because these characteristics have the potential not only to impact the success in asset accumulation independent of the intervention but could also interact with the intervention to improve outcomes.

Gender was a dichotomous variable that we coded as 1 for *female* and 0 for *male*. Education was also a dichotomous variable coded as 1 for *secondary and higher education* level and 0 for *primary and lower education* level. Marital status was a dichotomous variable coded 1 for *married* and 0 for *not married*. Prior asset-ownership variables were interval-level variables measured as the amount of productive and financial assets a participant reported at baseline. Prior ownership of productive assets was measured in tropical livestock units (see Productive assets section for definition). Prior ownership of financial assets was measured by summing the value of all the money a participant had saved in formal and informal savings accounts as reported in the baseline survey. Age was a continuous variable measured in years. All covariates used in the propensity-score matching were measured at baseline.

**Treatment variable.** A variable for the intervention was coded as 1 if a participant received the intervention and 0 if a participant did not receive the intervention (i.e., assigned to the control group).

**Wealth outcomes.** Measures for wealth outcomes included financial and productive assets.

**Productive assets.** Productive assets were measured in tropical livestock units (TLU). TLU is an aggregate of the livestock owned by a household multiplied by the relative exchange value of each type of livestock according to current market rates of exchange. In this study, cattle, sheep, and goats were included in the TLU calculation with the following values: cow = 1; sheep or goat = 0.12.

**Financial assets.** Financial assets were measured by taking the aggregate value of all the money a participant had in the asset-building account (i.e., the closing balance at the end of the program for treatment participants) plus any money saved in other accounts (both formal and informal) as reported in the follow-up survey (for both treatment and control group participants). The values of financial assets

were converted to U.S. dollars from Ugandan shillings. Both outcomes were interval-level variables.

### Data Analysis

Drawing causal inferences in observational studies is challenging particularly because observational studies often violate the ignorable treatment assignment assumption and selection bias is presumed to be present (Rosenbaum & Rubin, 1983). Unlike observational studies, the researcher conducting a randomized experiment can be reasonably confident that the ignorable treatment assignment assumption holds because randomization balances the observed and unobserved variables between treated and control participants and makes treatment assignment independent of the outcomes under the two conditions (Rosenbaum, 2002; Rosenbaum & Rubin, 1983; Rubin, 2008). When treatment assignment is nonignorable, evaluation of treatment effects using nonrandomized or nonexperimental approaches is misguided because the treated and control groups are prone to numerous selection biases, and data may be imbalanced on observed and unobserved covariates. Thus, a key issue in observational studies is selection bias.

The problem of selection bias has led researchers to develop more rigorous and efficient analytical methods that can help evaluate treatment effects in studies based on observational data (e.g., Heckman, 1978, 1979; Rosenbaum & Rubin, 1983). These methods are known collectively as propensity score analysis. Propensity score analysis aims to accomplish data balancing when treatment assignment is nonignorable; reduce multidimensional covariates to a one-dimensional score called a propensity score; and allow a more rigorous evaluation of treatment effects (Guo & Fraser, 2010). This study used propensity score analysis to correct for the effects of selection bias based on available covariates, and provide a rigorous estimation of the treatment effects (i.e., to test a potentially causal relationship, conditional on observed covariates, between participation in an asset-building program and wealth outcomes). Specifically, this study used propensity score optimal matching (Hansen, 2007; Haviland et al., 2007; Rosenbaum, 2002), and matching estimators (Abadie & Imbens, 2002, 2006) to estimate the hypothesized causal relationship

**Research framework.** To draw valid causal inference and guide data analysis, this study used the Neyman-Rubin counterfactual framework of causality (Neyman, 1923; Rubin, 1974, 1986). Under this framework, a counterfactual is a potential outcome that would have happened in the absence of the cause (Shadish et al., 2002). Because the counterfactual is not observed in real data, the Neyman-Rubin framework holds that the researcher can assess the counter-

factual by evaluating the difference in mean outcomes between the two groups or “averaging out” the outcome values of all individuals in the same condition (Guo & Fraser, 2010). More formally, let  $E(Y_0|W = 0)$  denote the mean outcome of individuals in the control group, and  $E(Y_1|W = 1)$  denote the mean outcome of the individuals in the treatment group. Because both outcomes are observable and we are using data from a sample that represents the population of interest, we can define the treatment effect as a mean difference:  $\hat{\tau} = E(\hat{y}_1|w = 1) - E(\hat{y}_0|w = 0)$ , where  $\hat{\tau}$  denotes treatment effect. This formula is called the standard estimator for the average treatment effect, which is defined as the difference between two estimated means from sample data (Guo & Fraser, 2010). In the current study, the dilemma of not observing the levels of asset ownership for treated individual  $i$  in the condition of not having participated in *AssetsAfrica* was resolved by examining the average asset-ownership level among the sample individuals in the control group (i.e., those who did not receive the treatment). Similarly, if the comparison of the two mean outcomes leads to  $\hat{\tau} = E(\hat{y}_1|w = 1) - E(\hat{y}_0|w = 0) > 0$ , or the mean outcome of all sample individuals who participated in *AssetsAfrica* is higher than nontreated participants, then the researcher can infer that participation in *AssetsAfrica* causes higher levels of asset ownership.

**Propensity score optimal matching.** The first propensity score model used in this study was optimal matching. Optimal matching was used over greedy matching because of limitations inherent in greedy matching (e.g., requirement of a sizable common support region and problem of incomplete and inaccurate matching; Guo & Fraser, 2010). We used optimal pair matching (i.e., each treated participant matches to a single control) and full matching (each participant matches to one or more controls, and similarly each control participant matches to one or more treated participants) to balance data. We conducted generalized boosted regression (GBR) to estimate propensity scores. GBR and the regression tree method handle continuous, nominal, ordinal, and missing independent variables, and they capture nonlinear and interaction effects (McCaffrey, Ridgeway, & Morral, 2004). Because GBR appears to be promising in solving the variable specification problem, this approach is more robust than logistic regression when estimating propensity scores (Guo & Fraser, 2010). After optimal full matching, we performed Hodges-Lehmann aligned rank test to estimate the average treatment effect (ATE; Hodges & Lehmann, 1962). After obtaining a matched sample using optimal pair matching, we conducted a regression of difference scores with covariance control to estimate ATE

(Rosenbaum, 2002; Rubin, 1979). We used imbalance indexes (Guo, 2008; Haviland et al., 2007) to check covariate imbalance before and after optimal matching. We conducted chi-square tests and independent sample  $t$ -tests to check the significance level of any covariate imbalance before matching.

**Sensitivity analysis.** Because each propensity score model requires different assumptions and findings are sensitive to different data situations, we used matching estimator methods to cross-validate the findings of optimal matching. We used matching estimators because this type of propensity score analysis allows estimation of different types of treatment effects. We were particularly interested in estimating the average treatment effect for the treated (ATT). Rather than being used to determine whether a program, on average, is beneficial for all individuals, the ATT is used to determine if a program is beneficial for those assigned to the treatment or those who would assign themselves to the treatment (Winship & Morgan, 1999).

**Matching estimators.** Matching estimators match a treated case to a control (or vice versa) based on observed covariates. However, matching estimators do not use logistic regression or GBR to predict propensity scores. Instead, a vector norm is used to calculate distances on the observed covariates between a treated case and each of its potential control cases (Abadie & Imbens, 2002, 2006). To assess the treatment effect on wealth outcomes using matching estimators, we included the same covariates used in optimal matching. We used a combination of matching estimator methods. First, bias-corrected matching was used to remove bias caused by the three continuous-level covariates (Abadie & Imbens, 2002). We used the same set of matching variables as the independent variables for the regression adjustment in the bias correction process. Following the recommendation of Abadie and associates (2004), we chose four matches per observation in the analysis. Second, the variance estimator allowing for heteroscedasticity was used because results of the Breusch-Pagan and Cook-Weisberg tests indicated three covariates violated the assumption of constant variance. We used the same number of matches (i.e., four) in the second matching stage to run the robust variance estimator.

## Results

Because of the study’s small sample size and to maximize ability to detect an effect, we used a statistical significance criterion of  $\alpha = .10$  (see for example Ashraf et al., 2005; Dupas & Robinson, 2009). Table 1 presents descriptive statistics for the sample as well as the results of imbalance checks conducted before and after matching. Of the final sample, 52% of the

sample was in the treatment condition, and 48% were in the control condition. On average, the treated participants were 6 years younger than participants in the control group. Although 57% of the overall sample was male, 60% of the sample in the treatment condition was female. The majority (71%) of the sample

was married, and 33% of the sample had a secondary education or higher. At baseline, treated participants, on average, owned more productive assets than the control group. On the other hand, the control group, on average, owned more financial assets at baseline than the treatment group.

**Table 1**  
*Sample Description and Imbalance Check Before and After Matching*

Covariates	Overall sample before matching ( <i>n</i> = 382)		ASDCM after optimal matching ( <i>d<sub>xm</sub></i> )	
	% or <i>M</i> <sup>a</sup>	ASDCM ( <i>d<sub>x</sub></i> )	Pair matching ( <i>n</i> = 366)	Full matching ( <i>n</i> = 382)
No. of treated participants	199			
No. of nontreated participants	183			
Gender		0.75	0.67	0.16
Male	56.8**			
Female	43.2**			
Education at baseline		0.57	0.59	0.34
Primary or lower	67.0**			
Secondary or lower	33.0**			
Marital status at baseline		0.18	0.17	0.06
Not Married	28.5			
Married	71.5			
Age at baseline		0.59	0.56	0.08
Treatment	35.97**(10.39)			
Control	41.68**(12.13)			
Ownership of Productive Assets at baseline		0.52	0.50	0.15
Treatment	1.47**(2.72)			
Control	0.38**(1.24)			
Ownership of Financial Assets at baseline		0.31	0.30	0.35
Treatment	0.05* (0.11)			
Control	0.15* (0.43)			

Note: ASDCM = absolute standardized difference in covariate means.

<sup>a</sup> Each entry is a percentage of participants in the categorical variable or the mean of the continuous covariate by group. Standard deviations are presented in parentheses. \**p* < .01, \*\**p* < .001

**Optimal Matching**

As Table 1 shows, the overall sample before matching was not balanced on several covariates. For example, the table shows that the original sample included more individuals with lower education levels than individuals with higher education, and the difference was statistically significant (*p* < .001). Other statistically significant (*p* < .01) covariates predicting differences on asset-building participation included gender, age, and prior productive and financial asset-ownerships. If these differences were not taken into account in causal inference about the effect of participation in *AssetsAfrica* on wealth outcomes, the findings would be biased.

Results of optimal matching (Table 1) showed four covariates had absolute standardized differences in covariate means before matching (*d<sub>x</sub>*) that were

greater than 0.35. *d<sub>x</sub>* greater than 0.35 indicates that selection bias exists and conventional covariance control approach tend to be sensitive to the model specification (Imbens & Wooldridge, 2009; Guo, 2011). The sample sizes after optimal pair and optimal full matching are also presented in Table 1. After optimal pair matching, the matched sample included 183 treated participants and 183 paired or matched nontreated participants. Because there were more treated than control participants, optimal-pair matching lost 16 treated participants (or 8%) but retained all 183 control participants. On the other hand, optimal full matching retained all 199 treated and 183 non-treated participants.

As Table 1 illustrates, we can determine how well optimal matching reduced bias by comparing the absolute standardized differences in covariate means before and after matching (i.e., a comparison between



$d_x$  and  $d_{xm}$ ). Before matching procedures, the absolute standardized differences in covariate means generally had higher values than the index after optimal matching. For instance, the  $d_x$  of gender before optimal matching was 0.75. This means that the treatment and control groups were 75% of a standard deviation apart on gender. After optimal pair matching and optimal full matching, the  $d_{xm}$  of gender became 0.67 and 0.16, respectively. The value of most covariates decreased from the  $d_x$  to the  $d_{xm}$ , suggesting that optimal matching improved balance. Results also showed optimal full matching improved data balance better than optimal pair matching. There was only one covariate (*ownership of financial assets* at baseline) in which the  $d_{xm}$  for pair matching was lower than the  $d_{xm}$  for full matching.

Table 2 presents results of the post-matching analysis using Hodges-Lehmann test after full matching, and using regression of difference scores after pair matching. As the table shows, treated individuals had more financial assets than non-treated individuals. On average, individuals in the treated condition had

\$38.63 more in financial assets than individuals in the control group. The difference was statistically significant at a .05 level. The study also detected an effect size of .08, which is a small effect size in terms of Cohen's (1988) criteria. Further, treated individuals had more productive assets than nontreated individuals. On average, individuals in the treated condition had 0.15 TLU more in productive assets than individuals in the control group. The difference was statistically significant at a .10 level. Effect size is .06. Further, in a difference score regression, the intercept indicates the ATE of the sample (Guo & Fraser, 2010). The estimated intercept from this model was 58.61 for financial assets and -0.04 for productive assets. Thus, using pair matching and regression adjustment, the study found that, on average, treated participants had \$59 more in financial assets but 0.04 TLU less in productive assets than nontreated participants. However, both findings based on regression of difference scores were not statistically significant.

**Table 2**

*Estimated Average Treatment Effects: Results of the Propensity Score Models and Unadjusted Ordinary Least Square (OLS) Regression*

Test statistics	Estimated average treatment effects	
	Financial assets (US\$)	Productive assets (TLU)
Hodges-Lehmann Aligned Rank Test	38.63***	0.15*
Regression of Difference Scores	58.61	-0.04
Matching Estimators	60.15**	0.33
Unadjusted OLS Regression	73.65**	-0.05

Note. US\$ = U.S. dollars. TLU = tropical livestock units \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ , one-tailed test.

### Matching Estimators

The results of matching estimators supported some of the findings based on optimal matching. Table 3 shows the estimated treatment effects of *AssetsAfrica* on financial assets and productive assets. A specific sample effect is the same as its corresponding population effect in magnitude. For instance, both the sample average treatment effect (SATE) and the population average treatment effect (PATE) for financial assets were equal to \$60. The two effects differed only on the standard error. Results also indicated that, on average, treated participants had \$60 more in financial assets and 0.33 TLU more in productive assets than nontreated participants. This finding held true after selection bias was taken into account for six observed covariates. With regard to the subpopulation of treated participants, the treatment effect was even larger: \$76, or \$15 more than SATE on financial assets, and 0.63 TLU, or 0.30 TLU more

than SATE on productive assets. Further, had all controls (i.e., non-treated individuals) become treated participants and had all treated participants not received an asset-building intervention, then on average, the control participants would have \$43 more in financial assets and 0.01 TLU more in productive assets than their counterparts. In this study, the sample average treatment effect for the treated (SATT) equaled \$76 and the sample average treatment effect for the controls (SATC) equaled \$43, or a difference of \$33 in financial assets; and the difference in productive assets between SATT and SATC is 0.62 TLU. These differences are attributable to either additional selection bias not accounted for in the study or to study data that violated assumptions of matching estimators (Guo & Fraser, 2010). Nonetheless, these results support the hypothesized positive direction of the impact of *AssetsAfrica* on financial and productive assets.

**Table 3**  
*Estimated Average Treatment Effects: Results of the Matching Estimators*

Treatment effects	Financial assets	Productive assets
	(US\$) Coefficient (SE)	(TLU) Coefficient (SE)
Sample average treatment effect (SATE)	60.15 (31.02)**	0.33 (0.26)
Population average treatment effect (PATE)	60.15 (30.91)**	0.33 (0.27)
Sample average treatment effect for the treated (SATT)	75.62 (31.74)***	0.63 (0.38)*
Population average treatment effect for the treated (PATT)	75.62 (32.03)***	0.63 (0.40)*
Sample average treatment effect for the controls (SATC)	43.32 (38.13)	0.01 (0.20)
Population average treatment effect for the controls (PATC)	43.32 (37.43)	0.01 (0.21)

Note. US\$ = U.S. dollars. TLU = tropical livestock units SE = standard error. Matching variables are age, gender, marital status, education level, prior financial assets, and prior productive assets. \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ , one-tailed test.

Population effects indicate whether the tested intervention will be effective in a second sample taken from the same population (Guo & Fraser, 2010). Taking SATT ( $p < .01$ ) and PATT ( $p < .01$ ), which was the population average treatment effect for the treated, on financial assets as examples, the study indicated the treatment effect for the treated group was statistically significant in the sample at a level of .01. If we take a second sample from the population, we are likely to observe the same level of treatment effect for the treated, and the effect should remain statistically significant at a level of .01 (Guo & Fraser, 2010). Finally, our results showed four treatment effects (SATE, PATE, SATT, and PATT) for financial assets and two (SATT and PATT) for productive assets were statistically significant ( $p < .10$ ). These results suggest that, conditioned on the available data, *AssetsAfrica* contributed to a higher level of financial asset-ownership among individuals in the treatment condition (or those who would assign themselves to the treatment). Results of the treatment effects on productive asset-ownership were less conclusive.

Table 2 also shows the estimated ATE using four different statistical methods. Results indicated variation in the magnitude of ATE coefficients, direction of the intervention's effect, and level of statistical significance. For instance, unadjusted ordinary least square (OLS) regression had the highest ATE coefficient on financial assets among all four methods, followed by matching estimators. With the exception of regression of difference scores, all ATE coefficients on financial assets were statistically significant at a .05 level. Further, Table 2 indicates more variation in the results of ATE on productive assets. Result using Hodges-Lehmann test suggests a statistically significant positive impact of *AssetsAfrica* on productive assets. All other test statistics were not statistically significant. Further, results using regression of difference scores and unadjusted OLS regression indicated a much lower ATE coefficient and a negative, but

statistically nonsignificant, impact of *AssetsAfrica* on ownership of productive assets. Matching estimators had the highest ATE coefficient, albeit not statistically significant, on productive assets than the other three methods. These results suggest that, based on the coefficient size, direction of effect, and level of statistical significance estimated by using different statistical methods, the ATEs on financial assets were more consistent than the ATEs on productive assets.

Further, this study underscores the importance of using propensity score analysis than conventional covariance control method such as OLS. Unadjusted OLS results led to biased and inconsistent estimation of the treatment coefficient and direction of treatment effect. For instance, unadjusted OLS overestimated the ATE on financial assets. Hodges-Lehmann test and matching estimators showed an ATE on financial assets of \$39 and \$60, respectively, whereas unadjusted OLS regression showed an ATE of \$74. Thus, unadjusted OLS overestimated ATE by \$35 and \$14. With regard to productive assets, Hodges-Lehmann aligned rank test showed a statistically significant ATE on productive assets ( $p < .10$ ), whereas unadjusted OLS showed a statistically nonsignificant ATE. In addition, unadjusted OLS showed a negative impact, albeit statistically nonsignificant, of the intervention (i.e., treatment participants had less productive assets than nontreated participants). This result was contradictory to the positive impact findings of the propensity score models used in this study.

### Discussion and Implications

This study aims to determine the impacts of an asset-building intervention on ownership of financial and productive assets among rural, low-income households in Sub-Saharan Africa. The results of the analysis were mixed. Two propensity score methods used in the study indicated a positive impact of the intervention on financial assets. The Hodges-Lehmann test indicated a statistically significant positive impact of the intervention on financial assets, that is, individ-

uals who received the asset-building intervention had \$39 more in financial assets than nontreated individuals. Further, results of matching estimators indicated a statistically significant larger treatment effect on the treated. SATT was \$15 more than SATE. In some cases, particularly in policymaking, the results of ATT is important because it shows that an asset-building intervention is beneficial for all individuals who are assigned or who would assign themselves to the treatment. However, the effect of an asset-building intervention on ownership of productive assets was less conclusive. Although the result of Hodges-Lehmann test indicated a positive effect of the intervention on ownership of productive assets, results of the other methods indicated a statistically nonsignificant effect.

The effects of the intervention on ownership of financial assets are not only significant, but more importantly, the effects are economically meaningful. Positive changes in financial resources of this magnitude among poor villages in rural Uganda are substantial. An increase of \$40 to \$75 more in financial resources can mean that children can stay in school for an entire year, household members can go to health clinics when they are sick and buy medications, and households can buffer the effects of income shocks and the associated long-term adverse consequences. Similarly, larger financial assets can also mean increased opportunities to accumulate additional assets that, in turn, can generate additional income for the household. Further, the more consistent positive impact of the intervention on ownership of financial assets may be reasonable to expect because of the nature of the intervention. Because the program provided access to a formal savings account, and required a commitment from the participants to make regular deposits into the account without making frequent withdrawals, it is reasonable to expect that treated participants would have higher savings than those who did not receive the intervention. Similarly, because treatment group participants had formal bank accounts with saving statements, unlike their counterparts in the control group, it is possible—maybe likely—that those in the intervention had a recollection of amounts in their accounts, and therefore, made more accurate reports of savings in their survey answers. In addition, savings data could easily be compared with the account monitoring software MISIDA (a management information systems software used to monitor the savings accounts of the treatment group) for verification. In contrast, the control group had to rely on memory recall of savings amounts, and those recollections could not be verified. The control participants' reliance on memory may have introduced an imbalance into the comparison of the financial assets between the two groups.

Unlike the consistent and positive treatment effects of the intervention on financial assets, results of our analyses show a less conclusive impact of the intervention on productive assets, specifically live-stock ownership. Our findings provide little and inconclusive evidence that *AssetsAfrica* led to an accumulation of productive assets. The nonsignificant effect of the intervention on productive assets can be attributed to several reasons. First, productive assets might not have been measured well using TLU (recall that we used average market prices rather than participant reported values for productive assets). Second, savings intended for productive assets could have been kept in financial form and reported. Third, treated participants might not have yet purchased their productive assets during the follow-up period. Fourth, productive assets that were purchased during the intervention might have been sold for cash during the follow-up period.

### Policy Implications

The present study finds positive effects of an asset-building intervention on financial assets. These results are similar to findings from asset-building research in industrialized countries that have shown that planned asset-building vehicles contribute in some extent to savings, asset accumulation, economic stability, political participation, and better social outcomes (McBride, Lombe, & Beverly, 2003; Scanlon & Page-Adams, 2001).

In Sub-Saharan Africa, poor people's access to institutionalized asset-building instruments is quite limited. This lack of access to institutional banking is a primary reason poor households continue to use informal systems of accumulating assets. As few as one-quarter of households in developing countries have any form of financial savings with formal banking institutions (Mas & Siedek, 2008). Having access to financial services is a fundamental tool to building productive capacity of households, to smoothing expenditure when cash inflows are erratic (e.g., due to seasonality of crops), and to protecting against emergencies (natural disasters or death in a family). Although families accumulate some assets through informal savings groups, those savings tend to be small amounts that do not enhance long-term well-being or economic stability. Providing access to safe, secure, and simple asset-building vehicles that are protected by law may assist poor families to accumulate assets that can enhance their well-being.

Asset-building intervention provides poor households opportunities to build assets through access to financial services. Financial services play an important role not only in securing savings but also in improving productivity of assets through access to

insurance and capital, which then can be used to access markets and better technologies. In addition, assistance to poor families should include incentives or capital (sometimes called cash transfers) to boost the families' immediate asset base, allowing them to engage in meaningful asset accumulation activities. Cash transfers or other forms of safety nets can also protect households against loss of key assets and insure vulnerable households against falling into chronic poverty. Asset-building interventions in Sub-Saharan Africa must prevent people from falling into deeper, persistent poverty while building up the assets of the poor and creating pathways out of poverty. Such assets policy should ensure inclusion of those who are typically denied access to asset-building products because of prohibitive requirements such as requiring formal employment to open an account. In addition, increasing technological development, including cell-phone banking and bio-identification may be used to overcome institutional barriers for those who have lacked access to financial services and products. The accounts offered in this applied research offer an example of an asset-building instrument that successfully provided a simple, safe, and easily understood product that was accessible for poor people in a developing country.

One of the main constraints to accessing asset-building programs and other financial services is the cost of reaching geographically dispersed and low-income populations. Greater access may be achieved by adopting systems that use a low-cost, high-volume transactional environment such as branchless banking, or mobile banking using cell phones. A flexible banking system should allow people to pay into or cash out their accounts by interacting remotely with the bank using information technology in a trusted way. Given the expansion and reduction in costs of computer access and related information technology, the potential for greater—perhaps even universal—access seems promising.

### **Limitations of Current Study and Implications for Future Research**

The current study has noteworthy limitations. First, although this study used propensity score analysis in an attempt to control statistically for the effects of economic status and several other influential variables that could influence the outcomes, this methodology cannot conclusively rule out unmeasured or unobserved variables that may be central to the intervention effects. The ideal study would be a randomized experiment in which both observed and unobserved predictors are balanced. Propensity score models do not address selection bias that results from the presence of unobserved variables. If the matching process omits important covariates that predict asset owner-

ship, the study findings may be prone to error. Because propensity score analysis fails to balance study conditions that are due to unmeasured or unobserved variables, the study findings do not indicate a clear causal relationship between the intervention and wealth outcomes. Unmeasured variables such as household income, household size, and measures of financial capability (for example, attitudes toward money management and financial socialization) might have affected our results. Nonetheless, the propensity score model used in this study included all available variables theorized to predict ownership of assets among low-income households in rural Sub-Saharan Africa. In developing the model to estimate the propensity score, we tested other specifications and inclusion of additional predictors. These other specifications included health and employment predictors. We did not include health and employment predictors in the final model because adding or dropping these two predictors did not change the results of our analyses. For the sake of parsimony, our analyses and results excluded health and employment. In addition, the analytic methods used in this study were carefully chosen to address limitations of conventional covariance control approach, and therefore, provide more rigorous evidence to support the conclusion that there is a likely net association between participation in *AssetsAfrica* and higher financial asset-ownership.

Second, measurement problems may have confounded the study findings. Unlike the treated participants who were given bank statement accounts and whose savings were tracked by MISIDA software, the participants in the control group had to rely on memory to recall the amount of their savings. This less reliable report of financial assets may have introduced an imbalance into the comparison of the financial assets between the two groups.

Third, this study was not able to determine which particular aspects of the multifaceted intervention led to the outcomes. Because the intervention included several components (e.g., access to a formal savings account, financial education, saving incentives), it is possible that only one or a combination of these components led to positive and meaningful results. Perhaps it is less a matter of savings incentives, and more a question of access to financial services. Or perhaps with the same training and support, the control group could have accumulated assets as effectively as the treatment group.

Results of this study may be compelling but they are preliminary. More rigorous research, particularly using a randomized experimental design, is needed to investigate the efficacy and effectiveness of asset-building strategies in Sub-Saharan Africa. Future research should examine studies using a longitudinal

design to address causal relationships that take into account temporal and other contextual factors. In addition, future research should consider the effects of asset-building programs in other domains by examining social, education, and health outcomes. Such findings would offer definitive evidence to inform programs and policies. Because asset-building interventions include several components, future studies should also examine which program components influence which outcomes.

### Conclusion

This study investigated the impacts of an asset-building intervention on rural households in Sub-Saharan Africa. The goal was to demonstrate that an intervention consisting of access to banking mechanisms, financial education, saving incentives, and peer support may have positive effects on asset holding and the ability to save. Due to the study design, we can say with reasonable confidence that the combined intervention led to positive and meaningful results in financial asset-ownership. However, we did not find a consistent, positive impact on productive assets. Given the economic and social context of Sub-Saharan Africa, it is particularly challenging for poor households to gain economic stability. Because of limited access to formal financial instruments and tools, these households engage in innovative but often less-than-successful strategies for acquiring economic stability. Informal and unregulated ways of saving often put poor people's savings at risk. In addition, the complexity of available financial products, lack of familiarity with financial institutions, and high transaction costs (e.g. distance to financial institutions) may limit access to formal saving services. The asset-building intervention in this study addressed some of the crucial barriers (e.g. access and incentives) that have been shown to affect saving behaviors of the poor. The asset-building intervention in this study was simple, accessible and localized, and appealed to poor people because the intervention allowed them to accumulate assets that are viable and useful in their everyday lives.

Overall, results of this study show that asset-building interventions have potential utility as a policy solution for improving the economic well-being of poor households in Sub-Saharan Africa. As an incentive to encourage the poor to save, many asset-building interventions provide an opportunity for matched savings. In addition, asset development accounts can provide governments and international organizations with opportunities to channel resources for development directly to poor families. Because the resources reach the poor families directly, expenditures for overhead costs by NGOs are eliminated or greatly

reduced, which gives poor people more resources at their disposal to improve their economic well-being.

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