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Cash Transfers, Young Women's Economic Well-Being, and HIV Risk: Evidence from HPTN 068

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Abstract
Despite the large interest in economic interventions to reduce HIV risk, little research has been done to show whether there are economic gains of these interventions for younger women and what intermediary role economic resources play in changing participants' sexual behavior. This paper contributes to this gap by examining the impacts of a conditional cash transfer (CCT) for young women in South Africa on young women's economic resources and the extent to which they play a role in young women's health and behavior. We used data from HIV Prevention Trials Network 068 study, which provided transfers to young women (in addition to their parents) conditional on the young woman attending at least 80% of school days in the previous month. We found that the CCT increased young women's economic wellbeing in terms of having savings, spending money, being unindebted, and food secure. We also investigated heterogeneous effects of the program by household economic status at baseline because the program was not specifically poverty targeted and found that the results were driven by young women from the poorest families. From these results, we examined heterogeneity by baseline poverty for other outcomes related to HIV risk including sexual behavior and psychosocial well-being. We found psychosocial well-being benefits in young women from the poorest families and that economic wellbeing gains explained much these impacts.

Keywords Adolescent girls and young women · South Africa · Economic empowerment · Cash transfers · Psychosocial well-being

Introduction

Globally, young women and adolescent girls are disproportionally affected by poverty [1, 2]. Girls that grow up in poor contexts encounter more discrimination and violence and have less access to education and health services than their male counterparts [3]. They also have limited opportunities for economic advancement since they typically lack access to and control of economic resources including assets and financial capital [1]. Social norms such as early marriage and exclusion from economic institutions like formal banking all work to further entrench these economic asymmetries between men and women [2]. Poverty's disproportionate burden on young women has been recognized as an

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important risk factor in their increased vulnerability to HIV [4–6] and one reason for high sustained HIV rates among young women in sub-Saharan Africa (SSA) despite declining HIV rates across the general population [7–9].

For young women and adolescent girls in high-poverty contexts, economic vulnerability influences and interacts with gendered power imbalances in sexual relationships to increase their risk of HIV [10, 11]. Across poor rural and urban areas in SSA, young women often seek out sexual partnerships to increase their economic and social capital [10, 12–14]. With these goals in mind, young women may choose to partner with older men who are better able to provide them money and gifts [15, 16]. Partnerships with older men that are primarily transactional in nature enhance the gendered power imbalances within the relationship and it is men who tend to dominate sexual decision-making such as whether to use a condom [17–19]. Evidence shows that age and economic asymmetries play an important role in young women's HIV vulnerability as they are associated with riskier sexual behaviors [10, 17]. Further, age-disparate sex and transactional sex are associated with an increased risk of HIV acquisition [19, 20]. Young women have little power to challenge men's dominance in sexual decision-making because their economic vulnerability works to reinforce their low bargaining power [10]. Therefore, the pathway through which poverty is believed to increase young women's vulnerability to HIV is by furthering their dependence on men and constraining their relationship power such as their ability to refuse sex, negotiate safe sex, or leave risky relationships [5, 21].

In response to this evidence, structural interventions to increase economic resources and opportunities for young women and girls have been prioritized as an HIV prevention strategy in SSA because they are hypothesized to empower women and influence risk attitudes and behaviors [5, 22–25]. The economic theory underlying this reasoning is that individuals in poverty make decisions with survival or immediate gratification in mind rather than thinking and planning for their future. However, when subjected to the conditions of poverty such as chronic hunger, material deprivation, and social exclusion, these decisions, including sexual decisions that put individuals at greater risk of HIV, can be seen as logical based on the reality of available economic opportunities [26, 27]. Interventions that work to change the opportunities available to young women in poverty by increasing economic resources such as credit, savings, and financial capital, may empower young women to make decisions more amenable to the future rather than to immediate needs. Programs that enhance economic security and future expectations of young women may also increase self-esteem, self-efficacy around communication and negotiation skills, and enhance decision-making [21, 22]. Therefore, 'economic empowerment' interventions are hypothesized to reduce

sexual risk behaviors by building 'resistance' to risky situations and 'resilience' to face economic shocks [28].

Despite the theory that empowering aspects of a woman's economic resources can result in reduced risk of HIV acquisition, evidence to-date is mainly observational and does not show a clear pattern [29–31]. One recent study found positive associations between individual economic resources and protective sexual behaviors among sexually active young women in South Africa [31] while others have been more mixed [29, 30]. In Cameroon, economic resources were associated with protective factors among women aged 15–49 such as greater HIV knowledge and more condom use, but the same women were also more likely to test positive for HIV and to engage in riskier sexual behaviors such as having multiple partners in the past 12 months [30]. Poor women that participated in a microfinance intervention in South Africa had greater asset ownership at the end of the study compared to the control group, but participants were older women (aged 34–49) and self-selected into the program [32]. Some evidence also exists from economic empowerment interventions for adolescents but focuses on the impacts of economic resources on sexual risk-taking intentions instead of behaviors, also finding mixed results [33, 34].

Although there is mounting experimental evidence from structural HIV prevention interventions on sexual behaviors and HIV for young women [11, 25, 35–39], these studies rarely examine economic empowerment directly or how it functions as the pathway underlying program effects. Specifically, we know little about the impacts of interventions on (1) individual economic outcomes and (2) the mediating role of economic well-being on sexual decision-making or attitudes that influence decision-making.

This paper fills this gap by using longitudinal data from a randomized conditional cash transfer program (CCT) for HIV prevention (HPTN 068) to assess its impact on individual economic well-being and the role economic well-being had on program outcomes related to HIV risk. The CCT was targeted to young women attending high school in a poor, rural area of South Africa and provided monthly cash transfers to young women and their parents, conditional on continued school attendance. While there was no effect of the CCT intervention on HIV incidence, there were some improved sexual behaviors and a large reduction in the risk of intimate partner violence [39]. An analysis of baseline data also showed that individual economic resources among the study sample were associated with a number of HIV preventive practices including periodic sexual abstinence, having fewer sexual partners, and consistent condom use [31]. Further, a qualitative analysis by MacPhail et al. [12], found young women in the treatment group experienced a number of benefits due to the cash itself, including enhanced status with peers and feelings of independence, which may have consequently affected their sexual risk-taking behavior and

psychosocial well-being [40]. We therefore examine whether economic well-being went on to contribute to other program impacts on sexual behavior and subjective measures of well-being. While the HPTN 068 cash transfer experiment took place in a poor, rural area of South Africa, the program was not poverty targeted. Therefore, in addition to the total effect on the economic empowerment of young women, we also examined the heterogeneity in program effects by assessing the role of household socio-economic status at baseline.

Methods

Data

Study Site and Design

Participants for this study were recruited from villages within the Agincourt Health and Socio-Demographic Surveillance Systems (HDSS) catchment area in Mpumalanga province, South Africa near the Mozambique border. This rural area is characterized by both high poverty and HIV prevalence [41, 42]. Many households are food insecure and rely on government support in the form of non-contributory grants like the Child Support Grant and the Old Age Pension. Migration for work is also common for men and increasingly for younger women leaving older women to care for children [41]. The most recent HIV prevalence survey in 2010 indicated a prevalence of 5.5% among girls aged 15–19 and 27% among young women aged 20–24, with peak prevalence at 46% among women aged 35–39 [42]. The HPTN 068 trial found incidence among young women during the trial of around 2% (per person-year) [39].

HPTN 068 (or Swa Koteka) was an individually randomized CCT intervention for females aged 13–20 attending high school, designed to test whether CCTs are an effective HIV prevention strategy. It was hypothesized that cash would reduce HIV acquisition by helping keep girls in school. Study participants in the treatment arm received financial support in the form of monthly cash transfers, conditional on regular school attendance (at least 80% of school days in the previous month) while the control arm received no transfers. Participants continued to receive transfers for up to three academic years (as long as they met the attendance criteria) or until they graduated high school. In addition to the direct transfer for the young woman, Swa Koteka also included a monthly transfer to the parents (or guardians) of participants, which was also conditional on the young woman's school attendance. Cash transfers for both the young woman and the parent or guardian were deposited directly into their respective bank accounts. Monthly cash transfers amounted to 300 Rand (R), R100 for the young women and R200 for the parent or guardian (roughly US$ 10 and US$

20, respectively, using 2012 conversion rates). This total amount was chosen to be on par with the income from the Child Support Grant and represented a significant proportion of household consumption since average monthly per capita household expenditure was R295 at baseline.

Starting in March 2011, study participants were recruited, and by the end of 2012, 2537 young women were found eligible and joined the study. To be eligible for the study, young women had to be enrolled in a participating high school in the study location and between 13 and 20 years old. Other eligibility requirements included not being married or pregnant, living with at least one parent or guardian, being able to read, having or being able to open a bank or post office account, and willing to take an HIV and Herpes Simplex Virus 2 (HSV-2) test. After being recruited to the study, participants completed an Audio Computer-Assisted Self-Interview (ACASI) and HIV and HSV-2 tests, which included pre and post-test HIV counselling. Once baseline assessments were completed, young women (and their parent or guardian) were individually randomized (1:1) to either the treatment or control arm.

Follow-up visits occurred annually at 12, 24, and 36 months or until the participant graduated from high school. A flow diagram of study participants over the trial has been previously published [39]. At each follow-up visit, young women completed an ACASI, HIV and HSV-2 testing (if negative at the previous visit), and pre and post-test HIV counselling. Parents or guardians also completed a household survey at baseline and each follow-up visit. Consent for study participation was obtained at the home visits with written informed consent from both young women and her parent or guardian. Written assent was obtained for female participants under 18 years old. Institutional Review Board approval for this study was obtained from the University of North Carolina at Chapel Hill and the University of the Witwatersrand Human Research Ethics Committee as well as the Provincial Department of Health's Research Ethics Committee.

Measures

Economic well-being was measured at both the household level and the individual level of the young woman. Dependent variables at the household level include household per capita total and food consumption. Economic well-being outcomes for the young woman include measures of economic and food security—food worry, borrowed any money (from anyone outside the household), and paid work—as well as access to economic resources—savings, bank account, and spending money. To assess the overall impact of the CCT on young women's economic well-being, we created an index measure that consists of four indicators coded to represent greater well-being: (1) food secure

(no food worry past 12 months), (2) always had spending money (past 12 months), (3) never borrowed money (past 12 months), and (4) had any savings. We excluded access to bank accounts in our analysis since opening a bank or post office account was an eligibility requirement in order to safely transfer the cash to young women in the treatment arm. We also excluded paid work in our main index measure for economic well-being because it is uncertain whether engaging in paid work signifies greater well-being in our sample of school-attending young women. Participating in paid work could instead be a consequence of economic deprivation and demand time away from school.

Additional outcome measures include young women's sexual behaviors and psychosocial well-being to further examine whether baseline poverty status and individual economic well-being affected the CCT impacts on these measures. The importance of individual resources for young women's psychosocial well-being is becoming increasingly clear in the literature [43–45] including among these young women, as evidenced from both qualitative and quantitative data [40].

Psychosocial constructs include perceived power in sexual relationships, mental health, and hopefulness. Power in sexual relationships was measured using the 12-item sexual relationship power scale (SRPS), adapted for South Africa [46, 47]. Mental health was measured using the 20-item Center for Epidemiological Studies Depression scale (CES-D) [48][1] and hopefulness was measured using a 13-item Hope scale developed and validated for this population [49]. Each of the scales were scored on a four-point Likert scale, summed, and rebased to zero. Higher scores reflect greater power in relationships for the SRPS, greater depressive symptoms for the CES-D, and greater feelings of hope for the Hope scale. Each psychosocial measure was then standardized so that estimated effects represent changes in standard deviations (z-scores) in order to compare effects across these different scales. In addition, we tested for differential treatment effects for sexual behaviors that we hypothesized could be affected by individual economic resources including having any sexual partner, and for sexually active young women, having an older partner (5 or more years older) and having any transactional sex (exchange of sex for money and/or gifts).

Estimation Strategy

Since the Swa Koteka CCT program was not poverty targeted, we hypothesized that the money may have had a stronger economic benefit for young women from the poorest households. To understand this relationship, we first investigated the association between our outcomes of interest and relative baseline poverty, defined as being from the bottom 50% of the sample in terms of total per capita household consumption. We choose this cutoff as nearly half of the sample's total per capita household consumption fell below the South African food poverty line at baseline and this created large enough subsamples to retain power to estimate differential effects [50].

First, we estimated the effect of baseline poverty on each individual economic outcome using generalized linear models with robust standard errors adjusted for young women's age, grade level, household size, and whether they have ever had sex. Demographic controls were chosen based on existing literature on the confounders for our exposure–outcome relationships.

Next, we estimated the total effect of the CCT intervention on outcomes using an intent-to-treat (ITT) estimator. We used the linear model displayed in Eq. (1) where CCT_i is the indicator for treatment, Y_{it} is the outcome of interest and ε_{it} is the error.

$$Y_{it} = \beta_0 \alpha + \beta_1 CCT_i + \varepsilon_{it} \tag{1}$$

In addition to Eq. (1), which gives us the total ITT effect, we also estimated Eq. (2) to test for moderation of the treatment effect by baseline poverty status where P_i is an indicator for being in the bottom half of the sample at baseline, and $CCT_i P_i$ is an interaction term between indicators for treatment and the baseline bottom half.

$$Y_{it} = \beta_0 \alpha + \beta_1 CCT_i P_i + \beta_2 CCT_i + \beta_3 P_i + \varepsilon_{it} \tag{2}$$

Using the p value on the interaction term from Eq. (2), we can also test for significant differential treatment effects by baseline poverty status.

In addition, we further investigated the role of economic well-being as a mediator to explain other program impacts on sexual behaviors and psychosocial well-being. For this we examined the extent to which heterogeneous treatment effects can be explained through the impacts of the CCT on economic indicators for young women from the bottom half. We estimated a simple model for mediation that builds off Eq. (2) by including additional terms for economic index in the model.

$$Y_{it} = \beta_0 \alpha + \beta_1 CCT_i P_i + \beta_2 CCT_i + \beta_3 P_i + \beta_4 Econ_{it} + \varepsilon_{it} \tag{3}$$

$Econ_{it}$ is a vector that includes the economic index as both a contemporaneous and baseline covariate; baseline levels are controlled for to account for confounding between the mediator and dependent variable [51]. We then compared the treatment effect estimates from the mediated model to those from the unmediated model to evaluate how much the economic index attenuates the treatment effect. Attenuation

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[1] The CES-D was not included in the baseline survey so we show baseline descriptive data for the 10-item Children's Depression Index (cite) in Table 1.

Table 1 Baseline balance and summary statistics for outcomes and key demographic variables

	Mean (SD)/median (IQR), or (%)			
	Treatment $N=1272$	Control $N=1261$	Difference	p value (T–C)
Demographics				
Age	15.5 (1.7)	15.5 (1.6)	0.0	0.89
Household size	6.2 (2.7)	6.1 (2.6)	0.1	0.42
Ever had sex	27.1	27.7	− 0.6	0.72
Any sexual partner past 12 months	26.2	27.7	− 1.5	0.42
Transactional sex[1]	15.5	17.1	− 1.6	0.60
Older sexual partner (5+ years)[1]	19.9	20.6	− 0.7	0.82
Any unprotected sex (past 3 months)[1]	32.9	27.5	5.4	0.12
Psychosocial well-being				
Sexual relationship power scale (0–24)[1]	15.5 (6.1)	15.6 (5.8)	− 0.1	0.79
Hope score (range 0–39)	31.2 (7.2)	31.2 (7.2)	0.0	0.93
Child's Depression Index 10 item (0–18)	4.5 (3.1)	4.4 (3.0)	0.1	0.46
Young women's economic resources				
Always had spending money	9.7	11.0	− 1.3	0.28
Typical amount of spending money per month (if any)	50 (IQR 20,100)	50 (IQR 20,115)	–	0.42
Top three sources of young woman's funds				
Job	24.8	22.3	2.6	0.13
Family	31.8	32.3	− 0.5	0.79
Grants to the household	10.6	11.1	− 0.5	0.68
Engaged in paid work	15.0	17.1	− 2.1	0.15
Savings	24.8	25.2	− 0.4	0.80
Bank or post office account	15.8	16.5	− 0.7	0.63
Ever borrowed money 'to get by'	23.4	21.5	1.9	0.25
Food worry (young woman, past 12 months)	32.9	35.7	− 2.8	0.14
Household SES				
Household monthly per capita consumption (mean Rand)	455.0 (SD 675.3)	472.7 (SD 672.2)	− 17.7	0.51
Household monthly per capita food consumption (mean Rand)	233.6 (SD 467.8)	239.8 (SD 413.5)	− 6.1	0.73
Asset Index (mean, range 0–61)	14.3	14.2	0.1	0.61
Number of grants to the household	2.7 (SD 2.0)	2.7 (SD 1.9)	0.0	0.27
Poorest (bottom half of total per capita consumption)	50.7	49.2	1.5	0.45

p values based on equality of means tests with robust standard errors

[1]Only for young women who had ever had sex ($N=693$)

of the treatment effect would suggest that other program impacts can be explained, at least in part, by impacts on young women's economic well-being.

To estimate Eqs. (1)–(3), we used general estimating equation (GEE) models with exchangeable correlation structure and robust standard errors. GEE models were used to account for repeated observations on participants over the three follow-up study visits. Models with dependent variables at the level of the young woman additionally controlled for her age at baseline. Statistical analysis was performed using Stata 14.2.

Results

Sample and Baseline Balance

This analysis used data from the three follow-up visits during the main trial. The baseline sample included 2533 young women of which 2448 were HIV negative and included in the main analysis [39]. At the final planned visit, retention was 87% in the control group and 95% in the intervention group, however, differential retention was not significant and weighting for loss did not affect main study results [39]. Since we focus on economic outcomes in this analysis, we included all young women with at least one follow-up survey visit, N = 2438. Table 1 provides baseline descriptive statistics for demographic and outcome variables used in
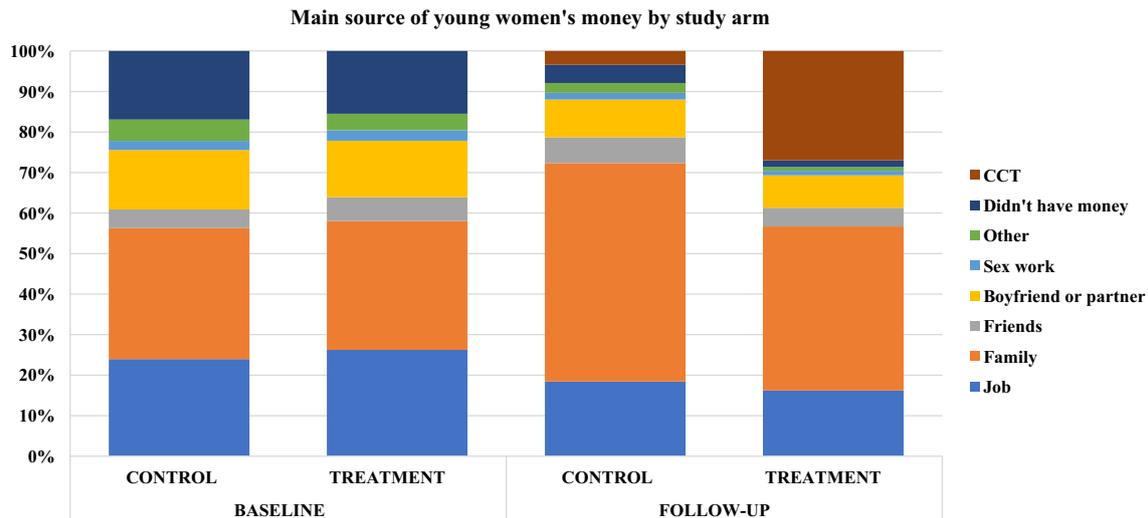
Fig. 1 Distribution of the source young women reported where they get most of their money by treatment status at baseline and follow-up

this analysis. We tested for balance by regressing baseline covariates on treatment indicators using OLS regression models. *P* values in the right-hand column show that there are no significant differences across the two groups. Study participants were also balanced on the main study outcomes of HIV and HSV-2 infection status [39].

All young women participating in the study were South African and of black race/ethnicity and had a median age of 15 years (IQR 14–17). More than 80% of households were receiving the South African Child Support Grant for at least one of their children during the study period, which indicates that young women in the study generally lived in poor households. Table 1 provides additional detail about the low socio-economic status of young women in the study. At baseline, only 25% had any savings and 16% had a bank or post office account. Additionally, a little over half of women had regular access to their own spending money (median amount per month: R50). For women that had any money, the main source of that money is from their families, followed by a job, and then outside grants (see Fig. 1 for full classification of sources). Despite a job being women's top three sources of their money, only 15% of young women report working at baseline. This low rate is likely due in part to eligibility requirements that young women enrolled in the study had to be in school and thus less able to hold a job at the same time. However, it also reflects the context of the study area, where employment opportunities are limited and youth unemployment is especially high [52].

Relative Poverty of Sample

At the time of baseline data collection in 2011, the poverty line set by the Government of South Africa was R620 per capita/month [53]. The mean total per capita consumption of treatment and control households was R455 and R473/month, respectively (Table 1), indicating a high rate of household poverty. However, this is only a rough indicator of poverty since our measure of aggregate consumption is not directly comparable to the government's measure used for determining poverty lines. The South African food poverty line (the amount which the government deems necessary for essential basic needs), on the other hand, provides a better basis of comparison as our survey included a comprehensive food consumption module. The food poverty line was R321 per capita/month in 2011 [53], which is around 70% of total per capita consumption and almost R100 higher than the average per capita food consumption among our sample (Table 1). Food consumption among our sample also makes up around half of total consumption signifying that most consumption is for basic needs in these households. Further evidence of low food consumption is reflected in the fact that nearly one-third of young women in both groups reported being worried about having enough food in the past 12 months.

Next, we estimated the baseline association between young women's economic outcomes and relative household poverty (Table 2). Relative household poverty was defined as being from the bottom half of the sample in terms of total per capita household consumption (a comparison of baseline characteristics for poverty subgroups can be found in Appendix Table 6). Table 2 shows that being relatively worse off is an important and significant predictor of young women's economic participation and control of economic resources. In particular, young women living in poorer households are 4 percentage points (pp) more likely to work while they are less likely to have savings (− 11 pp), a bank account

Table 2 Baseline relationships between relative poverty status and young women's economic resources

Dependent variable (yes/no)	Independent variable: baseline poverty (poorest 50% in terms of household consumption)	
	Risk difference (SE)	N
Engaged in paid work	0.04** (0.02)	2501
Had any savings	− 0.11*** (0.02)	2517
Had a bank account	− 0.07*** (0.02)	2522
Always had spending money	− 0.04*** (0.01)	2508
Never borrowed outside household	− 0.02 (0.02)	2508
Food secure	− 0.13*** (0.02)	2507

GLM linear estimates with robust standard errors. Models adjusted for age, grade level, household size, and ever had sex

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

(− 7 pp), or have discretionary funds (− 4 pp). There is no significant relationship, however, between relative poverty and whether a young woman borrowed money from anyone outside the family.

The relationships between relative poverty and young women's economic resources at baseline suggests that household poverty may play a role in the extent to which the cash transfer effects these economic resources. However, these baseline relationships do not make clear what direction the relationship would take. The design of this CCT provided both the young woman and her household with conditional monthly cash payments. Therefore, depending on both the perceptions of how the young woman's money was to be used and the impact of the household transfer on household economic well-being, a young woman may have felt obligated to use her own transfers to the contribute to the household [43]. In this case, we may find smaller treatment effects for young women from the poorest households if greater financial stress in these households translates into more pressure on the young woman to help out her family. Recent qualitative and quantitative findings, however, do not suggest that young women generally felt pressured to contribute to their households [40]. Consequently, we might observe larger treatment effects for young women from the poorest families since they start from a lower level of resources at baseline and thus have more to gain. In the following analysis, we further examine whether baseline poverty moderates the causal effect of the CCT on young women's resources.

Effects on Economic Well-Being

We first illustrate how young women's financial independence changed in Fig. 1, which shows the distribution of young women's 'main source of money' by time and treatment arm. The baseline categories include family, friends, job, boyfriend/partner, sex work, other, or 'didn't have money'. At follow-up, the CCT became an additional source. We see that there is a balance between treatment and control groups across categories at baseline, but during follow-up, there is a clear shift in the distributions between treatment and control groups, primarily because of the introduction of the CCT. At baseline, the most commonly reported source of young women's money was her family and then her job, these two accounting for over 50% of responses in both study arms. During follow-up study visits, however, jobs became less important and a woman's family was a larger source of money for both groups compared to baseline, but the CCT became the second largest main source (27%) for young women in the treatment group.[2] Additionally noteworthy is that reports of boyfriends as a 'main source of money' is low (less than 4%) across baseline and follow-up for both study arms.[3]

Next, Table 3 provides estimates for both the total and differential impacts of the CCT on household consumption and the index of young women's economic well-being. Columns 1 to 4 show that the CCT significantly increased both total and food per capita household consumption between 4% and 5%, but there was no significant differential effect by baseline poverty status as indicated by the interaction term in columns (2) and (4). Additionally, the coefficients for the baseline bottom half indicate that the poorest households in control group have much lower total and food consumption across follow-up visits, signifying that our baseline poverty designation was also a good measure for persistent poverty.

Comparatively, for young women, the CCT led to a significant increase in the index for economic well-being of 0.15 points (column 5, $p < 0.01$), an increase of 8.5% from baseline. There was also a significant differential treatment effect for the women from the bottom half at baseline (column 6). The interaction term in column (6) indicates the CCT led to a larger impact on the economic index (0.16 points, $p < 0.01$) for the bottom half over the top half. Consequently, the marginal effect of the CCT on the index for the bottom half is 0.23 points ($p < 0.01$), representing a 14.4% increase from baseline. The marginal effect of the CCT for the top half is much smaller at 0.07 points ($p < 0.1$).

This relationship is also apparent in CDF plots of the index by treatment status shown in the Appendix (Fig. 3). Compared to baseline, when distributions are equal, there is

[2] 3.4% of control group also reported the CCT as their main source of money. This data could be due to misreporting, but as there were reports of young women in the treatment group sharing their money with friends and siblings, this may reflect those allocations.

[3] Less than half of women report being sexual active during the trial, however, of the women that report having a partner, the majority report that they received money at some point from their partner.

Table 3 Intent-to-treat impacts of CCT on household consumption and index of economic resources, moderation by baseline poverty status

Dependent variable	Coefficient (SE)					
	Log per capita *total* expenditure[a]		Log per capita *food* expenditure[a]		Index of economic well-being	
	(1)	(2)	(3)	(4)	(5)	(6)
CCT	0.04* (0.02)	0.05* (0.03)	0.04** (0.02)	0.05** (0.03)	0.15*** (0.03)	0.07* (0.04)
CCT * baseline poverty		− 0.01 (0.04)		− 0.02 (0.04)		0.16*** (0.06)
Baseline poverty		− 0.44*** (0.03)		− 0.32*** (0.03)		− 0.23*** (0.04)
Mean of control group (± SD)	5.9 (0.6)	5.9 (± 0.6)	5.3 (± 0.6)	5.3 (± 0.6)	2.0 (± 0.9)	2.0 (± 0.9)
Observations	4974	4974	4973	4973	5048	5031

GEE linear estimates with robust standard errors. Baseline poverty is defined as being in the bottom half of households for total per capita household consumption at baseline. Models using the index of economic resources as the dependent variable are adjusted for age

[a]Excluding outliers (top 1%)

*$p<0.1$; **$p<0.05$; ***$p<0.01$

Table 4 Treatment impacts on standardized measures of subjective well-being and sexual behaviors, moderated by poverty status

	Coefficient (SE)			RR (95% CI)		
	SRPS z-scores[a]	CES-D z-scores	Hope z-scores	Any partner	Older partner[a]	Transactional sex[a]
	(1)	(2)	(3)	(4)	(5)	(6)
Model 1						
CCT (total effect)	0.00 (0.05)	− 0.02 (0.03)	− 0.02 (0.04)	0.91** (0.84–0.99)	0.91 (0.74–1.12)	1.03 (0.87–1.21)
Model 2						
CCT * baseline poverty	0.28*** (0.10)	− 0.14** (0.07)	0.14** (0.07)	1.03 (0.87–1.22)	0.81 (0.54–1.23)	0.93 (0.66–1.31)
CCT	− 0.14* (0.07)	0.05 (0.05)	− 0.09* (0.05)	0.90* (0.79–1.02)	1.08 (0.80–1.44)	1.08 (0.84–1.41)
Baseline poverty	− 0.22*** (0.07)	0.13*** (0.05)	− 0.16*** (0.05)	0.99 (0.87–1.12)	1.05 (0.79–1.41)	1.23* (0.97–1.57)
Observations	1884	4867	5031	5031	2189	1956

Coefficients estimated using GEE linear models with robust standard errors. Baseline poverty is defined as being in the bottom half of households for total per capita household consumption at baseline. Risk ratios estimated using GEE log-binomial models with robust standard errors. All models adjusted for age

[a]Only for young women who had ever had sex

$p<0.1$; **$p<0.05$; *** $p<0.01$

a clear shift at follow-up and this is driven by the effects for those in the bottom half.

We also examined marginal treatment effects on individual items in the index of economic well-being to understand which are most improved by the CCT (Fig. 4). We find significant increases in *savings* and *always having spending money* among the full sample but no heterogeneity across poverty subgroups. For *food secure* and *never borrowed*, however, we find significant differential treatment effects that are explained by improvements for young women from the poorest households. Additionally, young women from the bottom half are significantly less likely to be doing *paid work* compared to young women from the top half.

Effects on Other Outcomes

The second part of our analysis then examined whether baseline poverty status further influenced the treatment effect on other study outcomes of interest including sexual behaviors: having any sex partner, transactional sex and older partner (among sexually active), and psychosocial well-being. Psychosocial outcomes include sexual relationship power (SRPS z-scores) for the sexually active only, depressive symptoms (CES-D z-scores), and feelings of hopefulness (Hope z-scores)). For each of our outcomes, we tested for differential treatment effects using Eq. (2) but also show the total treatment effects using estimates from Eq. (1) (many of which have been presented elsewhere; see [39]).

Table 4 displays results for each outcome from separate regressions for the total effect (Model 1) and moderated effect (Model 2). For all sexual behavior outcomes
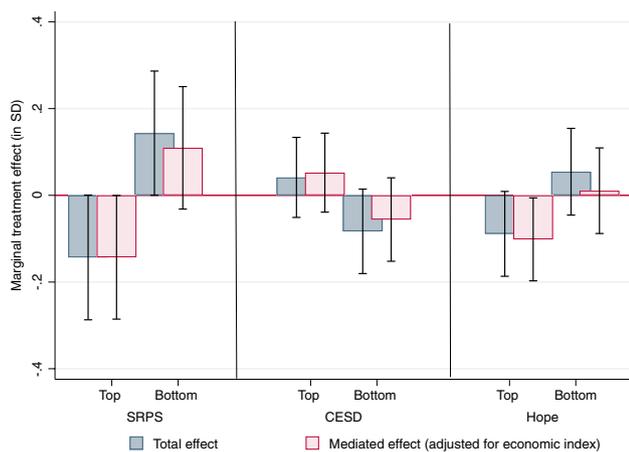
Fig. 2 Marginal treatment effects of the CCT on psychosocial well-being by baseline poverty status (total and mediated effects). Estimated marginal treatment effects for each psychosocial outcome grouped by baseline poverty status (top half or bottom half). Each bar represents a separate model. Blue bars are the marginal effect from Table 4 models while the red bars are the marginal effects from Table 5 models after accounting for the economic well-being index (excluding paid work)

(columns 3–6), there are no differential effects by baseline poverty status and the only significant treatment effect (as reported in the results from the main trial [39]) is for any sexual partner in the past 12 months (RR 0.91, $p < 0.05$). In contrast, for each psychosocial outcome in Table 4, we find no total treatment effect but large differential treatment effects. Results from the psychosocial outcomes indicate that the CCT had more beneficial effects on psychosocial well-being for young women from the poorest households at baseline. Coefficients, which are in standard deviations (SD), from the interaction terms show the poorest young women have higher sexual relationship power scores (0.28 SD, $p < 0.01$), greater hope (0.14 SD, $p < 0.05$), and lower depressive symptoms (− 0.12 SD, $p < 0.10$) than those from the top half at baseline. The positive impacts of the CCT for young women from poorest families at baseline are also in stark contrast to negative association between psychosocial well-being and being from the poorest families for the control group—coefficients for the 'Baseline poverty' indicator are all strongly significant and indicate lower psychosocial well-being.

Furthermore, we estimated marginal effects of treatment by poverty status using the model estimates presented in Table 4 (results not shown in Table 4). The marginal effects for young women from the bottom half calculated also indicate a beneficial effect of the CCT (SRPS 0.14 SD, $p = 0.05$; CES-D − 0.09 SD, $p = 0.07$; and Hope 0.05 SD, $p = 0.30$). Comparatively, marginal effects for women from the top half are all in the opposite direction (SRPS − 0.14 SD, $p = 0.05$; CESD 0.05 SD, $p = 0.31$; and Hope − 0.09 SD, $p = 0.08$).

Figure 2 provides a visualization of these contrasting effects, making it clear that the positive impacts for the bottom half were washed out by the top half, leading to near zero treatment effects for full sample.

Mediation of Impacts

Given the strong results for the poorest young women from Table 4, we then examined whether the differential treatment effects on psychosocial outcomes are attributable to the CCT impacts on their economic resources. We explored mediation of psychosocial well-being in Table 5 using the economic index used earlier (*always had funds, had savings, never borrows, and food secure*) in addition to a second economic index that adds *no paid work* to the existing measure. We chose to add this indicator to the index because of the large differential impact on paid work as shown in Fig. 4.

To examine these relationships, we estimated the simple mediation model shown in Eq. (3) that includes the economic index in the model at contemporaneous and baseline levels. Results in Table 5 show that for CES-D and Hope, the addition of the economic index clearly attenuates the total treatment impact for the poorest half with the strongest attenuation in the last model, where the index also includes *no paid work*. The magnitude of the treatment effect is attenuated by 21% (from − 0.14 SD to − 0.11 SD) for the standardized CES-D score and 36% (from 0.14 SD to 0.09 SD) for the standardized Hope score in the third models (column 6 and 9, respectively). The coefficients on treatment effects are also no longer significant below the 10% level. On the other hand, the strong effect of the CCT on the sexual relationship power scale (SRPS) for poorer young women is less affected by the economic index. The total treatment effect is attenuated by 18% in the last model (column 3) but is still significant at the 5% level. Notably, the economic index is strongly associated with psychosocial well-being as coefficients for the economic indices are large and highly significant ($p < 0.01$).

Lastly, Fig. 2 also shows the change in marginal effects for the bottom and top half after including the economic well-being index (without paid work) as a mediator.[4] The mediated effects for the bottom half are all clearly smaller (attenuated) and insignificant after accounting for young women's economic resources. The mediated effects for the top half, however, are either the same size or larger compared to the total treatment effect and significant for SRPS and Hope z-scores.

To summarize, the pattern of results indicates that the CCT had the largest impacts on young women's economic resources for those study participants that were from the

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[4] Results look the same for the resource index with no paid work.

Table 5 The role of economic resources as a mediator to explain the differential treatment effects on psychosocial well-being

| | Coefficient (SE) | | | | | | | | |
| | SRPS z-scores[a] | | | CES-D z-scores | | | Hope z-scores | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CCT * baseline poverty	0.28*** (0.10)	0.25** (0.10)	0.23** (0.10)	− 0.14** (0.07)	− 0.12* (0.07)	− 0.11 (0.07)	0.14** (0.07)	0.11 (0.07)	0.09 (0.07)
Economic index	–	0.17*** (0.03)	–	–	− 0.12*** (0.02)	–	–	0.18*** (0.02)	–
Economic index (with no paid work)	–	–	0.19*** (0.02)	–	–	− 0.14*** (0.02)	–	–	0.21*** (0.02)
CCT	− 0.14* (0.07)	− 0.14* (0.07)	− 0.13* (0.07)	0.05 (0.05)	0.06 (0.05)	0.05 (0.05)	− 0.09* (0.05)	− 0.10** (0.05)	− 0.09* (0.05)
Baseline poverty	− 0.22*** (0.07)	− 0.18** (0.07)	− 0.16** (0.07)	0.13 *** (0.05)	0.10** (0.05)	0.08 (0.05)	− 0.16*** (0.05)	− 0.12** (0.05)	− 0.09* (0.05)
Observations	1884	1884	1884	4867	4867	4867	5031	5031	5031

Coefficient estimated are in standard deviations. Baseline poverty is defined as being in the bottom half of households for total per capita household consumption at baseline. GEE linear models with robust standard errors. The first model for each dependent variable are the total effects from Table 4, the second and third models control for mediation through economic well-being (and also control for baseline levels of the mediator). All models adjusted for age

[a]Only for young women who had ever had sex

$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

poorest households at baseline and that these impacts help explain the psychosocial well-being improvements for those same participants. In this way, the CCT appears to be most protective of the young women that would have otherwise been more at risk for depression and lower sexual empowerment. However, the improvement in economic well-being for the poorest young women did not explain as much of their increase in sexual relationship power scale (SRPS) as it did for the CES-D and Hope scales.

Discussion

Economic empowerment has shown promise in reducing HIV risk for young women, however, research is scant on the role economic resources play in empowering participants to gain control over their sexual lives [11, 25, 35–39]. Here, we focused on the effects of the CCT on the economic resources of participants to provide new experimental evidence on the scope of cash transfers as a structural HIV intervention to impact women's economic empowerment. We found a significant increase in economic well-being for young women

who received transfers, and that the economic impact of the CCT is stronger for young women that come from the poorest families. In comparing the distribution of economic resources in each subgroup across treatment arms, it is clear that young women from the poorest households benefit most from the cash transfer because they would not have otherwise had those resources compared to young women from the better off households.

When we further examined other program outcomes for heterogeneous effects by relative baseline poverty status, we find evidence that the CCT also improved psychosocial well-being for young women from the poorest families but not the better off families. Program impacts on scales for depression, sexual relationship power, and hope each displayed the same contrasting pattern. Results show a beneficial effect of the CCT for young women from poorest families compared to a negative effect for young women from the better off families. In this way, the heterogeneity in treatment effects for the top and bottom half were washed out in the full sample so that the total treatment effect is both null and approximately zero. Further investigation revealed that these heterogeneous impacts are partly explained by the increase in economic

resources that were also driven by young women from the poorest families.

In assessing economic resources mediating role in young women's behavior and health outcomes, this analysis provides a greater understanding of the underlying mechanisms through which such programs affect outcomes. This is important for assessing the theory behind economic empowerment for HIV prevention in this population and for distinguishing the effectiveness of specific interventions. An earlier structural HIV prevention intervention for adolescent girls in Zimbabwe found that not only was microfinance ill-suited for younger women due to a combination of age, gender, and structural barriers, but having extra cash and traveling for business made some girls more vulnerable to theft and harassment [54]. Those findings highlighted the need to critically examine whether and how structural interventions improve economic empowerment or whether they lead to unintended consequences that can heighten young women's risk and vulnerability. This analysis contributes to our understanding of the process by which individual and household economic factors affect young women's ability to control and direct their lives. More rigorous research is needed on this relationship in other contexts and settings in order to design and target appropriate and effective economic interventions for girls and women across the region.

This work also builds on previous evidence from a similar cash transfer experiment in Malawi that also included direct transfers to girls. That program resulted in increased schooling and reduced HIV prevalence, in addition to lower rates of pregnancy and marriage in the unconditional arm [55]. Additionally, the Malawi experiment varied the size and recipient of the transfer and a heterogeneity analysis showed some differences for the unconditional arm on schooling, marriage, and pregnancy by cash transfer amounts to parents. The results did not show that giving different amounts to the girl improved any outcomes, leading the authors to suggest that giving transfers directly to the girls would not be more effective than parents [55]. While we do not have variation in the transfer size (or an unconditional treatment arm to separate the cash component from the schooling condition), we do have variation in the level of baseline poverty and can assess whether average treatment effects differ by baseline poverty status.

The biggest impacts for young women from the poorest households at baseline were on improving food security and reducing their likelihood of borrowing money (Table 7 and Fig. 4). Additionally, young women from the bottom half were less likely to be doing paid work during the study period compared to those from the top half. This result is surprising since young women from the bottom half were more likely to be doing paid work at baseline. What this means for economic empowerment is unclear, but since the CCT is conditional on school attendance and paid work can compete with a young woman's time spent on her schooling, this could suggest the transfer reduces the necessity of working for young women from poorer families who might otherwise have needed to help support their families. Anecdotally, however, some young women reported starting their own businesses with the money. Therefore, it is possible that the increase in paid work for the young women from the top half could reflect an increase in entrepreneurial activities. As these activities would require capital, young women that were better off to begin with economically would have an advantage over young women from the poorest households. Nevertheless, after including *no paid work* as part of the economic well-being index, we found that it increases the precision of the index as a pathway through which the CCT improved psychosocial well-being for young women from the bottom half.

Given the exceptionally high rates of school attendance in both study arms (over 95%), we can reasonably attribute the effects of treatment on individual resources as effects of the cash transfer component. There is a strong literature showing that cash transfers that target the most vulnerable and poor families have large impacts on child schooling and household poverty [56]. Although the transfer amounts to young women were not large relative to other grant programs in South Africa (e.g., Child Support Grant), the young women in this study come from a very poor area in South Africa. The baseline relationships between relative poverty and young women's economic resources suggested that household poverty could have played a role in the extent to which the cash transfer affected these economic resources as young women from the poorest households had significantly fewer economic resources and were more food insecure. In this case, we could have found smaller treatment effects for young women from the poorest households if greater financial stress in these households translated into more pressure on the young woman to help out her family. Recent quantitative and qualitative findings do not suggest that young women generally felt pressured to contribute to their households [40]. Noteworthy is that the CCT also included a monthly parental transfer (twice the size of the young women's). This likely contributed to the widespread account

by the young women that they were both able to keep and make decisions on how to spend their individual transfer [40]. Consequently, we found larger treatment effects for young women from the poorest families since they start from a lower level of resources at baseline and thus have more to gain. These results highlight the need to take into account how household poverty can act as a moderator of program effects.

Findings from this analysis have implications for HIV prevention and cash transfer programming. For one, age and gender-specific strategies might be further enhanced by poverty targeting to find the most vulnerable young girls. By including community involvement or traditional proxy means tests as part of targeting procedures, interventions could better reach the most vulnerable families and girls. This includes other hard-to-teach young people such as out-of-school girls that our study did not include. Although enhanced targeting may maximize potential impacts by improving coverage of the most vulnerable adolescents, it can also be costly. The costs and benefits of increasing targeting versus having fewer exclusion criteria should be determined and considered by policy-makers in response to each context and available resources.

Moreover, the design of this CCT—providing both the young woman and her household with monthly cash payments—appeared to play an important role. Young women, especially those from poorer families, may feel obligated to use their own resources to the contribute to their households. By explicitly designating part of the transfer to the young woman and providing a separate transfer to the family, the intervention not only set expectations about who had ownership over the transfers, but also supported household economic well-being. This in turn reduced a potential financial obligation for the young women. The evidence from the study demonstrates how increasing economic resources for young women contributes to greater well-being. This complements other studies that have shown the importance of young women's economic resources on sexual decision-making such as adopting sexual protective behaviors [14, 29–31]. Therefore, economic-strengthening initiatives for young women that allow for and encourage personal ownership over financial resources, could empower young women to avoid HIV, providing a missing link to support HIV prevention initiatives.

Concluding Remarks

Young women and adolescent girls' vulnerability to HIV makes them an important target group for policymakers. Structural interventions that target young women directly and increase their economic empowerment can provide a critical opportunity to reduce this vulnerability. Economic empowerment can drive change for young women in poverty by helping them to gain financial independence, opening opportunities for their future, strengthening their self-worth and confidence, and even improving sexual decision-making and health outcomes. Nonetheless, as this intervention was not specifically poverty targeted, we found that results varied across relative household poverty, suggesting that expansion of similar programs to all girls in SSA may not have the desired impacts.

Because the relationships between economic status and HIV risk are complex and vary by context, more research is needed to understand the linkages among age, gender, and poverty in specific contexts, as no single approach is likely to work for all young women. Future studies should carefully consider the role of relative poverty in HIV prevention for young women and anticipate how heterogeneity in baseline parameters may play out in hypothesized or desired outcomes. Policymakers planning to implement cash transfers and other economic interventions for HIV prevention, should reflect on whether more effective targeting of the most vulnerable girls and young women would lead to better use of limited resources.

Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.
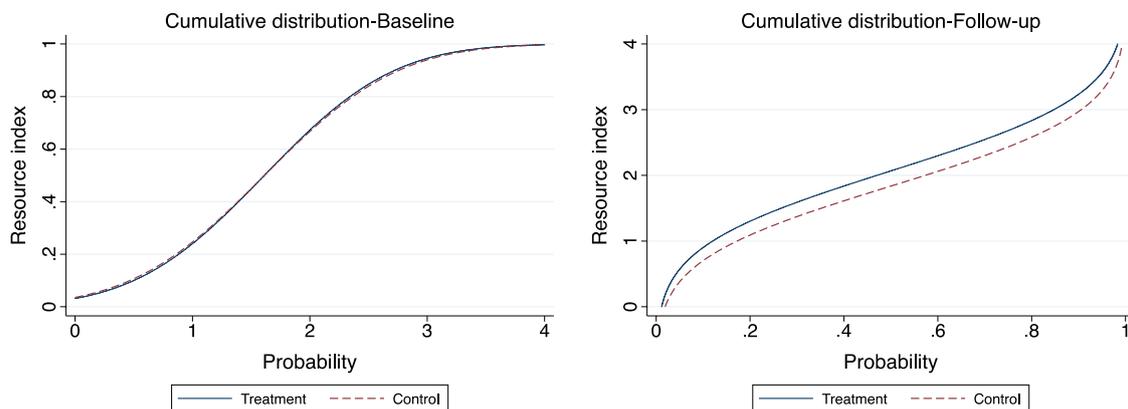
Appendix

See Figs. 3 and 4 and Tables 6 and 7.

Panel A2. Pooled sample (N=2,533)
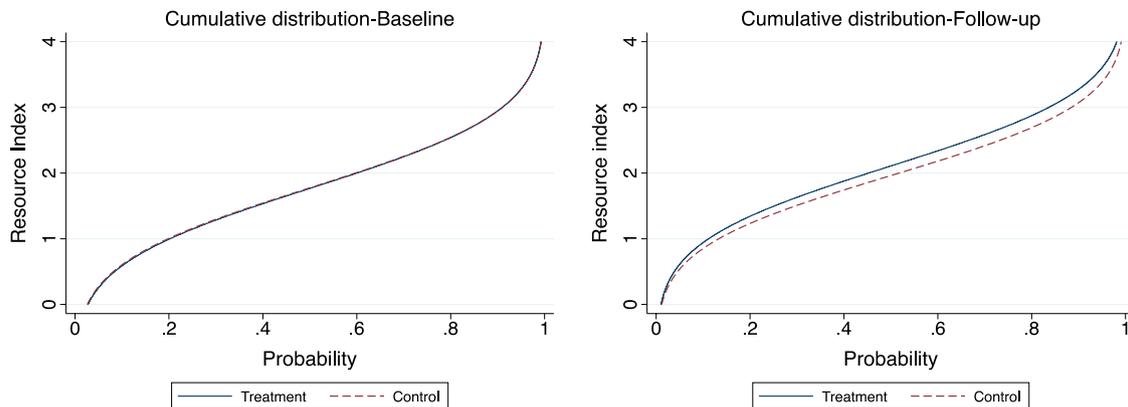
Panel 2. Poorest half sample (N=1,267)
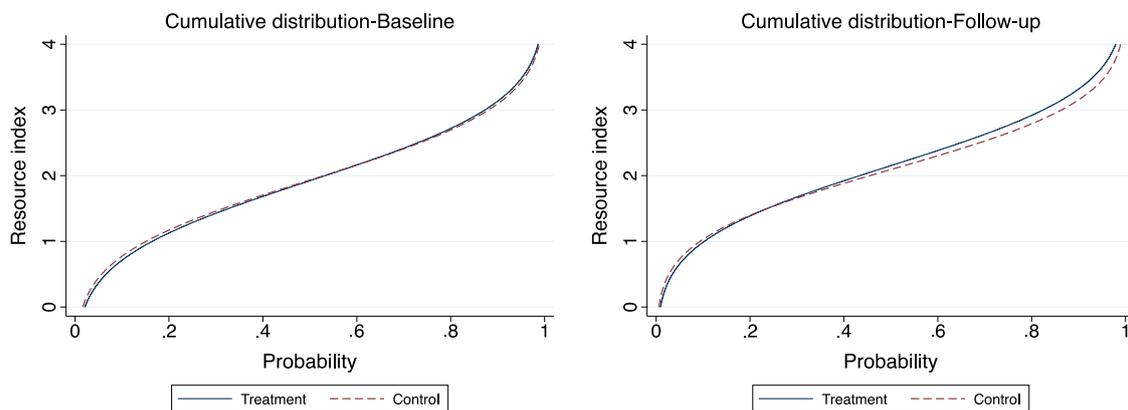

Panel 3. Top half sample (N=1,265)

Fig. 3 Cumulative distribution functions (CDFs) for the economic index. CDFs show the cumulative distribution of the economic index separately for treatment and control arms across baseline and follow-up visits. Panel 1 shows the distributions for full sample, while panels 2 and 3 divide the sample by baseline poverty status (panel 2, bottom half; panel 3, top half)
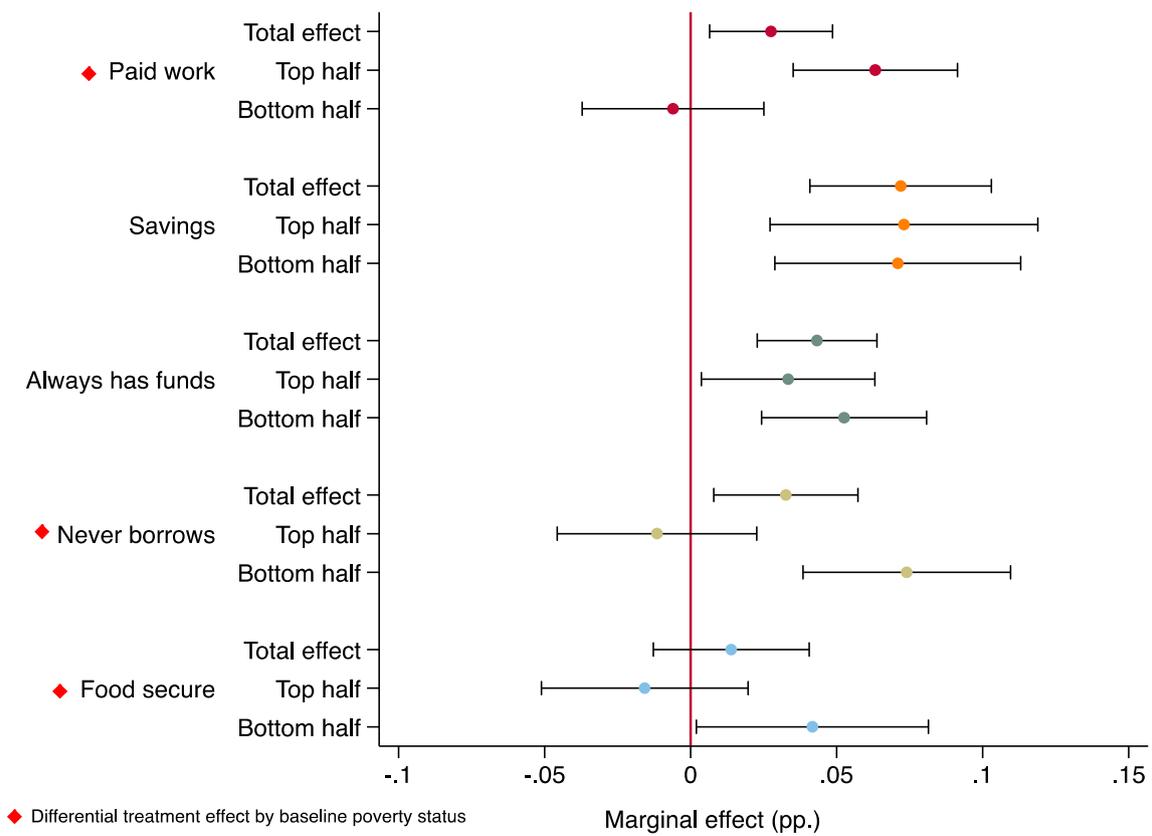
Fig. 4 Marginal effects for the impact of the CCT on young women's economic participation and resources. *Notes* Marginal effects for the total treatment effect and by baseline poverty status (top or bottom half). Estimates provided with 95% confidence interval bars (insignificant results cross the vertical line at 0)

Table 6 Baseline comparison between young women from the poorest (bottom half) of households to the top half at baseline

	% (unless otherwise stated)	
	Bottom half N = 1265	Top half N = 1267
Demographics		
Age	15.7	15.4
Household size	6.9	5.4
Ever had sex	28.8	26.0
Any sexual partner past 12 months	28.5	25.5
Transactional sex[a]		
Older sexual partner (5+ years)[a]	2.0	2.0
Any unprotected sex (past 3 months)[a]	33.2	26.6
Sexual relationship power scale (0–24)[a]	15.1 (SD 6.1)	16.1 (SD 5.8)
Hope score (0–39)	30.7 (SD 7.2)	31.7 (SD 6.9)
Child's Depression Index 10 item (0–18)	4.6 (SD 3.1)	4.4 (SD 3.0)
Young women's economic resources		
Always had spending money	8.2	12.5
Top three sources of young woman's funds		
Job	25.4	21.7
Family	27.2	36.9
Grants to the household	11.7	9.9
Engaged in paid work	17.9	14.2
Savings	19.5	30.4
Bank or post office account	12.4	19.9
Ever borrowed money 'to get by'	23.6	21.2
Food worry (young woman, past 12 months)		
Household SES		
Household monthly per capita consumption (mean Rand)	182.5	740.5
Household monthly per capita food consumption (mean Rand)	120.6	350.4
Asset Index (mean, range 0–61)	12.6	15.9
Number of grants to the household	3.1	2.3

p values based on equality of means tests with robust standard errors

[a]Only for young women who had ever had sex (N = 693)

Table 7 Impacts of CCT on Young women's economic resources and moderation by baseline poverty

	Coefficient (SE)							
	Paid work		Savings		Discretionary funds		Never borrow	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCT	0.03*** (0.01)	0.06*** (0.01)	0.07*** (0.02)	0.07*** (0.02)	0.04*** (0.01)	0.04** (0.02)	0.03** (0.01)	− 0.01 (0.02)
CCT*baseline poverty		− 0.07*** (0.01)		0.00 (0.03)		− 0.01 (0.01)		0.08*** (0.03)
Baseline poverty		0.07*** (0.01)		− 0.06** (0.02)		0.02 (0.02)		− 0.06*** (0.02)
Observations	4997	4980	5017	5000	4996	4979	5001	4984

GEE linear estimates with robust standard errors, adjusted for age. Baseline poverty is defined as being in the bottom half of households for total per capita household consumption at baseline

*p < 0.1; ** p < 0.05; ***p < 0.01

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