The Impact of a Cash Transfer Program on Contraception Utilization in Ecuador: A Regression Discontinuity Approach

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Funding sources:
Research reported in this publication was supported by Population Studies and Training Center (PSTC) at Brown University through the generosity of the Eunice Kennedy Shriver National Institute of Child Health and Human Development (P2C HD041020 and T32 HD007338). This work was also facilitated by the Providence/Boston Center for AIDS Research (P30AI042853).

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

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Abstract

Conditional cash transfer (CCT) programs have become important constituents of social protection policy in Latin America. By establishing co-responsibilities tied to health and education, CCTs aim to reduce poverty and encourage human capital investment. Although CCT programs have been found to have unintended effects in sexual and reproductive health outcomes, these effects have been mixed and barely documented in South America. The present study examines the impact of Ecuador's cash transfer program, the Bono de Desarrollo Humano (BDH), on the contraceptive behavior of women of childbearing age. It also explores the role of female empowerment and sexual and reproductive health knowledge as intermediary outcomes in the association between program participation and contraceptive use. We analyze nationally representative data with the quasi-experimental method of regression discontinuity. Using non-parametric local polynomial regression and a full set of robustness checks, our study finds no significant effects of the program on contraceptive use, female empowerment, or knowledge. We investigate and discuss potential explanations for the absence of association that are related to our intermediary outcomes. Our findings are initial steps to investigate the unintended effects of anti-poverty programs in South America. Current and future studies should build on and expand the causal mechanisms through which CCTs might influence sexual and reproductive health outcomes, as well as continue to explore the unintended effects of CCTs.

Keywords

Conditional cash transfer program; regression discontinuity; contraceptive use; sexual and reproductive health; Ecuador.

Highlights

- We measure the effect of Ecuador's conditional cash transfer program on contraceptive use among women of childbearing age.
- We use regression discontinuity design to isolate the program effects for women at both sides of the program eligibility threshold.
- We test specific pathways: female empowerment and sexual and reproductive health knowledge.
- We find no effects of the CCT program on contraceptive use, female empowerment and sexual or reproductive health knowledge.

Acknowledgements
This study was facilitated by the Providence/Boston Center for AIDS Research (P30 AI042853). We are grateful to the Population Studies and Training Center at Brown University (P2C HD041020 and T32 HD007338) for general support. The content and findings of this publication are solely the responsibility of the authors and do not represent the official views of any of our sponsors. The funding source(s) had no role in the study design; in the analysis and interpretation of data; in the writing of the article; or in the decision to submit it for publication.

1. Introduction

The *Bono de Desarrollo Humano* (BDH) is a conditional cash transfer (CCT) program in Ecuador that targets families who live in poverty. On December 22, 2017, Ecuador's President Lenin Moreno announced a new policy that raises the monthly monetary transfers from 50 USD to 150 USD according to the number and age of children living in beneficiary households (El Universo, 2017). A similar payment scheme implemented in Honduras was found to provide inadvertent large incentives for childbearing that increased fertility rates (Stecklov, Winters, Todd, & Regalia, 2007). Household childbearing decisions respond to economic incentives, so structural programs that do not target reproductive behavior change directly may still have (positive or negative) unintended effects on sexual and reproductive health outcomes.

The findings for the effects of cash transfers on contraceptive use – a key proximate determinant of fertility (Bongarrts, 1978) - have been mixed (Khan, Hazra, Kant, & Ali, 2016). While a study in India indicated that CCT beneficiaries were more likely to use contraceptives (Zavier & Santhya, 2013), studies in Nicaragua and Malawi found no association (Baird, Chirwa, McIntosh, & Özler, 2010; Stecklov et al., 2007). In the case of Mexico's CCT program, *Oportunidades*, impact evaluations found higher rates of contraceptive use among female beneficiaries than non-beneficiaries (Darney et al., 2013). However, this effect was short-term (Feldman, Zaslavsky, Ezzati, Peterson, & Mitchell, 2009) and only observed among non-married women (Stecklov et al., 2007) and the poorest women (Lamadrid-Figueroa et al., 2010).

The present study investigates whether Ecuador's CCT program, the BDH, increases contraceptive use among female beneficiaries. We explore the potential roles of women's empowerment and sexual and reproductive health knowledge as intermediate channels in the causal association between program participation and contraceptive use. We use nationally-representative data along with a rigorous regression discontinuity (RD) design to estimate program effects. Following Moscoe et. al.'s (2015) recommendations and Calonico et al.'s (2014) methods for robust RD practices, we do not find evidence that Ecuador's CCT program improves contraception use, knowledge, or empowerment of female beneficiaries. These results indicate that money transfers to women alone are insufficient to enact changes in contraceptive use in Ecuador.

The primary contributions of this paper are its subject matter and rigorous empirical approach. First, the present study contributes to the literature that examines the impact of Latin American CCT programs on sexual and reproductive health outcomes. While this topic has been well documented in Mexico, it has not been studied in smaller countries like Ecuador. To the best of our knowledge, this is the first study to evaluate contraceptive use among female beneficiaries of the Ecuadorian CCT program. Second, we implement a quasi-experimental method of RD. This design provides a good counterfactual to evaluate the program by comparing women at both sides of the BDH eligibility threshold who had similar characteristics except for their program participation status. Third, our estimates rely on a non-parametric identification that is robust to mild continuity conditions (Cattaneo, Calonico, & Titiunik, 2015). Fourth, because our analytical sample was restricted to women who were sexually active and did not want to have children, our results demonstrate the impact of CCTs on those beneficiaries who are in real need of contraception.

The remainder of this paper proceeds as follows. Section 2 provides background information on Ecuador's *Bono de Desarrollo Humano*. Section 3 presents the conceptual framework that guides our impact evaluation. Section 4 describes our data source, variable measures, RD design, and robustness checks. Section 5 presents the results for our primary and

intermediate outcomes. Finally, section 6 discusses possible explanations for our observed results, presents the limitations of the study, and suggest directions for future work.

1. Institutional Background

CCT programs have become increasingly popular approaches to social protection worldwide, especially in Latin America. They emerged in the late 1990s as attempts to address the inefficiency and clientelism tied to the previous-generation social protection programs (Holmes, Jones, Vargas, & Soares, 2010). Ecuador's *Bono de Desarrollo Humano* was established in 2003 to reformulate the *Bono Solidario* that unconditionally compensated women from poor households for the elimination of gas and electricity subsidies. Since then, the BDH has become a large national program. In 2017, more than 423,000 households (over 1.6 million people) benefited from the program, which had a budget of over 383 million USD the same year (El Universo, 2017). Following a gendered payment approach, almost every BDH monetary transfer is given directly to the female representative or caregiver of each household (Armas, 2005).

Ecuador's BDH, like all CCT programs, aims to encourage human capital investment and break the intergenerational transmission of poverty by establishing health and education co-responsibilities that beneficiaries must meet to receive the transfers. Some conditions to be enforced in theory by the BDH include: five prenatal visits for pregnant women, school attendance rate of at least 80% for family members aged 5-18, and bimonthly medical check-ups for children under the age of five (Martinez, Borja, Medellín, & Cueva, 2017). Although households are informed of their co-responsibilities as BDH beneficiaries, there is no systematic process in place to verify adherence or to penalize noncompliance (Martinez et al., 2017).

The targeting and selection process of BDH beneficiaries is revised and updated every 5 years[i]. A component that has not changed since the institution of the program is that beneficiary households are selected based on a socioeconomic status (SES) index (Armas, 2005). This index is built using the proxy means test of non-linear principal component analysis (non-linear PCA) (Martinez et al., 2017) and a scaling method (from 0 to 100) that facilitates the ordering of households' socioeconomic status in increasing manner. In 2009, the closest year to the implementation of the ENSANUT (survey used, described below), the BDH eligibility threshold was 36.5 (Martinez et al., 2017). This meant that households with SES index scores below 36.5 were eligible to receive the BDH. That same year, the indicators used to build the SES index included 34 variables that covered information about housing characteristics, access to services, availability of assets, family composition, and education attainment (Martinez et al., 2017).

2. Conceptual Framework

This study examined whether female empowerment and sexual and reproductive health knowledge are potential pathways through which the BDH could impact contraceptive use. For this purpose, we developed a conceptual framework (**Figure 1)**, drawing from Gaarder et al. (2010), Glassman et al. (2013), and Blackstone at al. (2017).

Women's empowerment has been consistently found to be an important determinant of access to care and health status for mothers and children (Pratley, 2016). However, there is little agreement on how to categorize and aggregate indicators to measure female empowerment given

[i]Appendix A summarizes the evolution of the identification process of program participants.

its multidimensional nature (Malhotra, Schuler, & Boender, 2002; Peterman, Schwab, Roy, Hidrobo, & Gilligan, 2015; Pratley, 2016). Despite the discrepancies in variable construction, and therefore, in findings, the empirical literature seems to support a positive relationship between female empowerment and contraceptive use (Malhotra et al., 2002; Prata et al., 2017). Likewise, studies have found positive effects of sexual and reproductive health knowledge on contraceptive use (Blackstone et al., 2017), particularly in the use of modern hormonal methods (Williamson, Parkes, Wight, Petticrew, & Hart, 2009).

Just as empowerment and knowledge may increase contraceptive use, Ecuador's CCT program has the potential to enhance women's empowerment and knowledge. CCT programs that provide monetary transfers to women affect not only households' resources, but also the distribution of those resources among household members. There have been mixed results regarding the impact of CCTs on female empowerment (Peterman et al., 2015). Proponents of CCTs argue that gendered cash payments increase women's economic and bargaining power within the household, while other analysts caution that these targeting mechanisms reinforce women's traditional roles as caregivers (Armas, 2005; Holmes et al., 2010). Evidence for the effects of CCTs on sexual and reproductive health knowledge is also equivocal largely due to differences in program specifications. However, the BDH has been found to have a large positive impact on school enrollment (Schady & Araujo, 2006). School might give women greater exposure to information about sexual and reproductive health, as well as greater agency to act upon this knowledge due to steady social support networks. Therefore, by promoting women's empowerment and access to information, the BDH may increase contraceptive use of beneficiaries.

(Figure 1 here)

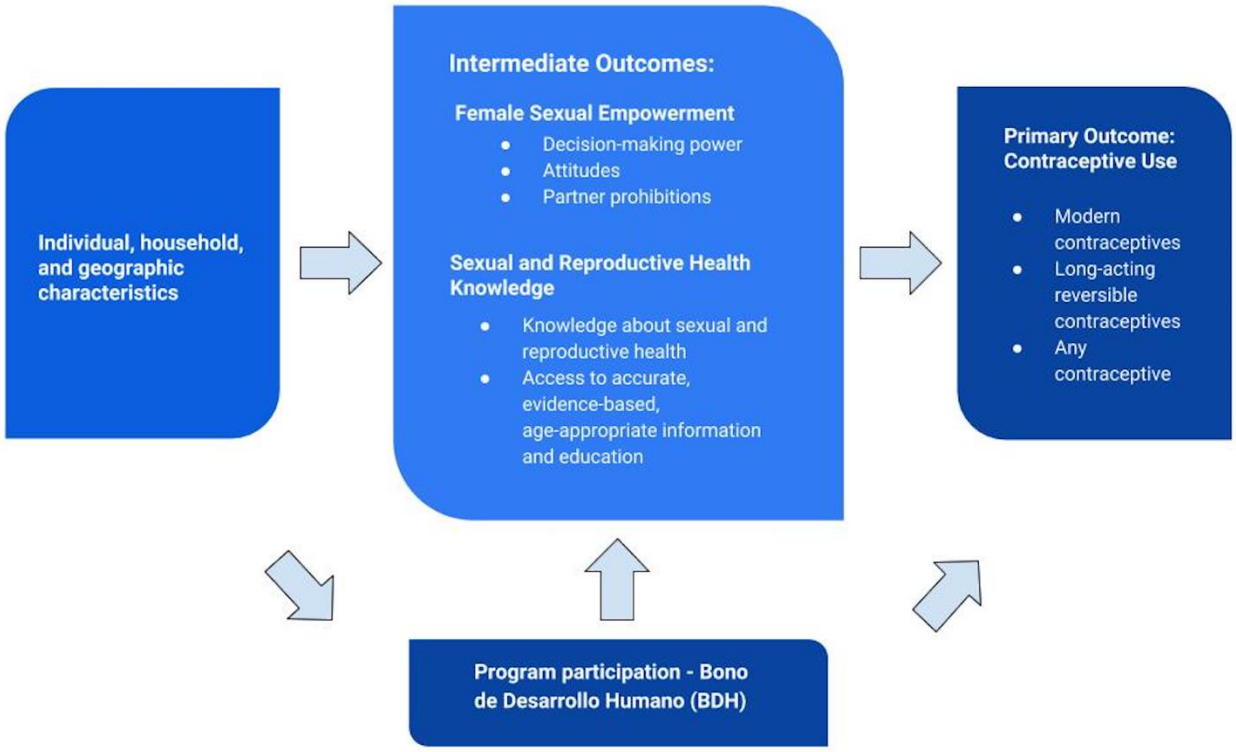

Figure 1: Conceptual framework. Source: Authors, drawing from Gaarder et al. (2010), Glassman et al. (2013), and Blackstone at al. (2017).

3. Empirical Approach

(a) Data

The data analyzed in this study came from the National Survey of Nutrition and Health (ENSANUT), a nationally representative survey of the Ecuadorian population. It was conducted in 2012 by the Ministry of Public Health and the National Institute of Statistics and Census. Using households as the unit of analysis, ENSANUT collected socio-economic, demographic, and housing information of all household members. Additionally, the survey's records correspond to a series of detailed questionnaires on the sexual, reproductive, maternal, child, and nutritional health of respondents.

For our analyses, we restricted the sample in two ways. First, we only considered the data from women who completed the questionnaire on maternal and reproductive health. This questionnaire was administered to one woman of reproductive age (12 – 49 years) per household. Second, we restricted the sample to women who reported being sexually active in the past month and not wanting to have children. These women are those who are in need for contraception and, therefore, to whom our primary outcomes are applicable. A total of 5,132 women – and their respective households – met our inclusion criteria for the analytical sample.

Table 1 describes the baseline characteristics of households and women by BDH participation status. If the head of the household and/or his/her spouse reported to be a recipient of the BDH, that household and, consequently all of its members, were considered BDH beneficiaries. **Table 1** indicates that beneficiaries and non-beneficiaries are markedly different in most of the selected variables. Compared to non-beneficiaries, beneficiaries live in bigger households with a higher percentage of illiterate, indigenous, and male heads. Regarding characteristics of women, a higher percentage of BDH recipients identify as indigenous, have a lower education attainment, and are married. Finally, female beneficiaries have more children who are alive than female non-beneficiaries. These substantial differences by program participation status are consistent with the target population of the BDH.

(Table 1 here)

Table 1: Descriptive statistics for the complete analytical sample (N=5132) by BDH participation status

	Beneficiaries (Std. Dev.) (n = 1960)	**Non-beneficiaries (Std. Dev.) (n = 3171)**	**Two-Sided P-value of Difference**
Household characteristics			
Household size	5.62 (1.96)	4.64 (1.65)	< 0.001
Household members aged ≤ 18	3.28 (1.60)	2.32 (1.18)	< 0.001
Household head is illiterate (%)	3.52	1.26	< 0.001
Household head is indigenous (%)	22.50	8.92	< 0.001
Household head is female (%)	9.44	12.14	0.003
Women characteristics			

Age	32.37 (7.68)	32.01 (8.24)	0.108
Ethnicity			< 0.001
Indigenous (%)	23.21	9.55	
Mestizo (%)	67.14	81.53	
Black (%)	3.06	3.47	
White (%)	1.38	1.89	
Other (%)	5.20	3.56	
Education			< 0.001
Without instruction (%)	3.16	0.88	
Literacy Center (%)	1.28	0.25	
Elementary (%)	56.84	25.47	
Middle School (%)	32.40	47.16	
High School (%)	3.57	5.74	
Superior (%)	2.76	20.49	
Marital Status			0.01
Single (%)	3.72	4.89	
Married or common law (%)	91.48	88.84	
Divorced, separated, or widow (%)	4.80	6.27	
Number of live children	3.62 (2.02)	2.46 (1.38)	< 0.001

Source: Authors' calculations, ENSANUT survey (2012).

(a) Estimation Strategy

(i) Variable Measures

Our primary analyses measured the effect of BDH participation on the use of modern contraceptives, long-acting reversible contraceptives, and any contraceptive method. Modern contraceptive methods include, among others, female/male condoms, female/ male sterilization, birth control pills, intrauterine devices (IUDs), and hormonal injectables or implants. Long-acting reversible contraception limits this list to intrauterine devices and systems (IUDs and IUSs), contraceptive injections, and contraceptive implants. Finally, traditional methods encompass periodic abstinence, withdrawal, and teas/herbs. Adhering to this classification, the outcomes of interest for our main analyses were indicator variables representing the use of (1) modern contraceptives, (2) long-acting reversible contraceptives, and (3) any contraceptive (either modern or traditional methods) in the past month.

Our secondary analyses assessed the role of female empowerment and sexual and reproductive health knowledge as potential intermediate outcomes in the causal association between program participation and contraceptive use. We operationalized women's empowerment at the household level with three domains: decision-making power, partner prohibitions, and attitudes. Decision-making power was gauged with two questions related to the decision-making process of the first and current contraceptive method and one related to the choice of delivery facility of the last child. Partner prohibitions were assessed with one questions about sterilization and one about condom use. Attitudes were measured with three questions regarding perceived gender roles in asking for and deciding on the use of contraceptive methods. Given the skip

patterns of the ENSANUT survey, 1,765 women had complete information on our empowerment indicators. Therefore, our analyses of female empowerment are restricted to this subsample.

The indicators for sexual and reproductive health knowledge did not only measure knowledge but also women's access to accurate, evidence-based, age-appropriate information (Sneha Barot , Susan A. Cohen , Jacqueline E. Darroch , Alanna J. Galati , Chelsea Polis, 2015). We selected four questions that gauged women's knowledge about sexual and reproductive health. Two questions asked respondents about their (spontaneous) familiarity with several family planning methods and sexually transmitted infections (measured as the number of methods and ITSs they are familiar with). A third question asked for their opinion as to whether a woman can get pregnant the first time she has sexual relations, and the fourth question asked about women's understanding of menstruation when they got their first period. We assessed women's access to information on topics of sexual and reproductive health with three questions that asked respondents whether they had received information about uterine cancer, breast cancer, and breast self-examination. All respondents in our analytical sample had information on our knowledge indicators.

We performed non-linear principal components analysis (PCA) to construct both the empowerment and knowledge indices. Following the considerations of Linting and colleagues (2012), the three-dimension non-linear PCA solution was considered the most adequate for the empowerment index and the two-dimension non-linear PCA solution was considered the most adequate for the knowledge index. The first three dimensions of the empowerment index explained 48.18% of the total variance and had a Cronbach's coefficient alpha of 0.85. Similarly, the first two dimensions of the knowledge index explained 47.4% of the total variance and had a Cronbach's coefficient alpha of 0.82 Following procedures adopted in previous research (Antony & Visweswara Rao, 2007; Sekhar, Indrayan, & Gupta, 1991), we built the composite indices as weighted sums of the obtained dimension scores for each household. We then standardized the indices so that they range from 0 to 100, 0 indicating lower empowerment and knowledge[ii].

(ii) Regression Discontinuity Design

We exploited the eligibility rule of the BDH and implemented a regression discontinuity (RD) design to identify the effect of the BDH on our primary and secondary outcomes. As stated earlier, BDH participation is determined by the SES index and, based on 2009 government guidelines, is intended for households scoring below 36.5 (Martinez et al., 2017). **Figure 2** illustrates that this rule generates a strong discontinuity in the probability of receiving the BDH at the eligibility cut-off point. Specifically, the probability of being a BDH beneficiary is about 10 percentage points greater for households with scores below 36.5 than for those with scores above 36.5. RD design assumes that the discontinuity in the conditional probability of program participation is unrelated to potential confounders. Consequently, RD infers that a difference in outcomes between beneficiaries and non-beneficiaries around the eligibility threshold is the direct result of program participation. These features make RD a rigorous quasi-experimental method that, under certain conditions that are evaluated subsequently, isolates program causal effects (Moscoe et al., 2015).

[ii] The construction of the empowerment and knowledge indices is available in Appendices B.1. and B.2., respectively.

(Figure 2 here)

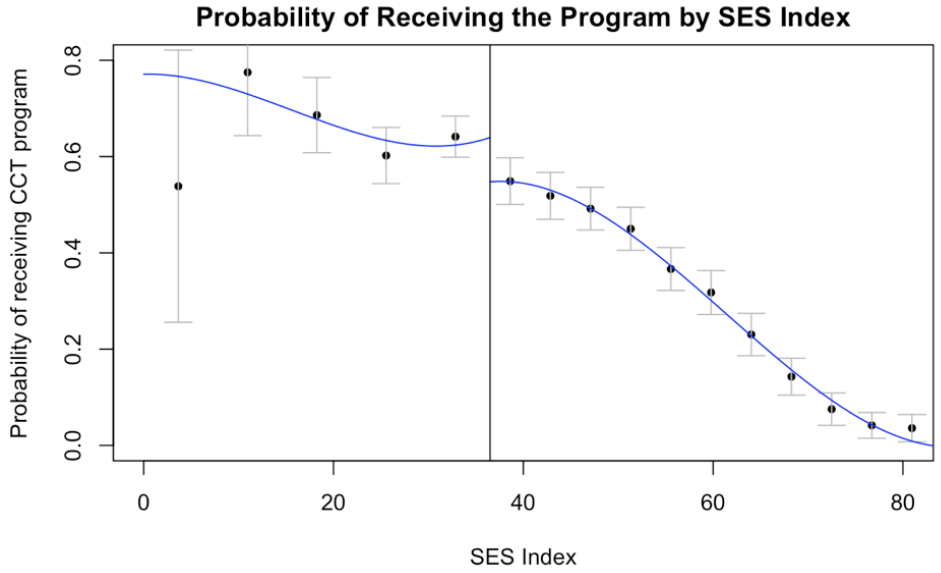

Figure 2: Probability of receiving the BDH by SES index score with 95% confidence intervals. Source: Authors' calculations using the *rdplot* command from *rdrobust* package in R (Cattaneo et al., 2015), ENSANUT survey (2012). Notes: The vertical line at 36.5 indicates the RD eligibility threshold (Martinez et al., 2017). We use a global cubic polynomial function with triangular kernel on both sides of the cut-off and the mean integrated squared error (IMSE)-optimal number of bins choice for evenly spaced bins.

It is noteworthy that, because the conditional probability of receiving the BDH does not drop from 1 to 0 at the eligibility threshold, program participation is not strictly governed by the SES index. As shown in **Table 2**, there is a high percentage of "non-compliance" between program eligibility and program participation. Only 64% of eligible households received the BDH, compared to 32% of non-eligible households. Given that program participation depends only stochastically on households' SES index scores, we relied on a fuzzy RD strategy.

(Table 2 here)

Table 2: Assignment rule and program participation status of total analytical sample (N=5132).

Program participation status	**SES Index Score**		
	Above cut-off point*	**Below cut-off point***	**Total**
Non-beneficiaries	2830 (67.7%)	342 (35.9%)	3172
Beneficiaries	1350 (32.3%)	610 (64.1%)	1960
Total	4180 (100%)	952 (100%)	5132

Source: Authors' calculations, ENSANUT survey (2012). *SES index cut-off point is 36.5 based on Martínez and colleagues (2017).

RD estimates reflect local average program effects at the eligibility threshold because they are based on observations just above and below the eligibility cut-off point. The fuzzy local average program effect is the ratio between the difference in average outcomes for program

beneficiaries and non-beneficiaries divided and the difference in program participation rate for both groups within a bandwidth around the eligibility threshold (Lee & Lemieux, 2010) . We can write this as:

$$\tau_{FRD} = \frac{\lim_{\varepsilon \downarrow c} \mathrm{E}[Y|X = c + \varepsilon] - \lim_{\varepsilon \uparrow c} \mathrm{E}[Y|X = c + \varepsilon]}{\lim_{\varepsilon \downarrow c} \mathrm{E}[P|X = c + \varepsilon] - \lim_{\varepsilon \uparrow c} \mathrm{E}[P|X = c + \varepsilon]}$$

where Y denotes the outcome of interest, P represents program participation status, X_i is the SES score, c is the SES cut-off point of 36.5, and ε is the error term.

We calculated τ_{FRD}, the local average program effects at the cut-off in a fuzzy RD design, with a non-parametric approach described extensively by Calonico and colleagues (2018, 2017; 2014; 2015). Our estimates are based on local linear regressions implemented before and after the cut-off by means of triangular Kernel, with observations closer to the eligibility threshold receiving greater weight. Choosing an appropriate bandwidth around the threshold is a key consideration in RD design. We employed a data-driven mean-squared error (MSE) – optimal bandwidth selection procedure to reduce the variance-bias trade-off of our estimates. An order-1 polynomial function was selected to optimize the bandwidth selection procedure and to reduce potential over-fitting. Additionally, we controlled for several variables to increase the precision and efficiency of the estimation. We implement these methods with the *rdrobust* package in R (Cattaneo et al., 2015).

(iii) Estimation of the Socioeconomic Status (SES) Index

The implementation of the RD design discussed above requires information on households' SES index scores. Following 2009 government guidelines (Martinez et al., 2017), we estimated the SES index for every household using non-linear PCA. The ENSANUT data had information on 18 of the 34 variables used for the construction of the 2009 SES index. The variables included households' area (i.e. urban/rural), land ownership, durable asset ownership (i.e. shower, color TV, refrigerator, telephone, car, stereo, DVD, kitchen), housing characteristics (i.e. type of toilet facility, type of floor materials, main source of lighting and cooking, and number of bedrooms in the dwelling), family composition (i.e. number of children under the age of six), and sociodemographic characteristics (i.e. household head is indigenous and illiterate). Through non-linear PCA, we reduced these 18 variables to two dimensions, which together accounted for 30.53% of the total variance and had a Cronbach's coefficient alpha of 0.87. We built the composite SES index just as we built the empowerment and knowledge indices. That is, we computed the weighted sum of the obtained dimension scores for each household and then standardized the index so that it ranges from 0 to 100, 0 indicating lower socioeconomic status[iii].

5. Empirical Results

(a) Primary Outcomes

Table 3 presents fuzzy RD average program effects on our three primary outcomes of contraceptive use. The table contains three specifications, which include baseline independent variables that have been found to influence contraceptive use (Mochache, Lakhani, El-Busaidy, Temmerman, & Gichangi, 2018; National Research Council (US) Working Group., 1993). The first specification includes women's characteristics such as age, second-degree polynomial of age,

[iii] The construction of the SES index is available in Appendix B.3.

ethnicity, marital status, education level, number of live children. The second specification includes – in addition to those in the first specification – three household variables indicating whether the head of the household is illiterate, indigenous, and female, as well two variables that capture household composition (i.e. size of the household and number of children under the age of 5). The third specification includes – in addition to the variables in the second specification – census geographic information (i.e. area, sector, and zone).

(Table 3 here)

Table 3: Fuzzy RD average program effects on contraceptive methods

Primary Outcomes	**(1)**	**(2)**	**(3)**
Modern Contraceptive Methods			
Beta Coefficient	0.127	0.176	0.466
(Std. Error)	(0.908)	(1.211)	(2.312)
Sample Size	1925	1844	1723
Long-Acting Reversible Contraceptive Methods			
Beta Coefficient	0.050	-0.107	0.198
(Std. Error)	(1.020)	(1.329)	(2.498)
Sample Size	1820	1799	1633
Any Contraceptive Method			
Beta Coefficient	0.317	0.489	0.873
(Std. Error)	(0.888)	(1.263)	(2.570)
Sample Size	1851	1784	1708
Controls			
Women Characteristics	✔	✔	✔
Household Characteristics		✔	✔
Geographic Characteristics			✔

Source: Authors' calculations using the *rdrobust* command from the *rdrobust* package in R (Cattaneo et al., 2015), ENSANUT survey (2012). Notes: *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged $\leq$ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone).

The estimates in **Table 3** represent the estimated marginal effect of BDH participation on the probability of contraceptive use. While at first glance the BDH seems to have an overall positive effect on contraceptive use, none of the estimates are statistically significant. The change in the value of the estimates as we move along the table from left to right are possibly attributed to differences in observable characteristics. Specifically, although insignificant, the impact of program participation on contraceptive use increases considerably when controlling for households' region, area, and zone (specification 3). **Figure 3** presents the reduced-form results for specification 2 graphically. In RD design, we measure the effect of program as the size of the

discontinuity at the cut-off point (Calonico et al., 2014). Although there are visible discontinuities in the probability of using modern (graph A) and long-acting reversible (graph B) contraception at the eligibility threshold, they are utterly small. There is not a clear jump at the threshold for any contraceptive method (graph C). Therefore, there is largely no evidence of a positive effect of BDH participation on the use of modern, long-acting reversible, and any contraceptive methods.

(Figure 3 here)

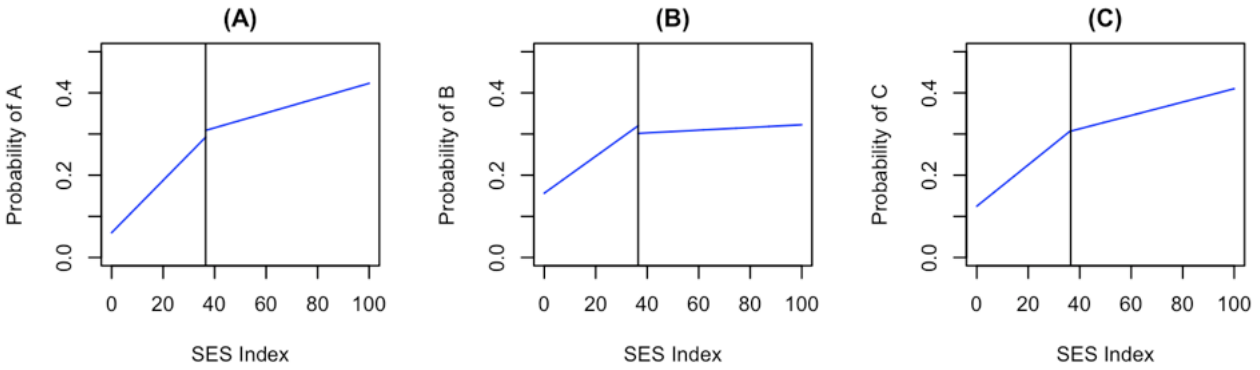

Figure 3: The program effect on contraceptive use in reduced-form using specification 2. (A) Modern contraceptive methods. (B) Long-acting reversible contraceptive methods. (C) Any contraceptive method (both modern and traditional). Source: Authors' calculations using the *rdplot* command from *rdrobust* package in R (Cattaneo et al., 2015), ENSANUT survey (2012). Notes: The vertical line indicates the RD cut-off (Martinez et al., 2017).

(b) Potential Mechanisms

Table 4 presents fuzzy RD average program effects on female empowerment and sexual and reproductive health knowledge. While the estimates for the empowerment index are implausibly large and positive, those for the knowledge index are reasonably sized. However, all the estimates are statistically insignificant, suggesting that BDH participation does not affect female empowerment or sexual and reproductive health knowledge.

(Table 4 here)

Table 4: Fuzzy RD average program effects on empowerment and knowledge indices

Intermediate Outcomes	(1)	(2)	(3)
Empowerment Index			
Beta Coefficient	133.814	99.177	69.678
(Std. Error)	(349.403)	(189.224)	(104.927)
Sample Size	488	490	483
Knowledge Index			
Beta Coefficient	-8.124	2.411	13.258
(Std. Error)	(21.409)	(25.768)	(49.540)
Sample Size	2061	1910	1787
Controls			
Women Characteristics	✔	✔	✔
Household Characteristics		✔	✔
Geographic Characteristics			✔

Source: Authors' calculations using the *rdrobust* command from the *rdrobust* package in R (Cattaneo et al., 2015), ENSANUT survey (2012). Notes: *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged $\leq$ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone).

(c) Validity of Regression Discontinuity Design:

We assessed the validity of our RD design in two ways. First, we tested whether the program assignment variable (i.e. the SES index score) is continuous near the cut-off value visually and numerically. **Figure 4** presents the distribution of the SES index. The "bunching" in the left side of the eligibly threshold suggests that there might be some manipulation of the assignment variable. This is a concern discussed in RD design, particularly when applied to CCT programs, because households or implementers could sway statements (i.e., responses to official government surveys) to move to the left of the eligibility threshold. Manipulation of the assignment variable may bias and threaten the validity RD estimates. **Figure 4** demonstrates that this could be the case, so we formally tested for manipulation. Relying on the methodology proposed by Cattaneo and colleagues (2016), we performed a manipulation test using local polynomial density estimation. We found no evidence of discontinuity of the assignment variable at the cut-off point (t-statistic of 0.814 and p-value of 0.412), so the program is locally randomized (Lee & Lemieux, 2010).

(Figure 4 here)

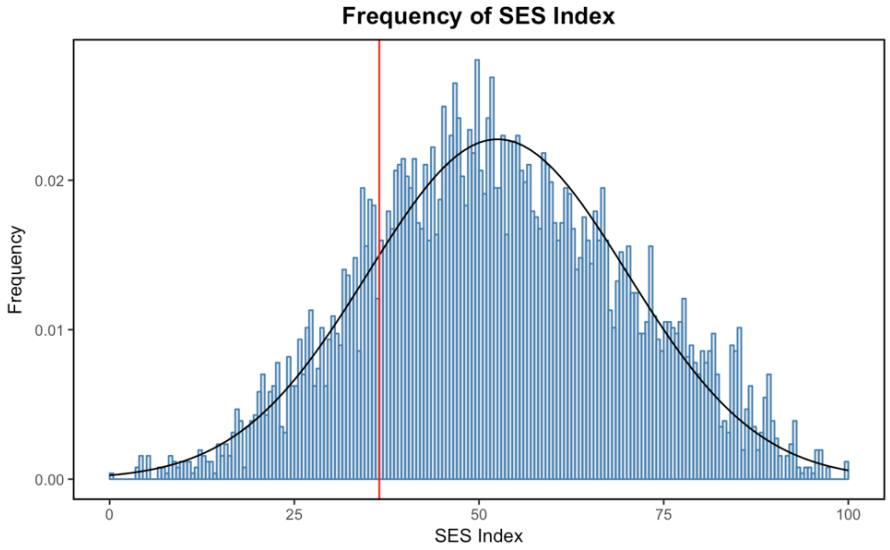

Figure 4: Distribution of SES index. Source: Authors' calculations, ENSANUT (2012). Notes: The vertical line represents the BDH eligibility threshold of 36.5 (Martinez et al., 2017).

Second, we tested the continuity of covariates around the cut-off. That is, we examined whether observed baseline covariates are locally balanced on either side of the cut-off (Moscoe et al., 2015). We performed formal RD estimation by replacing the dependent variable with each of the observed baseline covariates and found no evidence of significant discontinuity at the cut-off in any of the covariates (data not shown). We concluded that there are no covariates that are discontinuously associated with the outcome at the eligibility threshold. The assessment of these two conditions confirm the validity of our RD design.

(d) Robustness Checks

To ensure that our results are not sensitive to our non-parametric methodology or to specific choice of bandwidth, we report fuzzy RD local average effects using an instrumental variable (IV) approach for several bandwidths centered at the cut-off value of 36.5. These robustness checks were implemented using two-stage least squares (2SLS) linear probability models. 2SLS models address the endogeneity of program participation. Because the BDH purposely targets the poor, the program participation status is likely to be correlated with the error term, causing biased ordinary least squares estimators. Therefore, we estimated program participation as a function of an instrumental variable. We can write this first-stage equation as:

$$\boldsymbol{\tau_i = X_i\varphi + \gamma Z_i + \varepsilon_{1i}} \quad \textbf{(1)}$$

where $\boldsymbol{\tau_i}$ is an indicator variable of program participation, $\boldsymbol{X_i}$ is a vector of individual, household, and geographic characteristics, $\boldsymbol{Z_i}$ is the instrumental variable that equals 1 if the woman's SES index score is below the cut-off point and 0 if it is above, and $\boldsymbol{\varepsilon_{1i}}$ is an unobserved error term. Assuming that the instrument $\boldsymbol{Z_i}$ is uncorrelated with women's unobserved characteristics, we estimate program effects in the second-stage equation:

$$\boldsymbol{Y_i = X_i\beta + \alpha\hat{\tau}_i + \varepsilon_{2i}} \quad \textbf{(2)}$$

where $\boldsymbol{Y_i}$ represents each one of the three dependent variables of interest: (a) modern contraceptive use, (b) long-acting reversible contraceptive use, and (c) any contraceptive use (either modern or traditional methods), $\boldsymbol{\hat{\tau}_i}$ is obtained from Eqn. **(1)** and $\boldsymbol{\varepsilon_{2i}}$ is an error term. The estimate obtained

with Eqn. **(2)** is the local average program effect for the women whose SES index scores are within the optimal bandwidth.

We picked different bandwidths around the eligibility threshold by analyzing main baseline characteristics of participants within the selected intervals. The three reported bandwidths balance the trade-off between intervals that are small enough to ensure that women at each side of the cut-off point are comparable and wide enough to offer desired sample sizes. The 2SLS estimates of BDH participation on contraceptive use, female empowerment, and sexual and reproductive health knowledge are presented in Appendix C. Despite the changes in our estimation approach and choice of bandwidth, most of the estimates were statistically insignificant. The few results that were significant were implausibly large. This was most likely driven by the fact that the IV was found to be a weak instrument in all the models. Indeed, the correlation between the instrument and the endogenous variable was low given that the F-statistic of the first stage regression was smaller than 10 in all our models (Staiger & Stock, 1997). With this limitation in mind, we conducted a second set of robustness checks to verify whether our non-parametric findings were sensitive to the choice of the order of the polynomial regression. We fitted quadratic and cubic polynomial local regressions on both sides of the eligibility threshold with triangular kernels. Reassuringly, the results remained qualitatively unchanged when considering other functional forms (data not shown). These robustness checks confirm that our local estimates are not artifacts of our estimation strategy or choice of bandwidth.

4. Discussion and Concluding Remarks

To date, no study had assessed the impact of Ecuador's CCT program on beneficiaries' reproductive health behaviors. We found that the BDH does not have a direct effect on the use of modern, long-lasting reversible, or any other contraceptive methods. Our analyses on potential mechanisms that could influence the (lack of) association between the BDH and contraceptive use indicate that the program does not increase sexual and reproductive health knowledge. We offer three likely explanations for this null result that relate to our conceptual framework. First, while the health service utilization requirements of the BDH are opportunities to discuss sexual and reproductive health, the program does not mandate the content of counseling (Martinez et al., 2017). Therefore, topics like family planning may not be addressed during health visits. Second, school sex education is deficient in Ecuador. Up until 2009, the country did not have official materials to impart sex education at schools or strong legislation on the matter (Demaria, Galárraga, Campero, & Walker, 2009)[iv]. Third, although the BDH is in principle a *conditional* cash transfer program, cash payments are not strictly conditional on beneficiaries' adherence to the program co-responsibilities (Martinez et al., 2017). Without a normalized mechanism that penalizes beneficiaries for noncompliance, participants are more likely to evade the required

[iv] As an attempt to address the deficient sex education at schools and the high rates of teenage pregnancy, the Ecuadorian government implemented a politically progressive plan called National Intersectoral Strategy for Family Planning and Adolescent Pregnancy Prevention (ENIPLA) in 2011. Its efforts to promote access to sexual and reproductive health services and education are unlikely to have materialized by 2012, year when the ENSANUT survey was administered. In 2015, ENIPLA was replaced by a politically conservative program called the National Plan for Strengthening the Family (PNFF), which was in place until 2017. Emphasizing family's role in teaching sexual and reproductive health to adolescents, the PNFF promoted school sex education rooted on values and abstinence (Herrera Unapanta, 2016).

medical check-ups and school attendance conditions, obscuring the expected intermediate program outcomes.

The hypotheses discussed above are particularly relevant in a politically conservative country like Ecuador, where discussion about and openness to contraception are often tainted with concepts of morality, tradition, and machismo. Qualitative research has unearthed this context. Particularly, several studies conducted in Ecuador found moralistic constructions of women's sexual and reproductive health among health workers, who believed that contraception was inadequate for adolescents (Svanemyr, Guijarro, Riveros, & Chandra-Mouli, 2017) and thus sent contradictory messages regarding contraceptive use (Goicolea, Wulff, Sebastian, & Öhman, 2010). Another study indicated that parents held restricted views of sexuality that were grounded on repression, regulation, and supervision, especially for daughters (Jerves et al., 2014). Contextualizing sexuality as being exclusively relevant to adult married couples, parents often imparted abstinence-only sex education at home (Jerves et al., 2014). In such context, it might be difficult for women to change their sexual and reproductive health behaviors even when they receive appropriate, evidence-based reproductive health counseling.

Along with knowledge, female empowerment did not emerge as a potential pathway through which the BDH could influence contraceptive use. This finding might be an artifact of sample selection bias given that the analytic sample of our empowerment analyses was restricted to women who had information on all the indicators. A comparison of baseline characteristics of women included in and excluded from our empowerment analyses is presented in Appendix D. The groups were found to be significantly different, raising concerns of potential bias. Furthermore, our findings might reflect the inadequacy of the empowerment index at capturing actual female empowerment. Due to data constrains, our index included a limited number of empowerment domains that were directly related to reproductive and sexual health. The exclusion of other domains that are vital to encompass the multidimensional nature of empowerment – such as women's participation in household decision-making, freedom of mobility, and financial autonomy – suggests the narrow scope of our empowerment measure (Malhotra et al., 2002). Notwithstanding, cash transfers have been found to have no effect on female decision-making in Ecuador, irrespective of variations in composite indicator construction (Peterman et al., 2015).

This study has additional limitations that should be considered when interpreting our results. The ENSANUT data was cross-sectional in nature, so we were unable to assess the temporality between program participation and the outcomes of interest or the presence of outcome differences between BDH beneficiaries and non-beneficiaries at baseline. More importantly, we could not assess the change in contraception use, knowledge, or female empowerment across time. These shortcomings prevent us from inferring temporal relationships despite the use of a quasi-experimental RD design. Finally, our RD strategy estimated program effects only for women whose SES index scores were within the selected bandwidths around the cut-off point (i.e. local effects), and therefore, our findings are not generalizable to all beneficiaries.

We found that BDH cash transfers have no effects on contraceptive use. This is an important finding that could guide program planners to better implement social protection programs. We propose several recommendations for the advancement of the BDH. First, systematic enforcement and verification of beneficiaries' adherence to co-responsibilities are needed to ensure that families invest in human capital. Second, the implementation of program boosters that strengthen evidence-based sexual and reproductive health education and health care services are necessary to generate significant changes in contraceptive use. Third, systematic and well-documented evaluations of the impact of BDH participation on sexual and reproductive

health outcomes must take place. Future research should employ both experimental and non-experimental methods to assess how conditional cash transfers affect short- and long-term reproductive behaviors of beneficiaries.

Data Source

The ENSANUT data is publicly available in the following website:
http://www.ecuadorencifras.gob.ec/category/ensanut/

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Appendix A: Evolution of the identification process of program participants.

Table 5: Changes in the identification process of beneficiaries 2003-2013. Adapted from Martínez, Borja, Medellín, & Cueva (2017).

	2003	2009	2013
Targeting mechanism	Selben Index	Well-being Index	Well-being Index
Target population	Households living in poverty	Households living in poverty	Households living in extreme poverty
Cut-off point for eligibility	Quintiles 1 and 2	36.5	28.2
Organisms that compiled socioeconomic information	Public Universities	National Institute of Statistics and Census and Ministry Coordinator of Social Development	External surveyors hired by the Ministry Coordinator of Social Development

Appendix B: Construction of composite indices

Principal component analysis (PCA) reduces a large number of variables to a much smaller number of uncorrelated linear combinations of these variables, called principal components, that represent the observed data as closely as possible. Unlike linear PCA, non-linear or categorical PCA is suitable for variables of mixed measurement levels (i.e. nominal, ordinal, and numeric), and can handle and discover nonlinear relationships between variables. Following the recommendations of Linting et al. (2012), we performed non-linear PCA using the CATPCA program of the Categories module of SPSS.

To build a composite SES index for each household using either the first two or three principal components, we followed the guidelines from Antony et al. (2007) and Sekhar et al. (1991). Specifically, we computed a non-standardized composite index (NSCI) as the weighted sum of scores for each household, the weights being the percentage of the variation explained by each dimension.

$$NSCI_i = \frac{\%\ Variance\ Dim.1}{Total\ \%\ of\ Variance} * (Dim.1\ score_i) + \frac{\%\ Variance\ Dim.2}{Total\ \%\ of\ Variance} * (Dim.2\ score_i)$$

The value of the NSCI can be positive or negative, making it difficult to interpret. Therefore, a standardized index (SI) was computed by scaling the NSCI from 0 to 100 with the following formula:

$$SI_i = \frac{NSCI_i - Min(NSCI)}{Max(NSCI) - Min(NSCI)} * 100$$

B.1. Female empowerment index

Table 5: Variables, categories, measurement level, and loadings for each dimension used to construct the female empowerment index

			Component Loadings		
Variable	**Categories**	**Measurement Level**	**Dim. 1**	**Dim. 2**	**Dim. 3**
Decision-Making					
Who made the decision to use the first contraceptive method?	1 = woman only or joint decision, 0 = otherwise	Nominal	0.343	0.701	-0.045
Who made the decision to use the contraceptive method you are currently using?	1 = woman only or joint decision, 0 = otherwise	Nominal	0.287	0.71	-0.017
Who participated in the decision to give birth to your last child in the health facility or at home?	1 = woman only or joint decision, 0 = otherwise	Nominal	0.156	-0.126	-0.742
Partner Prohibitions					
What is the main reason why you have not been sterilized or are not interested in being sterilized?	1 = male partner is opposed, 0 = otherwise	Nominal	-0.119	-0.068	0.648
Why didn't you use a condom in your last sexual relation?	1 = male partner was opposed, 0 = otherwise	Nominal	-0.37	-0.187	-0.223
Attitudes					
According to your opinion, who should take the initiative to use a contraceptive method?	1 = woman only or joint decision, 0 = otherwise	Nominal	0.097	0.14	0.02
If your partner asked you to use a condom, would you be willing to use it?	1 = yes, 0 = no	Nominal	0.708	-0.396	-0.003
If it were you who asked your partner to use a condom, how do you think he would react?	1 = he would accept it, 0 = he would not accept it or would get upset	Nominal	0.773	-0.304	0.17

Table 6: Model summary of female empowerment index

Dimension	Cronbach's Alpha	Variance Accounted For	
		Total (Eigenvalue)	% of Variance
1	0.373	1.484	18.55
2	0.276	1.318	16.474
3	0.057	1.052	13.155
Total	0.846	3.854	48.178

B.2. Sexual and reproductive health knowledge index

Table 7: Variables, categories, measurement level, and loadings for each dimension used to construct the knowledge index

Variable	Categories	Measurement Level	Component Loadings	
			Dim. 2	Dim. 3
Knowledge				
What family planning methods do you know about?	Number	Numerical	0.628	0.188
What sexually transmitted infections have you heard of?	Number	Numerical	0.744	0.14
In your opinion, can a woman get pregnant the first time she has sexual relations?	1 =yes, 0 = no	Nominal	0.42	0.288
When you got your first period, did you know what menstruation was?			0.341	0.667
Access to evidence-based and age-appropriate information				
Have you received information about uterine cancer?	1 =yes, 0 = no	Nominal	0.574	-0.418
Have you received information about breast cancer?	1 =yes, 0 = no	Nominal	0.651	-0.109
Have you been taught how to examine your breasts on your own?	1 =yes, 0 = no	Nominal	0.614	-0.423

Table 8: Model summary of knowledge index

		Variance Accounted For	
Dimension	**Cronbach's Alpha**	**Total (Eigenvalue)**	**% of Variance**
1	0.674	2.369	33.846
2	-0.064	0.948	13.544
Total	.815[a]	3.317	47.39

B.3. Socioeconomic status (SES) index

Table 9: Variables, categories, measurement level, and loadings for each dimension used to construct the SES index

		Component Loadings	
Variable	**Measurement Level**	**Dim. 1**	**Dim. 2**
Area Urban	Nominal	0.532	-0.315
Own Shower	Nominal	0.398	0.162
Own Color TV	Nominal	0.417	-0.096
Own Refrigerator	Nominal	0.592	0.089
Own Telephone	Nominal	0.55	0.292
Own Car	Nominal	0.409	0.338
Own Stereo	Nominal	0.439	0.21
Own DVD	Nominal	0.426	0.079
Own Kitchen/Kitchenette	Nominal	0.365	-0.492
Main Source of Lighting is Electric	Nominal	0.317	-0.146
Main Cooking Fuel is Biomass	Nominal	-0.427	0.531
Owns Land	Nominal	-0.065	0.592
Household Head is Illiterate	Nominal	0.453	0.035
Household Head is Indigenous	Nominal	0.38	-0.204
No. of rooms for sleeping	Numerical	0.375	0.599

Number of children ≤ 5	Numerical	-0.341	-0.197
Type of floor material		0.665	0.081
Polished wood/parquet	Nominal		
Untreated wood	Nominal		
Ceramic tiles	Nominal		
Brick / cement	Nominal		
Earth	Nominal		
Others	Nominal		
Type of Sanitation Facility		0.669	-0.19
Toilet to sewer	Nominal		
Toilet to septic well	Nominal		
Toilet to blind well	Nominal		
Toilet to open river/ocean/stream	Nominal		
Latrine	Nominal		
No facility	Nominal		

Table 10: Model summary of SES index

		Variance Accounted For	
Dimension	**Cronbach's Alpha**	**Total (Eigenvalue)**	**% of Variance**
1	0.775	3.725	20.695
2	0.461	1.771	9.838
Total	0.866	5.496	30.533

Appendix C: Robustness Checks

Table 11: 2SLS estimates for contraceptive methods with optimal bandwidth

Primary Outcomes	(1)	(2)	(3)
Modern Contraceptive Methods			
Beta Coefficient	-0.907*	-0.983*	-1.311
(Std. Error)	(0.512)	(0.527)	(0.872)
Sample Size	1925	1876	1755
F Statistic on Excluded Instrument	7.262***	7.565***	3.868**
Long-Acting Reversible Contraceptive Methods			
Beta Coefficient	0.019	-0.042	-0.049
(Std. Error)	(0.366)	(0.362)	(0.528)
Sample Size	1882	1831	1664
F Statistic on Excluded Instrument	8.058***	8.357***	4.154**
Any Contraceptive Method			
Beta Coefficient	-0.521	-0.519	-0.691
(Std. Error)	(0.399)	(0.361)	(-0.556)
Sample Size	1851	1816	1740
F Statistic on Excluded Instrument	7.180***	8.784***	4.551**
Controls			
Women Characteristics	✓	✓	✓
Household Characteristics		✓	✓
Geographic Characteristics			✓

Source: Authors' calculations using the *ivreg* command from the *AER* package in R, ENSANUT survey (2012). Notes: Optimal bandwidth calculated using the *rdbwselect* command from the *rdrobust* package in R. Standard errors in parentheses are corrected for heteroscedasticity. *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged $\leq$ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone).

Table 12: 2SLS estimates for contraceptive methods with various bandwidth choices

Primary Outcomes	Bandwidths								
	Cutoff +/- 6.5 n = 1084			Cutoff +/- 5.5 n = 934			Cutoff +/- 4.5 n = 776		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Modern Contraceptive Methods									
Beta Coefficient	-0.508	-0.566	-0.729	-0.318	-0.400	-0.516	-0.514	-0.732	-0.909
(Std. Error)	(0.417)	(0.452)	(0.647)	(0.520)	(0.566)	(0.794)	(0.596)	(0.800)	(1.147)
Long-Acting Reversible Contraceptive Methods									
Beta Coefficient	-0.102	-0.172	-0.198	0.118	0.036	0.045	-0.068	-0.155	-0.164
(Std. Error)	(0.380)	(0.406)	(0.546)	(0.504)	(0.533)	(0.720)	(0.544)	(0.670)	(0.887)
Any Contraceptive Method									
Beta Coefficient	-0.244	-0.273	-0.326	-0.114	-0.163	-0.198	0.003	-0.103	-0.103
(Std. Error)	(0.341)	(0.360)	(0.491)	(0.438)	(0.465)	(0.629)	(0.466)	(0.565)	(0.748)
F Statistic on Excluded Instrument	7.598***	6.829***	4.000**	4.278**	3.815*	2.201	3.68*	2.478	1.468
Controls									
Women Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Household Characteristics		✓	✓		✓	✓		✓	✓
Geographic Characteristics			✓			✓			✓

Source: Authors' calculations using *ivreg* command from the *AER* package in R, ENSANUT survey (2012). Notes: Selected bandwidths balance the trade-off between intervals that are small enough to ensure that women at each side of the cut-off point are comparable and wide enough to offer desired sample sizes. Standard errors in parentheses are corrected for heteroscedasticity. *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged ≤ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone)

Table 13: 2SLS estimates for empowerment and knowledge indices with optimal bandwidth

Intermediate Outcomes	**(1)**	**(2)**	**(3)**
Empowerment Index			
Beta Coefficient	-18.571	-31.827	-51.617
(Std. Error)	(37.624)	(48.104)	(148.317)
Sample Size	488	491	484
F Statistic on Excluded Instrument	0.126	0.048	0.144
Knowledge Index			
Beta Coefficient	-44.180***	-40.541***	-53.469*
(Std. Error)	(16.500)	(5.341)	(31.039)
Sample Size	2061	1943	1819
F Statistic on Excluded Instrument	3.930**	3.963**	3.625*
Controls			
Women Characteristics	✓	✓	✓
Household Characteristics		✓	✓
Geographic Characteristics			✓

Source: Authors' calculations using the *ivreg* command from the *AER* package in R, ENSANUT survey (2012). Notes: Optimal bandwidth calculated using the *rdbwselect* command from the *rdrobust* package in R. Standard errors in parentheses are corrected for heteroscedasticity. *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged $\leq$ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone).

Table 14: 2SLS estimates for empowerment and knowledge indices with various bandwidth choices

Intermediate Outcomes	Bandwidths								
	Cutoff +/- 6.5 n = 1084			Cutoff +/- 5.5 n = 934			Cutoff +/- 4.5 n = 776		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Empowerment Index									
Beta Coefficient	-12.006	-25.424	-59.383	-36.227	-98.494	348.827	-31.163	-46.544	-62.965
(Std. Error)	(36.573)	(45.875)	(179.791)	(132.875)	(428.96)	(5430.142)	(58.947)	(95.700)	(204.421)
F Statistic on Excluded Instrument	0.134	0.134	0.134	0.004	0.004	0.004	0.121	0.121	0.121
Knowledge Index									
Beta Coefficient	-28.128**	-18.135**	-32.687	-22.177	-21.231	-24.57	-23.914	-25.227	-30.254
(Std. Error)	(12.180)	(13.942)	(20.385)	(15.424)	(16.014)	13.07	(17.305)	(21.670)	(31.765)
F Statistic on Excluded Instrument	4.000*	4.000*	4.000*	2.201	2.201	2.201	1.468	1.468	1.468
Controls									
Women Characteristics	✔	✔	✔	✔	✔	✔	✔	✔	✔
Household Characteristics		✔	✔		✔	✔		✔	✔
Geographic Characteristics			✔			✔			✔

Source: Authors' calculations using *ivreg* command from the *AER* package in R, ENSANUT survey (2012). Notes: Selected bandwidths balance the trade-off between intervals that are small enough to ensure that women at each side of the cut-off point are comparable and wide enough to offer desired sample sizes. Standard errors in parentheses are corrected for heteroscedasticity. *significant to 10%; **significant to 5%; ***significant to 1%. Specification 1 includes women characteristics (i.e. age, second-degree polynomial of age, ethnicity, marital status, education level, and number of live children). Specification 2 includes, in addition to women characteristics, household characteristics (i.e. household head is illiterate, household head is indigenous, household head is female, size of the household, and number of children aged ≤ 18). Specification 3 includes, in addition to women and household characteristics, geographic characteristics (i.e. region, area, and zone.

Appendix D: Potential sample selection bias in empowerment analyses

Table 16: Comparison of baseline characteristics of women who had and did not have information on all empowerment indicators

	No Information on Empowerment Indicators (Std. Dev.) (n = 3367)	**Information on Empowerment Indicators (Std. Dev.) (n = 1765)**	**Two-Sided P-value of Difference**
Household characteristics			
Household size	4.88 (1.80)	5.26 (1.89)	< 0.001
Household head is illiterate (%)	2.400	1.600	0.104
Household head is indigenous (%)	14.300	13.800	0.643
Household head is female (%)	12.600	8.200	< 0.001
Household members aged ≤ 18	2.58 (1.43)	2.89 (6.73)	< 0.001
Women characteristics:			
Age	33.74 (8.20)	29.10 (6.73)	< 0.001
Ethnicity			0.577
Indigenous (%)	14.800	14.700	
Mestizo (%)	76.000	76.100	
Black (%)	3.300	3.300	
White (%)	1.500	2.000	
Other (%)	4.400	3.800	
Education			< 0.001
Without instruction (%)	1.900	1.400	
Literacy Center (%)	0.800	0.400	
Elementary (%)	39.500	33.500	
Middle School (%)	40.000	44.400	
High School (%)	4.100	6.500	
Superior (%)	13.700	13.800	
Marital Status			< 0.001
Single (%)	5.200	3.100	
Married or common law (%)	88.100	93.100	
Divorced, separated, or widow (%)	6.700	3.900	
Number of live children	2.91 (1.83)	2.89 (1.59)	0.797