Targeting Women's vulnerable employment through social protection: A quasi-experimental regression discontinuity design

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ABSTRACT

In Pakistan, women face economic and social vulnerability, which keeps them underpaid even without social barriers. Government micro and macroeconomic policies are aimed at income generation rather than making women part of the economic mainstream. The cash transfer program is an essential component of social protection policy in the developing world, with one of its key objectives of raising women's financial autonomy. This research investigates the impact of Pakistan's first and largest cash transfer program, named Benazir Income Support Program (BISP), on women's vulnerable employment. BISP was initiated by identifying poor households based on poverty score cutoff, thereby exploiting Regression Discontinuity Design. The findings revealed that this program reduced vulnerable employment in the initial years of its inception. However, it does not impact the later follow-up years. Policymakers should take necessary measures so that women's non-vulnerable employment may improve.

1. Introduction

One of the critical components of social protection programs in developing countries is the cash transfers to poor households. The core objectives of such programs are to reduce poverty, empower women, improve child nutrition and education. These cash transfers are generally given to women in the household with an intent to empower them financially. However, there are concerns among policymakers regarding unintended consequences, such as whether programs affect the labor market participation of the recipients or not. Theoretically speaking, based on the standard consumer model, the increase in the non-labor income results in the rise in the value of leisure, leading to the reduction of the supply of labor in the market (Becker, 1965).

However, in developing countries context, the labor supply model predictions are not enough to explain labor supply changes in response to cash transfers. Interestingly, there are several reasons why there would be an increase in labor market participation by recipients. It lies within the realm of possibilities that recipients could pursue riskier and better jobs after receiving cash transfers. This pursuit for difficult and better jobs could be traced to the recipient household bargaining power, increasing due to the cash transfer (Chiappori, 1992). Another study did not find evidence of less work due to cash transfer programs in developing countries (Banerjee et al., 2017). Thus, it is observed that there are mixed results on the impact of these cash transfers on household employment (Baird et al., 2018).

A considerable amount of literature links the relationship between cash transfer and women's employment status with their decision-making power. The gender stratification theory by Blumberg (1988) provides the theoretical justification to explore this link. The theory argues that gender stratification is inversely linked to women's access to material resources and the level of women's economic power. An increase in women's access to resources and their ability to participate in the labor market can reduce their ideological and physical oppression in societies. Similar theoretical foundations are provided by the bargaining model, which is contrary to the idea of neoclassical theory's single utility
function of the household. The bargaining approach considers that different household members have distinct preferences, allows for the individual agency of men and women within a household, and provides evidence of changing bargaining power (Lundberg and Pollak, 1996). A study from a conditional cash transfer program in Honduras also found such a mechanism (Novella et al., 2021). Their research found that women with more bargaining power are less likely to be employed.

Regarding employment, there are different categories in which a person may be engaged. An individual's employment status describes one's socio-economic condition and work conditions (United Nations, 1997). Individuals with the employment status of 'contributing family workers' and 'own-account workers' are less likely to have formal work arrangements such as adequate social security and a voice at work. Therefore, these two statuses are classified as 'vulnerable employment' (International Labour Office, 2016). Developing countries with a much larger informal economy are more likely to have a higher share of vulnerable employment, mainly dominated by women. Extending on these lines, in this paper, we plan to investigate whether cash transfer helps women reduce vulnerable employment by leveraging on Pakistan's most extensive cash transfer program, Benazir Income Support Program (BISP). The program is based on unconditional cash transfers. The money is disbursed only to women in the household, and the eligibility of women for cash transfer depends on their poverty score.

BISP is a flagship cash transfer program initiated by the government of Pakistan in 2008 to reduce poverty that emerged from the food crisis (Gazdar, 2011). During the initial years of its inception, the Members of the National Assembly (MNAs) had the discretion to nominate the deserving and suitable households to be the cash recipient (Khan and Qutub, 2010). Since so many households qualified for becoming recipients, MNAs exercised their discretion in nominating the members of the low-income families. And consequently, it was found in a study that 16.1 percent of the recipients were not eligible for the BISP program (Nayab and Farooq, 2014). Objections were raised, and concerns were shown regarding sustain-ability and transparency in Universal Cash Transfer (World Bank, 2013). To address these concerns, the government of Pakistan collaborated with the World Bank to develop a poverty scorecard through a nationwide survey National Socio-Economic Registry (NSER), which was a benchmark for targeting potential beneficiaries (Hou, 2009).

BISP adopted the Proxy Means Test (PMT) approach to compute the poverty score from data collected through NSER on 23 poverty covariates. The cutoff score of 16.17, out of 100, was used to identify the treatment and control groups (Cheema et al., 2014). With this cutoff, BISP identified 7 million eligible families from all over Pakistan to receive unconditional cash benefits. The cash assistance was equivalent to Rs. 6000 (US$ 37) is disbursed to all ever-married women quarterly whose poverty score is less than 16.17 (Iqbal et al., 2020). The amount is distributed via the Pakistan Postal Service, BISP debit, smart card, or mobile money transfers. Gradually, the payment system was updated, and in 2016 biometric verification system (BVS) is introduced. With this new payment system, a beneficiary would personally receive the payment after biometric verification at specified ATMs and point of sales (POS). In a phased manner, all the beneficiaries have been shifted to the BVS system during the 2016–2019 periods (Iqbal et al., 2020).

The rest of the paper is organized as follows. Section 2 presents a review of the extant literature available. The econometric methodology for estimation is discussed in Section 3. Section 4 describes the summary of the BISP data for the three rounds based on the household's beneficiary status and the operationalization and descriptive statistics of variables. Section 5 presents the empirical findings from RD and a discussion of the results. Finally, Section 6 provides the policy implications, limitations, and recommendations for future research.

2. Literature review

This section presents a brief review of the extant literature on the effectiveness of several cash transfer programs worldwide. Based on data collected from one of the largest such cash transfer schemes, ‘Progresa’ in Mexico, Parker and Todd (2017) found that the program had no impact on neither labor supply nor leisure. In Brazil, the Bolsa Familia program differentially impacted the labor supply of the informal sector and formal sector, i.e., recipients were drawn more to the informal sector and less to the formal sector (De Brauw et al., 2015). In another study, Banerjee et al. (2017) re-analyzed the results of randomized control trials of conditional cash transfer programs. They found that cash transfer does not impact labor supply or hours worked.

Various studies have focused on the impact of cash transfer on formal and informal labor. A study argued that cash assistance programs targeted towards casual workers prevent these workers from engaging in the formal labor market (Levy, 2006). Moreover, studies such as (Asfaw et al., 2014; De Brauw et al., 2015; Garganta and Gasparini, 2015) also found a drop in formal work and wage employment due to cash transfer programs. Studies also provide evidence of a shift towards within-household work due to the cash assistance schemes. A study from African countries shows a decline in paid employees and increased engagement in the self-employed category (Covarrubias et al., 2012). Regarding the effect of Pakistan's conditional cash transfer program, a study argued that the program led to a reduction in paid work by mothers (Hasan, 2010).

However, for unconditional cash transfers, studies have found changes in labor supply among recipients and non-recipients. After receiving the cash transfers, workers in Zambia and Malawi devoted their time working on their farm rather than other's farm after receiving the cash transfers (Ervin et al., 2017). It has also been found that households with women pensioners contribute less to the labor supply on both intensive and extensive margins (Bertrand et al., 2003). Past research indicates that women are set to make more income gains upon receiving a pension as males contribute less to the labor market when they become pensioners, whereas women don’t (Ambler, 2016). It is still unclear in the South African context as to what effect the pensioner's presence in the household has on the participation by the prime-age adult.

Several studies have investigated the impact of BISP cash transfer on adult labor supply, child labor, and women's empowerment in Pakistan. These studies include Ambler and de Brauw (2019), who, in their research, find no overall impact of the BISP transfers on household labor supply in Pakistan. Though, within households they found weak evidence of a shift in the composition of labor supply, from women to men. At the individual level, they found inadequate evidence that women would like more involvement in the labor force by increasing women who can be considered unemployed. However, in another study, Ambler and de Brauw (2017) used fuzzy regression discontinuity methods to statistically identify impacts and found that BISP transfers have substantial, positive effects on variables measuring women's decision-making power and empowerment. Studies by Nayab and Farooq (2014), and Amjad et al. (2018) have measured BISP’s impact on poverty, and the analysis is cross-sectional.

This brief description of the literature implies that there are several studies on the impact of cash transfer programs on the labor supply behavior of men and women. Our research contributes to this existing literature in several ways. First, we intend to explicitly focus on women's vulnerable employment as an outcome of interest to have a distinct analysis regarding women's work. Second, we employ RDD – a quasi-experimental approach – to identify the causal impact of cash transfer on women’s vulnerable employment. This approach allows having an unbiased causal inference which further helps in developing sound policy implications. Third, we employ a large-scale nationwide cash transfer program data that supports estimating the program’s short-run and long-run impacts from the consistent panel sample.

This paper investigates the causal impact of the BISP cash transfer program on women's vulnerable employment by exploiting a quasi-experimental Regression Discontinuity Design (RDD) approach. We utilize the three rounds of BISP data, a baseline conducted in 2011, and two follow-up rounds completed in 2013 and 2016. Before collecting the 2016 sample, a resampling exercise was done to add new treatment and
control households from the existing primary sampling units (PSUs). Therefore, the 2016 round contains more households than the 2013 round (Ambler and Brauw, 2019). The RD analysis will be conducted on 1) panel households from 2011 and 2013 rounds, 2) panel households from 2011 and 2016 rounds, and 3) cross-section households from the 2016 round only.

3. Empirical estimation method

The present study employs Regression Discontinuity Design (RDD) to investigate the impact BISP cash transfer has on vulnerable employment of women who are just above the eligibility poverty score cutoff and compare them to those just below the cutoff. There has been growing empirical evidence using RDD to investigate several research questions such as the impact of welfare on labor supply, government’s disability programs, the effect of labor unions on employment and wages, and Medicaid effect on health outcomes (Lee and Lemieux, 2010). ‘Regres-
sion discontinuity (RD)’ analysis is a rigorous non-experimental approach that can be used to estimate program impacts in situations in which candidates are selected for treatment based on whether their value for a numeric rating exceeds a designated threshold or cut-point” (Jacob et al., 2012, p. iii).

RDD is a quasi-experimental approach first developed by Thistlethwaite and Campbell (1960) for treatment effects estimation. This approach is about finding a factor that explains the allocation of observation in a treatment group by exploiting an exogenously determined threshold of this factor (Anderson et al., 2012). The idea of discontinuity in a treatment group by exploiting an exogenously determined threshold. Empirical studies have used RDD to investigate the impact of social programs (Game et al., 2008), the impact of class size and financial aid (Angrist and Lavy, 1999), and school district boundaries (Black, 1999). This method is designed to compare the observation marginally above and below the cutoff to estimate the treatment effect (Hartmann et al., 2011).

In this paper, a dataset of a cash transfer program, eligibility based on a known poverty score cutoff, will allow utilizing regression discontinuity design (RDD). Following (Lee and Lemieux, 2010), we intend to use this setup to investigate the causal effect of cash transfer on women’s vulnerable employment. The central underlying assumption in RDD is that women who are just above the cutoff are not systematically different from those who are below the cutoff. Their observed and unobserved characteristics are similar. Therefore, a sample of women close to the poverty cutoff score of 16.17 will be utilized. BISP cash transfer program characteristics are similar. Therefore, a sample of women close to the eligibility poverty score cutoff and investigatethe impact BISP cash transfer has on vulnerable employment in our case.

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3.1. Data and operationalization of variables

In this research, we use BISP cash transfer program data sets. BISP contracted Oxford Policy Management (OPM) to conduct an independent impact evaluation of the BISP cash transfer program. This research utilizes the survey data sets collected by OPM. OPM conducts five impact evaluation surveys. A baseline, conducted in 2011, three midline surveys in 2013 and 2014, and 2016, and the end line survey in 2019. However, this study uses data from baseline 2011, and two midline panel surveys 2013 and 2016).

The baseline 2011 and 2013 round capture almost the same house-
holds, whereas the 2016 sample includes additional families close to the poverty threshold. Before collecting the 2016 sample, a resampling exercise was done to add new treatment and control households from the existing primary sampling units (PSUs), the central research communities (Ambler and de Brauw, 2019). In their study reported that through this exercise, all households that were matched with the BISP management information system (MIS) were retained, given the condition that they had a poverty score of less than 21.17. Secondly, PSUs from the evaluation sample were matched with BISP MIS. Thirdly, nine control and nine treatment households were chosen randomly from each PSU. With this sampling, the number of panel households was reduced in the 2016 round.

We conduct three different RD estimations. First, the panel sample from 2011 and 2013 estimates the short-run 2-years impact of this cash transfer program. This analysis will leverage a comparatively large number of panel households in these two years. Second, to estimate the 5-years implications of this program, a panel sample from 2011 and 2016 is utilized. The following Tables 1, 2, and 3 provide information on the total number of households in baseline and the two follow-up rounds of 2013 and 2016, the number of panel households in 2011 and 2013, the number of panel households in 2011 and 2016, disaggregated by their treatment status, respectively.

| Source: BISP Survey, own calculations. |
|---|

| Table 1. Summary of households in BISP data by treatment status. |
|---|---|---|
| Control | 2011 | 2013 | 2016 |
| Control | 4517 | 4230 | 4017 |
| Treated | 4158 | 3991 | 5300 |
| Observations | 8675 | 8221 | 9317 |

Where in Eq. (1), \( Y_i = a + \tau D_i + f(X_i - c) + \Sigma \beta_j X_{ji} W_i + \epsilon_i \) (1)

Where in Eq. (1), \( Y_i \) is the outcome of interest, which is women’s vulnerable employment in our case. \( X_i \) is the poverty score of household \( i \) called a running variable and \( f(X_i - c) \) is the function of the distance from the cutoff \( D_i = 1(X_i \leq c) \), i.e., \( D_i \epsilon \{0,1\} \) is 1 if the household poverty score is below the cutoff \( c \) of 16.17 and 0 otherwise \( \tau \) estimates the impact of the BISP cash transfer program, the treatment effect. Finally, \( \Sigma \beta_j X_{ji} \) captures the effect of other control variables.

An essential choice in RDD analysis is selecting the range of values of the running variable used to estimate the bandwidth. While the estimates are unbiased at the limit, the threshold, one must use data to estimate the treatment effect \( \tau \) using data, which implies that as data farther away from the threshold is used in estimation, estimates for \( \tau \) become more susceptible to bias, as observations on either side of the threshold become less and less comparable as data are added. On the other hand, additional data on either side of the threshold allows for more precise estimates. To choose a bandwidth for estimation, one must balance the bias of including more observations against the variance of treatment effect estimates. There are procedures developed by (Calonico et al., 2014a; 2014b) to determine the optimal bandwidth. The estimator uses a local linear regression on either side of the threshold and includes a data-driven bias correction and bias-corrected confidence interval estimation. The estimator uses a triangular kernel for data in regressions, as suggested by (Lee and Lemieux, 2010).

Another condition RDD requires is that units cannot strategically sort themselves around the cutoff, which means that women must not manipulate their poverty score (Lee and Lemieux, 2010). If this condition holds, then the allocation of units into treatment and control groups will be taken as ‘random.’ This condition is testable following density test by comparing the density of probability distribution of poverty score around both sides of the poverty score cutoff (McCrary, 2008). Moreover, RD estimates will be validated and falsified by investigating the impact of cash transfer on predetermined covariates and exploiting a placebo cutoff (Calonico et al., 2019).
has reduced from 24 percent in 2011 to 16 percent and 12 percent in
the second follow-up year, 2016, this percentage has reduced to 18%. A negligible number of women engaged in category concerning the
employer category, regardless of their beneficiary status.

The summary statistics of the other covariates (controls) are pre-
sented in Table 5 below. The average values of these variables are given for treated and control households for the three years. These variables include household head education (continuous variable), household size (continuous variable), the dependency ratio (continuous variable), female-headed household (dummy variable – 1 if the female is the head of household and 0 otherwise), and family type (categorical variable – 1 for nuclear family and 2 for extended family). The average years of household education are comparatively lower in the treated household compared to the control household in three years. Most household heads are ‘own account workers, which is higher in control household. The average dependency ratio is comparatively higher in treated households in the three survey years. Moreover, around 90% of households are not headed by females among treated and control groups. Finally, treated households have a larger average household size. However, the house-
hold size decreased over time.

### 4. Analysis and results interpretations

This paper focuses on investigating the impact of BISP cash transfer on women’s vulnerable employment. BISP is an unconditional cash transfer program with women as a beneficiary in the household. The eligibility for the program is based on the poverty score threshold, where women above the threshold are ineligible, and those below the threshold are eligible. The design of this program permits to exploit regression discontinuity to investigate its causal impact. However, the discontinuity is not sharp because of non-compliance. Therefore, fuzzy RDD is an appropriate estimation strategy (Ambler and de Brauw, 2019). The critical consideration in RD analysis is the selection of observations around the cutoff, called bandwidth. Some methods help in selecting bandwidth, and they are data-driven. We employ a technique developed

### Table 2. Summary of 2 Years panel households in BISP data by treatment status.

|       | 2011  | 2013  |
|-------|-------|-------|
| Control | 3932  | 3932  |
| Treated | 3631  | 3631  |
| Observations | 7563  | 7563  |

Source: BISP Survey, own calculations.

### Table 3. Summary of 5 Years panel households in BISP data by treatment status.

|       | 2011  | 2013  |
|-------|-------|-------|
| Control | 1410  | 1062  |
| Treated | 2176  | 2524  |
| Observations | 3586  | 3586  |

Source: BISP Survey, own calculations.

Regarding operationalization of our primary outcome variable, i.e.,
women’s vulnerable employment, a question is asked in the BISP survey
from all male and female members of the households who are 15 years of
age and older. For our analysis, we restrict our sample to women re-
spondents only who are asked What is your employment status? in response
of which they select from the options, which are:

1. Employer
2. Self-employed
3. Employee
4. Unpaid family helper
5. Casual laborer
6. Owner cultivator
7. Sharecropper
8. Other agriculture

We recoded these options as 1 = Employer, 2 = Self-employed non-
ariculture, 3 = Paid employee, 4 = Contributing family worker. Finally,
we add casual laborers, owner cultivator, sharecropper, and other agri-
culture to form the last category, i.e., 5 = Own account worker. We
further coded these five categories to create a binary variable of women’s
vulnerable employment where categories 1, 2, and 3 are coded as ‘0’ and
categories 4 and 5 are coded as ‘1’. This coding is applied according to the
definition of vulnerable employment (International Labor Office 2016).
The summary statistics of women’s employment status are presented
in Table 4. Women who belong to the treated group are found to have
reduced their availability for one of the types of vulnerable employment,
i.e., contributing family worker. The table shows that from baseline
2011, the percentage of beneficiary women in this employment category
has reduced from 24 percent in 2011 to 16 percent and 12 percent in the
next two follow-ups, 2013 and 2016, respectively. The same pattern
has been observed for women from the control group, i.e., lower
participation as ‘contributing family workers’ over time. However, irre-
spective of the beneficiary status of women, there is a slight increase in
the percentage of women working as ‘own account workers.’ Concerning
women’s involvement in non-vulnerable employment, it is seen that
treated woman increased their participation as ‘paid employees’ from 8% in
baseline to 9% and 15% in subsequent years.

Moreover, there is an increase in treated women as self-employed in
the non-agriculture sector from 19% in 2011 to 23% in 2013. However,
in the second follow-up year, 2016, this percentage has reduced to 18%.
A negligible number of women engaged in category concerning the
employer category, regardless of their beneficiary status.

The summary statistics of the other covariates (controls) are pre-
sented in Table 5 below. The average values of these variables are given
for treated and control households for the three years. These variables
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in the three survey years. Moreover, around 90% of households are not
headed by females among treated and control groups. Finally, treated
households have a larger average household size. However, the house-
hold size decreased over time.

### Table 4. Summary: Women employment status from BISP.

|       | 2011  | 2013  | 2011  | 2013  | 2011  | 2013  |
|-------|-------|-------|-------|-------|-------|-------|
| Employer | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| Self Employed | 0.25  | 0.19  | 0.23  | 0.23  | 0.19  | 0.18  |
| Paid Employee | 0.13  | 0.08  | 0.15  | 0.09  | 0.18  | 0.15  |
| Contributing | 0.23  | 0.24  | 0.13  | 0.16  | 0.10  | 0.12  |
| Family Worker | 0.38  | 0.48  | 0.47  | 0.51  | 0.53  | 0.55  |
| Own Account Worker | 1616  | 1953  | 1568  | 1875  | 1773  | 2731  |

Source: BISP Survey, own calculations.

### Table 5. Summary of control variables: BISP.

|       | 2011 Control | 2011 Treated | 2013 Control | 2013 Treated | 2016 Control | 2016 Treated |
|-------|--------------|--------------|--------------|--------------|--------------|--------------|
| Head Years of Education | 3.00 | 1.54 | 2.99 | 1.78 | 2.88 | 2.33 |
| Dependency Ratio | 1.12 | 1.67 | 1.03 | 1.40 | 1.02 | 1.15 |
| Female-Headed Household: | | | | | | |
| No | 0.91 | 0.94 | 0.90 | 0.92 | 0.87 | 0.87 |
| Yes | 0.09 | 0.06 | 0.10 | 0.08 | 0.13 | 0.13 |
| Household Size | 6.80 | 8.64 | 7.01 | 8.47 | 7.08 | 7.79 |
| Family Type: | | | | | | |
| Nuclear | 0.65 | 0.65 | 0.56 | 0.58 | 0.58 | 0.59 |
| Extended | 0.35 | 0.35 | 0.44 | 0.42 | 0.42 | 0.41 |

Source: BISP Survey, own calculations.
by (Calonico et al., 2014a; 2014b), which takes care of the "bias-variance trade-off." Figure 1 shows the visual description of the probability of receiving cash transfers above and below the threshold of 16.17. The score is normalized with 0’ as the threshold. Figure 1 below shows the discontinuity in receiving the benefit within the panel sample from 2011 and 2016 and the cross-section sample of 2016. The figure shows an apparent discontinuity at the poverty score threshold in both the samples, thereby confirming the applicability of RD for analysis.

The following Table 6 presents the results of RD estimates of the impact of BISP cash transfer on women’s vulnerable employment for three samples. 1) panel sample of baseline 2011 and first follow up BISP survey of 2013, 2) panel sample of 2011 baseline and second follow up survey 2016 which was after five years of program rollout, and 3) cross-section sample of 2016. The results are presented with optimal bandwidth selection and fixed bandwidth of 5. The findings show that women’s vulnerable employment significantly reduced in response to cash transfers after two years of the program’s inception. The estimated RD coefficient for the 2011–2013 panel sample with optimal bandwidth reveals a 79 percentage point decrease in women’s vulnerable employment compared to the sample mean of 65 percent. However, the results appear contrary after five years of the program rollout, but there is a lack of statistical significance. The 2011–2016 panel sample estimates show that women’s employment in vulnerable categories increased by 32% and 10% within optimal and fixed bandwidth of 5, respectively, but this result is statistically insignificant.

This paper also examines the impact of cash transfer on women’s vulnerable employment in the 2016 cross-section sample. The results in the 5th and 6th column of Table 6 below shows the RDD estimates for the 2016 cross-section sample with optimal bandwidth selection and fixed bandwidth selection, respectively. The results show a significant negative impact of being a cash recipient on women’s vulnerable employment with bandwidth selection. There is a 15% decline in women’s engagement in vulnerable work within optimal bandwidth within optimal bandwidth, which is significant at a 5% significance level. There is a 14% decline in vulnerable employment with fixed bandwidth, which is statistically significant at a 1% level.

### 4.1. Covariate adjusted RD analysis

RD analysis can be implemented by augmenting the model, given in Eq. (1), by including covariates and the running variable, i.e., poverty score in our case. These covariates are usually predetermined, i.e., their values are determined before the treatment is assigned to the households. This means that there is no effect of BISP cash transfer on these predetermined covariates. In other words, the average values of these covariates for the treatment and control group at the cutoff are equal to each other. Calonico et al. (2019) proposed augmenting the model by directly including the discrete or continuous covariates in a linear and additive-separable way. This involves fitting the regression on constant, treatment status, a running variable, and the other covariates. We used baseline values of household head education, household size, dependency ratio, female-headed household, and family type for covariate-adjusted analysis.

Table 7 presents covariates adjusted RD analysis for the 2011–2013 panel sample and 2011–2016 panel sample within the optimal and fixed bandwidth. The results are consistent with the RD analysis without including covariates. However, for the 2011–2016 panel sample, the effect of cash transfer on women’s vulnerable employment is positive,
and it is no more insignificant. This result is in line with what (Calonico et al., 2019) suggest that RD estimates gain efficiency if covariates are included, i.e., the inclusion of covariates increases the precision of statistical inference. However, in covariates adjusted analysis, the RD analysis could not be implemented for the 2016 cross-section sample because of the unavailability of predetermined covariates in the cross-section sample. Therefore, the results for the 2016 cross-section sample are not reported.

4.2. Robustness check

There are certain robustness checks proposed in the literature to validate the findings from RD. First, there may be a concern that to become the program’s beneficiary, the units can manipulate the running variable, i.e., poverty score. This will cause invalidity of the significant assumption of RDD analysis that households/units on both sides of the cutoff are directly comparable to each other, meaning that they have similar characteristics except their treatment status of the program since poverty score is computed from 23 poverty covariates, which are hard to manipulate, by the households. Because of the difficulty in concealing the information on these variables, we can rule out the possibility of manipulating the poverty score by the households. Regardless of this fact, we can use data to check for manipulating poverty scores. We do this by plotting the histogram of the poverty score in each estimation sample. The graph of these histograms is given in Figure 2 below. If households had manipulated their poverty score, we might expect more observations on the left side of the cutoff than observations on the right. The histograms do not show any visible pattern, thereby confirming the non-existence of manipulation of poverty score. A similar pattern is observed in another study (Ambler and de Brauw, 2019).

Another important RD validity test is whether treated, and control units are similar in observable characteristics around the threshold. The idea is that if units cannot manipulate their score, they should be identical for all the variables that could not have been affected by the treatment. These variables are predetermined covariates discussed above. To validate the RD estimates, we use a few baseline characteristics of households and investigate whether there is a continuity in the RD estimates for these predetermined covariates. We test the treatment effect on baseline values of household head education, household size, dependency ratio, female-headed household, and family type. The results are presented in Table 8, and the analysis is conducted similarly to choose the optimal bandwidth. However, the selected bandwidth will differ from what is selected for the original outcome variable, i.e., women’s vulnerable employment. The results show the failure to reject the null hypothesis of no treatment effect and thereby infer that the validity of RD estimates holds. Figure 3 presents the visual presentation

| Table 7. RD estimates - women vulnerable employment with controls. |
|---------------------------------------------------------------|
| **2011–2013 Panel Sample** | **2011–2016 Panel Sample** |
| RD Estimates | Optimal BW | Fixed BW | Optimal BW | Fixed BW |
| -------------- | ---------- | -------- | ---------- | -------- |
| -0.817*** | -0.437 | 0.397*** | 0.174 |
| (0.248) | (0.367) | (0.193) | (0.128) |
| Robust p-value | 0.00290 | 0.416 | 0.0873 | 0.341 |
| Bandwidth Left | 3.371 | 5 | 2.900 | 5 |
| Bandwidth Right | 5.236 | 5 | 1.636 | 5 |
| Effective Sample Size Left | 802 | 1077 | 361 | 599 |
| Effective Sample Size Right | 867 | 822 | 119 | 410 |
| Sample Mean | 0.658 | 0.658 | 0.700 | 0.700 |

Standard errors in parentheses ***p < 0.01, **p < 0.05, *p < 0.1. Controls include household head education, household size, dependency ratio, female-headed household, and family type.

| Table 8. RD estimates of predetermined covariates. |
|---------------------------------|
| **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Head Education | HH size | Female Head | Family Type | Dependency Ratio |
| RD Estimates | -0.904 | -1.35 | -0.0697 | 6.158 | 13.04 |
| (205.3) | (532.1) | (0.313) | (14.90) | (25.50) |
| Robust p-value | 0.667 | 0.984 | 0.854 | 0.701 | 0.625 |
| Bandwidth Left | 1.603 | 1.985 | 2.011 | 1.652 | 2.360 |
| Bandwidth Right | 0.520 | 0.647 | 0.898 | 0.632 | 0.366 |
| Effective Sample Size Left | 2658 | 3483 | 3515 | 2755 | 4449 |
| Effective Sample Size Right | 757 | 1088 | 1435 | 1088 | 460 |

Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.
of the RD plot. The figure shows the absence of discontinuity at the poverty score cutoff, which confirms that baseline covariates are unaffected by the program intervention.

An additional test for the validity of RD estimates is to analyze the treatment effect by using placebo cutoffs. The underlying motivation is to check whether the regression functions for the treatment and control group are continuous at a threshold other than the eligibility threshold. If there is evidence of discontinuity on placebo thresholds, then the validity of RD is questionable. This test uses another cutoff value at which there is no change in treatment status and provides inference based on these placebo cutoffs. Table 9 shows RD plots of different cutoff values other than 0 where the actual treatment effect occurs. The results show the failure to reject the null hypothesis of no treatment effect and thereby infer that the validity of RD estimates holds. The visual representation of these results is presented in Figure 4. The graphs show that there is no discontinuity at these placebo cutoffs.

Table 9. RD Estimates of placebo cutoffs on women’s vulnerable employment.

| Cutoff | RD Estimate | Robust p-value | Bandwidth Left | Effective Sample Size Left | Bandwidth Right | Effective Sample Size Right |
|--------|-------------|----------------|----------------|---------------------------|----------------|-----------------------------|
| -3     | 0.905       | (7.091)        | 0.703          | 123                       | 1.864          | 253                         |
| -2     | 0.683       | (3.294)        | 0.893          | 156                       | 1.644          | 181                         |
| -1     | 33.24       | (35.56)        | 1.024          | 99                        | 2.196          | 206                         |
| -1     | -0.613      | (0.631)        | 1.330          | 110                       | 1.550          | 124                         |
| -2     | 1.421       | (2.262)        | 1.557          | 114                       | 1.134          | 119                         |
| -3     | -1.160      | (1.453)        | 1.906          | 173                       | 0.397          | 33                          |

Standard errors in parentheses ***p < 0.01, **p < 0.05, *p < 0.15.

Figure 4. RD plot of placebo cutoffs on women’s vulnerable employment.
5. Conclusions

Cash transfer programs have the inherent objective of reducing poverty and inequality and raising women’s empowerment by making them financially stable. It is generally observed that women are more likely to be employed in the informal sector as either the own-account worker or contributing family workers in lower- and middle-income countries. Cash transfer programs are one channel through which women can be financially empowered to take a decent-paid job or become self-employed on a small business enterprise. In this paper, we have investigated this channel by exploiting RDD on Pakistan’s BISP cash transfer data and found that in the short run, i.e., after two years of program rollout, there was a significant drop in the number of women engaged in vulnerable employment.

This result is in line with the arguments presented by gender stratification theory and the bargaining model. The theories imply that women are more likely to have reduced financial oppression with access to financial resources, thereby increasing their bargaining power within the household, which ultimately leads to women’s involvement in the labor market. Pakistan’s BISP unconditional cash transfer to women has resulted in lower vulnerable employment among women. This implies that women are likely to be engaged in non-vulnerable employment categories such as the employer, self-employed non-agriculture or paid employee with access to cash. The findings also suggest that female entrepreneurship is more likely to increase in response to Pakistan’s government cash transfer program.

In the long run – after five years of program intervention – our study found no statistically significant impact of being a cash recipient on reducing vulnerable employment. This means that the program cannot bring the desired objectives over a more extended period. We may expect several factors responsible for lowering vulnerable employment among beneficiary women. Theoretically speaking, as BISP is a source of additional income for the household, the value of leisure will increase in light of the neoclassical household labor supply model, and individuals will reduce their services in the labor market. One study also negatively impacted BISP on women’s labor supply on the intensive margin (Ambler and de Brauw, 2019). Authors believe that beneficiary women decrease their labor in undesirable jobs they were engaged in due to economic necessity. Moreover, there is also a possibility that women reduce their engagement in economic activities in anticipation that they may become ineligible to receive the benefit due to an increase in labor income (Banerjee et al., 2017).

The analysis from the cross-section sample of 2016 reveals a drop in women’s vulnerable work, and the result is statistically significant. The cross-section results are also in line with the gender stratification theory and the bargaining model. The overall analysis of the results depicts that the cash transfer program in Pakistan has reduced women’s engagement in vulnerable employment. This suggests that women prefer to get themselves self-employed, i.e., women entrepreneurship is likely to increase. Government social policies like social protection through cash transfer have been beneficial in growing women’s entrepreneurship in Pakistan.

6. Limitations, recommendations, and implications

The present study is faced with a few limitations, and we offer recommendations for future research considering these limitations. First, as we concluded that BISP cash receipts reduced vulnerable employment among women, this result does not reflect whether women who reduced their engagement in vulnerable employment got engaged in non-vulnerable labor market activities. In other words, if women are not participating in vulnerable employment after being BISP cash recipients, there should be empirical evidence that there is an increase in women’s engagement in small business enterprises or they are given access to formal labor market opportunities. Second, we mainly focused in this research on the supply side of the labor market. However, the demand side of the labor market also plays a critical role in evaluating labor market circumstances holistically. Therefore, there is a need to emphasize whether beneficiary women are available with some avenues to be engaged in formal employment categories. Thirdly, while RD analysis produces mixed results for the short-run and long-run, the results cannot be generalized across the whole sample because RD is designed to estimate local average treatment effect, i.e., it considers observations within close vicinity of the threshold.

Findings from our study provide crucial policy implications. First, as we did not find a significant impact of cash transfer on a consistent panel sample of women, the government should facilitate these women to become small business entrepreneurs in the long run. When it comes to facilitation, finance is the constraint that women face, given that quarterly cash assistance amount of PKR 6000 or US$ 37.8 is not sufficient to start a small business. This can be overcome in collaboration with the financial sector by providing easy credit to start-up small business enterprises. Secondly, as there are regional diversities regarding women’s employment in Pakistan, there is a need to initiate employment opportunities in the most neglected regions. A homogenous pattern of women’s employment is maintained nationwide. Lastly, as 78% of women in Pakistan are employed in the informal sector (Zaidi and Farooq, 2016), the government should formalize their work through legislation, social security, and labor laws. Moreover, from the demand side perspective, women must be offered technical training of the skills that are high in demand.

Declarations

Author contribution statement

Mudassira Sarfraz: Conceived and designed the experiments; Wrote the paper.
Muhammad Kamran & Noorullah Khan: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Muhammad Khalique & Zubaria Andlib: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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