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**Working Paper**

## A Comment on "Vulnerability and Clientelism" (2022)

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No. 83  
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## I4R DISCUSSION PAPER SERIES

I4R DP No. 83

# **A Comment on “Vulnerability and Clientelism” (2022)**

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# A Comment On “Vulnerability and Clientelism” (2022)\*

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November 2023

## Abstract

The paper estimates the effect that changes in household vulnerability have on citizens’ participation in clientelist relationships. The authors exploit two sources of variation in household vulnerability: rainfall shocks, and a randomized intervention that provided cisterns in drought-prone areas. We reproduce all the findings presented in the four main results tables presented in the paper. The results of our robustness replication show that the results in the original paper are robust to variations in the rainfall period used as a baseline to assess changes in household vulnerability, and to exclusions that eliminate individuals in the sample who may have been substituted with others at different survey points. However, some of the original results that explain the underlying mechanisms are sensitive to how “clientelist relationships” are defined. When more frequent interactions with politicians are used as the defining characteristic of households in clientelist relationships, we find that the original results suggesting clientelism as a significant mechanism are no longer statistically significant at any standard significance level. We note, however, that the authors, in a reply to questions we sent them after the Replication Games, convincingly show that their results are robust to changing the definition of the clientelist marker.

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## 1 Introduction

Bobonis et al. (2022) study the effect that reductions in household vulnerability have on citizens' requests from politicians and how this relationship interacts with clientelism. The authors exploit two sources of variation in vulnerability in Brazil. The first is a randomized control trial that provides water cisterns to households in areas susceptible to drought. The second is rainfall. Data was collected from households at four points between 2011 and 2014, with the cistern intervention beginning in 2012 after baseline and localization data were collected.

The original study tested the impact that changes in vulnerability had on several outcomes including measures of well-being, household requests made for private goods from local politicians, and electoral outcomes. Looking at the impact on well-being, the authors find that the cisterns treatment and positive rainfall shocks—both of which reduce household vulnerability—improve household well-being. The authors note “the cisterns treatment leads to a reduction in depression of 0.09 units in 2013. This finding is significant at the 5 percent level and equivalent to 0.14 standard deviations in the CES-D scale. [...] the cisterns assignment to treatment leads to an improvement of 0.08 units among treated households (significant at the 5 percent level), representing 0.14 standard deviations on the SRHS scale.” (Bobonis et al., 2022, page 3644).

In terms of the impact that these changes in vulnerability have on requests for private goods, here they find that reductions in household vulnerability also decrease private requests from politicians. Specifically, the authors note that “the cisterns intervention reduces the likelihood that citizens request such benefits by 3.0 percentage points (17 percent of the control group mean, significant at the 5 percent level)” (Bobonis et al., 2022, page 3646) and that this effect appears to be stable whether or not the data was collected during an election year. However, they “find no evidence that the cisterns treatment or rainfall shocks cause a substitution of requests towards public goods” (Bobonis et al., 2022, page 3646).

Turning to the electoral outcomes, the authors have matched the household survey data to information from voting machines to examine the impact that changes in vulnerability have on electoral participation and voting patterns. They find that the cisterns treatment cause “the incumbent mayor receives 0.10 fewer votes (bootstrap p-value = 0.04)” (Bobonis et al., 2022, 3648) and that “for every additional respondent assigned to the treatment condition, the incumbent group receives 0.08 fewer votes (bootstrap p-value = 0.09)” (Bobonis et al., 2022, 3648).

In the paper, the authors also introduce interaction terms to assess whether clientelist relationships can explain the impact that is observed on these three outcomes. They find that “reduction in requests among citizens with frequent interactions with politicians is 10.9 percentage points (significant at the 1 percent level), but is indistinguishable from zero for citizens without such interactions. [...] A one standard deviation shock increases requests by 3.5 percentage points among citizens with the clientelism marker, compared to only 2.0 percentage points among citizens without the marker. The change in requests among the clientelist subgroup is significant for both cisterns and rainfall; their difference from the nonclientelist subgroup is only significant for the cisterns treatment” (Bobonis et al., 2022, 3650). This, combined with other findings summarized in Table 5 of the original paper suggests that clientelist relationships with politicians are an important mechanism mediating the impact that vulnerability has on well-being, political requests, and electoral outcomes.

We found that the results in the paper are reproducible, with no significant coding errors in the replication package. Based on this, the focus of our replication is on how robust the findings are to three empirical choices. This includes how the panel was matched across time, how clientelist relationships are defined, and the choice of historical rainfall period used in the main empirical findings. This allows us to test the robustness of all of the hypothesis tests from the original paper, and the main claims in the abstract regarding the sensitivity of clientelist relationships to household vulnerability.

Our robustness replication focuses on three main empirical choices made by the authors. First, we identified that approximately 9% of the sample has significantly different individual characteristics between waves of data collection. It's not clear what caused these changes since the data from different data collection waves were merged outside the code provided in the replication package. However, it may indicate enumerator errors or matching with different individuals across time that could impact the results of the study. After we contacted the original paper's authors to present the findings of this report, they were able to confirm that the match was done correctly using the non-anonymized surveys that were not available for replication due to IRB requirements, leading the authors of the original paper to conclude that some "minor measurement errors exist" in the reported ages. As a robustness check, individuals with varying ages were excluded from the sample. Even without these individuals, the results remain surprisingly stable in terms of both magnitude and statistical significance.

Second, we adapt what defines a "clientelist" relationship. The authors assume that an individual is in a clientelist relationship if they have met with their local politician at least monthly. However, the data allows us to identify households that have weekly or daily interactions with local politicians rather than just monthly interactions. When these more frequent definitions of clientelist relationships are used, the estimates are no longer statistically significant at conventional levels. Specifically, when we look at the impact on whether households have requested any private goods, the interaction between receiving the cistern treatment and having a clientelist relationship falls from -0.097 (p-value = 0.004) to -0.051 (p = 0.214) when weekly interactions are used to define clientelism, and to -0.066 (p-value = 0.374) when daily interactions are used to define clientelism.

Third, we change the historical rainfall period used as a baseline for how vulnerable households are, to more accurately reflect recent weather patterns. If weather has been more volatile in recent years then we may expect households to have adapted, meaning that using a longer historical period may overestimate changes

in vulnerability. The overall patterns suggested in the original study are mostly robust to this check as well.

## 2 Reproducibility

The first step in our replication involved reviewing all codes and data in the replication package. There were no major coding errors identified and the paper is reproducible. The rest of the report will focus on the robustness replication that we have completed.

## 3 Replication

### 3.1 Regression model

For our replication, we employ the same empirical strategy described in [Bobonis et al. \(2022\)](#). The authors use multiple regressions using fixed effects to estimate the impact that cistern interventions or rainfall changes have had on well-being outcomes, requests from politicians, and electoral outcomes. They use a clear and well-established estimation strategy to answer an interesting question. Based on this, we did not see a compelling reason to test alternative estimation methods. Instead, the focus of our replication is on verifying the sensitivity of the results to other empirical choices.

**3.1.1 Panel survey checks** We first investigated how the panel was constructed. The data made available in the replication package was already merged, and no code was provided to show how the multiple waves of the survey were collected so we turned our attention to compare individuals across each wave of the sample.

Given the timing between wave 1 and wave 2, we would expect individuals to be between 0 and 2 years older at wave 2 than they were at wave 1. We identified that 9.2% of the sample is either younger at wave 2, or more than 2 years older.<sup>1</sup> While

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<sup>1</sup>This corresponds to the total number of individuals surveyed. The analysis only includes the head of the household from each household.



Table 1: **Observation Age Difference Between Waves 1 and 2**

| Age at Wave 2 - Age at Wave 1 | Count | Age at Wave 2 - Age at Wave 1 | Count |
|-------------------------------|-------|-------------------------------|-------|
| -34                           | 1     | 1                             | 1,820 |
| -30                           | 1     | 2                             | 368   |
| -28                           | 1     | 3                             | 62    |
| -27                           | 1     | 4                             | 24    |
| -23                           | 1     | 5                             | 14    |
| -20                           | 1     | 6                             | 6     |
| -19                           | 1     | 7                             | 8     |
| -15                           | 1     | 8                             | 6     |
| -10                           | 3     | 9                             | 3     |
| -9                            | 6     | 10                            | 2     |
| -8                            | 7     | 11                            | 5     |
| -7                            | 3     | 12                            | 4     |
| -6                            | 3     | 13                            | 2     |
| -5                            | 3     | 14                            | 1     |
| -4                            | 3     | 17                            | 2     |
| -3                            | 10    | 18                            | 1     |
| -2                            | 17    | 21                            | 1     |
| -1                            | 43    | 28                            | 1     |
| 0                             | 247   |                               |       |

there may be some uncertainty around individuals' ages in these areas if precise birth dates are not clear, in Table 7, we show that there are individuals that appear to be up to 34 years younger or 28 years older at wave 2 than wave 1. These substantial age differences may suggest that the individuals sampled at wave 1 are different than those sampled at wave 2, or that there have been substantial enumerator errors. There were no other demographic indicators or personal identifiers to confirm this further without the replication files for the original dataset merge. However, as part of our replication, we tested whether the results were sensitive to the exclusion of these potentially different or "substituted" individuals.

Tables 2, 3, 4, and 5 present the results with these potential substituted individuals dropped from the analysis sample. In general, excluding individuals who have measurement errors in their demographics at waves 1 and 2 does not have a substantial impact on the economic or statistical significance of the original paper's findings. In some instances, the findings are slightly less significant after excluding individuals who appear to be different, however, the direction of the effect does not change and the significance level (1%, 5%, or 10%) only changes in three of the sixty-three parameter estimates presented in the main results tables in (Bobonis

et al. 2022) falls below commonly accepted significance thresholds. These tables are reproduced in Tables 2, 3, 4, and 5 with panels showing how results change when potential substitutes are excluded.

Table 2: **Cisterns Treatment, Rainfall Shocks, and Vulnerability**

|                                       | -(CES-D)<br>Scale<br>(2013)<br>(1) | SRHS<br>Index<br>(2013)<br>(2) | Child Food<br>Security Index<br>(2013)<br>(3) | Overall<br>Index<br>(2013)<br>(4) | Total HH<br>Expenditure<br>(2011)<br>(5) |
|---------------------------------------|------------------------------------|--------------------------------|---|-----------------------------------|--|
| <b>Panel A - Original Paper</b>       |                                    |                                |   |                                   |  |
| Cisterns Treatment                    | 0.092<br>(0.037)<br>[0.014]        | 0.075<br>(0.033)<br>[0.025]    | 0.084<br>(0.054)<br>[0.119]                   | 0.126<br>(0.043)<br>[0.003]       |  |
| Municipality Fixed Effects            | Yes                                | Yes                            | Yes   | Yes                               |  |
| <b>Panel B - Original Paper</b>       |                                    |                                |   |                                   |  |
| Rainfall Shock                        | 0.046<br>(0.016)<br>[0.004]        | 0.039<br>(0.017)<br>[0.021]    | 0.046<br>(0.026)<br>[0.080]                   | 0.064<br>(0.019)<br>[0.001]       | 24.736<br>(6.657)<br>[0.000]             |
| Municipality Fixed Effects            | No                                 | No                             | No  | No                                | No                                       |
| Observations                          | 1,128                              | 1,052                          | 1,128   | 1,128                             | 1,281                                    |
| <b>Panel C - Substitutes Excluded</b> |                                    |                                |   |                                   |  |
| Cisterns Treatment                    | 0.077<br>(0.040)<br>[0.053]        | 0.077<br>(0.038)<br>[0.040]    | 0.093<br>(0.060)<br>[0.122]                   | 0.123<br>(0.047)<br>[0.009]       |  |
| Municipality Fixed Effects            | Yes                                | Yes                            | Yes   | Yes                               |  |
| <b>Panel D - Substitutes Excluded</b> |                                    |                                |   |                                   |  |
| Rainfall Shock                        | 0.044<br>(0.016)<br>[0.006]        | 0.043<br>(0.019)<br>[0.023]    | 0.067<br>(0.027)<br>[0.013]                   | 0.071<br>(0.019)<br>[0.000]       | 26.846<br>(6.850)<br>[0.000]             |
| Municipality Fixed Effects            | No                                 | No                             | No  | No                                | No                                       |
| Observations                          | 1,010                              | 847                            | 1,010   | 1,010                             | 1,168                                    |

Note: standard errors in parentheses; p-values in brackets

**3.1.2 Definition of Clientelist Relationships** In the original study, the authors identify an individual who has met at least monthly with a local politician as being in a clientelist relationship. We examine how the use of different frequencies of interactions impact the main results of Table 5 examining treatment effect heterogeneity by clientelist status.

The results are reported in Table 6. We find that the statistical significance of the results supporting the clientelism mechanism is sensitive to the choice of the clientelist marker. Indeed, when we use weekly or daily interactions with local politicians as indicative of a clientelist relationship instead of monthly interactions, the estimates are no longer statistically significant at conventional levels.

For the main interaction (between the cisterns treatment status and the marker

Table 3: Citizen Requests, Cisterns Treatment, and Rainfall Shocks

|  | Request Any Private Good     |                              |                              |                              |                              |                              | Request Any Private Good Excluding Water | Request Any Public Good      |
|--|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--|------------------------------|
|  | (1)                          | (2)                          | (3)                          | (4)                          | (5)                          | (6)                          | (7)                                      | (8)                          |
| <b>Panel A - Original Paper</b>                              |                              |                              |                              |                              |                              |                              |  |                              |
| $\beta_1$ : Cisterns Treatment                               | -0.030<br>(0.013)<br>[0.019] |                              | -0.030<br>(0.013)<br>[0.019] | -0.030<br>(0.013)<br>[0.019] |                              |                              | -0.027<br>(0.012)<br>[0.029]             | -0.005<br>(0.005)<br>[0.348] |
| $\beta_2$ : Rainfall Shock                                   |                              | -0.023<br>(0.010)<br>[0.019] | -0.023<br>(0.010)<br>[0.018] | -0.021<br>(0.011)<br>[0.050] |                              |                              | -0.015<br>(0.009)<br>[0.091]             | -0.007<br>(0.004)<br>[0.103] |
| $\beta_3$ : Cisterns Treatment $\times$ Rainfall Shock       |                              |                              |                              | -0.004<br>(0.012)<br>[0.726] |                              |                              |  |                              |
| $\beta_4$ : Cisterns Treatment $\times$ 2012                 |                              |                              |                              |                              | -0.029<br>(0.017)<br>[0.091] |                              |  |                              |
| $\beta_5$ : Cisterns Treatment $\times$ 2013                 |                              |                              |                              |                              | -0.031<br>(0.016)<br>[0.046] |                              |  |                              |
| $\beta_6$ : Rainfall Shock $\times$ 2012                     |                              |                              |                              |                              |                              | -0.042<br>(0.011)<br>[0.000] |  |                              |
| $\beta_7$ : Rainfall Shock $\times$ 2013                     |                              |                              |                              |                              |                              | -0.004<br>(0.013)<br>[0.749] |  |                              |
| Municipality Fixed Effects                                   | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                          |
| Year Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                          |
| Observations   | 4,288                        | 4,288                        | 4,288                        | 4,288                        | 4,288                        | 4,288                        | 4,288                                    | 4,288                        |
| <b>Panel B - Substitutions Excluded</b>                      |                              |                              |                              |                              |                              |                              |  |                              |
| $\beta_1$ : Cisterns Treatment                               | -0.034<br>(0.013)<br>[0.011] |                              | -0.034<br>(0.013)<br>[0.011] | -0.034<br>(0.013)<br>[0.010] |                              |                              | -0.028<br>(0.013)<br>[0.029]             | -0.004<br>(0.005)<br>[0.398] |
| $\beta_2$ : Rainfall Shock                                   |                              | -0.023<br>(0.010)<br>[0.031] | -0.023<br>(0.010)<br>[0.030] | -0.019<br>(0.012)<br>[0.111] |                              |                              | -0.017<br>(0.009)<br>[0.078]             | -0.004<br>(0.005)<br>[0.437] |
| [1em] $\beta_3$ : Cisterns Treatment $\times$ Rainfall Shock |                              |                              |                              | -0.009<br>(0.013)<br>[0.488] |                              |                              |  |                              |
| $\beta_4$ : Cisterns Treatment $\times$ 2012                 |                              |                              |                              |                              | -0.034<br>(0.018)<br>[0.059] |                              |  |                              |
| $\beta_5$ : Cisterns Treatment $\times$ 2013                 |                              |                              |                              |                              | -0.035<br>(0.016)<br>[0.032] |                              |  |                              |
| $\beta_6$ : Rainfall Shock $\times$ 2012                     |                              |                              |                              |                              |                              | -0.041<br>(0.012)<br>[0.001] |  |                              |
| $\beta_7$ : Rainfall Shock $\times$ 2013                     |                              |                              |                              |                              |                              | -0.003<br>(0.013)<br>[0.794] |  |                              |
| Municipality Fixed Effects                                   | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                          |
| Year Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                          |
| Observations   | 3,898                        | 3,898                        | 3,898                        | 3,898                        | 3,898                        | 3,898                        | 3,898                                    | 3,898                        |

Note: standard errors in parentheses; p-values in brackets

Table 4: **Cisterns Treatment and Electoral Outcomes (2012)**

|   | Votes for<br>Incumbent<br>Mayor<br>(1) | Votes for<br>Incumbent<br>Group<br>(2) | Votes for<br>Challenger<br>Candidate<br>(3) | Turnout<br>(4)               | Blank and<br>Null Votes<br>(5) |
|---|--|--|---|------------------------------|--------------------------------|
| <b>Panel A - Original Paper</b>         |  |  |   |                              |                                |
| Treated Individuals                     | -0.101<br>(0.058)<br>[0.041]           | -0.076<br>(0.049)<br>[0.093]           | 0.098<br>(0.073)<br>[0.087]                 | -0.009<br>(0.059)<br>[0.853] | -0.006<br>(0.030)<br>[0.864]   |
| Respondents                             | 0.022<br>(0.044)<br>[0.520]            | 0.036<br>(0.038)<br>[0.316]            | -0.033<br>(0.058)<br>[0.458]                | -0.001<br>(0.049)<br>[0.993] | 0.011<br>(0.020)<br>[0.580]    |
| Control for Registered Voters           | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Location Fixed Effects                  | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Rescaled Regressors                     | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Observations                            | 909                                    | 1,641                                  | 909   | 909                          | 909                            |
| <b>Panel B - Substitutions Excluded</b> |  |  |   |                              |                                |
| Treated Individuals                     | -0.079<br>(0.055)<br>[0.100]           | -0.075<br>(0.047)<br>[0.077]           | 0.058<br>(0.069)<br>[0.277]                 | -0.018<br>(0.055)<br>[0.734] | 0.003<br>(0.030)<br>[0.942]    |
| Respondents                             | 0.018<br>(0.040)<br>[0.606]            | 0.032<br>(0.036)<br>[0.322]            | -0.014<br>(0.055)<br>[0.738]                | 0.004<br>(0.046)<br>[0.933]  | 0.000<br>(0.019)<br>[0.987]    |
| Control for Registered Voters           | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Location Fixed Effects                  | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Rescaled Regressors                     | Yes                                    | Yes                                    | Yes   | Yes                          | Yes                            |
| Observations                            | 906                                    | 1,631                                  | 906   | 906                          | 906                            |

Note: standard errors in parentheses; p-values in brackets

Table 5: **Citizen Requests and Heterogeneity by Clientelist Relationship**

|  | Request Any Private Good     |                              |                              | Request Any Private Good Excluding Water | Request and Receive Any Private Good |
|--|------------------------------|------------------------------|------------------------------|--|--------------------------------------|
|  | (1)                          | (2)                          | (3)                          | (4)                                      | (5)                                  |
| <b>Panel A - Original Paper</b>  |                              |                              |                              |  |                                      |
| $\beta_1$ : Cisterns Treatment   | -0.012<br>(0.013)<br>[0.351] |                              | -0.012<br>(0.013)<br>[0.344] | -0.016<br>(0.012)<br>[0.181]             | 0.005<br>(0.010)<br>[0.593]          |
| $\beta_2$ : Cisterns Treatment $\times$ Clientelist Relationship                           | -0.097<br>(0.034)<br>[0.004] |                              | -0.095<br>(0.034)<br>[0.005] | -0.056<br>(0.032)<br>[0.084]             | -0.068<br>(0.025)<br>[0.008]         |
| $\beta_3$ : Rainfall Shock   |                              | -0.020<br>(0.011)<br>[0.059] | -0.021<br>(0.011)<br>[0.052] | -0.013<br>(0.009)<br>[0.160]             | -0.007<br>(0.009)<br>[0.438]         |
| $\beta_4$ : Rainfall Shock $\times$ Clientelist Relationship                               |                              | -0.014<br>(0.016)<br>[0.359] | -0.012<br>(0.016)<br>[0.449] | -0.006<br>(0.015)<br>[0.699]             | -0.020<br>(0.012)<br>[0.095]         |
| $\beta_5$ : Clientelist Relationship   | 0.119<br>(0.026)<br>[0.000]  | 0.071<br>(0.018)<br>[0.000]  | 0.118<br>(0.026)<br>[0.000]  | 0.080<br>(0.025)<br>[0.001]              | 0.075<br>(0.020)<br>[0.000]          |
| <i>Effect of Cisterns Treatment for Individuals in Clientelist Relationship:</i>           |                              |                              |                              |  |                                      |
| $\beta_1 + \beta_2$  | -0.109<br>(0.032)<br>[0.001] |                              | -0.108<br>(0.032)<br>[0.001] | -0.072<br>(0.031)<br>[0.021]             | -0.062<br>(0.024)<br>[0.011]         |
| <i>Effect of Positive 1 SD Rainfall Shock for Individuals in Clientelist Relationship:</i> |                              |                              |                              |  |                                      |
| $\beta_3 + \beta_4$  |                              | -0.035<br>(0.016)<br>[0.027] | -0.032<br>(0.015)<br>[0.036] | -0.019<br>(0.014)<br>[0.177]             | -0.027<br>(0.013)<br>[0.031]         |
| Municipality Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Year Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Observations   | 4,288                        | 4,288                        | 4,288                        | 4,288                                    | 4,284                                |
| <b>Panel B - Substitutes Excluded</b>  |                              |                              |                              |  |                                      |
| $\beta_1$ : Cisterns Treatment   | -0.015<br>(0.014)<br>[0.285] |                              | -0.015<br>(0.014)<br>[0.281] | -0.016<br>(0.013)<br>[0.199]             | 0.006<br>(0.010)<br>[0.595]          |
| $\beta_2$ : Cisterns Treatment $\times$ Clientelist Relationship                           | -0.109<br>(0.036)<br>[0.003] |                              | -0.108<br>(0.036)<br>[0.003] | -0.065<br>(0.034)<br>[0.056]             | -0.080<br>(0.027)<br>[0.003]         |
| $\beta_3$ : Rainfall Shock   |                              | -0.020<br>(0.012)<br>[0.078] | -0.021<br>(0.011)<br>[0.068] | -0.016<br>(0.010)<br>[0.129]             | -0.009<br>(0.010)<br>[0.394]         |
| $\beta_4$ : Rainfall Shock $\times$ Clientelist Relationship                               |                              | -0.011<br>(0.017)<br>[0.490] | -0.008<br>(0.016)<br>[0.606] | -0.004<br>(0.016)<br>[0.776]             | -0.021<br>(0.013)<br>[0.091]         |
| $\beta_5$ : Clientelist Relationship   | 0.136<br>(0.027)<br>[0.000]  | 0.083<br>(0.019)<br>[0.000]  | 0.136<br>(0.027)<br>[0.000]  | 0.095<br>(0.025)<br>[0.000]              | 0.091<br>(0.021)<br>[0.000]          |
| <i>Effect of Cisterns Treatment for Individuals in Clientelist Relationship:</i>           |                              |                              |                              |  |                                      |
| $\beta_1 + \beta_2$  | -0.124<br>(0.034)<br>[0.000] |                              | -0.122<br>(0.034)<br>[0.000] | -0.082<br>(0.033)<br>[0.015]             | -0.075<br>(0.026)<br>[0.005]         |
| <i>Effect of Positive 1 SD Rainfall Shock for Individuals in Clientelist Relationship:</i> |                              |                              |                              |  |                                      |
| $\beta_3 + \beta_4$  |                              | -0.032<br>(0.016)<br>[0.047] | -0.029<br>(0.016)<br>[0.065] | -0.020<br>(0.015)<br>[0.169]             | -0.030<br>(0.013)<br>[0.023]         |
| Municipality Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Year Fixed Effects   | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Observations   | 3,898                        | 3,898                        | 3,898                        | 3,898                                    | 3,894                                |

Note: standard errors in parentheses; p-values in brackets

of a clientelist relationship), the magnitude of point estimates is not very much affected, but standard errors become larger. For example, the point estimate on this interaction on requesting any private good (column 1) drops from -0.097 ( $p = 0.004$ ) to -0.051 ( $p = 0.214$ ) for weekly interactions and to -0.066 ( $p = 0.374$ ) for daily interactions.

We note, however, that the authors, in a reply to questions we sent them after the Replication Games, convincingly show that their results are robust to changing the definition of the clientelist marker. The authors made us notice that the alternative specifications above were making inappropriate comparisons. Too few individuals have daily interactions with politicians, which makes them a too narrow treatment group. Furthermore, since individuals who had monthly interactions are put in the control group in our analysis, this introduces bias. We thank the authors for their feedback on this replication.

**3.1.3 Historical Rainfall Period** We investigated the sensitivity of the main results to the length of the time period considered for historical rainfall. Given the rapid global warming experienced in the past decades, rainfall episodes in the 1980s and 1990s might have less predictive power over normal rainfall during the study period. In light of this, this exercise thus aims at understanding whether having access to shorter rainfall time series would affect the results of the analysis. To do so, we ran the empirical analysis using rainfall shocks limiting the time period considered for historical rainfall to the 21st century. This sample restriction leaves us with less than half of the rainfall dataset (2000-2011 instead of 1986-2011). We first report the analysis of rainfall and well-being (panel B of Table 2 in original paper) in Table 7. We find that the results are relatively robust to this alternative use of the rainfall data with the exception of one outcome. For the child food security index, the point estimate is of the opposite sign of the original estimate. Nevertheless, the overall message remains the same: a positive rainfall shock reduces economic hardship.

Second, we replicate the analysis of rainfall and citizens' requests to politicians

Table 6: **Citizen Requests and Heterogeneity by Clientelist Relationship**

|   | Request Any Private Good     |                              |                              | Request Any Private Good Excluding Water | Request and Receive Any Private Good |
|---|------------------------------|------------------------------|------------------------------|--|--------------------------------------|
|   | (1)                          | (2)                          | (3)                          | (4)                                      | (5)                                  |
| <b>Panel A: monthly interactions as clientelist marker (original paper)</b> |                              |                              |                              |  |                                      |
| $\beta_1$ : Cisterns Treatment  | -0.012<br>(0.013)<br>[0.351] |                              | -0.012<br>(0.013)<br>[0.344] | -0.016<br>(0.012)<br>[0.181]             | 0.005<br>(0.010)<br>[0.593]          |
| $\beta_2$ : Cisterns Treatment<br>× Clientelist Relationship                | -0.097<br>(0.034)<br>[0.004] |                              | -0.095<br>(0.034)<br>[0.005] | -0.056<br>(0.032)<br>[0.084]             | -0.068<br>(0.025)<br>[0.008]         |
| $\beta_3$ : Rainfall Shock  |                              | -0.020<br>(0.011)<br>[0.059] | -0.021<br>(0.011)<br>[0.052] | -0.013<br>(0.009)<br>[0.160]             | -0.007<br>(0.009)<br>[0.438]         |
| $\beta_4$ : Rainfall Shock<br>× Clientelist Relationship                    |                              | -0.014<br>(0.016)<br>[0.359] | -0.012<br>(0.016)<br>[0.449] | -0.006<br>(0.015)<br>[0.699]             | -0.020<br>(0.012)<br>[0.095]         |
| $\beta_5$ : Clientelist Relationship  | 0.119<br>(0.026)<br>[0.000]  | 0.071<br>(0.018)<br>[0.000]  | 0.118<br>(0.026)<br>[0.000]  | 0.080<br>(0.025)<br>[0.001]              | 0.075<br>(0.020)<br>[0.000]          |
| <b>Panel B: weekly interactions as clientelist marker</b>                   |                              |                              |                              |  |                                      |
| $\beta_1$ : Cisterns Treatment  | -0.024<br>(0.013)<br>[0.060] |                              | -0.024<br>(0.013)<br>[0.059] | -0.025<br>(0.012)<br>[0.038]             | -0.001<br>(0.010)<br>[0.949]         |
| $\beta_2$ : Cisterns Treatment<br>× Clientelist Relationship                | -0.051<br>(0.041)<br>[0.214] |                              | -0.050<br>(0.042)<br>[0.227] | -0.014<br>(0.038)<br>[0.721]             | -0.054<br>(0.032)<br>[0.094]         |
| $\beta_3$ : Rainfall Shock  |                              | -0.022<br>(0.010)<br>[0.030] | -0.023<br>(0.010)<br>[0.026] | -0.015<br>(0.009)<br>[0.105]             | -0.010<br>(0.009)<br>[0.286]         |
| $\beta_4$ : Rainfall Shock<br>× Clientelist Relationship                    |                              | -0.006<br>(0.018)<br>[0.739] | -0.003<br>(0.018)<br>[0.873] | 0.001<br>(0.017)<br>[0.959]              | -0.012<br>(0.014)<br>[0.422]         |
| $\beta_5$ : Clientelist Relationship  | 0.075<br>(0.031)<br>[0.018]  | 0.050<br>(0.021)<br>[0.020]  | 0.075<br>(0.032)<br>[0.019]  | 0.039<br>(0.029)<br>[0.177]              | 0.062<br>(0.025)<br>[0.015]          |
| <b>Panel C: daily interactions as clientelist marker</b>                    |                              |                              |                              |  |                                      |
| $\beta_1$ : Cisterns Treatment  | -0.027<br>(0.013)<br>[0.035] |                              | -0.027<br>(0.013)<br>[0.034] | -0.025<br>(0.012)<br>[0.041]             | -0.005<br>(0.010)<br>[0.619]         |
| $\beta_2$ : Cisterns Treatment<br>× Clientelist Relationship                | -0.066<br>(0.074)<br>[0.374] |                              | -0.069<br>(0.075)<br>[0.356] | -0.028<br>(0.066)<br>[0.667]             | -0.056<br>(0.056)<br>[0.317]         |
| $\beta_3$ : Rainfall Shock  |                              | -0.025<br>(0.010)<br>[0.012] | -0.026<br>(0.010)<br>[0.011] | -0.015<br>(0.009)<br>[0.093]             | -0.013<br>(0.009)<br>[0.143]         |
| $\beta_4$ : Rainfall Shock<br>× Clientelist Relationship                    |                              | 0.033<br>(0.037)<br>[0.366]  | 0.035<br>(0.036)<br>[0.331]  | 0.005<br>(0.034)<br>[0.879]              | 0.020<br>(0.030)<br>[0.505]          |
| $\beta_5$ : Clientelist Relationship  | 0.078<br>(0.059)<br>[0.189]  | 0.051<br>(0.040)<br>[0.199]  | 0.078<br>(0.059)<br>[0.186]  | 0.049<br>(0.050)<br>[0.328]              | 0.053<br>(0.042)<br>[0.201]          |
| Municipality Fixed Effects  | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Year Fixed Effects  | Yes                          | Yes                          | Yes                          | Yes                                      | Yes                                  |
| Observations  | 4,288                        | 4,288                        | 4,288                        | 4,288                                    | 4,284                                |

Note: standard errors in parentheses; p-values in brackets

(Table 3 in original paper) in Table 8. For this relationship, having limited rainfall data has an impact on the magnitudes and statistical significance of the results. Not only do the effects of rainfall shocks using the limited time series reduce the magnitude of point estimates, but it also increases noise. As such, point estimates become imprecisely estimated and lose statistical significance.

Third, we replicate the results investigating clientelism as a mechanism for the effect of rainfall shocks on citizens' requests (Table 5 in original paper). Using the limited rainfall time series does not impact the results as the effect of the interaction between rainfall shocks and the clientelist marker simply vanishes even further for all outcomes considered (requesting private goods, private goods excluding water, and receiving a private good).

Overall, this exercise illustrates that, in this context, properly identifying historical temporary shocks requires sufficiently long time series on climatic conditions. Otherwise, the rainfall shock measure might simply pick-up more normal variations in rainfall, an issue which could be avoided with a longer time horizon. As stated earlier, given the current global warming, there is, however, a tension between using a longer time horizon and having climate data which are more representative of the current state of the world.

Table 7: **Rainfall Shocks and Vulnerability**

|                               | -(CES-D)<br>Scale<br>(2013)<br>(1) | SRHS<br>Index<br>(2013)<br>(2) | Child Food<br>Security Index<br>(2013)<br>(3) | Overall<br>Index<br>(2013)<br>(4) | Total Household<br>Expenditure<br>(2011)<br>(5) |
|-------------------------------|------------------------------------|--------------------------------|---|-----------------------------------|---|
| <b>Original Specification</b> |                                    |                                |   |                                   |   |
| Rainfall Shock (1986-2011)    | 0.046<br>(0.016)<br>[0.004]        | 0.039<br>(0.017)<br>[0.021]    | 0.046<br>(0.026)<br>[0.080]                   | 0.064<br>(0.019)<br>[0.001]       | 24.736<br>(6.657)<br>[0.000]                    |
| Rainfall Shock (2000-2011)    | 0.039<br>(0.022)<br>[0.076]        | 0.025<br>(0.017)<br>[0.146]    | -0.049<br>(0.028)<br>[0.077]                  | 0.017<br>(0.023)<br>[0.476]       | 17.796<br>(7.024)<br>[0.012]                    |
| Municipality Fixed Effects    | No                                 | No                             | No  | No                                | No  |
| Observations                  | 1,128                              | 1,052                          | 1,128   | 1,128                             | 1,281   |

Note: standard errors in parentheses; p-values in brackets



Table 8: Citizen Requests, Cisterns Treatment, and Rainfall Shocks

|  | Request Any<br>Private Good  |                              |                              |                              | Request Any<br>Private Good<br>Excluding<br>Water | Request Any<br>Public Good   |
|--|------------------------------|------------------------------|------------------------------|------------------------------|---|------------------------------|
|  | (1)                          | (2)                          | (3)                          | (4)                          | (5)   | (6)                          |
| $\beta_2$ : Rainfall Shock (1986-2011)             | -0.023<br>(0.010)<br>[0.019] | -0.023<br>(0.010)<br>[0.018] | -0.021<br>(0.011)<br>[0.050] |                              | -0.015<br>(0.009)<br>[0.091]                      | -0.007<br>(0.004)<br>[0.103] |
| $\beta_1$ : Cisterns Treatment                     |                              | -0.030<br>(0.013)<br>[0.019] | -0.030<br>(0.013)<br>[0.019] |                              | -0.027<br>(0.012)<br>[0.029]                      | -0.005<br>(0.005)<br>[0.348] |
| $\beta_3$ : Cisterns Treatment<br>× Rainfall Shock |                              |                              | -0.004<br>(0.012)<br>[0.726] |                              |   |                              |
| $\beta_6$ : Rainfall Shock (1986-2011)<br>× 2012   |                              |                              |                              | -0.042<br>(0.011)<br>[0.000] |   |                              |
| $\beta_7$ : Rainfall Shock (1986-2011)<br>× 2013   |                              |                              |                              | -0.004<br>(0.013)<br>[0.749] |   |                              |
| $\beta_2$ : Rainfall Shock (2000-2011)             | -0.010<br>(0.027)<br>[0.721] | -0.009<br>(0.027)<br>[0.731] | -0.011<br>(0.027)<br>[0.701] |                              | -0.002<br>(0.025)<br>[0.942]                      | -0.014<br>(0.011)<br>[0.179] |
| $\beta_1$ : Cisterns Treatment                     |                              | -0.030<br>(0.013)<br>[0.019] | -0.030<br>(0.013)<br>[0.019] |                              | -0.027<br>(0.012)<br>[0.029]                      | -0.005<br>(0.005)<br>[0.352] |
| $\beta_3$ : Cisterns Treatment<br>× Rainfall Shock |                              |                              | 0.003<br>(0.011)<br>[0.810]  |                              |   |                              |
| $\beta_6$ : Rainfall Shock (2000-2011)<br>× 2012   |                              |                              |                              | -0.029<br>(0.028)<br>[0.296] |   |                              |
| $\beta_7$ : Rainfall Shock (2000-2011)<br>× 2013   |                              |                              |                              | 0.011<br>(0.027)<br>[0.678]  |   |                              |
| Municipality Fixed Effects<br>Yes                  | Yes                          | Yes                          | Yes                          | Yes                          | Yes   | Yes                          |
| Year Fixed Effects<br>Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes   | Yes                          |
| Observations                                       | 4,288                        | 4,288                        | 4,288                        | 4,288                        | 4,288   | 4,288                        |

Note: standard errors in parentheses; p-values in brackets

Table 9: Citizen Requests and Heterogeneity by Clientelist Relationship

|  | Request Any Private Good     |                               | Request Any Private Good Excluding Water | Request and Receive Any Private Good |
|--|------------------------------|-------------------------------|--|--------------------------------------|
|  | (1)                          | (2)                           | (3)                                      | (4)                                  |
| <b>Panel A: Rainfall shock using 1986-2011 data (original paper)</b> |                              |                               |  |                                      |
| $\beta_1$ : Cisterns Treatment                                       |                              | -0.010<br>(0.018)<br>[-0.010] | -0.014<br>(0.017)<br>[-0.014]            | 0.012<br>(0.014)<br>[0.012]          |
| $\beta_2$ : Cisterns Treatment<br>× Clientelist Relationship         |                              | -0.090<br>(0.044)<br>[0.042]  | -0.052<br>(0.043)<br>[0.223]             | -0.081<br>(0.035)<br>[0.021]         |
| $\beta_5$ : Clientelist Relationship                                 | 0.087<br>(0.024)<br>[0.000]  | 0.131<br>(0.033)<br>[0.000]   | 0.090<br>(0.031)<br>[0.004]              | 0.095<br>(0.027)<br>[0.000]          |
| $\beta_3$ : Rainfall Shock (1986-2011)                               | -0.095<br>(0.024)<br>[0.000] | -0.093<br>(0.025)<br>[0.000]  | -0.059<br>(0.024)<br>[0.014]             | -0.072<br>(0.019)<br>[0.000]         |
| $\beta_4$ : Rainfall Shock (1986-2011)<br>× Clientelist Relationship | -0.029<br>(0.025)<br>[0.245] | -0.026<br>(0.025)<br>[0.298]  | -0.005<br>(0.024)<br>[0.849]             | -0.030<br>(0.019)<br>[0.113]         |
| <b>Panel A: Rainfall shock using 2000-2011 data</b>                  |                              |                               |  |                                      |
| $\beta_1$ : Cisterns Treatment                                       |                              | -0.012<br>(0.013)<br>[0.359]  | -0.016<br>(0.012)<br>[0.186]             | 0.006<br>(0.010)<br>[0.572]          |
| $\beta_2$ : Cisterns Treatment<br>× Clientelist Relationship         |                              | -0.097<br>(0.034)<br>[0.005]  | -0.057<br>(0.032)<br>[0.080]             | -0.070<br>(0.025)<br>[0.007]         |
| $\beta_5$ : Clientelist Relationship                                 | 0.068<br>(0.018)<br>[0.000]  | 0.116<br>(0.026)<br>[0.000]   | 0.080<br>(0.025)<br>[0.001]              | 0.073<br>(0.019)<br>[0.000]          |
| $\beta_3$ : Rainfall Shock (2000-2011)                               | -0.006<br>(0.028)<br>[0.836] | -0.005<br>(0.027)<br>[0.849]  | -0.001<br>(0.026)<br>[0.976]             | 0.004<br>(0.025)<br>[0.871]          |
| $\beta_4$ : Rainfall Shock (2000-2011)<br>× Clientelist Relationship | -0.018<br>(0.018)<br>[0.312] | -0.017<br>(0.017)<br>[0.305]  | -0.006<br>(0.016)<br>[0.731]             | -0.020<br>(0.014)<br>[0.153]         |
| Municipality Fixed Effects   | Yes                          | Yes                           | Yes                                      | Yes                                  |
| Year Fixed Effects   | Yes                          | Yes                           | Yes                                      | Yes                                  |
| Observations   | 4,288                        | 4,288                         | 4,288                                    | 4,284                                |

Note: standard errors in parentheses; p-values in brackets

### 3.2 Alternative Variable Specification

We considered two other variations to the initial specification. First, we checked the assignment of variables that were based on Portuguese text inputs, and did not identify any notable issues in how these were translated and assigned to variables.

Second, based on the description provided in the authors' protocol submitted to the American Economics Association's RCT registry, we planned on estimating the impact that the change in economic vulnerability had on the education outcomes of children in affected households. This was something that was originally identified in the RCT pre-registry trial, but was not included in the paper. However, we could not identify any measure of education outcomes in the data provided in the replication package. It would be interesting to examine these relationships in future research if education measures were collected by the original research team.

We also identified a minor coding error in the voting data. The voting data has been matched with data from voting machines used during elections in 2012. In our replication, we found that large portions of the voting data files do not have codebooks or variable labels. Based on this, we have reviewed the do-file provided in the replication package.

We find a minor error in the merging process, however it does not impact the results. The 2008 voting section dataset has some duplications related to the municipal ID, zone number, and voter section where there are multiple numbers of people who voted indicated. However, after the merge with the 2012 voting data, the replication file only keeps one observation for each voter section, and there is no rule for dropping the other records for each unique identifying. However, these variables are not used in the analysis, so it does not affect the results.

## 4 Conclusion

We conducted a robustness replication of the [Bobonis et al. \(2022\)](#) paper. By using rainfall shocks, as well as a randomized control trial that provided Brazilian households with cisterns in 2012, the authors test the impact that household vulnerability has on well-being, political requests, and electoral outcomes. They also introduce interaction terms to assess whether clientelist relationships act as a mechanism in the causal impacts they find. In our robustness replication, we found that the results in the original paper remain relatively constant if the historical rainfall period is changed to focus on only a more recent time period, and if individuals who may have been substituted at different data collection waves are excluded. The finding that clientelist relationships are a significant mechanism in explaining the causal impacts in this paper is not robust to the definition used to define clientelism, though the original authors' convincingly showed that their results are robust to changing the definition of the clientelist marker in a follow up after this replication was completed.

## References

Bobonis, G. J., Gertler, P. J., Gonzalez-Navarro, M. and Nichter, S.: 2022, Vulnerability and clientelism, *American Economic Review* **112**(11), 3627–59.