

README File:

Paper: "Cooperative Property Rights and Development: Evidence from Land Reform in El Salvador"

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Abstract: In cooperative property rights systems, workers jointly own and manage production, whereas in outside-ownership systems, an owner contracts workers. Despite a rich theoretical literature on how the allocation of property rights matters for specialization, efficiency, and equity, little causal evidence of their impacts exists. During a land reform in El Salvador in 1980, the military government expropriated properties owned by individuals with cumulative landholdings over 500 hectares and re-organized them into cooperatives managed by the properties' former workers. Properties belonging to individuals with less than 500 hectares remained as outside-owned properties. Using the discontinuous probability of a property becoming a cooperative and a regression discontinuity design, I present causal evidence on the effects of cooperative property rights relative to outside ownership on crop specialization, productivity, and worker equity. I find that cooperatives are (i) less likely to produce cash crops and more likely to produce staple crops; (ii) less productive when producing cash crops but more productive when producing staple crops; and (iii) have more equitable worker incomes relative to outside-owned properties. The results are consistent with an incomplete contracting model that compares cooperatives and outside-owned properties.

Table of Contents:

1. Software & Package Requirements
2. Replication Folder Description and Structure
3. Replication Instructions

Software and Packages Requirements

Software Requirements:

- Stata (code last run with version 16)
- R (code last run with version 4.0.3)

Stata Packages Needed:

- *rdrobust*
- *ristinct*
- *estout*
- *outreg2*
- *binscatter*
- *lpoly*
- *ranktest*
- *dsconcat*
- *parmest*
- *gtools*
- *boottest*
- *winsor2*
- *frmttable*
- *cmogram*
- *rdbwselect*
- *dm88_1*
- *gr0002_3*
- *grqreg*
- *univar*
- *rdlocrand*
- *rdpower*

R Libraries Required:

- *foreign*
- *ggplot2*
- *rdrobust*
- *rgdal*
- *rgeos*
- *maptools*
- *tidyverse*
- *mapproj*
- *raster*
- *tidyr*
- *readstata13*
- *haven*
- *gstat*
- *PBSmapping*
- *Ggsn*
- *GISTools*

- *dotwhisker*
- *broom*
- *haven*
- *scales*
- *rdrubust*
- *sf*
- *RColorBrewer*
- *Hmisc*
- *lubridate*
- *lmtest*
- *sandwich*
- *stringr*
- *stringi*
- *stringdist*
- *fuzzyjoin*
- *zoo*
- *rdd*
- *stargazer*
- *readxl*
- *extrafont*
- *benford.analysis*
- *sampleSelection*
- *exactextractr*
- *elevatr*

Replication Folder Description and Structure

Table 1: Description of Main Folders in Replication Folder:

Folder	Description
Code	Contains all do files and R scripts
Data	Contains all main datasets.
Output	Empty folder to be filled with tables and figures created by do-files and R scripts.
Output/Temp	Empty folder to save temporary files created by do files.

Replication Folder Structure:

```
./Replication/.
  /Code/.
  /Data/.
    /crop_suit/.
```

/suit/.
 /suit/.
/Prices /.
 /Consejo Salvadoreno del Cafe/.
 /FAO_Price_Data/.
 /IMF_IFS/.
 /MAG/.
 ./Costos de Produccion/.
 /USDA/.
 /WB/.
/GIS_LatinAmerica /.
/ wc2.1_2.5m_prec_2000-2009 /.
/Output/.
 /Temp/.

Replication Instructions:

Instructions:

- *Workspace Path*: edit the workspace path in ESLR_Master.do and ESLR_RSScripts.R to match the location of the replication folder.
- *Packages*: Ensure that all packages/ado's/libraries listed previously are properly installed.
- Follow the order of scripts detailed in ESLR_Master.do. See Table 2 for all of the relevant scripts, their input data files, and the output produced.

Table 2: Do-Files, R Code, Input Data, and Output:

Do-File/R-Script (in ./Code/ folder)	Output (in ./Output/ folder)
ESLR_Master.do	N/A. This file lists the do-files and scripts required for replication, along with their order of operations. It can be run in its entirety, followed by ESLR_RSScripts.R, to reproduce all the output.
ESLR_RSScripts.R	N/A. The file lists the figure or table produced by each R script.
ESLR_LatAmMaps.R	FIGURE 1: Land Reforms that Redistributed Haciendas as Cooperatives
ESLR_ESMap.R	FIGURE 2: Land Reform by Canton - El Salvador
ESLR_Balance_PropLevel.R	FIGURE 4: Estimates for Differences in Geography & FIGURE 3: McCrary Sorting Test
ESLR_RDPlots_PropData.do	FIGURE 5: Phase I Expropriation RD Plot
ESLR_Analysis_IVCenso.do	TABLES 2-4: Agriculture Choices and Productivity
ESLR_Analysis_EHPM.do	TABLE 5 & FIGURE 6: Impact of Ownership Type on Earnings and Earnings Distributions
ESLR_Analysis_IVCenso_Credit.do	TABLE 6: Credit Access and Sources - RD Estimates
ESLR_RDPlots_AgCensus.do	FIGURES D1-D2: RD Plots - Crop Choices & RD Plots - Agricultural Productivity
ESLR_RDPlots_PropDataModern_Existence.do	FIGURE D3: RD Plots - Existence in 2007
ESLR_IVCensus_Matching.R	FIGURE D4: Matching Estimates
ESLR_Unbalancedness.R	FIGURE D5: Sensitivity to Balance
ESLR_TemporalEV.R	FIGURE D6: Temporal External Validity Exercise
ESLR_Prop_SummStats.do	TABLES D1-D2: Summary Statistics
ESLR_Robustness_Existence.R	FIGURE D7: Coefficient Estimates For Existence in 2007 - Heterogeneity by Geographic Characteristics
ESLR_Digits.R	TABLE D3 & FIGURE D8: Testing for Differences in the Distribution of Digits for Reported Crop Outputs & Testing for Differences in Bunching in Crop Output Across Ownership Types
ESLR_YieldsSampleSelection.R	FIGURE D9: Yield Results: Correcting for Possible Selection Bias
ESLR_Analysis_IVCenso_Other.do, followed by ESLR_IVCensus_AdditionalPlots.R	FIGURES D10-D13: Production of Minor Crops - Fruits & Production of Minor Crops - Vegetables & Capital Ownership & Input Use
ESLR_IVCensus_Power.do	FIGURE D14: RD Power Calculations - Revenues per Hectare

ESLR_EHPM_Sensitivity.do	TABLE D4: Impact of Ownership Structure on Earnings Differences - Sensitivity to Land Value Return
ESLR_EHPM_Consumption.do	TABLE D5: Consumption and Consumption Distributions
ESLR_RDPlots_NonShares.do	FIGURE D15: RD Plot - Share of Land Not Devoted to Staple or Cash Crops in 2007
ESLR_AgHeterogeneity.do	TABLES D6-D7: Heterogeneity in a Cooperatives' Census Neighborhoods
ESLR_IVCensus_Controls.R	FIGURES D16-D18: Controlling for Migration Rates – Main Outcomes & Main Results - Controlling for Property Size & Controlling for Conflict During the Civil War – Main Outcomes
ESLR_IVCensus_HetPlots.R	FIGURE D19: Heterogeneity by Number of Plots Owned By Previous Owner – Main Outcomes
ESLR_IVCensus_NonComplierPlot.R	FIGURE D20: Crop Allocation - Haciendas Above vs. Below 500 ha Ownership Threshold
ESLR_EHPM_PGs.do, followed by ESLR_EHPM_PGsCoefPlot.R	FIGURE E1: Public Good Access – Time to Nearest Public Good – Estimated Differences
ESLR_IVCensus_HetPlots.R	FIGURE F1: Heterogeneity by Access to Cities – Main Outcomes
ESLR_IVCenso_Commercialization.do	TABLE F1: Commercialization Avenues - RD Estimates
ESLR_IVCensus_Controls.R	Figure F2: Controlling for Commercialization Avenues – Main Outcomes
ESLR_EHPM_Educ.do	TABLES G1-G2: Impact of Ownership Type on Education Outcomes & Differences in Age and Household Size
ESLR_EHPM_Mig.do	TABLE H1: Migration Outcomes - Household Survey Data
ESLR_CensusMigration.R	TABLES H2-H3: Migration Outcomes - Population Census & Migration Outcomes - Individuals that Completed High School - Population Census
ESLR_IVCenso_RDRandInf.do	TABLES I1-I2: Robustness to Alternative RD Method - Randomization Inference Approach
ESLR_IVCenso_RDRobustness.do	TABLES J1-I5: Robustness to Alternative RD Specifications
ESLR_IVCensus_RDRobustnessPlots.R	FIGURES J1-J6: Robustness to Alternative RD Specifications

Additional Information:

Computing Environment:

- MacBook Pro (13-inch), 3.1 GHz Dual-Core Intel Core i5, 16 GB 2133 MHz LPDDR3, MacOS Catalina (version 10.15.3)
- Stata version 16
- R version 4.0.3

R Session Info:

```
R version 4.0.3 (2020-10-10)
Platform: x86_64-apple-darwin17.0 (64-bit)
Running under: macOS Catalina 10.15.3

Matrix products: default
BLAS:
/System/Library/Frameworks/Accelerate.framework/Versions/A/Frameworks/vecLib.framework/Versions/A/libBLAS.dylib
LAPACK: /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRlapack.dylib

locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

attached base packages:
[1] tcltk      stats      graphics  grDevices  utils      datasets  methods    base

other attached packages:
[1] fuzzyjoin_0.1.6      estimatr_0.30.2      lfe_2.8-6            Matrix_1.2-18
cem_1.1.27            imputeTS_3.1         MatchIt_4.0.1
[8] TOSTER_0.3.4         animation_2.6        ggrepel_0.9.1        stargazer_5.2.2
rdd_0.57              AER_1.2-9            car_3.0-10
[15] carData_3.0-4        gdata_2.18.0         ggvis_0.4.6          stringi_1.5.3
elevatr_0.3.1         sf_0.9-6             exactextractr_0.5.0  miscTools_0.6-26
[22] sampleSelection_1.2-12 maxLik_1.4-6         rdrobust_1.0.2       ggmap_3.0.0
benford.analysis_0.1.5 stringdist_0.9.6.3   readxl_1.3.1         stringr_1.4.0
[29] extrafont_0.17       rmapshaper_0.4.4     sandwich_3.0-0
broom_0.7.5           dotwhisker_0.5.0     lubridate_1.7.9.2    Hmisc_4.4-1
[36] lmtest_0.9-38        zoo_1.8-8            lattice_0.20-41
Formula_1.2-4         survival_3.2-7       haven_2.3.1
[43] ncdif4_1.17          gstat_2.0-6          raster_3.4-5         mapproj_1.2.7
readstata13_0.9.2     tidyr_1.1.2          plyr_1.8.6           gridExtra_2.3
[50] maps_3.3.0           dplyr_1.0.2          RColorBrewer_1.1-2   sp_1.4-4
scales_1.1.1          maptools_1.0-2       ggplot2_3.3.3
[57] rgeos_0.5-5          rgdal_1.5-18
foreign_0.8-80

loaded via a namespace (and not attached):
[1] utf8_1.1.4           ggstance_0.3.4        tidyselect_1.1.0      htmlwidgets_1.5.3
grid_4.0.3            combinat_0.0-8         munsell_0.5.0          codetools_0.2-16
[9] units_0.6-7          withr_2.3.0           colorspace_2.0-0       knitr_1.30
rstudioapi_0.13       stats4_4.0.3          Rttf2pt1_1.3.8        TTR_0.24.2
[17] labeling_0.4.2       RgoogleMaps_1.4.5.3   farver_2.0.3          vctrs_0.3.8
generics_0.1.0        xfun_0.19             randomForest_4.6-14    R6_2.5.0
[25] optmatch_0.9-13      VGAM_1.1-5            bitops_1.0-6          assertthat_0.2.1
promises_1.1.1        nnet_7.3-14           forecast_8.13          texreg_1.37.5
[33] gtable_0.3.0         svd_0.5               timeDate_3043.102     rlang_0.4.11
splines_4.0.3         extrafontdb_1.0       checkmate_2.0.0        abind_1.4-5
[41] backports_1.2.0      httpuv_1.5.4          quantmod_0.4.18        gridtext_0.1.3
tools_4.0.3           stinepack_1.4          ellipsis_0.3.1         jsonvalidate_1.1.0
[49] Rcpp_1.0.5           base64enc_0.1-3       progress_1.2.2         classInt_0.4-3
purrr_0.3.4           prettyunits_1.1.1     rpart_4.1-15          systemfit_1.1-24
[57] fracdiff_1.5-1       cluster_2.1.0         crul_1.0.0            magrittr_2.0.1
data.table_1.13.2     openxlsx_4.2.3        SparseM_1.78          spacetime_1.2-3
[65] mvtnorm_1.1-1        hms_0.5.3            mime_0.9              xtable_1.8-4
rio_0.5.16           jpeg_0.1-8.1          RITools_0.1-17        compiler_4.0.3
```



```

[73] tibble_3.1.0      KernSmooth_2.23-17 V8_3.4.0      crayon_1.3.4
htmltools_0.5.0    later_1.1.0.1      ggtext_0.1.0    DBI_1.1.0
[81] MASS_7.3-53       readr_1.4.0        cli_2.1.0        quadprog_1.5-8
parallel_4.0.3     forcats_0.5.0      pkgconfig_2.0.3  xml2_1.3.2
[89] geojsonlint_0.4.0 digest_0.6.27      httpcode_0.3.0   cellranger_1.1.0
intervals_0.15.2   htmlTable_2.1.0    curl_4.3         shiny_1.5.0
[97] gtools_3.8.2      urca_1.3-0         rjson_0.2.20     lifecycle_0.2.0
nlme_3.1-149       jsonlite_1.7.1     tseries_0.10-48  fansi_0.4.1
[105] pillar_1.5.0      fastmap_1.0.1      httr_1.4.2       glue_1.4.2
xts_0.12.1         zip_2.1.1          FNN_1.1.3        png_0.1-7
[113] class_7.3-17      latticeExtra_0.6-29 e1071_1.7-4

```

Stata Package Information:

(Note: Information from the mypkg command)

number	package	date
[25]	acreg	6 May 2020
[27]	avar	19 May 2020
[14]	avg_effect	6 Jan 2020
[1]	binscatter	2 Oct 2019
[37]	binscatter2	8 Jul 2020
[48]	binsreg	14 Mar 2021
[70]	boottest	29 May 2021
[17]	carryforward	4 Feb 2020
[43]	cfout	7 Oct 2020
[24]	chartab	30 Apr 2020
[47]	ciplot	5 Jan 2021
[28]	clustse	20 May 2020
[5]	cmogram	12 Nov 2019
[60]	coefplot	14 May 2021
[44]	coldiag2	12 Oct 2020
[42]	corrmatrix	23 Jul 2020
[65]	did_multiplegt	14 May 2021
[6]	distinct	12 Nov 2019
[52]	dm0082	26 Apr 2021
[4]	dm88_1	12 Nov 2019
[3]	dsconcat	24 Oct 2019
[16]	egenmore	3 Feb 2020
[59]	ereplace	14 May 2021
[21]	estout	31 Mar 2020
[49]	eventdd	5 Apr 2021
[39]	freqindex	20 Jul 2020
[19]	ftools	18 Mar 2020
[46]	fuzzydid	21 Dec 2020
[23]	geoinpoly	9 Apr 2020
[10]	gr0002_3	26 Nov 2019
[31]	gr0034	11 Jun 2020
[9]	grqreg	26 Nov 2019
[20]	gtools	18 Mar 2020
[29]	hdfe	21 May 2020
[40]	hhi	22 Jul 2020
[63]	icw_index	14 May 2021
[11]	ietoolkit	26 Nov 2019
[13]	ivreg2	9 Dec 2019
[32]	ivreg2hdfe	11 Jun 2020
[30]	ivreghdfe	5 Jun 2020

[15]	jb	10 Jan 2020
[56]	lassopack	14 May 2021
[38]	matchit	20 Jul 2020
[50]	matsort	5 Apr 2021
[34]	mdesc	17 Jun 2020

[66]	moremata	14 May 2021
[53]	mypkg	13 May 2021
[69]	onewayplot	24 May 2021
[2]	outreg2	7 Oct 2019
[71]	panelstat	4 Jun 2021

[64]	parment	14 May 2021
[7]	pdslasso	15 Nov 2019
[62]	pylearn	14 May 2021
[35]	randcmd	18 Jun 2020
[58]	ranktest	14 May 2021

[18]	rdlocrand	6 Feb 2020
[73]	rdpower	14 Jun 2021
[55]	rdrobust	14 May 2021
[26]	reghdfe	18 May 2020
[12]	revrs	5 Dec 2019

[36]	ritest	18 Jun 2020
[51]	sdecode	26 Apr 2021
[22]	sg97_5	8 Apr 2020
[67]	tab2xl	24 May 2021
[68]	tabout	24 May 2021

[33]	tstransform	11 Jun 2020
[45]	twowayfeweights	21 Dec 2020
[57]	unique	14 May 2021
[8]	univar	26 Nov 2019
[61]	weakivtest	14 May 2021

[41]	winsor	22 Jul 2020
[54]	winsor2	14 May 2021
