README File:

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

Author: Eduardo Montero

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:

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*
- *gr0002_3 (net install gr0002_3, from(http://www.stata-journal.com/software/sj4-3))*
- *dm88_1 (net install dm88_1, from(http://www.stata-journal.com/software/sj5-4))*
- *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*
- *rdrobust*
- *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_RScripts.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, 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_RScripts.R, to reproduce all the output.
ESLR_RScripts.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_Unbalacedness.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/Ve
rsions/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
[22] sampleSelection_1.2-12 maxLik_1.4-6           miscTools_0.6-26
benford.analysis_0.1.5 stringdist_0.9.6.3     rdrobust_1.0.2         ggmap_3.0.0
[29] extrafont_0.17         rmapshaper_0.4.4       readxl_1.3.1           stringr_1.4.0
broom_0.7.5            dotwhisker_0.5.0       sandwich_3.0-0
[36] lmtest_0.9-38          zoo_1.8-8              lubridate_1.7.9.2      Hmisc_4.4-1
Formula_1.2-4          survival_3.2-7         lattice_0.20-41
[43] ncdf4_1.17             gstat_2.0-6            haven_2.3.1
readstata13_0.9.2      tidyr_1.1.2            raster_3.4-5           mapproj_1.2.7
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scales_1.1.1           maptools_1.0-2         RColorBrewer_1.1-2
[57] rgeos_0.5-5            rgdal_1.5-18           sp_1.4-4               ggplot2_3.3.3
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
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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
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data.table_1.13.2   openxlsx_4.2.3      SparseM_1.78        spacetime_1.2-3
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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
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 [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
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nlme_3.1-149        jsonlite_1.7.1      tseries_0.10-48     fansi_0.4.1
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xts_0.12.1          zip_2.1.1           FNN_1.1.3           png_0.1-7
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```

Stata Package Information:

(Note: Information from the mypkg command)

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[25]	acreg	6 May 2020
[27]	avar	19 May 2020
[14]	avg_effect	6 Jan 2020
[1]	binscatter	2 Oct 2019
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[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]	corrmat	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] parmest 14 May 2021 |
| [7] pdslasso 15 Nov 2019 |
| [62] pylearn 14 May 2021 |
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| [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 |
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| [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 |