DEV Tests 4

Contents

Setup

```r
rm(list=ls())
require(tinytex) #LaTeX
require(ggplot2) #plots
require(haven) #load data
require(dplyr) #data management
require(lubridate) #data dates management
require(zoo) #for lagging
require(jtools) #tables
require(huxtable) #tables
require(lmtest) #reg tests
require(data.table) #for data filtering
require(sandwich) #regression errors
require(readxl) #for reading excel data
require(tidyr) #data
require(tidyverse) #data
require(did) #DiD (support staggered treatment)
require(panelView) #for panel data treatment visibility
require(modelsummary) #for nice DiD tables
require(fixest) #TWFE regression

getwd()
setwd("...")
set.seed(123)
```

Data Load

```r
load("final_data.Rdata")
load("final_data_quartiles.Rdata")
load("final_data_deciles.Rdata")
load("final_data_household.Rdata")
```

Descriptive Evidence
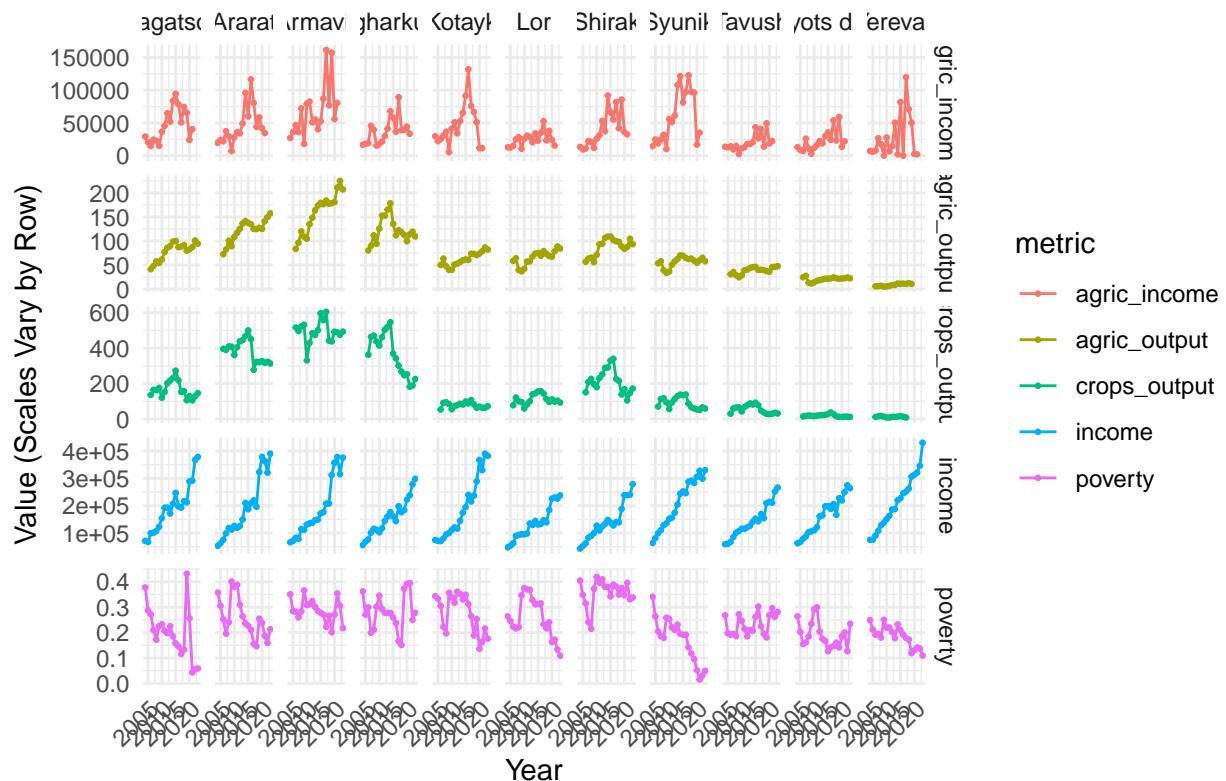
Graph 1

```r
# Prepare data
plot_data1 <- dataset %>%
  pivot_longer(cols = c(income, agric_income, agric_output, crops_output, poverty),
    names_to = "metric",
    values_to = "value" )

plot_data2 <- dataset %>%
  pivot_longer(cols = c(spei, share, agric_stress, Total_Rainfall, crops_land),
    names_to = "metric",
    values_to = "value" )

# Plot
ggplot(plot_data1, aes(x = year, y = value, color = metric)) +
  geom_line(aes(group = metric)) +
  geom_point(size = 0.5) +
  facet_grid(metric ~ district, scales = "free_y") +
  labs(
    title = "x and SPEI Over Time by District",
    x = "Year",
    y = "Value (Scales Vary by Row)") +
  theme_minimal() +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1))
```
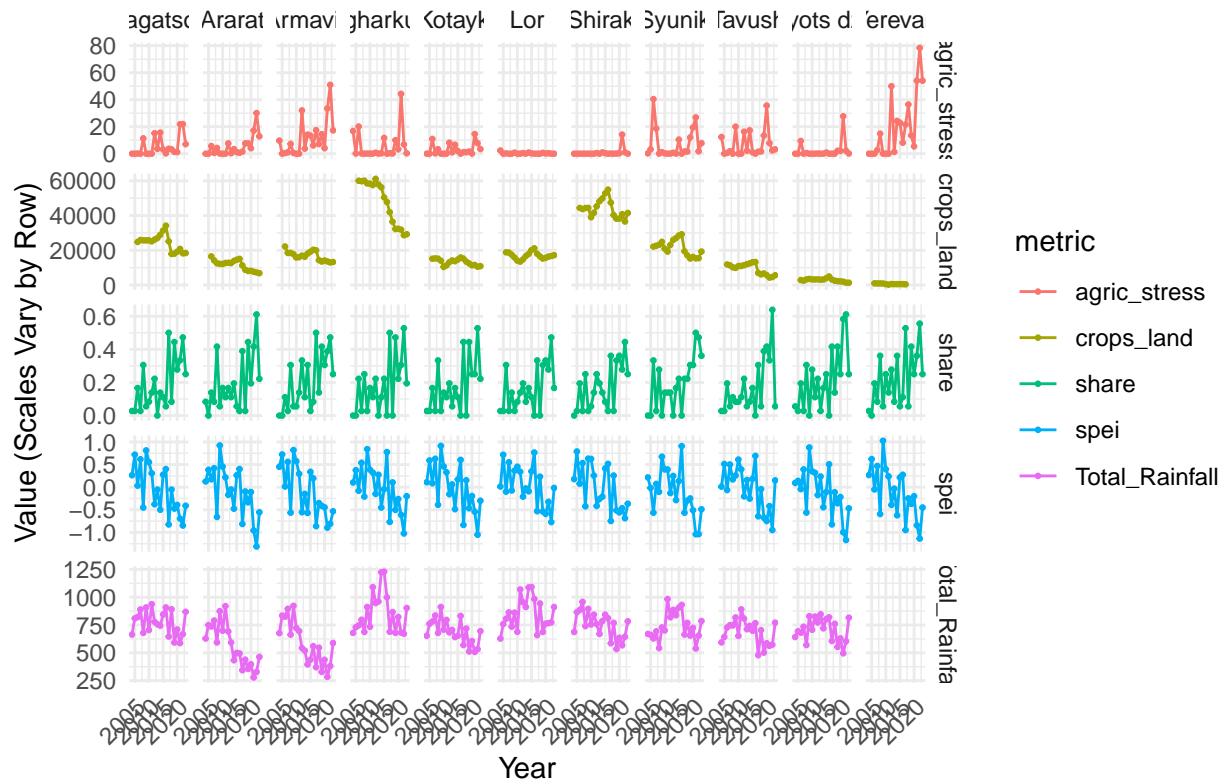
x and SPEI Over Time by District


```r
ggplot(plot_data2, aes(x = year, y = value, color = metric)) +
  geom_line(aes(group = metric)) +
  geom_point(size = 0.5) +
  facet_grid(metric ~ district, scales = "free_y") +
  labs(
    title = "x and SPEI Over Time by District",
    x = "Year",
    y = "Value (Scales Vary by Row)") +
  theme_minimal() +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1))
```

x and SPEI Over Time by District
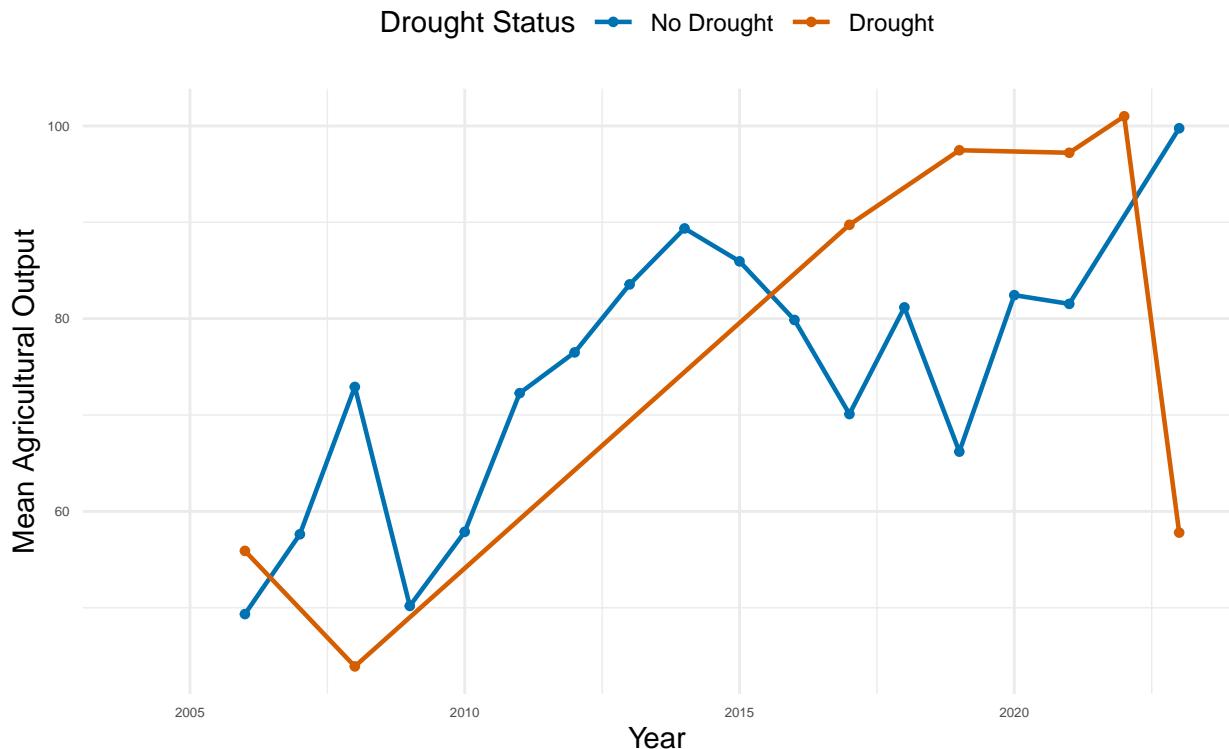
Graph with Drought Dummy

```r
# Compute, for each years, the mean of agricultural output between districts
#  that experience drought vs no drought
agric_plot <- dataset %>%
  group_by(year, drought_dummy) %>%
  summarise(mean_agric = mean(agric_output, na.rm = TRUE), n_district = n())

ggplot(agric_plot, aes(x = year, y = mean_agric,
                       color = factor(drought_dummy), group = factor(drought_dummy))) +
  geom_line(linewidth = 0.8) +
  geom_point(size = 1.2) +
  scale_color_manual(values = c("0" = "#0072B2", "1" = "#D55E00"),
                     labels = c("No Drought", "Drought")) +
  labs(x = "Year", y = "Mean Agricultural Output", color = "Drought Status",
       title = "Impact of Drought on Agricultural Output") +
  theme_minimal() +
  theme(legend.position = "top",
    axis.text.x = element_text(size = 5),
    axis.text.y = element_text(size = 5),
    plot.title = element_text(size = 20, face = "bold", hjust = 0.5),
    strip.text = element_text(size = 4, face = "bold"))
```

Impact of Drought on Agricultural Output

Drought Status ●— No Drought ●— Drought

With Quartiles

```r
# Data Prep
dataset_prepped_q <- dataset_quartiles %>%
  mutate(drought_status = factor(drought_dummy,
                          levels = c(0, 1),
                          labels = c("No Drought Event", "Drought Event")),
         income_quartile = factor(national_quartile,
                          levels = c(1, 2, 3, 4),
                          labels = c("Q1 (Poorest)", "Q2", "Q3", "Q4 (Richest)")))

# A1. Aggregate the data: Find the mean income for each year and quartile
plot1_data_q <- dataset_prepped_q %>%
  group_by(year, income_quartile) %>%
  summarize(avg_income = mean(income, na.rm = TRUE),
            avg_agr_income = mean(agric_income, na.rm = TRUE), .groups = 'drop')


# A2. Create the plot q
ggplot(plot1_data_q, aes(x = year, y = avg_income, color = income_quartile, group = income_quartile)) +
  geom_line(linewidth = 1.2, alpha = 0.8) +
  geom_point(size = 2) +

  # --- Aesthetics & Labels ---
```
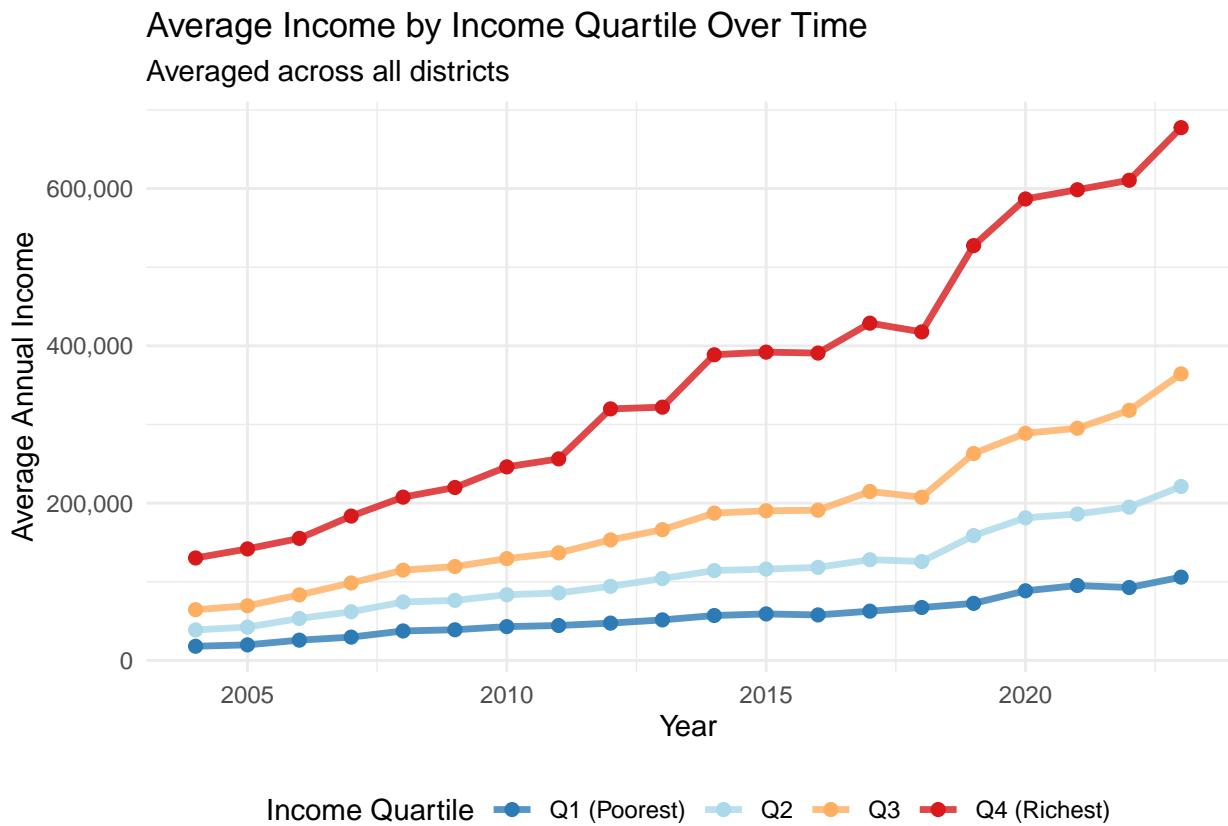
```r
  scale_y_continuous(labels = scales::comma) + # Formats y-axis labels (e.g., 50,000)
  scale_color_brewer(palette = "RdYlBu", direction = -1) +
  labs(
    title = "Average Income by Income Quartile Over Time",
    subtitle = "Averaged across all districts",
    x = "Year",
    y = "Average Annual Income",
    color = "Income Quartile") +
  theme_minimal() + theme(legend.position = "bottom")
```


Average Income by Income Quartile Over Time
Averaged across all districts

```r
# B1. Aggregate data: Mean income by year, quartile, AND drought status
plot2_data_q <- dataset_prepped_q %>%
  group_by(year, income_quartile, drought_status) %>%
  summarize(avg_income = mean(income, na.rm = TRUE),
            avg_agr_income = mean(agric_income, na.rm = TRUE), .groups = 'drop')


# B2. Create the faceted plot q
ggplot(plot2_data_q, aes(x = year, y = avg_income, color = drought_status, group = drought_status)) +
  geom_line(linewidth = 1.1, alpha = 0.9) +

  # Create 4 separate plots, one for each 'income_quartile'
  facet_wrap(~ income_quartile, scales = "free_y") +

  # --- Aesthetics & Labels ---
```
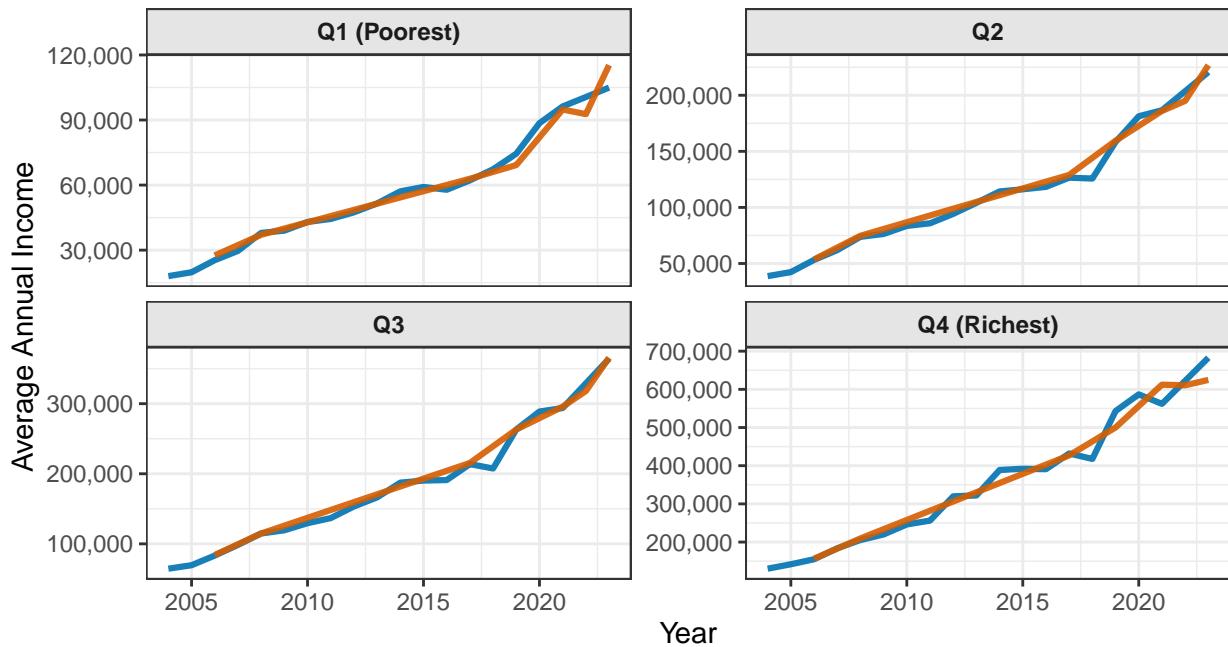
```
scale_y_continuous(labels = scales::comma) +
scale_color_manual(values = c("No Drought Event" = "#0072B2", "Drought Event" = "#D55E00")) +
labs(
  title = "Impact of Drought Events on Income, by Income Quartile",
  subtitle = "Average income trends faceted by income group",
  x = "Year",
  y = "Average Annual Income",
  color = "Drought Status") +
theme_bw() + # A clean theme
theme(
  legend.position = "top",
  strip.background = element_rect(fill = "grey90"), # Style the facet labels
  strip.text = element_text(face = "bold") )
```

Impact of Drought Events on Income, by Income Quartile
Average income trends faceted by income group

TWFE Regressions

Data Subset Selection

```
# Base case
twfe_data = dataset

# Excluding Yerevan
#twfe_data = subset(dataset, district != "Yerevan")

# Selecting majority-rural districts
#twfe_data = subset(dataset, urban < 0.5)

# Selecting the poorest income decile
#twfe_data = subset(dataset_deciles, national_decile == 1)

# Selecting the poorest income quartile
#twfe_data = subset(dataset_quartiles, national_quartile == 1)

# Selecting poorer regions
#twfe_data = subset(control, poverty > 0.3)

# Selecting a certain timeframe
#twfe_data = subset(control, year > 2015)
```

Regression on SPEI

```
# Income TWFE
TWFE <- feols(income ~ spei | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(income ~ spei + spei_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(income ~ spei + spei_lag1 + spei_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Agricultural Income TWFE
TWFE <- feols(agric_income ~ spei | district + year,
              data = twfe_data,
              cluster = ~ district)
```

	Model 1: TWFE wit..	Model 2: TWFE wit..	Model 3: TWFE wit..
Dependent Var.:	income	income	income
spei	-8,536.0 (10,344.4)	-8,581.6 (10,001.6)	-8,500.9 (10,718.1)
spei_lag1		4,203.4 (15,713.3)	4,189.0 (15,563.1)
spei_lag2			1,712.4 (16,355.1)
Fixed-Effects:	———————-	———————-	———————-
district	Yes	Yes	Yes
year	Yes	Yes	Yes
————————	————————	————————	————————
S.E.: Clustered	by: district	by: district	by: district
Observations	220	220	220
R2	0.91279	0.91285	0.91286
Within R2	0.00317	0.00390	0.00402

```r
TWFE_1lag <- feols(agric_income ~ spei + spei_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_income ~ spei + spei_lag1 + spei_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

```r
# Agricultural Output TWFE

TWFE <- feols(agric_output ~ spei | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_output ~ spei + spei_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_output ~ spei + spei_lag1 + spei_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)
```

	Model 1: TWFE w..	Model 2: TWFE wit..	Model 3: TWFE wit..
Dependent Var.:	agric_income	agric_income	agric_income
spei	-330.4 (10,874.5)	-493.9 (11,685.9)	-194.8 (12,408.0)
spei_lag1		-6,658.7 (13,072.1)	-6,824.2 (12,517.6)
spei_lag2			4,950.3 (13,712.0)
Fixed-Effects:	——————	——————	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
————————	————————	————————	————————
S.E.: Clustered	by: district	by: district	by: district
Observations	198	198	198
R2	0.67535	0.67664	0.67728
Within R2	1.06e-5	0.00398	0.00598

```r
etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

```r
# Crops Output TWFE
TWFE <- feols(crops_output ~ spei | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(crops_output ~ spei + spei_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(crops_output ~ spei + spei_lag1 + spei_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

	Model 1: TWF..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	agric_output	agric_output	agric_output
spei	-6.566 (5.684)	-6.695 (5.691)	-7.248 (5.949)
spei_lag1		-6.555 (7.294)	-6.623 (7.096)
spei_lag2			-11.58 (8.812)
Fixed-Effects:	—————	—————	—————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
——————————	——————————	——————————	——————————
S.E.: Clustered	by: district	by: district	by: district
Observations	194	194	194
R2	0.91746	0.91803	0.91980
Within R2	0.00658	0.01342	0.03466

Regression on Share (percentage of SPEI observations below -1)

```r
# Income TWFE
TWFE <- feols(income ~ share | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(income ~ share + share_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(income ~ share + share_lag1 + share_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Agricultural Income TWFE
TWFE <- feols(agric_income ~ share | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_income ~ share + share_lag1 | district + year,
```

	Model 1: TW..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	crops_output	crops_output	crops_output
spei	9.430 (8.006)	9.443 (8.216)	9.539 (8.549)
spei_lag1		0.6712 (12.47)	0.7005 (12.59)
spei_lag2			1.932 (12.22)
Fixed-Effects:	—————-	—————	—————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	192	192	192
R2	0.94095	0.94095	0.94096
Within R2	0.00157	0.00158	0.00165

```r
                    data = twfe_data,
                    cluster = ~ district)

TWFE_2lag <- feols(agric_income ~ share + share_lag1 + share_lag2 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

```r
# Agricultural Output TWFE
TWFE <- feols(agric_output ~ share | district + year,
                data = twfe_data,
                cluster = ~ district)

TWFE_1lag <- feols(agric_output ~ share + share_lag1 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

TWFE_2lag <- feols(agric_output ~ share + share_lag1 + share_lag2 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
```

	Model 1: TWFE with..	Model 2: TWFE with..	Model 3: TWFE with..
Dependent Var.:	income	income	income
share	-13,807.5 (23,095.4)	-24,717.3 (31,463.2)	-26,216.3 (33,301.2)
share_lag1		-53,629.6 (42,822.5)	-61,881.4 (51,897.8)
share_lag2			-47,299.4 (46,966.1)
Fixed-Effects:	_____	_____	_____
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	220	220	220
R2	0.91260	0.91376	0.91463
Within R2	0.00098	0.01433	0.02430

```
                      "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Crops Output TWFE
TWFE <- feols(crops_output ~ share | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(crops_output ~ share + share_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(crops_output ~ share + share_lag1 + share_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

Regression on Agricultural Stress

```
# Income TWFE
TWFE <- feols(income ~ agric_stress | district + year,
```

	Model 1: TWFE with..	Model 2: TWFE with..	Model 3: TWFE with ..
Dependent Var.:	agric_income	agric_income	agric_income
share	-21,457.8 (22,463.5)	-20,264.1 (23,747.9)	-24,273.6 (26,891.9)
share_lag1		5,929.1 (37,929.3)	-7,330.1 (40,398.9)
share_lag2			-61,396.2* (25,213.0)
Fixed-Effects:	_____	_____	_____
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	198	198	198
R2	0.67704	0.67715	0.68760
Within R2	0.00522	0.00555	0.03776

```
                    data = twfe_data,
                    cluster = ~ district)

TWFE_1lag <- feols(income ~ agric_stress + agric_stress_lag1 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

TWFE_2lag <- feols(income ~ agric_stress + agric_stress_lag1 + agric_stress_lag2 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Agricultural Income TWFE
TWFE <- feols(agric_income ~ agric_stress | district + year,
                data = twfe_data,
                cluster = ~ district)

TWFE_1lag <- feols(agric_income ~ agric_stress + agric_stress_lag1 | district + year,
                    data = twfe_data,
                    cluster = ~ district)

TWFE_2lag <- feols(agric_income ~ agric_stress + agric_stress_lag1 + agric_stress_lag2 | district + yea
                    data = twfe_data,
```

	Model 1: TW..	Model 2: TW..	Model 3: TW..
Dependent Var.:	agric_output	agric_output	agric_output
share	8.258 (13.15)	10.09 (17.22)	10.94 (18.20)
share_lag1		8.022 (19.37)	10.83 (22.35)
share_lag2			13.69 (21.43)
Fixed-Effects:	—————-	—————-	—————-
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	194	194	194
R2	0.91703	0.91713	0.91741
Within R2	0.00140	0.00258	0.00590

```
                    cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

```
# Agricultural Output TWFE

TWFE <- feols(agric_output ~ agric_stress | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_output ~ agric_stress + agric_stress_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_output ~ agric_stress + agric_stress_lag1 + agric_stress_lag2 | district + year
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

	Model 1: TW..	Model 2: TW..	Model 3: TW..
Dependent Var.:	crops_output	crops_output	crops_output
share	6.720 (34.53)	9.520 (39.82)	9.917 (41.26)
share_lag1		12.43 (30.45)	13.94 (36.15)
share_lag2			7.393 (49.80)
Fixed-Effects:	—————-	—————-	—————-
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	192	192	192
R2	0.94087	0.94089	0.94089
Within R2	0.00011	0.00044	0.00055

```r
# Crops Output TWFE
TWFE <- feols(crops_output ~ agric_stress | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(crops_output ~ agric_stress + agric_stress_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(crops_output ~ agric_stress + agric_stress_lag1 + agric_stress_lag2 | district + year
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

Regression on (Severe) Drought Dummy

```r
# Income TWFE
TWFE <- feols(income ~ drought_dummy | district + year,
              data = twfe_data,
              cluster = ~ district)
```

	Model 1: TW..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	income	income	income
agric_stress	363.6 (257.7)	235.2 (178.0)	242.7 (182.8)
agric_stress_lag1		528.0. (275.2)	495.6. (241.6)
agric_stress_lag2			249.9 (320.1)
Fixed-Effects:	————-	————	————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	220	220	220
R2	0.91374	0.91602	0.91638
Within R2	0.01410	0.04010	0.04422

```r
TWFE_1lag <- feols(income ~ drought_dummy + drought_dummy_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(income ~ drought_dummy + drought_dummy_lag1 + drought_dummy_lag2 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

```r
# Agricultural Income TWFE
TWFE <- feols(agric_income ~ drought_dummy | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_income ~ drought_dummy + drought_dummy_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_income ~ drought_dummy + drought_dummy_lag1 + drought_dummy_lag2 | district + y
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
```

	Model 1: TWF..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	agric_income	agric_income	agric_income
agric_stress	-41.71 (226.7)	-41.84 (228.5)	-29.53 (236.8)
agric_stress_lag1		35.89 (318.7)	68.28 (303.9)
agric_stress_lag2			-312.6 (278.3)
Fixed-Effects:	——————	——————	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	198	198	198
R2	0.67544	0.67549	0.67922
Within R2	0.00028	0.00046	0.01195

```
              "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
              "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Agricultural Output TWFE

TWFE <- feols(agric_output ~ drought_dummy | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_output ~ drought_dummy + drought_dummy_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_output ~ drought_dummy + drought_dummy_lag1 + drought_dummy_lag2 | district + y
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Crops Output TWFE
TWFE <- feols(crops_output ~ drought_dummy | district + year,
              data = twfe_data,
              cluster = ~ district)
```

	Model 1: TWFE..	Model 2: TWFE..	Model 3: TWFE ..
Dependent Var.:	agric_output	agric_output	agric_output
agric_stress	0.2976 (0.3617)	0.2845 (0.3350)	0.2799 (0.3357)
agric_stress_lag1		0.1748 (0.2631)	0.1834 (0.2574)
agric_stress_lag2			-0.1595 (0.2139)
Fixed-Effects:	———————	———————	———————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
—————————————	—————————————	—————————————	—————————————
S.E.: Clustered	by: district	by: district	by: district
Observations	194	194	194
R2	0.91910	0.91985	0.92035
Within R2	0.02627	0.03535	0.04131

```r
TWFE_1lag <- feols(crops_output ~ drought_dummy + drought_dummy_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(crops_output ~ drought_dummy + drought_dummy_lag1 + drought_dummy_lag2 | district + y
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

Regression on (Severe) Drought Dummy 2

```r
# Income TWFE
TWFE <- feols(income ~ drought_dummy2 | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(income ~ drought_dummy2 + drought_dummy2_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(income ~ drought_dummy2 + drought_dummy2_lag1 + drought_dummy2_lag2 | district + yea
```

	Model 1: TWFE ..	Model 2: TWFE ..	Model 3: TWFE ..
Dependent Var.:	crops_output	crops_output	crops_output
agric_stress	-0.5345 (0.5392)	-0.5148 (0.5316)	-0.5227 (0.5313)
agric_stress_lag1		-0.3144 (0.4382)	-0.3059 (0.4446)
agric_stress_lag2			-0.2968 (0.3546)
Fixed-Effects:	—————-	—————-	—————-
district	Yes	Yes	Yes
year	Yes	Yes	Yes
S.E.: Clustered	by: district	by: district	by: district
Observations	192	192	192
R2	0.94142	0.94161	0.94175
Within R2	0.00940	0.01262	0.01501

```
                    data = twfe_data,
                    cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Agricultural Income TWFE
TWFE <- feols(agric_income ~ drought_dummy2 | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_income ~ drought_dummy2 + drought_dummy2_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_income ~ drought_dummy2 + drought_dummy2_lag1 + drought_dummy2_lag2 | district
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

	Model 1: TWFE wit..	Model 2: TWFE wit..	Model 3: TWFE with..
Dependent Var.:	income	income	income
drought_dummy	-9,810.7 (12,383.2)	-9,739.1 (13,206.6)	-10,256.3 (12,917.5)
drought_dummy_lag1		962.0 (11,973.0)	1,500.8 (12,830.8)
drought_dummy_lag2			7,490.4 (11,148.2)
Fixed-Effects:	——————-	——————-	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	220	220	220
R2	0.91317	0.91318	0.91353
Within R2	0.00757	0.00763	0.01169

```r
# Agricultural Output TWFE

TWFE <- feols(agric_output ~ drought_dummy2 | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(agric_output ~ drought_dummy2 + drought_dummy2_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)

TWFE_2lag <- feols(agric_output ~ drought_dummy2 + drought_dummy2_lag1 + drought_dummy2_lag2 | district
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))


# Crops Output TWFE
TWFE <- feols(crops_output ~ drought_dummy2 | district + year,
              data = twfe_data,
              cluster = ~ district)

TWFE_1lag <- feols(crops_output ~ drought_dummy2 + drought_dummy2_lag1 | district + year,
                   data = twfe_data,
                   cluster = ~ district)
```

	Model 1: TWFE wi..	Model 2: TWFE wi..	Model 3: TWFE wi..
Dependent Var.:	agric_income	agric_income	agric_income
drought_dummy	-6,578.0 (6,096.4)	-6,742.8 (6,356.8)	-6,518.3 (6,084.6)
drought_dummy_lag1		-2,377.1 (5,412.6)	-2,639.5 (5,594.2)
drought_dummy_lag2			-3,649.5 (4,481.6)
Fixed-Effects:	_____	_____	_____
district	Yes	Yes	Yes
year	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: district	by: district	by: district
Observations	198	198	198
R2	0.67788	0.67815	0.67878
Within R2	0.00780	0.00863	0.01058

```
TWFE_2lag <- feols(crops_output ~ drought_dummy2 + drought_dummy2_lag1 + drought_dummy2_lag2 | district
                   data = twfe_data,
                   cluster = ~ district)

etable(list("Model 1: TWFE with 0 Lags" = TWFE,
            "Model 2: TWFE with 1 Lag"  = TWFE_1lag,
            "Model 3: TWFE with 2 Lags" = TWFE_2lag))
```

	Model 1: TW..	Model 2: TW..	Model 3: TWF..
Dependent Var.:	agric_output	agric_output	agric_output
drought_dummy	3.655 (3.393)	4.076 (3.792)	4.048 (3.502)
drought_dummy_lag1		5.009 (4.552)	5.041 (4.940)
drought_dummy_lag2			0.3839 (5.454)
Fixed-Effects:	—————-	—————-	—————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
—————————	———————	———————	———————
S.E.: Clustered	by: district	by: district	by: district
Observations	194	194	194
R2	0.91727	0.91788	0.91788
Within R2	0.00427	0.01155	0.01159

	Model 1: TWF..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	crops_output	crops_output	crops_output
drought_dummy	-15.48 (16.99)	-17.26 (18.25)	-15.94 (16.31)
drought_dummy_lag1		-20.88 (18.70)	-22.11 (20.25)
drought_dummy_lag2			-15.25 (22.43)
Fixed-Effects:	—————	—————	—————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
—————————	———————	———————	———————
S.E.: Clustered	by: district	by: district	by: district
Observations	192	192	192
R2	0.94138	0.94225	0.94270
Within R2	0.00881	0.02344	0.03118

	Model 1: TWFE wi..	Model 2: TWFE wi..	Model 3: TWFE wit..
Dependent Var.:	income	income	income
drought_dummy2	4,417.2 (10,008.8)	4,375.4 (11,719.3)	4,726.7 (10,885.9)
drought_dummy2_lag1		-254.6 (12,168.2)	-522.2 (13,724.3)
drought_dummy2_lag2			-1,980.6 (14,424.0)
Fixed-Effects:	——————	——————	——————-
district	Yes	Yes	Yes
year	Yes	Yes	Yes
————————————	————————————	————————————	————————————
S.E.: Clustered	by: district	by: district	by: district
Observations	220	220	220
R2	0.91261	0.91261	0.91263
Within R2	0.00116	0.00116	0.00138

	Model 1: TWFE w..	Model 2: TWFE w..	Model 3: TWFE wi..
Dependent Var.:	agric_income	agric_income	agric_income
drought_dummy2	2,929.1 (7,917.2)	3,799.0 (8,427.7)	4,004.8 (8,289.1)
drought_dummy2_lag1		5,480.4 (3,437.8)	5,330.4 (3,499.4)
drought_dummy2_lag2			-1,128.2 (8,667.5)
Fixed-Effects:	——————	——————	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
————————————	————————————	————————————	————————————
S.E.: Clustered	by: district	by: district	by: district
Observations	198	198	198
R2	0.67575	0.67680	0.67684
Within R2	0.00126	0.00449	0.00460

	Model 1: TWFE..	Model 2: TWF..	Model 3: TWF..
Dependent Var.:	agric_output	agric_output	agric_output
drought_dummy2	-0.9607 (1.974)	-1.348 (2.379)	-1.615 (2.012)
drought_dummy2_lag1		-2.216 (2.696)	-2.006 (3.067)
drought_dummy2_lag2			1.458 (3.961)
Fixed-Effects:	——————	——————	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
S.E.: Clustered	by: district	by: district	by: district
Observations	194	194	194
R2	0.91693	0.91703	0.91707
Within R2	0.00022	0.00134	0.00181

	Model 1: TW..	Model 2: TW..	Model 3: TWF..
Dependent Var.:	crops_output	crops_output	crops_output
drought_dummy2	11.95 (12.06)	12.96 (13.67)	13.45 (11.78)
drought_dummy2_lag1		5.791 (11.77)	5.345 (13.63)
drought_dummy2_lag2			-2.981 (14.60)
Fixed-Effects:	————-	————-	——————
district	Yes	Yes	Yes
year	Yes	Yes	Yes
S.E.: Clustered	by: district	by: district	by: district
Observations	192	192	192
R2	0.94109	0.94114	0.94116
Within R2	0.00394	0.00482	0.00504