Effect of Crop-rotation Methods on Productivity

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1 Data Description

1.1 Subset for DID

We used only half of the data for the regressions. Specifically, we removed those who received treatment in 1996-2000 but not in 2001-2005, and those who received treatment throughout the entire period (1996-2005).

1.2 Data Cleaning

In regressions that included control variables, we excluded rows that included NA.

2 Empirical Strategy

2.1 Model

We run a DID to estimate the effect of crop-rotation methods on productivity. The reasons for choosing DID are as follows: First, the subset of the data fits into DID, which only includes two categories of data. The first category is those who were not treated in 1996-2000 and were treated in 2001-2005, which we can consider as 'treatment group'. The second category is those who did not receive treatment during the entire observation period (1996-2005), which can be considered as 'control group'. Second, the assumption of DID (common trend) holds in this case.

2.2 Assumption

Our identification assumption is common trend assumption (assumption of DID).

3 Results

3.1 Regression Results

First, we estimate the basic DID model (Baseline in Table 1) using an OLS regression framework with the following regression equation.

$$Productivity_{it} = \beta_0 + \gamma treat_i \times post_t + \alpha treat_i + \delta post_t + \mu_{it}$$

where

$$treat_i = \begin{cases} 1 & i = treatment \\ 0 & i \neq treatment \end{cases} \tag{1}$$

$$post_i = \begin{cases} 1 & t > 2000 \\ 0 & t \leq 2000 \end{cases} \tag{2}$$

$$treat_i \times post_t = method_{it}$$

Then we add year and state fixed effects to this model (FE and Proj. in Table 1), followed by additional control variables (Cont. in Table 1), and then time trends (Trends in Table 1).

Table 1: Effect of Crop-rotation Methods on Productivity

	Baseline	FE	Proj.	Cont.	Trends
Treat	1.055***	1.055***	1.055***	1.590	1.548
	(0.060)	(0.060)	(0.060)	(1.144)	(1.227)
Cluster			(0.061)	(1.122)	(1.206)
Observations	4950	4950	4950	4430	4430

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Finally, we cluster the standard errors at the id level (Cluster in Table 1) because the standard errors are most likely correlated within states across time.

Table 1 shows that the instructing farmers how to use crop-rotation methods optimally increased productivity by 1.055 (level 0.001, s.e. 0.06) points. We have strong confidence on the results because it's stable across specifications of baseline model and fixed effect model.

3.2 Assumption Test

We then plotted productivity trends separately for the treatment and control groups (Figure 1).

Figure 1: Test of Common Trend Assumption

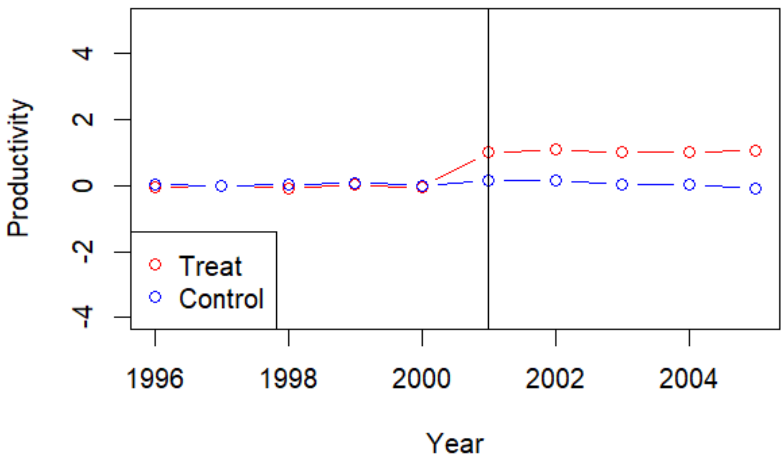

Figure 1 shows that the assumption holds, as the treatment and control groups have the same common trend before the treatment (crop-rotation methods) is applied, and only after the treatment is applied do they have different results.

4 Conclusion

By using DID model, we conclude that instructing farmers how to use crop-rotation methods optimally increased productivity by 1.055 points in Costa Rica in 1996-2005. The results are significant with low standard error and stable across specifications while assumption holds.

However, only using half of the data may cause bias, which will be dealt with later.