Empowerment and Efficiency

Tenancy Reform in West Bengal

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The Model

- Infinitely lived landlord who owns a plot of land that he can not crop himself.
- Large population of identical infinitely lived tenants who are willing to work foe the tenant as long as landlord pays them their ouside option, m, which is exogenously given.
- Landlord and tenant share same discount factor, $\delta < 1$
- In each period, output can take on two values, $Y_H = 1$("high"or"low") with prob. e and $Y_L = 0$("low"or"failure") with prob. $(1 - e)$
- Tenant chooses e ("effort") which costs him $c(e) = \frac{1}{2}ce^2$ with $c > 1$

Assumptions

1. Only the tenant's effort matter for output which is nonobservable and hence noncontractible.
2. In a given period, each tenant has a limited amount of wealth $w > 0$, so that least he can paid is $-w$.
3. Both the tenant and landlord are risk-neutral.
4. Strategies are history-independent i.e. the contract in any given period will just need to specify four numbers:
   - **HIGH OUTPUt:** Tenant's payment, *h* and the prob. of his continuing in the job, φ
   - **LOW OUTPUT:** Tenant's payment, *l* and the prob. of his continuing in the job, ψ.

Optimal tenancy contract without eviction

Incumbent tenant will continue to be tenant in all future periods

Optimal contract is a solution of the following problem:

$$\max_{e,h,l} \pi = e - [eh + (1-e)l]$$

s. t.

$$\textbf{LLC}: \quad h \geq -(1+w), l \geq -w$$

$$\textbf{PC:} \quad v = eh + (1-e)l - \frac{1}{2}ce^2 \geq m$$

$$\textbf{ICC:} \quad e = \arg\max_{e \in [0,1]} \{eh + (1-e)l - \frac{1}{2}ce^2\}$$

Notice

1. Optimal incentive contract (h, l) must have $h > l$
2. landlord will set $1 \geq h > l$
3. One of the two LLCs, $h \geq -(1 + w)$ cannot bind.
4. Total social surplus generated project is $s = e - (\frac{ce^2}{2})$
   $\Rightarrow$ First best level of e, is $\frac{1}{c} < 1$
   $\Rightarrow$ No reason to choose $h - l > 1$ since the first level of effort is achieved when $h - l = 1$.
5. ICC can be rewritten as

$$e = \frac{h - l}{c} \in (0, 1)$$

Problem to solve

$$\max_{h,l} \pi(h,l) = \frac{h-l}{c} - \frac{(h-l)^2}{c} - l$$

s.t.

$$\frac{(h-l)^2}{2c} + l \geq m$$

and

$$l \geq -w$$

Solution to the problem

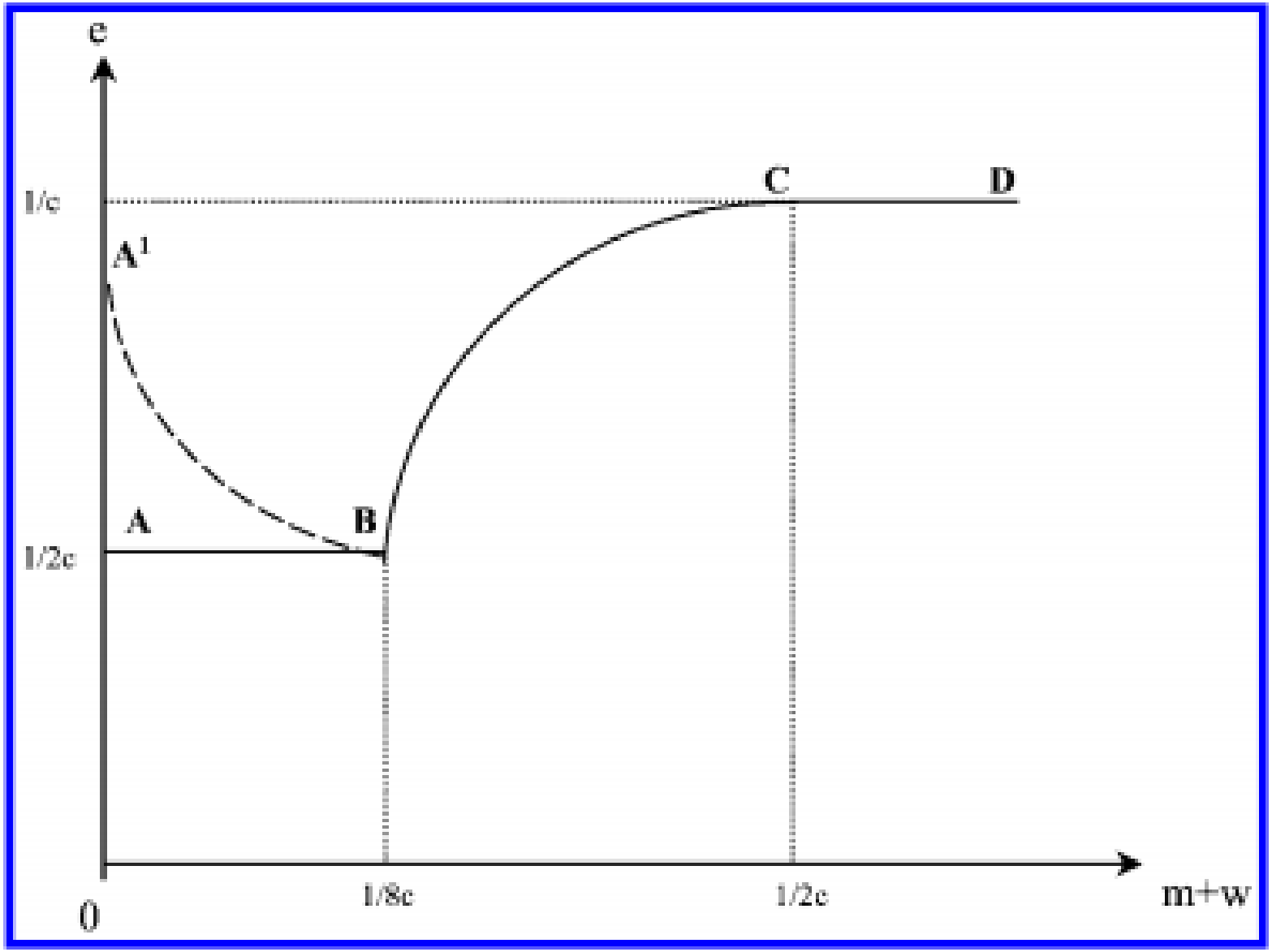
$$
\begin{aligned}
e^* &= \frac{1}{2c} && m + w < \frac{1}{8c} \\
&= \sqrt{\frac{2(m+w)}{c}} && \frac{1}{8c} \leq m + w < \frac{1}{2c} \\
&= \frac{1}{c} && \frac{1}{2c} \leq m + w
\end{aligned}
$$

Result 1

An improvement in the incumbent's outside option always (weakly) increases effort.

Result 2

The tenant,s participation does not bind as long as $m + w < \frac{1}{8c}$ and hence he earns rents.


e
1/c
C
D
A1
A
B
1/2c
0
1/8c
1/2c
m+w

Optimal Tenancy Contracts with eviction

$*$ Landlord can evict the tenant at will.

$*$ Tenant earn rents unless his outside option is sufficiently good

$\Longrightarrow$ The tenant will strictly prefer to continue being a tenant.

$\Longrightarrow$ The threat of eviction if output is low can be used as an incentive device.

$*$ V: expected equilibrium lifetime utility of an incumbent tenant in the next period.

$*$ $M = \frac{m}{(1-\delta)}$: equilibrium lifetime expected utility of someone who is currently not a tenant.

$*$ History independence$\Longrightarrow$ Landlord cannot precommit anything beyond the current-period incentive contract,(h, l) and the corresponding probabilities of eviction, $(1-\varphi, 1-\psi)$.

Notice

∗Tenant's expected lifetime utility in the current period from choosing a level of effort, e, V_o must satisfy the Bellman equation:

$$V_o = \max_{e\in[0,1]} \{eh+\delta[\varphi e+(1-e)\psi](V-M)+\delta M-(1-e)w-\frac{1}{2}ce^2\} \quad (1)$$

∗Differentiating this w.r.t. e gives new ICC:

$$h + w + \delta(V - M)(\varphi - \psi) = ce \quad (2)$$

∗Compare it to ICC in previous case: Existence of rents and the tenant's foresight reduces marginal cost of implementing e by the amount $\delta(V - M)(\varphi - \psi)$.

Contd...

- $\varphi = 1$ and $\psi = 0$ in the optimal dynamic contract.
  As long as tenant is still getting more than his outside option, raising the prob. of eviction is preferred by the landlord rather than raising h, for giving more incentives as it is costless from his point of view.
- ψ should be set at 0 to give maximum punishment to the tenant for failure.
- φ should be set at 1, to maximally reward the tenant for success.
- ICC becomes:

$$h + w + \delta(V - M) = ce \tag{3}$$

Participation constraint

* PC is: $V_o \geq M$
* In a stationary state equilibrium: $V_o = V$

(1)$\Longrightarrow$

$$V - M = \frac{eh - (1-e)w - \frac{1}{2}ce^2 - m}{1 - \delta e} \tag{4}$$

* Substituting(3) into (4), we get

$$V - M = \frac{1}{2}ce^2 - w - m \tag{5}$$

* In any equilibrium in which eviction threats are used, $V - M$ must be positive i.e. $(5) \geq 0$

Problem to solve

∗Landlord has to maximize

$$\max_{\{e,h,l\}} e(1-h)-(1-e)l$$

s.t. ICC (3) and LLC, $l=-w$

∗ Using the 2 constraints, the objective function can be rewritten as :

$$\max_{e}\{1-ce+\delta(V-M)\}e+w \tag{6}$$

∗ maximizing this leads to:

$$e=\frac{1+\delta(V-M)}{2c} \tag{7}$$

Solution

Eviction threats are effective

- $V - M$ has to be positive:
  - When $V - M = 0$ then $e = \frac{1}{2c}$
  - At $e = \frac{1}{2c}$, $m + w = \frac{1}{8c}$
  - For $V - M > 0, m + w > \frac{1}{8c}$
  - As $m + w$ goes down $V - M$ goes up and e goes up $\implies e \in (\frac{1}{2c}, \frac{1}{c})$

Solution

Eviction threats are not effective

- $V - M \leq 0$

- substitute (3) into (7), we get optimal share of the tenant:

$$h^* - l^* = \frac{1}{2} - \delta\frac{1}{2}(V - M)$$

S $m + w$ goes up, it goes down.

- Solving PC gives $e^* = \sqrt{\frac{2(m+w)}{c}}$ which is exactly the value we found when eviction was not an option under the assumption $\frac{1}{2c} \geq m + w \geq \frac{1}{8c}$ and the optimal choice of tenant's share is also exactly the same.
- For $m + w > \frac{1}{2c}$, effort will be set its first best level, $e^* = \frac{1}{c}$ and $h^* - l^* = 1$ and LLC will no longer bind, which is also same as no eviction case.

Result

When evicting the tenant is an option, the optimal choice of e, $h - l$ coincides with for the non-eviction case as long as $m + w \geq \frac{1}{8c}$. For $m + w < \frac{1}{8c}$, the value of chosen e with eviction is strictly higher than the corresponding value without evictions. Moreover, over the range, a higher m is associated with a lower choice of e but a higher value of $h - l$.

◦ In an eviction equilibrium, h is lower and e is higher than in non eviction case; the tenant's utility per period has to be lower

Operation Barga, Security of Tenure and Crop shares

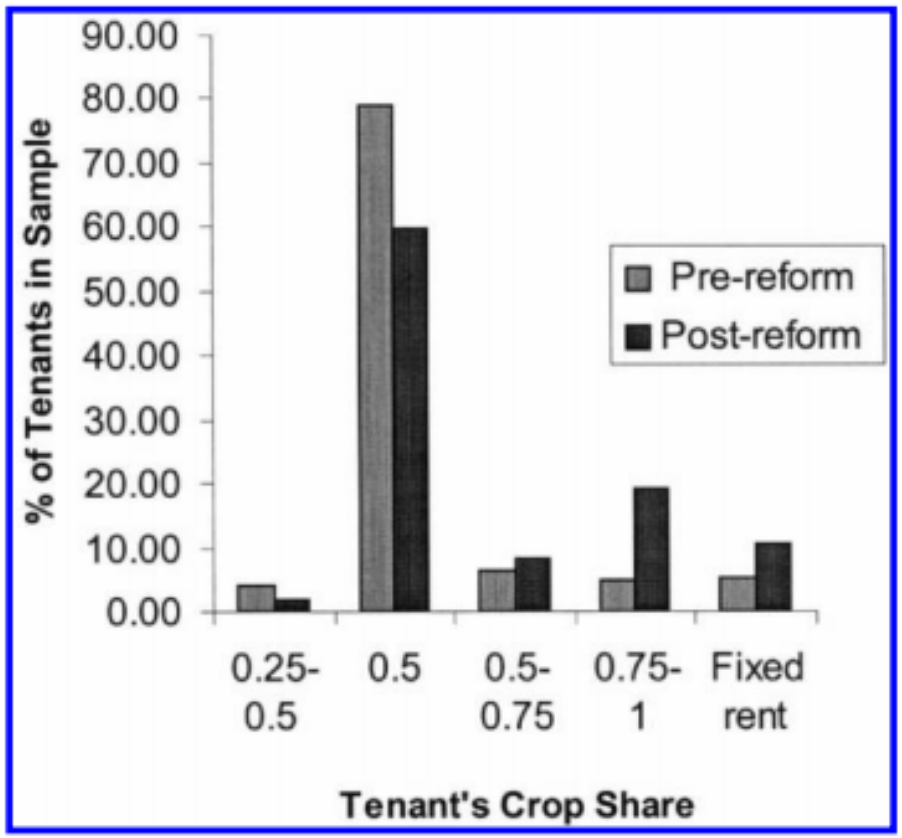
- Tenants responded positively to the reform: By 1993, about 65% of all sharecroppers were registered, compared to 15% before Operation Barga.
- A survey with random sample of 480 sharecroppers from 48 villages in West Bengal showed that reform greatly improved security of tenure.
- **Pre reform:** $*$ 74% of tenants surveyed didn't have specified duration tenure and tenure was subject to arbitrary termination by the landlord.
  $*$ In 80% cases landlord had used eviction threat. The reason cited for this include both low production(40%) and disputes withe landlord(55%).

Contd...

- **After reform:** $*$ 96% of all respondents reported that evicting registered tenant is difficult or impossible.
  $*$ 67% also reported that it is difficult to evict even unregistered tenants - largely because they can register themselves whenever they want.
- Since eviction threats were used by the landlord in bargaining in the pre reform period, making eviction difficult or impossible must have strengthened the tenant's bargaining position: m should have gone up.
- Our model says that tenant's share of the crop should go up, or at least not go down, when m goes up.

Contd..

Proportion of the tenant in the sample getting more than 50% of output increased from 17% to 39%.



Estimating the effect of reforms on Productivity

Comparison to Bangladesh

- **Before Operation Barga**, agricultural productivity was growing at almost identical rates in two 2 states: Between 1969 and 1978, rice yields increased by 9.3% in West Bengal and by 11% in Bangladesh.
- **After Operation Barga**, (1979-93) rice yields in West Bengal increased 69% compared to 44% in Bangladesh.

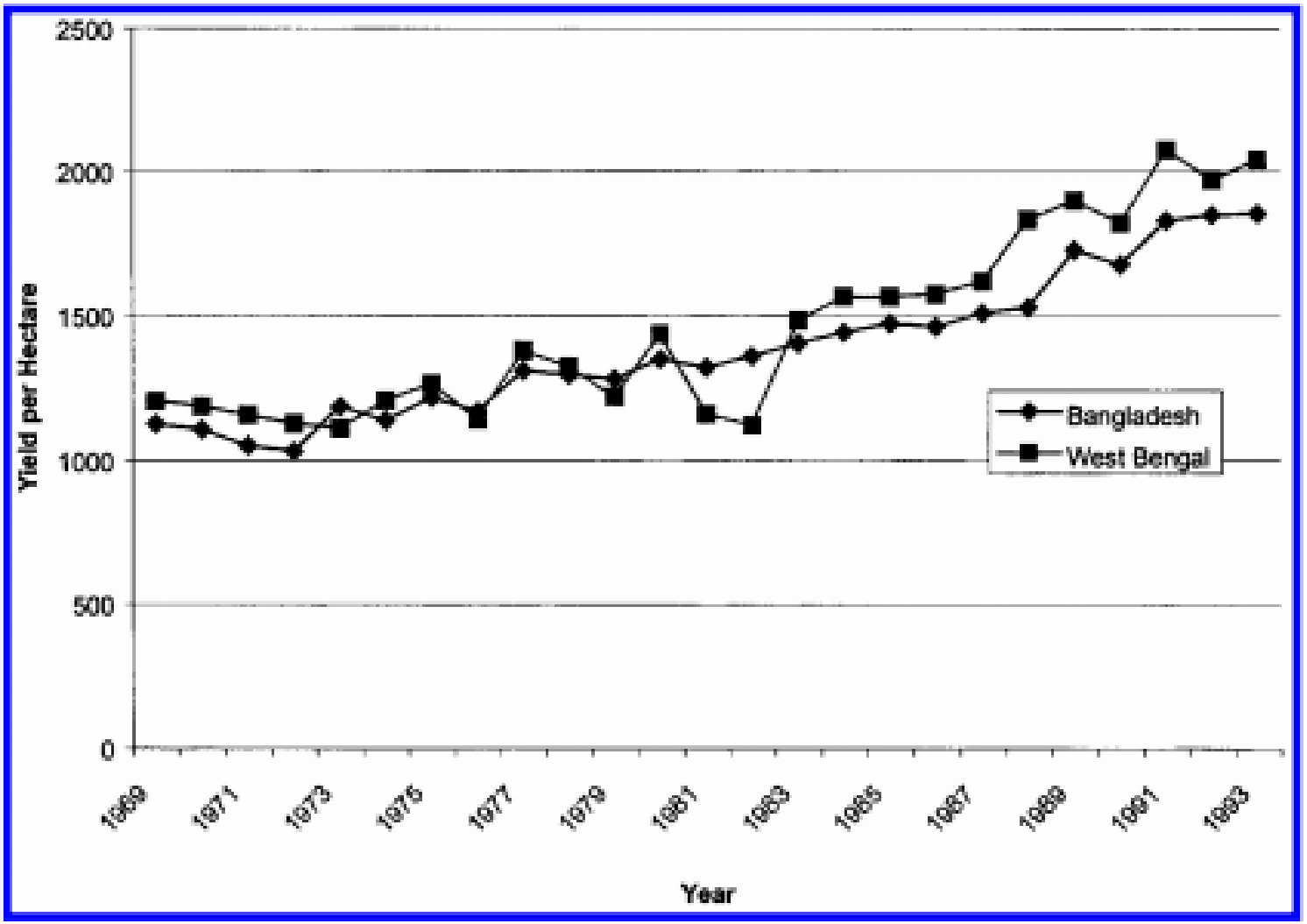


FIG. 4.—Rice yield in West Bengal and Bangladesh, 1969–93

- During the period of study, agricultural productivity in both the regions g grew in part as a result of 3 common factors:
  - Arrival of green revolution permitted by the spread of High Yield Variety(HYV) of rice.
  - A fall In the prices of fertilizers.
  - An increase in small scale private irrigation.
- Even though the rate of adoption of HYV rice was faster in Bangladesh than in West Bengal, the rate of growth in rice productivity was higher in West Bengal. This difference is what we shall attribute to the implementation of Operation Barga.

Using a difference-in-difference estimator

district level panel data

- The diff-in-diff specification compares the change(before and after Oration Barga) in yields in treatment districts(West Bengal) with the corresponding change in control districts (Bangladesh).
- model can be specified in regression form as:

$$\ln y_{dt} = \alpha_d + \psi_t + \beta \times treatment_d \times post_t + \sum \phi_j X_{jdt} + \epsilon_{dt}$$

Simple Diff-in-Diff Results

DIFFERENCE-IN-DIFFERENCE MODELS OF LOG OF RICE YIELD PER HECTARE (1969–93)

	DIFFERENCE (1969–78) (1)	LEVEL 1969–93 (2)	LEVEL Excluding 1981–82 (3)
West Bengal (=1)	.004 (.17)	...	...
West Bengal × (1979–83)[a]	...	-.09*** (3.75)	−.01 (.38)
West Bengal × (1984–88)	...	.05** (1.99)	.05** (2.00)
West Bengal × (1988–93)	...	.05* (1.77)	.05* (1.78)
District fixed effects F statistic	...	44.55	42.61
Year fixed effects F statistic	4.26***	29.75***	31.81***
R^2	.12	.80	.81
Sample size	256	717	659

NOTE.—t-statistics are in parentheses.

Adjusted Diff-in-Diff Results

TABLE 3

DIFFERENCE-IN-DIFFERENCE MODELS OF LOG OF RICE YIELD (1977–91)

	Whole Sample			Excluding Drought Years 1981–82		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
West Bengal × (1979–83)	−.08*** (−2.43)	−.07** (−2.05)	−.05 (−1.58)	.001 (.01)	.002 (.06)	.015 (.47)
West Bengal × (1984–87)	.04 (1.17)	.05 (1.47)	.07** (2.04)	.04 (1.24)	.04 (1.26)	.06** (1.93)
West Bengal × (1988–91)	.08** (2.20)	.12*** (3.28)	.18*** (5.11)	.07** (2.33)	.11*** (2.97)	.17*** (4.95)
Log(rainfall)	...	.01 (.40)	.007 (.32)	...	.019 (.70)	.01 (.46)
Log(public irrigation)	...	.122*** (7.22)	.07*** (4.27)	...	.103 (5.77)	.04*** (2.69)
HYV share of grain cultivation area	...	...	1.04*** (8.18)	...	...	1.05*** (8.21)
District fixed effects *F*statistic	40.02***	20.14***	14.76***	41.43***	18.8***	14.64***
Year fixed effects *F*statistic	20.18***	12.14***	7.73***	21.67***	12.41***	6.04***
R^2	.82	.85	.87	.83	.85	.88
Sample size	424	424	424	367	367	367

Expansion of Public Policies

DIFFERENCE-IN-DIFFERENCE MODELS OF OTHER PUBLIC POLICIES (1977–91)

	Log(Public Irrigation)		HYV SHARE	
	Whole Sample	Excluding 1981–82	Whole Sample	Excluding 1981–82
West Bengal × (1979–83)	−.24**	−.18	−.03**	−.022
	(−2.28)	(−1.61)	(−2.25)	(−1.45)
West Bengal × (1984–87)	−.27***	−.24**	−.014*	−.029**
	(−2.44)	(−2.18)	(−1.88)	(−1.95)
West Bengal × (1988–91)	−.57***	−.53***	−.083***	−.085***
	(−4.97)	(−4.69)	(−5.25)	(−5.58)
Log(rainfall)	.06	.005	.006	.007
	(.82)	(.06)	(.56)	(.67)
District fixed effects F statistic	250.66***	227.98***	55.32***	49.21***
Year fixed effects F statistic	8.68***	9.51***	29.65***	31.22***
R^2	.96	.96	.85	.85
Sample size	424	367	424	367

Approach 2: Program intensity

Model to be estimated:

$$\ln y_{dt} = \alpha_d + \psi_t + \gamma b_{dt-1} + \sum_k \beta_k \ln X_{kdt} + \epsilon_{dt}$$

where $b_{dt-1} = \lambda_d \nu_{dt-1}$

Results

EFFECT OF REGISTRATION ON THE LOG OF RICE YIELD IN WEST BENGAL, 1979–93
(N=210)

	Model 1 (1)	Model 2 (2)	Model 3 (3)	Model 4 (4)	Model 5 (5)	Model 6 (6)
Sharecropper registration (one year lagged)	.43*** (3.46)	.42*** (3.44)	.43*** (3.55)	.35*** (2.69)	.36*** (2.64)	.36*** (2.63)
Log(rainfall)	...	−.07* (−1.67)	−.08* (−1.82)	−.07 (−1.59)	−.08* (−1.74)	−.08* (−1.77)
Log(public irrigation)	...	.02 (1.01)	.01 (.70)	.01 (.60)	.02 (.83)	.02 (.79)
Log(roads)	...	.28*** (2.75)	.25** (2.46)	.21** (1.99)	.19 (1.55)	.22 (1.54)
HYV share of rice area	...	...	.57*** (2.85)	.45** (2.10)	.47** (2.16)	.47** (2.16)
F-statistic:						
South × year[a]	...	...	...	4.73***	4.36***	4.38***
Left Front × year[b]	...	...	...	...	2.64**	2.65**
Sharecropping × year[c]	...	...	...	...	2.64**	.12
District fixed effects	72.23***	15.10***	8.99***	9.01***	8.47***	7.68***
Year fixed effects	28.31***	27.67***	21.60***	17.63***	17.83***	12.17***
R^2	.91	.92	.92	.92	.92	.92

NOTE.—t-statistics are in parentheses.

[a] Represents a set of variables obtained by interacting a dummy variable that takes the value one if that district is in southern W

[b] Represe

a Left Front

[c] Represents a set of variables obtained by interacting the initial extent of sharecropping in a district with each year.

Conclusion

* **Theoretical Analysis:** Tenancy laws that lead to improve crop shares and shares security of tenure for tenants can have a positive effect on productivity.
*__Evidence:__ Based on aggregate district level data showed tenancy reform program called Operation Barga explains around 28% of the subsequent growth of agricultural productivity in West Bengal.
* **Limitation:** micro level data not available which is required to get more precise estimates.