

Land Redistribution

EC307 ECONOMIC DEVELOPMENT

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MOTIVATION

Finding effective means to tackle poverty is crucial to the defining mission of development economics

But which forms of *intervention* can be effective?

Should we just rely on growth promoting policies to reduce poverty?

land reform – prominent in 60s & 70s as mechanism for achieving “*redistribution with growth*” ? (Chenery et. al.)

Limited rigorous quantitative analysis of effectiveness

Link between *land scarcity* and *hunger*

Key platform for political parties in low income countries – motivation for land reform – “*land to the tiller*” programmes

These results indicate that Mao’s legacy of universal and egalitarian access to land represents a *key means of avoiding hunger*

- helps us to understand how China has managed to escape the high levels of hunger which typify low income countries
- events in China cannot be replicated elsewhere
but
- paper suggests that providing **access to land** may be central to current attempts to tackle hunger in the modern world

SET-UP

Representative household data from State Statistical Bureau

Table 1 Looks at 2 provinces which have rapidly diverged since onset of rural reforms in 1978 and 1990

- Jiangsu rich and diversified
- Sichuan poor and heavily dependent on agriculture

We would like to know whether land allocation system differs in these two settings

- Collectivisation → incentive failures → abandonment in 1978

Under Household Responsibility System (HRS) adopted from 1978, village governments are *de jure* owners of land and autonomously decide how it is allocated to households

- *Re-allocation of land* is *decentralised*

Village land zoned by quality and then village meetings convened to decide allocation

Bargaining process Each household has multiple plots spread across zones

- households enter into 15 year contracts to farm land
- village government retains right to adjust allocations
 - minor adjustments are often made if there are changes in demographic composition of household
- if land left fallow, it is confiscated

To examine the factors that determine how much land a household receives we look at regressions of the form:

$$A_h = \alpha + \sum_{j=1}^J \gamma_j n_j + \lambda n_{c>2} + \delta z + u$$

A_h land holding of household h

n_j demographic classes – no. in age-group band j in household

- these classes are (0-4), (5-9), (10-14), (15-54) and (55+).

γ_j marginal area of land allocated due to individual of type j

$n_{c>2}$ dummy for household with more than two children

z village dummy

- account for village level variation in **land allocation rule**

EQUIVALENCE SCALE

Demographic Class	Relative Weights	
	<i>Rural Sichuan</i>	<i>Jiangsu</i>
<i>0–4 Non Farm</i>	0.23	0.23
<i>5–9 Non Farm</i>	0.58	0.54
<i>10–14 Non Farm</i>	0.88	0.75
<i>15–54 Farm</i>	1	1
<i>15–54 Non Farm</i>	0.8	0.58
<i>55+ Non Farm</i>	0.91	0.82

- universal access to land
- subsistence concerns of households taken into account given
 - limited labour mobility
 - off-farm employment opportunities

Demogrant is a pure lump-sum transfer based on demographic characteristics paid irrespective of income or wealth

Land transfer to household (A_h) resembles a demogrant – determined by demographic composition of the household which is proxy of nutritional need

- Allocation rule tracks nutritional need more exactly than per capita rule

Universal access to land: virtually all household in both Sichuan and Jiangsu receive some land to farm

- Opinion surveys suggest that egalitarian rules popular with farmers - **Kung**

Equivalence Scales based on land and calorie demand line up – allocation rule appears to be based on consumption needs of households

TABLE 2

Table 2 includes village fixed effects so we are looking at allocations within villages

- *Equivalence Scale* tells us that non-productive household members are taken into account in allocation rule
- Negative coefficient for $n_{c>2}$
 - *marginal punishment for extra children*
 - limited ability to affect allocation by having more kids
- persistence of *egalitarian norms* in environment of rapidly developing markets

allocation rules extremely similar across Jiangsu and Sichuan
Cadre dummy insignificant

Table 1: Sample Characteristics, Rural Sectors, 1990

	Sichuan	Jiangsu
Rural PCE (yuan)	569	953
Rural industry/ rural output (%)	26.9	60.4
Location	Central inland	East coastal
Climate	Subtropical	Subtropical
Main food crop	Rice	Rice
Household size	4.35	4.15
Sample size {counties}	{54}	{34}
[villages]	[538]	[336]
<household> (persons)	<5380> (23416)	<3364> (13920)

Source: SSB Rural Household Surveys. China Statistical Yearbook (1991).

Table 3: Calorie Availability by Per Capita Expenditure (PCE) Decile: China and India

PCE decile	Per capita calorie availability			Per capita cultivable land		Per capita expenditure means	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	RS	RJ	RM	RS	RJ	RS	RJ
1	1772	2046	1429	0.066	0.083	284	347
2	2024	2245	na	0.068	0.091	354	473
3	2170	2450	na	0.073	0.092	400	555
4	2301	2479	na	0.072	0.091	442	633
5	2393	2513	na	0.078	0.090	485	714
6	2480	2612	na	0.074	0.095	532	804
7	2624	2675	na	0.077	0.094	586	920
8	2683	2787	na	0.082	0.097	654	1081
9	2834	2784	na	0.079	0.097	769	1321
10	3140	3057	3167	0.081	0.087	1156	2556
All	2442	2565	2120	0.075	0.092	566	941

Notes: Calorie availability for rural Sichuan (RS) and rural Jiangsu (RJ) is computed from SSB Rural Household Surveys, 1990. The source of the calorie figures for rural Maharashtra (RM) is Subramanian and Deaton (1993); na means not available. Per capita land refers to the mean per capita land holding for households in the relevant decile or deciles. Land is measured in hectares. PCE is measured in 1990 yuan. The computations are based on 5379 households for Sichuan and 3354 households for Jiangsu.

Table 4: Welfare Indicators in China and India, 1990

	CHINA	INDIA
GNP per Capita	410	370
Daily calorie supply	2630	2238
Children 0-5 below -2 s.d. weight for age	17.4	63.9
Children 0-5 below -2 s.d. height for age	31.4	62.1
Infant mortality rate	31	97

Source: World Bank (1993), United Nations (1993), World Health Organisation (1997).

ACCESS TO LAND AND HUNGER

How does access to land affect hunger?

Previous studies of land reform have looked at effects on poverty (Besley- Burgess 2000) and productivity (Banerjee, Gertler and Ghatak, 2001)

This paper looks at the links between access to land and calorie consumption

Agricultural household model – households make joint decisions over consumption, production and labor input

perfect markets – consumption decisions do not affect production decisions, production is independent of household preferences and income home produced and purchased calories are perfect substitutes

Result 1: Under *perfect markets* land only has an effect on calorie consumption via its effect on income.

$$\frac{\partial x_c}{\partial \bar{A}} = \underbrace{\frac{\partial x_c}{\partial y^*}}_{+} \cdot \underbrace{\frac{\partial y^*}{\partial \bar{A}}}_{+}$$

- x_c demand for calories
- \bar{A} household's land holding
- y^* household's income

When one or more market is incomplete then recursiveness breaks down

- consumption variables determine production (e.g., due to transaction costs or thin markets)

Price band between the buying and selling price of calorie widens with poorer infrastructure, less competitive marketing system (e.g. procurement), poorer information flow, greater price risk

Expect price band to be wide in transition country like China but to diminish with market development

\tilde{p}_c “shadow price” of calories equilibrates demand and supply

Own price advantage – households with more land face lower prices for the calories they consume than households with less land

Result 2: *In incomplete food market settings access to land can affect calorie demand through two distinct mechanisms.*

- (i) via an *income effect* (this is the whole effect in the perfect markets case).
- (ii) via an *own price effect*

$$\frac{\partial x_c}{\partial \bar{A}} = \underbrace{\frac{\partial x_c}{\partial y^*} \cdot \frac{\partial y^*}{\partial \bar{A}}}_{+} + \underbrace{\frac{\partial x_c}{\partial \tilde{p}_c} \cdot \frac{\partial \tilde{p}_c}{\partial \bar{A}}}_{+}$$

Result 3: *In incomplete food market settings the own price effect of having access to land is unambiguously positive. Increasing access to land lowers the shadow price of calories and increases demand for calories.*

- **Cross-price Effects positive**

Result 4: *With an incomplete food market and controlling for the income effect we would expect increasing access to land, which lowers the shadow calorie price, to have a negative impact on non-food consumption and a positive impact on food consumption.*

TESTABLE HYPOTHESIS

Result 5: *Controlling for the income effect we would expect increasing access to land, by lowering the shadow price of food, to have*

- i. a negative impact on purchased calorie consumption and*
- ii. a positive effect on own produced calorie consumption.*

EMPIRICAL TEST

$$\ln\left(\frac{x_c}{n}\right) = \alpha + \beta \ln\left(\frac{x}{n}\right) + \zeta \ln\left(\frac{A}{n}\right) + \eta \ln(n) + \sum_{j=1}^{J-1} \gamma_j \left(\frac{n_j}{n}\right) + \sum_{k=1}^{K-1} \gamma_k \left(\frac{n_k}{n}\right) + \delta z + u$$

- x_c calorie consumption
- x total consumption
- A land
- n household size
- n_j demographic classes
- n_k number of adults engaged in primary, secondary and tertiary employment
- z village dummies

using log variables allows us to calculate elasticities

We want to look at how *access to land* A/n effects *calorie consumption* x_c/n

Exploit *non-market allocation* of land in China allow us to separate out *income* and *land effects*

- typically not possible in market economies where jointly determined

Specification builds directly on standard calorie demand equation from Subramanian and Deaton (1996)

- Control for overall *income effect* (including that coming through land) by including total per capita expenditure variable (x/n)
- Then interpret coefficient on land (A/n) as picking up own *price effect*

FINDINGS

Finding 1 Income exerts a positive and significant effect on calorie consumption

- see columns (1) and (4) of Table 5
- confirmation of Subramanian and Deaton (1996) finding

Finding 2 Controlling for income still see large effect of land

- evidence of own price effect and that we are in imperfect food market setting
- see columns (2) and (5) of Table 5 – in line with Result (2) confirmed

Finding 3 In line with Result 3 we find this effect to be positive and significant and persist when we instrument for income

- see columns (3) and (6) in Table 5

FINDINGS

Finding 4 Own price effect larger in poorer less developed province

Finding 5: Own price effect large relative to income effect

- see Table 6 robustness – cross-price effects

Finding 6: In line with Result 4 we find that increasing access to land has a positive effect on food consumption and a negative effect on non-food consumption

- see columns (1)-(2) and (5)-(6) in Table 7

Finding 7: In line with Result 5 we find that increasing access to land has

- i. a positive effect on own produced calorie consumption and
- ii. a negative effect on purchased calorie consumption

– see columns (3)-(4) and (7)-(8) in Table 7

- Results point to coefficient on land picking up own price effect
- In China important pathway through which access to land affects calorie consumption – land does not appear to be picking up omitted wealth or political influence effects

Table 5: Access to Land and Nutritional Status: Basic Results

	Rural Sichuan			Rural Jiangsu		
	log per capita calories	log per capita calories	log per capita calories	log per capita calories	log per capita calories	log per capita calories
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	OLS	OLS	IV
log per capita land		0.131 (12.09)	0.148 (11.61)		0.092 (6.45)	0.098 (6.10)
log per capita expenditure	0.311 (27.48)	0.298 (27.30)		0.198 (20.31)	0.189 (19.48)	
instrumented log per cap exp			0.231 (14.88)			0.153 (8.96)
log household size	-0.119 (13.10)	-0.100 (11.31)		-0.195 (14.80)	-0.184 (14.20)	
Adj. R ²	0.741	0.757	0.648	0.619	0.630	0.562
no. obs.	5379	5379	5379	3354	3354	3354

Absolute t statistics in parenthesis based on robust (Huber) standard errors clustered at the village level. Regressions also contain controls for the occupational status and demographic composition of households and dummies for 537 villages (clusters) in Sichuan and 336 villages (clusters) in Jiangsu.

Table 6: Decomposition of Land Effect on Calorie Availability

Province	Total Effect (A) x (B) + (C) $\frac{d\ln PCCAL}{d\ln PCLAND}$	(A) $\frac{\partial \ln PCCAL}{\partial \ln PCE}$	(B) $\frac{\partial \ln PCE}{\partial \ln PCLAND}$	Income Effect (A) x (B)	Own-Price Effect (C) $\frac{\partial \ln PCCAL}{\partial \ln PCLAND}$ (PCE constant)
	(1)	(2)	(3)	(4)	(5)
Sichuan	0.18	0.31	0.16	0.05	0.13
Jiangsu	0.12	0.20	0.16	0.03	0.09

Column (2) is from columns (1) and (4) of Table 5. Column is from a regression of log per capita land on log per capita expenditure which contains the same controls as Table 5. Column (5) is from columns (2) and (5) of Table 5.

Table 7: Access to Land and Consumption: Robustness Checks

	Rural Sichuan				Rural Jiangsu			
	log per capita food exp	log per capita non-food exp	log per capita own prod grain cal	log per capita purch grain cal	log per capita food exp	log per capita non-food exp	log per capita own prod grain cal	log per capita purch grain cal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
log per capita land	0.075 (6.50)	-0.084 (5.14)	0.285 (10.67)	-0.264 (2.55)	0.087 (5.84)	-0.060 (3.18)	0.328 (9.69)	-0.887 (5.55)
log per capita expenditure	0.549 (32.83)	1.560 (104.37)	0.141 (9.33)	0.524 (7.63)	0.443 (20.23)	1.447 (65.52)	0.066 (3.49)	0.292 (2.80)
log hh size	-0.108 (8.65)	0.133 (10.10)	-0.041 (2.58)	-0.309 (4.03)	-0.200 (12.36)	0.178 (9.20)	-0.165 (5.95)	-0.502 (3.43)
Adj. R ²	0.830	0.883	0.718	0.525	0.750	0.912	0.683	0.424
no. obs.	5359	5359	5343	4224	3339	3339	3324	1919

Notes: Absolute t statistics in parenthesis based on robust (Huber) standard errors clustered at the village level. Regressions also contain controls for the occupational status and demographic composition of households and dummies for 537 villages (clusters) in Sichuan and 336 villages (clusters) in Jiangsu.

CONCLUSIONS

- access to land not a salient political issue in high income countries
but
in low income countries where many households dependent on agriculture it is a big issue
- Link between lack of access to land and hunger
 - the motivation for Mao land reforms
 - effect of reforms felt in system of land allocation we observe in China in 1990

Mao's legacy: universal and egalitarian access to land

DISCUSSION

- This institutional feature sets China apart from other low income countries
- Institution has persisted during period of rapid market development
- The paper exploit *non-market allocation* to map out the different pathways through which *access to land* can affect *hunger*
- The paper found that *land* exerts an influence on *calorie consumption* both through the *income* it generates as well as by acting as a *cheaper source of calories*
- Own-price effect important relative to income effect – interesting policy implications

- 1 Problem of *market incompleteness* in food markets likely to be widespread in poor countries
- 2 where markets are underdeveloped, having access to land enables households to avoid hunger both by providing them with a source of income but also by providing them with a “cheaper” source of calories relative to the market.
- 3 *Market development* will make access to land less important for achieving sufficient calorie consumption – happening rapidly
- 4 Removal of procurement system or raising of procurement prices would be beneficial
- 5 Results help us to understand how China has managed to escape the high levels of hunger which typify low income countries (see Table 3 and 4)

- 6 improving access to land via either land redistribution or improving the functioning land rental markets (which allow land rich and land scarce households to trade) could significantly contribute to the *Millennium Development Target* of halving the proportion of people suffering from hunger between 1990 and 2015
- 7 However political events in China unlikely to be replicated elsewhere
- 8 the Chinese example underlines the importance of providing access but has less clear-cut answers in terms of providing guidance on how access can be improved.

Land Reform, Poverty Reduction, and Growth: Evidence from India

Background and Data:

India: It is an important example for the study of land reform – largest body of land reform legislation ever passed in the world

Data considerations make it ideal for assessing impacts on poverty and growth:

LAND REFORM ENVIRONMENT IN INDIA

1. land reform is a state subject under the constitution
2. Many different forms and types of land reform attempted in different states within India
3. **Federal democracy**: scope to understand political economy of policy determination
4. **Common institutions** across India
5. **Common data collection methodologies**: comparable poverty measures (NSS)
6. **Panel data** over a long time period covering numerous land reform episodes

Estimation via generalized least squares will also allow for a heteroscedasticity in error structure, with each state having its own error variance.

We use three different poverty measures:

- 1. head-count measure
- 2. poverty gap measure
- 3. difference between rural and urban poverty

Econometric Concerns:

- l_{st} is endogenous and/or measured with error
- l_{st} is proxying for other omitted policies

In principal these can be dealt with using instrumental variables, but in practice instruments are hard to find.

- We use *political variables* as **instruments** (they pass tests of over-identifying restrictions and predict land reforms quite well)

TABLE III
 LAND REFORM AND POVERTY IN INDIA: BASIC RESULTS

	rural poverty gap	rural poverty gap	rural poverty gap	rural head count	urban poverty gap	poverty gap difference	poverty gap difference	headcount difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Model	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)
four year lagged cumulative land reform legislation	-0.281 (2.18)	-0.443 (3.21)			0.085 (1.05)	-0.534 (5.24)		
four year lagged cumulative tenancy reform legislation			-0.604 (2.52)	-1.378 (3.13)			-0.736 (3.27)	-1.916 (4.37)
four year lagged cumulative abolition of intermediaries legislation			-2.165 (4.08)	-4.354 (4.11)			-1.327 (2.59)	-3.364 (3.73)
four year lagged cumulative land ceiling legislation			0.089 (0.11)	0.734 (0.86)			0.230 (0.61)	0.888 (1.14)
four year lagged cumulative land consolidation legislation			0.456 (0.82)	-0.208 (0.19)			-0.210 (0.42)	-1.737 (1.62)
state effects	YES	YES	YES	YES	YES	YES	YES	YES
year effects	YES	YES	YES	YES	YES	YES	YES	YES
number observations	507	300	507	507	507	507	507	507

TABLE IV
LAND REFORM AND POVERTY IN INDIA: CONTROLLING FOR OMITTED POLICY EFFECTS

	rural poverty gap	rural poverty gap	rural head count	urban poverty gap	poverty gap difference	head count difference
	(1)	(2)	(3)	(4)	(5)	(6)
model	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)
four year lagged cumulative land reform legislation	-0.378 (3.78)			0.037 (0.042)	-0.539 (4.63)	-1.298 (5.04)
four year lagged cumulative tenancy reform legislation		-0.565 (2.32)	-0.897 (1.98)			
four year lagged cumulative abolition intermediaries legislation		-1.790 (2.81)	-3.14 (2.48)			
four year lagged cumulative land ceiling legislation		-0.352 (0.82)	-0.121 (0.14)			
four year lagged cumulative land consolidaton legislation		0.164 (0.32)	-1.000 (1.02)			
population growth rate	-90.61 (1.14)	-97.99 (1.21)	-87.59 (0.50)	-74.32 (1.22)	74.81 (0.91)	-145.05 (0.90)
four year lagged per capita education expenditure	0.063 (2.04)	0.070 (2.24)	0.076 (1.10)	0.041 (1.73)	0.077 (2.18)	0.034 (0.42)
four year lagged per capita health expenditure	0.038 (0.88)	0.041 (0.91)	0.072 (0.76)	-0.003 (0.09)	0.042 (0.83)	0.218 (1.76)
four year lagged per capita other expenditure	0.020 (2.69)	0.017 (2.31)	0.026 (1.56)	0.012 (2.40)	0.0009 (0.12)	-0.008 (0.40)
four year lagged per capita redistributive state taxes	-0.130 (2.70)	-0.142 (2.92)	-0.364 (3.25)	-0.045 (1.25)	-0.182 (3.53)	-0.422 (3.21)
four year lagged state taxes as a percentage of state domestic product	-49.59 (2.99)	-49.11 (2.94)	-87.33 (2.46)	-27.70 (2.23)	16.43 (0.97)	4.790 (0.13)
four year lagged agricultural yield	0.001 (0.05)	-0.003 (0.02)	-0.507 (1.19)	-0.006 (0.42)	0.031 (1.45)	-0.013 (0.30)
state effects	YES	YES	YES	YES	YES	YES
year effects	YES	YES	YES	YES	YES	YES
number of observations.	436	436	436	436	436	436

TABLE V
LAND POLICY DETERMINATION

	cumulative total land reform legislation	cumulative tenancy reform legislation	cumulative abolition of intermediaries legislation	cumulative land ceiling legislation	cumulative land consolidation legislation
	(1)	(2)	(3)	(4)	(5)
model	OLS	OLS	OLS	OLS	OLS
four year lagged cumulative land reform legislation	0.406 (12.23)				
four year lagged cumulative tenancy reform legislation		0.693 (16.26)	-0.002 (0.16)	-0.009 (0.38)	0.021 (1.13)
four lagged cumulative abolition of intermediaries legislation		0.041 (0.53)	0.664 (14.21)	0.109 (1.51)	-0.029 (1.06)
four year lagged cumulative land ceiling legislation		-0.131 (2.11)	-0.172 (0.65)	0.631 (15.60)	-0.045 (1.44)
four year lagged cumulative land consolidation legislation		0.694 (5.06)	-0.038 (1.14)	0.174 (2.93)	0.772 (7.85)
four year lagged congress party share of seats	-0.460 (2.81)	-0.472 (4.78)	-0.098 (2.37)	-0.066 (1.85)	-0.075 (1.85)
four year lagged hard left share of seats	2.837 (2.95)	0.476 (0.72)	0.149 (0.97)	1.437 (5.46)	-0.302 (0.73)
four year lagged soft left share of seats	-3.921 (3.09)	-2.363 (3.25)	-1.101 (2.60)	-1.990 (3.63)	-0.426 (1.06)
four year lagged hindu parties share of seats	0.270 (0.33)	-0.089 (0.19)	-0.045 (0.15)	0.556 (2.01)	-0.410 (2.08)
state effects	YES	YES	YES	YES	YES
year effects	YES	YES	YES	YES	YES
number of observations	474	474	474	474	474

TABLE VI
LAND REFORM AND POVERTY IN INDIA: INSTRUMENTATION

	rural poverty gap	rural head count	rural poverty gap	rural head count	poverty gap difference	rural poverty gap	rural head count	rural head count	rural poverty gap	rural head count
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
model	IV1	IV1	IV1	IV1	IV1	IV2	IV2	IV2	IV3	IV3
four year lagged cumulative land reform legislation	-0.732 (6.02)	-1.360 (5.68)			-0.438 (3.60)	-0.659 (4.09)	-1.192 (3.67)		-0.599 (3.18)	-1.263 (3.24)
four year lagged cumulative tenancy reform legislation			-0.998 (3.16)	-2.404 (3.67)				-4.595 (4.69)		
four year lagged cumulative abolition of intermediaries legislation			-2.271 (2.58)	-5.701 (3.64)				-7.408 (4.10)		
four year lagged cumulative land ceiling legislation			-1.372 (2.34)	0.432 (0.38)				-1.998 (1.89)		
four year lagged cumulative land consolidation legislation			1.624 (1.72)	1.969 (1.00)				-4.027 (1.45)		
over identification test p-value	0.93	0.98	0.99	0.98	0.99	0.93	0.98	0.98	0.92	0.96
state effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
year effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
number of observations	410	410	410	410	410	410	410	410	410	410

TABLE VII
LAND REFORM AND AGRICULTURAL WAGES

	real agricultural wages	real agricultural wages
	(1)	(2)
model	GLS AR(1)	GLS AR(1)
four year lagged cumulative land reform legislation	0.081 (2.71)	
four year lagged cumulative tenancy reform legislation		0.049 (0.88)
four year lagged cumulative abolition of intermediaries legislation		0.339 (2.61)
four year lagged cumulative land ceiling legislation		0.069 (0.09)
four year lagged cumulative consolidation of land holdings legislation		0.018 (0.13)
state effects	YES	YES
year effects	YES	YES
number of observations	441	441

TABLE VIII
LAND REFORM AND GROWTH IN INDIA

Model	log of state income per capita	log of agricultural state income per capita	log of agricultural state income per capita	log of agricultural yield	log of agricultural yield
	(1)	(2)	(3)	(4)	(5)
	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)	GLS AR(1)
one year lagged log of state income per capita	0.497 (12.53)				
one year lagged log of agricultural state income per capita		0.195 (4.17)	0.167 (3.29)		
four year lagged cumulative tenancy reforms	-0.002 (0.43)	-0.037 (4.54)	-0.033 (2.94)	-0.050 (6.55)	-0.038 (3.92)
four year lagged cumulative abolition of intermediaries	-0.005 (0.54)	0.005 (0.27)	-0.016 (0.76)	-0.002 (0.12)	-0.013 (0.49)
four year lagged cumulative land ceiling legislation	-0.002 (0.22)	0.019 (1.26)	0.012 (0.64)	0.015 (0.95)	0.015 (0.88)
four year lagged land consolidation legislation	-0.013 (1.29)	0.065 (3.31)	0.057 (2.12)	0.074 (3.87)	0.054 (2.15)
population growth rate			-2.567 (0.75)		4.166 (1.11)
four year lagged per capita education expenditures			0.003 (1.48)		0.003 (1.67)
four year lagged per capita health expenditures			-0.005 (1.97)		-0.002 (0.77)
four year lagged per capita other expenditures			-0.0004 (0.99)		-0.0002 (0.40)
four year lagged per capita tax revenue from redistributive taxes			-0.004 (1.51)		-0.003 (1.05)
four year lagged state taxes as a percentage of state domestic product			0.474 (0.54)		0.278 (0.31)
four year lagged log of agricultural yield			0.010 (0.17)		-0.018 (0.32)
state effects	YES	YES	YES	YES	YES
year effects	YES	YES	YES	YES	YES
number of observations	484	484	433	488	433

SUMMARY OF RESULTS

1. Poverty Reduction

- land reform associated with reductions in rural poverty with effects coming mainly through abolition of intermediaries and tenancy reform
- The results are robust to different poverty measures, inclusion of other policy variables and our instrumentation procedure

2. Agricultural Wages: land reform also appears to raise agricultural wages

3. Output effects

- Tenancy reform’s effect is ambiguous.
- Consolidation should increase the output and by that same measure ceiling should reduce the aggregate output through effect on efficiency of agricultural production.

MAKING SENSE OF THE RESULTS

- The theoretical model focuses on two things:
- a model of agricultural contracting and
 - a model of labor supply by tenants.

Labor supply is decreasing in $x =$ non-labor income = value of tenancy in for tenant – if land reforms increase x , then tenants would reduce labor supply to the market – tightening of labor market would lead to increased agricultural wages

Now consider agricultural contracting problem of landlord and tenant – output depends on effort, $R(e)$, tenants have to be monitored to put in effort on the land thus contract specifies effort level e – tenant caught shirking with probability p – payment schedule needed to induce effort level e at wage ω can be written as:

$$w(e, \omega) = v^{-1} \left(v(0, \omega) + \frac{e}{p} \right)$$

the contract must now specify a payment/effort pair consistent with this schedule.

The optimal effort that the landlord choose to induce is given by

$$e(p) = \operatorname{argmax}_e = \{R(e) - w(e, \omega)\}$$

it is easy to verify that $e(p)$ is increasing. The tenant's equilibrium payoff is $V(p) = v(0, \omega) + \frac{e(p)(1-p)}{p}$, which is larger than the payoff from being a landless laborer.

It is straightforward to calculate the impact of changes in p on output and the tenant's payoff – an increase in p will increase net-output since $e(p)$ is increasing. The effect on the tenant's payoff is given by:

$$V'(p) = e'(p) \frac{1-p}{p} - e(p) \left(\frac{1}{p^2} \right)$$

